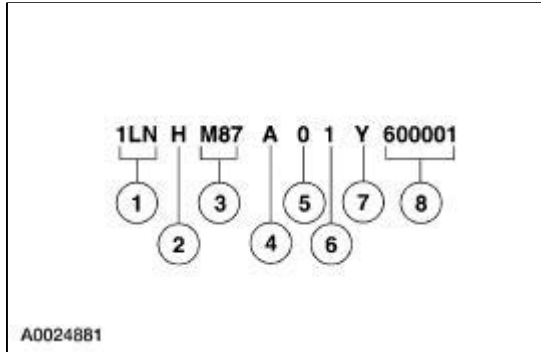


Identification Codes

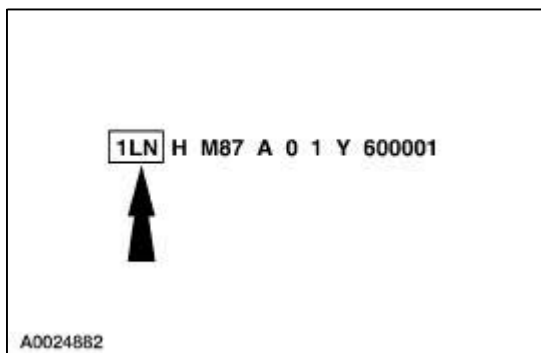
The vehicle identification number (VIN) is a 17-digit combination of letters and numbers. The VIN is stamped on a metal tab riveted to the instrument panel, top upper left of the dash. The VIN number is also found on the vehicle certification (VC) label.



Item	Description
1	World manufacturer identifier (WMI)
2	Restraint type code
3	Line and series
4	Engine code
5	VIN check digit
6	Model year code
7	Assembly plant code
8	Production sequence number

Vehicle Identification Number

World Manufacturer Identifier

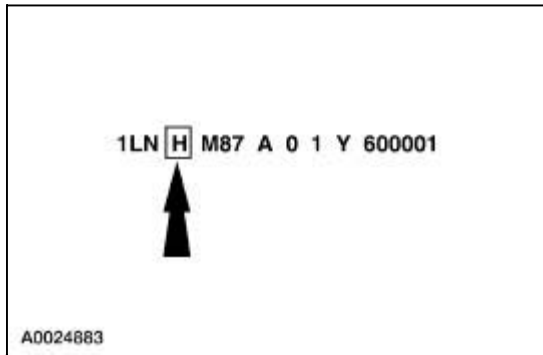


The first three vehicle identification number (VIN) positions are the world manufacturer code.

- 1LN — Ford Motor Company — Lincoln, USA, passenger car

- 1LJ — Ford Motor Company — Lincoln, USA, incomplete vehicle

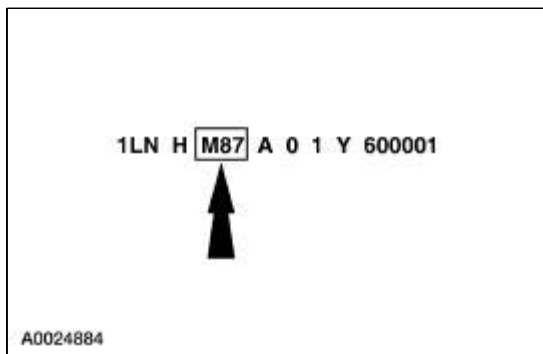
Vehicle Restraint Type



The fourth VIN position is the vehicle restraint system type code.

- L — Active safety belts — all positions, driver and front passenger air bags
- F — Active safety belts — all positions, second generation driver and front passenger air bags
- H — Active safety belts — all positions, driver and front passenger air bags, driver and front passenger side impact air bags

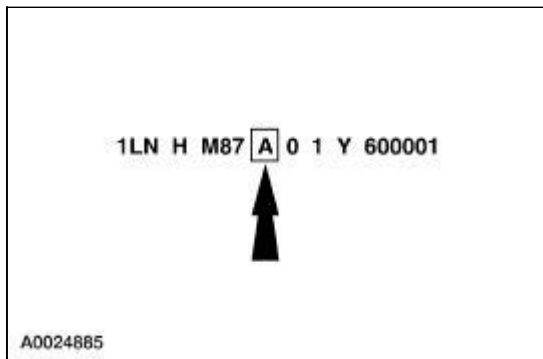
Line and Series



Positions 5 through 7 indicate vehicle line and series.

- M86 — Lincoln LS — six cylinder
- M87 — Lincoln LS — eight cylinder

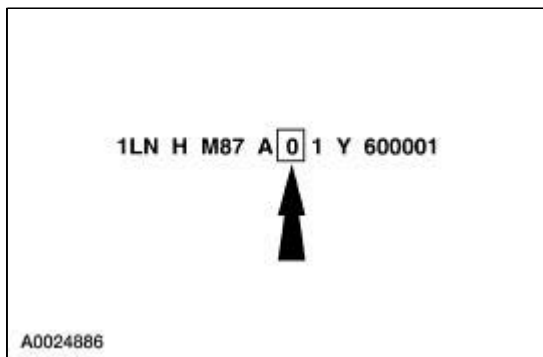
Engine Code



The eighth VIN position is the engine displacement and number of cylinders code.

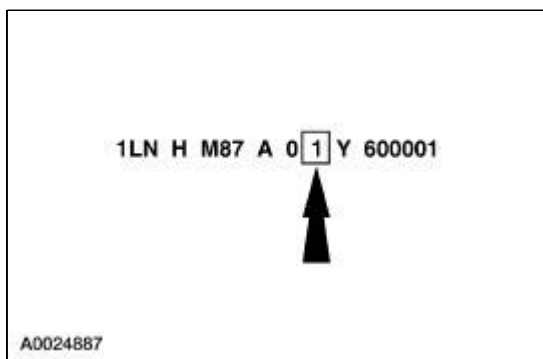
- A — 3.9L, eight cylinder, DOHC, EFI
- S — 3.0L, six cylinder, DOHC, EFI

Check Digit



The ninth VIN position is the check digit code (0-9).

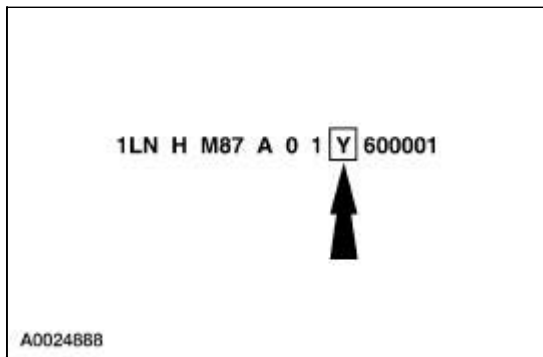
Model Year



The tenth VIN position is the model year code.

- 1— 2001

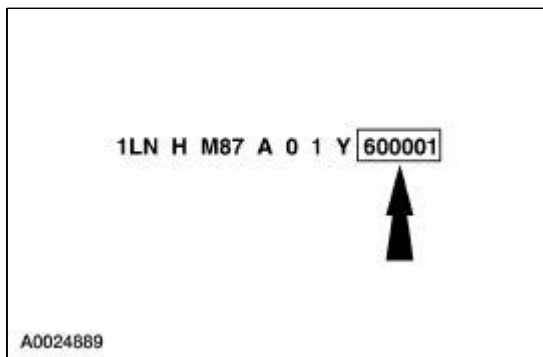
Assembly Plant



The eleventh VIN position is the assembly plant code.

- S — Pilot Plant, Allen Park, Michigan (USA)
- Y — Wixom, Michigan (USA)

Production Sequence Number

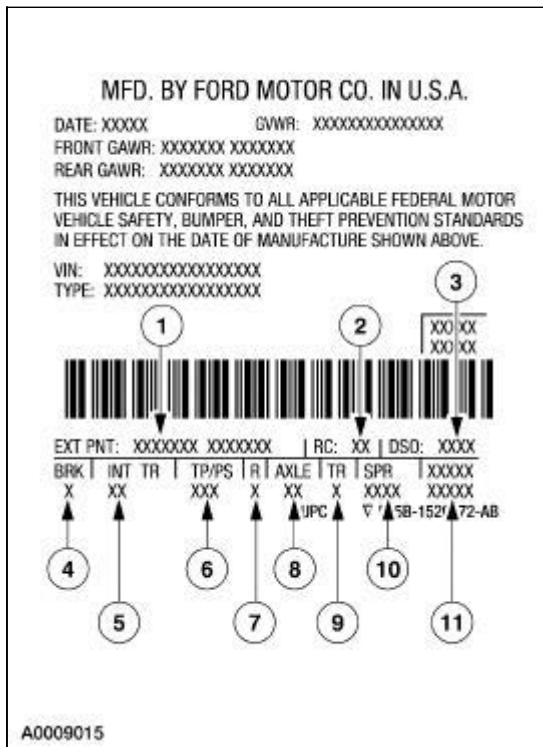


The last six VIN positions are the production sequence number. This set of numbers is also used as the vehicle serial and warranty number.

- Lincoln/Mercury — Begins with 600001

Vehicle Certification (VC) Label

The upper portion of the vehicle certification (VC) label contains the manufacturer name, the month and year of manufacture, the certification statement and the VIN. It also includes gross vehicle weight ratings (GVWR). The VC label is located on the left-hand front door jamb.



Item	Description
1	Exterior paint color code
2	Region code
3	Special order code (DSO — domestic special order FSO — foreign special order PTO — paint, tire option special order)
4	Brake type code
5	Interior trim code
6	Tape/paint stripe code
7	Radio type code
8	Axle ratio code
9	Transmission code
10	Spring code
11	Powertrain calibration code

Vehicle Certification (VC) Label Reference

Paint Codes

MFD. BY FORD MOTOR CO. IN U.S.A.

DATE: XXXX GVWR: XXXXXXXXXXXXXXXX
FRONT GAWR: XXXXXX XXXXXX
REAR GAWR: XXXXXX XXXXXX

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR
VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS
IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VIN: XXXXXXXXXXXXXXXXXXXX
TYPE: XXXXXXXXXXXXXXXXXXXX

XXXXX
XXXXX




EXT PNT:	XXXXXXXX XXXXXX	RC: XX	DSD: XXXX	
BRK	INT TR	TP/PS	R AXLE TR SPR	XXXXX
X	XX	XXX	X XX X	XXXX XXXX

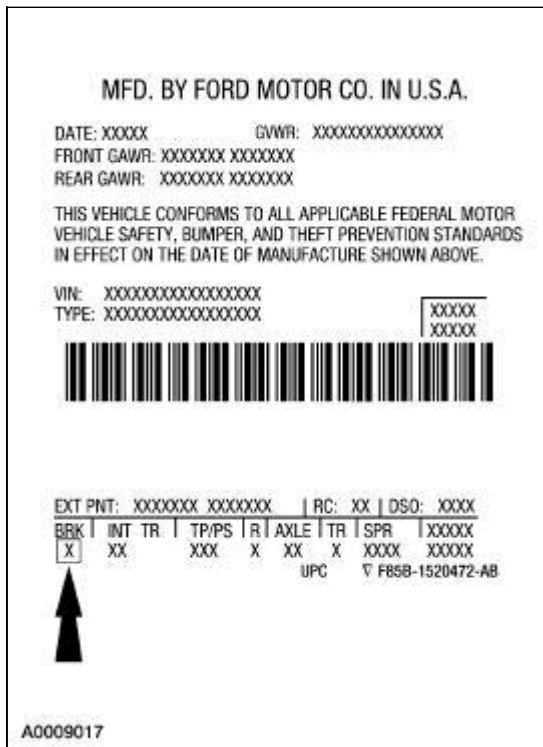
UPC ▽ F85B-1520472-AB

A0009016

The exterior color codes are:

- BQ — Light parchment gold
- HC — Ivory parchment (tri-coat)
- GT — Autumn red
- TS — Silver frost
- TV — Midnight Gray
- L2 — True Blue
- L3 — Pacific Blue Metallic
- F3 — Medium Cypress Green
- F7 — Charcoal Green
- W5 — Ceramic White Solid
- UA — Ebony
- WF — White pearl (tri-coat)

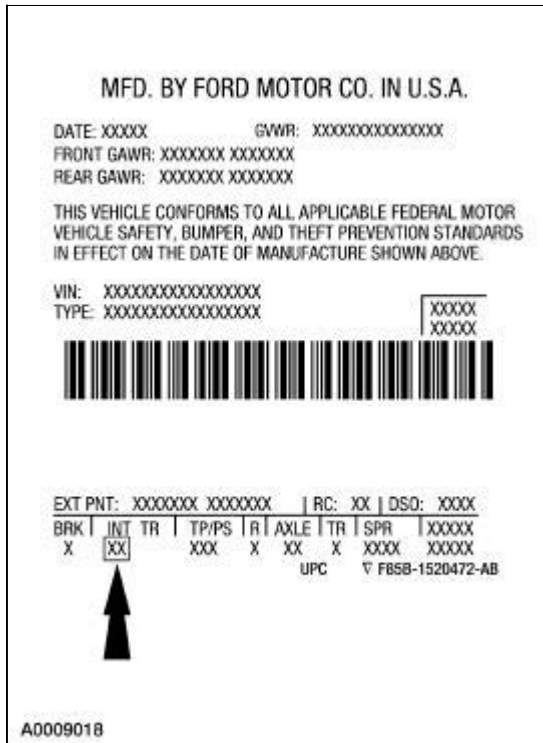
Brake Code



The brake type codes are:

- 6 — Anti-lock brakes (ABS) with Advancetrac®
- 3 — Anti-lock brakes (ABS) with Traction Control

Interior Trim Code



The interior trim codes are listed below. The first letter/number is for the interior fabric. The second

letter/number is for the interior color.

- 4 — Leather interior
- 5 — Nudo leather

The interior trim colors are:

- H — Medium parchment
- T — Truffle
- 2 — Light graphite
- W — Midnight black
- G — Light parchment
- B — Tutone black

Tape/Paint Stripe Code


MFD. BY FORD MOTOR CO. IN U.S.A.

DATE: XXXX GVWR: XXXXXXXXXXXXXXXX
FRONT GAWR: XXXXXX XXXXXX
REAR GAWR: XXXXXX XXXXXX

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR
VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS
IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VIN: XXXXXXXXXXXXXXXX
TYPE: XXXXXXXXXXXXXXXX

XXXXX
XXXXX



EXT PNT: XXXXXX XXXXXX | RC: XX | DSO: XXXX
BRK | INT TR | TP/PS | R | AXLE | TR | SPR | XXXX
X | XX | [XXX] | X | XX | X | XXXX | XXXX
UPC V F85B-1520472-AB

A0009019

Tape and paint stripe codes do not apply.


Radio Code

MFD. BY FORD MOTOR CO. IN U.S.A.

DATE: XXXXX GVWR: XXXXXXXXXXXXXXXX
 FRONT GAWR: XXXXXXX XXXXXXX
 REAR GAWR: XXXXXXX XXXXXXX

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VIN: XXXXXXXXXXXXXXXXXXXX
 TYPE: XXXXXXXXXXXXXXXXXXXX



EXT PNT: XXXXXXX XXXXXXX | RC: XX | DSO: XXXX
 BRK | INT TR | TP/PS | R | AXLE | TR | SPR | XXXX
 X | XX | XXX | X | XX | X | XXXX | XXXX
 UPC ∇ F85B-1520472-AB

A0009020

The radio type codes are:

- 8 — Premium AM/FM stereo cassette with clock
- X — AM/FM stereo with in-dash six disc CD changer
- S — AM/FM stereo with cassette, clock and navigation system


Axle Ratio Code

MFD. BY FORD MOTOR CO. IN U.S.A.

DATE: XXXXX GVWR: XXXXXXXXXXXXXXXX
 FRONT GAWR: XXXXXXX XXXXXXX
 REAR GAWR: XXXXXXX XXXXXXX

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VIN: XXXXXXXXXXXXXXXXXXXX
 TYPE: XXXXXXXXXXXXXXXXXXXX



EXT PNT: XXXXXXX XXXXXXX | RC: XX | DSO: XXXX
 BRK | INT TR | TP/PS | R | AXLE | TR | SPR | XXXX
 X | XX | XXX | X | XX | X | XXXX | XXXX
 UPC ∇ F85B-1520472-AB

A0009021

The axle ratios are:

- 1 — 3.58 conventional (3.0L and 3.9L engines)
- 2 — 3.31 conventional (3.9L engine)
- 3 — 3.07 conventional (3.0L engine with manual transmission)


Transmission Code

MFD. BY FORD MOTOR CO. IN U.S.A.

DATE: XXXXX GVWR: XXXXXXXXXXXXXXXX
FRONT GAWR: XXXXXXX XXXXXXX
REAR GAWR: XXXXXXX XXXXXXX

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR
VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS
IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VIN: XXXXXXXXXXXXXXXXXXXX
TYPE: XXXXXXXXXXXXXXXXXXXX



EXT PNT: XXXXXXX XXXXXXX | RC: XX | DSD: XXXX
BRK | INT TR | TP/PS | R | AXLE | TR | SPR | XXXXX
X | XX | XXX | X | XX | X | XXXX | XXXXX

UPC
V F85B-1520472-AB

A0009022

The transmission/transaxle codes are:

- 5 — 5-Speed manual (M5 221), Getrag
- A — 5-speed, automatic (5R55N), Sharonville

Spring Code


MFD. BY FORD MOTOR CO. IN U.S.A.

DATE: XXXX GVWR: XXXXXXXXXXXXXXXX
FRONT GAWR: XXXXXX XXXXXXX
REAR GAWR: XXXXXX XXXXXXX

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.


VIN: XXXXXXXXXXXXXXXXXXXX
TYPE: XXXXXXXXXXXXXXXXXXXX

XXXXX
XXXXX



EXT PNT: XXXXXX XXXXXX		RC: XX	DSD: XXXX
BRK	INT TR	TP/PS	R AXLE TR SPR
X	XX	XXX	X XX X XXXX XXXX

UPC ∇ 15B-1520472-AB



A0009023

The spring codes are:

- Front spring modules — base part number — 18B036
- Rear spring — base part number — 5560

Powertrain Calibration Information


MFD. BY FORD MOTOR CO. IN U.S.A.

DATE: XXXX GVWR: XXXXXXXXXXXXXXXX
FRONT GAWR: XXXXXX XXXXXXX
REAR GAWR: XXXXXX XXXXXXX

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.


VIN: XXXXXXXXXXXXXXXXXXXX
TYPE: XXXXXXXXXXXXXXXXXXXX

XXXXX
XXXXX



EXT PNT: XXXXXX XXXXXX		RC: XX	DSD: XXXX
BRK	INT TR	TP/PS	R AXLE TR SPR
X	XX	XXX	X XX X XXXX XXXX

UPC ∇ F85B-152772-AB



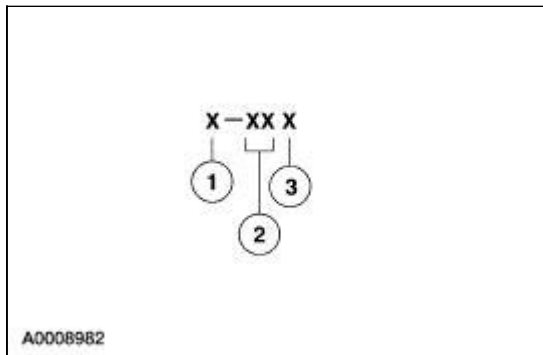
A0009024

NOTE: Powertrain calibration information is limited to a maximum of five characters per line on the Vehicle Certification (VC) Label. Because of this, calibration identification consisting of more than five

characters will wrap to the second line in the powertrain calibration field of the VC label.

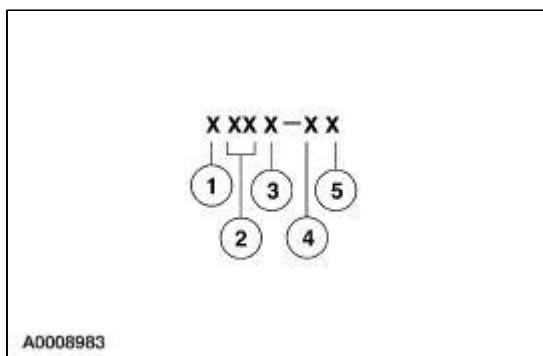
Powertrain calibration information is printed in the lower right corner of the Vehicle Certification (VC) Label. Only the base calibration information is printed. Revision levels will not appear, however, they can be found in On Line Automotive Service Information System (OASIS). For the current model year, Ford Motor Company is using three different protocols which describe powertrain base calibration. These protocols are designed to provide worldwide standardization for vehicle calibration. If the electronic calibration strategy has been used since 1998 and carried into the current model year, protocol 1 will be used. Refer to Protocol 1 below. If the electronic calibration strategy was introduced in 1999 and carried into the current model year, protocol 2 will be used. Refer to Protocol 2 below. For electronic calibration introduced in 2000 through the current model year, protocol 3 is used. Refer to Protocol 3 below.

Protocol 1



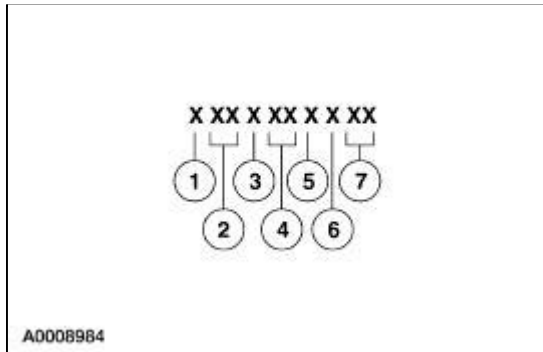
Item	Description
1	Model year (year in which calibration strategy was introduced)
2	Engine code
3	Engine revision level

Protocol 2



Item	Description
1	Model year (year in which calibration strategy was introduced)
2	Engine code
3	Transmission code
4	Emission standard (designates the specific country emission standard)
5	Design level (design level assigned to the engine)

Protocol 3



Item	Description
1	Model year
2	Vehicle code
3	Transmission code
4	Unique calibration
5	Fleet code
6	Certification region
7	Revision level (will advance as revisions occur). Not printed on label

Protocol 3

The following offers a more detailed explanation of the coding strategy for protocol 3.

Model Year

- 1 — 2001

Vehicle Line

- LQ — Lincoln LS

Transmission

- 1 — Automatic transmission
- 2 — Manual transmission

Unique Calibration

The Emission/CAFE/CO2 Compliance Department is responsible for assigning these calibration numbers. Unique calibration identifications are assigned to cover similar vehicle to differentiate tires, drive configurations, final drive ratios and other certification-significant factors.

These two characters are chosen by the analyst to provide easily identifiable information unique to each calibration. For example, using the number 2 to denote a two-valve engine versus the number 4 to denote a four-valve engine.

Fleet Code

- 0 — Certification (U. S. 4K, final sale in an export market)

- 1 — HDGE/Dyno
- 2 — Fast AMA U. S.
- 3 — ADP U. S.
- 4 — Not assigned
- 5 — Not assigned
- 6 — Evaporative emissions
- 7 — MACAA
- 8 — On-board diagnostics
- 9 — Not assigned

Certification Region


- 5 — U. S. fifty states
- A — U. S. federal, including altitude, may include Canada and Mexico
- B — U. S. California standard, includes U. S. green states
- C — Canada
- D — China
- E — European community
- F — Israel, South Korea
- G — Gulf Cooperative Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, Jordan, Lebanon and UAE)
- H — Hong Kong
- J — Japan
- K — Korea
- L — Malaysia
- M — Mexico
- N — New Zealand
- P — Australia
- Q — South America (Brazil)
- S — Singapore
- T — Taiwan
- U — South America (unleaded fuel regions)
- V — Vietnam
- X — Rest of world (ROW)
- Y — Military
- Z — Israel


Revision Level (not printed on label)


- 91-99 — Hardware and certification levels
- 01-04 — Preliminary levels
- 00 — Job 1 production (initial certification)
- 05-09 — Pre-job 1 revisions to calibrations


- 10-89 — Post-job 1 revisions to calibrations
 - 0B — Durability test level
 - BD — On-board diagnostics (OBD) intermediate level (pre-05)
-

Jacking

 **WARNING:** Never run the engine with one wheel off the ground, such as when changing a tire. The wheel still on the ground could cause the vehicle to move.

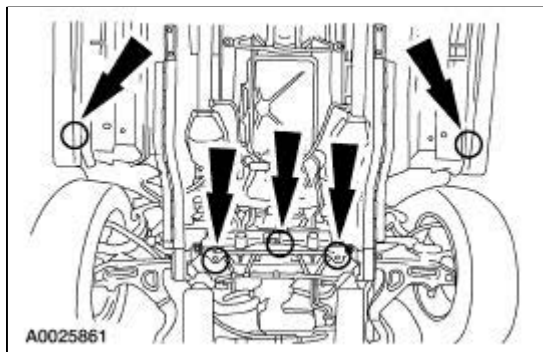
 **CAUTION:** The jack (17080) provided with the vehicle is intended to be used in an emergency for changing a deflated tire. To avoid damage to the vehicle, never use the jack to lift the vehicle for any other purpose. Refer to the Owner Literature when using the jack supplied with the vehicle.

 **CAUTION:** Under no circumstances should the vehicle ever be lifted by the front control arms, front I-braces, suspension arm brackets, rear stabilizer or differential housing. Severe damage to the vehicle could result.

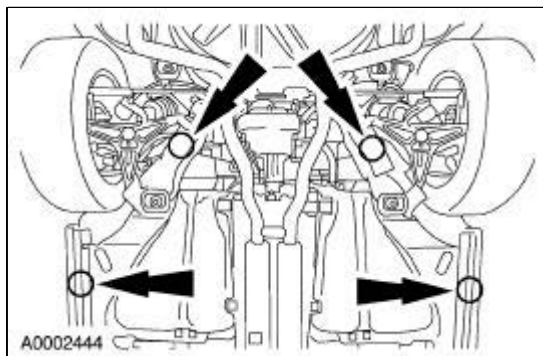
 **CAUTION:** Do not attempt to use jack pressure on either the front bumper (17757) or the rear bumper (17906) of any vehicle. Damage to the bumper covers will occur.

Lift the vehicle using the following procedure.

Jacking Points




To lift the front or either side of the front end, position the floor jack or the hoist under the front frame lift points.



To lift the rear or either side of the rear end, position the floor jack or the hoist under the rear lift points.

Lifting


 **CAUTION:** Do not allow the lift adapters to contact the steering linkage, suspension arms, front I-braces, stabilizer bar, or to compress the lower suspension arm stabilizer bar insulator (5493). Damage to the suspension, exhaust and steering linkage components may occur if care is not exercised when positioning the lift adapters prior to lifting the vehicle.

 **CAUTION:** Never use the differential housing as a lift point. Damage to the differential housing and cover may occur.

 **CAUTION:** Do not lift the vehicle on the rocker panel pinch flange except at the designated lift points or body damage may occur.

Lift the vehicle using the following procedure.

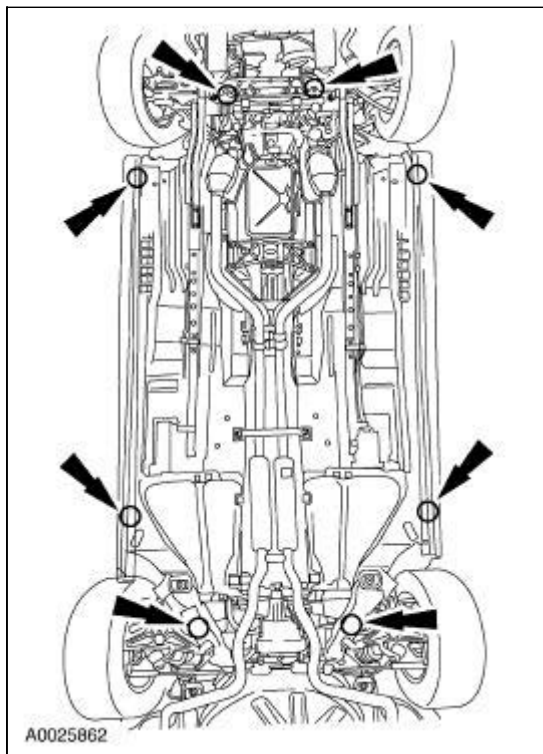
Lifting Points—Drive-On Hoist

 **CAUTION:** To prevent possible damage to the underbody, do not drive the vehicle onto the drive-on hoist without first checking for possible interference.

Check for interference between the upright flanges of the hoist rails and the underbody.

If an interference exists, modify the hoist flanges or build up the approach ramps as necessary to provide clearance.

Lifting Points—Frame Contact Lift, Single-Post Lift, Two-Post Lift



⚠ CAUTION: Under no circumstances should the vehicle be lifted by the front control arms, front I-braces or rear control arms. Severe damage to the vehicle could result.

⚠ CAUTION: Do not position the lift pads under the No. 3 crossmember.

NOTE: Adapters maybe necessary to clear vehicle components to lift the vehicle safely. The adapters must be placed at the four designated contact points. Position the adapters so they are centered on the adapter contact area.

Lift the vehicle at the applicable lift points.

Noise, Vibration And Harshness (NVH)

Noise is any undesirable sound, usually unpleasant in nature. Vibration is any motion, shaking or trembling, that can be felt or seen when an object moves back and forth or up and down. Harshness is a ride quality issue where the vehicle's response to the road transmits sharply to the customer. Harshness normally describes a firmer than usual response from the suspension system. Noise, vibration and harshness (NVH) is a term used to describe these conditions, which result in varying degrees of dissatisfaction. Although, a certain level of NVH caused by road and environmental conditions is normal. This section is designed to aid in the diagnosis, testing and repair of NVH concerns.

Acceptable Noise, Vibration and Harshness

All internal combustion engines and drivelines produce some noise and vibration; operating in a real world environment adds noise that is not subject to control. Vibration isolators, mufflers and dampers reduce these to acceptable levels. A driver who is unfamiliar with a vehicle can think that some sounds are abnormal when actually the sounds are normal for the vehicle type. For example, Traction-Lok® differentials produce a slight noise on slow turns after extended highway driving. This is acceptable and has no detrimental effect on the locking axle function. As a technician, it is very important to be familiar with vehicle features and know how they relate to NVH concerns and their diagnosis. For example, if the vehicle has automatic overdrive, it is important to test drive the vehicle both in and out of overdrive mode.

Diagnostic Theory

The shortest route to an accurate diagnosis results from:

- system knowledge, including comparison with a known good system.
- system history, including repair history and usage patterns.
- condition history, especially any relationship to repairs or sudden change.
- knowledge of possible sources.
- using a systematic diagnostic method that divides the system into related areas.

The diagnosis and correction of noise, vibration and harshness concerns requires:

- a road or system test to determine the exact nature of the concern.
- an analysis of the possible causes.
- testing to verify the cause.
- repairing any concerns found.
- a road test or system test to make sure the concern has been corrected or brought back to within an acceptable range.

Glossary of Terms

Acceleration-Light

An increase in speed at less than half throttle.

Acceleration-Medium

An increase in speed at half to nearly full throttle, such as 0-97 km/h (0-60 mph) in approximately 30 seconds.

Acceleration-Heavy

An increase in speed at one-half to full throttle, such as 0-97 km/h (0-60 mph) in approximately 20 seconds.

Ambient Temperature

The surrounding or prevailing temperature.

Amplitude

The quantity or amount of energy produced by a vibrating component (G force). An extreme vibration has a high amplitude. A mild vibration has a low amplitude.

Backlash

Gear teeth clearance.

Boom

Low frequency or low pitched noise often accompanied by a vibration. Also refer to Drumming.

Bound Up

An overstressed isolation (rubber) mount that transmits vibration/noise instead of absorbing it.

Brakes Applied

When the service brakes are applied with enough force to hold the vehicle against movement with the transmission in gear.

Buffet/Buffeting

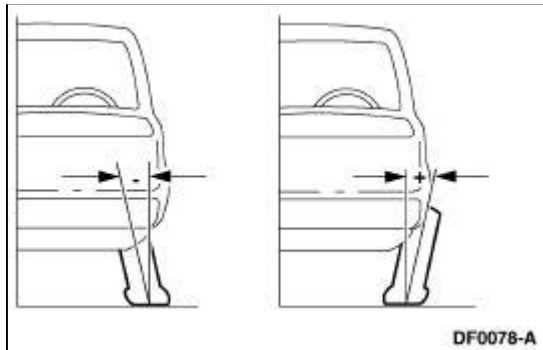
Strong noise fluctuations (less than 1000 Hz) caused by gusting winds. An example would be wind gusts against the side glass.

Buzz

A low-pitched sound like (200-5000 Hz) that from a bee. Often a metallic or hard plastic humming sound. Also describes a high frequency (200-800 Hz) vibration. Vibration feels similar to an electric razor.

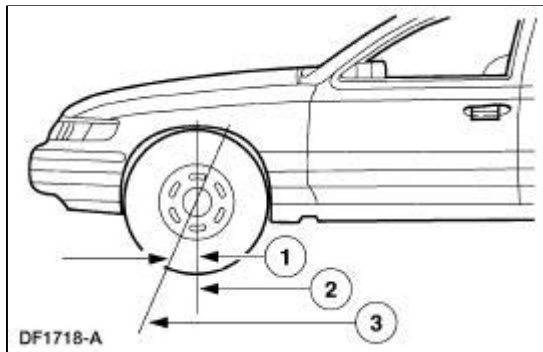
Camber

The angle of the wheel in relation to the true vertical as measured looking from the front of the vehicle. Camber is positive when the wheel angle is offset so that the top of the wheel is positioned away from the vehicle.



Caster

The angle of the steering knuckle in relation to the true vertical as measured looking from the side of the vehicle.



Item	Description
1	Positive caster
2	True vertical
3	Steering axis

Chatter

A pronounced series of rapidly repeating rattling or clicking sounds.

Chirp

A short-duration high-pitched noise associated with a slipping drive belt.

Chuckle

A repetitious low-pitched sound. A loud chuckle is usually described as a knock.

Click

A sharp, brief, non-resonant sound, similar to actuating a ball point pen.

Clonk

A hydraulic knocking sound. Sound occurs with air pockets in a hydraulic system. Also described as hammering.

Clunk/Driveline Clunk

A heavy or dull, short-duration, low-frequency sound. Occurs mostly on a vehicle that is accelerating or decelerating abruptly. Also described as a thunk.

Coast/Deceleration

Releasing the accelerator pedal at cruise, allowing the engine to reduce vehicle speed without applying the brakes.

Coast/Neutral Coast

Placing the transmission range selector in NEUTRAL (N) or depressing the clutch pedal while at cruise.

Constant Velocity (CV) Joint

A joint used to absorb vibrations caused by driving power being transmitted at an angle.

Controlled Rear Suspension Height

The height at which a designated vehicle element must be when driveline angle measurements are made.

Coupling Shaft

The shaft between the transfer case and the front drive axle or, in a two-piece rear driveshaft, the front section.

CPS

Cycles per second. Same as hertz (Hz).

Cracks

A mid-frequency sound, related to squeak. Sound varies with temperature conditions.

Creak

A metallic squeak.

Cruise

Constant speed on level ground; neither accelerating nor decelerating.

Cycle

The process of a vibrating component going through a complete range of motion and returning to the

starting point.

Decibel

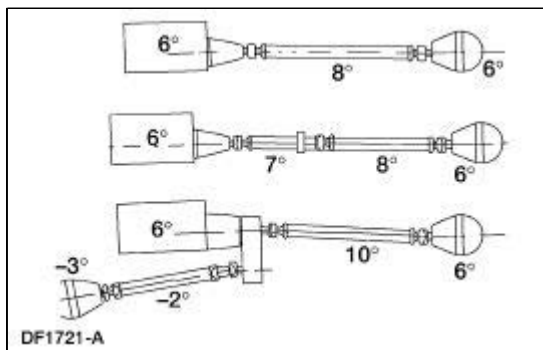
A unit of measurement, referring to sound pressure level, abbreviated dB.

Drive Engine Run-Up (DERU) Test

The operation of the engine through the normal rpm range with the vehicle standing still, the brakes applied and the transmission engaged. This test is used for noise and vibration checks.

Driveline Angles

The differences of alignment between the transmission output shaft, the driveshaft, and the rear axle pinion centerline.



Driveshaft

The shaft that transmits power to the rear axle input shaft (pinion shaft). In a two-piece driveshaft, it is the rearmost shaft.

Drivetrain

All power transmitting components from the engine to the wheels; includes the clutch or torque converter, the transmission, the transfer case, the driveshaft, and the front or rear drive axle.

Drivetrain Damper

A weight attached to the engine, the transmission, the transfer case, or the axle. It is tuned by weight and placement to absorb vibration.

Drone

A low frequency (100-200 Hz) steady sound, like a freezer compressor. Also described as a moan.

Drumming

A cycling, low-frequency (20-100 Hz), rhythmic noise often accompanied by a sensation of pressure on the ear drums. Also described as a low rumble, boom, or rolling thunder.

Dynamic Balance

The equal distribution of weight on each side of the centerline, so that when the wheel and tire assembly spins, there is no tendency for the assembly to move from side-to-side (wobble). Dynamically unbalanced wheel and tire assemblies can cause wheel shimmy.

Engine Imbalance

A condition in which an engine's center mass is not concentric to the rotation center, causing excessive motion.

Engine Misfire

When combustion in one or more cylinders does not occur or occurs at the wrong time.

Engine Shake

An exaggerated engine movement or vibration that directly increases in frequency as the engine speed increases. It is caused by non-equal distribution of mass in the rotating or reciprocating components.

Flexible Coupling

A flexible joint.

Float

A drive mode on the dividing line between cruise and coast where the throttle setting matches the engine speed with the road speed.

Flutter

Mid to high (100-2000 Hz) intermittent sound due to air flow. Similar to a flag flapping in the wind.

Frequency

The rate at which a cycle occurs within a given time.

Gravelly Feel

A grinding or growl in a component, similar to the feel experienced when driving on gravel.

Grind

An abrasive sound, similar to using a grinding wheel, or rubbing sand paper against wood.

Hiss

Steady high frequency (200-800 Hz) noise. Vacuum leak sound.

Hoot

A steady low frequency tone (50-500 Hz), sounds like blowing over a long neck bottle.

Howl

A mid-range frequency (200-800 Hz) noise between drumming and whine. Also described as a hum.

Hum

Mid-frequency (200-800 Hz) steady sound, like a small fan motor. Also described as a howl.

Hz

Hertz; a frequency measured in cycles per second.

Imbalance

Out of balance; heavier on one side than the other. In a rotating component, imbalance often causes vibration.

Inboard

Toward the centerline of the vehicle.

Intensity

The physical quality of sound that relates to the strength of the vibration (measured in decibels). The higher the sound's amplitude, the higher the intensity and vice versa.

Isolate

To separate the influence of one component to another.

Knock

A heavy, loud, repetitious sound, like a knock on the door.

Moan

A constant, low-frequency (100-200 Hz) tone. Also described as a hum.

Neutral Engine Run-Up (NERU) Test

The operation of the engine through the normal rpm range with the vehicle standing still and the transmission disengaged. This test is used to identify engine related vibrations.

Neutralize/Normalize

To return to an unstressed position. Used to describe mounts. Refer to Bound Up.

Outboard

Away from the centerline of the vehicle.

Ping

A short duration, high-frequency sound, which has a slight echo.

Pinion Shaft

The input shaft in a driving axle that is usually a part of the smaller driving or input hypoid gear of a ring and pinion gearset.

Pitch

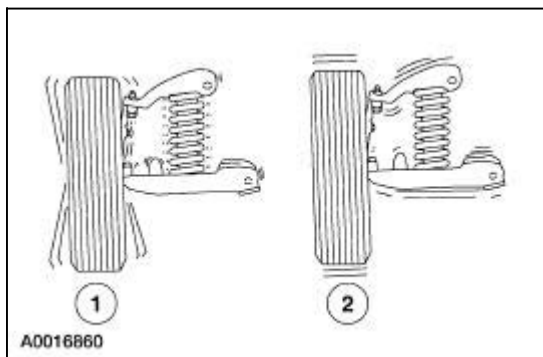
The physical quality of sound that relates to its frequency. Pitch increases as frequency increases and vice versa.

Pumping Feel

A slow, pulsing movement.

Radial/Lateral

Radial is in the plane of rotation; lateral is at 90 degrees to the plane of rotation.



Item	Description
1	Lateral runout
2	Radial runout

Rattle

A random and momentary or short duration noise.

Ring Gear

The large, circular, driven gear in a ring and pinion gearset.

Road Test

The operation of the vehicle under conditions intended to produce the concern under investigation.

Roughness

A medium-frequency vibration. A slightly higher frequency (20 to 50 Hz) than a shake. This type of vibration is usually related to drivetrain components.

Runout

Lateral runout means measuring the movement or "wobble" of a wheel or tire at the sidewall. Radial runout means measuring the out-of-round at the tread surface.

Rustling

Intermittent sound of varying frequency (100-2000 Hz), sounds similar to shuffling through leaves.

Shake

A low-frequency vibration (5-20 Hz), usually with visible component movement. Usually relates to tires, wheels, brake drums or brake discs if it is vehicle speed sensitive, or engine if it is engine speed sensitive. Also referred to as a shimmy or wobble.

Shimmy

An abnormal vibration or wobbling, felt as a side-to-side motion of the steering wheel in the driveshaft rotation. Also described as waddle.

Shudder

A low-frequency vibration that is felt through the steering wheel or seat during light brake application.

Slap

A resonance from flat surfaces, such as safety belt webbing or door trim panels.

Slip Yoke/Slip Spline

The driveshaft coupling that allows length changes to occur while the suspension articulates and while the driveshaft rotates.

Squeak

A high-pitched transient sound, similar to rubbing fingers against a clean window.

Squeal

A long-duration, high-pitched noise.

Static Balance

The equal distribution of weight around the wheel. Statically unbalanced wheel and tire assemblies can cause a bouncing action called wheel tramp. This condition will eventually cause uneven tire wear.

Tap

A light, rhythmic, or intermittent hammering sound, similar to tapping a pencil on a table edge.

Thump

A dull beat caused by two items striking together.

Tick

A rhythmic tap, similar to a clock noise.

Tip-In Moan

A light moaning noise heard during light vehicle acceleration, usually between 40-100 km/h (25-65 mph).

TIR

The acronym for total indicated runout is TIR.

Tire Deflection

The change in tire diameter in the area where the tire contacts the ground.

Tire Flat Spots

A condition commonly caused by letting the vehicle stand while the tires cool off. This condition can be corrected by driving the vehicle until the tires are warm. Also, irregular tire wear patterns in the tire tread resulting from wheel-locked skids.

Tire Force Vibration

A tire vibration caused by variations in the construction of the tire that is noticeable when the tire rotates against the pavement. This condition can be present on perfectly round tires because of variations in the inner tire construction. This condition can occur at wheel rotation frequency or twice rotation frequency.

Transient

A noise or vibration that is momentary, a short duration.

Two-Plane Balance

Radial and lateral balance.

Vibration

Any motion, shaking or trembling, that can be felt or seen when an object moves back and forth or up and down.

Whine

A constant, high-pitched noise. Also described as a screech.

Whistle

High-pitched noise (above 500 Hz) with a very narrow frequency band. Examples of whistle noises are a turbocharger or airflow around an antenna.

Wind Noise

Any noise caused by air movement in, out or around the vehicle.

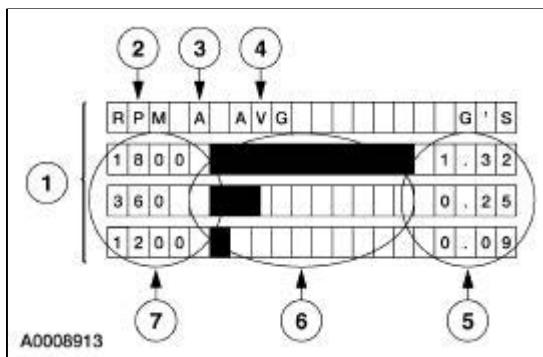
WOT

The acronym for wide open throttle is WOT.

Tools and Techniques

Electronic Vibration Analyzer (EVA)

The EVA is a hand-held electronic diagnostic tool which will assist in locating the source of unacceptable vibrations. The vibration sensor can be remotely mounted anywhere in the vehicle for testing purposes. The unit displays the three most common vibration frequencies and their corresponding amplitudes simultaneously. A bar graph provides a visual reference of the relative signal strength (amplitude) of each vibration being displayed and its relative G force. The keypad is arranged to make the EVA simple to program and use. Some of the functions include the ability to average readings as well as record, play back and freeze readings. The EVA has a strobe balancing function that can be used to detect imbalance on rotating components such as a driveshaft or engine accessories.



Item	Description
1	EVA screen
2	Frequency mode displayed in rpm or Hz
3	Active sensor input (A or B)
4	Current active mode
5	G force indicators or the strongest frequencies in descending strength of each vibration
6	Strength of each vibration
7	Frequency in rpm/Hz of each vibration

The EVA allows for a systematic collection of information that is necessary to accurately diagnose and repair NVH problems. For the best results, carry out the test as follows:

- a. Test drive the vehicle with the vibration sensor inside the vehicle.
- b. Place the sensor in the vehicle according to feel.
 - If the condition is felt through the steering wheel, the source is most likely in the front of the vehicle.
 - A vibration that is felt in the seat or floor only will most likely be found in the driveline, drive axle or rear wheels and tires.
- c. Record the readings. Also note when the condition begins, when it reaches maximum intensity, and if it tends to diminish above/below a certain speed.
 - Frequencies should be read in the "average" mode.

- Frequencies have a range of plus or minus 2. A reading of 10 Hz can be displayed as an 8 Hz through 12 Hz.
- d. Place the vibration sensor on or near the suspect area outside the vehicle.
- e. Continue the road test, driving the vehicle at the speed the symptom occurs, and take another reading.
- f. Compare the readings.
 - A match in frequency indicates the problem component or area.
 - An unmatched test could indicate the concern is caused by the engine, torque converter, or engine accessory. Use the EVA in the rpm mode and check if concern is rpm related.
 - Example: A vibration is felt in the seat. Place the sensor on the console. Record the readings. Place the vibration sensor on the rear axle. Compare the readings. If the frequencies are the same, the axle is the problem component.

Vibrate Software®

Vibrate Software® (Rotunda tool number 215-00003) is a diagnostic aid which will assist in pinpointing the source of unacceptable vibrations. The engine's crankshaft is the point of reference for vibration diagnosis. Every rotating component will have an angular velocity that is faster, slower, or the same as the engine's crankshaft. Vibrate Software® calculates the angular velocity of each component and graphically represents these velocities on a computer screen and on a printed vibration worksheet. The following steps outline how Vibrate Software® helps diagnose a vibration concern:

- Enter the vehicle information. Vibrate will do all the calculations and display a graph showing tire, driveshaft and engine vibrations.
- Print a Vibration Worksheet graph. The printed graph is to be used during the road test.
- Road test the vehicle at the speed where the vibration is most noticeable. Record the vibration frequency (rpm) and the engine rpm on the worksheet graph. The point on the graph where the vibration frequency (rpm) reading and the engine rpm reading intersect indicates the specific component group causing the concern.
 - An EVA or equivalent tool capable of measuring vibration frequency and engine rpm will be needed.
- Provide pictures of diagnostic procedures to aid in testing components.

Combination EngineEAR/ChassisEAR

An electronic listening device used to quickly identify noise and the location under the chassis while the vehicle is being road tested. The ChassisEARs can identify the noise and location of damaged/worn wheel bearings, CV joints, brakes, springs, axle bearings or driveshaft carrier bearings.

EngineEAR Basic Unit

An electronic listening device used to detect even the faintest noises. The EngineEARs can detect the noise of damaged/worn bearings in generators, water pumps, A/C compressors and power steering pumps. They are also used to identify noisy lifters, exhaust manifold leaks, chipped gear teeth and for detecting wind noise. The EngineEAR has a sensing tip, amplifier, and headphones. The directional sensing tip is used to listen to the various components. Point the sensing tip at the suspect component and adjust the volume with the amplifier. Placing the tip in direct contact with a component will reveal structure-borne noise and vibrations, generated by or passing through, the component. Various volume levels can reveal different sounds.

Ultrasonic Leak Detector

The Ultrasonic Leak Detector is used to detect wind noises caused by leaks and gaps in areas where there is weather-stripping or other sealing material. It is also used to identify A/C leaks, vacuum leaks

and evaporative emission noises. The Ultrasonic Leak Detector includes a multi-directional transmitter (operating in the ultrasonic range) and a hand-held detector. The transmitter is placed inside the vehicle. On the outside of the vehicle, the hand-held detector is used to sweep the area of the suspected leak. As the source of the leak is approached, a beeping sound is produced which increases in both speed and frequency.

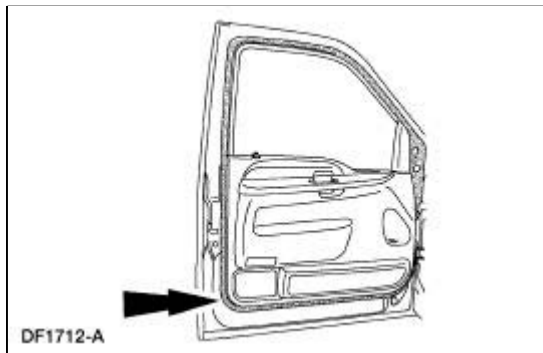
Squeak and Rattle Repair Kit

The squeak and rattle repair kit (Rotunda tool number 164-R4900) contains lubricants and self-adhesive materials that can be used to eliminate interior and exterior squeaks and rattles. The kit consists of the following materials:

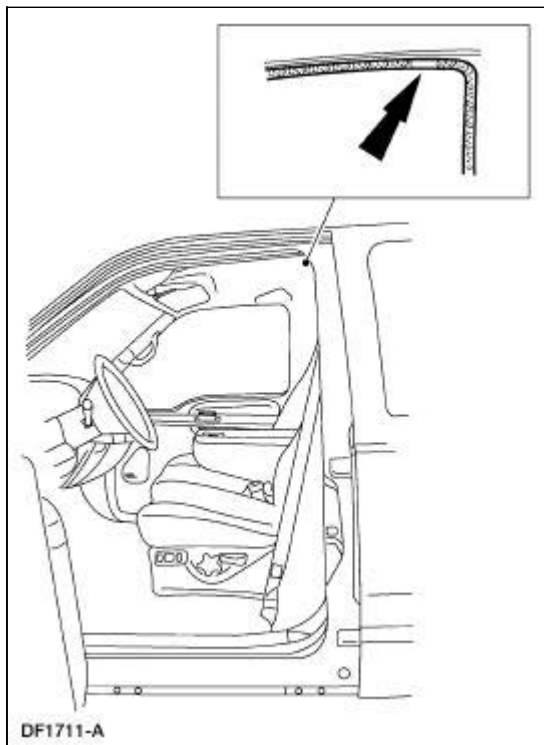
- PVC (soft foam) tape
- Urethane (hard foam) tape
- Flocked (black fuzzy) tape
- UHMW (frosted) tape
- Squeak and rattle oil tube
- Squeak and rattle grease tube

Tracing Powder

Tracing powder is used to check both the uniformity of contact and the tension of a seal against its sealing surface. These tests are usually done when a suspected air leak/noise appears to originate from the seal area or during the alignment and adjustment of a component to a weatherstrip. Tracing powder can be ordered from Crest Industries as ATR Leak Trace. Carry out the tracing powder test as follows:

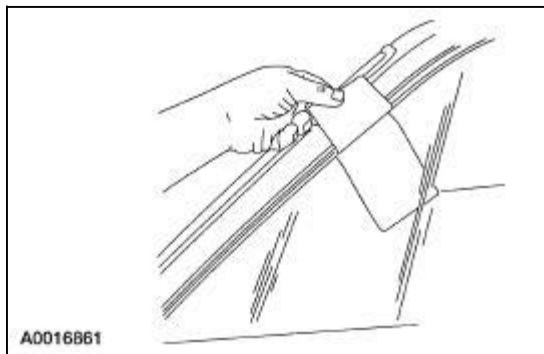


- a. Clean the weatherstrip.
- b. Spray the tracing powder on the mating surface only.
- c. Close the door completely. Do not slam the door.
- d. Open the door. An imprint is made where the weatherstrip contacted the mating surface seal. Gaps or a faint imprint will show where there is poor contact with the weatherstrip.



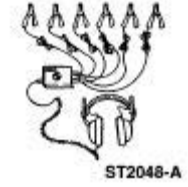



Index Card

Place an index card or a piece of paper between the weatherstrip and the sealing surface, then close the door. Slowly withdraw the index card or paper after the door is closed and check the amount of pressure on the weatherstrip. There should be a medium amount of resistance as it is withdrawn. Continue around the entire seal area. If there is little or no resistance, this indicates insufficient contact to form a good seal. At these points, the door, the glass, or the weatherstrip is out of alignment.



Noise, Vibration And Harshness (NVH)

Special Tool(s)

 ST2048-A	ChassisEAR 107-R2102 or Equivalent
 ST2311-A	Vibration Analyzer 100-F027 (014-00344) or Equivalent
 ST2312-A	EngineEAR 107-R2100 or Equivalent
 ST2314-A	Ultrasonic Leak Detector 134-R0135 or Equivalent

To assist the service advisor and the technician, a Write-up Job Aid and an NVH Diagnostic Guide are included with this material. The Write-up Job Aid serves as a place to record all important symptom information. The NVH Diagnostic Guide serves as a place to record information reported on the Write-up Job Aid as well as data from the testing to be carried out.

To begin a successful diagnosis, fill out the NVH Diagnostic Guide, record the reported findings, then proceed to each of the numbered process steps to complete the diagnosis.



"WRITE-UP" JOB AID

REPAIR ORDER # _____
CUSTOMER CONCERN # _____

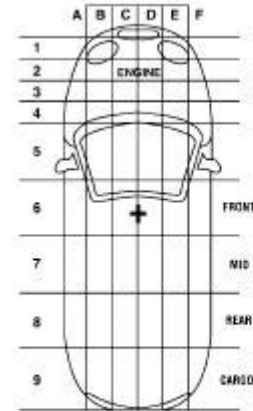
SPECIFIC SENSE IDENTIFICATION AND LOCATION ON VEHICLE OF CUSTOMER SYMPTOM(S)

INSTRUCTIONS: Check below sense affected and location of concern on the generic vehicle illustration (darken the vehicle area). Plus circle appropriate responses to the right.

NOTE: Shaded backgrounds indicate caution areas. Selection of two or more caution areas "flag" difficult repairs. In general, shaded areas are the more difficult to verify and repair, and require all applicable columns to be completed.

	SEE YES <input type="checkbox"/>		FEEL YES <input type="checkbox"/>
--	-------------------------------------	--	--------------------------------------

	HEAR YES <input type="checkbox"/>		SMELL YES <input type="checkbox"/>
--	--------------------------------------	--	---------------------------------------



VEHICLE SYMPTOM AREA	HOW OFTEN?	VEHICLE OPERATING MODE	VEHICLE CONDITIONS	VEHICLE SPEED(mph)	WHEN VEHICLE IS?	AMBIENT CONDITION
Front of Vehicle	Always	Start Up	Accessories On	0	Turning Left	Below Zero
Engine Compartment	Daily (A.M.) (P.M.)	Idle	(define below)	1-9	Turning Right	Below Freezing (0°-19°)
Dash	Conditional	Gear Selection	Windows Open	10-19	Over Bumps	Below Freezing (20°-32°)
Steering Wheel	Weekly	Accel Light	4x4	20-29	Up Hills	33°-49°
Accelerator Pedal	Monthly	Accel Moderate	Hauling	30-39	Down Hills	50°-69°
Brake Pedal	Intermittent	Accel Heavy	Towing	40-49	Shifting	70°-89°
Clutch Pedal	Unknown	Steady Speed	Snow Plowing	50-59	Parked	90°+
Seat		Deceleration	Other	60-69	In Traffic	Sunny
Rear of Vehicle		Neutral	(define below)	70+		Dry
Top of Vehicle		Reverse		ENGINE		Windy
Floor Pan		Stopping/Braking		TEMP		Wet/Humid
Under Vehicle				Cold		Rain
Other (define below)				Normal		Snow
				Hot		Ice

DEALER VERIFICATION	WHAT THE CUSTOMER SAID
SERVICE ADVISOR <input type="checkbox"/> YES <input type="checkbox"/> NO	_____
SHOP FOREMAN <input type="checkbox"/> YES <input type="checkbox"/> NO	_____
SERVICE MANAGER <input type="checkbox"/> YES <input type="checkbox"/> NO	_____
QC MANAGER <input type="checkbox"/> YES <input type="checkbox"/> NO	_____
TECHNICIAN <input type="checkbox"/> YES <input type="checkbox"/> NO	_____
VERIFIED WITH CUSTOMER <input type="checkbox"/> YES <input type="checkbox"/> NO	_____
OASIS SYMPTOM CODE(S)	VIN NUMBER
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

NVH DIAGNOSTIC GUIDE

Dealer: _____ Date: _____

P.A. Code: _____ Order No. _____ Technician: _____

Owner's Name: _____ Address: _____

Phone No. Home: _____ Work: _____

Vehicle Make: _____ Model: _____ Year: _____

VIN: _____ Mileage: _____ Engine: _____ Trans: _____ Axle: _____

OWNER'S DESCRIPTION OF COMPLAINT:

Did Condition Exist When Vehicle Was New? **Yes / No** (circle one)

How Did Condition Begin? Gradually Suddenly

At What Mileage Did it Occur Or Begin Occurring? _____

Which Driving Conditions Affect The Vehicle?

Light Accel Closed Throttle Decel Brakes Applied/Released
Medium Accel Coast (Float) Driving The Vehicle: Straight
Heavy Accel Constant Speed Cornering

Is Vibration Noticed? If So, Where:

Seat Steering Wheel Instrument Panel Floor Body Panels Ft/Rr of Vehicle

Is There Sound Or Sensation Of Sound? **Yes / No** (circle one)

If So, Describe The Sound:

Boom Hum Whine Growl Other: _____
Drone Tip-In-Moan Squeak Rattle

PREDRIVE CHECKS

Tire Condition/Pressure: _____

Vehicle Body Damage? _____

Other: _____

ROAD TEST:

Vibration/Noise Occurs:

Vehicle Speed _____ Accel _____ Vibration Frequency _____ Hz/RPM
Gear Range _____ Decel/Coast _____ Engine Speed _____ RPM

ENGINE RUN-UP TESTS

Neutral Engine Run-Up (NERU) **Yes / No** Engine RPM _____ Vibration/Frequency _____ Hz/RPM

Drive Engine Run-Up (DERU) **Yes / No** Engine RPM _____ Vibration/Frequency _____ Hz/RPM

Drivetrain Run-Up (DTRU) **Yes / No** Engine RPM _____ Vibration/Frequency _____ Hz/RPM

Indicate Suspected Area of Concern:

Tire/Wheel/Brakes Engine/Accessory Rear
Driveline/Axle Susp/Steering Right
Body Front Left
Other _____

Equipment Used:

Reed Tachometer Electronic Noise Detector Tape
Engine Tachometer Ultrasonic Leak Detector Other _____

WHEEL/TIRE/BRAKES CHECK:Balance Check **Yes / No**

Maximum Runout Allowed:

Wheel: Radial _____ Lateral _____
Tire: Radial _____ Lateral _____

Measured Runout:

Tire/Wheel Radial: LF _____ LR _____ RF _____ RR _____
Lateral: LF _____ LR _____ RF _____ RR _____
Wheel Only Radial: LF _____ LR _____ RF _____ RR _____
Lateral: LF _____ LR _____ RF _____ RR _____**SUSPENSION INSPECTION:**Can Cause: Shimmy Clunk Squeak Harshness Suspension Bushings: Loose Worn Missing OK Front Upper Control Arm Stabilizer (sway bar) Rear Lower Control Arm Front Lower Control Arm Rear Upper Control Arm Rear Upper Control Arm

Other _____

Suspension/Steering Components:

Loose Worn Missing OK

Ball Joints Idler Arm Pitman Arm Shock Absorbers F/R Center Link Steering Gear Springs F/R Tie Rod Ends/Sleeve Steering Coupler **DRIVESHAFT CONDITION:**Noise Vibration Balance Weights Missing/Other Visual Defects? **Yes / No**

Maximum Allowable Runout: _____

Actual Runout: Front _____ Middle _____ Rear _____

Two-Piece Driveshaft Runout: Front _____ Rear _____

Middle Support Bearing: Loose Damaged Worn Other _____

Suspect Driveshaft Balanced?

Yes / No**Pinion Angle:**

Engine Height: Specification _____ Actual _____

Pinion Angle: Specification _____ Actual _____

Driveline Angle - Truck:

Specification _____ Actual _____

ENGINE/ACCESSORY CHECK:

Visual Inspection for Damage or Grounded Condition:

Powertrain Mounts Fuel Lines A/C Lines Power Steering/Cooler Lines Air Intake Accessories Exhaust Radiator/Condensor **BODY (NOISE/RATTLE)**Indicate Suspected Area of Concern: Doors Windows Dash Panel Other _____

Tests Used to Isolate

NVH Concern: Vacuum/Leak Detector Ultrasonic Leak Detector Tracing Powder Electronic Noise Detector Other _____**ROAD/ENGINE RUN-UP TESTS:**Improved? **Yes / No** Vehicle Acceptable? **Yes / No**

Comments: _____

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1: Customer Interview

The diagnostic process starts with the customer interview. The service advisor must obtain as much information as possible about the concern and take a test drive with the customer. There are many ways a customer will describe NVH concerns and this will help minimize confusion arising from descriptive language differences. It is important that the concern is correctly interpreted and the customer descriptions are recorded. During the interview, ask the following questions:

- When was the concern first noticed?
- Did the concern appear suddenly or gradually?

- Did any abnormal occurrence coincide with or proceed its appearance?

Use the information gained from the customer to accurately begin the diagnostic process.

2: Pre-Drive Check

It is important to do a pre-drive check before road testing the vehicle. A pre-drive check verifies that the vehicle is relatively safe to drive and eliminates any obvious faults on the vehicle.

The pre-drive check consists of a brief visual inspection. During this brief inspection, take note of anything that will compromise safety during the road test and make those repairs or adjustments before taking the vehicle on the road.

3: Preparing for the Road Test

Observe the following when preparing for the road test:

- Review the information recorded on the NVH Diagnostic Guide. It is important to know the specific concern the customer has with the vehicle.
- Do not be misled by the reported location of the noise or vibration. The cause can actually be some distance away, transferred from another part of the vehicle.
- Remember that the vibrating source component (originator) may only generate a small vibration. This small vibration can in turn cause a larger vibration or noise to emanate from another receiving component (reactor), due to contact with other components (transfer path).
- Conduct the road test on a quiet street where it is safe to duplicate the vibration/noise. The ideal testing route is an open, low-traffic area where it is possible to operate the vehicle at the speed in which the condition occurs.
- If possible, lower the radio antenna in order to minimize turbulence. Identify anything that could potentially make noise or be a source of wind noise. Inspect the vehicle for add-on items that create vibration/noise. Turn off the radio and the heating and cooling system blower.
- The engine speed is an important factor in arriving at a final conclusion. Therefore, connect an accurate tachometer to the engine, even if the vehicle has a tachometer. Use a tachometer that has clearly defined increments of less than 50 rpm. This ensures an exact engine speed reading.

4: Verify the Customer Concern

Verify the customer concern by carrying out a road test, an engine run-up test, or both.

The decision to carry out a road test, an engine run-up test, or both depends on the type of NVH concern. A road test may be necessary if the symptom relates to the suspension system or is sensitive to torque. A drive engine run-up (DERU) or a neutral engine run-up (NERU) test identifies noises and vibrations relating to engine and drivetrain rpm. Remember, a condition will not always be identifiable by carrying out these tests, however, they will eliminate many possibilities if carried out correctly.

5: Road Test

NOTE: It may be necessary to have the customer ride along or drive the vehicle to point out the concern. During the road test, take into consideration the customer's driving habits and the driving conditions. The customer's concern just may be an acceptable operating condition for that vehicle.

The following is a brief overview of each test in the order in which it appears. A review of this information helps to quickly identify the most appropriate process necessary to make a successful diagnosis. After reviewing this information, select and carry out the appropriate test(s), proceeding to the next step of this process.

- The Slow Acceleration Test is normally the first test to carry out when identifying an NVH concern, especially when a road test with the customer is not possible.
- The Heavy Acceleration Test helps to determine if the concern is torque-related.
- The Neutral Coast Down Speed Test helps to determine if the concern is vehicle speed-related.
- The Downshift Speed Test helps to determine if the concern is engine speed-related.
- The Steering Input Test helps to determine how the wheel bearings and other suspension components contribute to a vehicle speed-related concern.
- The Brake Test helps to identify vibrations or noise that are brake related.
- The Road Test Over Bumps helps isolate a noise that occurs when driving over a rough or bumpy surface.
- The Engine Run-Up Tests consist of the Neutral Run-up Test and the Engine Load Test. These tests help to determine if the concern is engine speed-related.
- The Neutral Run-up Test is used as a follow-up test to the Downshift Speed Test when the concern occurs at idle.
- The Engine Load Test helps to identify vibration/noise sensitive to engine load or torque. It also helps to reproduce engine speed-related concerns that cannot be duplicated when carrying out the Neutral Run-up Test or the Neutral Coast Down Test.
- The Engine Accessory Test helps to locate faulty belts and accessories that cause engine speed-related concerns.
- The Vehicle Cold Soak Procedure helps to identify concerns occurring during initial start-up and when an extended time lapse occurs between vehicle usage.

Slow Acceleration Test

To carry out this test, proceed as follows:

- Slowly accelerate to the speed where the reported concern occurs. Note the vehicle speed, the engine rpm and, if possible, determine the vibration frequency.
- Attempt to identify from what part of the vehicle the concern is coming.
- Attempt to identify the source of the concern.
- Proceed as necessary.

Heavy Acceleration Test

To carry out this test, proceed as follows:

- Accelerate hard from 0-64 km/h (0-40 mph).
- Decelerate in a lower gear.
- The concern is torque related if duplicated while carrying out this test.
- Proceed as necessary.

Neutral Coast Down Speed Test

To carry out this test, proceed as follows:

- Drive at a higher rate of speed than where the concern occurred when carrying out the Slow Acceleration Test.
- Place the transmission in NEUTRAL and coast down past the speed where the concern occurs.
- The concern is vehicle speed-related if duplicated while carrying out this test. This eliminates the engine and the torque converter as sources.
- If the concern was not duplicated while carrying out this test, carry out the Downshift Speed Test to verify if the concern is engine speed related.
- Proceed as necessary.

Downshift Speed Test

To carry out this test, proceed as follows:

- Shift into a lower gear than the gear used when carrying out the Slow Acceleration Test.
- Drive at the engine rpm where the concern occurs.
- The concern is engine speed related if duplicated while carrying out this test. This eliminates the tires, wheels, brakes and the suspension components as sources.
- If necessary, repeat this test using other gears and NEUTRAL to verify the results.
- Proceed as necessary.

Steering Input Test

To carry out this test, proceed as follows:

- Drive at the speed where the concern occurs, while making sweeping turns in both directions.
- If the concern goes away or gets worse, the wheel bearings, hubs, U-joints (contained in the axles of 4WD applications), and tire tread wear are all possible sources.
- Proceed as necessary.

Brake Test

To carry out this test, proceed as follows:

- Warm the brakes by slowing the vehicle a few times from 80–32 km/h (50–20 mph) using light braking applications. At highway speeds of 89–97 km/h (50–60 mph), apply the brake using a light pedal force.
- Accelerate to 89–97 km/h (55–60 mph).
- Lightly apply the brakes and slow the vehicle to 30 km/h (20 mph).
- A brake vibration noise can be felt in the steering wheel, seat or brake pedal. A brake noise can be heard upon brake application and diminish when the brake is released.

Road Test Over Bumps

To carry out this test, proceed as follows:

- Drive the vehicle over a bump or rough surface one wheel at a time to determine if the noise is coming from the front or the back and the left or the right side of the vehicle.
- Proceed as necessary.


Neutral Engine Run-up (NERU) Test


To carry out this test, proceed as follows:

- Install a tachometer.
- Increase the engine rpm up from an idle to approximately 4000 rpm while in PARK on front wheel drive vehicles with automatic transmissions, or NEUTRAL for all other vehicles. Note the engine rpm and, if possible, determine the vibration frequency.
- Attempt to identify what part of the vehicle the concern is coming from.
- Attempt to identify the source of the concern.
- Proceed as necessary.

Drive Engine Run-up (DERU) Load Test

To carry out this test, proceed as follows:

-  **WARNING: Block the front and rear wheels, and apply the parking brake and the service brake, or injury to personnel can result.**


 **CAUTION: Do not carry out the Engine Load Test for more than five seconds or damage to the transmission or transaxle can result.**


Block the front and rear wheels.

- Apply the parking brake and the service brake.
- Install a tachometer.
- Shift the transmission into DRIVE, and increase and decrease the engine rpm between an idle to approximately 2000 rpm. Note the engine rpm and, if possible, determine the vibration frequency.
- Repeat the test in REVERSE.
- If the vibration/noise is duplicated when carrying out this test, inspect the engine and transmission or transaxle mounts.
- If the concern is definitely engine speed-related, carry out the Engine Accessory Test to narrow down the source.
- Proceed as necessary.

Engine Accessory Test

To carry out this test, proceed as follows:

-  **WARNING: Block the front and rear wheels, and apply the parking brake and the service brake, or injury to personnel can result.**

 **CAUTION: Limit engine running time to one minute or less with belts removed or serious engine damage will result.**


NOTE: A serpentine drive belt decreases the usefulness of this test. In these cases, use a vibration analyzer, such as the VA, to pinpoint accessory vibrations. An electronic listening device, such as an EngineEAR, will also help to identify noises from specific accessories.

Remove the accessory drive belts.

- Increase the engine rpm to where the concern occurs.
- If the vibration/noise is duplicated when carrying out this test, the belts and accessories are not sources.
- If the vibration/noise was not duplicated when carrying out this test, install each accessory belt, one at a time, to locate the source.

Vehicle Cold Soak Procedure

To carry out this procedure, proceed as follows:

- Test preparations include matching customer conditions (if known). If not known, document the test conditions: gear selection and engine rpm. Monitor the vibration/noise duration with a watch for up to three minutes.
- Park the vehicle where testing will occur. The vehicle must remain at or below the concern temperature (if known) for 6-8 hours.
- Before starting the engine, conduct a visual inspection under the hood.
- Turn the key on, but do not start the engine. Listen for the fuel pump, anti-lock brake system (ABS) and air suspension system noises.
- Start the engine.
-  **CAUTION: Never probe moving parts.**

Isolate the vibration/noise by carefully listening. Move around the vehicle while listening to find the general location of the vibration/noise. Then, search for a more precise location by using a stethoscope or EngineEAR.

- Refer to Idle Noise/Vibration in the Symptom Chart to assist with the diagnosis.

6: Check OASIS/TSBs/Repair History

After verifying the customer concern, check for OASIS reports, TSBs and the vehicle repair history for related concerns. If information relating to a diagnosis/repair is found, carry out the procedure(s) specified in that information.

If no information is available from these sources, carry out the vehicle preliminary inspection to eliminate any obvious faults.

7: Diagnostic Procedure

Qualifying the concern by the particular sensation present can help narrow down the concern. Always use the "symptom" to "system" to "component" to "cause" diagnosis technique. This diagnostic method divides the problem into related areas to correct the customer concern.

- Verify the "symptom".
- Determine which "system(s)" can cause the "symptom".

- If a vibration concern is vehicle speed related, the tire and wheel rpm/frequency or driveshaft frequency should be calculated.
- If a vibration concern is engine speed related, the engine, engine accessory or engine firing frequencies should be calculated.
- After determining the "system", use the diagnostic tools to identify the worn or damaged "components".
- After identifying the "components", try to find the "cause" of the failure.

Once the concern is narrowed down to a symptom/condition, proceed to NVH Condition and Symptom Categories.

NVH Condition and Symptom Categories

A good diagnostic process is a logical sequence of steps that lead to the identification of a causal system. Use the condition and symptom categories as follows:

- Identify the operating condition that the vehicle is exhibiting.
- Match the operating condition to the symptom.
- Verify the symptom.
- Identify which category or system could cause the symptom.
- Refer to the diagnostic symptom chart that is referred to.

Operating Condition—Vehicle is Not Moving

1. Static operation
 - Noise occurs during component/system functioning. GO to [Symptom Chart — Squeak and Rattle](#) .
2. While cranking
 1. Grinding or whine, differential ring gear or starter motor pinion noise. GO to [Symptom Chart — Engine Noise/Vibration](#) .
 2. Rattle. Exhaust hanger, exhaust heat shield or A/C line noise. GO to [Symptom Chart — Squeak and Rattle](#) .
 3. Vibration. Acceptable condition.
3. At idle
 - Idle noise. GO to [Symptom Chart — Idle Noise/Vibration](#) .
 - Idle vibration or shake. GO to [Symptom Chart — Idle Noise/Vibration](#) .
4. During Gear Selection
 1. Vehicle parked on a steep incline. Acceptable noise.
 2. Vehicle parked on a flat surface. GO to [Symptom Chart — Driveline Noise/Vibration](#) .
 3. Vehicle with a manual transmission. GO to [Symptom Chart — Transmission \(Manual\) and Transfer Case Noise/Vibration](#) .

Operating Condition—Vehicle is Moving

1. Depends more on how the vehicle is operated
 1. Speed related
 - Related to vehicle speed

- Pitch increases with vehicle speed. GO to [Symptom Chart — Tire Noise/Vibration](#).
 - Noise occurs at specific vehicle speed. A high-pitched noise (whine). GO to [Symptom Chart — Driveline Noise/Vibration](#).
 - Loudness proportional to vehicle speed. Low-frequency noise at high speeds, noise and loudness increase with speed. GO to [Symptom Chart — Driveline Noise/Vibration](#).
 - A low-pitched noise (drumming). GO to [Symptom Chart — Engine Noise/Vibration](#).
 - Vibration occurs at a particular speed (mph) regardless of acceleration or deceleration. GO to [Symptom Chart — Tire Noise/Vibration](#).
 - Noise varies with wind/vehicle speed and direction. GO to [Symptom Chart — Air Leak and Wind Noise](#).
- Related to engine speed.
 - Noise varies with engine rpm. GO to [Symptom Chart — Engine Noise/Vibration](#).
 - Vibration occurs at a particular speed (mph) regardless of engine speed (rpm).
2. Acceleration
- Wide open throttle (WOT)
 - Engine induced contact between components. Inspect and repair as necessary.
 - Noise is continuous throughout WOT. Exhaust system or engine ground out. GO to [Symptom Chart — Engine Noise/Vibration](#).
 - Light/moderate acceleration
 - Tip-in moan. Engine/exhaust noise. GO to [Symptom Chart — Engine Noise/Vibration](#).
 - Knock-type noise. GO to [Symptom Chart — Engine Noise/Vibration](#).
 - Driveline shudder. GO to [Symptom Chart — Driveline Noise/Vibration](#).
 - Engine vibration. GO to [Symptom Chart — Engine Noise/Vibration](#).
3. Turning noise. GO to [Symptom Chart — Steering Noise/Vibration](#).
4. Braking
- Clicking sound is signaling ABS is active. Acceptable ABS sound.
 - A continuous grinding/squeal. GO to [Symptom Chart — Brake Noise/Vibration](#).
 - Brake vibration/shudder. GO to [Symptom Chart — Brake Noise/Vibration](#).
5. Clutching
- A noise occurring during clutch operation. GO to [Symptom Chart — Transmission \(Manual\) and Transfer Case Noise/Vibration](#).
 - Vibration. GO to [Symptom Chart — Transmission \(Manual\) and Transfer Case Noise/Vibration](#).
6. Shifting
- Noise or vibration condition related to the transmission (automatic). GO to [Symptom Chart — Transmission \(Automatic\) Noise/Vibration](#).
 - Noise or vibration related to the transmission (manual). GO to [Symptom Chart — Transmission \(Manual\) and Transfer Case Noise/Vibration](#).
7. Engaged in four-wheel drive. GO to [Symptom Chart — Transmission \(Manual\) and Transfer Case Noise/Vibration](#).
8. Cruising speeds
- Accelerator pedal vibration. GO to [Symptom Chart — Engine Noise/Vibration](#).

- Driveline vibration. GO to [Symptom Chart — Driveline Noise/Vibration](#) .
 - A shimmy or shake. GO to [Symptom Chart — Tire Noise/Vibration](#) .
9. Driving at low/medium speeds
- A wobble or shudder. GO to [Symptom Chart — Tire Noise/Vibration](#) .
2. Depends more on where the vehicle is operated
1. Bump/pothole, rough road or smooth road. GO to [Symptom Chart — Suspension Noise/Vibration](#) .
- Noise is random or intermittent occurring from road irregularities. GO to [Symptom Chart — Squeak and Rattle](#) .
 - Noise or vibration changes from one road surface to another. Normal sound changes.
 - Noise or vibration associated with a hard/firm ride. GO to [Symptom Chart — Suspension Noise/Vibration](#) .

Symptom Charts

Symptom Chart — Air Leak and Wind Noise

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Air leak around door perimeter 	<ul style="list-style-type: none"> ● Loose fit seal. ● Seal installed incorrectly. ● Door misaligned. ● Scuff plate installed incorrectly. ● Seal or seal push pins damaged. 	<ul style="list-style-type: none"> ● PINCH the seal carrier to improve retention on the seal flange. ● REINSTALL the seal. ● REALIGN the door. CHECK door gaps and fit in the door opening and ADJUST as necessary. ● REINSTALL the scuff plate. ● INSTALL a new seal.
<ul style="list-style-type: none"> ● Air leak around glass run 	<ul style="list-style-type: none"> ● Door glass misaligned. ● Glass run installed incorrectly. ● Leak path behind glass run. ● Glass run channel spread wide. ● Blow-out clip bent or contacting door glass. ● Glass run damaged. 	<ul style="list-style-type: none"> ● ADJUST the door glass. ● ADJUST the glass run. INSERT foam in the glass run carrier. ● INSTALL foam rope behind the glass run. ● PINCH the glass run channel to reduce the size of the opening. ● ADJUST the blow-out clip or INSTALL a new glass run/blow-out clip molding assembly. ● INSTALL a new glass run.
<ul style="list-style-type: none"> ● Air leak at inner belt line 	<ul style="list-style-type: none"> ● Belt line seal installed incorrectly on flange. ● Belt line seal integrated 	<ul style="list-style-type: none"> ● ADJUST the seal. (Do not bend the flange.) ● REINSTALL the door trim.

	<p>with door trim installed incorrectly (no glass contact).</p> <ul style="list-style-type: none"> ● No contact with side glass. ● No contact with glass runs at both ends of belt line seal. ● Belt line seal damaged. 	<ul style="list-style-type: none"> ● ADJUST the door glass. ● ADJUST the belt line seal or ADD foam at the seal ends. ● INSTALL a new seal.
<ul style="list-style-type: none"> ● Air leak at outer belt line 	<ul style="list-style-type: none"> ● Belt line seal installed incorrectly on flange (no glass contact). ● Belt line seal does not contact the glass. ● No contact with glass runs at both ends of belt line seal. ● Belt line seal damaged. 	<ul style="list-style-type: none"> ● ADJUST the seal. ● ADJUST the door glass. ● ADJUST the belt line seal/ADD foam at the seal ends. ● INSTALL a new seal.
<ul style="list-style-type: none"> ● Draft at inner door handle/speaker opening 	<ul style="list-style-type: none"> ● Hole in watershield. ● Watershield misaligned. ● Exterior door handle seal misaligned/damaged. 	<ul style="list-style-type: none"> ● SEAL the hole with a suitable tape. ● REALIGN the watershield. INSTALL a new watershield if the pressure sensitive adhesive fails. ● REALIGN or INSTALL a new seal as necessary.
<ul style="list-style-type: none"> ● Wind noise from side view mirror 	<ul style="list-style-type: none"> ● Outside mirror housing misaligned. ● Mirror sail gasket folded/misaligned. ● Mirror housing trim cap installed incorrectly. ● Air leak through mirror housing hinge. ● Inner sail trim installed incorrectly. ● Inner sail gasket/barrier installed incorrectly. ● Air path through wiring bundle/fastener access holes. ● Exposed fastener access hole on mirror 	<ul style="list-style-type: none"> ● REALIGN with the edges shingled correctly and no gaps. ● REINSTALL with the gasket unfolded and aligned correctly. ● REINSTALL with the edges shingled to the air flow. ● Fully ENGAGE the mirror into its operating position/USE foam to block the air path through the hinge. ● REINSTALL the sail trim/ADJUST the door trim. ● REINSTALL the trim cover with the gasket/barrier aligned correctly. ● BLOCK the air path(s) with foam/tape. ● INSTALL a new cap if it is missing.

	housing/sail.	
<ul style="list-style-type: none"> ● Air leak around perimeter of fixed glass 	<ul style="list-style-type: none"> ● Gaps in the sealant bead. ● Air traveling up windshield molding along A-pillar. ● Windshield/backlite misaligned or not installed correctly. ● Rear hood seal at base of windshield misaligned/damaged. 	<ul style="list-style-type: none"> ● APPLY approved sealant. ● INSTALL foam rope the full length of the A-pillar. ● REINSTALL the windshield/backlite. ● REALIGN or INSTALL a new seal as necessary.
<ul style="list-style-type: none"> ● Air leak at cowl 	<ul style="list-style-type: none"> ● Cowl gasket misaligned/damaged. 	<ul style="list-style-type: none"> ● REALIGN or INSTALL a new seal as necessary.
<ul style="list-style-type: none"> ● Air leak around liftgate perimeter 	<ul style="list-style-type: none"> ● Loose fit seal. ● Seal misaligned. ● Liftgate misaligned. ● Scuff plate misaligned. ● Seal or seal push pins damaged. 	<ul style="list-style-type: none"> ● PINCH the seal carrier to improve retention on the seal flange or INSERT foam in the carrier. ● REINSTALL the seal. ● REALIGN the liftgate. CHECK the liftgate fit in the body opening and ADJUST as necessary. ● REINSTALL the scuff plate. ● INSTALL a new seal.
<ul style="list-style-type: none"> ● Air leak around the liftgate flip window perimeter 	<ul style="list-style-type: none"> ● Loose fit seal. ● Seal misaligned. ● Glass misaligned. ● Seal damaged. 	<ul style="list-style-type: none"> ● PINCH the seal carrier to improve the retention to the seal flange. ● REINSTALL the seal. ● REALIGN the glass. ● INSTALL a new seal.
<ul style="list-style-type: none"> ● Wind noise from antenna 	<ul style="list-style-type: none"> ● Shape of antenna. ● Air leak around antenna cable access hole. 	<ul style="list-style-type: none"> ● INSTALL an antenna boot or a spiral antenna. ● INSPECT the antenna access hole grommet. REPAIR as necessary.
<ul style="list-style-type: none"> ● Air leak from closed roof opening panel 	<ul style="list-style-type: none"> ● Seal installed incorrectly. ● Roof opening panel glass/door misaligned. ● Roof opening panel damaged. 	<ul style="list-style-type: none"> ● REINSTALL the seal. ● REALIGN the roof opening panel glass/door. ● INSTALL a new roof opening panel.
<ul style="list-style-type: none"> ● Buffeting from an open roof opening panel 	<ul style="list-style-type: none"> ● Wind deflector inoperative/damaged. ● Wind deflector height incorrect. 	<ul style="list-style-type: none"> ● REPAIR or INSTALL a new wind deflector as necessary. ● ADJUST the wind deflector higher.
<ul style="list-style-type: none"> ● Wind noise 	<ul style="list-style-type: none"> ● Fender splash shield 	<ul style="list-style-type: none"> ● REALIGN the fender

<p>created by airflow over or behind body panels</p>	<p>misaligned.</p> <ul style="list-style-type: none"> ● Body panel misaligned (exposed edge). ● Hood misaligned (front margin). ● Front grille edge noise. 	<p>splash shield.</p> <ul style="list-style-type: none"> ● REALIGN the appropriate body panel. ● CHECK hood gaps and fit. ADJUST the hood as necessary. ● APPLY foam in the hollow areas behind the louvers.
<ul style="list-style-type: none"> ● Wind noise created by grille opening panel 	<ul style="list-style-type: none"> ● Grille relationship to leading edge on hood. ● Sharp edges due to material imperfections. 	<ul style="list-style-type: none"> ● ADJUST the grille opening panel forward to eliminate wind noise. ● REMOVE the sharp edges (no damage to visible surface).
<ul style="list-style-type: none"> ● Wind noise from air extractor 	<ul style="list-style-type: none"> ● Air extractor housing seated incorrectly. ● Air extractor housing or flaps damaged. 	<ul style="list-style-type: none"> ● REINSTALL the air extractor housing. ● INSTALL a new air extractor.
<ul style="list-style-type: none"> ● Air leak at top of A-pillar — vehicles with a convertible top 	<ul style="list-style-type: none"> ● Seal at windshield header installed incorrectly. ● Seal pinched. ● Gap between side rail and header seal at A-pillar. 	<ul style="list-style-type: none"> ● REINSTALL the seal. ● FILL the seal with foam to reshape it. ● ADJUST the J-hook/vinyl top.
<ul style="list-style-type: none"> ● Air leak at rear quarter glass (division bar) — vehicles with a convertible top 	<ul style="list-style-type: none"> ● No contact between front side glass and quarter glass division bar. 	<ul style="list-style-type: none"> ● ADJUST the front side glass regulator and the rear quarter glass regulator.
<ul style="list-style-type: none"> ● Air leak or wind noise from top of side glass — vehicles with a convertible top 	<ul style="list-style-type: none"> ● Gap between side rail and vinyl top. ● Seal at windshield header installed incorrectly. ● Seal damaged between side rail and vinyl top. ● Vinyl top damaged. 	<ul style="list-style-type: none"> ● ADD additional foam tape to seal between the side rail and the vinyl top. ● REINSTALL the seal. ● INSTALL a new seal. ● INSPECT the vinyl top. INSTALL a new vinyl top as necessary.
<ul style="list-style-type: none"> ● Air leak or wind noise at windshield header — vehicles with a convertible top 	<ul style="list-style-type: none"> ● Vinyl top not flush with header. 	<ul style="list-style-type: none"> ● ADJUST the J-hook to lower the top to achieve a flush condition.

	<ul style="list-style-type: none"> ● Seal at windshield header installed incorrectly. ● Header seal not flush with header. 	<ul style="list-style-type: none"> ● REINSTALL the seal. ● REINSTALL the seal.
<ul style="list-style-type: none"> ● Convertible top flapping with the top up 	<ul style="list-style-type: none"> ● Vinyl top contacting interior headliner. 	<ul style="list-style-type: none"> ● Working from front to back, INSTALL a 6.35 mm (0.25 in) foam sheet between the headliner and the vinyl top at the suspected area. Allow a clearance of 50 mm (2 in) - 75 mm (3 in) away from the roof bows and the side rails.
<ul style="list-style-type: none"> ● Noise from roof rack 	<ul style="list-style-type: none"> ● Roof rack rails or crossbars loose. ● Roof rack fasteners missing. ● Roof rack crossbars installed backward. ● Roof rack rub strips partially lifting from roof. ● Roof rack gaskets loose or misaligned. 	<ul style="list-style-type: none"> ● TIGHTEN the fasteners. ● INSTALL the approved fasteners. ● REINSTALL the crossbars. ● REAPPLY adhesive or fasteners or INSTALL new rub strips as necessary. ● REINSTALL the gasket.
<ul style="list-style-type: none"> ● Wind noise from bug shield/exterior windshield sun visor 	<ul style="list-style-type: none"> ● Turbulence created by location and shape. 	<ul style="list-style-type: none"> ● REMOVE per customer direction if it is a dealer installed option.

Symptom Chart—Brake Noise/Vibration

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Rattling noise 	<ul style="list-style-type: none"> ● Caliper mounting bolts loose. ● Damaged or worn caliper pins or retainers. ● Missing or damaged anti-rattle clips or springs. ● Loose brake disc shield. 	<ul style="list-style-type: none"> ● CHECK the caliper bolts. TIGHTEN to specifications. ● CHECK the caliper pins and retainers for lubrication and correct fit. LUBRICATE or INSTALL new components as necessary. REFER to Section 206-03 for front disc brake pads or Section 206-04 for rear disc brake pads. ● CHECK the brake pads for missing clips or broken springs. INSTALL new components as necessary. REFER to Section 206-03 for front disc brake pads or Section 206-04 for rear disc brake pads. ● TIGHTEN the brake disc shield bolts to specification. REFER to Section 206-03

		for front disc brake pads or Section 206-04 for rear disc brake pads.
<ul style="list-style-type: none"> ● Clicking noise—with brakes applied with ABS brakes 	<ul style="list-style-type: none"> ● ABS hydraulic control unit. 	<ul style="list-style-type: none"> ● Acceptable condition.
<ul style="list-style-type: none"> ● Squealing noise—occurs on first (morning) brake application 	<ul style="list-style-type: none"> ● Disc brake pads. 	<ul style="list-style-type: none"> ● Acceptable condition. Caused by humidity and low disc brake pad temperature.
<ul style="list-style-type: none"> ● Squealing noise—a continuous squeal 	<ul style="list-style-type: none"> ● Disc brake pads or linings worn below minimum thickness. 	<ul style="list-style-type: none"> ● INSTALL new disc brake pads. REFER to Section 206-03 for front disc brake pads or Section 206-04 for rear disc brake pads.
<ul style="list-style-type: none"> ● Squealing noise—an intermittent squeal brought on by cold, heat, water, mud or snow 	<ul style="list-style-type: none"> ● Disc brake pads. 	<ul style="list-style-type: none"> ● Acceptable condition.
<ul style="list-style-type: none"> ● Groaning noise—occurs at low speeds with brake lightly applied (creeping) 	<ul style="list-style-type: none"> ● Disc brake pads. 	<ul style="list-style-type: none"> ● Acceptable condition.
<ul style="list-style-type: none"> ● Grinding noise—continuous 	<ul style="list-style-type: none"> ● Disc brake pads or linings worn below minimum thickness. 	<ul style="list-style-type: none"> ● INSPECT the disc brake pads, brake discs/drums and attaching hardware for damage. REPAIR or INSTALL new components as necessary. REFER to Section 206-03 for front disc brake pads or Section 206-04 for rear disc brake pads.
<ul style="list-style-type: none"> ● Moaning noise 	<ul style="list-style-type: none"> ● Brake linings contaminated with grease or oil. 	<ul style="list-style-type: none"> ● INSPECT the brake pads and shoes for contamination. REPAIR or INSTALL new components as necessary.
<ul style="list-style-type: none"> ● Brake vibration/shudder—occurs when brakes are applied 	<ul style="list-style-type: none"> ● Uneven disc or drum wear. ● Uneven disc brake pad or lining transfer. ● Suspension components. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test A .
<ul style="list-style-type: none"> ● Brake vibration/shudder—occurs when the brake pedal is released 	<ul style="list-style-type: none"> ● Brake drag. 	<ul style="list-style-type: none"> ● INSPECT the disc brake pads or linings for premature wear. REPAIR or INSTALL a new caliper or wheel cylinder as necessary. REFER to Section 206-03 for front disc brake pads or Section 206-04 for rear disc brake pads

Symptom Chart—Driveline Noise/Vibration

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Axle howling or whine—front or rear axle 	<ul style="list-style-type: none"> ● Axle lubricant low. ● Axle housing damage. ● Damaged or worn wheel bearings or axle bearings. ● Damaged or worn differential ring and pinion. ● Damaged or worn differential side or pinion bearings. ● Damaged or worn differential side gears and pinion gears. 	<ul style="list-style-type: none"> ● CHECK the lubricant level. FILL the axle to specification. REFER to Section 205-02. ● INSPECT the axle housing for damage. REPAIR or INSTALL a new axle as necessary. REFER to Section 205-02. ● CHECK for abnormal wheel bearing play or roughness. Refer to Wheel Bearing Check in this section. ADJUST or INSTALL new wheel bearings as necessary. ● INSPECT the ring and pinion ring for abnormal wear patterns or broken teeth. INSTALL a new ring and pinion as necessary. REFER to Section 205-02. ● CHECK for abnormal bearing play or roughness. INSTALL new bearings as necessary. REFER to Section 205-02. ● DISASSEMBLE the differential carrier. INSPECT the side and pinion gears for abnormal wear patterns or broken teeth. INSTALL new gears as necessary. REFER to Section 205-02.
<ul style="list-style-type: none"> ● Driveline clunk—loud clunk when shifting from reverse to drive 	<ul style="list-style-type: none"> ● Incorrect axle lubricant level. ● Excessive backlash in the axle or transmission. ● Damaged or worn pinion bearings. ● Damaged or worn universal joints (U-joints). ● Loose suspension components. ● Broken powertrain 	<ul style="list-style-type: none"> ● CHECK the lubricant level. FILL the axle to specification. REFER to Section 205-02. ● CARRY OUT a total backlash check. REFER to Section 205-00. ● CHECK for abnormal bearing play or roughness. INSTALL new bearings as necessary. REFER to Section 205-02. ● INSPECT the U-joints for wear or damage. INSTALL new U-joints as necessary. REFER to Section 205-01. ● INSPECT the suspension for damage or wear. REPAIR or INSTALL new components as necessary. ● INSPECT the powertrain mounts. CARRY OUT

	<p>mounts.</p> <ul style="list-style-type: none"> ● Idle speed too high. 	<p><u>Powertrain/Drivetrain Mount Neutralizing</u> in this section. INSTALL new mounts as necessary. REFER to <u>Section 303-01A</u> for the 3.0L engine, <u>Section 303-01B</u> for the 3.9L engine, <u>Section 307-01</u> for automatic transmissions and <u>Section 308-03</u> for manual transmissions.</p> <ul style="list-style-type: none"> ● CHECK for the correct idle speed.
<ul style="list-style-type: none"> ● Driveline clunk—occurs as the vehicle starts to move forward following a stop 	<ul style="list-style-type: none"> ● Worn or galled driveshaft slip-yoke splines. ● Worn or galled driveshaft and coupling shaft splines. ● Loose rear leaf spring U-bolts. 	<ul style="list-style-type: none"> ● CLEAN and INSPECT the splines of the yoke for a worn or galled condition. INSTALL a new yoke as necessary. REFER to <u>Section 205-01</u>. ● CLEAN and INSPECT the splines of the driveshaft and coupling shaft for a worn or galled condition. INSTALL a new driveshaft assembly as necessary. REFER to <u>Section 205-01</u>. ● CHECK the U-bolts for loose nuts. TIGHTEN to specification.
<ul style="list-style-type: none"> ● Driveline clunk (FWD vehicles)—occurs during acceleration or from cruise to coast/deceleration 	<ul style="list-style-type: none"> ● Damaged or worn inboard constant velocity CV joint. 	<ul style="list-style-type: none"> ● INSPECT the inboard CV joint and boot. REPAIR or INSTALL a new CV joint as necessary.
<ul style="list-style-type: none"> ● Driveline clunk (4WD vehicles)—occurs during shift-on-the-fly engagement 	<ul style="list-style-type: none"> ● Clutch relay. ● Shift motor. ● Transfer case. ● GEM. 	<ul style="list-style-type: none"> ● CHECK the 4WD engagement system. REPAIR or INSTALL new components as necessary.
<ul style="list-style-type: none"> ● Clicking, popping or grinding—occurs while vehicle is turning 	<ul style="list-style-type: none"> ● Inadequate or contaminated lubrication in the CV joints. ● Another component contacting the halfshaft. ● Brake components. ● Steering components. ● Suspension components. 	<ul style="list-style-type: none"> ● CHECK the CV boots and joints for wear or damage. REPAIR or INSTALL new components as necessary. REFER to <u>Section 205-05</u>. ● CHECK the halfshafts and the area around the halfshafts. REPAIR as necessary. ● INSPECT the front brakes for wear or damage. REPAIR as necessary. REFER to <u>Section 206-03</u>. ● INSPECT the drag link, inner and outer tie-rods or idler arm for wear or damage. REPAIR as necessary. REFER to <u>Section 211-02</u>. ● INSPECT the upper and lower ball joints for wear or

	<ul style="list-style-type: none"> ● Damaged or worn wheel bearings. 	<p>damage. REPAIR as necessary. REFER to Section 204-01.</p> <ul style="list-style-type: none"> ● CHECK for abnormal wheel bearing play or roughness. Refer to Wheel Bearing Check in this section. ADJUST or INSTALL new wheel bearings as necessary.
<ul style="list-style-type: none"> ● Clicking or snapping—occurs when accelerating around a corner 	<ul style="list-style-type: none"> ● Damaged or worn outboard CV joint. 	<ul style="list-style-type: none"> ● INSPECT the outboard CV joint and boot. REPAIR or INSTALL a new CV joint as necessary. REFER to Section 205-05.
<ul style="list-style-type: none"> ● High pitched chattering—noise from the rear axle when the vehicle is turning 	<ul style="list-style-type: none"> ● Incorrect or contaminated lubricant. ● Damaged or worn differential (differential side gears and pinion gears). 	<ul style="list-style-type: none"> ● CHECK the vehicle by driving in tight circles (5 clockwise, 5 counterclockwise). FLUSH and REFILL with the specified rear axle lubricant and friction modifier as necessary. ● DISASSEMBLE the differential assembly. INSPECT the differential case, pin and gears for wear or damage. REPAIR or INSTALL a new differential as necessary. REFER to Section 205-02.
<ul style="list-style-type: none"> ● Buzz—buzzing noise is the same at cruise or coast/deceleration 	<ul style="list-style-type: none"> ● Damaged or worn tires. ● Incorrect driveline angles. 	<ul style="list-style-type: none"> ● CHECK for abnormal tire wear or damage. INSTALL new tire(s) as necessary. REFER to Section 204-04. ● CHECK for correct driveline angles. REPAIR as necessary. REFER to Section 205-00.
<ul style="list-style-type: none"> ● Rumble or boom—noise occurs at coast/deceleration, usually driveshaft speed related and noticeable over a wide range of speeds 	<ul style="list-style-type: none"> ● Driveshaft is out-of-balance. ● U-joints binding or seized. ● Excessive pinion flange runout. 	<ul style="list-style-type: none"> ● CHECK the driveshaft for damage, missing balance weights or undercoating. CHECK the driveshaft balance. CARRY OUT a driveline vibration test. REFER to Section 205-00. ● ROTATE the driveshaft and CHECK for rough operation or seized U-joints. INSTALL new U-joints as necessary. REFER to Section 205-01. ● CARRY OUT a runout check. REPAIR as necessary. REFER to Section 205-00.
<ul style="list-style-type: none"> ● Grunting—normally associated with a shudder experienced during acceleration 	<ul style="list-style-type: none"> ● Driveshaft slip yoke binding. 	<ul style="list-style-type: none"> ● CLEAN and LUBRICATE the male and female splines.

<p>from a dead stop</p>	<ul style="list-style-type: none"> ● Loose rear spring U-bolts. 	<ul style="list-style-type: none"> ● INSPECT the rear suspension. TIGHTEN the U-bolt nuts to specification.
<ul style="list-style-type: none"> ● Howl—can occur at various speeds and driving conditions. Affected by acceleration and deceleration 	<ul style="list-style-type: none"> ● Incorrect ring and pinion contact, incorrect bearing preload or gear damage. 	<ul style="list-style-type: none"> ● CHECK the ring and pinion and bearings for damage. INSPECT the ring and pinion wear pattern. REFER to Checking Tooth Contact Pattern and Condition of the Ring and Pinion component test in this section. ADJUST or INSTALL new components as necessary. REFER to Section 205-02.
<ul style="list-style-type: none"> ● Chuckle—heard at coast/deceleration. Also described as a knock 	<ul style="list-style-type: none"> ● Incorrect ring and pinion contact or by damaged teeth on the coast side of the ring and pinion. 	<ul style="list-style-type: none"> ● CHECK the ring and pinion for damage. INSPECT the ring and pinion wear pattern. REFER to Checking Tooth Contact Pattern and Condition of the Ring and Pinion component test in this section. ADJUST or INSTALL new components as necessary. REFER to Section 205-02.
<ul style="list-style-type: none"> ● Knock—noise occurs at various speeds. Not affected by acceleration or deceleration 	<ul style="list-style-type: none"> ● Gear tooth damage to the drive side of the ring and pinion. ● Excessive axle shaft end play. (Vehicles with integral axles). 	<ul style="list-style-type: none"> ● CHECK the differential case and ring and pinion for damage. INSTALL new components as necessary. REFER to Section 205-02. ● CHECK the axle end play using a dial indicator. INSTALL a new axle shaft or side gears as necessary. REFER to Section 205-02.
<ul style="list-style-type: none"> ● Scraping noise—a continuous low pitched noise starting at low speeds 	<ul style="list-style-type: none"> ● Worn or damaged pinion bearings. 	<ul style="list-style-type: none"> ● CHECK the pinion bearings. INSTALL new pinion bearings as necessary. REFER to Section 205-02.
<ul style="list-style-type: none"> ● Driveline shudder—occurs during acceleration from a slow speed or stop 	<ul style="list-style-type: none"> ● Rear drive axle assembly mispositioned. ● Loose rear spring U-bolts. ● Incorrect or high CV joint operating angle. ● Damaged or worn front suspension components. 	<ul style="list-style-type: none"> ● CHECK the axle mounts and the rear suspension for damage or wear. REPAIR as necessary. ● INSPECT the U-bolts. TIGHTEN the U-bolt nuts to specification. ● CHECK vehicle ride height is within limits. REPAIR as necessary. REFER to Section 204-00. ● CHECK for a loose stabilizer bar, damaged or loose strut/strut bushings or loose or worn ball joints. INSPECT the steering linkage for wear or damage. REPAIR or INSTALL new components

	<ul style="list-style-type: none"> ● Driveline angles out of specification. ● U-joints binding or seized. ● Binding, damaged or galled splines on the driveshaft slip-yoke. 	<p>as necessary. REFER to Section 204-01.</p> <ul style="list-style-type: none"> ● CHECK for correct driveline angles. REPAIR as necessary. REFER to Section 205-00. ● ROTATE the driveshaft and CHECK for rough operation or seized U-joints. INSTALL new U-joints as necessary. REFER to Section 205-01. ● CLEAN and INSPECT the splines of the slip-yoke, driveshaft and coupling shaft for a worn, damaged or galled condition. INSTALL a new slip-yoke or driveshaft assembly as necessary. REPAIR as necessary. REFER to Section 205-01.
<ul style="list-style-type: none"> ● Driveline vibration—occurs at cruising speeds 	<ul style="list-style-type: none"> ● U-joints are worn. ● Worn or damaged driveshaft center bearing support. ● Loose axle pinion flange bolts. ● Excessive axle pinion flange runout. ● Driveshaft is out-of-balance. ● Binding or damaged splines on the driveshaft slip-yoke. ● Driveshaft runout. 	<ul style="list-style-type: none"> ● CHECK for wear or incorrect seating. INSTALL new U-joints as necessary. REFER to Section 205-01. ● CHECK the insulator for damage or wear. ROTATE the driveshaft and CHECK for rough operation. INSTALL a new center bearing support as necessary. REFER to Section 205-01. ● INSPECT the axle pinion flange. TIGHTEN the pinion flange bolts to specification. REFER to Section 205-01. ● CARRY OUT a Runout Check. REPAIR as necessary. REFER to Section 205-00. ● CHECK the driveshaft for damage, missing balance weights or undercoating. CHECK driveshaft balance. CARRY OUT a driveline vibration test. REFER to Section 205-00. REPAIR as necessary. ● CLEAN and INSPECT the splines of the slip-yoke, driveshaft and coupling shaft for wear or damage. INSTALL a new slip-yoke or driveshaft assembly as necessary. REFER to Section 205-01. REPAIR as necessary. ● CARRY OUT a Runout Check. REFER to Section

	<ul style="list-style-type: none"> ● Incorrect lateral and radial tire/wheel runout. ● Driveline angles out of specification. ● Incorrectly seated CV joint in the front wheel hub. 	<p><u>205-00</u> . REPAIR as necessary.</p> <ul style="list-style-type: none"> ● INSPECT the tire and wheels. MEASURE tire runouts. REFER to <u>Section 204-04</u> . REPAIR or INSTALL new components as necessary. ● CHECK for correct driveline angles. REPAIR as necessary. REFER to <u>Section 205-00</u> . ● CHECK the outer CV joint for correct seating into the hub. REPAIR as necessary. REFER to <u>Section 205-05</u> .
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Symptom Chart — Engine Noise/Vibration

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Grinding noise—occurs during engine cranking 	<ul style="list-style-type: none"> ● Incorrect starter motor mounting. ● Starter motor. ● Incorrect starter motor drive engagement. 	<ul style="list-style-type: none"> ● INSPECT the starter motor for correct mounting. REPAIR as necessary. REFER to <u>Section 303-06</u> . ● CHECK the starter motor. REPAIR or INSTALL a new starter motor as necessary. REFER to <u>Section 303-06</u> . ● INSPECT the starter motor drive and flywheel for wear or damage. INSTALL a new starter motor drive or flexplate as necessary. REFER to <u>Section 303-01A</u> for 3.0L engines or <u>Section 303-01B</u> for 3.9L engines.
<ul style="list-style-type: none"> ● Engine ticking noise 	<ul style="list-style-type: none"> ● Fuel injector. ● Fuel line. ● Oil pump. ● Valve lifter. ● Belt tensioner. ● Water pump. ● Obstruction of cooling fan. 	<ul style="list-style-type: none"> ● <u>Go To Pinpoint Test B</u> .
<ul style="list-style-type: none"> ● Engine drumming noise—normally accompanied by vibration 	<ul style="list-style-type: none"> ● Powertrain mount. ● Damaged or misaligned exhaust system. 	<ul style="list-style-type: none"> ● CARRY OUT <u>Powertrain/Drivetrain Mount Neutralizing</u> in this section. ● INSPECT the exhaust system for loose or broken clamps and brackets. CARRY OUT <u>Exhaust System Neutralizing</u> in this section.
<ul style="list-style-type: none"> ● Whistling noise—normally accompanied with poor idle condition 	<ul style="list-style-type: none"> ● Air intake system. 	<ul style="list-style-type: none"> ● CHECK the air intake ducts, air cleaner, throttle body and vacuum hoses for leaks and correct fit. REPAIR or ADJUST as necessary.

<ul style="list-style-type: none"> ● Clunking noise 	<ul style="list-style-type: none"> ● Water pump has excessive end play or imbalance. ● Generator has excessive end play. 	<ul style="list-style-type: none"> ● CHECK the water pump for excessive end play. INSPECT the water pump with the drive belt off for imbalance. INSTALL a new water pump as necessary. REFER to Section 303-03. ● CHECK the generator for excessive end play. REPAIR or INSTALL a new generator. REFER to Section 414-02.
<ul style="list-style-type: none"> ● Pinging noise 	<ul style="list-style-type: none"> ● Exhaust system leak. ● Gasoline octane too low. ● Knock sensor operation. ● Incorrect spark timing. ● High operating temperature. ● Foul-out spark plug. ● Catalytic converter. 	<ul style="list-style-type: none"> ● INSPECT the exhaust system for leaks. REPAIR as necessary. REFER to Section 309-00. ● VERIFY with customer the type of gasoline used. CORRECT as necessary. ● CHECK the knock sensor. INSTALL a new knock sensor as necessary. REFER to Section 303-14. ● CHECK the spark timing. REPAIR as necessary. ● INSPECT cooling system for leaks. CHECK the coolant level. REFILL as necessary. CHECK the coolant for the correct mix ratio. DRAIN and REFILL as needed. CHECK engine operating temperature is within specifications. REPAIR as necessary. REFER to Section 303-03. ● CHECK the spark plugs. REPAIR or INSTALL new spark plugs as necessary. ● Acceptable noise.
<ul style="list-style-type: none"> ● Knocking noise—light knocking noise, also described as piston slap. Noise is most noticeable when engine is cold with light to medium acceleration. Noise disappears as engine warms 	<ul style="list-style-type: none"> ● Excessive clearance between the piston and the cylinder wall. 	<ul style="list-style-type: none"> ● Engine cold and at high idle. Using an EngineEAR, pull a spark plug or fuel injector connector until the noise goes away. CARRY OUT a cylinder bore clearance to piston check. INSTALL a new piston. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines.
<ul style="list-style-type: none"> ● Knocking noise—light double knock or sharp rap sound. Occurs mostly with warm engine 	<ul style="list-style-type: none"> ● Excessive clearance between the piston and the piston pin. 	<ul style="list-style-type: none"> ● INSTALL a new piston or piston pin. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines.

<p>at idle or low speeds in DRIVE. Increases in relation to engine load. Associated with poor lubrication history</p>		
<ul style="list-style-type: none"> ● Knocking noise—light knocking noise is most noticeable when engine is warm. Noise tends to decrease when vehicle is coasting or in neutral 	<ul style="list-style-type: none"> ● Excessive clearance between the connecting rod bearings and the crankshaft. 	<ul style="list-style-type: none"> ● Engine warm and at idle. Using an EngineEAR, PULL a spark plug or fuel injector connector until the noise goes away. INSTALL new bearings. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines.
<ul style="list-style-type: none"> ● Knocking—deep knocking noise. Noise is most noticeable when engine is warm, at lower rpm and under a light load and then at float 	<ul style="list-style-type: none"> ● Worn or damaged crankshaft main bearings. 	<ul style="list-style-type: none"> ● CARRY OUT Drive Engine Run-Up (DERU) test. CHECK for noise with vehicle at operating temperature, during medium to heavy acceleration. CHECK at idle with injector disconnected, noise does not change. INSTALL new main bearings. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines.
<ul style="list-style-type: none"> ● Knocking noise—occurs mostly with warm engine at light/medium acceleration 	<ul style="list-style-type: none"> ● Spark plugs. ● Carbon accumulation in combustion chamber. 	<ul style="list-style-type: none"> ● CHECK the spark plugs for damage or wear. INSTALL new spark plugs as necessary. ● REMOVE carbon from combustion chamber.
<ul style="list-style-type: none"> ● Whine or moaning noise 	<ul style="list-style-type: none"> ● Air intake system. ● Generator electrical field or bearings. 	<ul style="list-style-type: none"> ● CHECK the air cleaner and ducts for correct fit. INSPECT the air intake system for leaks or damage. REPAIR as necessary. REFER to Section 303-12 . ● CARRY OUT generator load test. REPAIR or INSTALL a new generator as necessary. REFER to Section 414-02 .
<ul style="list-style-type: none"> ● Drone type noise 	<ul style="list-style-type: none"> ● Exhaust system. ● A/C compressor. 	<ul style="list-style-type: none"> ● CARRY OUT Exhaust System Neutralizing in this section. REPAIR as necessary. ● CHECK for noise with vehicle at constant speeds. CYCLE the compressor on

	<ul style="list-style-type: none"> ● Powertrain mounts. 	<p>and off and listen for a change in pitch. REPAIR as necessary. REFER to Section 412-03.</p> <ul style="list-style-type: none"> ● CARRY OUT Powertrain/Drivetrain Mount Neutralizing in this section.
<ul style="list-style-type: none"> ● Sputter type noise—noise worse when cold, lessens or disappears when vehicle is at operating temperature 	<ul style="list-style-type: none"> ● Damaged or worn exhaust system components. 	<ul style="list-style-type: none"> ● INSPECT the exhaust system for leaks or damage. REPAIR as necessary. REFER to Section 309-00.
<ul style="list-style-type: none"> ● Rattling noise—noise from the upper engine (valve train). Worse when engine is cold 	<ul style="list-style-type: none"> ● Low oil level. ● Thin or diluted oil. ● Low oil pressure. ● Worn rocker arms/fulcrums or followers. ● Worn valve guides. ● Excessive runout of valve seats on the valve face. 	<ul style="list-style-type: none"> ● CHECK oil level. FILL as necessary. ● INSPECT the oil for contamination. If oil is contaminated, CHECK for the source. REPAIR as necessary. CHANGE the oil and filter. ● CARRY OUT an oil pressure test. If not within specifications, REPAIR as necessary. REFER to Section 303-00. ● CARRY OUT a valve train analysis. INSTALL new valve train components as necessary. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines. ● CARRY OUT a valve train analysis. INSTALL new valve guides as necessary. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines. ● CARRY OUT a valve seat runout test. INSPECT the valve face and seat. INSTALL new valves as necessary. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines.
<ul style="list-style-type: none"> ● Rattling noise—from the bottom of the vehicle 	<ul style="list-style-type: none"> ● Loose muffler shields or catalytic converter shields. 	<ul style="list-style-type: none"> ● CHECK the exhaust system for loose exhaust shields. REPAIR as necessary.
<ul style="list-style-type: none"> ● Thumping noise—from the bottom of the 	<ul style="list-style-type: none"> ● Exhaust pipe/muffler grounded to chassis. 	<ul style="list-style-type: none"> ● CHECK the exhaust system to chassis clearance. CHECK the exhaust system

<p>vehicle, worse at acceleration</p>		<p>hangers for damage. REPAIR as necessary. REFER to Section 309-00.</p>
<ul style="list-style-type: none"> ● Whoosh—occurs during light vehicle acceleration. Heard inside the vehicle 	<ul style="list-style-type: none"> ● Throttling late, creating turbulence transmitted through the plastic manifold. 	<ul style="list-style-type: none"> ● CHECK for leaks or missing seal in the dash panel.
<ul style="list-style-type: none"> ● Engine vibration—increases intensity as engine rpm is increased 	<ul style="list-style-type: none"> ● Engine out-of-balance. 	<ul style="list-style-type: none"> ● CARRY OUT Neutral Engine Run-Up (NERU) test. ROTATE the torque converter, 120° for 3 bolt and 180° for 4 bolt. INSPECT torque converter pilot outer diameter to crankshaft pilot inner diameter. REPAIR as necessary. REFER to Section 307-01.
<ul style="list-style-type: none"> ● Engine vibration—is felt with increases and decreases in engine rpm 	<ul style="list-style-type: none"> ● Strain on exhaust mounts. ● Damaged or worn powertrain/drivetrain mounts. ● Engine or transmission grounded to chassis. 	<ul style="list-style-type: none"> ● CARRY OUT Exhaust System Neutralizing in this section. REPAIR as necessary. ● CHECK the powertrain/drivetrain mounts for damage. CARRY OUT Powertrain/Drivetrain Mount Neutralizing in this section. REPAIR as necessary. REFER to Section 303-01A for 3.0L engines, Section 303-01B for 3.9L engines, Section 307-01 for automatic transmissions or Section 308-03 for manual transmissions. ● INSPECT the powertrain/drivetrain for correct clearances. REPAIR as necessary. REFER to Section 303-01A for 3.0L engines, Section 303-01B for 3.9L engines, Section 307-01 for automatic transmissions or Section 308-03 for manual transmissions.
<ul style="list-style-type: none"> ● Engine vibration—vibration felt at all times 	<ul style="list-style-type: none"> ● Excessive engine pulley runout. ● Damaged or worn accessory component. 	<ul style="list-style-type: none"> ● CARRY OUT Engine Accessory Test. INSTALL a new engine pulley as necessary. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines. ● CARRY OUT Engine Accessory Test. REPAIR or INSTALL a new component

		as necessary.
<ul style="list-style-type: none"> ● Accelerator pedal vibration—felt through the pedal as a buzz 	<ul style="list-style-type: none"> ● Throttle cable loose or misrouted. 	<ul style="list-style-type: none"> ● INSPECT the throttle cable. REPAIR as necessary. REFER to Section 310-02.
<ul style="list-style-type: none"> ● Engine vibration—mostly at coast/neutral coast. Condition improves with vehicle accelerating 	<ul style="list-style-type: none"> ● Combustion instability. 	<ul style="list-style-type: none"> ● CHECK the ignition system. INSTALL new components as necessary.
<ul style="list-style-type: none"> ● Engine vibration or shudder—occurs with light to medium acceleration above 56 km/h (35 mph) 	<ul style="list-style-type: none"> ● Worn or damaged spark plugs. ● Plugged fuel injector. ● Damaged spark plug wire. ● Contaminated fuel. ● Worn or damaged torque converter. 	<ul style="list-style-type: none"> ● INSPECT the spark plugs for cracks, high resistance or broken insulator. INSTALL a new spark plug (s) as necessary. REFER to Section 303-04A for 3.0L engines or Section 303-04B for 3.9L engines. ● REPAIR or INSTALL a new injector as necessary. ● INSPECT the spark plug wires for damage. INSTALL a new spark plug wire(s) as necessary. ● INSPECT the fuel for contamination. DRAIN the fuel system and refill. REFER to Section 310-01. ● CHECK the torque converter. INSTALL a new torque converter as necessary. REFER to Section 307-01.

Symptom Chart—Idle Noise/Vibration

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Idle air control (IAC) valve moan — occurs on throttle tip-out 	<ul style="list-style-type: none"> ● IAC valve is contaminated with oil. 	<ul style="list-style-type: none"> ● GO to Component Tests in this section.
<ul style="list-style-type: none"> ● Accessory drive belt chirp — occurs at idle or high idle, cold or hot. Most common occurrence is during humid weather 	<ul style="list-style-type: none"> ● Accessory drive belt worn, or pulley is misaligned or loose. 	<ul style="list-style-type: none"> ● INSPECT for loose or misaligned pulleys. CHECK the drive belt for wear or damage. INSTALL new pulley(s)/FEAD or drive belt, as necessary. REFER to Section 303-05.
<ul style="list-style-type: none"> ● Accessory drive bearing hoot — occurs at idle or high idle in cold temperatures of approximately +4°C (+40°F) or colder at first start of the day 	<ul style="list-style-type: none"> ● Accessory drive idler or tensioner pulley bearing is experiencing stick/slip between ball bearings and bearing race. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test C.

<ul style="list-style-type: none"> ● Power steering moan — occurs at high idle and possibly at idle during the first cold start of the day in temperatures of approximately -18°C (0°F) or colder. Noise can even be a severe screech for less than one minute in very cold temperatures of approximately -29°C (-20°F) or colder 	<ul style="list-style-type: none"> ● High fluid viscosity, or plugged reservoir screen in power steering reservoir starves pump causing cavitation. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test D .
<ul style="list-style-type: none"> ● Generator whine — during high electrical loads at idle or high idle, a high pitch whine or moan is emitted from the generator 	<ul style="list-style-type: none"> ● Generator electrical field noise. 	<ul style="list-style-type: none"> ● Using an EngineEAR, PROBE near the generator housing. LISTEN for changes in the noise level while changing electrical loads (such as rear defrost, headlamps, etc.). CARRY OUT a generator load test. REFER to Section 414-00 . If the system passes the load test, the noise is from the generator bearings, INSTALL new bearings. If the system fails the load test, INSTALL a new generator. REFER to Section 414-02 .
<ul style="list-style-type: none"> ● Engine-driven cooling fan moan — occurs during the first start of the day. It is most objectionable near idle speeds up to 2000 rpm. The noise increases with rpm 	<ul style="list-style-type: none"> ● The viscous cooling fan clutch engages until the fluid in the clutch reaches normal operating temperature, causing the fan to fully engage. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test E .
<ul style="list-style-type: none"> ● Drumming noise — occurs inside the vehicle during idle or high idle, hot or cold. Very low-frequency drumming is very rpm dependent 	<ul style="list-style-type: none"> ● Exhaust system vibration excites the body resonances inducing interior noise. ● Engine vibration excites the body resonances inducing interior noise. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test F .
<ul style="list-style-type: none"> ● Hissing noise — occurs during idle or high idle that is apparent with the hood open 	<ul style="list-style-type: none"> ● Vacuum leak or idle air control (IAC) valve flow noise. 	<ul style="list-style-type: none"> ● Use the Ultrasonic Leak Detector/EngineEAR to locate the source. Scan the air intake system from the inlet to each cylinder intake port. DISCARD the leaking parts, and INSTALL a new

	<ul style="list-style-type: none"> ● Vehicles with a plastic intake manifold. 	<p>component.</p> <ul style="list-style-type: none"> ● Acceptable condition. Some plastic manifolds exhibit this noise, which is the effect of the plastic manifold.
<ul style="list-style-type: none"> ● Automatic transmission buzz or hiss 	<ul style="list-style-type: none"> ● Incorrect driveline angles. ● Worn or damaged main control solenoids or valves. 	<ul style="list-style-type: none"> ● CHECK for correct driveline angles. REPAIR as necessary. REFER to Section 205-00. ● Using a transmission tester, activate the solenoids to duplicate sound. INSTALL new components as necessary. REFER to Section 307-01.
<ul style="list-style-type: none"> ● Manual Transmission Clutch throw-out bearing whine. A change in noise pitch or loudness while depressing the clutch pedal 	<ul style="list-style-type: none"> ● Worn throw-out bearing. 	<ul style="list-style-type: none"> ● INSTALL a new throw-out bearing. REFER to Section 308-01.
<ul style="list-style-type: none"> ● Heating, vacuum and air conditioning (HVAC) system chirp — most audible inside the vehicle. Listen for a change in noise pitch or loudness while changing the HVAC system blower speed 	<ul style="list-style-type: none"> ● Damaged or worn HVAC blower bearing. 	<ul style="list-style-type: none"> ● INSTALL a new blower motor. REFER to Section 412-02.
<ul style="list-style-type: none"> ● Air conditioning (A/C) clutch ticking — occurs when the compressor clutch engages 	<ul style="list-style-type: none"> ● Acceptable noise. ● Incorrect air gap. 	<ul style="list-style-type: none"> ● LISTEN to the clutch to determine if the noise occurs with clutch engagement. A small amount of noise is acceptable. If the noise is excessive, CHECK the A/C clutch air gap. INSPECT the A/C clutch for wear or damage. INSTALL a new clutch as necessary. REFER to Section 412-03.
<ul style="list-style-type: none"> ● Intermittent rattle, or scraping/rubbing noise 	<ul style="list-style-type: none"> ● Loose exhaust heat shield(s). ● Wiring, hose or other part interfering with accessory drive belt or pulley. 	<ul style="list-style-type: none"> ● INSPECT the exhaust system for loose parts using a glove or clamps to verify cause. REPAIR as necessary. REFER to Section 309-00. ● INSPECT accessory drive system closely verifying there is adequate clearance to all rotating components. REPAIR as necessary.
<ul style="list-style-type: none"> ● Engine ticking or knocking noise — occurs during idle or high idle during the first cold start of the 	<ul style="list-style-type: none"> ● Piston noise or valvetrain noise (bled down lifter/lash adjuster). 	<ul style="list-style-type: none"> ● Go To Pinpoint Test G.

day		
<ul style="list-style-type: none"> ● A continuous, speed-dependent rattle from the engine — occurs during idle or high idle during the first cold start of the day and disappears as the engine warms up 	<ul style="list-style-type: none"> ● Piston noise or valvetrain noise (bled down lifter/lash adjuster). 	<ul style="list-style-type: none"> ● Go To Pinpoint Test G.
<ul style="list-style-type: none"> ● Idle vibration—a low-frequency vibration (5-20 Hz) or mild shake that is felt through the seat/floorpan 	<ul style="list-style-type: none"> ● Cylinder misfire. ● Engine or torque converter out of balance. 	<ul style="list-style-type: none"> ● Using a scan tool, CHECK the ignition system. CARRY OUT a cylinder power test. REFER to Section 303-00. ● VERIFY the torque converter to crankshaft pilot clearance is correct, REPAIR as necessary. RE-INDEX the torque converter on the flex plate by 120° on a 3 bolt converter or 180° for a 4 bolt converter. REFER to Section 307-01. RETEST the vehicle.
<ul style="list-style-type: none"> ● Idle vibration—a high-frequency vibration (20–80 Hz) or buzz, that is felt through the steering wheel or seat 	<ul style="list-style-type: none"> ● Exhaust system mounts bound up. ● Body mounts loose. ● Power steering lines grounded out. 	<ul style="list-style-type: none"> ● VERIFY concern occurs at engine firing frequency. CHECK that the exhaust system vibrates at the same frequency as the engine. ADD 9–14 km (20–30 lb.) to the tail pipe to test. CARRY OUT Exhaust System Neutralizing in this section. ● INSPECT the body mounts. CARRY OUT a Neutral Engine Run-Up (NERU) Test. REPAIR as necessary. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines. ● INSPECT that the power steering lines are not contacting the chassis or each other. REPAIR as necessary.

Symptom Chart—Squeak and Rattle

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Squeak—heard inside the vehicle when closing/opening the door 	<ul style="list-style-type: none"> ● Insufficient lubrication on the door hinge or check strap. ● Internal door components loose, rubbing or misaligned. 	<ul style="list-style-type: none"> ● LUBRICATE the hinge or check strap. ● CHECK the inside of the door. TIGHTEN or ALIGN as necessary. USE the Rotunda Squeak and Rattle Kit to isolate

		any rubbing components.
<ul style="list-style-type: none"> ● Squeak—heard inside the vehicle when closing/opening the window 	<ul style="list-style-type: none"> ● Worn or damaged glass run/channel. 	<ul style="list-style-type: none"> ● REPAIR or INSTALL a new glass run/channel. REFER to Section 501-11.
<ul style="list-style-type: none"> ● Squeak—heard outside of vehicle when closing/opening the door 	<ul style="list-style-type: none"> ● Exhaust shield rubbing against the chassis or exhaust pipe. 	<ul style="list-style-type: none"> ● CHECK the exhaust system. REPAIR as necessary. REFER to Section 309-00.
<ul style="list-style-type: none"> ● Squeak—occurs with initial brake pedal application 	<ul style="list-style-type: none"> ● Disc brake pads. 	<ul style="list-style-type: none"> ● Under certain conditions, asbestos free pads can generate a squeak noise. This noise is normal and does not indicate a concern.
<ul style="list-style-type: none"> ● Squeak—a constant noise that occurs with brake pedal applications 	<ul style="list-style-type: none"> ● Damaged or worn disc brake pads. 	<ul style="list-style-type: none"> ● INSPECT the pads for oil, grease or brake fluid contamination. CHECK for glazed linings. A brake disc with hard spots will also cause a squeak type noise. REPAIR or INSTALL new pads as necessary. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.
<ul style="list-style-type: none"> ● Squeak—noise occurs over bumps or when turning 	<ul style="list-style-type: none"> ● Worn control arm bushings. ● Worn or damaged shock absorber/strut. 	<ul style="list-style-type: none"> ● INSPECT the control arm bushings. Spray with lubricant and CARRY OUT a "bounce test" to determine which bushing. REPAIR as necessary. REFER to Section 204-01 for the front suspension or Section 204-02 for the rear suspension. ● INSPECT the shock absorber for damage. CARRY OUT a "bounce test" to isolate the noise. INSTALL a new shock absorber/strut as necessary. REFER to Section 204-01 for the front shock absorber/strut or Section 204-02 for the rear shock absorber/strut.
<ul style="list-style-type: none"> ● Rattle—heard when closing/opening the door or window 	<ul style="list-style-type: none"> ● Loose internal door mechanism, bracket or attachment. 	<ul style="list-style-type: none"> ● REPEAT the motion or CARRY OUT a "tap test" to duplicate the noise. INSPECT the door for loose components. TIGHTEN loose components or USE the Rotunda Squeak and Rattle Kit to isolate any rattling components.
<ul style="list-style-type: none"> ● Squeak or rattle—heard inside the vehicle over rough roads/bumps 	<ul style="list-style-type: none"> ● Misaligned glove compartment door/hinge. ● Instrument panel trim loose or misaligned. 	<ul style="list-style-type: none"> ● ALIGN the glove compartment door. ● INSPECT the instrument panel trim for missing or loose clips or screws. REPAIR as necessary.

	<ul style="list-style-type: none"> ● Loose interior component or trim. 	<ul style="list-style-type: none"> ● CARRY OUT a "touch test". ELIMINATE the noise by pressing or pulling on interior trim and components. USE the Rotunda Squeak and Rattle Kit to isolate any rattling/squeaking components.
<ul style="list-style-type: none"> ● Squeak or rattle—noise with a vibration concern 	<ul style="list-style-type: none"> ● Damaged or worn body mounts. ● Damaged or worn sub-frame mounts. 	<ul style="list-style-type: none"> ● INSPECT the upper and lower absorbers and washers for damage or wear. CHECK the body mount brackets for damage. CHECK the nuts and bolts are tightened to specifications. TIGHTEN as necessary. ● INSPECT the upper and lower absorbers for damage or wear. CHECK the sub-frame for damage. CHECK the nuts and bolts are tightened to specifications. TIGHTEN as necessary.

Symptom Chart—Steering Noise/Vibration

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Steering grunt or shudder — occurs when turning into or out of a turn at low speeds (temperature sensitive) 	<ul style="list-style-type: none"> ● Steering gear or power steering hoses. 	<ul style="list-style-type: none"> ● GO to Steering Gear Grunt/Shudder Test component test in this section.
<ul style="list-style-type: none"> ● Steering System clonk—hydraulic knocking sound 	<ul style="list-style-type: none"> ● Air in the steering hydraulic system. 	<ul style="list-style-type: none"> ● PURGE the air from the system. REFER to Section 211-00. CHECK for leaks in the system.
<ul style="list-style-type: none"> ● Power steering pump moan — loud humming noise occurs when the steering wheel is rotated to the stop position. Produces a 120-600 Hz frequency that changes with rpm. 	<ul style="list-style-type: none"> ● Power steering hose grounded out to chassis. ● Aerated fluid. ● Steering gear isolators. ● Low fluid. 	<ul style="list-style-type: none"> ● INSPECT the power steering hoses. REPAIR as necessary. ● PURGE the air from the system. REFER to Section 211-00. CHECK for leaks in the system. ● INSPECT the isolators for wear or damage. REPAIR as necessary. ● CHECK the fluid level. REFILL as necessary.

	<ul style="list-style-type: none"> ● Power steering pump brackets loose or misaligned. 	<ul style="list-style-type: none"> ● CHECK bolts, brackets and bracket alignment. TIGHTEN bolts to specification. REPAIR or INSTALL new brackets as necessary. REFER to Section 211-02.
<ul style="list-style-type: none"> ● Steering gear clunk — occurs only while cornering over a bump (can be temperature sensitive) 	<ul style="list-style-type: none"> ● Steering gear. 	<ul style="list-style-type: none"> ● INSPECT the steering gear for loose mounting bolts. TIGHTEN as necessary. REFER to Section 211-02.
<ul style="list-style-type: none"> ● Feedback (rattle, chuckle or knocking noise in the steering gear) — a condition where roughness is felt in the steering wheel when the vehicle is driven over rough surfaces 	<ul style="list-style-type: none"> ● Column intermediate/flexible shaft joints damaged or worn. ● Loose, damaged or worn tie-rod ends. ● Steering gear insulators or mounting bolts loose or damaged. ● Steering column intermediate shaft bolts are loose. ● Steering column damaged or worn. ● Loose suspension bushings, bolts or ball joints. 	<ul style="list-style-type: none"> ● INSTALL a new intermediate/flexible shaft. REFER to Section 211-04. ● TIGHTEN the nuts to specification or INSTALL new tie-rod ends as necessary. REFER to Section 211-02. ● TIGHTEN the bolts or INSTALL new bolts as necessary. REFER to Section 211-02. ● TIGHTEN the bolts to specification. REFER to Section 211-04. ● REPAIR or INSTALL a new steering column as necessary. REFER to Section 211-04. ● INSPECT the suspension system. TIGHTEN or INSTALL new components as necessary. REFER to Section 204-01.
<ul style="list-style-type: none"> ● Feedback (nibble at the steering wheel) — a condition where slight rotational movement is felt in the steering wheel when the vehicle is driven over rough or grooved surfaces 	<ul style="list-style-type: none"> ● Lateral runout in the tire or wheel. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test H.

	<ul style="list-style-type: none"> ● Yoke spring in the steering gear. 	<ul style="list-style-type: none"> ● CHECK TSBs for revised yoke spring for applicable vehicles.
<ul style="list-style-type: none"> ● Accessory drive belt squeal/chirp—when rotating the steering wheel from stop to stop 	<ul style="list-style-type: none"> ● Loose or worn accessory drive belt. 	<ul style="list-style-type: none"> ● ADJUST or INSTALL a new accessory belt as necessary. REFER to Section 303-05.
<ul style="list-style-type: none"> ● Power steering gear hiss 	<ul style="list-style-type: none"> ● Steering column intermediate/flexible shaft-to-steering gear is binding or misaligned. ● Grounded or loose steering column boot at the dash panel. ● Damaged or worn steering gear input shaft and valve. 	<ul style="list-style-type: none"> ● REPAIR or INSTALL a new intermediate/flexible shaft as necessary. REFER to Section 211-04. ● REPAIR as necessary. ● REPAIR or INSTALL a new steering gear as necessary. REFER to Section 211-02.
<ul style="list-style-type: none"> ● Steering column rattle 	<ul style="list-style-type: none"> ● Loose bolts or attaching brackets. ● Loose, worn or insufficiently lubricated column bearings. ● Steering shaft insulators damaged or worn. ● Intermediate/flexible shaft compressed or extended. 	<ul style="list-style-type: none"> ● TIGHTEN the bolts to specifications. ● LUBRICATE or INSTALL new steering column bearings as necessary. REFER to Section 211-04. ● INSTALL new insulators. REFER to Section 211-04. ● INSPECT the rubber spider coupling for damage. INSTALL a new intermediate/flexible shaft. REFER to Section 211-04.
<ul style="list-style-type: none"> ● Steering column squeak or cracks 	<ul style="list-style-type: none"> ● Insufficient lubricated steering shaft bushings. ● Loose or misaligned steering column shrouds. ● Steering wheel rubbing against steering column shrouds. ● Insufficient lubricated speed control slip ring. ● Upper or lower bearing sleeve out of position. 	<ul style="list-style-type: none"> ● LUBRICATE the steering shaft and shaft tube seals. ● TIGHTEN or ALIGN the steering column shrouds. ● REPOSITION the steering column shrouds. ● LUBRICATE the speed control slip ring. ● REPOSITION the bearing sleeves.
<ul style="list-style-type: none"> ● Power steering pump noisy 	<ul style="list-style-type: none"> ● Incorrect assembly of components. ● Imperfections on the outside diameter or end surface of the power steering pump 	<ul style="list-style-type: none"> ● REPAIR or INSTALL a new power steering pump as necessary. REFER to Section 211-02.

	<ul style="list-style-type: none"> rotor. ● Damaged or worn power steering pump rotor splines. ● A crack on the inner surface of the power steering pump cam. ● Interference between the power steering pump rotor and cam. ● Damaged or worn power steering pump rotor and pressure plates. 	
<ul style="list-style-type: none"> ● Power steering pump swish noise 	<ul style="list-style-type: none"> ● Power steering fluid flow into the bypass valve of the pump valve housing with fluid temperature below 54° C (130°F). 	<ul style="list-style-type: none"> ● Acceptable condition.
<ul style="list-style-type: none"> ● Power steering pump whine noise 	<ul style="list-style-type: none"> ● Aerated fluid. ● Damaged power steering pump cam. ● Damaged valve cover O-ring seal. 	<ul style="list-style-type: none"> ● CHECK for a leak in the system. PURGE the air from the system. REFER to Section 211-00. ● REPAIR or INSTALL a new power steering pump as necessary. REFER to Section 211-02. ● REPAIR or INSTALL a new power steering pump as necessary. REFER to Section 211-02.
<ul style="list-style-type: none"> ● Power steering pump clicking (mechanical) noise 	<ul style="list-style-type: none"> ● Power steering pump rotor slippers too long, excessive rotor slipper-to-slot clearance or damaged or worn rotor assembly. 	<ul style="list-style-type: none"> ● REPAIR or INSTALL a new power steering pump as necessary. REFER to Section 211-02.
<ul style="list-style-type: none"> ● Power steering pump clatter noise 	<ul style="list-style-type: none"> ● Damaged corners on the outside diameter or the power steering rotor or distorted rotor slipper ring. 	<ul style="list-style-type: none"> ● REPAIR or INSTALL a new power steering pump as necessary. REFER to Section 211-02.

Symptom Chart—Suspension Noise/Vibration

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Squeak or grunt—noise from the front suspension, occurs more in cold ambient temperatures. More noticeable over rough roads or when turning 	<ul style="list-style-type: none"> ● Front stabilizer bar insulators. 	<ul style="list-style-type: none"> ● Under these conditions, the noise is acceptable. CHECK TSBs for applicable vehicle.
<ul style="list-style-type: none"> ● Clunk—noise from the front suspension, occurs 	<ul style="list-style-type: none"> ● Loose front struts or shocks. 	<ul style="list-style-type: none"> ● INSPECT for loose nuts or bolts. TIGHTEN to

in and out of turns		specifications. REFER to Section 204-01 .
<ul style="list-style-type: none"> ● Clunk—noise from the rear suspension, occurs when shifting from reverse to drive 	<ul style="list-style-type: none"> ● Loose rear suspension components. 	<ul style="list-style-type: none"> ● INSPECT for loose or damaged rear suspension components. REPAIR or INSTALL new components as necessary. REFER to Section 204-02.
<ul style="list-style-type: none"> ● Click or pop—noise from the front suspension. More noticeable over rough roads or over bumps 	<ul style="list-style-type: none"> ● Worn or damaged ball joints. 	<ul style="list-style-type: none"> ● CARRY OUT a ball joint inspection. INSTALL new ball joints or control arms as necessary. REFER to Section 204-01.
<ul style="list-style-type: none"> ● Click or pop (FWD vehicles)—noise occurs when vehicle is turning 	<ul style="list-style-type: none"> ● Worn or damaged ball joints. 	<ul style="list-style-type: none"> ● CARRY OUT a ball joint inspection. INSTALL new ball joints or control arms as necessary.
<ul style="list-style-type: none"> ● Click or snap—occurs when accelerating around a corner 	<ul style="list-style-type: none"> ● Damaged or worn outboard CV joint. 	<ul style="list-style-type: none"> ● INSPECT the outboard CV joint and boot. REPAIR or INSTALL a new CV joint as necessary. REFER to Section 205-05.
<ul style="list-style-type: none"> ● Front suspension noise—a squeak, creak or rattle noise. Occurs mostly over bumps or rough roads 	<ul style="list-style-type: none"> ● Steering components. ● Loose or bent front struts or shock absorbers. ● Damaged spring or spring mounts. ● Damaged or worn control/radius arm bushings. ● Worn or damaged stabilizer bar bushings or links. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test H.
<ul style="list-style-type: none"> ● Rear suspension noise—a squeak, creak or rattle noise. Occurs mostly over bumps or rough roads 	<ul style="list-style-type: none"> ● Loose or bent rear shock absorbers. ● Damaged spring or spring mounts. ● Damaged or worn control arm bushings. ● Worn or damaged stabilizer bar bushings or links. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test I.
<ul style="list-style-type: none"> ● Shudder—occurs during acceleration from a slow 	<ul style="list-style-type: none"> ● Rear drive axle assembly 	<ul style="list-style-type: none"> ● CHECK the axle mounts and the rear suspension

speed or stop	<p>mispositioned.</p> <ul style="list-style-type: none"> ● Incorrect or high CV joint operating angle. ● Damaged or worn front suspension components. 	<p>for damage or wear. REPAIR as necessary. REFER to Section 204-02.</p> <ul style="list-style-type: none"> ● CHECK vehicle ride height is within limits. REPAIR as necessary. REFER to Section 204-00. ● CHECK for a loose stabilizer bar, damaged or loose strut/strut bushings or loose or worn ball joints. INSPECT the steering linkage for wear or damage. REPAIR or INSTALL new components as necessary.
<ul style="list-style-type: none"> ● Shimmy—most noticeable on coast/deceleration. Also hard steering condition 	<ul style="list-style-type: none"> ● Excessive positive caster. 	<ul style="list-style-type: none"> ● CHECK the caster alignment angle. CORRECT as necessary. REFER to Section 204-00.

Symptom Chart—Tire Noise/Vibration

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Tire noise—hum/moan at constant speeds 	<ul style="list-style-type: none"> ● Abnormal wear patterns. 	<ul style="list-style-type: none"> ● SPIN the tire and CHECK for tire wear. INSTALL a new tire as necessary. INSPECT for damaged/worn suspension components. CARRY OUT wheel alignment.
<ul style="list-style-type: none"> ● Tire noise—noise tone lowers as the vehicle speed is lowered 	<ul style="list-style-type: none"> ● Out-of-balance tire. 	<ul style="list-style-type: none"> ● BALANCE the tire and road test. INSTALL a new tire as necessary. REFER to Section 204-04.
<ul style="list-style-type: none"> ● Tire noise — ticking noise, changes with speed 	<ul style="list-style-type: none"> ● Nail puncture or stone in tire tread. 	<ul style="list-style-type: none"> ● INSPECT the tire. REPAIR as necessary.
<ul style="list-style-type: none"> ● Wheel and tire—vibration and noise concern is directly related to vehicle speed and is not affected by acceleration, coasting or decelerating 	<ul style="list-style-type: none"> ● Damaged or worn tire. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test J.
<ul style="list-style-type: none"> ● Tire wobble or shudder — occurs at lower speeds 	<ul style="list-style-type: none"> ● Damaged wheel bearings. ● Damaged wheel. 	<ul style="list-style-type: none"> ● SPIN the tire and CHECK for abnormal wheel bearing play or roughness. ADJUST or INSTALL new wheel bearings as necessary. REFER to Section 204-01. ● INSPECT the wheel for

	<ul style="list-style-type: none"> ● Damaged or worn suspension components. ● Loose wheel nuts. ● Damaged or uneven tire wear. 	<p>damage. INSTALL a new wheel as necessary. REFER to Section 204-04.</p> <ul style="list-style-type: none"> ● INSPECT the suspension components for wear or damage. REPAIR as necessary. ● CHECK the wheel nuts. TIGHTEN to specification. REFER to Section 204-04. ● SPIN the tire and CHECK for abnormal tire wear or damage. INSTALL a new tire as necessary. REFER to Section 204-04.
<ul style="list-style-type: none"> ● Tire shimmy or shake— occurs at lower speeds 	<ul style="list-style-type: none"> ● Wheel/tire out of balance. ● Uneven tire wear. ● Excessive radial runout of wheel or tire. ● Worn or damaged wheel studs or elongated stud holes. ● Excessive lateral runout of the wheel or tire. ● Foreign material between the brake disc and hub or in the brake disc fins. 	<ul style="list-style-type: none"> ● BALANCE the wheel/tire assembly. ● CHECK for abnormal tire wear. INSTALL a new tire as necessary. REFER to Section 204-04. ● CARRY OUT a radial runout test of the wheel and tire. INSTALL a new tire as necessary. REFER to Section 204-04. ● INSPECT the wheel studs and wheels. INSTALL new components as necessary. REFER to Section 204-01 for the front wheels or Section 204-02 for the rear wheels. ● CARRY OUT a lateral runout test of the wheel and tire. CHECK the wheel, tire and hub. REPAIR or INSTALL new components as necessary. REFER to Section 204-04. ● CLEAN the mounting surfaces of the brake disc and hub. CHECK the brake disc fins for material.
<ul style="list-style-type: none"> ● High speed shake or shimmy—occurs at high speeds 	<ul style="list-style-type: none"> ● Excessive wheel hub runout. ● Damaged or worn tires. ● Damaged or worn wheel bearings. ● Worn or damaged suspension or 	<ul style="list-style-type: none"> ● Go To Pinpoint Test K.

	steering linkage components. ● Brake disc or drum imbalance.	
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Symptom Chart—Transmission (Manual) Noise/Vibration

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Clutch rattling noise—occurs with clutch engaged, noise changes/disappears with clutch pedal depressed 	<ul style="list-style-type: none"> ● Flywheel bolts, clutch housing bolts or clutch pressure plate bolts loose. 	<ul style="list-style-type: none"> ● TIGHTEN the bolts to specifications. CHECK the bolts for damage. REFER to Section 308-01.
<ul style="list-style-type: none"> ● Clutch squeaking noise—noise is heard when the clutch is operated. Vehicle moves slowly or creeps when the clutch is disengaged. Can also be difficult to shift into first and reverse gear 	<ul style="list-style-type: none"> ● Pilot bearing seized or damaged. 	<ul style="list-style-type: none"> ● INSTALL a new pilot bearing. REFER to Section 308-01.
<ul style="list-style-type: none"> ● Clutch squeaking noise—occurs with clutch pedal depressed/released 	<ul style="list-style-type: none"> ● Worn clutch pedal shaft or bushings. 	<ul style="list-style-type: none"> ● INSPECT the clutch pedal for wear or damage. REPAIR as necessary. REFER to Section 308-02.
<ul style="list-style-type: none"> ● Clutch whirring/rattle noise—occurs when clutch pedal is depressed 	<ul style="list-style-type: none"> ● Worn, damaged or misaligned clutch release bearing. 	<ul style="list-style-type: none"> ● INSTALL a new clutch release bearing. REFER to Section 308-01.
<ul style="list-style-type: none"> ● Clutch grating/grinding noise—occurs when clutch pedal is depressed 	<ul style="list-style-type: none"> ● Clutch pressure plate fingers bent or worn. ● Contact surface of clutch release bearing worn or damaged. 	<ul style="list-style-type: none"> ● INSPECT the clutch pressure plate release fingers. INSTALL a new pressure plate as necessary. REFER to Section 308-01. ● INSTALL a new clutch release bearing. REFER to Section 308-01.
<ul style="list-style-type: none"> ● Clutch chatter—a small amount of noise when clutch pedal is released at initial take-off 	<ul style="list-style-type: none"> ● Clutch engagement. 	<ul style="list-style-type: none"> ● Acceptable operating condition.
<ul style="list-style-type: none"> ● Clutch chatter/grabs—in some cases a shudder is felt. Occurs with clutch pedal depressed/released 	<ul style="list-style-type: none"> ● Damaged or worn powertrain/driveline mounts. 	<ul style="list-style-type: none"> ● INSPECT the powertrain/drivetrain mounts. CARRY OUT Powertrain/Drivetrain Mount Neutralizing in this section. INSTALL new mounts as necessary. REFER to Section 303-01A for 3.0L engines, Section 303-01B for 3.9L

	<ul style="list-style-type: none"> ● Binding or dragging plunger of the clutch master cylinder or slave cylinder. ● Grease or oil on the clutch disc facing. ● Clutch disc surface glazed or damaged. ● Damaged or worn clutch pressure plate. ● Flywheel surface damaged or glazed. 	<p>engines or Section 308-03.</p> <ul style="list-style-type: none"> ● CHECK the master and slave cylinder operation. INSPECT the components for damage or wear. INSTALL a new master or slave cylinder as necessary. REFER to Section 308-02. ● CHECK the input shaft seal and rear main oil seal. REPAIR as necessary. INSTALL a new clutch disc. REFER to Section 308-01. ● INSPECT the clutch disc surface for a glazed, hardened or damage condition. CARRY OUT a disc check. INSTALL a new clutch disc as necessary. REFER to Section 308-01. ● INSPECT the clutch pressure plate for wear or damage. INSTALL a new clutch pressure plate as necessary. REFER to Section 308-01. ● INSPECT the flywheel for damage or wear. CARRY OUT a flywheel runout check. INSTALL a new flywheel as necessary. REFER to Section 308-01.
<ul style="list-style-type: none"> ● Clutch chatter noise—noise when clutch pedal is released at initial take-off. Clutch is hard to engage and disengage 	<ul style="list-style-type: none"> ● Pilot bearing worn, damaged or not correctly aligned in bore. 	<ul style="list-style-type: none"> ● INSPECT the clutch pressure plate release fingers for uneven wear, clutch components burnt or a seized pilot bearing. INSTALL a new pilot bearing as necessary. REFER to Section 308-01.
<ul style="list-style-type: none"> ● Clutch vibration 	<ul style="list-style-type: none"> ● Loose flywheel bolts. ● Damaged or loose clutch pressure plate. ● Excessive flywheel runout. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test L.
<ul style="list-style-type: none"> ● Transmission rattling/clattering noise—noise at idle or on light acceleration 	<ul style="list-style-type: none"> ● Gearshift lever joint worn or damaged. 	<ul style="list-style-type: none"> ● INSTALL a new gearshift lever. REFER to Section 308-03.

<p>from a stop. Gear selection difficult</p>	<ul style="list-style-type: none"> ● Gearshift lever loose. ● Gearshift linkage rods worn or damaged. 	<ul style="list-style-type: none"> ● TIGHTEN the bolts to specification. REFER to Section 308-03. ● CHECK the linkage bushings for wear. INSTALL new linkage rods as necessary. REFER to Section 308-03.
<ul style="list-style-type: none"> ● Transmission rattling/clattering noise—occurs in neutral or in gear, at idle 	<ul style="list-style-type: none"> ● Incorrect fluid level or fluid quality. 	<ul style="list-style-type: none"> ● CHECK that the transmission is filled to the correct level and with the specified fluid. REFER to Section 308-03.
<ul style="list-style-type: none"> ● Transmission rattling/clattering noise—noise at idle in neutral 	<ul style="list-style-type: none"> ● Worn or rough reverse idler gear. ● Rough running engine, cylinder misfire. ● Excessive backlash in gears ● Worn countershaft gears. 	<ul style="list-style-type: none"> ● CHECK the reverse idler gear. REPAIR as necessary. REFER to Section 308-03. ● CHECK the ignition system. CARRY OUT a cylinder power test. REFER to Section 308-03. ● CHECK the gear backlash. ADJUST as necessary. REFER to Section 308-03. ● REPAIR as necessary. REFER to Section 308-03.
<ul style="list-style-type: none"> ● Transmission whine—a mild whine at extreme speeds or high rpm 	<ul style="list-style-type: none"> ● Rotating gears/geartrain. 	<ul style="list-style-type: none"> ● Acceptable noise.
<ul style="list-style-type: none"> ● Transmission whine—a high pitched whine, also described as a squeal 	<ul style="list-style-type: none"> ● Transmission gears are worn (high mileage vehicle). ● Mismatched gear sets. ● Damaged or worn transmission bearing. 	<ul style="list-style-type: none"> ● Result of normal gear wear. REPAIR as necessary. REFER to Section 308-03. ● INSPECT the gear sets for an uneven wear pattern on the face of the gear teeth. REPAIR as necessary. REFER to Section 308-03. ● INSPECT the transmission bearings. INSTALL new bearings as necessary. REFER to Section 308-03.
<ul style="list-style-type: none"> ● Transmission growling/humming—noise occurs in the forward gears. The noise is more prominent when the 	<ul style="list-style-type: none"> ● Gear is cracked, chipped or rough. 	<ul style="list-style-type: none"> ● INSPECT the transmission gears for damage or wear. INSTALL new gears as necessary. REFER to Section 308-03.

gear is loaded. The problem gear can be located as the noise occurs in a specific gear position		
<ul style="list-style-type: none"> ● Transmission hissing—noise in neutral or in forward gears. As bearings wear or break up, the noise changes to a thumping noise 	<ul style="list-style-type: none"> ● Damaged or worn bearings. 	<ul style="list-style-type: none"> ● INSPECT the transmission bearings. INSTALL new bearings as necessary. REFER to Section 308-03.
<ul style="list-style-type: none"> ● Transmission knocking/thudding—noise at low speeds in forward gears 	<ul style="list-style-type: none"> ● Bearings with damaged balls or rollers or with pitted and spalled races. 	<ul style="list-style-type: none"> ● INSPECT the transmission bearings. INSTALL new bearings as necessary. REFER to Section 308-03.
<ul style="list-style-type: none"> ● Transmission rumble/growl—noise at higher speeds in forward gears, more pronounced in a coast/deceleration condition 	<ul style="list-style-type: none"> ● Incorrect driveline angle. ● Driveshaft out of balance or damaged. 	<ul style="list-style-type: none"> ● CHECK the driveline angle. REPAIR as necessary. REFER to Section 205-00. ● CHECK the driveshaft for damage, missing balance weights or undercoating. Using the vibration analyzer (VA). CHECK the driveshaft balance. CARRY OUT a driveline vibration test. REFER to Section 205-01. REPAIR as necessary.
<ul style="list-style-type: none"> ● Transmission rumble/growl—noise at all speeds in forward gears, more pronounced in a heavy acceleration condition 	<ul style="list-style-type: none"> ● Damaged or worn transmission bearing or gears (high mileage vehicles). 	<ul style="list-style-type: none"> ● CHECK transmission fluid for excessive metal particles. REPAIR as necessary. REFER to Section 308-03.

Symptom Chart—Transmission (Automatic) Noise/Vibration

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Rattle—occurs at idle or at light acceleration from a stop 	<ul style="list-style-type: none"> ● Damaged engine or transmission mounts. ● A loose front exhaust pipe heat shield. ● Loose inspection plate or dust cover plate. ● Loose flexplate to converter nuts. 	<ul style="list-style-type: none"> ● CHECK the powertrain/drivetrain mounts for damage. CARRY OUT Powertrain/Drivetrain Mount Neutralizing in this section. ● REPAIR or INSTALL a new heat shield as necessary. ● CHECK for loose bolts. TIGHTEN to specifications. REFER to Section 307-01. ● CHECK for loose nuts. TIGHTEN to specifications. REFER to Section 307-01.

<ul style="list-style-type: none"> ● Whine—pitch increases with vehicle speed. Starts in first and second gear, decreases or goes away at higher gears. 	<ul style="list-style-type: none"> ● Damaged or worn low one-way clutch. ● Damaged or worn intermediate one-way clutch. ● Friction elements. ● Damaged or worn planetary or sun gear. 	<ul style="list-style-type: none"> ● INSPECT the transmission for wear or damage. REPAIR or INSTALL new components as necessary. REFER to Section 307-01.
<ul style="list-style-type: none"> ● Whine—the pitch changes with engine speed 	<ul style="list-style-type: none"> ● A worn or damaged accessory drive component. ● Incorrect fluid level. ● Partially blocked filter. ● Worn or damaged torque converter. ● Worn or damaged front pump. 	<ul style="list-style-type: none"> ● CARRY OUT the Engine Accessory Test. REPAIR or INSTALL new components as necessary. ● CHECK that the transmission is filled to the correct level. ADD fluid as necessary. REFER to Section 307-01. ● INSPECT the filter. CLEAN or INSTALL a new filter as necessary. REFER to Section 307-01. ● CARRY OUT the torque converter service and replacement check. REFER to Section 307-01. ● INSPECT the front pump. INSTALL a new front pump as necessary. REFER to Section 307-01.
<ul style="list-style-type: none"> ● Whine—pitch changes with vehicle speed 	<ul style="list-style-type: none"> ● Speedometer cable or gears. 	<ul style="list-style-type: none"> ● REPAIR or INSTALL new cables or gears as necessary. REFER to the appropriate workshop manual for the service procedures.
<ul style="list-style-type: none"> ● Whine/roan type noise—pitch increases or changes with vehicle speed 	<ul style="list-style-type: none"> ● Damaged engine or transmission mount. ● U-joints worn or damaged. ● Damaged or worn differential ring and pinion. ● Planetary gears nicked or chipped. 	<ul style="list-style-type: none"> ● CHECK the powertrain/drivetrain mounts for damage. CARRY OUT Powertrain/Drivetrain Mount Neutralizing in this section. ● INSPECT the U-joints for wear or damage. INSTALL new U-joints as necessary. REFER to Section 205-01. ● INSPECT the differential ring and pinion for damage. CARRY OUT the Checking Tooth Contact Pattern and Condition of the Ring and Pinion component test in this section. REPAIR or INSTALL a new differential ring and pinion as necessary. REFER to Section 205-02. ● CHECK the planetary gears for damage. INSTALL new components as necessary. REFER to Section 307-01.

<ul style="list-style-type: none"> ● Whistle—noise is high pitched, constant. Changes in pitch with throttle position 	<ul style="list-style-type: none"> ● Hydraulic pressure in the main control. ● Incorrect band/clutch apply pressure. ● Worn or damaged torque converter. 	<ul style="list-style-type: none"> ● INSPECT the main control. REPAIR or INSTALL new components as necessary. REFER to Section 307-01. ● CARRY OUT the line pressure tests. REPAIR or INSTALL components as necessary. REFER to Section 307-01. ● CARRY OUT the torque converter service and replacement check. REFER to Section 307-01.
<ul style="list-style-type: none"> ● Clunk—occurs when shifting from PARK to a drive or reverse position 	<ul style="list-style-type: none"> ● Damaged powertrain mounts. ● Damaged or worn pinion bearings. ● Worn or galled driveshaft slip yoke splines. ● Worn friction elements or excessive clutch pack end plate play. 	<ul style="list-style-type: none"> ● INSPECT the powertrain mounts for damage. INSTALL new mounts as necessary. REFER to Section 303-01A for 3.0L engines, Section 303-01B for 3.9L engines or Section 307-01. ● CHECK for abnormal bearing play or roughness. INSTALL new bearings as necessary. REFER to Section 205-02. ● CLEAN and INSPECT the splines of the yoke. INSTALL a new slip yoke as necessary. REFER to Section 205-01. ● INSPECT the transmission for wear. CHECK that all end play and clearances are within specification. REPAIR or INSTALL new components as necessary. REFER to Section 307-01.
<ul style="list-style-type: none"> ● Bump—occurs when shifting from PARK to a drive or reverse position. Similar to Clunk but with no sound 	<ul style="list-style-type: none"> ● Initial gear engagement. 	<ul style="list-style-type: none"> ● Acceptable condition.
<ul style="list-style-type: none"> ● Buzz or hiss 	<ul style="list-style-type: none"> ● Incorrect driveline angles. ● Worn or damaged main control solenoids or valves. 	<ul style="list-style-type: none"> ● CHECK for correct driveline angles. REPAIR as necessary. REFER to Section 205-00. ● Using a transmission tester, ACTIVATE the solenoids to duplicate sound. INSTALL new components as necessary. REFER to Section 307-01.
<ul style="list-style-type: none"> ● Vibration—a high frequency 	<ul style="list-style-type: none"> ● Transmission cooler lines grounded out. 	<ul style="list-style-type: none"> ● CHECK the transmission cooler lines. REPAIR as

<p>(20–80 Hz) that is felt through the seat or gear shifter. Changes with engine speed</p>	<ul style="list-style-type: none"> ● Flexplate to torque converter nuts loose. ● Fluid filler tube grounded out. ● Shift cable incorrectly routed, grounded out or loose. 	<p>necessary.</p> <ul style="list-style-type: none"> ● CHECK the flexplate nuts. TIGHTEN to specification. REFER to Section 307-01. ● CHECK the fluid filler tube. REPAIR as necessary. ● CHECK the shift cable. REPAIR as necessary. REFER to Section 307-05.
<ul style="list-style-type: none"> ● Shutter or chatter—occurs with light to medium acceleration from low speeds or a stop 	<ul style="list-style-type: none"> ● Electrical inputs/outputs. ● Vehicle wiring harness. ● Incorrect inputs/outputs from the powertrain control module (PCM), digital transmission range (TR) sensor, brake pedal position (BPP) sensor, throttle position (TP) sensor, transmission speed sensor (TSS), output speed shaft (OSS) sensor or the torque converter clutch (TCC). 	<ul style="list-style-type: none"> ● CARRY OUT a Torque Converter Clutch Operation Test. RUN on-board diagnostics or self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the powertrain control system. CLEAR the DTCs, road test and rerun on-board diagnostics or self-test. REFER to Section 307-01.

Pinpoint Tests

The pinpoint tests are a step-by-step diagnostic process designed to determine the cause of a condition. It may not always be necessary to follow a pinpoint test to its conclusion. Carry out only the steps necessary to correct the condition. Then, test the system for normal operation. Sometimes, it is necessary to remove various vehicle components to gain access to the component requiring testing. For additional information, REFER to the appropriate Workshop Manual section for removal and installation procedures. Reinstall all components after verifying system operation is normal.

PINPOINT TEST A: BRAKE VIBRATION/SHUDDER

CONDITIONS	DETAILS/RESULTS/ACTIONS
	<p>A1 ROAD TEST THE VEHICLE—LIGHT BRAKING</p> <ol style="list-style-type: none"> 1 Check that the wheel and tires are correct for the vehicle. Inspect the tires for abnormal wear patterns. 2 Road test the vehicle. Warm the brakes by slowing the vehicle a few times from 80–32 km/h (50 to 20 mph) using light braking applications. At highway speeds of 89–97 km/h (55-60 mph), apply the brake using a light pedal force.

● **Is there a vibration/shudder felt in the steering wheel, seat or brake pedal?**

→ **Yes**
GO to A4.

→ **No**
GO to A2.

A2 ROAD TEST THE VEHICLE—MODERATE TO HEAVY BRAKING

1 Road test the vehicle. At highway speeds of 89–97 km/h (55-60 mph), apply the brake using a moderate to heavy pedal force.

● **Is there a vibration/shudder?**

→ **Yes**
For vehicles with ABS, GO to A3.
For vehicles with standard brakes, GO to A4.

→ **No**
Vehicle is OK. VERIFY condition with customer. TEST the vehicle for normal operation.

A3 NORMAL ACTUATION OF THE ABS SYSTEM DIAGNOSIS

1 During moderate to heavy braking, noise from the hydraulic control unit (HCU) and pulsation in the brake pedal can be observed. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps, wet or snowy surfaces is acceptable and indicates correct functioning of the ABS system. Pedal pulsation or steering wheel nibble (frequency is proportioned to the vehicle speed) indicates a concern with a brake or suspension component.

● **Is the vibration/shudder vehicle speed sensitive?**

→ **Yes**
GO to A5.

→ **No**
The brake system is operating correctly.

A4 APPLICATION OF THE PARKING BRAKE

1 **NOTE:** Begin at the front of the vehicle unless the vibration or shudder has been isolated to the rear.

This test is not applicable to vehicles with drum-in-hat type parking brakes. For vehicles with drum-in-hat parking brakes, proceed to the next test. For all other vehicles, apply the parking brake to identify if the problem is in the front or rear brake. At highway speeds of 89–97 km/h (55-60 mph), lightly apply the parking brake until the vehicle slows down. Release the parking brake immediately after the test.

● **Is there a vibration/shudder?**

→ **Yes**
GO to A8.

→ **No**
GO to A5.

A5 CHECK THE FRONT WHEEL BEARINGS

1 Check the front wheel bearings. Refer to Wheel Bearing Check in this section.

- **Are the wheel bearings OK?**

→ **Yes**
GO to A6.

→ **No**
INSPECT the wheel bearings. ADJUST or REPAIR as necessary. TEST the system for normal operation.

A6 CHECK THE FRONT SUSPENSION

1 Check the front suspension for:

- Broken or loose bolts.
- Damaged springs.
- Worn or damaged upper and lower control arm bushings.
- Loose or rough front bearings.
- Uneven tire wear.

- **Are all the suspension components in satisfactory condition?**

→ **Yes**
GO to A7.

→ **No**
REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

A7 RESURFACE THE FRONT BRAKE DISCS

1  **CAUTION: Do not use a bench lathe to machine brake discs.**

NOTE: Follow the manufacturer's instructions to machine the brake discs. After machining, make sure the brake disc meets the thickness specification.

Resurface the front brake discs. Refer to Brake Disc Machining in this section. Road test the vehicle.

- **Is the vibration/shudder present?**



→ **Yes**
GO to A8.

→ **No**
Vehicle is OK.



A8 CHECK THE REAR SUSPENSION

1 Check the rear suspension for:

- Broken or loose bolts.

	<ul style="list-style-type: none"> ● Damaged or worn springs or spring bushings. ● Worn or damaged upper and lower control arm bushings. ● Worn or damaged trailing arms. ● Loose or rough rear bearings. ● Uneven tire wear. <p>● Are all the suspension components in satisfactory condition?</p> <p>→ Yes GO to <u>A9</u>.</p> <p>→ No REPAIR or INSTALL new components as necessary. TEST the system for normal operation.</p>
A9 RESURFACE THE REAR BRAKE DISC OR DRUM	
	<p>  CAUTION: Do not use a bench lathe to machine brake discs.</p> <p>NOTE: Follow the manufacturers instructions to machine the brake discs. After machining, make sure the brake disc meets the thickness specification.</p> <p>Resurface the rear brake discs or drums. Refer to <u>Brake Disc Machining</u> in this section. Road test the vehicle.</p> <p>● Is the vibration/shudder present?</p> <p>→ Yes CHECK the front suspension for wear or damage. RESURFACE the front brake discs. TEST the system for normal operation.</p> <p>→ No Vehicle is OK.</p>

PINPOINT TEST B: ENGINE TICKING NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK FOR TICKING NOISE AT THE FUEL RAIL	
	<p> Disconnect the first fuel line clip.</p> <p>● Is the ticking noise gone?</p> <p>→ Yes CHECK for TSB for applicable vehicle. REPAIR as necessary. TEST the system for normal operation.</p> <p>→ No GO to <u>B2</u>.</p>
B2 CHECK FOR TICKING NOISE AT THE FUEL INJECTOR	
	<p> Using an EngineEAR, listen at the fuel injectors by placing a probe on each injector. To isolate the faulty injector, disconnect the injector electrical connector and listen for the noise.</p>

● **Is the fuel injector the source of the ticking noise?**

→ **Yes**
INSTALL a new fuel injector. REFER to [Section 303-04A](#) for 3.0L engines or [Section 303-04B](#) for 3.9L engines. TEST the system for normal operation.

→ **No**
GO to [B3](#).

B3 CHECK THE BELT TENSIONER FOR TICKING NOISE

1 INSPECT the accessory drive. CHECK for the belt tensioner bottoming at end of travel or not at end of stroke.

2 Using an EngineEAR, listen at the belt tensioner.

● **Is the belt tensioner the source of the noise?**

→ **Yes**
INSTALL a new belt tensioner. TEST the system for normal operation.

→ **No**
GO to [B4](#).

B4 CHECK THE WATER PUMP FOR TICKING NOISE

1 Using an EngineEAR, listen at the water pump for ticking noise.

● **Is the water pump the source of the noise?**

→ **Yes**
INSTALL a new water pump. TEST the system for normal operation.

→ **No**
GO to [B5](#).

B5 CHECK FOR AN OBSTRUCTION OF THE COOLING FAN

1 Inspect the cooling fan for obstructions.

2 Check the cooling fan and shroud for wear or damage.

● **Was there an obstruction or does the cooling fan show signs of damage?**

→ **Yes**
REPAIR or INSTALL a new cooling fan. REFER to [Section 303-03](#). TEST the system for normal operation.

→ **No**
GO to [B6](#).



B6 CHECK THE OIL PUMP FOR TICKING NOISE

1 CHECK the oil pump using EngineEARs and probe at the oil filter adapter to verify the oil pump as a source.

● **Is the oil pump the source of the noise?**

	<p>→ Yes INSTALL a new oil pump. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines. TEST the system for normal operation.</p> <p>→ No GO to B7.</p>
B7 CHECK VALVE LIFTERS OR LASH ADJUSTERS FOR CORRECT OPERATION	
	<p>1 CHECK valve lifter/lash adjuster for correct operation, using EngineEARs.</p> <ul style="list-style-type: none"> ● Are the valve lifters/lash adjusters operating correctly? <p>→ Yes VERIFY customer concern. CONDUCT a diagnosis of other suspect components.</p> <p>→ No INSTALL a new valve lifter/lash adjuster(s). TEST the system for normal operation.</p>


PINPOINT TEST C: ACCESSORY DRIVE BEARING HOOT

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE ACCESSORY DRIVE IDLER AND TENSIONER PULLEY BEARINGS	
<p>2</p>  <p>4</p> 	<p>1 Carry out the Vehicle Cold Soak Procedure in this section.</p> <p>3 Place an EngineEAR probe directly on the pulley center post or bolt to verify which bearing is making the noise.</p> <ul style="list-style-type: none"> ● Is either bearing making the noise? <p>→ Yes INSTALL a new pulley/idler. CARRY OUT the Vehicle Cold Soak Procedure and TEST the system for normal operation.</p> <p>→ No CONDUCT a diagnosis on other suspect accessory drive components.</p>


PINPOINT TEST D: POWER STEERING MOAN

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK THE POWER STEERING SYSTEM	

1 Carry out the Vehicle Cold Soak Procedure in this section.

2 

3 Turn the steering wheel while the noise is occurring and listen for changes in sound pitch or loudness.


4 

- Does the sound pitch or loudness change while turning the steering wheel?


→ **Yes**
GO to D2.

→ **No**
CONDUCT a diagnosis on other suspect accessory drive components.

D2 VERIFY THE SOURCE

1 

2 Place an EngineEAR probe near the power steering pump/reservoir while the noise is occurring. While an assistant turns the steering wheel, listen for changes in sound pitch or loudness.

3 



- Does the sound pitch or loudness change while turning the steering wheel?

→ **Yes**
VERIFY that the supply tube to the pump is unobstructed. CHECK the fluid condition and level. DRAIN the fluid and REFILL. REFER to Section 211-02. CARRY OUT the Vehicle Cold Soak Procedure and TEST the system for normal operation.



→ **No**
Normal system operation.

PINPOINT TEST E: ENGINE DRIVEN COOLING FAN MOAN

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK THE ENGINE DRIVEN COOLING FAN AFTER A COLD SOAK	

<p>2</p>  <p>5</p> 	<p>1 Carry out the Vehicle Cold Soak Procedure in this section.</p> <p>3 Assess the airflow.</p> <p>4 Raise the engine speed to 1500 rpm while listening for the moan to increase in proportion to the airflow.</p> <p>● Does the moan increase in proportion to the airflow?</p> <p>→ Yes TEST the fan for normal operation. If the fan tests normal, GO to <u>E2</u>. Otherwise, REPAIR as necessary.</p> <p>→ No Normal system operation.</p>
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E2 CHECK THE ENGINE DRIVEN COOLING FAN AT NORMAL OPERATING TEMPERATURE

<p>1</p>  <p>3</p> 	<p>2 Run the engine to normal operating temperature while listening for the moan to stop.</p> <p>● Does the moan stop?</p> <p>→ Yes Normal clutch operation.</p> <p>→ No INSTALL a new fan clutch. TEST the system for normal operation.</p>
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PINPOINT TEST F: DRUMMING NOISE

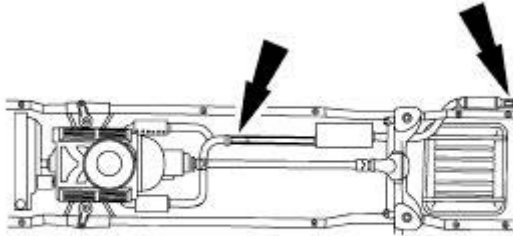
CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE EXHAUST SYSTEM	
1	



3



4



DF1766-A

5



7



2 Increase the engine rpm until the noise is the loudest. Note the engine rpm.

4 Add approximately 9 kg (20 lb) of weight to the exhaust system. First place the weight at the tail pipe and test, then at the front pipe.

6 Increase the engine rpm and listen for the drumming noise. Note the engine rpm if the noise occurs.

8 Using a vibration analyzer (VA), determine the amount of vibration that occurs with the drumming noise.

- Is the noise/vibration reduced or eliminated, or does the noise/vibration occur at a different rpm?

→ Yes
CARRY OUT Exhaust System Neutralizing in this section. TEST the system for normal operation.




→ No
GO to F2.

F2 POWERTRAIN/DRIVETRAIN MOUNT NEUTRALIZING

1 Carry out Powertrain/Drivetrain Mount Neutralizing in this section. Test the system for normal operation.

	<ul style="list-style-type: none"> ● Is the noise reduced or eliminated? <p>→ Yes Vehicle OK. TEST the system for normal operation.</p> <p>→ No CONDUCT diagnosis of other suspect components.</p>
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PINPOINT TEST G: ENGINE TICKING, KNOCKING OR CONTINUOUS RATTLE

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK FOR NOISE AT THE VALVE COVERS AND THE FRONT COVERS (OHC ENGINES)	
<p>2</p>  <p>4</p> 	<p>1 Carry out the Vehicle Cold Soak Procedure in this section.</p> <p>3 NOTE: For a short-duration ticking noise, multiple engine starts may be necessary.</p> <p>Using an EngineEAR, listen closely at the valve covers and the front covers (OHC engines) by placing the probe near the surface of the valve cover and then on the surface front cover.</p> <ul style="list-style-type: none"> ● Is the noise source apparent? <p>→ Yes REMOVE the appropriate cover and INSPECT for loose, worn/broken components. REPAIR as necessary. TEST the system for normal operation.</p> <p>→ No GO to <u>G2</u>.</p>
G2 CHECK FOR NOISE AT THE CYLINDER BLOCK	
<p>1</p>  <p>3</p>	<p>2 Using an EngineEAR, listen closely at the cylinder block by placing a probe on or near each freeze plug.</p>



● **Is the noise source apparent?**

- **Yes**
REPAIR or INSTALL new components as necessary.
- **No**
GO to G3.

G3 CHECK FOR NOISE WHILE DISCONNECTING EACH FUEL INJECTOR ELECTRICAL CONNECTOR, ONE AT A TIME

1



2 Disconnect each fuel injector electrical connector, one at a time, to decrease piston force and listen for the noise.

3



● **Is the noise reduced or eliminated?**


- **Yes**
INSTALL a new fuel injector. TEST the system for normal operation.
- **No**
INSPECT accessory drive or the transmission as a possible source.

PINPOINT TEST H: FRONT SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 ROAD TEST THE VEHICLE	<p>1 Test drive the vehicle.</p> <p>2 NOTE: An assistant will be needed for this road test.</p> <p>During the road test, drive the vehicle over a rough road. Using ChassisEARS, determine from which area/component the noise is originating.</p> <p>● Is there a squeak, creak or rattle noise?</p> <ul style="list-style-type: none"> → Yes GO to <u>H2</u>. → No

The suspension system is OK. CONDUCT a diagnosis on other suspect systems.

H2 INSPECT THE STEERING SYSTEM

1  **WARNING:** The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.

Raise and support the vehicle.

2 Check the steering system for wear or damage. Carry out a steering linkage test. Refer to [Section 211-00](#).

3 Inspect the tire wear pattern. Refer to Tire Wear Patterns chart in this section.

● **Are the steering components worn or damaged?**

→ **Yes**

REPAIR the steering system. INSTALL new components as necessary. TEST the system for normal operation.

→ **No**

GO to [H3](#).

H3 FRONT SHOCK ABSORBER/STRUT CHECK

1 Check the front shock absorbers/strut mounts for loose bolts or nuts.

2 Check the front shock absorbers/struts for damage or wear. Carry out a "bounce test".

● **Are the front shock absorbers/struts loose or damaged?**

→ **Yes**

TIGHTEN to specifications if loose. INSTALL new front shock absorbers/struts if damaged. TEST the system for normal operation.

→ **No**

GO to [H4](#).

H4 CHECK THE FRONT SPRINGS

1 Check the front spring and front spring mounts/brackets for wear or damage.

● **Are the front springs or spring mounts/brackets worn or damaged?**

→ **Yes**

REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

→ **No**


GO to [H5](#).

H5 CHECK THE CONTROL ARMS/RADIUS ARMS

1 Inspect the control arm bushings for wear or damage.

	<p>2 Inspect for twisted or bent control/radius arm.</p> <ul style="list-style-type: none"> ● Are the control/radius arms damaged or worn? <p>→ Yes REPAIR or INSTALL new components as necessary. TEST the system for normal operation.</p> <p>→ No GO to <u>H6</u>.</p>
H6 CHECK THE STABILIZER BAR/TRACK BAR	
	<p>1 Check the stabilizer bar/track bar bushings and links for damage or wear.</p> <p>2 Check the stabilizer bar/track bar for damage.</p> <p>3 Check for loose or damaged stabilizer bar isolators or brackets.</p> <ul style="list-style-type: none"> ● Are the stabilizer bar/track bar components loose, worn or damaged? <p>→ Yes REPAIR or INSTALL new components as necessary. TEST the system for normal operation.</p> <p>→ No Suspension system OK. CONDUCT diagnosis on other suspect systems.</p>

PINPOINT TEST I: REAR SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 ROAD TEST THE VEHICLE	
	<p>1 Test drive the vehicle.</p> <p>2 NOTE: An assistant will be needed for this road test.</p> <p>During the road test, drive the vehicle over a rough road. Using ChassisEARS, determine from which area/component the noise is originating.</p> <ul style="list-style-type: none"> ● Is there a squeak, creak or rattle noise? <p>→ Yes GO to <u>I2</u>.</p> <p>→ No The suspension system is OK. CONDUCT a diagnosis on other suspect systems.</p>
I2 REAR SHOCK ABSORBER/STRUT CHECK	
	<p>1  WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during</p>

these operations.

Raise and support the vehicle.

2 Check the rear shock absorber/strut mounts for loose bolts or nuts.

3 Check the rear shock absorbers/struts for damage. Carry out a shock absorber check.

● Are the rear shock absorbers/struts loose or damaged?

→ Yes

TIGHTEN to specifications if loose. INSTALL new rear shock absorbers/struts if damaged. TEST the system for normal operation.

→ No

GO to 13.

13 CHECK THE REAR SPRINGS

1 Check the rear springs and rear spring mounts/brackets for wear or damage.

● Are the rear springs or spring mounts/brackets worn or damaged?

→ Yes

REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

→ No

GO to 14.

14 CHECK THE CONTROL ARMS/TRAILING ARMS

1 Inspect the control arm/trailing arm bushings for wear or damage. Check for loose control arm/trailing arm bolts.

2 Inspect for twisted or bent control arm/trailing arms.

● Are the control arms/trailing arms loose, damaged or worn?

→ Yes

REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

→ No

GO to 15.

15 CHECK THE STABILIZER BAR/TRACK BAR

1 Check the stabilizer bar/track bar bushings and links for damage or wear.

2 Check the stabilizer bar/track bar for damage.

3 Check for loose or damaged stabilizer bar isolators or brackets.

● Are the stabilizer bar/track bar components loose, worn or damaged?

→ Yes

REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

→ **No**
 Suspension system OK. CONDUCT diagnosis on other suspect systems.

PINPOINT TEST J: WHEEL AND TIRE

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 ROAD TEST THE VEHICLE	
	<p>1 NOTE: Wheel or tire vibrations felt in the steering wheel are most likely related to the front wheel or tire. Vibration felt through the seat are most likely related to the rear wheel or tire. This may not always be true, but it can help to isolate the problem to the front or rear of the vehicle.</p> <p>Test drive the vehicle at different speed ranges.</p> <p>2 During the road test, if the vibration can be eliminated by placing the vehicle in neutral or is affected by the speed of the engine, the cause is not the wheels or tires.</p> <p>● Is there a vibration and noise?</p> <p>→ Yes GO to <u>J2</u>.</p> <p>→ No The wheel and tires are OK. CONDUCT a diagnosis on other suspect systems.</p>
J2 CHECK THE FRONT WHEEL BEARINGS	
	<p>1 Check the front wheel bearings. Refer to <u>Wheel Bearing Check</u> in this section.</p> <p>● Are the wheel bearings OK?</p> <p>→ Yes GO to <u>J3</u>.</p> <p>→ No INSPECT the wheel bearings. ADJUST or REPAIR as necessary. TEST the system for normal operation.</p>
J3 INSPECT THE TIRES	
	<p>1 Check the tires for missing weights.</p> <p>2 Check the wheels for damage.</p> <p>3 Inspect the tire wear pattern. Refer to the Tire Wear Patterns chart in this section.</p>

- **Do the tires have an abnormal wear pattern?**

→ **Yes**
CORRECT the condition that caused the abnormal wear. INSTALL new tire(s). TEST the system for normal operation.

→ **No**
GO to J4.

J4 TIRE ROTATION DIAGNOSIS

1



DF1713-A

2



DF1714-A

1 Spin the tires slowly and watch for signs of lateral runout.

2 Spin the tires slowly and watch for signs of radial runout.

- **Are there signs of visual runout?**

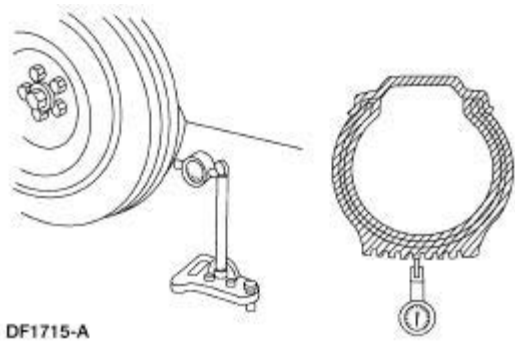
→ **Yes**
GO to J5.

→ **No**
CHECK the wheel and tire balance. CORRECT as necessary. TEST the system for normal operation.

J5 RADIAL RUNOUT CHECK ON THE TIRE

1

1 Measure the radial runout of the wheel and tire assembly. A typical specification for total radial runout is 0.045 inch.



DF1715-A

- Is the radial runout within specifications?

→ **Yes**
GO to J8.

→ **No**
GO to J6.

J6 RADIAL RUNOUT CHECK ON THE WHEEL

1 Measure the radial runout of the wheel. A typical specification for total radial runout is 0.045 inch.

- Is the radial runout within specifications?

→ **Yes**
INSTALL a new tire. TEST the system for normal operation.

→ **No**
GO to J7.

J7 CHECK THE HUB/BRAKE DISC OR DRUM PILOT RUNOUT OR BOLT CIRCLE RUNOUT

1 Measure the pilot or bolt circle runout. A typical specification for radial runout is:

- Pilot runout— less than 0.15 mm (0.006 inch).
- Bolt circle runout— less than 0.38 mm (0.015 inch).

- Is the radial runout within specifications?

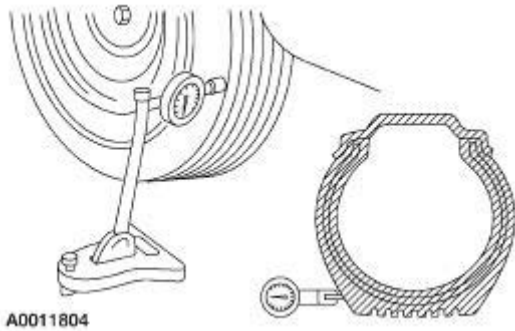
→ **Yes**
INSTALL a new wheel. TEST the system for normal operation.

→ **No**
REPAIR or INSTALL new components as necessary. REFER to Section 204-01 for the front wheels or Section 204-02 for the

rear wheels.

J8 LATERAL RUNOUT CHECK ON THE TIRE

1



1

Measure the lateral runout of the wheel and tire assembly. A typical specification for total lateral runout is 1.14 mm (0.045 inch).

- Is the lateral runout within specifications?

→ **Yes**

Wheel and tires OK. CONDUCT diagnosis on other suspect systems.

→ **No**

GO to J9.

J9 LATERAL RUNOUT CHECK ON THE WHEEL

1

Measure the lateral runout of the wheel. A typical specification for total radial runout is 1.14mm (0.045 inch).

- Is the lateral runout within specifications?

→ **Yes**

INSTALL a new tire. TEST the system for normal operation.

→ **No**

GO to J10.

J10 CHECK THE FLANGE FACE LATERAL RUNOUT

1

Measure the flange face lateral runout. A typical specification for lateral runout is:

- Hub/brake disc— less than 0.13 mm (0.005 inch).
- Axle shaft— less than 0.25 mm (0.010 inch).

- Is the lateral runout within specifications?

→ **Yes**

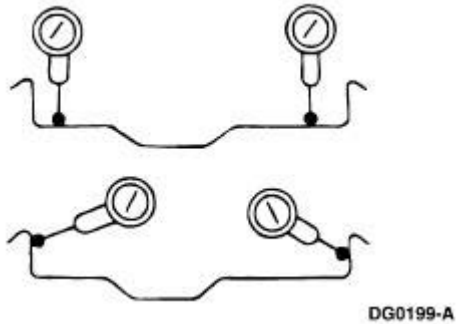
INSTALL a new wheel. TEST the system for normal operation.

→ **No**
 REPAIR or INSTALL new components as necessary. REFER to [Section 204-01](#) for the front wheels or [Section 204-02](#) for the rear wheels.

PINPOINT TEST K: HIGH SPEED SHAKE OR SHIMMY

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 CHECK FOR FRONT WHEEL BEARING ROUGHNESS	
	<p>1 Check the rear wheels.</p> <p>2 Raise and support the front end of the vehicle so that the front wheel and tire assemblies can spin.</p> <p>3 Spin the front tires by hand. Refer to Wheel Bearing Check in this section.</p> <p>● Do the wheel bearings feel rough?</p> <p>→ Yes INSPECT the wheel bearings. REPAIR as necessary. TEST the system for normal operation.</p> <p>→ No GO to K2.</p>
K2 CHECK THE END PLAY OF THE FRONT WHEEL BEARINGS	
	<p>1 Check the end play of the front wheel bearings. Refer to Section 204-00.</p> <p>● Is the end play OK?</p> <p>→ Yes GO to K3.</p> <p>→ No ADJUST or REPAIR as necessary. TEST the system for normal operation.</p>
K3 MEASURE THE LATERAL RUNOUT AND THE RADIAL RUNOUT OF THE FRONT WHEELS ON THE VEHICLE	
	<p>1 Measure the lateral runout and the radial runout of the front wheels on the vehicle. Go To Pinpoint Test J.</p> <p>● Are the measurements within specifications?</p> <p>→ Yes GO to K4.</p>

	<p>→ No INSTALL new wheels as necessary and BALANCE the assembly. TEST the system for normal operation.</p>
K4 MEASURE THE LATERAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
	<p>1 Measure the lateral runout of the front tires on the vehicle. <u>Go To Pinpoint Test J.</u></p> <p>● Is the runout within specifications?</p> <p>→ Yes GO to <u>K5.</u></p> <p>→ No INSTALL new tires as necessary and BALANCE the assembly. TEST the system for normal operation.</p>
K5 MEASURE THE RADIAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
	<p>1 Measure the radial runout of the front tires on the vehicle. <u>Go To Pinpoint Test J.</u></p> <p>● Is the runout within specifications?</p> <p>→ Yes BALANCE the front wheel and tire assemblies. If any tire cannot be balanced, INSTALL a new tire. TEST the system for normal operation.</p> <p>→ No GO to <u>K6.</u></p>
K6 MATCH MOUNT THE TIRE AND WHEEL ASSEMBLY	
	<p>1 Mark the high runout location on the tire and also on the wheel. Break the assembly down and rotate the tire 180 degrees (halfway around) on the wheel. Inflate the tire and measure the radial runout.</p> <p>● Is the runout within specifications?</p> <p>→ Yes BALANCE the assembly. TEST the system for normal operation.</p> <p>→ No If the high spot is not within 101.6 mm (4 inches) of the first high spot on the tire, GO to <u>K7.</u></p>
K7 MEASURE THE WHEEL FLANGE RUNOUT	
1	1 Dismount the tire and mount the wheel



on a wheel balancer. Measure the runout on both wheel flanges. Refer to [Section 204-04](#).

● **Is the runout within specifications?**


→ **Yes**

LOCATE and MARK the low spot on the wheel. INSTALL the tire, matching the high spot on the tire with the low spot on the wheel. BALANCE the assembly. TEST the system for normal operation. If the condition persists, GO to [K8](#).

→ **No**

INSTALL a new wheel. CHECK the runout on the new wheel. If the new wheel is within limits, LOCATE and MARK the low spot. INSTALL the tire, matching the high spot on the tire with the low spot on the wheel. BALANCE the assembly. TEST the system for normal operation. If the condition persists, GO to [K8](#).

K8 CHECK FOR VIBRATION FROM THE FRONT OF THE VEHICLE

 **WARNING:** If only one drive wheel is allowed to rotate, speed must be limited to 55 km/h (34 mph) using the speedometer reading, since actual wheel speed will be twice that indicated on the speedometer. Exceeding a speed of 55 km/h (34 mph) or allowing the drive wheel to hang unsupported can result in tire disintegration or differential failure, which can cause serious personal injury and extensive vehicle damage.

1 Spin the front wheel and tire assemblies with a wheel balancer while the vehicle is raised on a hoist. Feel for vibration in the front fender or while seated in the vehicle.

● **Is the vibration present?**

→ **Yes**

SUBSTITUTE known good wheel and tire assemblies as necessary. TEST the system for normal operation.

→ **No**

GO to [K9](#).


K9 CHECK FOR VIBRATION FROM THE REAR OF THE VEHICLE

 **WARNING:** If only one drive wheel is allowed to rotate, speed must be limited to 55

km/h (34 mph) using the speedometer reading, since actual wheel speed will be twice that indicated on the speedometer. Exceeding a speed of 55 km/h (34 mph) or allowing the drive wheel to hang unsupported can result in tire disintegration or differential failure, which can cause serious personal injury and extensive vehicle damage.

	<ol style="list-style-type: none"> 1 Chock the front wheels. 2 Raise and support the rear end of the vehicle so that the rear wheel and tire assemblies can spin. 3 Engage the drivetrain and carefully accelerate the drive wheels while checking for vibration. <p>● Is the vibration present?</p> <p>→ Yes GO to <u>K10</u>.</p> <p>→ No TEST the system for normal operation.</p>
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K10 CHECK THE DRIVETRAIN

 **WARNING:** If only one drive wheel is allowed to rotate, speed must be limited to 55 km/h (34 mph) using the speedometer reading, since actual wheel speed will be twice that indicated on the speedometer. Exceeding a speed of 55 km/h (34 mph) or allowing the drive wheel to hang unsupported can result in tire disintegration or differential failure, which can cause serious personal injury and extensive vehicle damage.

	<ol style="list-style-type: none"> 1 Remove the rear wheel and tire assemblies. Refer to <u>Section 204-04</u>. 2 Secure the brake drums (if so equipped), by installing wheel hub bolt nuts, reversed. 3 Carefully accelerate the drivetrain while checking for vibration. <p>● Is the vibration present?</p> <p>→ Yes CHECK/TEST the drivetrain and driveline components. TEST the system for normal operation.</p> <p>→ No SUBSTITUTE known good wheel and tire assemblies as necessary. TEST the system for normal operation.</p>
--	---

PINPOINT TEST L: CLUTCH VIBRATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1 CHECK ENGINE COMPONENTS FOR GROUNDING	
	<ol style="list-style-type: none"> 1 NOTE: Make sure the clutch is the cause of the vibration concern. The

vibration should occur during clutch operation. The clutch can also be difficult to engage or disengage. Eliminate all related systems before checking the clutch components.

NOTE: Check the driveline angles and driveshaft runout before disassembling the clutch system. Refer to [Section 205-00](#).

Check the powertrain/drivetrain mounts, exhaust manifolds or other engine components for grounding on the chassis.

● **Are any mounts or engine components grounded?**

→ **Yes**
REPAIR as necessary. TEST the system for normal operation.

→ **No**
GO to [L2](#).

L2 CHECK THE ACCESSORY DRIVE BELT

1 Remove the accessory drive belt.

● **Does the vibration stop with the accessory drive belt removed?**

→ **Yes**
DIAGNOSE the accessory drive components.

→ **No**
GO to [L3](#).

L3 CHECK FOR LOOSE CLUTCH PRESSURE PLATE BOLTS

1 Check for loose clutch pressure plate bolts. Inspect the clutch pressure plate for damage or for material between the pressure plate and flywheel.

● **Are there any loose bolts or damage?**

→ **Yes**
TIGHTEN the bolts to specifications or if damaged, INSTALL a new clutch pressure plate. REFER to [Section 308-01](#). TEST the system for normal operation.

→ **No**
GO to [L4](#).

L4 CHECK THE CLUTCH DISC SPRINGS

1 Check for worn, broken or loose clutch disc springs.

● **Are the clutch springs worn, broken or loose?**

→ **Yes**
INSTALL a new clutch disc. REFER to [Section 308-01](#). TEST the system for normal operation.

→ **No**
GO to [L5](#).

L5 CHECK THE CLUTCH DISC SPLINES

	<p>1 Inspect the clutch disc splines for damage or wear.</p> <ul style="list-style-type: none"> ● Is there damage or wear? <p>→ Yes INSTALL a new clutch disc. REFER to Section 308-01. TEST the system for normal operation.</p> <p>→ No GO to L6.</p>
<p>L6 CHECK THE FLYWHEEL BOLTS</p>	
	<p>1 Check for loose flywheel bolts.</p> <ul style="list-style-type: none"> ● Are the bolts loose? <p>→ Yes TIGHTEN the bolts to specifications. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines. TEST the system for normal operation.</p> <p>→ No GO to L7.</p>
<p>L7 CHECK THE FLYWHEEL SURFACE</p>	
	<p>1 Inspect the flywheel surface for wear or damage. Check the flywheel runout.</p> <ul style="list-style-type: none"> ● Is there any damage or excessive wear? <p>→ Yes INSTALL a new flywheel. REFER to Section 303-01A for 3.0L engines or Section 303-01B for 3.9L engines. TEST the system for normal operation.</p> <p>→ No Clutch system normal. CONDUCT a diagnosis on other suspect systems.</p>

Component Tests

Idle Air Control (IAC) Valve


1. Open the hood.
2. **NOTE:** Key symptom is elevated idle speed while noise is occurring.

NOTE: "Snapping" the throttle can induce the noise.

Verify the condition by operating the vehicle for a short time.

3. Inspect the IAC valve. If physical evidence of contamination exists, install a new IAC valve.
4. While the noise is occurring, either place an EngineEAR probe near the IAC valve and the inlet tube, or create a 6.35 mm (0.25 in)-12.7 mm (0.50 in) air gap between the inlet tube and the clean air tube. If the IAC valve is making the noise, install a new IAC valve.
5. Test the vehicle for normal operation.

Steering Gear Grunt/Shudder Test

1. Start and run the vehicle to operating temperature.
2. Set engine idle speed to 1200 rpm.
3.  **CAUTION: Do not hold the steering wheel against the stops for more than three to five seconds at a time. Damage to the power steering pump will occur.**

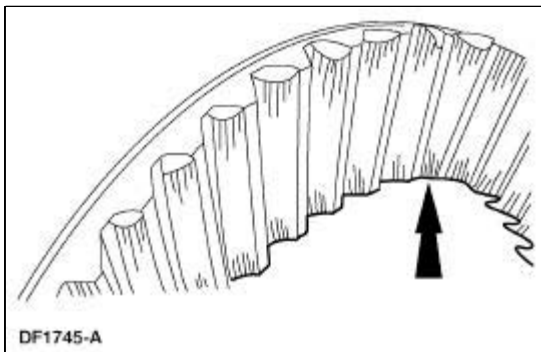
Rotate the steering wheel to the RH stop, then turn the steering wheel 90° back from that position. Turn the steering wheel slowly in a 15° to 30° arc.

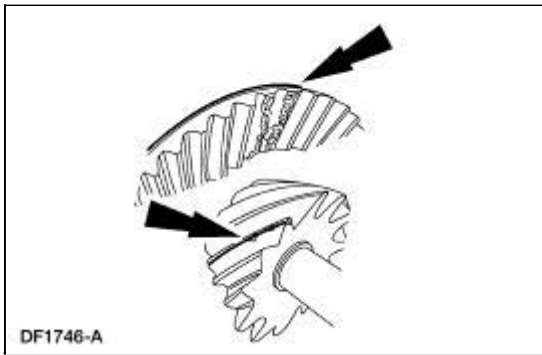
4. Turn the steering wheel another 90°. Turn the steering wheel slowly in a 15° to 30° arc.
5. Repeat the test with power steering fluid at different temperatures.
6. If a light grunt is heard or a low (50-200 Hz) shudder is present, this is a normal steering system condition.
7. If a loud grunt is heard, or strong shudder is felt, fill and purge the power steering system.

Checking Tooth Contact Pattern and Condition of the Ring and Pinion

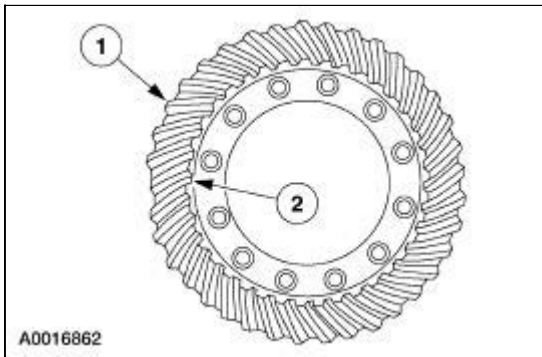
There are two basic types of conditions that will produce ring and pinion noise. The first type is a howl or chuckle produced by broken, cracked, chipped, scored or forcibly damaged gear teeth and is usually quite audible over the entire speed range. The second type of ring and pinion noise pertains to the mesh pattern of the gear pattern. This gear noise can be recognized as it produces a cycling pitch or whine. Ring and pinion noise tends to peak in a narrow speed range or ranges, and will tend to remain constant in pitch.

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Drain the axle lubricant. For additional information, refer to [Section 205-02](#).
3. Remove the carrier assembly or the axle housing cover depending on the axle type. Refer to [Section 205-02](#).
4. Inspect the gear set for scoring or damage.



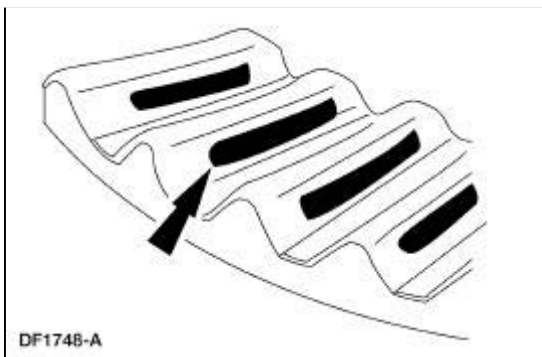


- In the following steps, the movement of the contact pattern along the length is indicated as toward the "heel" or "toe" of the differential ring gear.



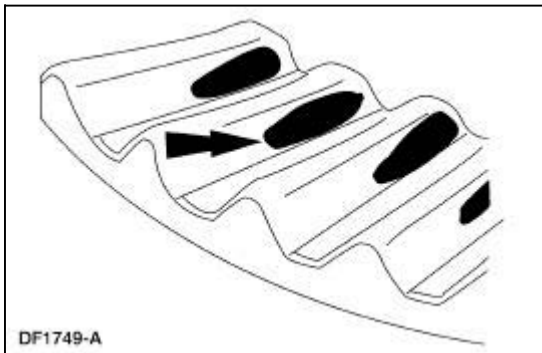
Item	Description
1	Heel
2	Toe

- Apply a marking compound to a third of the gear teeth on the differential ring gear. Rotate the differential ring gear several complete turns in both directions until a good, clear tooth pattern is obtained. Inspect the contact patterns on the ring gear teeth.
- A good contact pattern should be centered on the tooth. It can also be slightly toward the toe. There should always be some clearance between the contact pattern and the top of the tooth.
 - Tooth contact pattern shown on the drive side of the gear teeth.



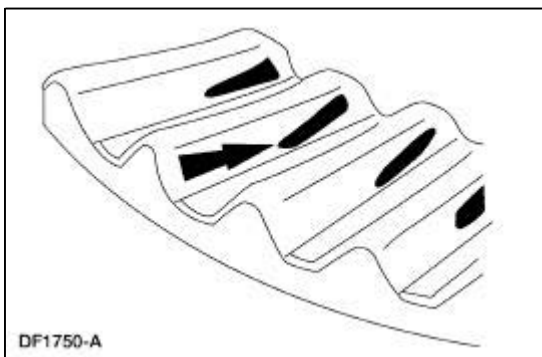
- A high, thick contact pattern that is worn more toward the toe.
 - Tooth contact pattern shown on the drive side of the gear teeth.

- The high contact pattern indicates that the drive pinion is not installed deep enough into the carrier.
- The differential ring gear backlash is correct, a thinner drive pinion shim is needed. A decrease will move the drive pinion toward the differential ring gear.



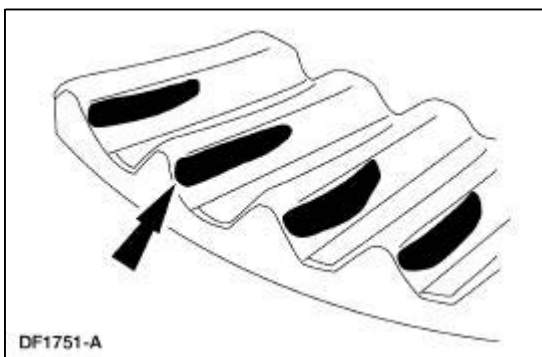
9. A high, thin contact pattern that is worn toward the toe.

- Tooth contact pattern shown on the drive side of the gear teeth.
- The drive pinion depth is correct. Increase the differential ring gear backlash.



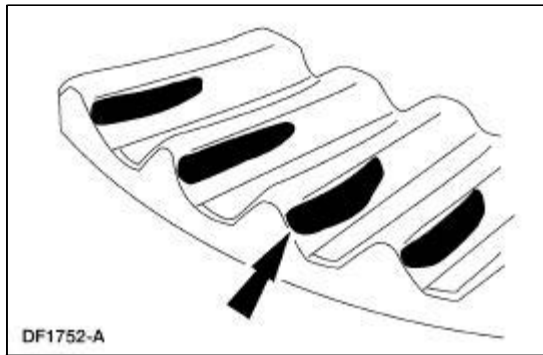
10. A contact pattern that is worn in the center of the differential ring gear tooth toward the heel.

- Tooth contact pattern shown on the drive side of the gear teeth.
- The low contact pattern indicates that the drive pinion is installed too deep into the carrier.
- The differential ring gear backlash is correct. A thicker drive pinion shim is needed.



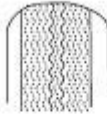
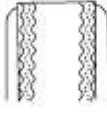
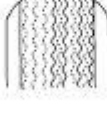




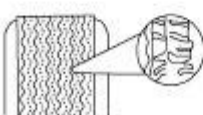
11. A contact pattern that is worn at the top of the differential ring gear tooth toward the heel.

- Tooth contact pattern shown on the drive side of the gear teeth.
- The pinion gear depth is correct. Decrease the differential ring gear backlash.



Tire Wear Patterns and frequency calculations

Tire Wear Chart

TIRE WEAR	CONDITION	POSSIBLE CAUSES
	<ul style="list-style-type: none"> • Rapid wear at both shoulders. 	<ul style="list-style-type: none"> • Tires underinflated. • Worn suspension components. • Excessive cornering speeds. • Lack of rotation.
	<ul style="list-style-type: none"> • Rapid wear at the center. 	<ul style="list-style-type: none"> • Tires overinflated. • Lack of rotation. • Excessive toe on drive wheels. • Heavy acceleration on drive wheels.
	<ul style="list-style-type: none"> • Wear at one shoulder. 	<ul style="list-style-type: none"> • Toe adjustment out of specification. • Camber out of specification. • Damaged strut. • Damaged lower control arm.
	<ul style="list-style-type: none"> • Feather edges. 	<ul style="list-style-type: none"> • Toe adjustment out of specification. • Damaged or worn tie rods. • Damaged spindle or knuckle.
	<ul style="list-style-type: none"> • Bald spots or cupping. 	<ul style="list-style-type: none"> • Unbalanced wheel. • Excessive radial runout. • Worn strut or shock absorber.
	<ul style="list-style-type: none"> • Tire scalloped. 	<ul style="list-style-type: none"> • Toe adjustment out of specification. • Camber out of specification. • Worn or damaged suspension components.
	<ul style="list-style-type: none"> • Wear pattern - FWD vehicles. 	<ul style="list-style-type: none"> • Excessive toe on non-drive wheels. • Lack of rotation.
	<ul style="list-style-type: none"> • Wear pattern - FWD vehicles. • Edge of tread blocks worn. 	<ul style="list-style-type: none"> • Excessive toe on non-drive wheels. • Lack of rotation.

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Wheel and tire NVH concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated by placing the transmission in NEUTRAL is not related to the tire and wheel. As a general rule, tire and wheel vibrations felt in the steering wheel are related to the front tire and wheel assemblies. Vibrations felt in the seat or floor are related to the rear tire and wheel assemblies. This can initially isolate a concern to the front or rear.

Careful attention must be paid to the tire and wheels. There are several symptoms that can be caused by damaged or worn tire and wheels. Carry out a careful visual inspection of the tires and wheel assemblies. Spin the tires slowly and watch for signs of lateral or radial runout. Refer to the tire wear chart to determine the tire wear conditions and actions.

For a vibration concern, use the vehicle speed to determine tire/wheel frequency and rpm. Calculate tire and wheel rpm and frequency by carrying out and following:



- Measure the diameter of the tire.
- Record the speed at which the vibration occurs.
- Obtain the corresponding tire and wheel rpm and frequency from the Tire Speed and Frequency Chart.
 - If the vehicle speed is not listed, divide the vehicle speed at which the vibration occurs by 16 km/h (10 mph). Multiply that number by 16 km/h (10 mph) tire rpm listed for that tire diameter in the chart. Then divide that number by 60. For example: a 40 mph vibration with 835 mm (33 in) tires. $40 \div 10 = 4$. Multiply 4 by 105 = 420 rpm. Divide 420 rpm by 60 seconds = 7 Hz at 40 mph.

Tire Speed and Frequency Chart

Tire Diameter	Tire RPM/Hz	Tire RPM/Hz	Tire RPM/Hz	Tire RPM/Hz
mm (inch)	@ 16 km/h (10 mph)	@ 80 km/h (50 mph)	@ 97 km/h (60 mph)	@ 113 km/h (70 mph)
483 (19)	182	910/15	1092/18	1274/21
508 (20)	173	865/14	1038/17	1211/20
533 (21)	165	825/14	990/16	1155/19
560 (22)	158	790/13	948/16	1106/18
585 (23)	151	755/13	906/15	1057/18
610 (24)	145	725/12	870/14	1015/17
635 (25)	139	695/12	834/14	973/16
660 (26)	134	670/11	804/13	938/16
685 (27)	129	645/11	774/13	903/15
710 (28)	124	620/10	744/12	868/14
735 (29)	119	595/10	714/12	833/14
760 (30)	115	575/10	690/11	805/13
785 (31)	111	555/9	666/11	777/13
810 (32)	108	540/9	648/11	756/13
835 (33)	105	525/9	630/10	735/12
864 (34)	102	510/8	612/10	714/12

Brake Disc Machining

Special Tool(s)

 <p>ST1348-A</p>	<p>Gauge, Clutch Housing 308-021 (T75L-4201-A)</p>
 <p>ST1214-A</p>	<p>Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent</p>

Material

Item	Specification
Metal Surface Cleaner F4AZ-19A536-RA or equivalent	WSE-M5B392-A
High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA or equivalent	ESE-M12A4-A


⚠ WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.

⚠ CAUTION: Do not install brake discs that are less than the minimum thickness specified. Do not machine a brake disc below the minimum thickness specification.

1. Check wheel bearing end-play and correct as necessary.
2. **NOTE:** Begin at the front of the vehicle unless the vibration has been isolated to the rear.

Remove the tire and wheel assembly.
3. Remove the brake caliper and the brake caliper anchor plate. Refer to the appropriate section in Group 206 for the procedure.
4. Inspect the brake linings. Install new brake linings if below specification. For additional information, refer to the appropriate brake section.
5. Measure and record the brake disc thickness. Install a new brake disc if the thickness after machining will be at or below specification. The specification is molded into the brake disc.
 - Do not machine a new brake disc.

6. For vehicles with a two-piece hub and brake disc assembly:
 - Match-mark before disassembly.
 - Remove the brake disc.
 - Clean the hub and brake disc mounting surfaces with metal surface cleaner.
 - Using a die grinder with a mild abrasive (Scotch Brite® type), remove any rust or corrosion from the hub and brake disc mounting surfaces.
 - Align the match-marks and reinstall the brake disc on the hub.

7.  **CAUTION: Do not use a bench lathe to machine brake discs.**

NOTE: The depth of cut must be between 0.10 and 0.20 mm (0.004 and 0.008 inch). Lighter cuts will cause heat and wear. Heavier cuts will cause poor brake disc surface finish.

Using an on-car brake lathe, machine the brake discs. Follow the manufacturer's instructions. After machining, make sure the brake disc still meets the thickness specification.

8. Using the special tools, verify that the brake disc lateral runout is now within specification. For additional information, refer to [Section 206-00](#).
 9. Remove the special tool hub adapter.
 10. Remove any remaining metal chips from the machining operation.
 11. For vehicles with a two-piece hub and brake disc assembly:
 - Remove the brake disc from the hub.
 - Remove any remaining metal chips from hub and brake disc mounting surfaces and from the ABS sensor.
 - Apply a liberal amount of lubricant to the hub flange, pilot area and to the brake disc-to-hub mounting surface.
 - Using the match marks, mount the brake disc on the hub.
 12. Install the brake caliper anchor plate and the brake caliper.
 13. Install the tire and wheel assembly.
 14. Test the system for normal operation.
-

Powertrain/Drivetrain Mount Neutralizing



WARNING: The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.

1. Raise and support the vehicle.
2. Loosen, but do not remove, the powertrain/drivetrain mount fasteners.
3. Lower the vehicle.



4. **CAUTION:** Do not twist or strain the powertrain/drivetrain mounts.

Move the vehicle in forward and reverse 0.6-1.2 meters (2-4 ft).

5. Raise and support the vehicle.
 6. Tighten the powertrain/drivetrain mount fasteners.
 7. Lower the vehicle.
 8. Test the system for normal operation.
-

Exhaust System Neutralizing




WARNING: Exhaust gases contain carbon monoxide, which is harmful to health and potentially lethal. Repair exhaust system leaks immediately. Never operate the engine in an enclosed area.



WARNING: Exhaust system components are hot.

NOTE: Neutralize the exhaust system to relieve strain on mounts which can be sufficiently bound up to transmit vibration as if grounded.

1.  **WARNING:** The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.




CAUTION: Make sure the system is warmed up to normal operating temperature, as thermal expansion can be the cause of a strain problem.

Raise and support the vehicle.

2. Loosen all exhaust hanger attachments and reposition the hangers until they hang free and straight.
 3. Loosen all exhaust flange joints.
 4. Place a stand to support the muffler parallel to the vehicle frame with the muffler pipe bracket free of stress.
 5. Tighten the muffler connection.
 6. Tighten all the exhaust hanger clamps and flanges (tighten the exhaust manifold flange joint last).
 - Verify there is adequate clearance to prevent grounding at any point in the system. Make sure that the catalytic converter and heat shield do not contact the frame rails.
 - After neutralization, the rubber in the exhaust hangers should show some flexibility when movement is applied to the exhaust system.
 - With the exhaust system installed securely and cooled, the rear hanger should be angled forward.
 7. Lower the vehicle.
 8. Test the exhaust system for normal operation.
-

Wheel Bearing Check

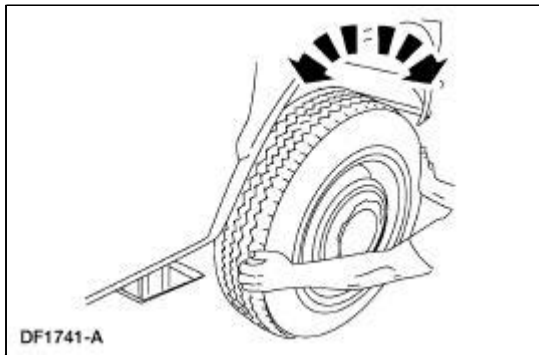
1.  **WARNING:** The electrical power to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch. Failure to do so can result in unexpected inflation or deflation of the air springs, which can result in shifting of the vehicle during these operations.

Raise the vehicle until the front tires are off the floor.

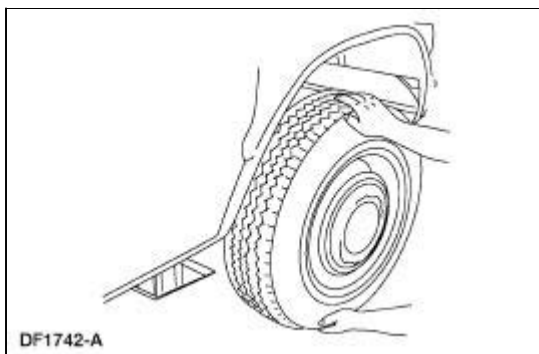
- Make sure the wheels are in a straight forward position.

2. **NOTE:** Make sure the wheel rotates freely and that the brake pads are retracted sufficiently to allow free movement of the tire and wheel assembly.

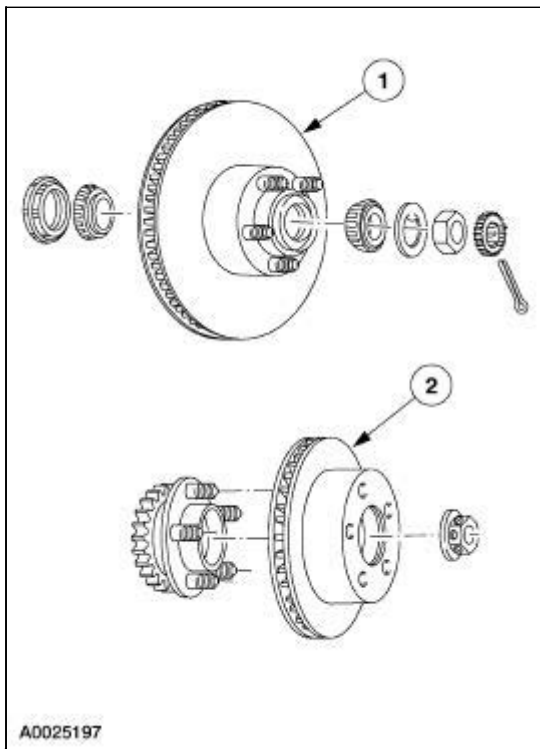
Spin the tire by hand to check the wheel bearings for roughness.



3. Grip each front tire at the top and bottom and move the wheel inward and outward while lifting the weight of the tire off the front wheel bearing.



4. If the tire and wheel (hub) is loose on the spindle, does not rotate freely, or has a rough feeling when spun, carry out one of the following:
 1. On vehicles with inner and outer bearings, inspect the bearings and cups for wear or damage. Adjust or install new bearings and cups as necessary.
 2. On vehicles with one sealed bearing, install a new wheel hub.



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General Specifications

Item	LH	RH	Split
Alignment Specifications — Front			
Caster	8.10° ± 0.50°	8.10° ± 0.50°	0° ± 0.70°
Camber	-0.15° ± 0.50°	-0.15° ± 0.50°	0° ± 0.70°
Toe @ curb ride height (positive value is toe-in, negative value is toe-out)	—	—	+0.16° ± 0.25°
Alignment Specifications — Rear			
Caster	—	—	—
Camber	-1.0° ± 0.75°	-1.0° ± 0.75°	0° ± 0.75°
Toe @ curb ride height (positive value is toe-in, negative value is toe-out)	0.12° ± 0.25°	0.12° ± 0.25°	0.24° ± 0.25°

General Specifications

Item	Specification
Dogtracking — maximum (centerline of front tires compared to centerline of rear tires)	12.7 mm (0.5 in.)
Clear Vision	
Clear vision (negative value is counterclockwise)	0° ± 3°
Ride Height	
Front	60.5 mm ± 8 mm (2.4 in. ± 0.3 in.)
Rear	25.8 mm ± 8 mm (1 in. ± 0.3 in.)
Ball Joint Radial Play	
Lower ball joint — maximum	0.8 mm (1/32 in.)
Upper ball joint — maximum	0.8 mm (1/32 in.)
Vehicle Lean (Side-to-Side Height Differences)	
Front wheel opening difference — maximum	12 mm

	(0.5 in.)
Rear wheel opening difference — maximum	12 mm (0.5 in.)
Vehicle Attitude (Front-to-Rear Height Difference)	
Maximum vehicle attitude = average front - average rear	14.5 mm (0.6 in.)

Torque Specifications

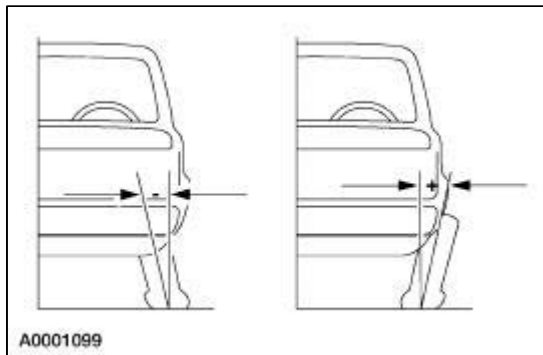
Description	Nm	lb-ft
Lower front suspension arm nuts	175	129
Rear toe link lock nuts	70	52
Steering column intermediate shaft pinch bolt	35	26
Steering gear lock nuts	103	76

Wheel Alignment Angles

Camber, caster and toe are adjustable on the front suspension system. Only the toe is adjustable on the rear suspension system. Camber and caster are adjusted by means of eccentric cams on the lower control arm mounting bolts. The front toe is adjusted by use of the front wheel spindle tie rod (3280). The rear toe is adjusted by the use of toe link assemblies connecting the knuckles to the rear sub-frame.

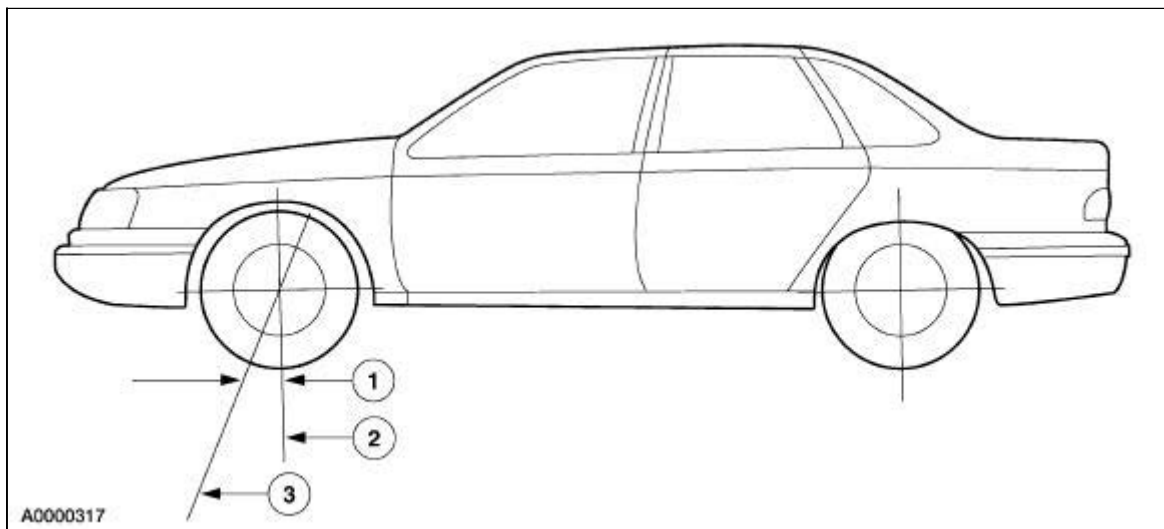
Camber

Negative and Positive Camber



Camber is the vertical tilt of the wheel when viewed from the front. Camber can be positive or negative and has a direct effect on tire wear.

Caster



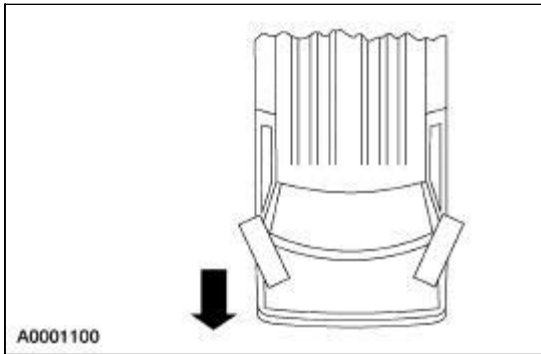
Item	Description

1	Positive caster
2	True vertical
3	Steering axis

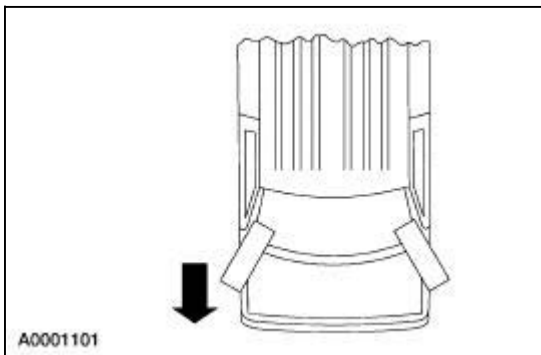
Caster is the deviation from vertical of an imaginary line drawn through the ball joints when viewed from the side. The caster specifications in this section will give the vehicle the best directional stability characteristics when loaded and driven. The caster setting is not related to tire wear.

Toe

Positive Toe (Toe-In)



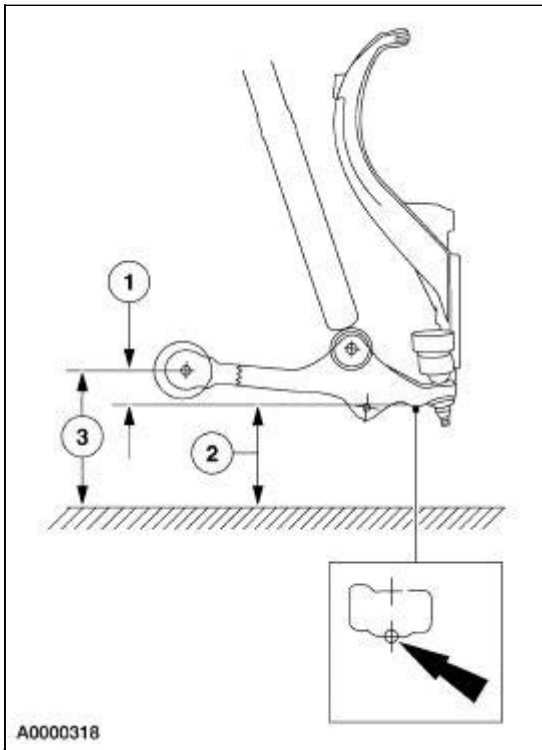
Negative Toe (Toe-Out)



The vehicle toe setting affects tire wear and directional stability.

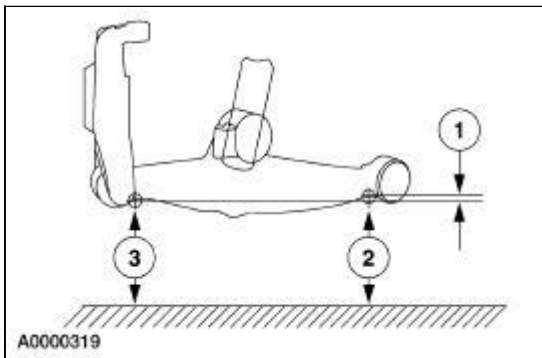
Ride Height

Front Ride Height Measurement



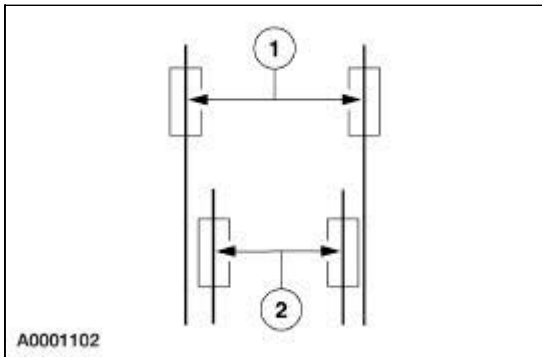
Item	Description
1	Ride height = B-A
2	Measurement A
3	Measurement B

Rear Ride Height Measurement



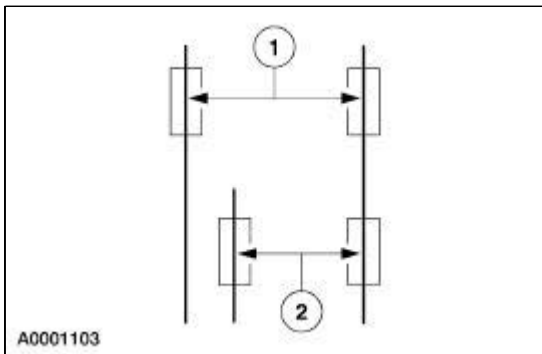
Item	Description
1	Ride height = A-B
2	Measurement A
3	Measurement B

Wheel Track



Item	Description
1	Front track
2	Rear track

Dogtracking



Item	Description
1	Front track
2	Rear track dogtracking

Dogtracking is the condition in which the independent rear suspension (IRS) system is not square to the chassis. Heavily crowned roads can give the illusion of dogtracking.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel (3600) corrections to maintain a straight path down a level road.

Shimmy

Shimmy, as observed by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tire

contacts pot holes or irregularities in the road surface.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces and observed by the driver as small rotational oscillations of the steering wheel.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe the poor return of the steering wheel to center after a turn or the steering correction is completed.

Drift/Pull

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel.

- A vehicle-related drift/pull, on a flat road, will cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull may be induced by conditions external to the vehicle (i.e., wind, road crown).

Poor Groove Feel

Poor groove feel is characterized by little or no buildup of turning effort felt in the steering wheel as the wheel is rocked slowly left and right within very small turns around center or straight-ahead (under 20 degrees of steering wheel turn). Efforts may be said to be "flat on center."

- Under 20 degrees of turn, most of the turning effort that builds up comes from the mesh of gear teeth in the steering gear (3504). In this range, the steering wheel is not yet turned enough to feel the effort from the self-aligning forces at the road wheel or tire patch.
 - In the diagnosis of a roadability problem, it is important to understand the difference between wander and poor groove feel.
-

Suspension System

Inspection and Verification

1. Road test.
 - Verify the customer's concern by performing a road test on a smooth road. If any vibrations are apparent, refer to [Section 100-04](#).
2. Inspect tires.
 - Check the tire pressure with all normal loads in the vehicle and the tires cold. For additional information, refer to the vehicle certification (VC) label.
 - Verify that all tires are sized to specification.
 - Inspect the tires for incorrect wear and damage.
3. Inspect chassis and underbody.
 - Remove any excessive accumulation of mud, dirt or road deposits from the chassis and underbody.
4. Inspect for aftermarket equipment.
 - Check for aftermarket changes to the steering, suspension, wheel and tire components (such as competition, heavy duty, etc.) The specifications shown in this manual do not apply to vehicles equipped with aftermarket equipment.

Visual Inspection Chart

Mechanical
<ul style="list-style-type: none">● Wheel bearing(s)● Loose or damaged front or rear suspension components● Loose, damaged or missing suspension fastener(s)● Incorrect spring usage● Damaged or sagging spring(s)● Damaged or leaking shock absorber(s)● Damaged or leaking strut(s)● Worn or damaged suspension bushing(s)● Loose, worn or damaged steering system components● Damaged axle components

5. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the next step.
6. If the fault is not visually evident, determine the symptom and proceed to the following symptom chart.

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Dogtracking 	<ul style="list-style-type: none"> ● Incorrect rear thrust angle. ● Front or rear suspension components. ● Drive axle damaged. 	<ul style="list-style-type: none"> ● CHECK the wheel alignment. ADJUST as necessary. ● INSPECT the front and rear suspension systems. REPAIR or INSTALL new suspension components as necessary. REFER to Section 204-01 or Section 204-02. ● REPAIR as necessary. REFER to appropriate section in Group 2.
<ul style="list-style-type: none"> ● Drift/Pull 	<ul style="list-style-type: none"> ● Unequal tire pressure. ● Excessive side-to-side difference in caster or camber. ● Tire forces. ● Unevenly loaded or overloaded vehicle. ● Steering components. ● Brake drag. 	<ul style="list-style-type: none"> ● ADJUST tire pressure. REFER to the VC label. ● CHECK the wheel alignment. ADJUST as necessary. ● ROTATE tires front to rear. ● NOTIFY the customer of incorrect vehicle loading. ● REFER to Section 211-00. ● REFER to Section 206-00.
<ul style="list-style-type: none"> ● Front Bottoming or Riding Low 	<ul style="list-style-type: none"> ● Shock absorbers (s). ● Sagging spring (s). ● Incorrect spring (s). 	<ul style="list-style-type: none"> ● INSTALL new shock and spring assemblies as necessary. REFER to Section 204-01. ● CHECK ride height. INSTALL new springs as necessary. REFER to Section 204-01. ● NOTE the part number on the spring(s). NOTE the spring code on the vehicle certification (VC) label. REFER to Section 100-01 to convert the spring code to a part number. VERIFY that the part numbers match. INSTALL new spring(s) with the correct part number, if necessary. REFER to Section 204-01.
<ul style="list-style-type: none"> ● Incorrect Tire Wear 	<ul style="list-style-type: none"> ● Incorrect tire pressure (rapid center rib or inner and outer edge wear). ● Excessive front or rear toe (rapid inner or outer edge wear). ● Excessive negative or positive camber (rapid inner or outer edge wear). 	<ul style="list-style-type: none"> ● ADJUST tire pressure. REFER to the VC label. ● CHECK the wheel alignment. ADJUST as necessary. ● CHECK the wheel alignment. ADJUST as necessary.

	<ul style="list-style-type: none"> ● Tires out of balance (tires cupped or dished). 	<ul style="list-style-type: none"> ● BALANCE tires.
<ul style="list-style-type: none"> ● Rough Ride 	<ul style="list-style-type: none"> ● Shock absorber (s). ● Sagging or weak spring(s). ● Incorrect spring (s). 	<ul style="list-style-type: none"> ● INSTALL new shock and spring assemblies as necessary. REFER to Section 204-01 . ● INSTALL new springs as necessary. REFER to Section 204-01 . ● NOTE the part number on the spring(s). NOTE the spring code on the vehicle certification (VC) label. REFER to Section 100-01 to convert the spring code to a part number. VERIFY that the part numbers match. INSTALL new spring(s) with the correct part number, if necessary. REFER to Section 204-01 .
<ul style="list-style-type: none"> ● Shimmy or Wheel Tramp 	<ul style="list-style-type: none"> ● Loose wheel nut (s). ● Loose front suspension fasteners. ● Front wheel bearing(s). ● Wheel or tire concerns. ● Shock absorber (s). ● Sagging or weak spring(s). ● Incorrect spring (s). ● Loose, worn or damaged ball joint(s). ● Loose, worn or damaged steering components. ● Front wheel alignment. 	<ul style="list-style-type: none"> ● TIGHTEN to specification. REFER to Section 204-04 . ● TIGHTEN to specification. REFER to Section 204-01 . ● REFER to Wheel Bearing Inspection—Front and Rear ● REFER to Section 204-04 . ● INSTALL new shock and spring assemblies as necessary. REFER to Section 204-01 . ● INSTALL new springs as necessary. REFER to Section 204-01 or Section 204-02 . ● NOTE the part number on the spring(s). NOTE the spring code on the vehicle certification (VC) label. REFER to Section 100-01 to convert the spring code to a part number. VERIFY that the part numbers match. INSTALL new spring(s) with the correct part number, if necessary. REFER to Section 204-01 or Section 204-02 . ● GO to the Ball Joint Inspection component test in this section. ● REFER to Section 211-00 . ● CHECK the wheel alignment. ADJUST as necessary.
<ul style="list-style-type: none"> ● Sticky Steering, Poor 	<ul style="list-style-type: none"> ● Ball joints. 	<ul style="list-style-type: none"> ● GO to the Ball Joint Inspection component test in this section.

Returnability	<ul style="list-style-type: none"> ● Steering components. 	<ul style="list-style-type: none"> ● REFER to Section 211-00.
<ul style="list-style-type: none"> ● Steering Wheel Off-Center 	<ul style="list-style-type: none"> ● Unequal front or rear toe settings (side-to-side). ● Steering components. 	<ul style="list-style-type: none"> ● CHECK the wheel alignment. ADJUST as necessary. ● REFER to Section 211-00.
<ul style="list-style-type: none"> ● Sway or Roll 	<ul style="list-style-type: none"> ● Overloaded, unevenly or incorrectly loaded vehicle. ● Loose wheel nut (s). ● Sagging or weak spring(s). ● Incorrect spring (s). ● Shock absorber (s). ● Loose front stabilizer bar (5482) or rear stabilizer bar (5A772). ● Worn lower suspension arm stabilizer bar insulators (5493). 	<ul style="list-style-type: none"> ● NOTIFY the customer of incorrect vehicle loading. ● TIGHTEN to specification. REFER to Section 204-04. ● INSTALL new springs as necessary. REFER to Section 204-01 or Section 204-02. ● NOTE the part number on the spring(s). NOTE the spring code on the vehicle certification (VC) label. REFER to Section 100-01 to convert the spring code to a part number. VERIFY that the part numbers match. INSTALL new spring(s) with the correct part number, if necessary. REFER to Section 204-01 or Section 204-02. ● INSTALL new shock and spring assemblies as necessary. REFER to Section 204-01. ● TIGHTEN to specification. REFER to Section 204-01 or Section 204-02. ● INSTALL new lower suspension arm stabilizer bar insulators as necessary. REFER to Section 204-01 or Section 204-02.
<ul style="list-style-type: none"> ● Vehicle Leans to One Side 	<ul style="list-style-type: none"> ● Unevenly loaded or overloaded vehicle. ● Front or rear suspension components. ● Shock absorber (s). ● Sagging spring (s). ● Incorrect spring 	<ul style="list-style-type: none"> ● NOTIFY the customer of incorrect vehicle loading. ● INSPECT the front and rear suspension systems. REPAIR or INSTALL new suspension components as necessary. REFER to Section 204-01 or Section 204-02. ● INSTALL new shock and spring assemblies as necessary. REFER to Section 204-01. ● INSTALL new springs as necessary. REFER to Section 204-01 or Section 204-02. ● NOTE the part number on the

	(s).	spring(s). NOTE the spring code on the vehicle certification (VC) label. REFER to Section 100-01 to convert the spring code to a part number. VERIFY that the part numbers match. INSTALL new spring(s) with the correct part number, if necessary. REFER to Section 204-01 or Section 204-02 .
<ul style="list-style-type: none"> ● Vibration/Noise 	<ul style="list-style-type: none"> ● Incorrect ride height. Lateral tilt out of specification. ● Tires and wheel concerns. ● Wheel bearings. ● Wheel hubs. ● Brake components. ● Suspension components. ● Steering components. 	<ul style="list-style-type: none"> ● CHECK the ride height. INSTALL new springs as necessary. REFER to Section 204-01 or Section 204-02. ● REFER to Section 100-04.
<ul style="list-style-type: none"> ● Wander 	<ul style="list-style-type: none"> ● Unevenly loaded or overloaded vehicle. ● Ball joint(s). ● Front wheel bearing(s). ● Loose, worn or damaged suspension components. ● Loose suspension fasteners. ● Steering components. ● Wheel alignment (excessive total front or rear toe-out). 	<ul style="list-style-type: none"> ● NOTIFY the customer of incorrect vehicle loading. ● GO to the Ball Joint Inspection component test in this section. ● REFER to Wheel Bearing Inspection—Front and Rear ● INSTALL new suspension components as necessary. REFER to Section 204-01 or Section 204-02. ● TIGHTEN to specification. REFER to Section 204-01 or Section 204-02. ● REFER to Section 211-00. ● CHECK the wheel alignment. ADJUST as necessary.

Component Tests

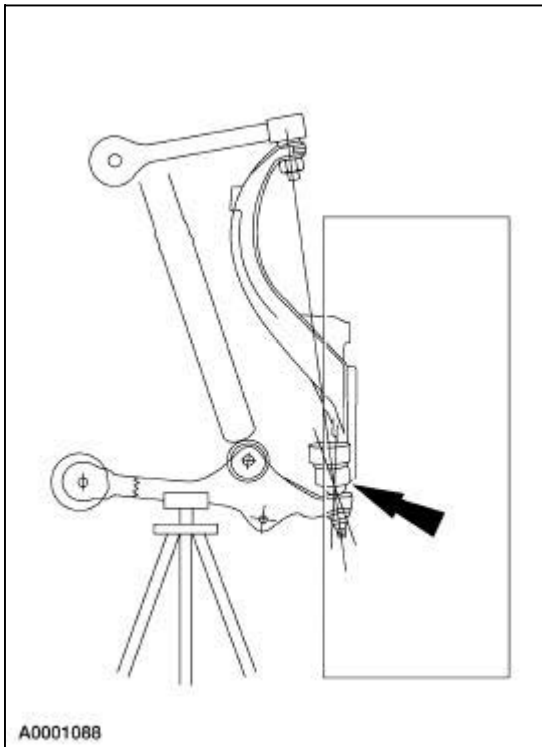
Ball Joint Inspection

NOTE: The front suspension is shown in the following procedures. The inspection of the rear suspension upper ball joint is similar.

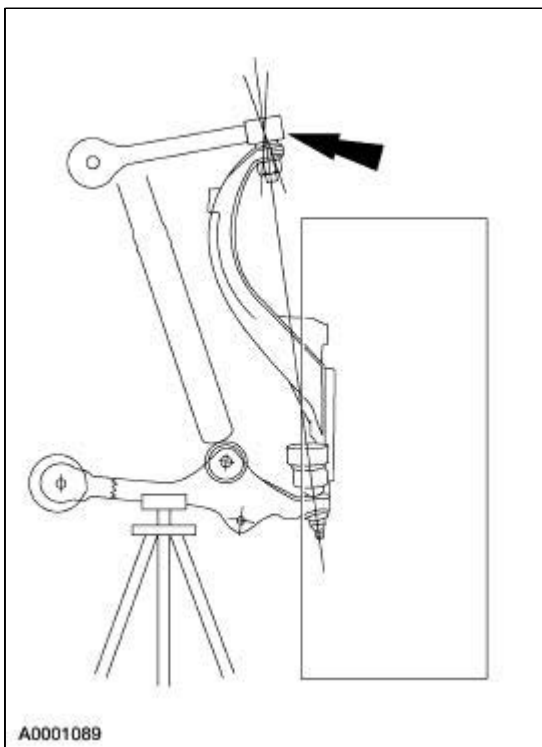
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Prior to performing any inspection of the ball joints, inspect the front wheel bearings. For

additional information, refer to [Wheel Bearing Inspection—Front and Rear](#).

3. Position a safety stand beneath the front suspension lower arm (3079) or rear suspension lower arm to be tested.



4. While an assistant pulls and pushes the top and bottom of the tire, observe the relative movement between the ball joint and the front suspension lower arm. Any movement at or exceeding the specification indicates a worn or damaged ball joint. Install a new spindle as necessary. For additional information, refer to [Section 204-01](#).



5. While an assistant pulls and pushes the top and bottom of the tire, observe the relative movement between the ball joint and the front suspension upper arm or rear suspension upper arm. Any movement at or exceeding the specification indicates a worn or damaged ball joint. Install a new front suspension upper arm or rear suspension upper arm as necessary. For additional information, refer to [Section 204-01](#) or [Section 204-02](#).
 6. Remove the safety stand.
 7. Lower the vehicle.
-

Wheel Bearing Inspection —Front and Rear

1. Raise the vehicle until the tire is off the floor. For additional information, refer to [Section 100-02](#).
2. **NOTE:** Make sure the wheel rotates freely and the brake pads are retracted sufficiently to allow movement of the tire and wheel assembly.

Grasp each tire at the top and bottom and move the wheel inward and outward while lifting the weight of the tire off the wheel bearing.

3. If the tire and wheel (hub) is loose on the wheel spindle or does not rotate freely, install a new front wheel hub (1104) or rear hub (1109) as necessary. For additional information, refer to [Section 204-01](#) or [Section 204-02](#).
-

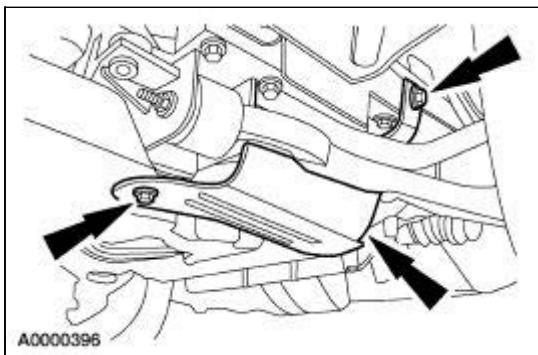
Camber and Caster Adjustment

NOTE: If the vehicle is equipped with hex head bolts in the lower control arm, new cam bolts and lock nuts must be installed before adjusting the cast and camber.

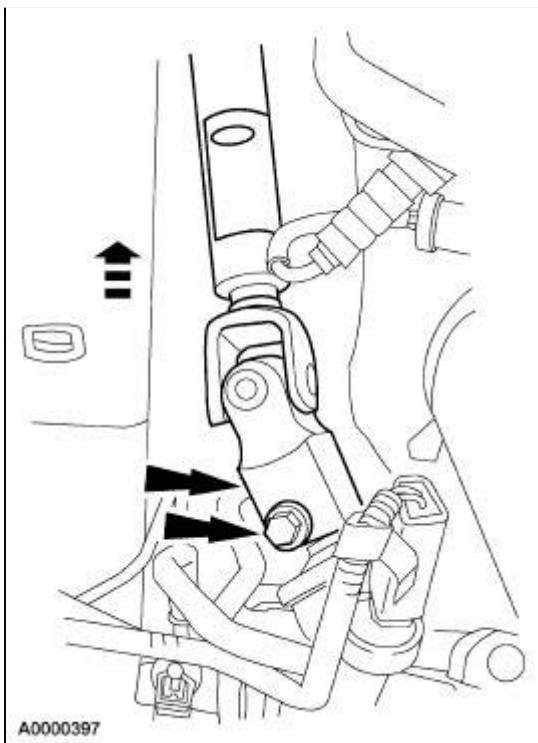
NOTE: The camber and caster adjustment for the LH side is shown. The procedure for adjusting the RH side is similar.

Vehicles without camber and caster adjustment cam bolts

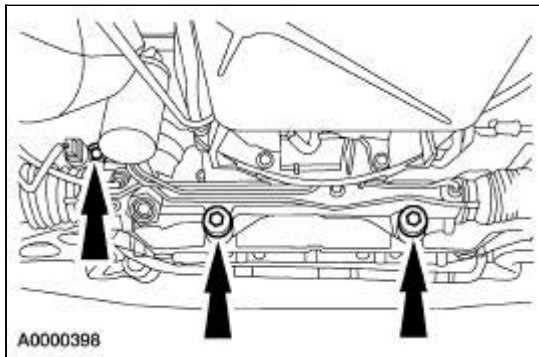
1. Remove two bolts, one pushpin and the splash shield.



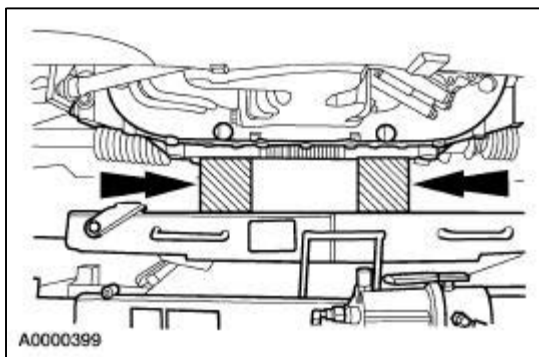
2. Remove and discard the pinch bolt. Disconnect the steering shaft.



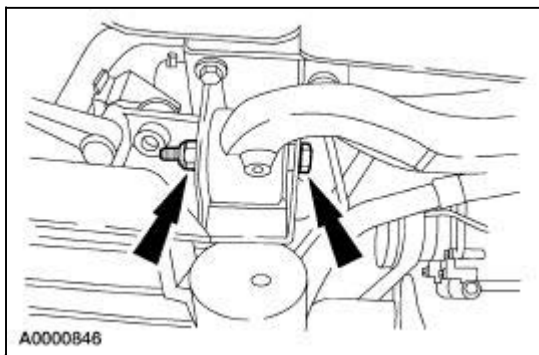
3. Remove three lock nuts and bolts. Discard the lock nuts.



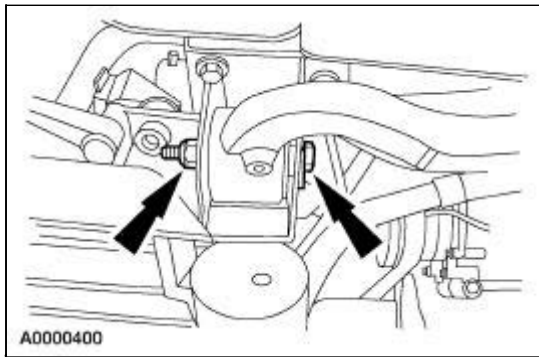
4. Raise and support the front end and the No. 2 crossmember.
 - Position two 4 in. x 4 in. pieces of wood between the No. 2 crossmember and the lifting device.



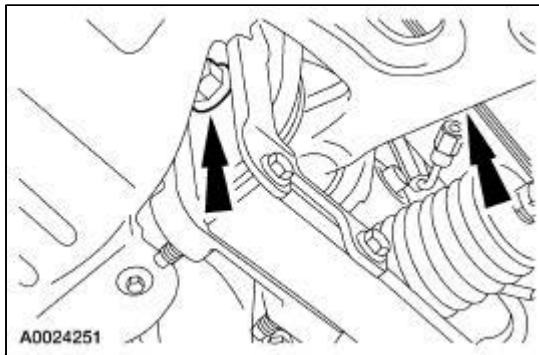
5. Remove and discard the front nut and bolt.



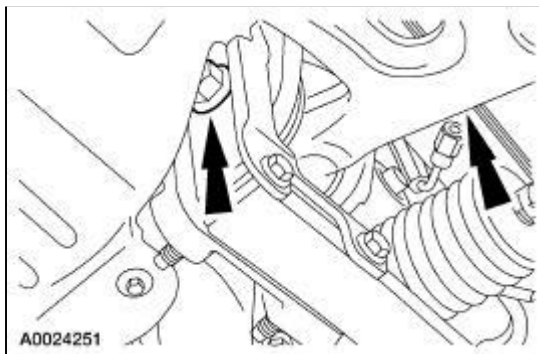
6. Install the caster adjustment cam bolt and a new lock nut.
 - The bolt must be installed from the rear as shown.
 - Install the bolt with the cam lobe down.
 - The cam must be seated between the cam guides on the No. 1 crossmember.



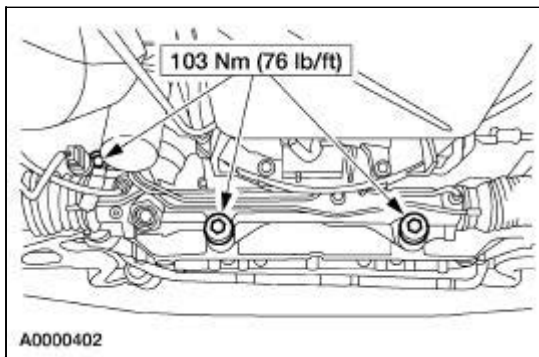
7. Position the steering gear (3504) aside.
8. Remove and discard the rear nut and bolt.



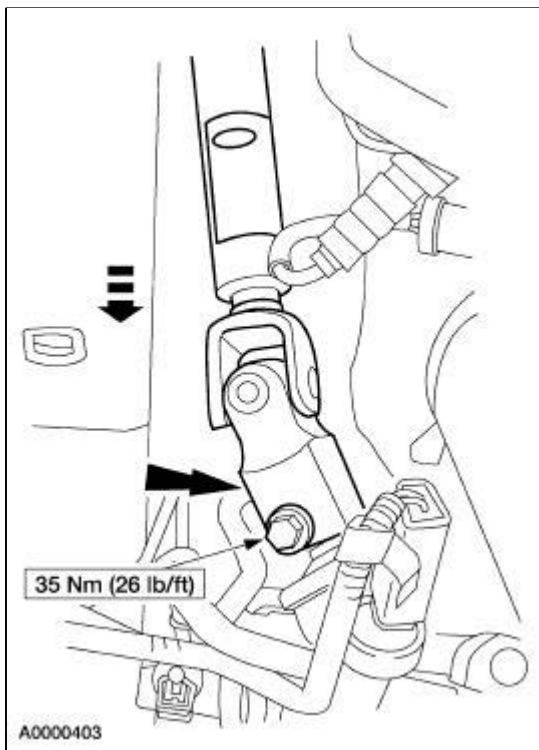
9. Loosely, install the camber adjustment cam bolt, a new lock nut and the I-brace bracket (if equipped).
 - The bolt must be installed from the rear as shown.
 - Install the bolt with the cam lobe down.
 - The cam must be seated in the groove in the No. 2 crossmember.



10. Lower the front end.
11. Install the steering gear, three bolts and new lock nuts.



12. Connect the steering shaft. Install a new pinch bolt.

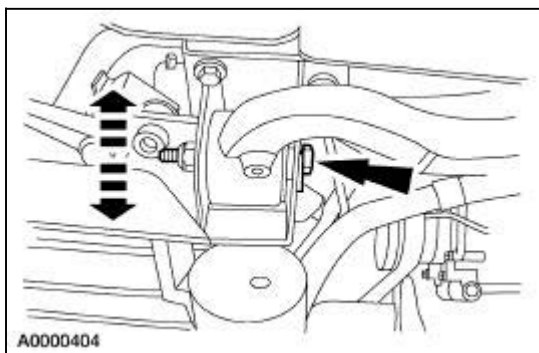


All vehicles

13. Measure the wheel alignment values. Follow the equipment manufacturer's instructions.

Vehicles requiring caster adjustment

14. Rotate the caster adjustment cam bolt (front) to adjust the caster.



15. Recheck the alignment settings. Follow the equipment manufacturer's instructions. Readjust as necessary.

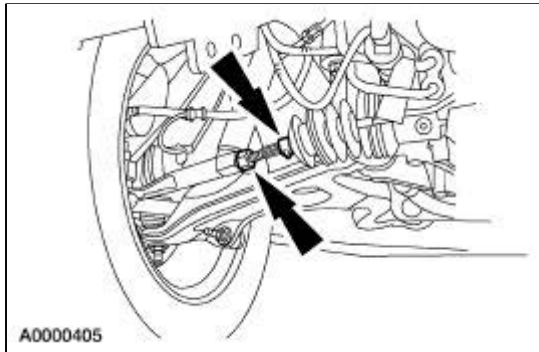
Vehicles requiring camber adjustment

16. **NOTE:** Adjustments to the camber impact the toe settings. Therefore, the camber and toe may need to be adjusted at the same time to get the correct values.

NOTE: Both the LH and RH toe need to be adjusted when adjusting the camber.

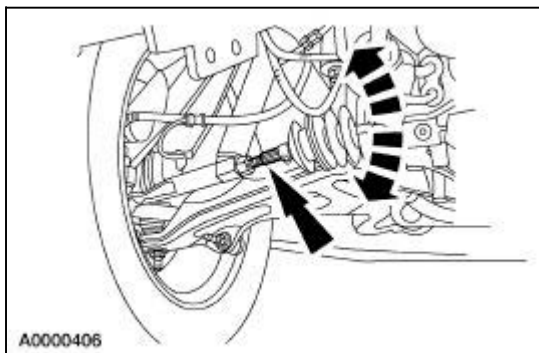
Loosen the jam nut. Remove the clamp.

- Clean and lubricate the jam nut and front wheel spindle tie-rod threads.



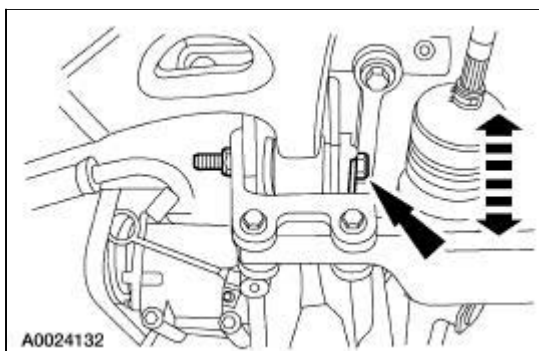
17. **NOTE:** Do not allow the steering gear bellows to twist when the front wheel spindle tie-rod is rotated.

Rotate the front wheel spindle tie-rod to adjust the toe.



18. **NOTE:** To aid in accurate camber and toe measurements, support the front suspension lower arm by hand while rotating the camber adjustment cam bolt.

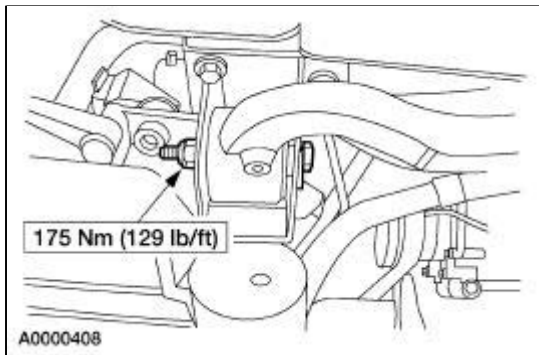
Rotate the camber adjustment cam bolt (rear) to adjust the camber.



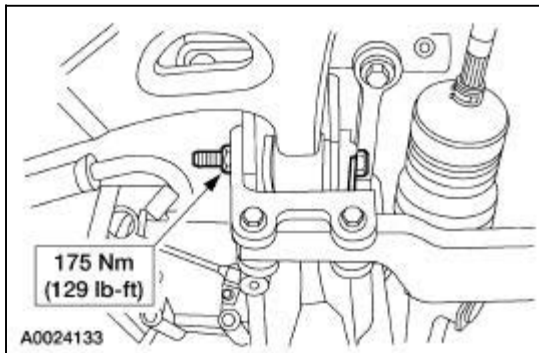
19. Repeat the above camber adjustment steps until the correct camber and toe measurements are achieved.

All vehicles

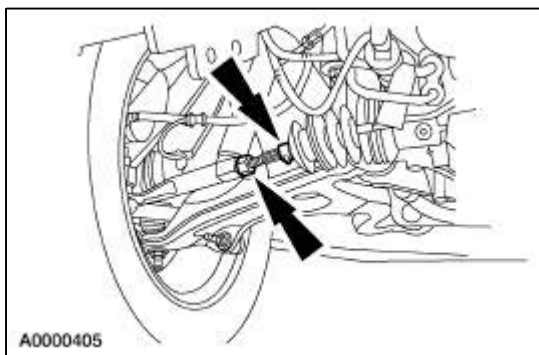
20. Tighten the nut.



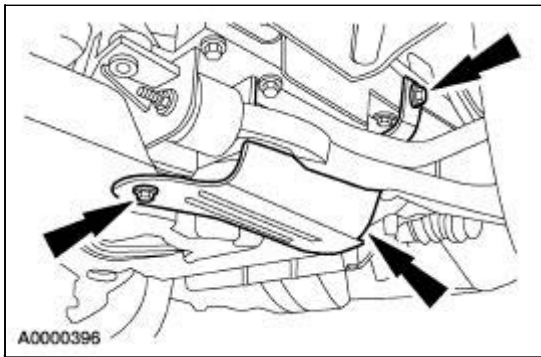
21. Tighten the nut.



22. Tighten the nut. Install the clamp.



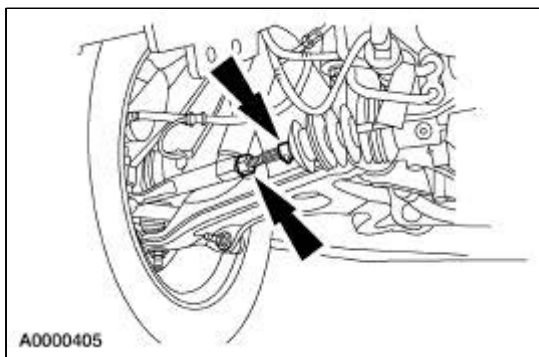
23. Recheck the alignment settings. Follow the equipment manufacturer's instructions. Readjust the caster as necessary.
24. Install the splash shield, one pushpin, and two bolts.



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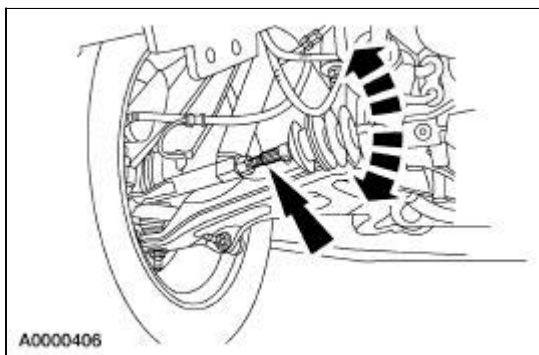
Toe Adjustment —Front

1. Start the engine and center the steering wheel (3600).
2. Turn the engine off, and hold the steering wheel in the "straight forward" position by attaching a rigid link from the steering wheel to the brake pedal.
3. Check the toe settings. Follow the equipment manufacturer's instructions.
4. Loosen the nuts. Remove the clamps.
 - Clean and lubricate the nuts and front wheel spindle tie-rod threads.

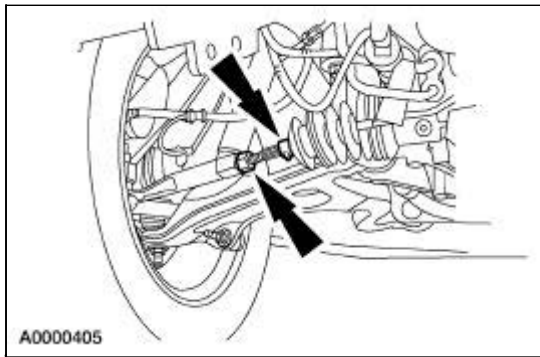


5. **NOTE:** Do not allow the steering gear bellows to twist when the front wheel spindle tie-rod (3280) is rotated.

Rotate the front wheel spindle tie-rods.



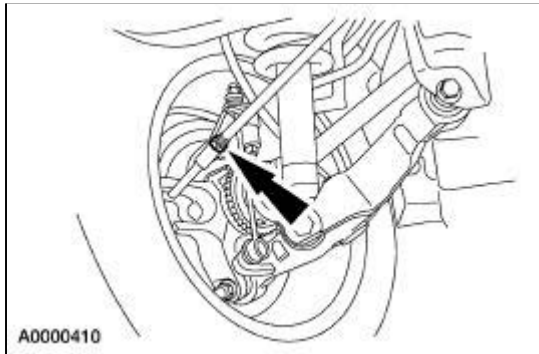
6. Tighten the nuts. Install the clamps.



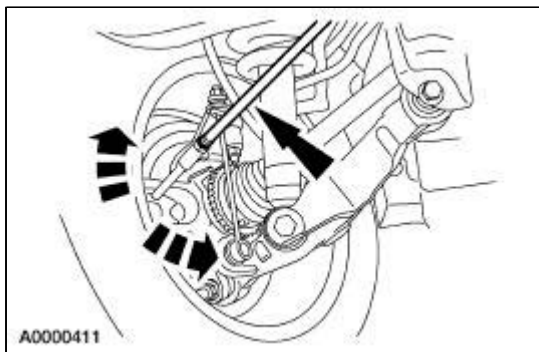
7. Recheck the toe settings. Follow the equipment manufacturer's instructions.
-

Toe Adjustment —Rear

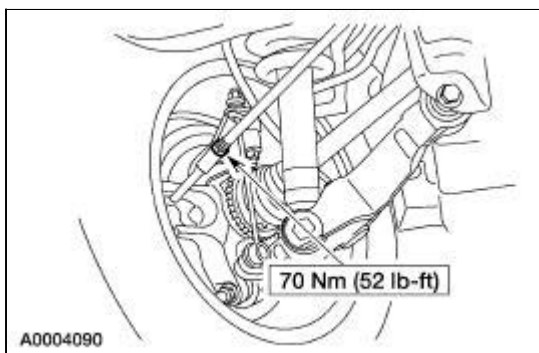
1. Loosen the nut.
 - Clean the nut and toe link threads.



2. Rotate the toe link to adjust the toe.



3. Tighten the nut.



4. Recheck the toe settings. Follow the equipment manufacturer's instructions.

General Specifications

Item	Specification
Motorcraft High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA (in Canada CXG-2-B)	ESE-M12A4-A
Rust Penetrant and Inhibitor F2AZ-19A501-A (in Canada CXC-51-A)	ESR-M99C56-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Suspension upper arm-to-body nuts	48	35	—
Suspension upper arm-to-knuckle nut	90	66	—
Suspension lower arm-to-frame nuts	175	129	—
Suspension lower arm-to-knuckle nut	150	111	—
Stabilizer bar bracket bolts	75	55	—
Stabilizer bar link nuts	55	41	—
Tie-rod end-to-knuckle nut	80	59	—
Hub and bearing-to-knuckle bolts	90	66	—
Shock and spring assembly-to-lower control arm bolts and nuts	175	129	—
Shock and spring assembly-to-body nuts	28	21	—
Upper shock rod-to-upper mount nut	50	37	—
Wheel nuts	135	100	—
Heater water valve bracket	5	—	44
Engine control wiring bracket	5	—	44
Power steering gear nuts and bolts	103	76	—

Front Suspension



WARNING: All vehicles are equipped with gas-pressurized shock absorbers which will extend unassisted. Do not apply heat or flame to the shock absorbers during removal or component servicing. Failure to follow these instructions may result in personal injury.

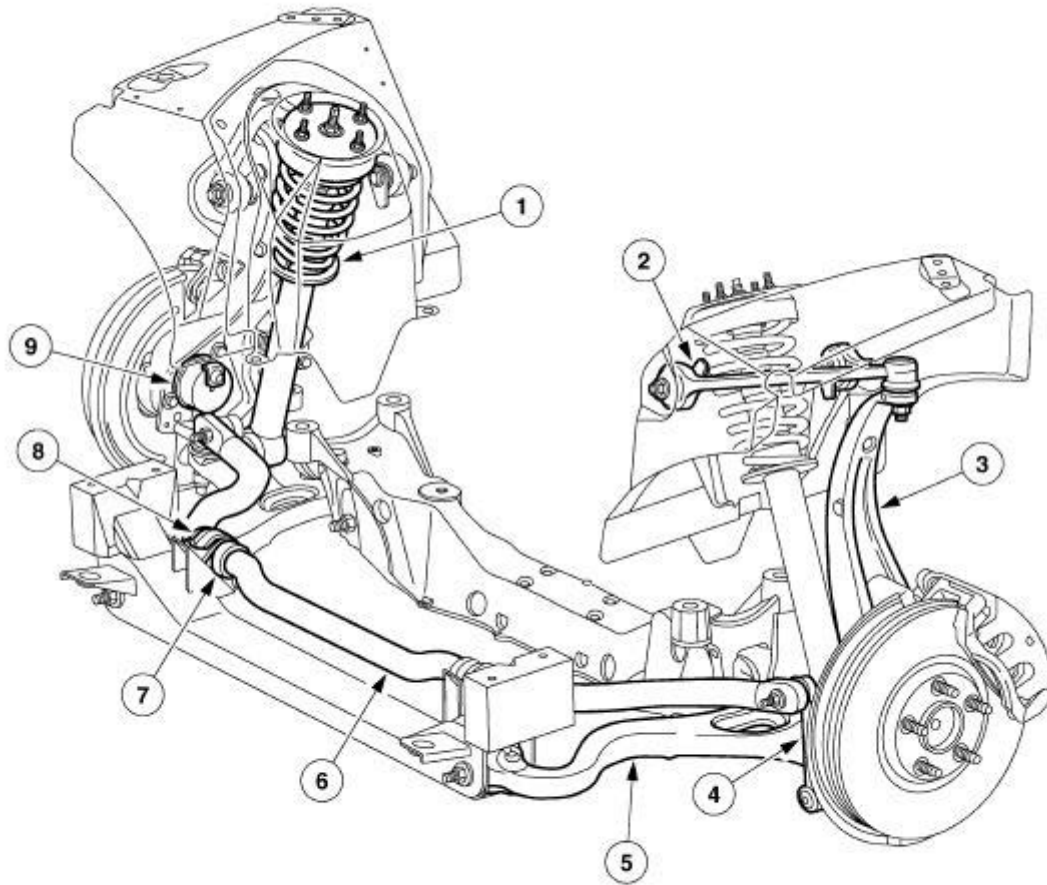


CAUTION: All front suspension fasteners are important attaching parts because they can affect the performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during assembly to make sure of correct retention of these parts. Never attempt to heat, quench or straighten any front suspension part. Install a new part.

The front suspension consists of the following components:

- upper suspension arm and bushing (3082)
- lower suspension arm and bushing (3078)
- shock absorber and spring assembly
- stabilizer bar (5482)
- stabilizer bar bushings (5493)
- stabilizer bar brackets (5486)
- stabilizer bar links (5K483)
- wheel knuckle (3K185)
- wheel hub and bearing (1104)

Front Suspension



A0001090


Item	Part Number	Description
1	—	Shock absorber and spring assembly
2	3082	Upper arm and bushing
3	3K185	Wheel knuckle
4	5K483	Stabilizer bar link
5	3078	Lower arm and bushing
6	5482	Stabilizer bar
7	5493	Stabilizer bar bushing
8	5486	Stabilizer bar bracket
9	1104	Wheel hub and bearing

Front Suspension

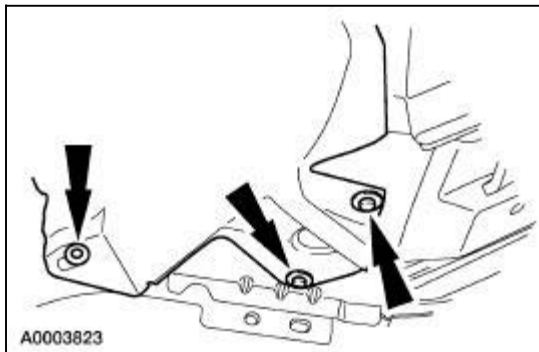
Refer to Section 204-00 .

Wheel Bearing and Hub

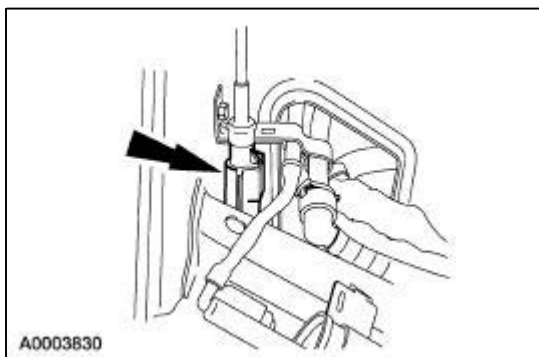
Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

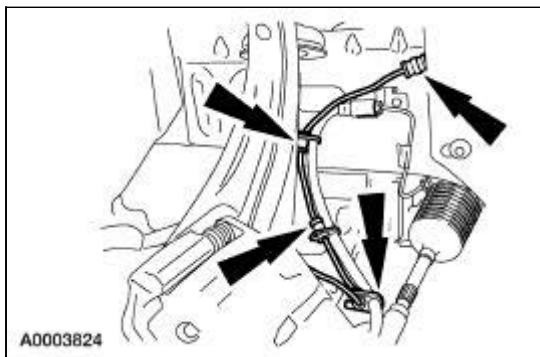
1. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
2. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
3. Remove the brake disc. For additional information, refer to [Section 206-03](#).
4. Remove the pushpins.




5. Move the inner fender skirt aside and disconnect the anti-lock brake (ABS) sensor.



6. Detach the ABS sensor wire from the retainers.

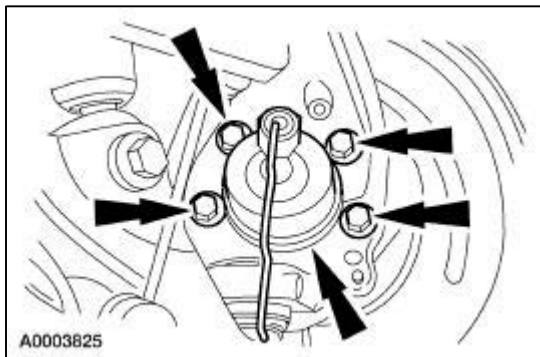


7.  **CAUTION:** The wheel hub and bearing (1104) is not pressed into the wheel knuckle (3K185). Do not use a slide hammer, or strike the back of the wheel hub and bearing to remove a stuck wheel hub and bearing. Damage to the bearing or the wheel hub will occur.


NOTE: If necessary, clean any rust or corrosion from the back of the wheel hub and bearing and lubricate the wheel hub and bearing with Rust Penetrant and Inhibitor D7AZ-19A501-AA or equivalent meeting Ford specification ESR-M99C56-A.

NOTE: Do not remove the ABS sensor and wire from the hub and bearing unless a new ABS sensor and wire is being installed. If the ABS sensor is separated from the hub and bearing, make sure the O-ring is in place and is not worn or damaged. Install a new O-ring if necessary.

Remove and discard the bolts. Remove the wheel hub and bearing.

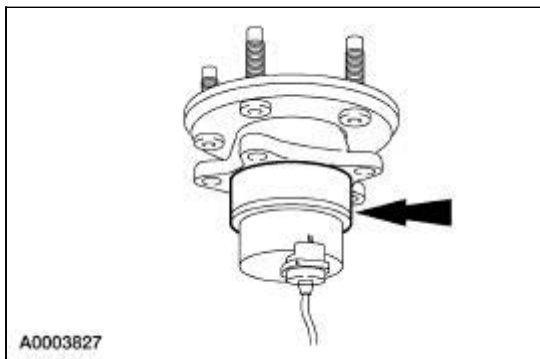


Installation

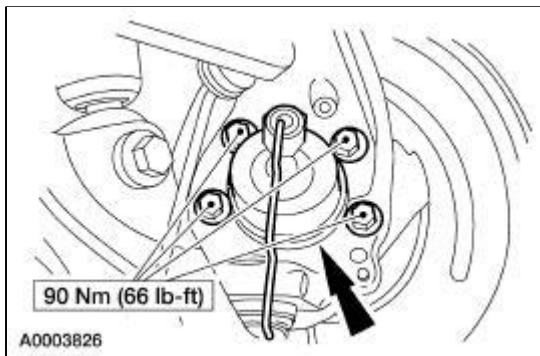
1.  **CAUTION:** The knuckle bore must be clean to allow the wheel hub and bearing to be completely seated by hand. Do not press or draw the wheel hub and bearing into place.

Clean and inspect the knuckle bearing bore.

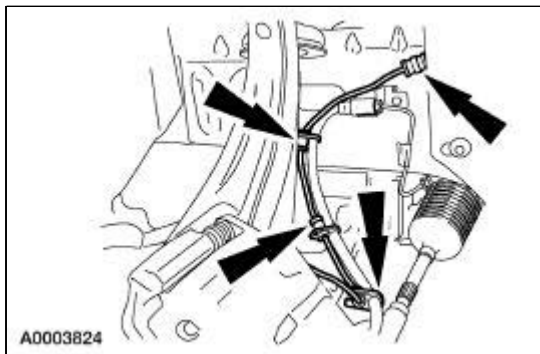
2. Lightly coat the surfaces of the bearing carrier and the wheel knuckle with Motorcraft High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA or equivalent meeting Ford specification ESE-M12A4-A.



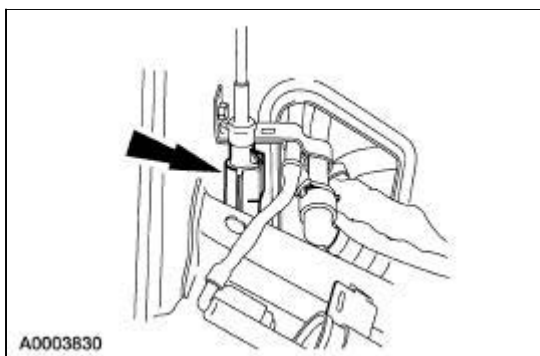
3. Install the wheel hub and bearing and new bolts.



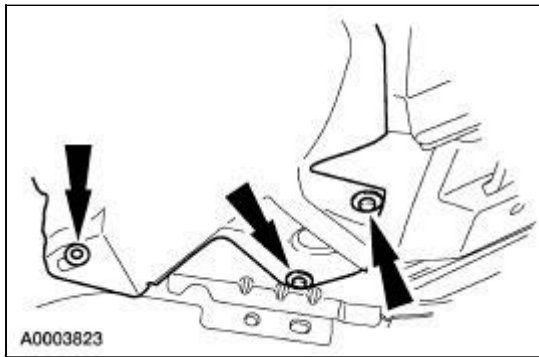
4. Route the ABS sensor wire and attach it to the retainers.



5. Move the inner fender skirt aside and connect the ABS sensor.



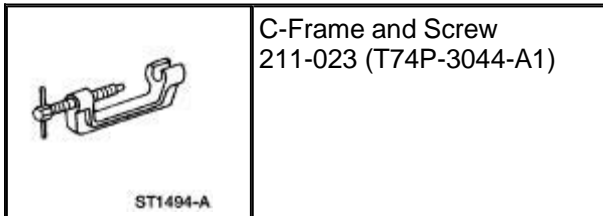
6. Position the inner fender skirt and install the pushpins.




7. Install the brake disc. For additional information, refer to [Section 206-03](#).
 8. Install the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
 9. Lower the vehicle.
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Wheel Studs

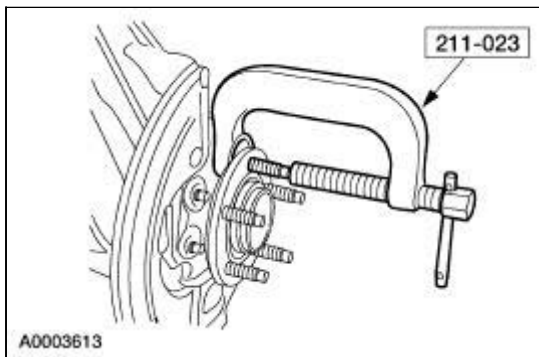
Special Tool(s)



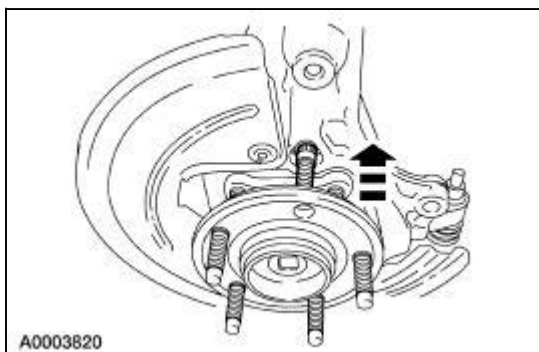
Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
2. Remove the front brake disc. For additional information, refer to [Section 206-03](#).
3. Using the special tool, press the stud from the flange.

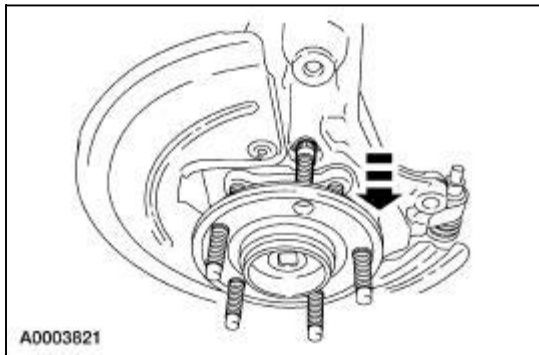


4. Line up the stud with the hole in the knuckle and remove the stud.



Installation

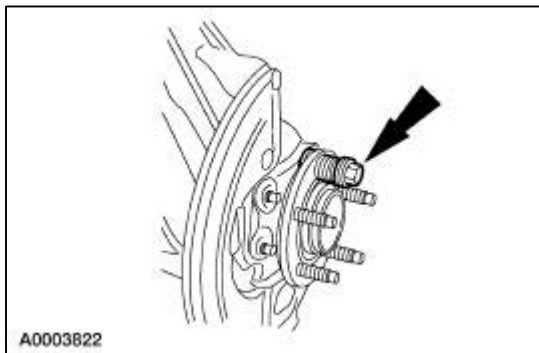
1. Insert the stud through the hole in the knuckle and into the flange, making sure the serrations on the stud line up with the serrations in the flange.



2.  **CAUTION:** Do not use power tools to install a wheel stud. The serrations in the flange can be stripped.

NOTE: Do not use the wheel nuts that came with the vehicle.


Install washers and a wheel nut on the wheel stud and tighten the nut until the stud seats against the flange. Discard the nut after use.



3. Install the front brake disc. For additional information, refer to [Section 206-03](#).
 4. Install the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
-

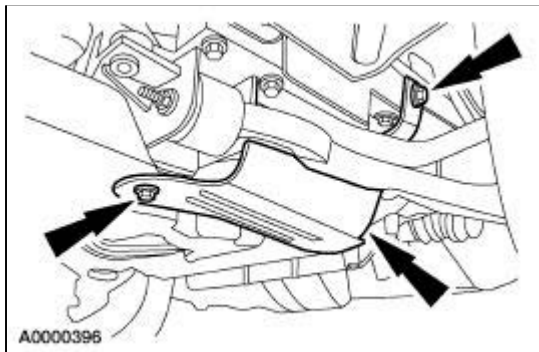
Lower Arm

Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

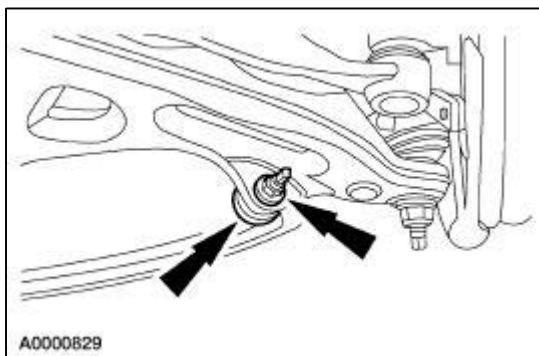
NOTE: New cam bolts and lock nuts must be installed whenever the lower control arm is removed.

1. Turn the ignition switch to the off, unlocked position.
2. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
3. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
4. Remove two bolts, one pushpin and the splash shield.

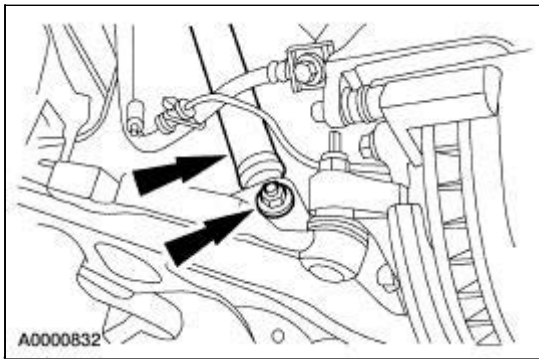


5. **NOTE:** To remove the nut, first loosen the nut, then use the hex holding feature to prevent the stabilizer bar link ball joint from turning while removing the nut.

Remove and discard the nut. Disconnect the stabilizer bar link (5K483).



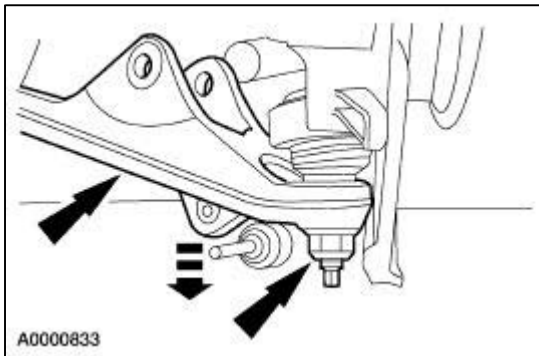
6. Remove and discard the nut and bolt. Disconnect the shock absorber and spring assembly.



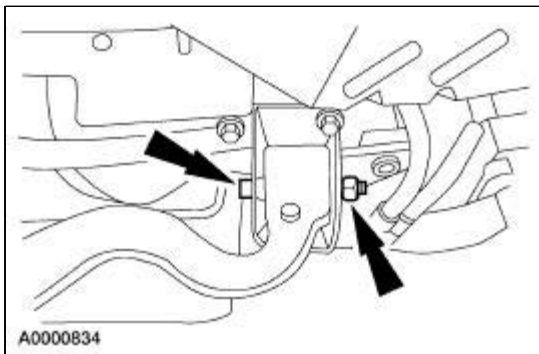
7. **NOTE:** To remove the nut, first loosen the nut, then use the hex holding feature to prevent the lower control arm ball joint from turning while removing the nut.

NOTE: Make sure not to lose the tapered washer on the ball joint.

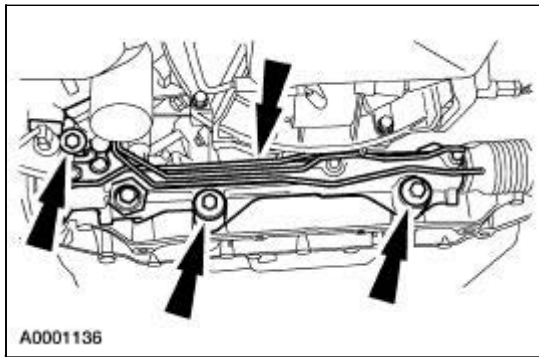
Remove and discard the nut. Separate the front suspension lower arm (3078) from the wheel knuckle.



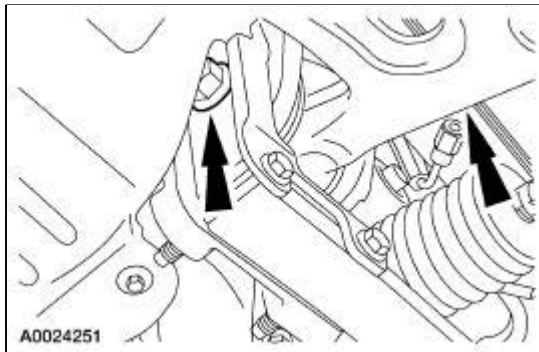
8. Remove and discard the front nut and bolt.



9. Position the power steering gear aside.
- Remove two nuts and bolts. Discard the nuts.
 - Remove the nut and bolt. Discard the nut.
 - Position the power steering gear to access the lower control arm rear bolt.

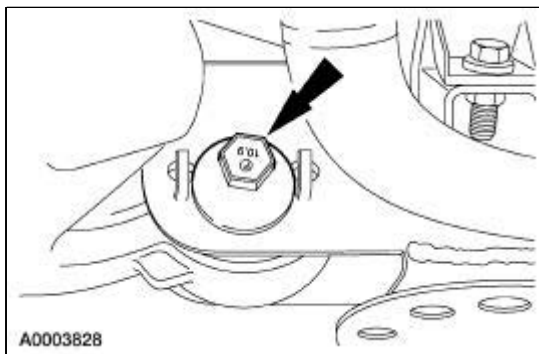


10. Remove and discard the rear nut and bolt. Remove the front suspension lower arm.

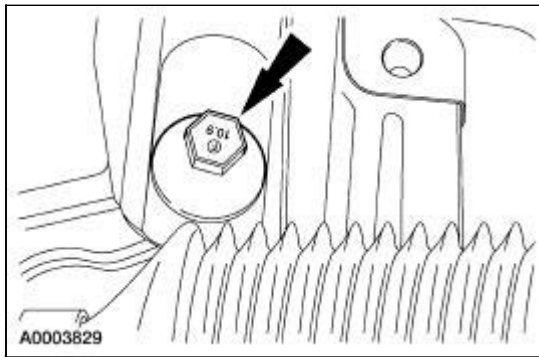


Installation

1. Position the front suspension lower arm.
2. Install a new caster adjustment cam bolt and a new nut.
 - The bolt must be installed from the rear, as shown.
 - Install the bolt with the cam lobe down.
 - The cam must be seated between the cam guides on the No. 1 crossmember.
 - The nut should only be snugged up at this time to allow for wheel alignment adjustment.



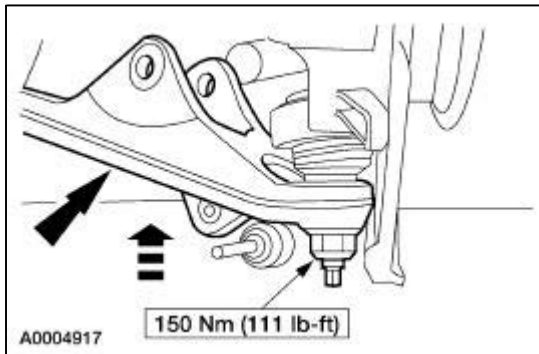
3. Install a new camber adjustment cam bolt and a new nut.
 - The bolt must be installed from the rear as shown.
 - Install the bolt with the cam lobe down.
 - The cam must be seated in the groove in the No. 2 crossmember.
 - The nut should only be snugged up at this time to allow for wheel alignment adjustment.



4. **NOTE:** Make sure the tapered washer is installed on the ball joint before connecting the lower control arm to the knuckle.

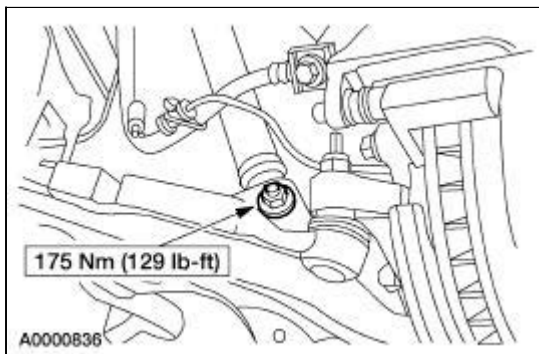
NOTE: To install the nut, first install the nut until snug using the hex holding feature. Final tighten the nut using a socket and a torque wrench. If the ball stud turns during final tighten, use a crow's foot wrench while using the hex holding feature to final tighten the nut.

Connect the lower control arm to the knuckle. Install a new nut.



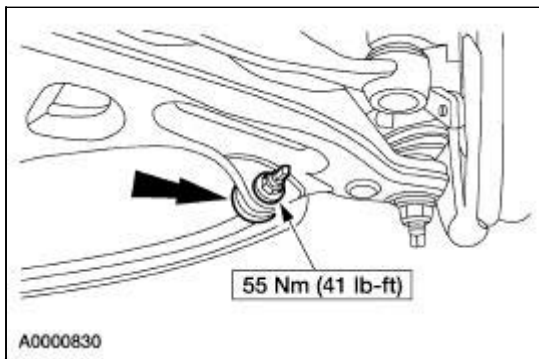
5. **NOTE:** Make sure the shock absorber lower bushing end caps are in place before installing the bolt and nut.

Connect the shock absorber and spring assembly. Install a new bolt and nut.

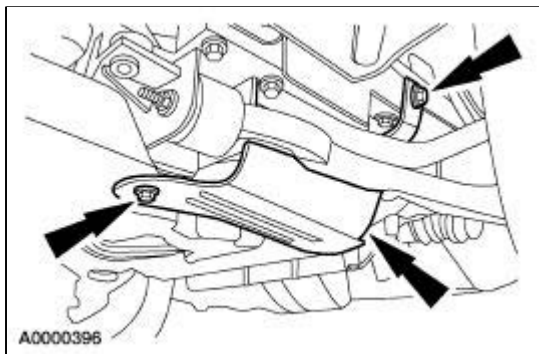


6. **NOTE:** To install the nut, first install the nut until snug using the hex head feature. Final tighten the nut using a socket and a torque wrench.

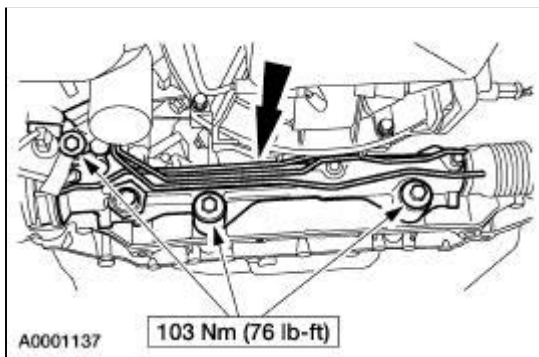
Connect the stabilizer bar link. Install a new nut.



7. Install the splash shield, two bolts and one pushpin.




8. Attach the power steering gear.
 1. Remove the nut from the center bolt.
 2. Install two bolts and three new nuts.



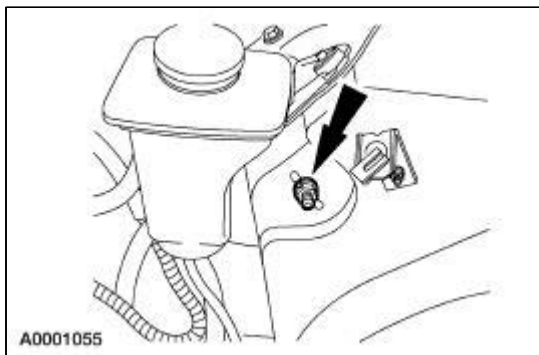
9. Install the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
 10. Lower the vehicle.
 11. Check the wheel alignment. Adjust as necessary. For additional information, refer to [Section 204-00](#).
-

Upper Arm —Left Side

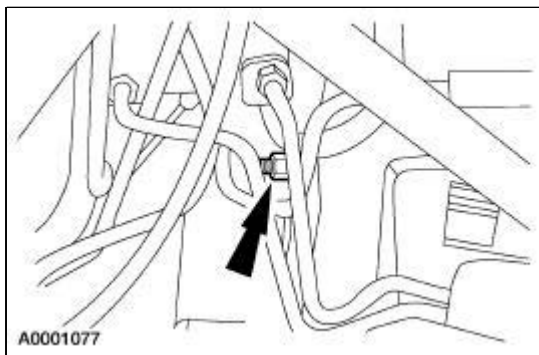
Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the air cleaner. For additional information, refer to [Section 303-12](#).
2. Remove and discard the nut.



3. Remove the canister purge valve. For additional information, refer to [Section 303-13](#).
4. Remove and discard the nut.



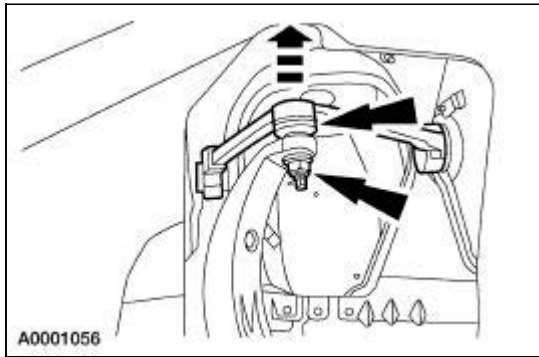
5. Remove the shock absorber and spring assembly. For additional information, refer to [Shock Absorber and Spring Assembly](#) in this section.
6. **NOTE:** Wire the top of the wheel knuckle to the body to prevent knuckle movement.

NOTE: To remove the nut, first loosen the nut, then use the hex holding feature to prevent the upper control arm ball joint from turning while removing the nut.

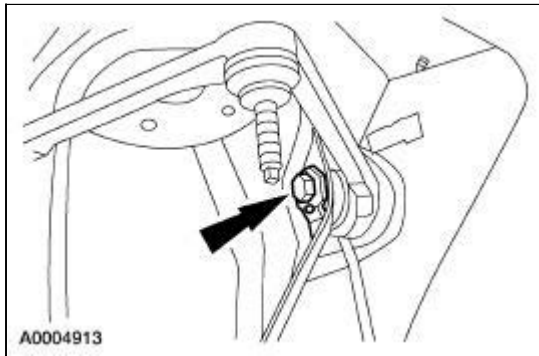
NOTE: Make sure not to lose the tapered washer on the ball joint.

Remove and discard the nut. Disconnect the suspension upper arm (3082) from the knuckle

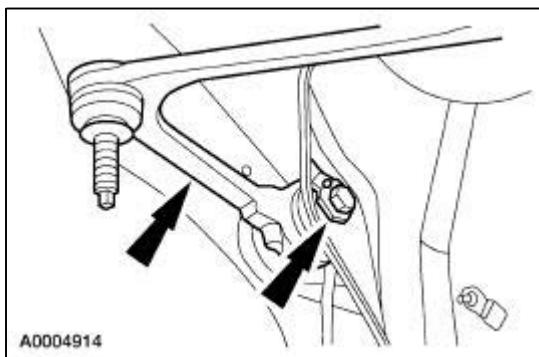
(3K185).



7. Remove and discard the bolt.

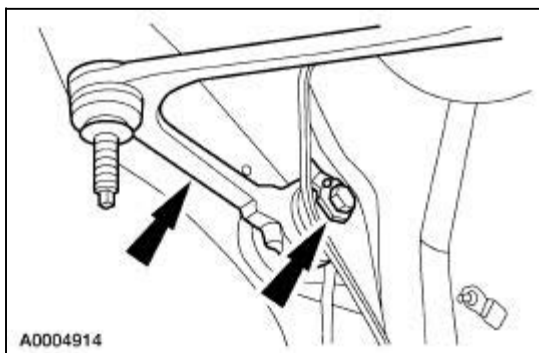


8. Remove the bolt and the suspension upper arm. Discard the bolt.

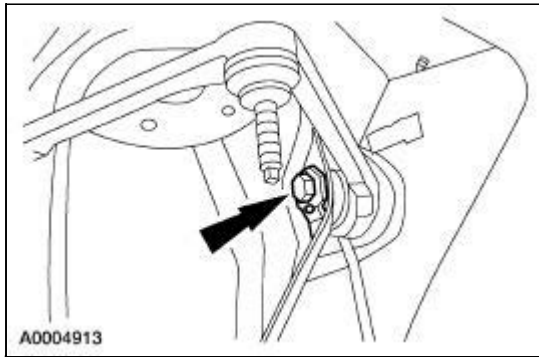


Installation

1. Position the suspension upper arm and install a new bolt.



2. Install a new bolt.

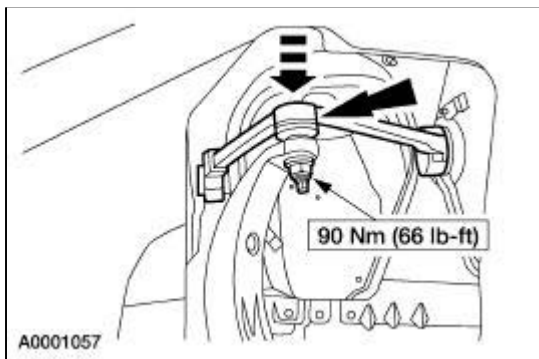


3. **NOTE:** Make sure the tapered washer is installed on the ball joint before connecting the upper control arm to the knuckle.

NOTE: To install the nut, first install the nut until snug using the hex holding feature. Final tighten using a socket and a torque wrench.

NOTE: Remove the wire holding the knuckle after tightening the nut.

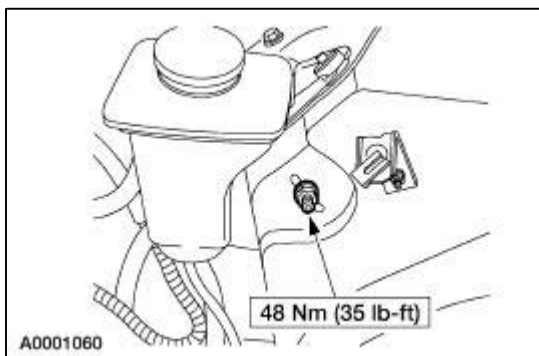
Connect the suspension upper arm to the knuckle. Install a new nut.



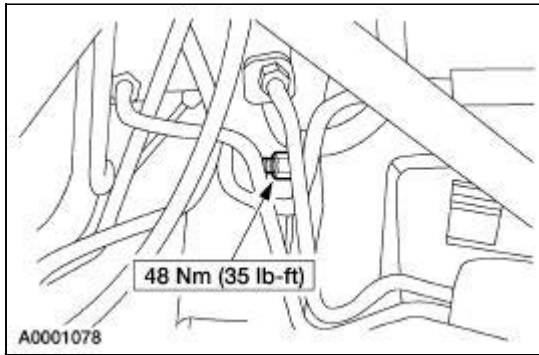
4. Install the shock absorber and spring assembly. For additional information, refer to [Shock Absorber and Spring Assembly](#) in this section.

5. **⚠ CAUTION:** The suspension lower arm-to-body nuts must be tightened with the suspension at curb height. Make sure the vehicle is completely lowered before tightening these nuts. Failure to do so can cause bushing failure, resulting in poor ride and handling.

Install a new nut.




6. Install a new nut.



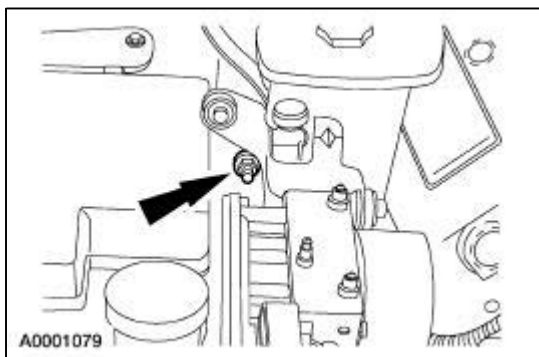
7. Install the air cleaner. For additional information, refer to [Section 303-12](#).
 8. Install the canister purge valve. For additional information, refer to [Section 303-13](#).
-

Upper Arm —Right Side

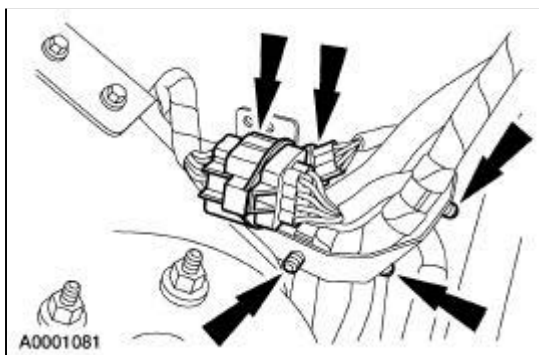
Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

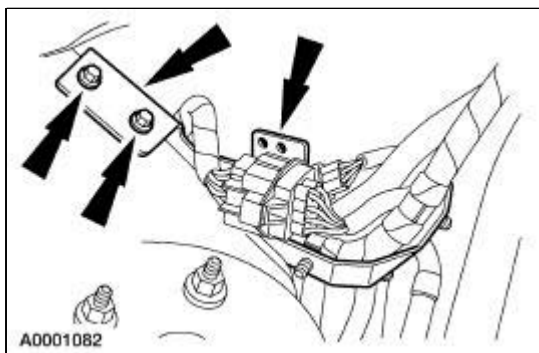
1. Remove and discard the nut.



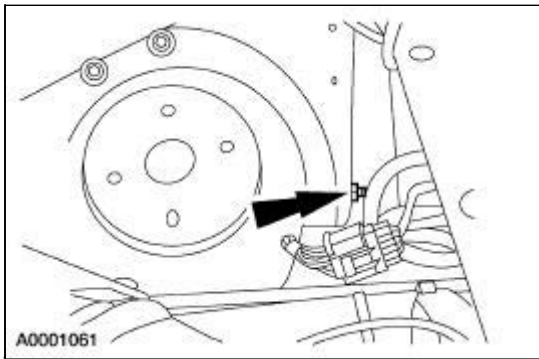
2. Detach the wires and electrical connectors from the bracket.



3. Remove three bolts and the bracket.



4. Remove and discard the nut.



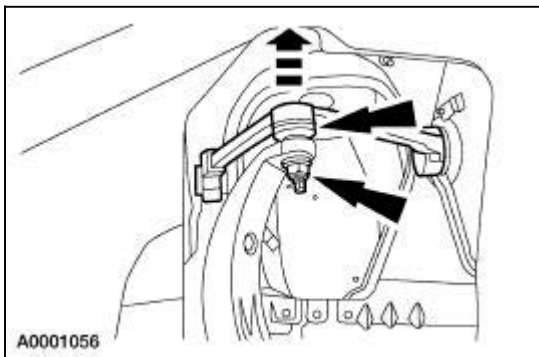
5. Remove the strut and spring assembly. For additional information, refer to [Shock Absorber and Spring Assembly](#) in this section.

6. **NOTE:** Wire the top of the wheel knuckle to the body to prevent knuckle movement.

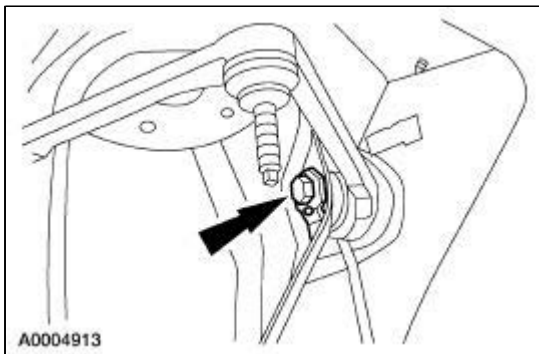
NOTE: To remove the nut, first loosen the nut, then use the hex holding feature to prevent the ball joint from turning while removing the nut.

NOTE: Make sure not to lose the tapered washer on the ball joint.

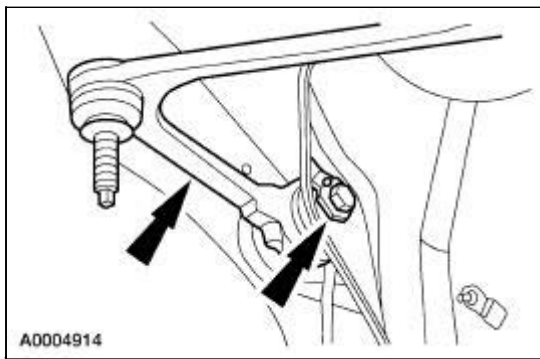
Remove and discard the nut. Disconnect the suspension upper arm (3082) from the knuckle (3K185).




7. Remove and discard the bolt.



8. Remove the bolt and the suspension upper arm. Discard the bolt.



Installation

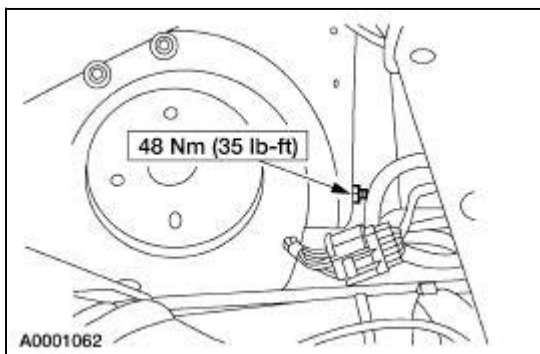
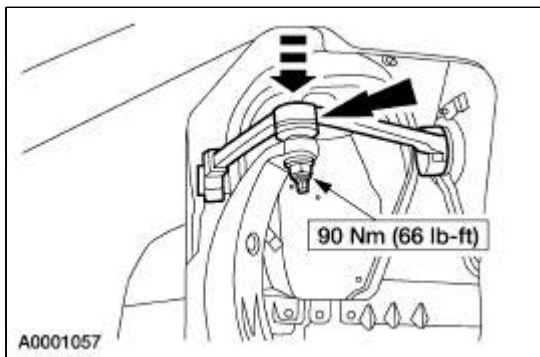
1.  **CAUTION:** The suspension upper arm nuts must be tightened with the suspension at curb height. Make sure the vehicle is completely lowered before tightening these nuts. Failure to do so can cause bushing failure, resulting in poor ride and handling.

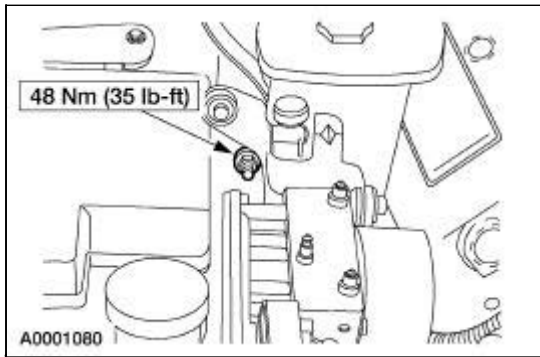
NOTE: The suspension upper arm bolts and nuts are of a torque prevailing design. New bolts and nuts must be installed.

NOTE: Make sure the tapered washer is installed on the ball joint before connecting the upper control arm to the knuckle.

NOTE: To install the upper control arm ball joint nut, first install the nut until snug using the hex holding feature, then final tighten the nut using a socket and torque wrench.


To install, reverse the removal procedure.



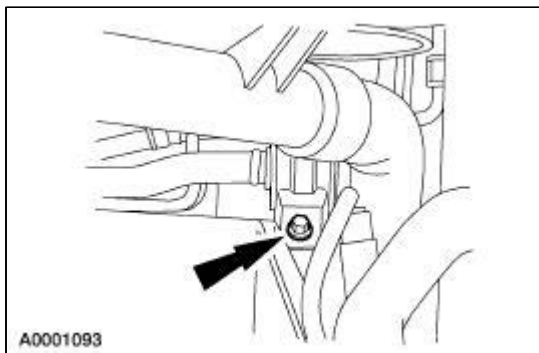


Stabilizer Bar

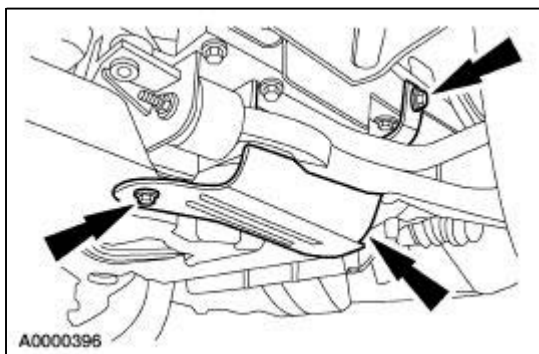
Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

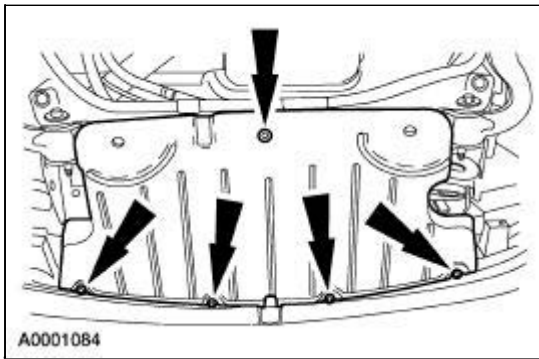
1. Remove the air cleaner. For additional information, refer to [Section 303-12](#).
2. Remove the bolt.



3. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
4. Remove both wheel and tire assemblies. For additional information, refer to [Section 204-04](#).
5. Remove two pushpins, four bolts and both splash shields.

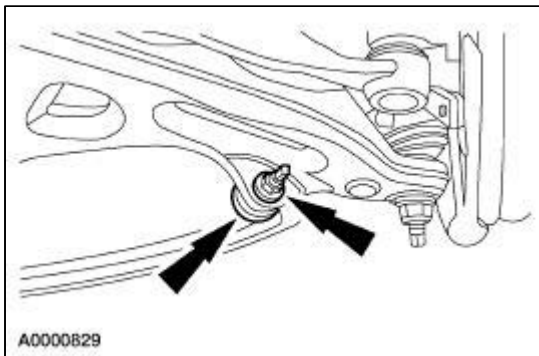


6. Remove the bolts and the shield.



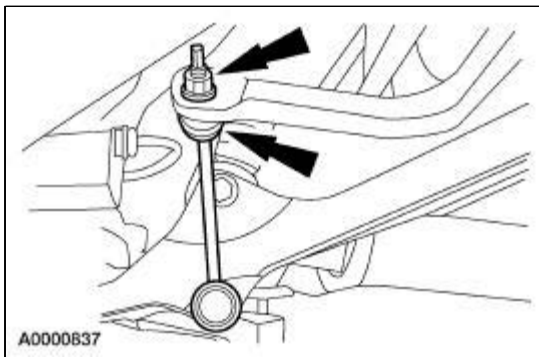
7. **NOTE:** To remove the nut, first loosen the nut, then use the hex holding feature to prevent the stabilizer bar link ball joint from turning while removing the nut.

Remove the nut and disconnect the stabilizer bar link (5K483). Discard the nut.

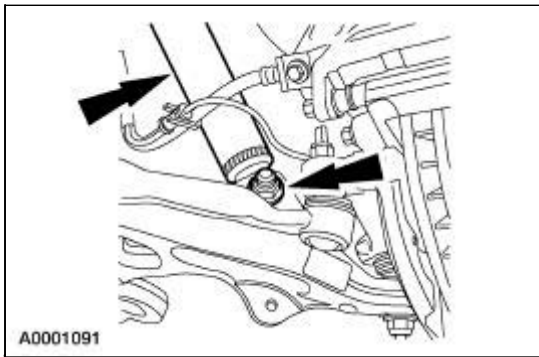


8. **NOTE:** To remove the nut, first loosen the nut, then use the hex holding feature to prevent the stabilizer bar link ball joint from turning while removing the nut.

Remove the nut and stabilizer bar link. Discard the nut.



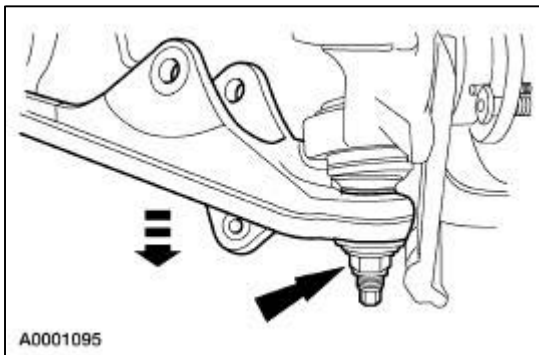
9. Remove and discard the nut and bolt. Disconnect the left shock absorber and spring assembly.



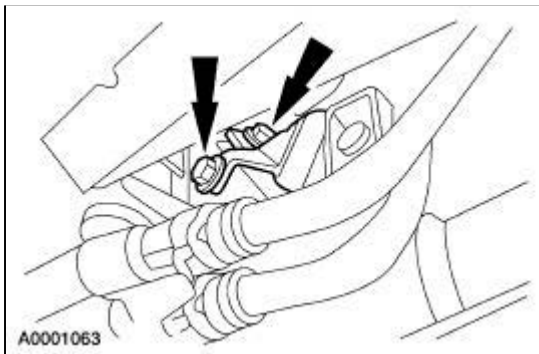
10. **NOTE:** To remove the nut, first loosen the nut, then use the hex holding feature to prevent the lower control arm ball joint from turning while removing the nut.

NOTE: Make sure not to lose the tapered washer on the ball joint.

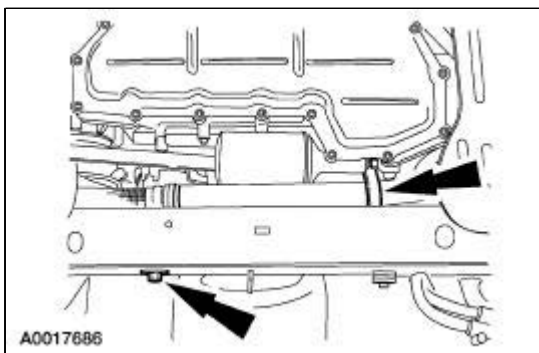
Remove and discard the nut. Disconnect the left suspension lower arm and position the knuckle (3K185) out of the way.



11. Remove the bolts and position the heater water valve and bracket out of the way.

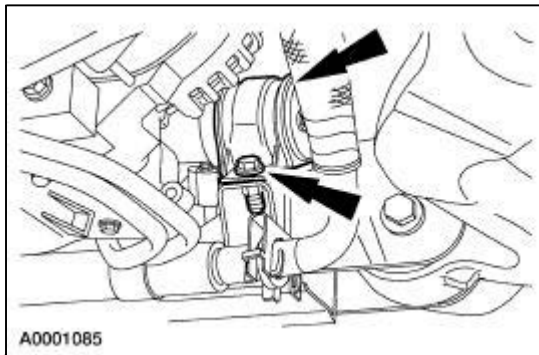


12. Remove the bolt and detach the A/C hose retainer. Position the A/C hose aside.

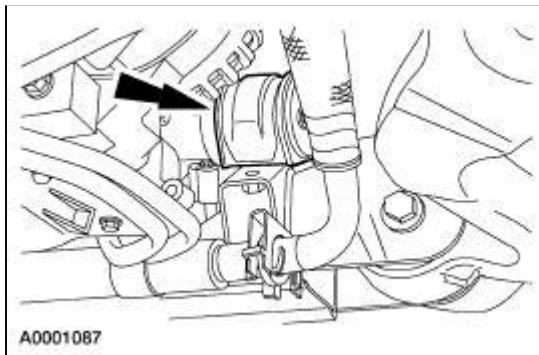


- NOTE:** To ease removal of the right front bolt, remove it first.

Remove the bolts and the stabilizer bar brackets (5486).



- Remove the stabilizer bar bushings (5493).



- NOTE:** Deflect the LH lower control arm downward to ease removal of the stabilizer bar.

Carefully remove the stabilizer bar through the left wheel well.

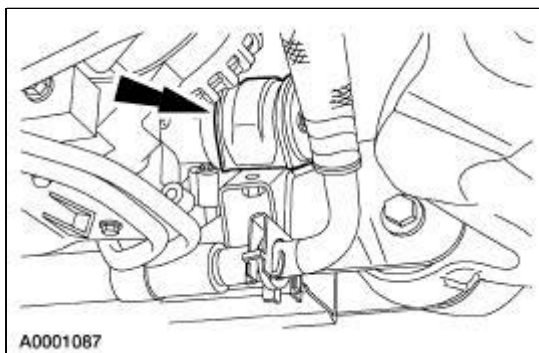
Installation

- NOTE:** Deflect the LH lower control arm downward to ease installation of the stabilizer bar.

Carefully install the stabilizer bar through the left wheel well.

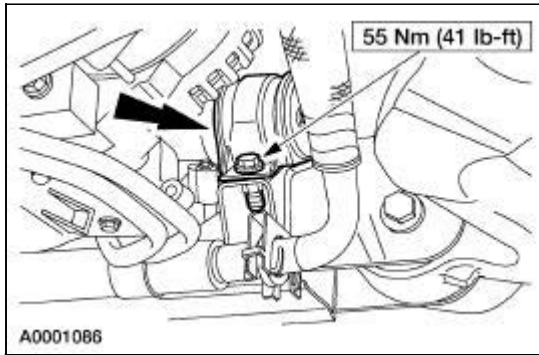
- NOTE:** If the stabilizer bar bushings are badly worn or have no grease, install new bushings. Do not grease the bushings.

Install the stabilizer bar bushings.

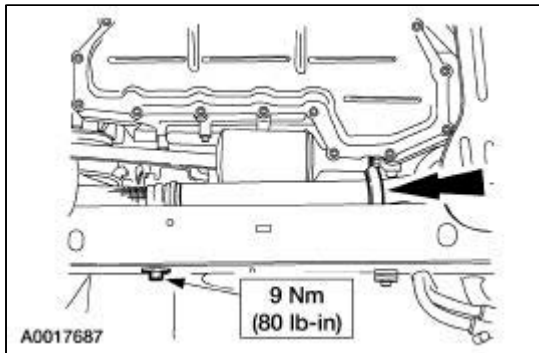


- NOTE:** To ease installation of the right front bolt, install the right rear bolt first.

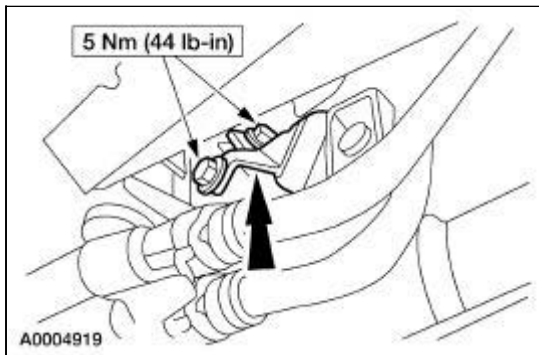
Install the stabilizer bar brackets and the bolts.



4. Position the A/C hose, attach the retainer, and install the bolt.



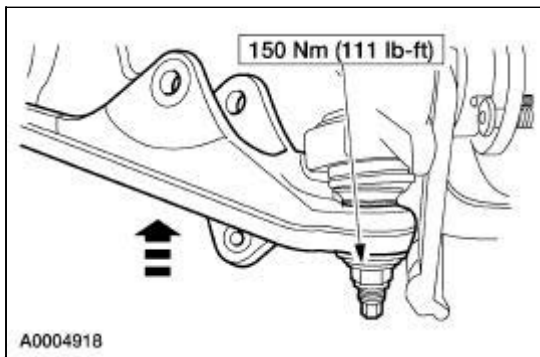
5. Position the heater water valve and bracket and install the bolts.



6. **NOTE:** Make sure the tapered washer is installed on the ball joint before connecting the lower control arm to the knuckle.

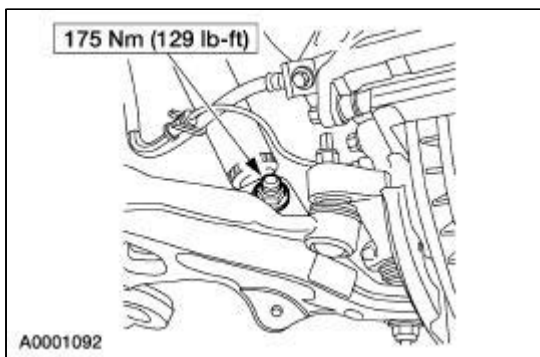
NOTE: To install the nut, first install the nut until snug using the hex holding feature. Final tighten the nut using a socket and a torque wrench. If the ball stud turns during final tighten, use a crow's foot wrench to turn the nut while using the hex holding feature to final tighten the nut.

Connect the suspension lower arm and install a new nut.



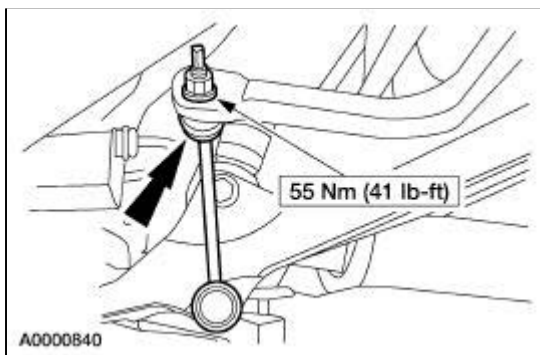
7. **NOTE:** Make sure the shock absorber lower bushing end caps are in place before installing the bolt and nut.

Connect the shock absorber and spring assembly and install a new nut and bolt.



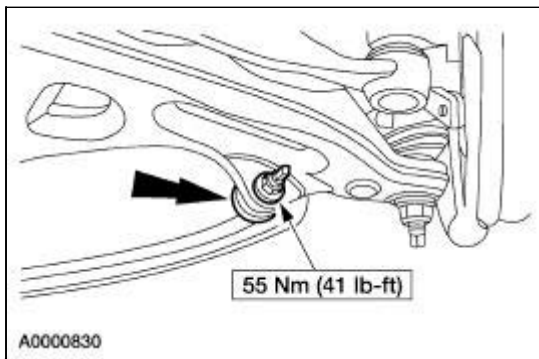
8. **NOTE:** To install the nut, first install the nut until snug using the hex holding feature. Final tighten the nut using a socket and a torque wrench.

Position the stabilizer bar link and install a new nut.

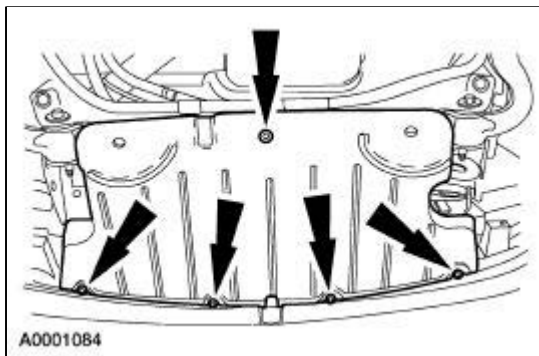


9. **NOTE:** To install the nut, first install the nut until snug using the hex holding feature. Final tighten the nut using a socket and a torque wrench.

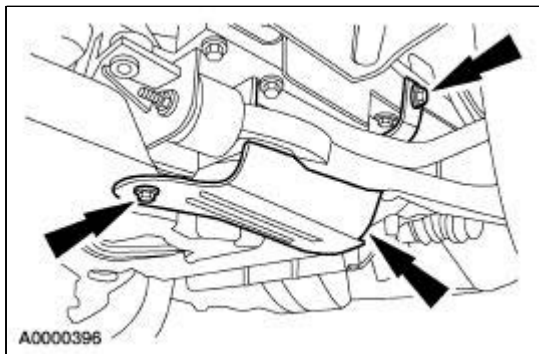
Connect the stabilizer bar link and install a new nut.



10. Install the shield and the bolts.



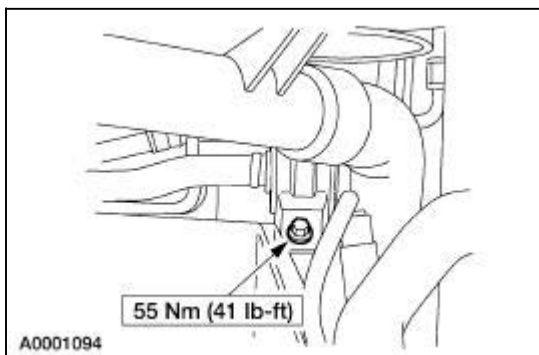
11. Install the shields, two pushpins and four bolts.



12. Install the wheel and tire assemblies. For additional information, refer to [Section 204-04](#).

13. Lower the vehicle.


14. Install the bolt.



15. Install the air cleaner. For additional information, refer to [Section 303-12](#).

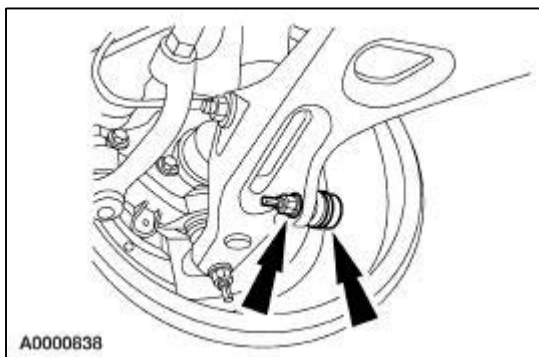
Stabilizer Bar Link

Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

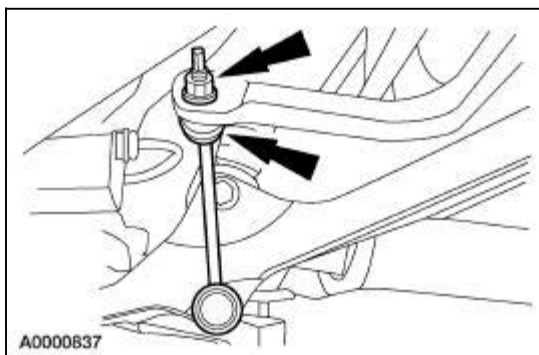
1. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
2. **NOTE:** To remove the nut, first loosen the nut, then use the hex holding feature to prevent the stabilizer bar link ball joint from turning while removing the nut.

Remove the nut and disconnect the stabilizer bar link (5K483) from the suspension lower arm (3078).



3. **NOTE:** To remove the nut, first loosen the nut, then use the hex holding feature to prevent the stabilizer bar link ball joint from turning while removing the nut.

Remove the nut and stabilizer bar link.



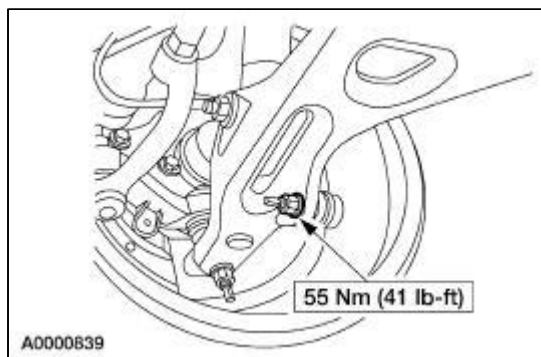
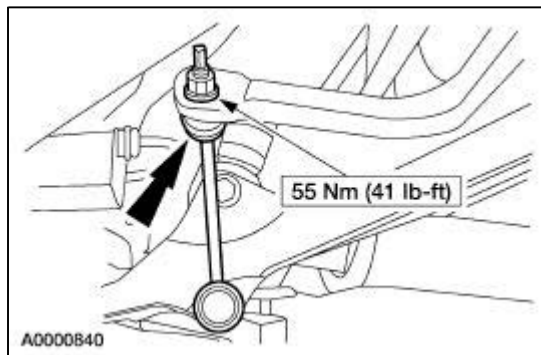
Installation

1. **NOTE:** The stabilizer bar nuts are of torque prevailing design. New nuts must be installed during assembly.

NOTE: To install the nuts, first install the nuts until snug using the hex holding feature. Final


tighten the nuts using a socket and a torque wrench.

To install, reverse the removal procedure.

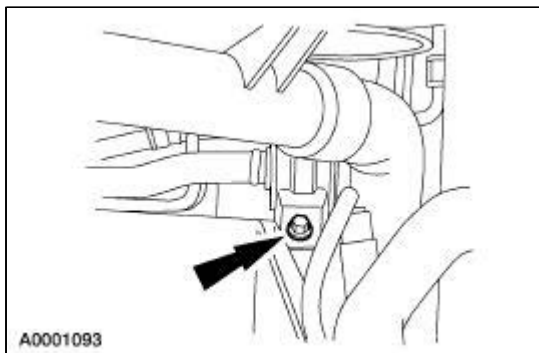


Stabilizer Bar Bushing

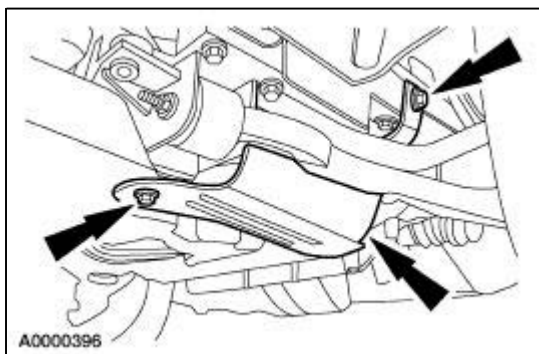
Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

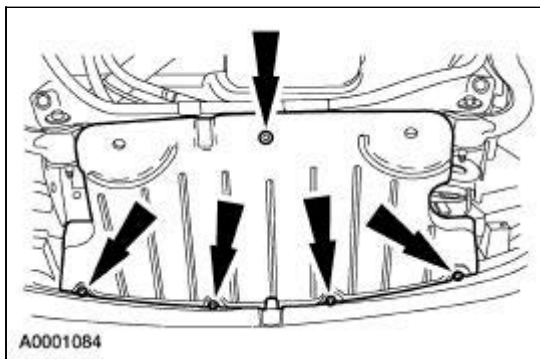
1. Remove the air cleaner. For additional information, refer to [Section 303-12](#).
2. Remove the bolt.



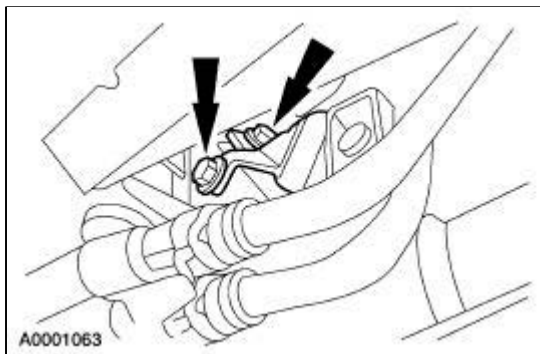
3. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
4. Remove both wheel and tire assemblies. For additional information, refer to [Section 204-04](#).
5. Remove two pushpins, four bolts and both splash shields.



6. Remove the bolts and the shield.

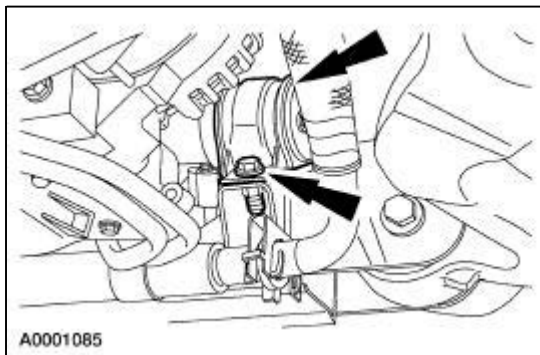


7. Remove the bolts and position the heater water valve and bracket out of the way.

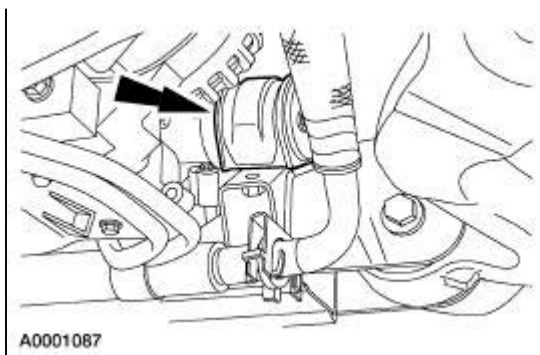


8. **NOTE:** To ease removal of the right front bolt, remove it first.

Remove the bolts and the stabilizer bar brackets (5486).



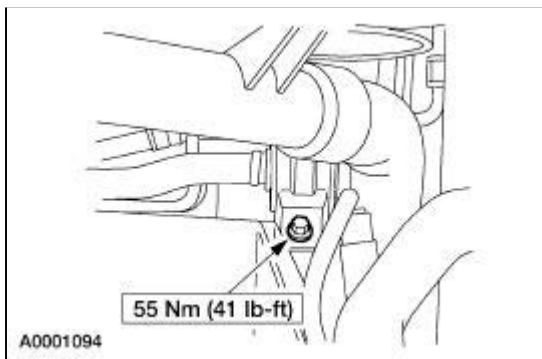
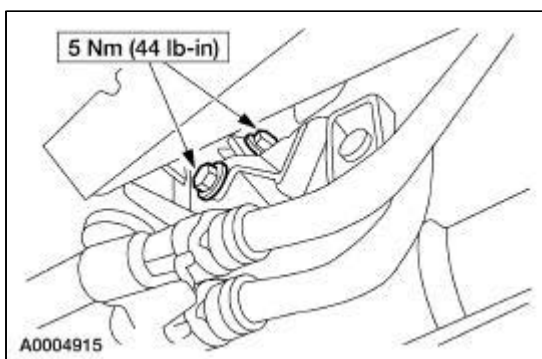
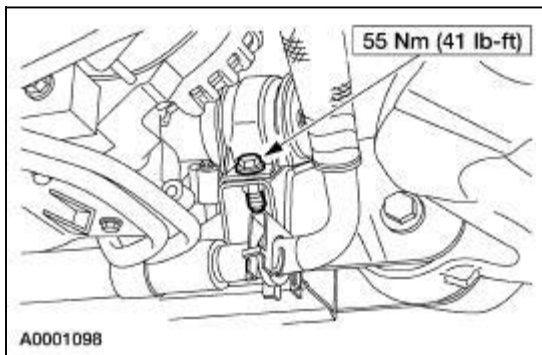
9. Remove the stabilizer bar bushings (5493).



Installation


1. **NOTE:** If the stabilizer bar bushings are badly worn or have no grease, install new bushings. Do not grease the bushings.

To install, reverse the removal procedure.



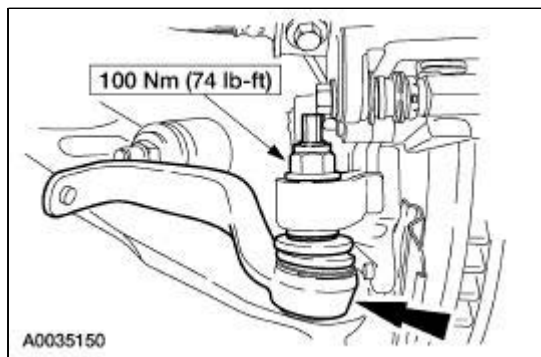
Wheel Knuckle


Removal and Installation

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the wheel bearing and hub (1104). For additional information, refer to [Wheel Bearing and Hub](#) in this section.
2. **NOTE:** The hex holding feature can be used to prevent turning of the stud while removing the nut.

Remove the nut and disconnect the tie-rod end from the wheel knuckle (3K185). Discard the nut.

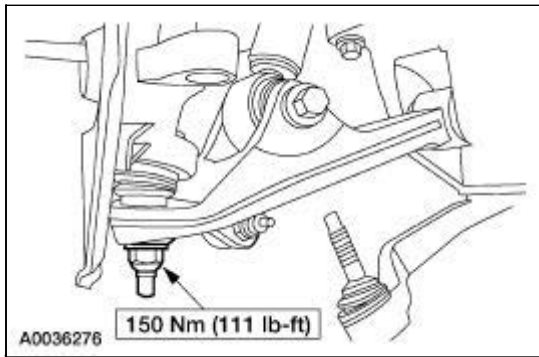


3.  **CAUTION:** Support the weight of the knuckle with a jack stand after disconnecting the lower control arm, or damage to the upper control arm can result.

NOTE: The hex holding feature can be used to prevent turning of the stud while removing the nut.

NOTE: Make sure not to lose the tapered washer from the ball joint.

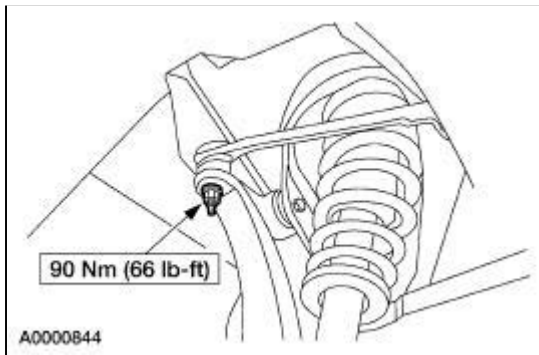
Remove the nut and disconnect the suspension lower arm (3078) from the knuckle. Discard the nut.




4. **NOTE:** The hex holding feature can be used to prevent turning of the stud while removing the nut.

NOTE: Make sure not to lose the tapered washer from the ball joint.

Remove the nut and the knuckle. Discard the nut.



5.  **CAUTION:** Support the weight of the knuckle with a jack stand while connecting the knuckle to the upper control arm or damage to the upper control arm can result.


NOTE: The upper arm-to-knuckle nut, lower arm-to-knuckle nut and the tie-rod-to-knuckle nut are of a torque prevailing design. New nuts must be installed.

NOTE: Make sure the tapered washer is installed on the ball joints before connecting the upper and lower control arms to the knuckle.

To install, reverse the removal procedure.

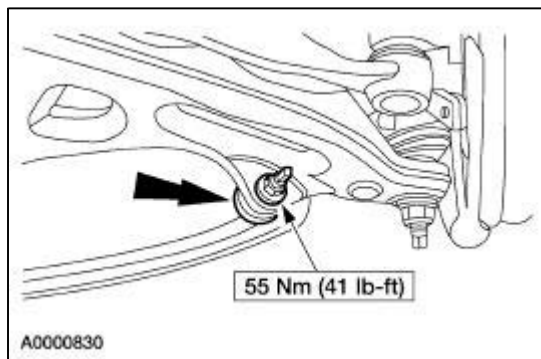
Shock Absorber and Spring Assembly

Removal and Installation

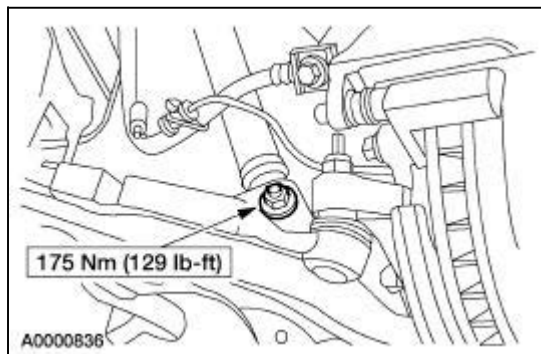
 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
2. **NOTE:** The hex holding feature can be used to prevent turning of the stud while removing the nut.

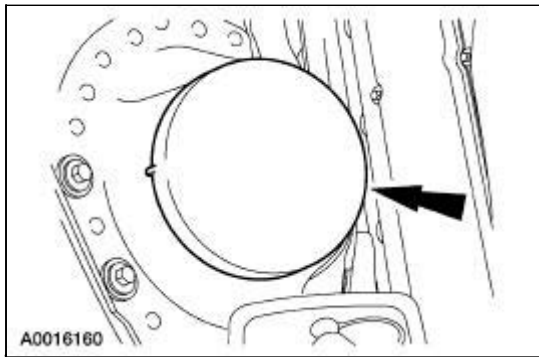
Remove the nut and disconnect the stabilizer bar link (5K483). Discard the nut.



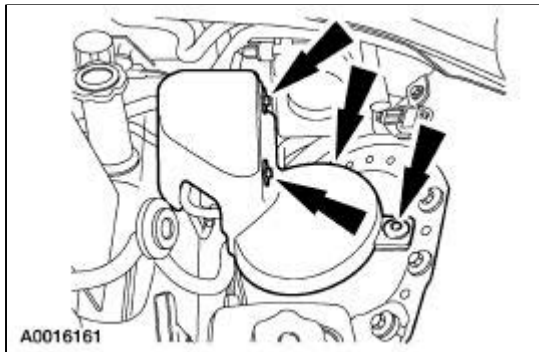
3. Remove the nut and bolt and disconnect the shock absorber and spring assembly.
 - Discard the nut and bolt.




4. Partially lower the vehicle.
5. Remove the right upper shock mount cover.

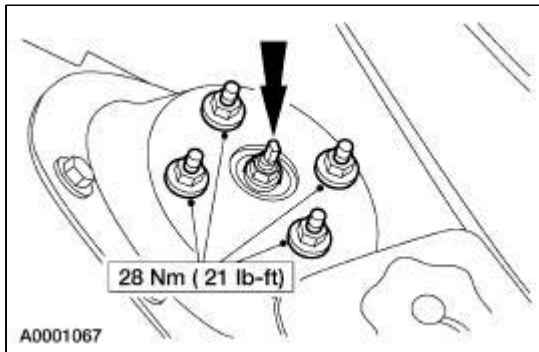


6. Remove the retainers and the left upper shock mount cover.



7.  **WARNING:** Do not remove the center nut. This nut holds the upper spring mount in place and if this nut is removed the spring tension will be released. Failure to follow these instructions may result in personal injury.

Remove and discard four nuts. Remove the shock absorber and spring assembly.





8.  **CAUTION:** Make sure the shock absorber lower bushing end caps are in place before installing the bolt and nut.


To install, reverse the removal procedure.

Shock Absorber and Spring Assembly

Disassembly

 **WARNING:** All vehicles are equipped with gas pressurized shock absorbers which will extend unassisted. Do not apply heat or flame to the shock absorbers during removal or component servicing. Failure to follow these instructions can result in personal injury.

 **WARNING:** The shock absorber and spring assembly is under extreme load. Do not attempt to disassemble the shock absorber and spring assembly without using a spring compressor. Failure to follow these instructions can result in personal injury.

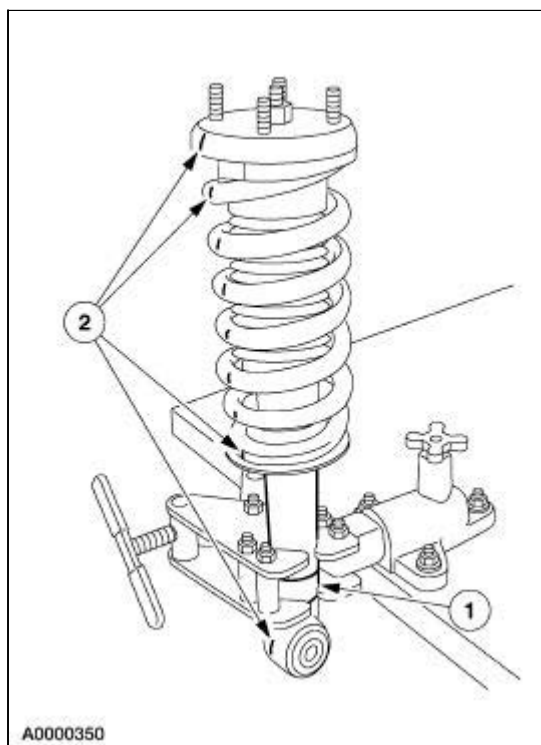
 **CAUTION:** Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the shock absorber and spring assembly. For additional information, refer to [Shock Absorber and Spring Assembly](#) in this section.

2.  **CAUTION:** Over tightening the vise can damage the shock absorber tube.

Mount and mark the shock absorber and spring assembly.

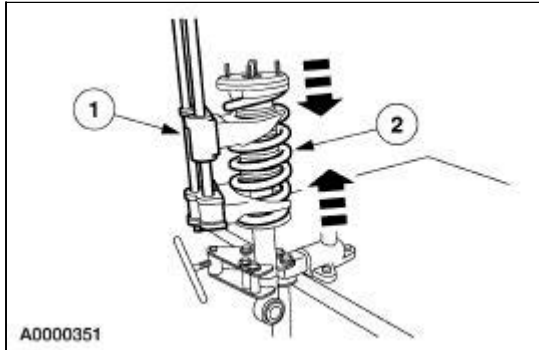
1. Position the shock absorber and spring assembly in a suitable holding device.
2. Mark the upper mount, spring and shock absorber for assembly reference.



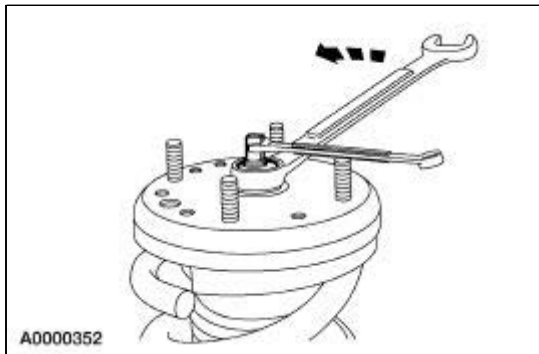
3. **NOTE:** If installing a new spring, make sure the part number is correct. Refer to the vehicle certification (VC) label for the correct spring code. Refer to [Section 100-01](#) to convert the spring code to a part number.

Compress the spring.

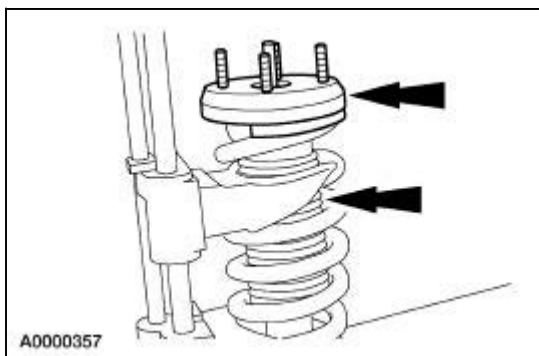
1. Install an appropriate spring compressor.
2. Compress the spring.



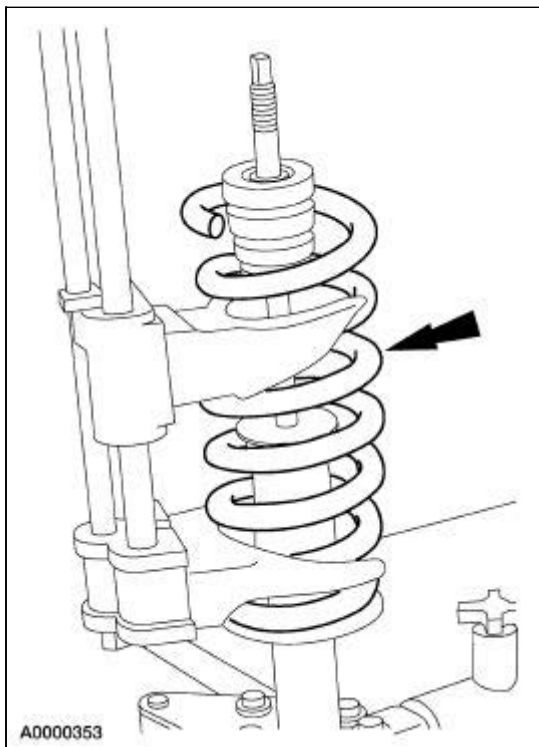
4. While holding the shock absorber rod, remove and discard the nut.



5. Remove the upper mount and dust boot as an assembly.



6. Carefully remove the spring and spring compressor.



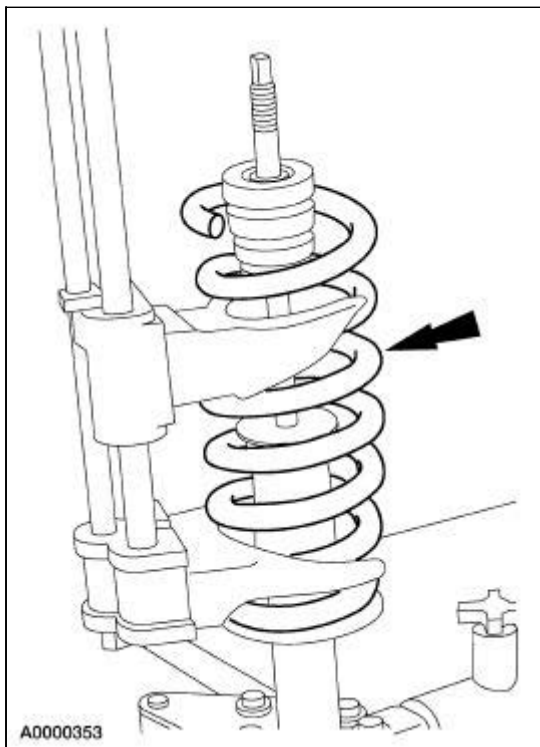
Assembly

NOTE: If a new shock absorber, spring or upper mount is installed, the new part should be marked in the same place as the old part to make sure the assembly is correctly aligned.

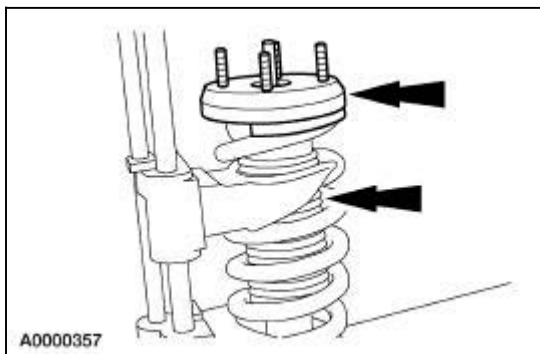
1. Inspect the lower and upper spring seats for damage.
2. Inspect the spring insulator for wear or damage. Install a new upper mount if necessary.
3. **NOTE:** If installing a new spring make sure the part number is correct. Refer to the vehicle certification (VC) label for the correct spring code. Refer to [Section 100-01](#) to convert the spring code to a part number.

Inspect the spring for nicked or scratched paint. If the paint is nicked or scratched, install a new spring.

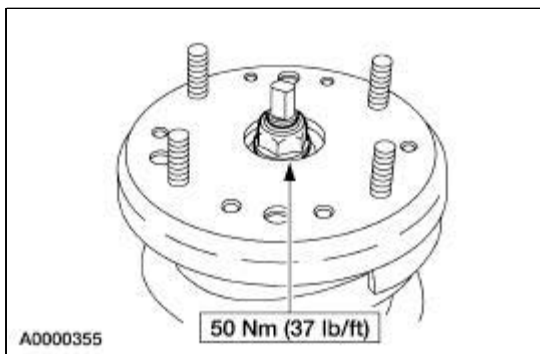
4. If removed, place the shock absorber into the vise.
5. Position the shock and spring compressor onto the strut.



6. Position the upper mount and dust boot onto the spring. Make sure the marks made during disassembly, Step 2, are lined up.



7. Install a new nut.



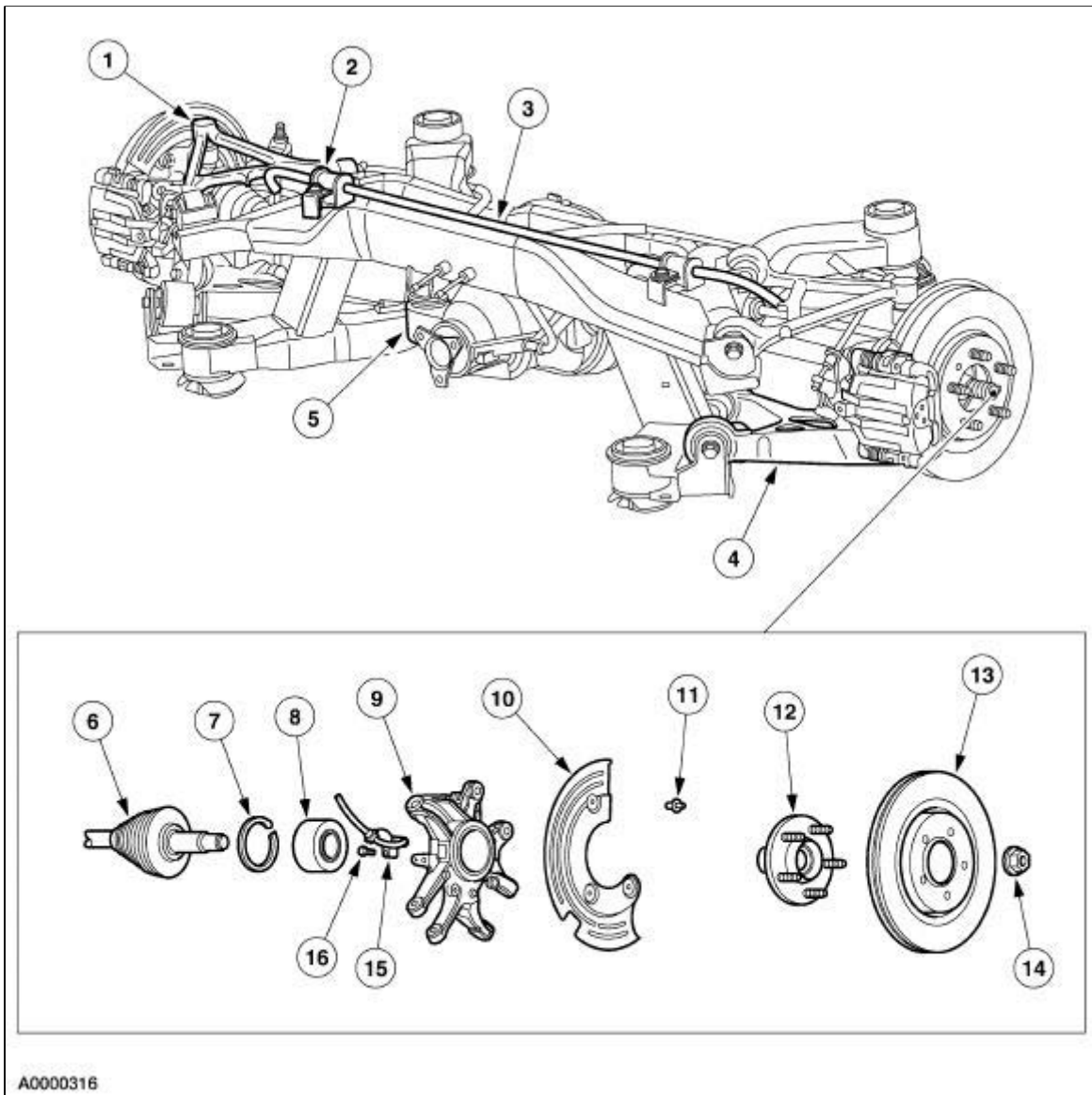
8. Remove the spring compressor.
9. Install the shock absorber and spring assembly. For additional information, refer to [Shock Absorber and Spring Assembly](#) in this section.

Torque Specifications

Description	Nm	lb-ft	lb-in
Subframe-to-body bolts	103	76	—
Upper arm and bushing-to-subframe pivot bolt nuts	90	66	—
Upper ball joint nut	90	66	—
Lower arm and bushing-to-subframe pivot bolt and nut	150	111	—
Lower arm and bushing-to-knuckle pivot bolt nut	150	111	—
Toe link nut (outer)	55	41	—
Toe link nut (inner)	70	52	—
Stabilizer bar link nuts	48	35	—
Stabilizer bar bracket bolts	55	41	—
Anti-lock brake sensor bolt	10	—	89
Shock absorber and spring assembly-to-lower arm and bushing bolt	133	98	—
Upper shock absorber rod-to-upper shock absorber mount nut	50	37	—
Upper shock absorber mount-to-body nuts	28	21	—
Axle shaft retaining nut	300	221	—

Rear Suspension

Rear Suspension Components



A0000316

Item	Part Number	Description
1	5500	Upper arm
2	5C488	Stabilizer bar link
3	5486	Stabilizer bar retaining bracket
4	5A772	Stabilizer bar
5	—	Lower arm
6	—	Axle shaft
7	W701904-S309M	Snap ring
8	1244	Wheel hub bearing

9	—	Knuckle
10	2C028	Rear brake disc shield
11	W701950-S100	Rivet
12	1109	Hub
13	2C026	Rear brake disc
14	4B477	Hub retainer
15	2C190	ABS sensor
16	W500014-S426	Screw

The independent rear suspension consists of the following components:

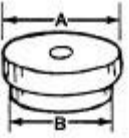

- upper arms (5500)
 - lower arms
 - shock absorber and spring assemblies
 - adjustable toe links
 - stabilizer bar (5A772)
 - rear wheel knuckles
 - hubs (1109)
 - wheel bearings (1244)
-

Rear Suspension


Refer to Section 204-00 .


Hub

Special Tool(s)

 <p>ST1690-A</p>	Step Plate Adapter Set 205-DS011 (D80L-630-A) or Equivalent
 <p>ST1310-A</p>	Universal Bearing Puller 205-055 (T71P-4621-B)

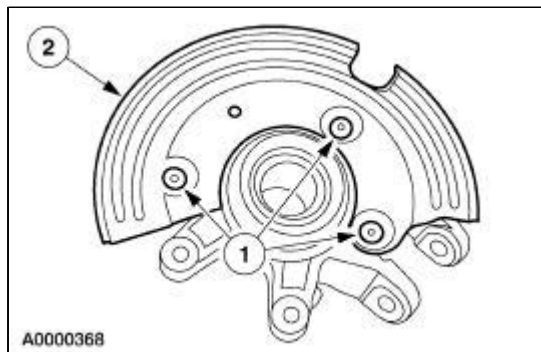
Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the knuckle. For additional information, refer to [Knuckle](#) in this section.
2.  **CAUTION:** Use extreme care not to damage the knuckle when drilling out the dust shield rivets.

Remove the dust shield (2C028).

1. Using a 5.5 mm (0.22 in) drill bit, drill out the dust shield rivets. If a larger drill bit is needed, it must not be larger than 6 mm (0.24 in).
2. Remove the dust shield.

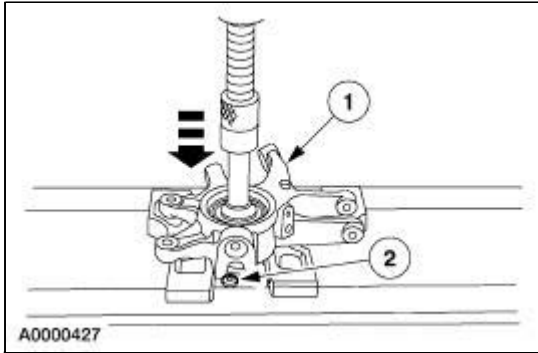


3.  **CAUTION:** When the wheel hub is pressed from the bearing, the bearing inner race will come out with the hub. Never try to install the race back into the bearing. Always install a new bearing.

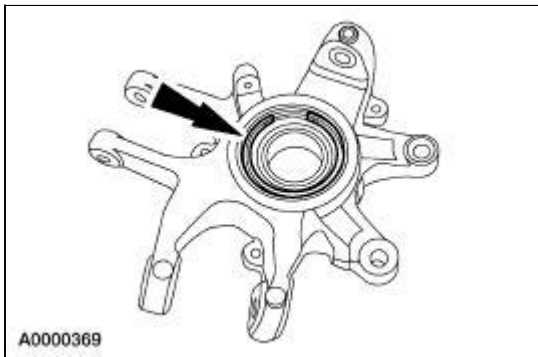
⚠ CAUTION: Make sure to keep the knuckle level and supported during pressing operations, or damage to the knuckle can occur. Support the knuckle as close to the bearing bore as possible. Do not use knuckle extremities as supports.

Remove the hub (1109).

1. Correctly support the knuckle in a press.
2. Using the appropriate step plate adapter, press the hub from the bearing. The bearing inner race will come out with the hub.



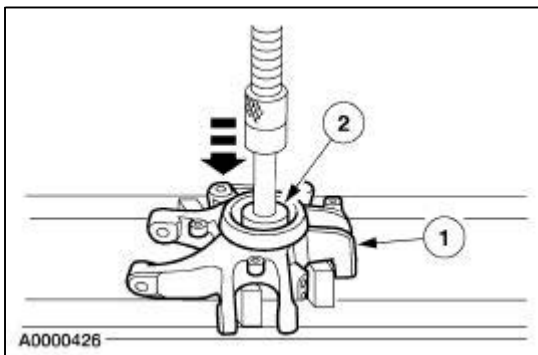
4. Remove the snap ring.



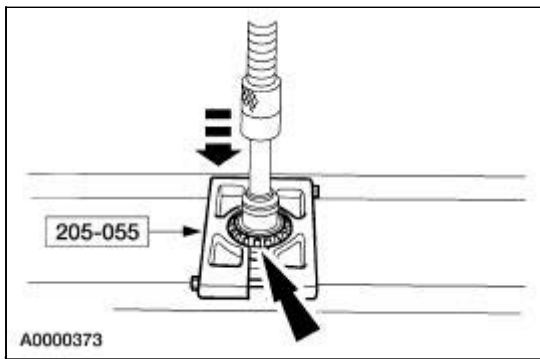
5. **⚠ CAUTION: Make sure to keep the knuckle level and supported during pressing operations, or damage to the knuckle can occur. Support the knuckle as close to the bearing bore as possible. Do not use knuckle extremities as supports.**

Remove the bearing (1244).


1. Correctly support the knuckle in a press.
2. Using the appropriate step plate adapter, press the bearing from the knuckle.



6. If the hub is to be reused, remove the bearing inner race from the hub using the special tool.

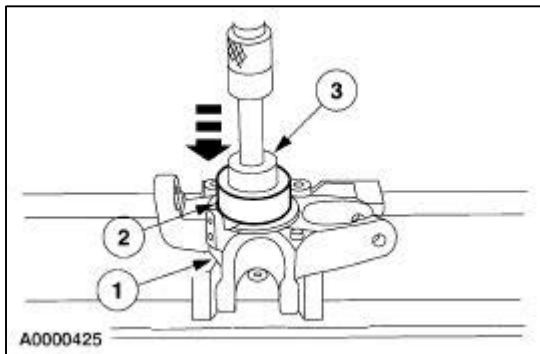


Installation

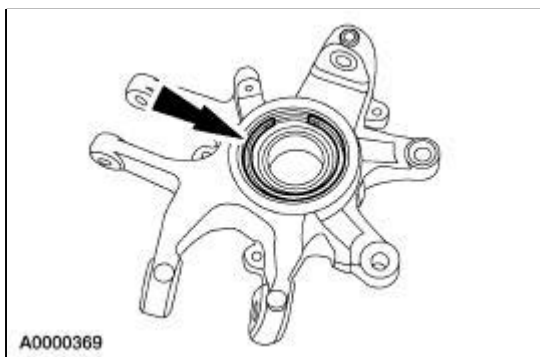
1. Thoroughly clean and inspect the wheel knuckle to bearing mating surface before installing the bearing.
2.  **CAUTION: Make sure to keep the knuckle level and supported during pressing operations, or damage to the knuckle can occur. Support the knuckle as close to the bearing bore as possible. Do not use knuckle extremities as supports.**

Install a new bearing.

1. Correctly support the knuckle in a press.
2. Position the new bearing in the knuckle.
3. Using the appropriate step plate adapter, press the new bearing into the knuckle until the bearing clears the snap ring groove and bottoms out in the bore.



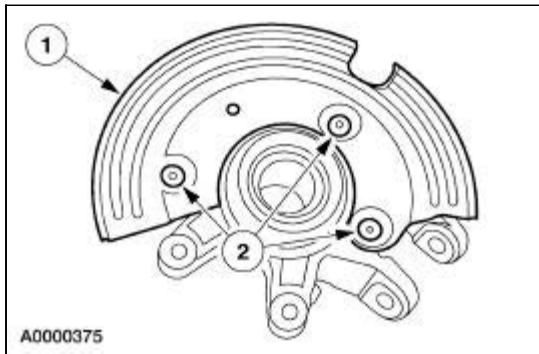
3. Install the snap ring.




4.  **CAUTION: Use only the appropriate size aluminum rivets on the rear brake disc dust shield. Galvanic corrosion will result if steel rivets are used.**

Install the rear brake dust shield.

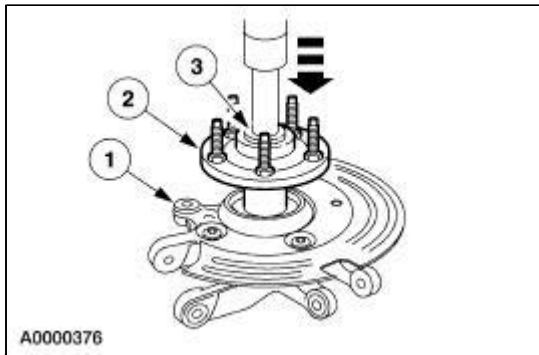
1. Position the shield on the knuckle.
2. Install the rivets.



5.  **CAUTION: The wheel bearing inner race must be supported during hub installation. Failure to do so will damage the bearing.**

Install the hub.


1. Position the knuckle in a press, using the appropriate step plate adapter to support the wheel bearing inner race.
2. Position the hub in the bearing.
3. Using the appropriate step plate adapter, press the hub into the bearing.



6. Install the knuckle. For additional information, refer to [Knuckle](#) in this section.
-

Wheel Studs

Special Tool(s)

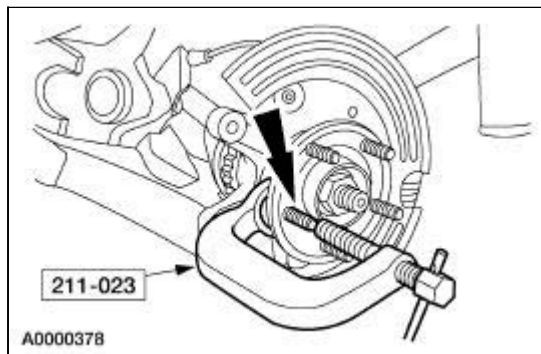
	C-Frame and Clamp Assembly 211-023 (T74P-3044-A1)
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Removal

1. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
2. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
3. Remove the rear brake disc. For additional information, refer to [Section 206-04](#).
4. **NOTE:** Grind off the stud to ease removal if necessary.

Using the special tool, press the wheel stud (1107) out of the rear hub (1109) between the caliper mounting pads.

- Discard the wheel stud. Do not reuse wheel studs.

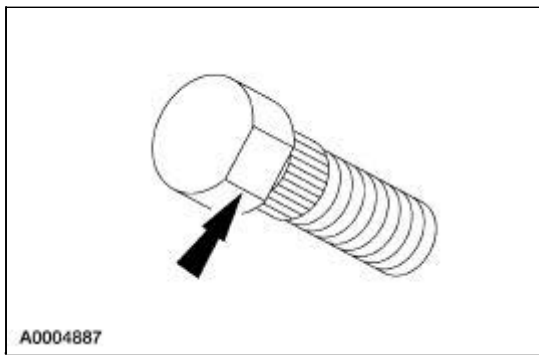


Installation



CAUTION: Never use air tools to install wheel studs. The serrations can be stripped from the stud.

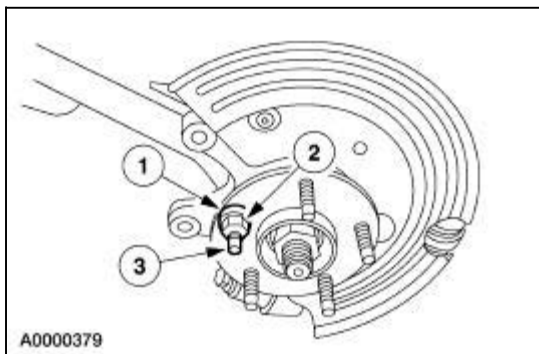
1. If necessary, grind the head of a new wheel stud to a "D" shape to clear the wheel knuckle.



2. Position the new wheel stud into the hub flange, making sure the serrations on the stud are aligned with the serrations in the flange.
3. Install the wheel stud.
 1. Place four flat washers on the wheel stud.
 2. **NOTE:** Do not use the wheel nuts that came with the vehicle.

Thread a standard wheel nut (1012) onto the wheel stud with the flat side against the washers.


3. Tighten the wheel nut until the wheel stud head seats against the hub flange.



4. Remove the wheel nut and washers.
 5. Install the rear brake disc. For additional information, refer to [Section 206-04](#).
 6. Install the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
 7. Lower the vehicle.
-

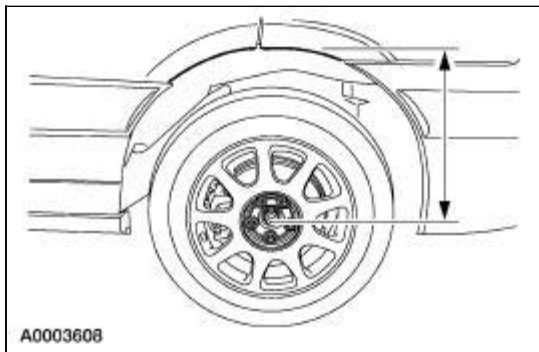
Arm —Upper

Removal

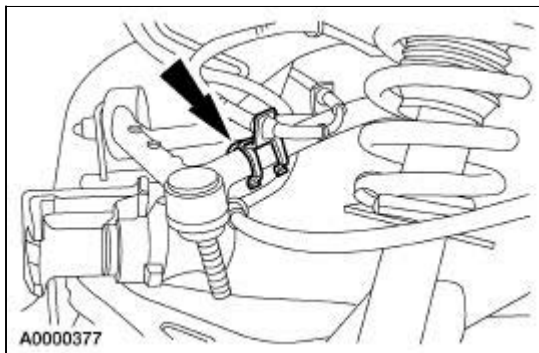
 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: The suspension upper arm bushings or ball joints are not serviced separately from the upper rear suspension arm. If the bushings or ball joints require service a new suspension upper arm (5500) must be installed.

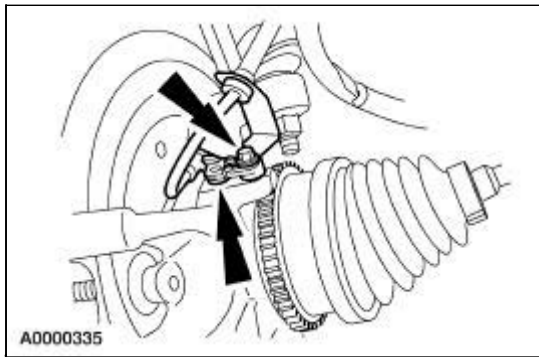
1. Remove the hub cap. Measure the distance from the center of the hub to the lip of the fender with the vehicle in a level, static ground position.




2. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
3. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
4. Unclip the ABS sensor wire retainer from the suspension upper arm.



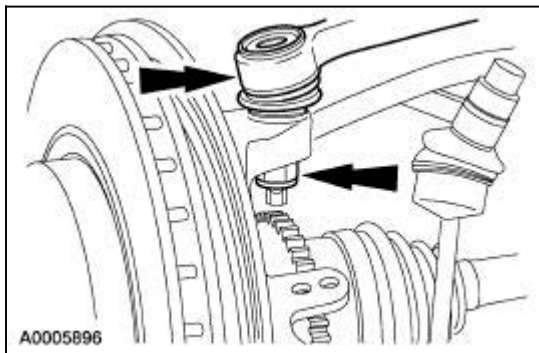
5. Remove the bolt and disconnect the ABS sensor. Position the sensor aside.



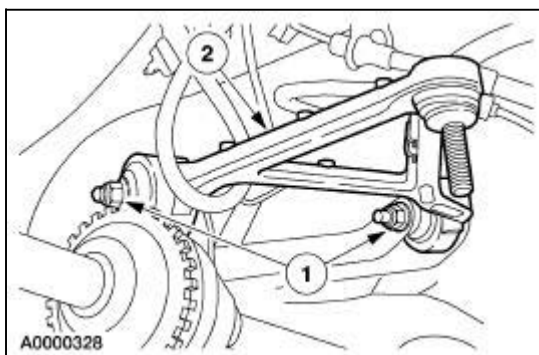
6.  **CAUTION:** Use care not to damage the anti-lock brake system (ABS) sensor ring. A damaged sensor ring will result in incorrect ABS operation.

NOTE: To remove the nut, first loosen the nut, then use the hex holding feature to prevent the ball joint from turning while removing the nut.


Remove and discard the nut. Disconnect the ball joint from the knuckle.



7. Remove the suspension upper arm (5500).
1. Remove the suspension upper arm-to-subframe nuts and bolts. Discard the nuts and bolts.
 2. Remove the suspension upper arm.



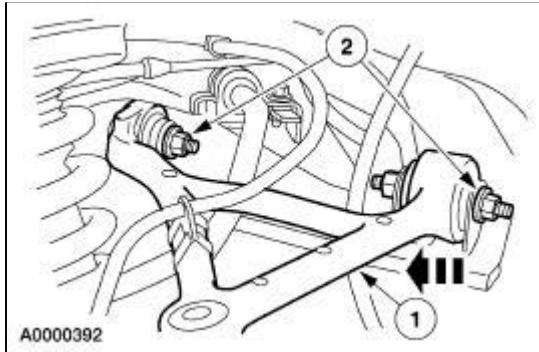
Installation


 **CAUTION:** Do not tighten the suspension upper arm-to-subframe nuts until the suspension is at curb height. Failure to do so can cause severe damage to the bushings resulting in poor ride quality and handling.

1. **NOTE:** The bolts and nuts retaining the suspension upper arm are of a torque prevailing design. New bolts and nuts must be used.

Install the suspension upper arm.

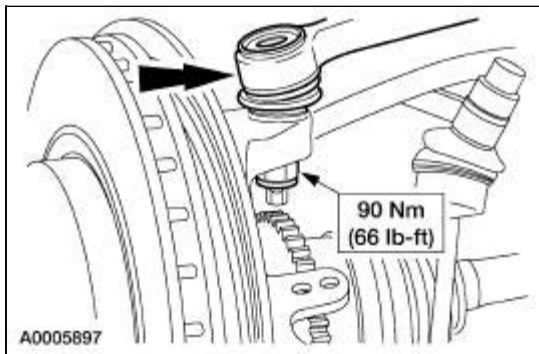
1. Position the arm on the subframe.
2. Install new nuts and bolts. Do not tighten at this time.



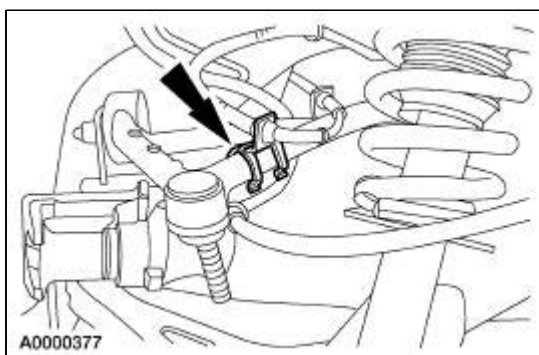
2.  **CAUTION:** Use care not to damage the anti-lock brake system (ABS) sensor ring. A damaged sensor ring will result in incorrect ABS operation.

NOTE: To install the nut, first install the nut using the hex holding feature until snug. Final tighten the nut using a line-type crow's foot and a torque wrench.

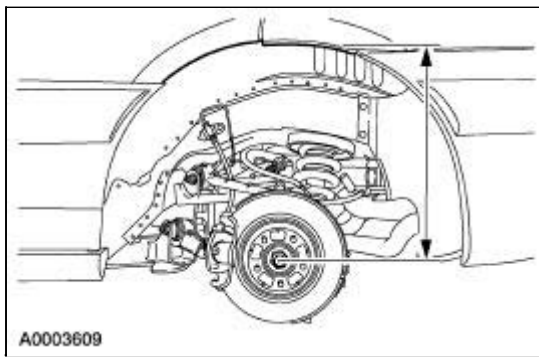
Connect the ball joint to the knuckle and install a new nut.



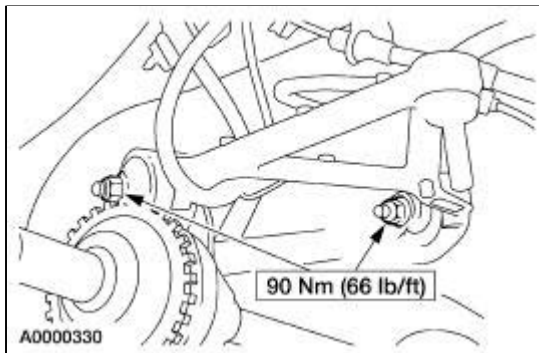
3. Clip the ABS sensor wire to the suspension upper arm.



4. Position a jack stand under the suspension lower arm and raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Removal, Step 1.




5. Tighten the nuts.



6. Lower the suspension and remove the jack stand.
 7. Install the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
 8. Lower the vehicle.
-

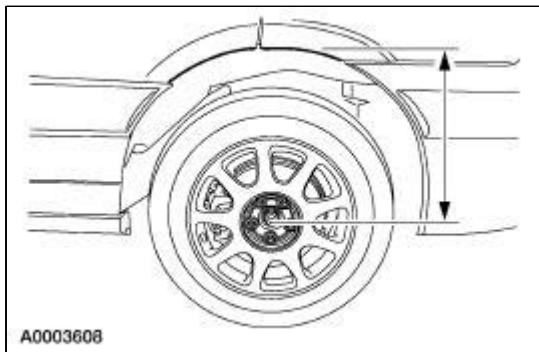
Arm —Lower

Removal

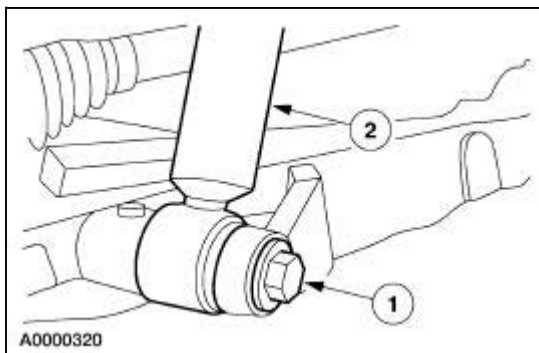
 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: The suspension lower arm bushings are not serviced separately from the lower suspension arm. If the bushings require service a new lower arm must be installed.

1. With the vehicle in a static, level ground position, remove the hub cap and measure the distance from the center of the hub (1109) to the lip of the fender (curb height).



2. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
3. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
4. Remove the rear brake disc. For additional information, refer to [Section 206-04](#).
5. Disconnect the shock absorber and spring assembly.
 1. Remove and discard the bolt.
 2. Disconnect the shock absorber and spring assembly from the lower arm and bushing.

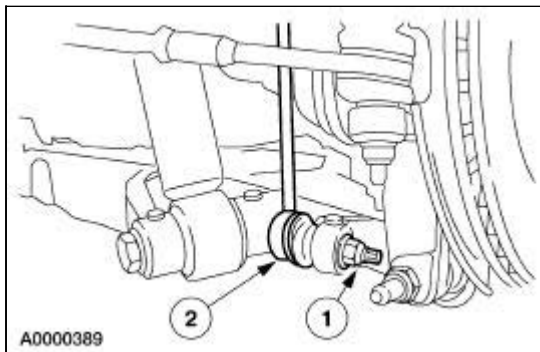


6.  **CAUTION:** Do not use air tools to remove the nut. Damage to the boot can result.

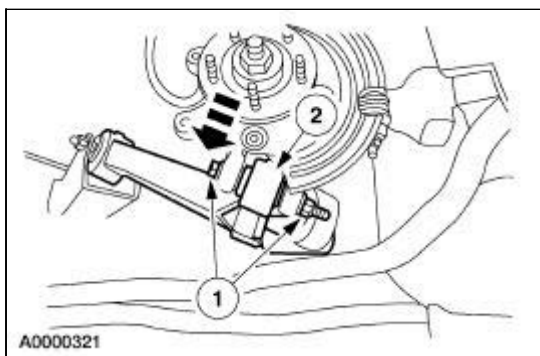
NOTE: To remove the nut, first loosen the nut, then remove the nut using the hex holding feature to prevent the stabilizer bar link ball joint from turning.

Disconnect the stabilizer bar link (5C488) from the suspension lower arm.

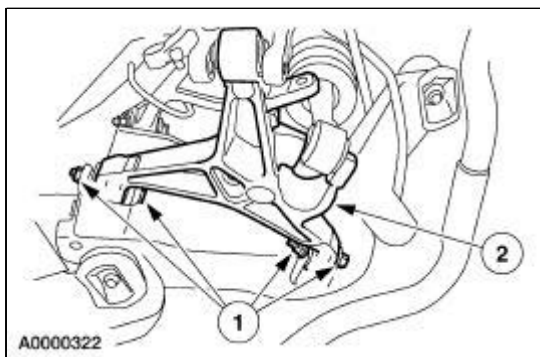
1. Remove and discard the nut.
2. Disconnect the stabilizer bar link.



7. Disconnect the suspension lower arm from the knuckle.
 1. Remove and discard the nut and bolt.
 2. Disconnect the suspension lower arm.



8. Remove the suspension lower arm and bushing.
 1. Remove and discard the nuts and bolts.
 2. Remove the suspension lower arm.

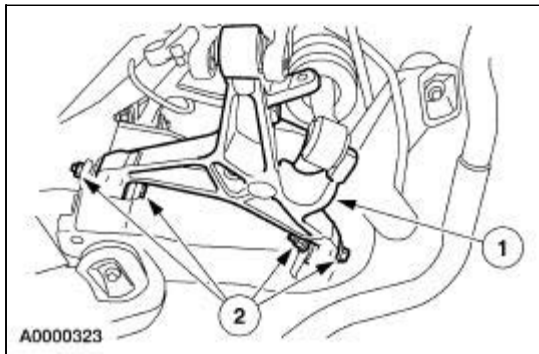


Installation

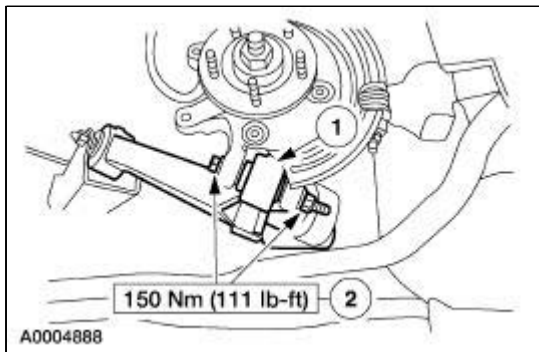
⚠ CAUTION: Do not tighten the suspension lower arm-to-subframe fasteners until the suspension is at curb height. Failure to do so can cause severe damage to the bushings resulting in poor ride quality and handling.

1. Install the suspension lower arm.

1. Position the suspension lower arm onto the subframe (5R003).
2. Install new bolts and nuts. Do not tighten at this time.



2. Connect the suspension lower arm to the knuckle.
 1. Position the suspension lower arm.
 2. Install a new bolt and nut. Tighten the nut.

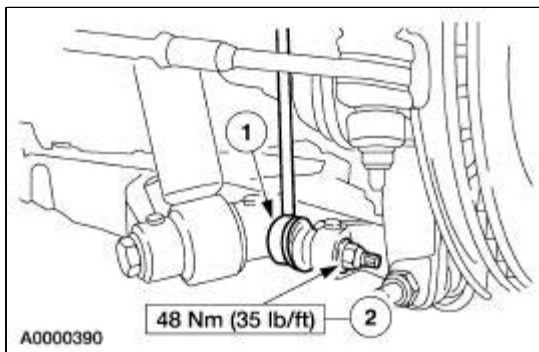


3.  **CAUTION: Do not use air tools to install the nut. Damage to the boot can result.**

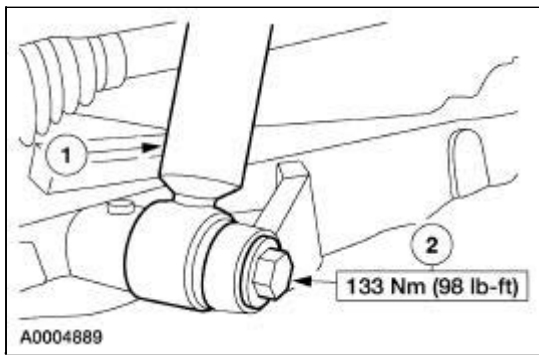
NOTE: To install the nut, first install the nut until snug using the hex holding feature. Final tighten the nut using a socket and a torque wrench.

Connect the stabilizer bar link to the suspension lower arm.

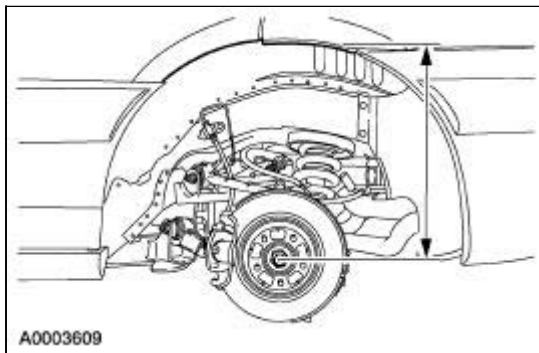
1. Position the stabilizer bar link on the suspension lower arm.
2. Install a new nut.



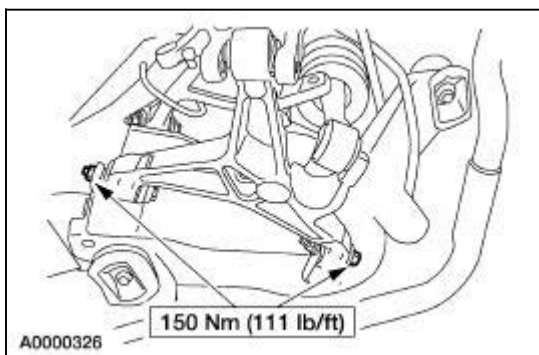
4. Install the rear shock absorber and spring assembly.
 1. Position the shock absorber and spring assembly onto the suspension lower arm.
 2. Install a new bolt.



5. Position a jack stand under the suspension lower arm and raise the suspension until the measurement between the center of the hub and the lip of the fender is equal to the measurement taken in Removal, Step 1 (curb height).



6. Tighten the lower suspension arm -to-subframe rear bolt. Tighten the suspension lower arm-to-subframe front nut.




7. Lower the suspension and remove the jack stand.
 8. Install the rear brake disc. For additional information, refer to [Section 206-04](#).
 9. Install the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
 10. Lower the vehicle.
-

Bar —Stabilizer

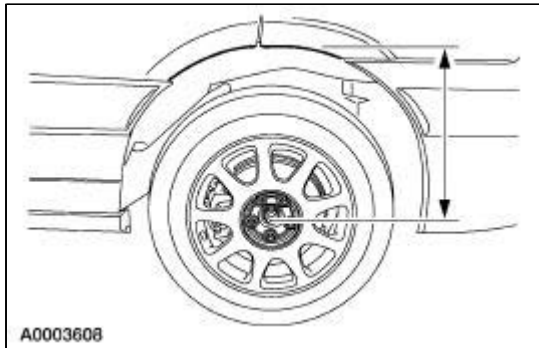
Special Tool(s)




Removal

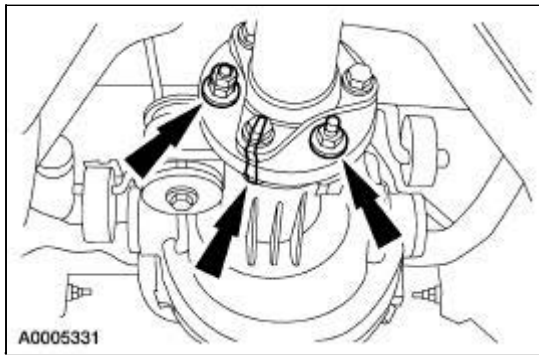
 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the hub cap and measure the distance from the center of the wheel hub to the lip of the fender with the vehicle in a static, level ground position (curb height).



2. Remove both wheel and tire assemblies. For additional information, refer to [Section 204-04](#).
3. Remove the muffler and heat shield. For additional information, refer to [Section 309-00](#).
4.  **CAUTION:** The driveshaft-to-pinion flange bolts, nuts and weighted nuts must be installed in the same locations from which they were removed.

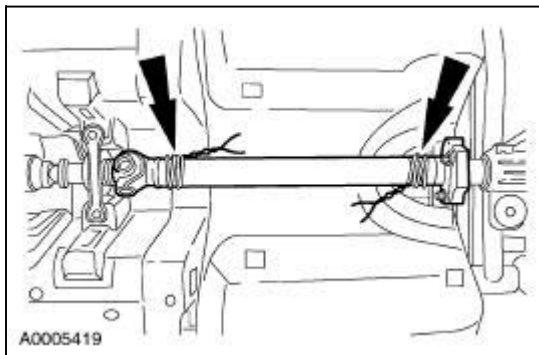
Mark the pinion flange, the driveshaft flexible coupling and each of the three driveshaft-to-pinion flange bolts, nuts and weighted nuts with different color paint so that the driveshaft and differential may be realigned during installation.



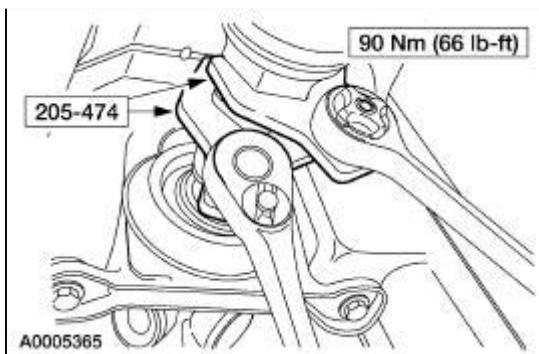
5.  **CAUTION:** Do not remove the flex coupling on the driveshaft flange. Make sure to remove only the driveshaft-to-pinion flange bolts and nuts.

Remove the three driveshaft-to-pinion flange bolts and nuts.

6. Support the driveshaft at the center and rear.



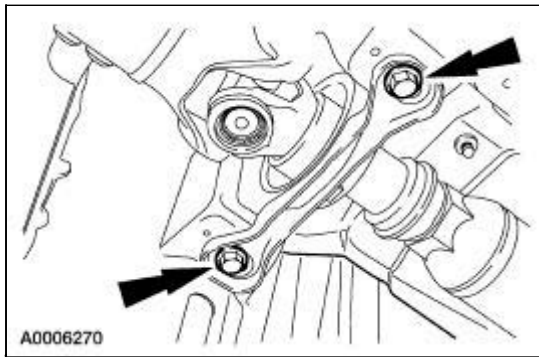
7. Loosen the driveshaft yoke adjuster nut.





8. **NOTE:** There are shims between the center bearing mounting bracket and the body.

NOTE: The shims must be installed in their original locations.

Remove the bolts and the shims.



9. Position special tool 014-00765, or equivalent, under the rear subframe (5R003).
10.  **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions can result in personal injury.

 **CAUTION:** Do not allow the subframe to hang from the shock absorbers. The shock absorbers can be damaged. Always keep the subframe supported on the special tool.

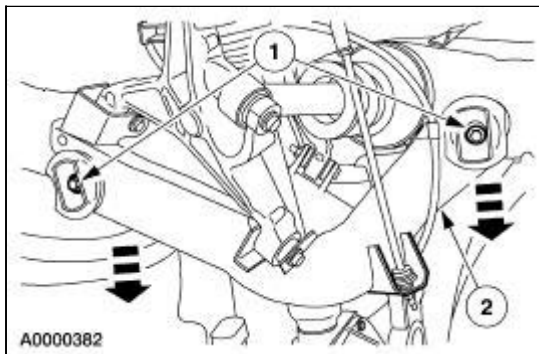
Lower the rear subframe.

1. **NOTE:** Paint or otherwise mark the relative position of the subframe retaining bolts to the subframe bushings for assembly reference.

Remove the four subframe bolts.

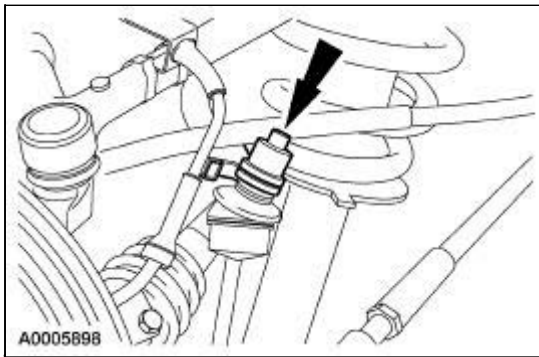
2.  **CAUTION:** To avoid damaging the fuel tank filler hose, do not lower the subframe more than specified.


Carefully lower the subframe approximately 56.25 mm (2.25 in) using the special tool.



NOTE: Components must be removed from both sides of the vehicle. Only the right side is shown.

11. Remove the cap from the stabilizer link.

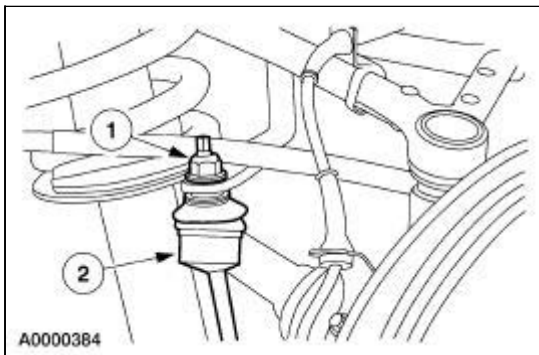


12.  **CAUTION: Do not use air tools to remove the nut. Damage to the boot can occur.**

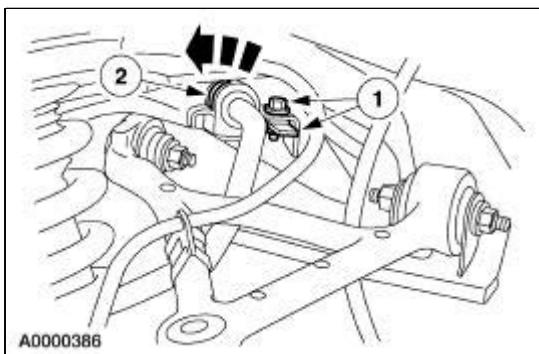
NOTE: To remove the nut, first loosen the nut, then use the hex holding feature to prevent the stabilizer bar link ball joint from turning.

Disconnect the rear stabilizer bar links (5C488) from the rear stabilizer bar (5A772).

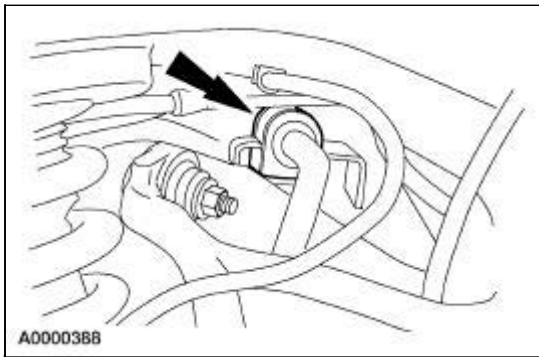
1. Remove and discard the nuts.
2. Disconnect the links from the bar.



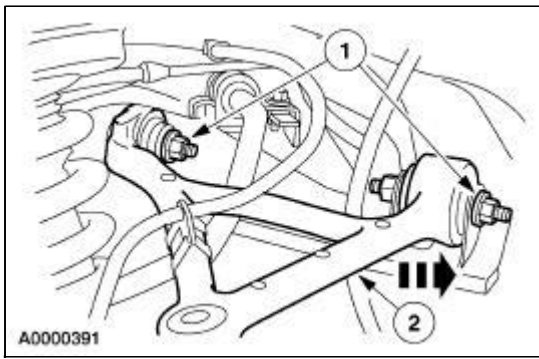
13. Remove the stabilizer bar brackets.
1. Remove the bolts and nuts.
 2. Remove the brackets.



14. Remove the stabilizer bar bushings.

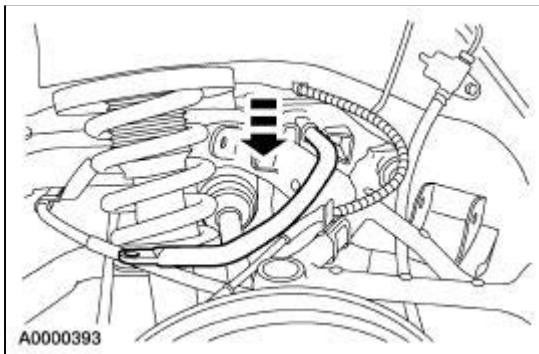


15. Secure the knuckles to the subframe with mechanic's wire.
16. Disconnect the suspension upper arms (5500) from the subframe.
 1. Remove and discard the nuts and bolts.
 2. Disconnect the arms and rotate them out of the way.



17. **NOTE:** The stabilizer bar can be removed from either side.

Remove the stabilizer bar.

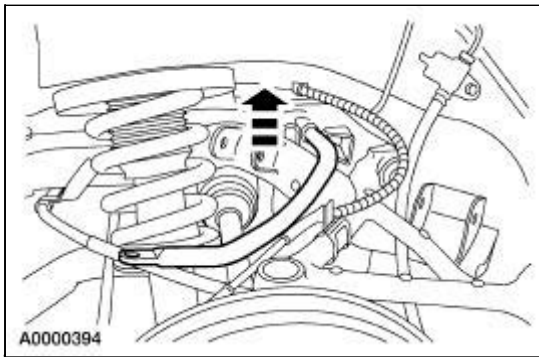


Installation

NOTE: Components on both sides of the vehicle must be installed or connected. Only the right side is shown.

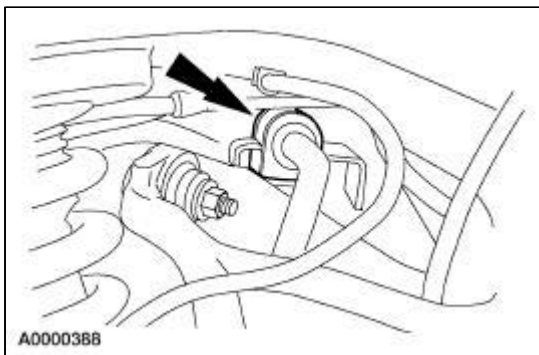
1. **NOTE:** The stabilizer bar can be installed from either side.

Position the stabilizer bar in the vehicle.

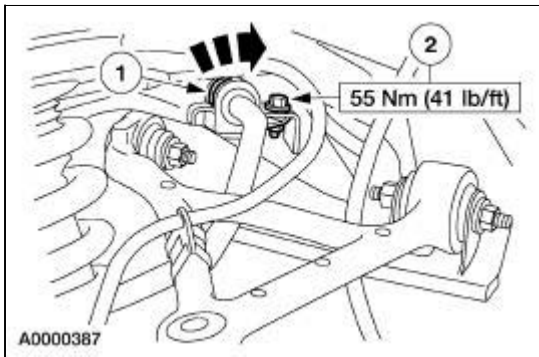


2. **NOTE:** If the stabilizer bar bushings are badly worn or have no grease, install new bushings. Do not grease the bushings.

Install the stabilizer bar bushings.



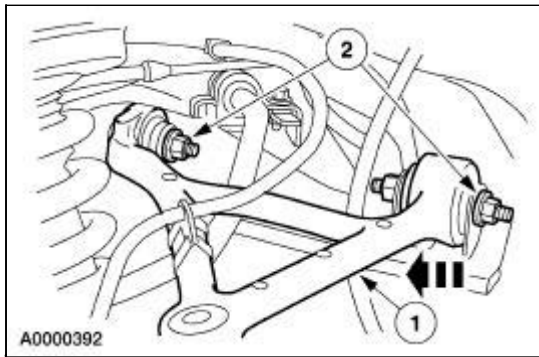
3. Install the stabilizer bar brackets.
 1. Position the brackets on the bushings.
 2. Install the nuts and bolts.



4. **CAUTION:** The suspension upper arm and bushing must be at curb height before the nuts can be tightened. Failure to do so will result in damage to the bushings resulting in poor ride quality and handling.

Connect the suspension upper arm and bushing to the subframe.

1. Position the arm on the subframe.
2. Install new bolts and nuts. Do not tighten the nuts at this time.



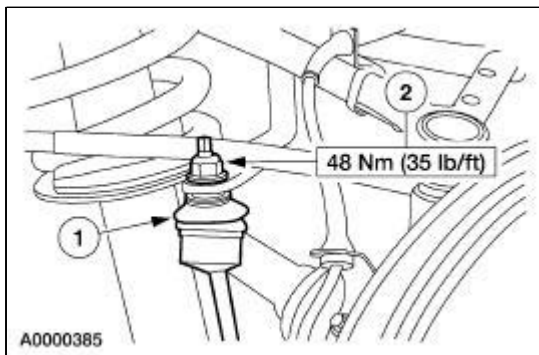
5. Remove the wires holding the knuckles to the subframe.

6.  **CAUTION: Do not use air tools to install the nut. Damage to the boot can occur.**

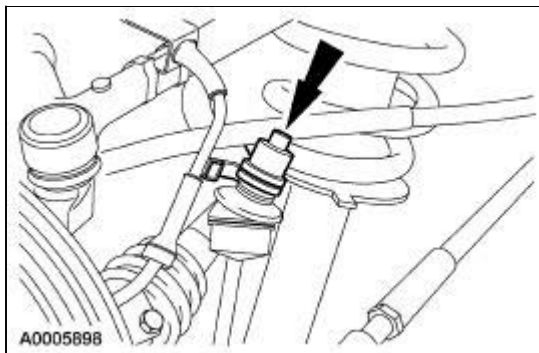
NOTE: To install the nut, first install the nut until snug using the hex holding feature. Final tighten the nut using a socket and a torque wrench.

Connect the stabilizer bar links to the stabilizer bar.

1. Connect the links to the bar.
2. Install new nuts.



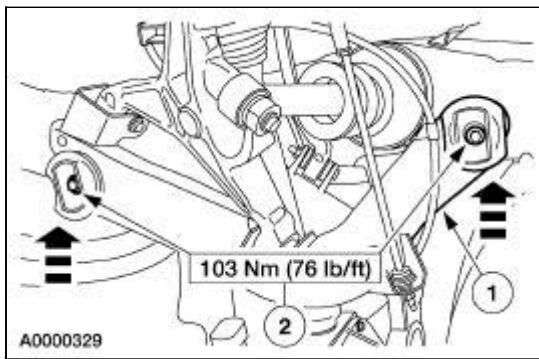
7. Install the protective cap on the stabilizer bar link.



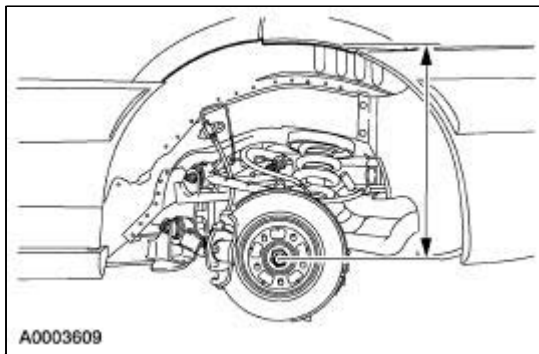
8. Secure the subframe to the body.

1. Raise the subframe using the special tool.
2. **NOTE:** Make sure the bolts are installed in the same position on the subframe bushings as they were before removal.

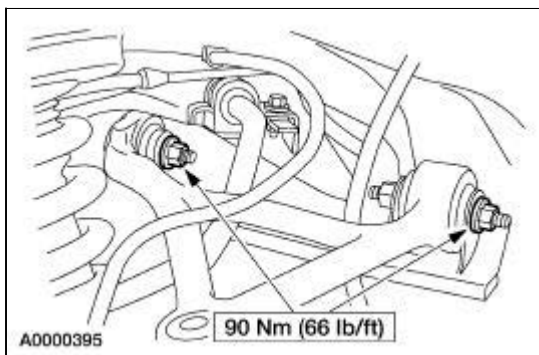
Install the four bolts.



9. Remove the special tool.
10. Position jack stands under the suspension lower arm and bushings and raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken during Removal, Step 1 (curb height).




11. Tighten the suspension upper arm and bushing nuts.



12. Lower the suspension and remove the jack stands.
 13. Connect the driveshaft to the rear axle housing. For additional information, refer to [Section 205-01](#).
 14. Install both wheel and tire assemblies. For additional information, refer to [Section 204-04](#).
 15. Lower the vehicle.
-

Link —Stabilizer Bar

Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

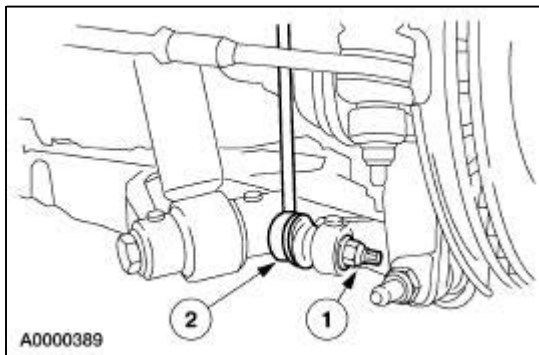
1. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
2. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).

3.  **CAUTION:** Do not use air tools to remove the nut. Damage to the boot can occur.

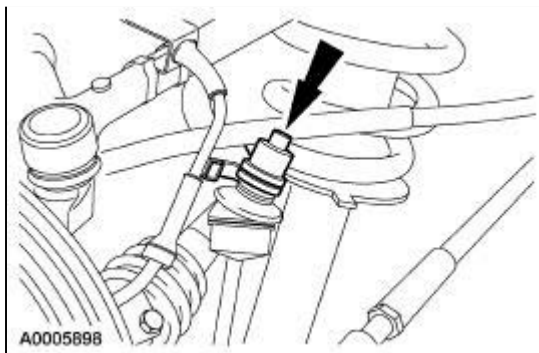
NOTE: To remove the nut, first loosen the nut, then use the hex holding feature to prevent the stabilizer bar link ball joint from turning while removing the nut.

Disconnect the stabilizer bar link (5C488) from the suspension lower arm.

1. Remove and discard the nut.
2. Remove the link from the arm.



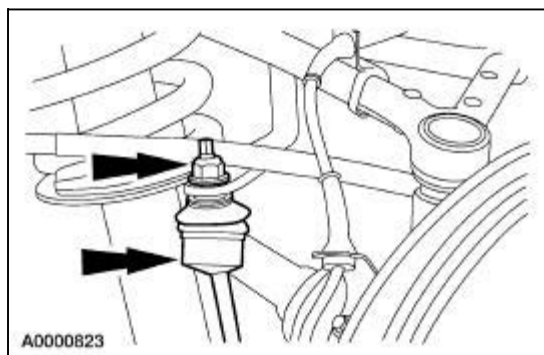
4. Remove the protective cap from the stabilizer bar link.



5.  **CAUTION:** Do not use air tools to remove the nut. Damage to the boot can occur.

NOTE: To remove the nut, first loosen the nut, then use the hex holding feature to prevent the stabilizer link ball joint from turning while removing the nut.

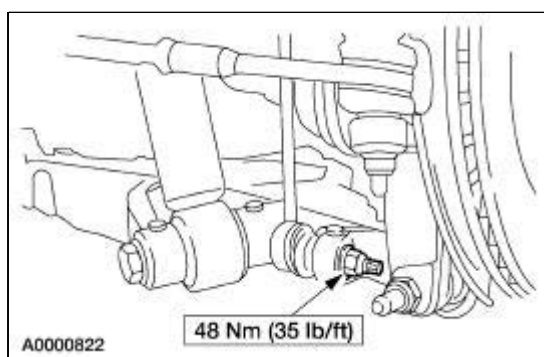
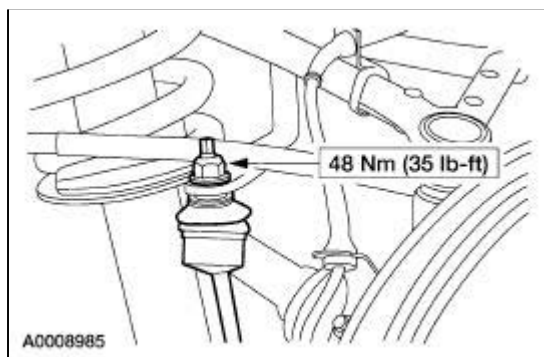
Remove the nut and the stabilizer bar link. Discard the nut.



Installation


1. **NOTE:** The nuts retaining the stabilizer bar link are of a torque prevailing design and new nuts must be used during installation of the stabilizer bar link.

To install, reverse the removal procedure.



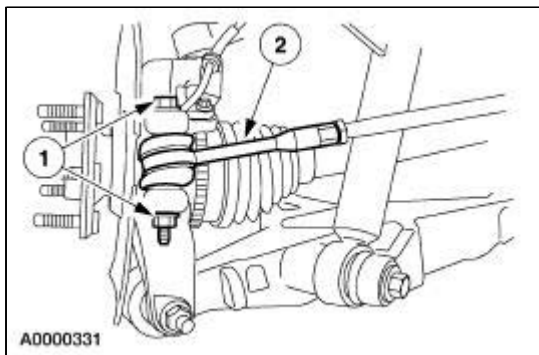
Link —Toe

Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

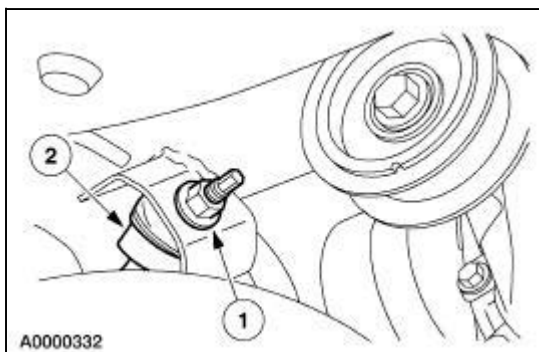
NOTE: The toe links are not serviced separately. If a toe link requires service a new assembly must be installed.

1. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
2. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
3. Disconnect the toe link from the knuckle.
 1. Remove and discard the nut and bolt.
 2. Disconnect the toe link.



4. Remove the toe link from the subframe.
 1. **NOTE:** To remove the nut, first loosen the nut, then use the hex holding feature to prevent the ball joint from turning while removing the nut.

Remove and discard the nut.
 2. Remove the toe link.

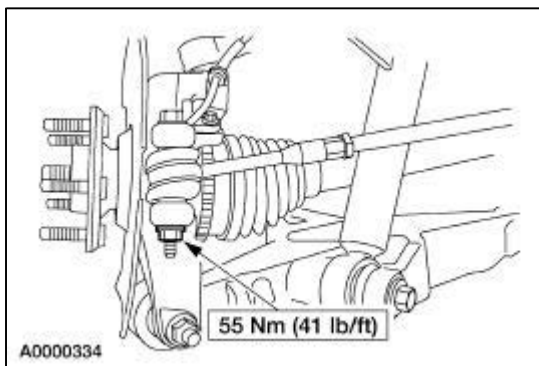
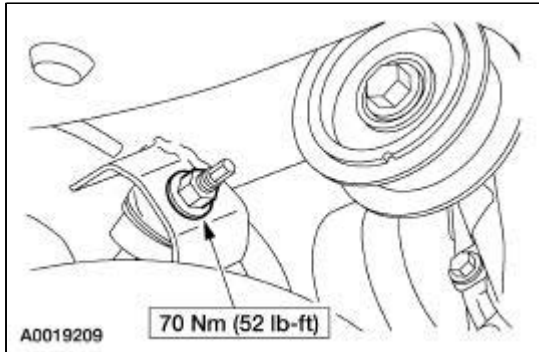


Installation

1. **NOTE:** The bolts and nuts retaining the toe link are of a torque prevailing design and new bolts and nuts must be used during installation of the toe link.

NOTE: To install the toe link-to-subframe nut, first install the nut until snug while using the hex holding feature. Final tighten the nut using a socket and a torque wrench.

To install, reverse the removal procedure.




2. Check wheel alignment. Adjust as necessary. For additional information, refer to [Section 204-00](#).
-


Bushing —Stabilizer Bar

Special Tool(s)

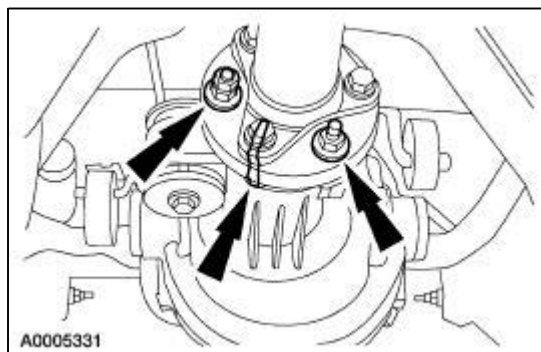


Removal

 **CAUTION:** Suspension fasteners are critical parts because they affect the performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove both wheel and tire assemblies. For additional information, refer to [Section 204-04](#).
2. Remove the muffler and heat shield. For additional information, refer to [Section 309-00](#).
3.  **CAUTION:** The driveshaft-to-pinion flange bolts, nuts and weighted nuts must be installed in the same locations from which they were removed.

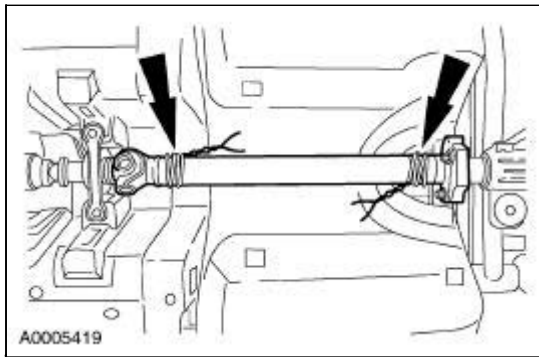
Mark the pinion flange, the driveshaft flexible coupling and each of the three driveshaft-to-pinion flange bolts, nuts and weighted nuts with different color paint so that the driveshaft and differential may be realigned during installation.



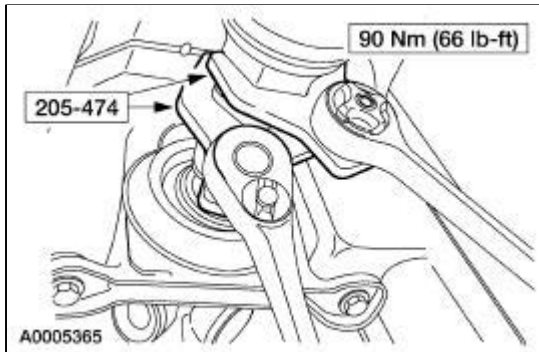
4.  **CAUTION:** Do not remove the flex coupling on the driveshaft flange. Make sure to remove only the driveshaft-to-pinion flange bolts and nuts.

Remove the three driveshaft-to-pinion flange bolts and nuts.

5. Support the driveshaft at the center and rear.



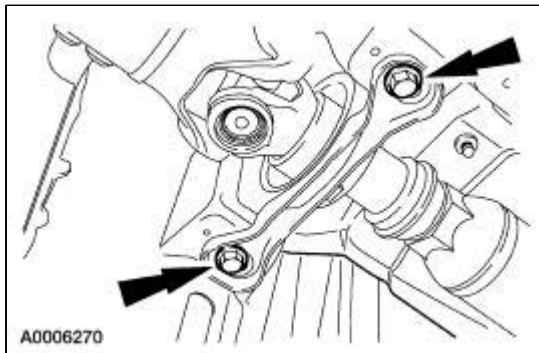
6. Loosen the driveshaft yoke adjuster nut.



7. **NOTE:** There are shims between the center bearing mounting bracket and the body.

NOTE: The shims must be installed in their original locations.

Remove the bolts and the shims.



8. Position the special tool 014-00765, or equivalent, under the rear subframe (5R003).

9. **⚠ WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions can result in personal injury.

⚠ CAUTION: Do not allow the subframe to hang from the shock absorbers. The shock absorbers can be damaged. Always keep the subframe supported on the special tool.

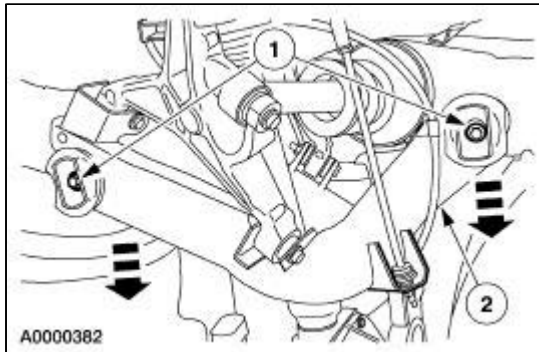
Lower the rear subframe.

1. **NOTE:** Paint or otherwise mark the relative position of the subframe retaining bolts to the subframe bushings for assembly reference.

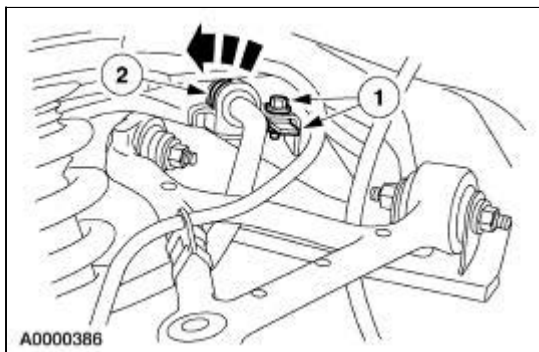
Remove the four subframe bolts.

2.  **CAUTION:** To avoid damaging the fuel tank filler hose, do not lower the subframe more than specified.

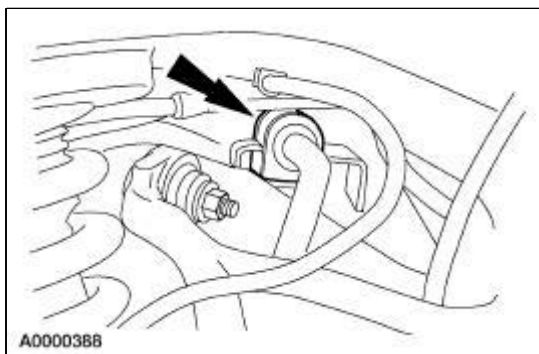
Carefully lower the subframe approximately 56.25 mm (2.25 in) using the special tool 014-00765.



10. Remove the stabilizer bar bracket.
 1. Remove the bolt and nut.
 2. Remove the bracket.



11. Remove the stabilizer bar bushing.

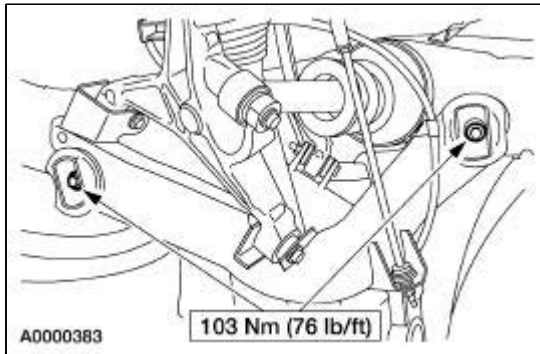
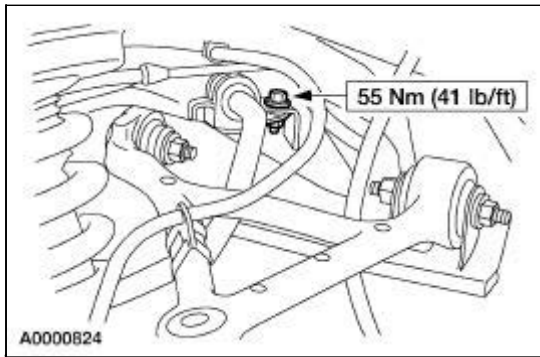


Installation

1. **NOTE:** If the stabilizer bar bushings are badly worn or have no grease, install new bushings. Do not grease the bushings.

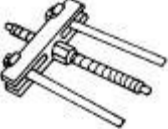

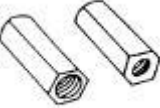
NOTE: Make sure the subframe-to-body bolts are installed in the same position on the subframe bushings as they were before removal.

To install, reverse the removal procedure.




Knuckle


Special Tool(s)

 ST1516-A	Hub Remover/Replacer 204-069 (T81P-1104-C)
 ST1517-A	Metric Hub Remover Adapter 205-237 (T86P-1104-A1)
 ST1518-A	Metric Hub Remover Adapters 204-085 (T83P-1104-BH)

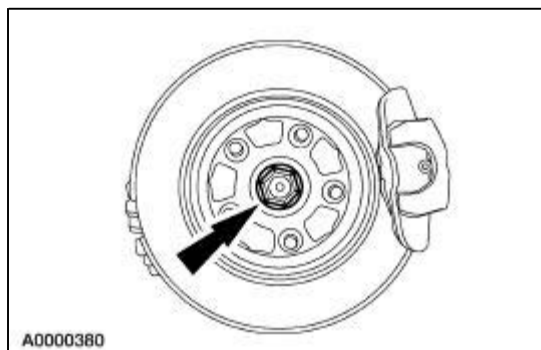
Removal

 **CAUTION:** Suspension fasteners are important parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

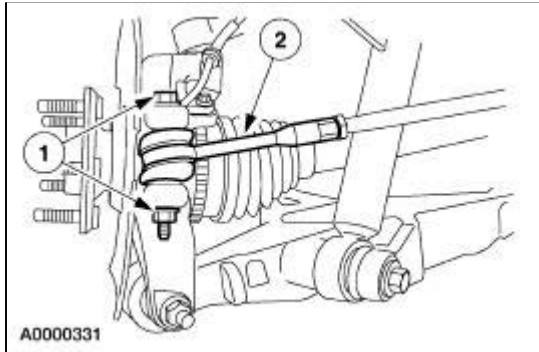
1. Remove the rear brake disc. For additional information, refer to [Section 206-04](#).

2.  **CAUTION:** The wheel hub retainer (4B477) is a one time use item and a new retainer must be installed when removed. Failure to do so can cause the retainer to come loose during vehicle operation resulting in loss of vehicle control.

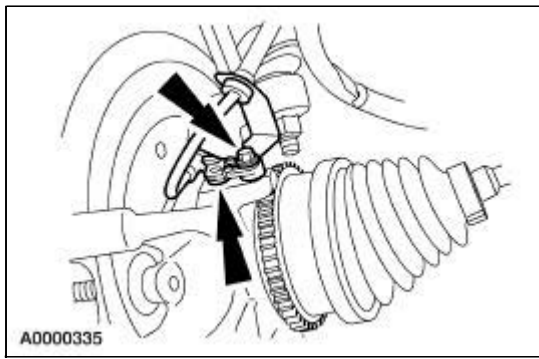
Remove and discard the wheel hub retainer.



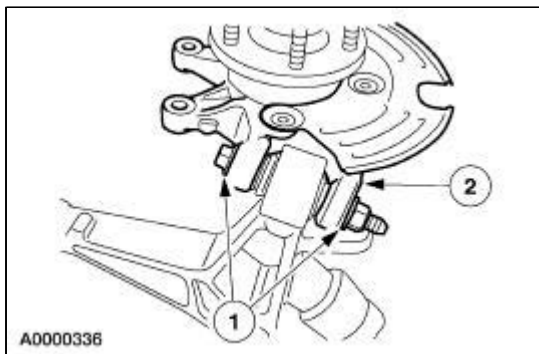
3. Disconnect the toe link from the knuckle.
 1. Remove and discard the nut and bolt.
 2. Disconnect the toe link.




4. Remove the bolt and disconnect the ABS sensor.

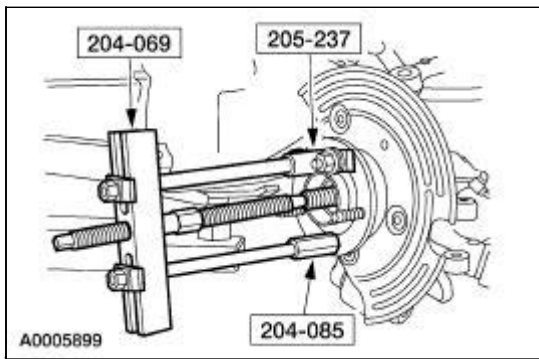


5. Disconnect the suspension lower arm from the knuckle.
 1. Remove the nut and bolt. Discard the nut.
 2. Disconnect the suspension lower arm and bushing.



6.  **CAUTION: Support the axle shaft after removing it from the hub (1109). Failure to do so can damage the axle shaft.**

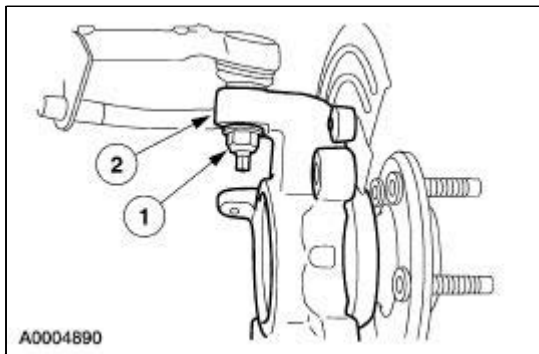
Using the special tools, separate the axle shaft from the hub. Support the axle shaft.



7. Remove the knuckle.
 1. **NOTE:** To remove the nut, first loosen the nut, then use the hex holding feature to remove the nut while holding the ball joint.

Remove and discard the suspension upper arm ball joint nut.

2. Remove the knuckle.



8. Remove the hub. For additional information, refer to [Hub](#) in this section.

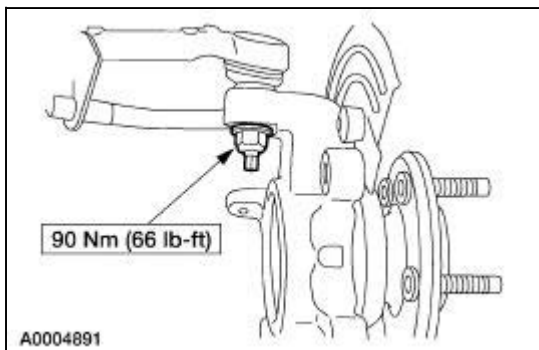
Installation



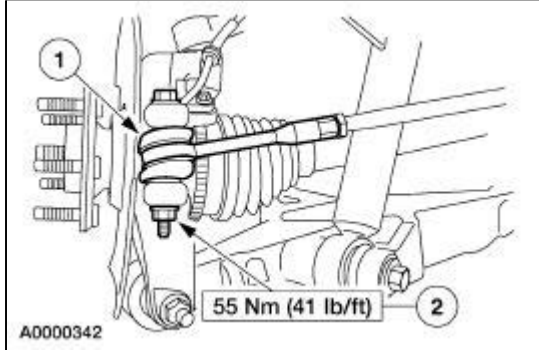
CAUTION: Do not tighten the suspension lower arm fasteners until the suspension is at curb height. Failure to do so can cause severe damage to the bushings resulting in poor ride quality and handling.

1. Install the hub. For additional information, refer to [Hub](#) in this section.
2. **NOTE:** To install the nut, first install the nut until snug using the hex holding feature. Final tighten the nut using a torque wrench and a socket.

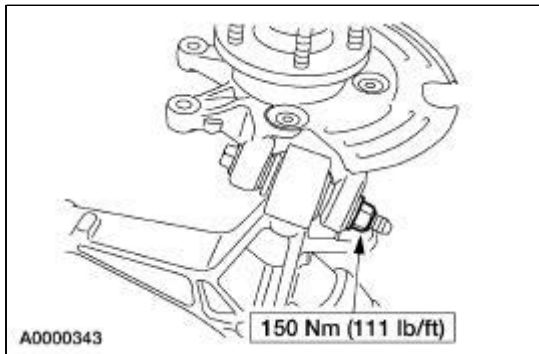
Position the knuckle on the suspension upper arm ball joint stud and install a new nut.



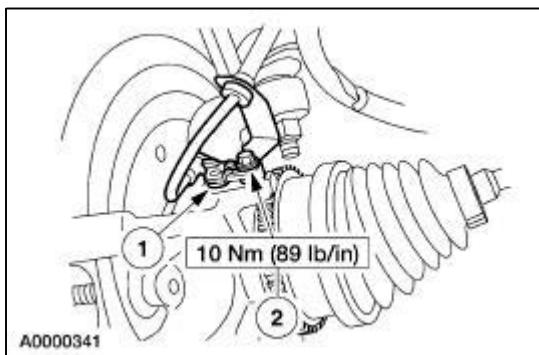
3. Install the toe link.
 1. Position the toe link onto the knuckle.
 2. Install a new bolt and nut.



4. Install the axle shaft into the hub. Make sure the splines on the shaft line up with the splines in the hub.
5. Position the knuckle onto the suspension lower arm and install a new bolt and nut. Tighten the nut.

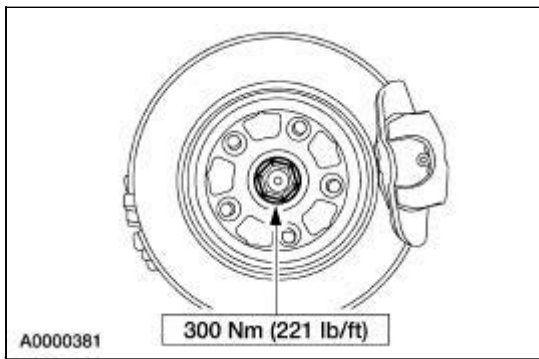


6. Install the ABS sensor.
 1. Install the sensor.
 2. Install the bolt.



7. Install the rear brake disc. For additional information, refer to [Section 206-04](#).
8. **NOTE:** Lower the vehicle and apply the parking or service brakes before tightening the wheel hub retainer.


Install a new wheel hub retainer.




9. Install the wheel and tire. For additional information, refer to [Section 204-04](#).
-

Shock Absorber and Spring Assembly

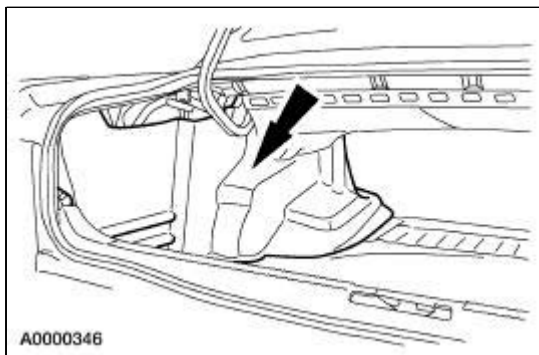
Removal

 **WARNING:** All vehicles are equipped with gas-pressurized rear shock absorbers which will extend unassisted. Do not apply heat or flame to the shock absorbers during removal or component service. Failure to do so may cause personal injury.

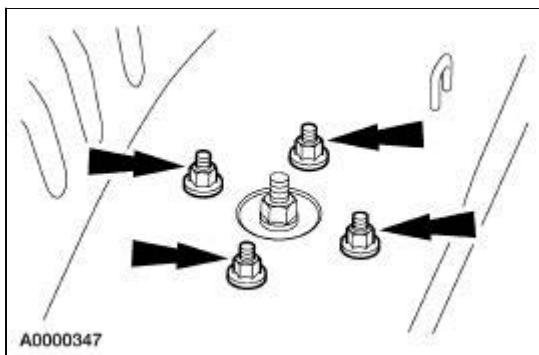
 **CAUTION:** Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: Shock absorber and spring removal is the same for both sides. The left side is shown.

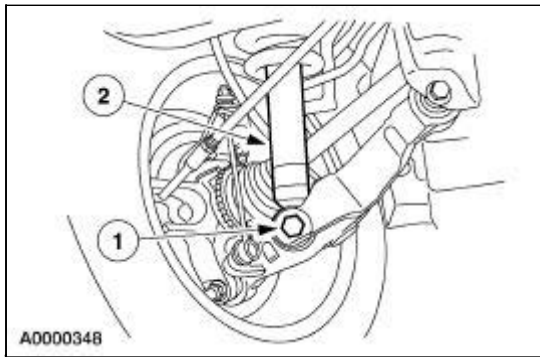
1. Open the luggage compartment lid.
2. Position the trim cover aside.



3. Remove and discard the nuts.



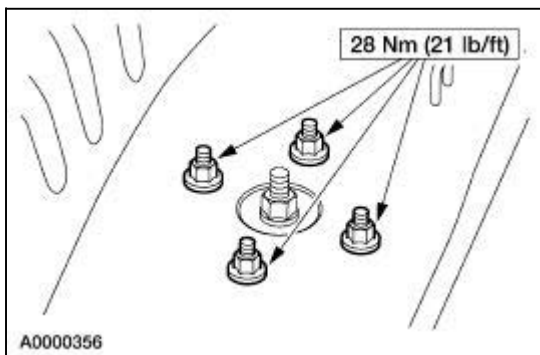
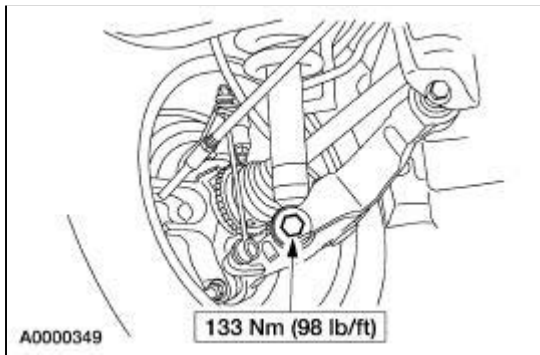
4. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
5. Remove the shock absorber and spring assembly.
 1. Remove and discard the bolt.
 2. Remove the shock absorber and spring assembly.



Installation


1. **NOTE:** The fasteners retaining the shock absorber and spring assembly are of a torque prevailing design. New fasteners must be used.


To install, reverse the removal procedure.




Shock Absorber and Spring Assembly

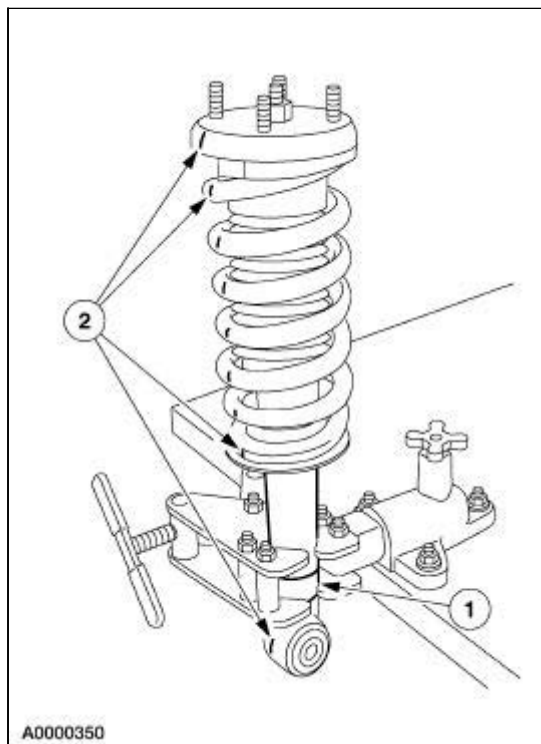
Disassembly

 **WARNING:** All vehicles are equipped with gas pressurized shock absorbers which will extend unassisted. Do not apply heat or flame to the shock absorbers during removal or component servicing. Failure to follow these instructions may result in personal injury.

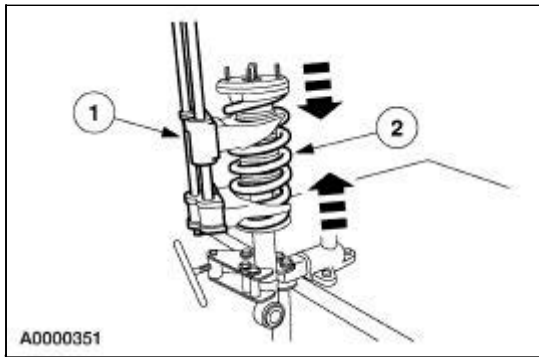
 **WARNING:** The shock absorber and spring assembly is under extreme load. Do not attempt to disassemble the shock absorber and spring assembly without using a spring compressor. Failure to follow these instructions may result in personal injury.

 **CAUTION:** Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation is necessary. Do not use a new part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

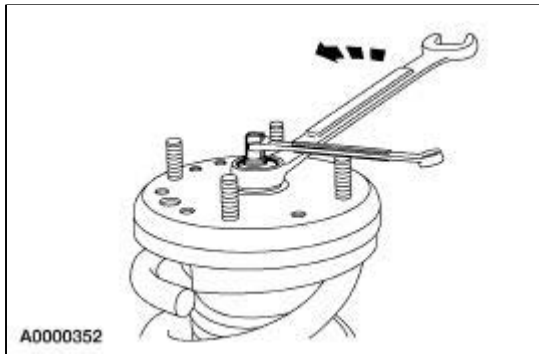
1. Remove the shock absorber and spring assembly. For additional information, refer to [Shock Absorber and Spring Assembly](#) in this section.
2. Mount and mark the shock absorber and spring assembly.
 1. Position the shock absorber and spring assembly in an appropriate vise.
 2. Mark the upper mount, spring and shock absorber for assembly reference.



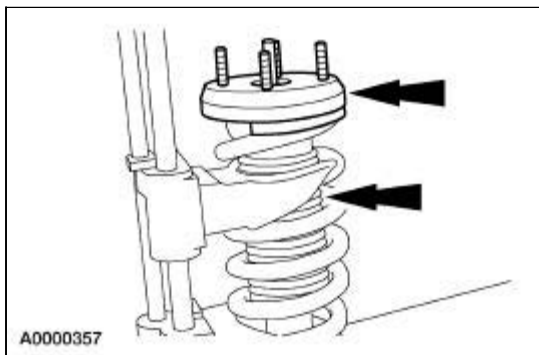
3. Compress the spring.
 1. Install an appropriate spring compressor.
 2. Compress the spring.



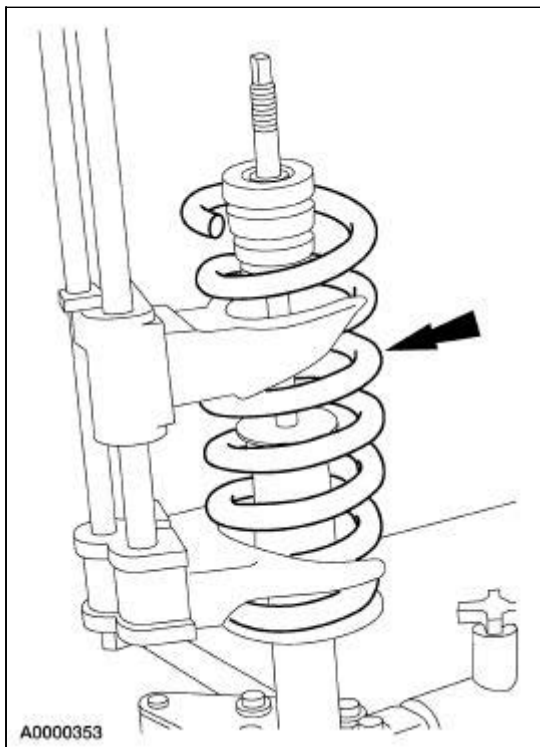
4. While holding the shock absorber rod, remove the nut.



5. Remove the upper mount and dust boot as an assembly.



6. Carefully remove the spring and the spring compressor.



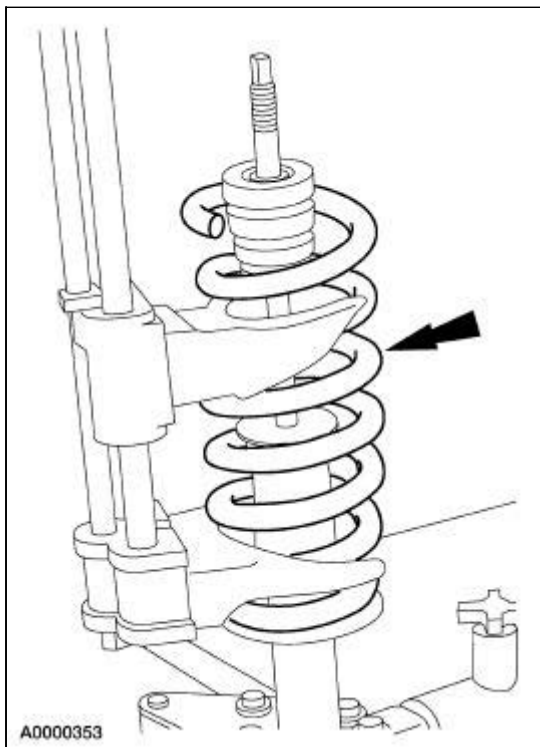
Assembly

NOTE: If a new shock absorber, spring or upper mount is installed, the new part should be marked in the same place the old part is marked to make sure the assembly is correctly aligned.

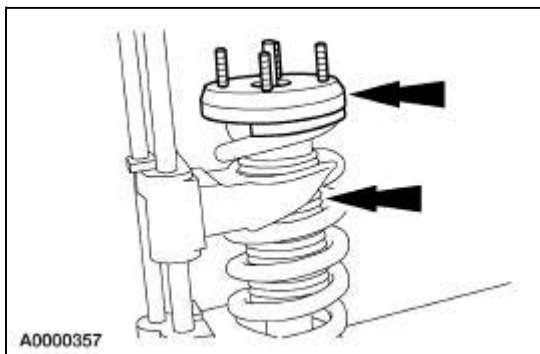
1. Inspect the lower and upper spring seats for damage.
2. Inspect the spring insulator for wear or damage. Install a new insulator if necessary.
3. **NOTE:** Install a new spring with the correct part number only. Refer to the vehicle certification (VC) label for the correct spring code. Refer to [Section 100-01](#) to convert the spring code to a part number.

Inspect the spring for nicked or scratched paint. If the paint is nicked or scratched, install a new spring.

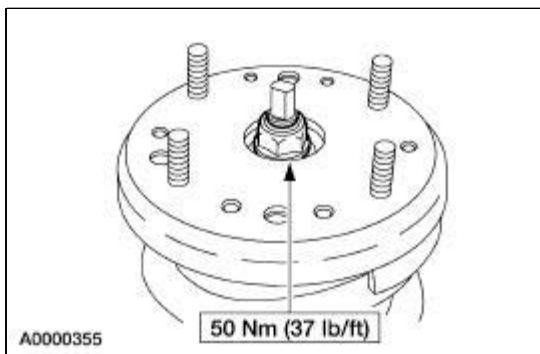
4. Install the spring and the spring compressor on the shock absorber.



5. Position the upper mount and dust boot on the spring. Make sure the marks made during disassembly, Step 2, are aligned.



6. Install a new nut.



7. Remove the spring compressor.
8. Remove the shock absorber and spring assembly from the vise.
9. Install the shock absorber and spring assembly. For additional information, refer to [Shock](#)

Absorber and Spring Assembly in this section.

General Specifications

Item	Specification
Wheel stud and wheel nuts (metric)	M12x1.5-19 mm hex
Maximum tire balance weight	140 g (5.0 oz) per wheel 70 g (2.5 oz) per flange
Wheel bolt circle runout	0.65 mm (0.02 in)
Tire Inflation	
Tires	See safety certification sticker located on driver door jamb or tire inflation placard on the passenger door jamb.
Tire Tread Depth	
P215/60R16 94H	8.6 mm (0.34 in)
P215/60R16 94V	8.4 mm (0.33 in)
215/60R16 95W	8.1 mm (0.32 in)
235/50R17 95V	8.4 mm (0.33 in)
245/45R17 95W	7.6 mm (0.30 in)
Wheels	
Painted aluminum	16x7J
Bright machined aluminum	16x7J
Bright polished aluminum	16x7J
Painted aluminum	17x7.5J
Wheel offset	60 mm (2.4 in)
Wheel bolt circle runout	0.65 mm (0.02 in)
Cleaners — Wheel	
Metal Surface Cleaner F4AZ-19A536-RA	WSE-M5B392-A
Custom Bright Metal Cleaner 8A-19522-A	ESR-M5B194-B
Repair Compound	
Aluminum Wheel Repair Compound	ESA-M4G280-A

Wheel Rim Runout

Max. radial runout	Max. lateral runout
0.64 mm (0.02 in)	0.89 mm (0.03 in)

Tire Runout Specifications

Max. radial runout	Max. lateral runout
1 mm (0.04 in)	2 mm (0.08 in)


Torque Specifications


Description	Nm	lb-ft
Wheel nuts	135	100

Wheels and Tires

Part # - 1007-	Color/Style	Wheel Size	No. of Bolts	Bolt Circle Diameter	Offset	Tire Usage
-	Steel or aluminum mini-spare	16 X 4	5	107.95 mm (4.31 in)	40	T145/80R16 105
-	Silver sparkle, forged aluminum/9 spoke	16 X 7	5	107.95 mm (4.31 in)	60	P215/60R16 94H or 215/60R16 95W
-	Bright machined, forged aluminum/5 spoke	16 X 7	5	107.95 mm (4.31 in)	60	P215/60R16 V rated or 215/60R16 95W
-	Bright polished forged aluminum/5 spoke	16 X 7	5	107.95 mm (4.31 in)	60	P215/60R16 94H or P215/60R16 94V or 215/60R16 95W
-	Silver gray cast aluminum/5 spoke	17 X 7.5	5	107.95 mm (4.31 in)	60	P235/50R17 95V or 245/45R17 95W


Safety Precautions


 **WARNING:** Never run the engine with one wheel off the ground, for example, when changing a tire. The wheel(s) resting on the ground can cause the vehicle to move.

 **WARNING:** The tire and wheel must always be correctly matched. It is very important to determine the size of each component before any assembly operations commence. Failure to adhere to these instructions can result in an explosive separation and cause serious bodily injury or death.


 **WARNING:** Aftermarket aerosol tire sealants are extremely flammable. Always question the customer to make sure these products have not been used.

 **WARNING:** Aftermarket wheel assemblies may not be compatible with the vehicle. Use of incompatible wheel assemblies can result in equipment failure and possible injury. Use only approved wheel assemblies.

 **WARNING:** Use only wheels and wheel nuts that have been designed for current model year Ford vehicles. Aftermarket wheels or wheel nuts may not fit or function correctly, and can cause personal injury or damage the vehicle.

 **WARNING:** Always wear safety goggles or a face shield when performing any work with tire and wheel assemblies.

 **CAUTION:** Do not clean aluminum wheels with steel wool, abrasive-type cleaners or strong detergents. Use Custom Bright Metal Cleaner 8A-19522-A or equivalent meeting Ford specification ESR-M5B194-B.

 **CAUTION:** Reduce the air pressure as much as possible by pushing the valve core plunger in prior to removing the valve core. Avoid working in a position in which the face or body is directly over a tire in which there is pressure.

When carrying out any inspection or repair procedures on wheels (1007) and tires, follow the preceding safety precautions.

Wheels and Tires



WARNING: Do not mix different types of tires, such as radial, bias, or bias-belted, on the same vehicle except in emergencies (temporary spare usage). Vehicle handling can be seriously affected and can result in loss of control.


If the vehicle is equipped with uni-directional tires, mount the tires on the vehicle only in accordance with the manufacturer's instructions for direction of rotation printed on the side wall.

Original equipment uni-directional full-size spare tires can be operated with rotation counter to the directional arrow on the tire sidewall, but will perform best when rotating with the directional arrow on the sidewall.


Factory-installed tires and wheels are designed to operate satisfactorily with loads up to and including full-rated load capacity when inflated to recommended inflation pressures.


Wheels and Tires

Special Tool(s)

 A technical drawing of a radial runout gauge, labeled ST1238-A. It consists of a vertical rod with a horizontal arm at the top and a base at the bottom. The horizontal arm has a circular dial or sensor at its end. The base has a small wheel or contact point.	Radial Runout Gauge 418-F123 (007-0056A) or Equivalent
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Inspection and Verification

 **WARNING:** Never run the engine with one wheel off the ground, for example, when changing a tire. The wheel(s) resting on the ground can cause the vehicle to move.

 **WARNING:** Do not balance the wheels and tires while they are mounted on the vehicle. Possible tire disintegration or differential failure can result, causing personal injury and extensive component damage. Use off-vehicle wheel and tire balancer only.

Be sure to follow the warnings when performing inspection and verification.

Road Test

Verify the customer concern by performing a road test on a smooth road. If any vibrations are apparent, go to [Section 100-04](#).

To maximize tire performance, inspect for signs of incorrect inflation and uneven wear, which can indicate a need for balancing, rotation, or front suspension alignment.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increases tire wear.

New tires must follow the recommended:

- tire sizes.
- speed rating.
- load range.
- tire construction type.

Use of any other tire size or type can seriously affect:

- ride.
- handling.

- speedometer/odometer calibration.
- vehicle ground clearance.
- tire clearance between the body and chassis.
- wheel bearing life.
- brake cooling.

New wheels need to be installed when:

- bent.
- cracked.
- dented.
- heavily corroded.
- leaking.
- they have elongated wheel hub bolt holes.
- they have excessive lateral or radial runout.

Wheel and tire assemblies are attached by five wheel nuts.

It is mandatory to use only the tire sizes recommended on the tire chart attached to the vehicle. Larger or smaller tires can damage the vehicle, affect durability, and require changing the speedometer calibration. Make sure wheel size and offsets match those recommended for the tire in use.

1. Inspect for signs of uneven wear that can indicate a need for balancing, rotation, front suspension alignment, damaged tie-rod, or steering components.
2. Check tires for:
 - cuts.
 - stone bruises.
 - abrasions
 - blisters.
 - embedded objects.
3. Tread wear indicators are molded into the bottom of the tread grooves. Install a new tire when the indicator bands become visible.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Tires Show Excess Wear on Edge of Tread 	<ul style="list-style-type: none"> ● Underinflated tires. ● Vehicle overloaded. ● High-speed cornering. 	<ul style="list-style-type: none"> ● ADJUST air pressure in tires. ● RETURN vehicle — NOTIFY customer of overload condition. ● RETURN vehicle — NOTIFY customer of

	<ul style="list-style-type: none"> ● Incorrect wheel alignment. ● Incorrect tire rotation intervals. 	<p>cause of condition.</p> <ul style="list-style-type: none"> ● SET toe to specification. REFER to <u>Section 204-00</u> . ● ADVISE customer of condition. ROTATE tires.
<ul style="list-style-type: none"> ● Tires Show Excess Wear in Center of Tread 	<ul style="list-style-type: none"> ● Tires overinflated. 	<ul style="list-style-type: none"> ● ADJUST air pressure.
<ul style="list-style-type: none"> ● Other Excessive Tire Wear Problems 	<ul style="list-style-type: none"> ● Incorrect tire pressure. ● Loose or leaking shock absorbers. ● Front end out of alignment. ● Front wheel bearings out of adjustment. ● Loose, worn or damaged suspension components. ● Wheel and tire assembly out of balance. ● Excessive lateral or radial runout of wheel or tire. ● Incorrect tire rotation intervals. 	<ul style="list-style-type: none"> ● ADJUST pressure. ● TIGHTEN or INSTALL new shock absorbers as necessary. ● ALIGN front end. REFER to <u>Section 204-00</u> . ● REFER to <u>Section 204-00</u> for inspection procedure. ● REFER to <u>Section 204-00</u> . ● BALANCE wheel and tire assembly. ● REFER to Component Tests in this section. ● ADVISE customer of condition. ROTATE tires.
<ul style="list-style-type: none"> ● Wobble or Shimmy 	<ul style="list-style-type: none"> ● Damaged wheel bearings. ● Loose or damaged suspension components. ● Bent wheel. ● Damaged tire. ● Loose wheel nuts. 	<ul style="list-style-type: none"> ● REFER to <u>Section 204-00</u> . ● REFER to <u>Section 204-00</u> . ● INSTALL a new wheel as necessary. ● INSTALL a new tire as necessary. ● TIGHTEN to specification.
<ul style="list-style-type: none"> ● High-Speed Shake 	<ul style="list-style-type: none"> ● Wheel hub face/pilot/bolt circle runout. ● Tires/wheels. ● Wheel bearings. ● Suspension/steering linkage. ● Engine. ● Transmission. ● Brake discs/imbalance. 	<ul style="list-style-type: none"> ● REFER to <u>Section 100-04</u> .
<ul style="list-style-type: none"> ● Vehicle Vibration 	<ul style="list-style-type: none"> ● Driveline — engine. ● Tires. 	<ul style="list-style-type: none"> ● REFER to <u>Section 100-04</u> .

Component Tests

Tire and Wheel Runout

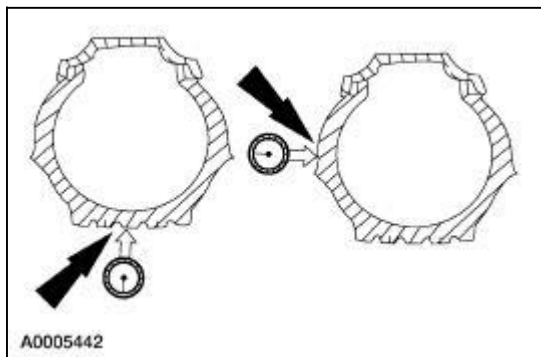
Excessive radial and lateral runout of a wheel and tire assembly can cause roughness, vibration, wheel tramp, tire wear, and steering wheel tremor.

Before checking runout, and to avoid false readings caused by temporary flat spots in the tires, check runout only after the vehicle has been driven far enough to warm the tires.

The extent of the runout is measured with the radial runout gauge. All measurements are made on the vehicle with the tires inflated to recommended inflation pressures and with the front wheel bearings adjusted to specifications.

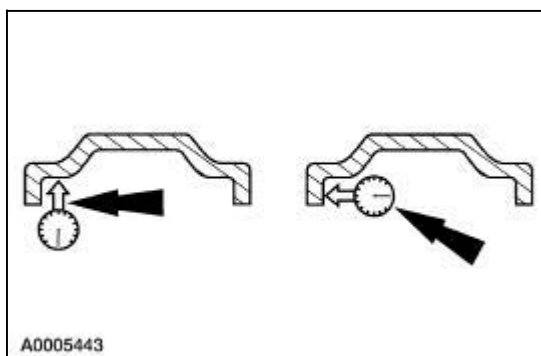
Tire Runout

Measure radial and lateral tire runout at the positions shown in the illustration. Runout should not exceed specifications.



Wheel Runout

Measure radial and lateral wheel runout at the positions shown in the illustration. Runout should not exceed specifications. Note that the tire has been removed.



Wheel Leaks




WARNING: Wheel repairs that use welding or peening are not approved. An inner tube is not an acceptable repair for leaking wheels (1007) or tires.

If the air pressure in a tire mounted on an aluminum wheel is found to be low, carry out the following procedure before considering installation of a new wheel.

1. Remove the wheel and tire assembly and inspect the wheel for structural damage. If none exists, go to Step 2. If the wheel is damaged, install a new wheel.
2. With the tire mounted on the wheel, locate the air leak using a water bath or equivalent method, and mark the location. Check the complete wheel for possible additional leaks. When the leaks are marked, dismount the tire, marking valve location on the tire for correct indexing.
3. On the tire side of the wheel, thoroughly clean the leaking area with an appropriate cleaner (Metal Surface Cleaner F4AZ-19A536-RA or equivalent meeting Ford specification WSE-M5B392-A) or use sandpaper of approximately 80-grit to remove all contamination. Using the sandpaper, score the surface of the leaking area to improve adhesion of the sealer. If the valve stem is close to the area, remove it.
4. Use a clean cloth to remove all cleaner and sanding dust.
5. **NOTE:** Do not use a torch containing oxyacetylene.

Heat the prepared area with a Heat Gun or a propane torch. Apply Aluminum Wheel Repair Compound meeting Ford specification ESA-M4G280-A or equivalent over the prepared area using a liberal flow and wiping action. Repair is most effective when heat is applied to the brake side of the rim, and the sealer is melted by heat in the metal.

6. Apply only enough heat to melt the sealer, then remove the heat source. After repairing the leak, allow the wheel to cool until it can be handled safely.
7.  **CAUTION:** Use caution when mounting the tire so as not to damage the sealer.

Index and assemble the wheel and tire. Inflate the tire to the recommended pressure as indicated on the tire pressure decal.

8. Repeat Step 2 to verify repair.
 9. When the repair is completed, balance the assembly and install it on the vehicle.
-

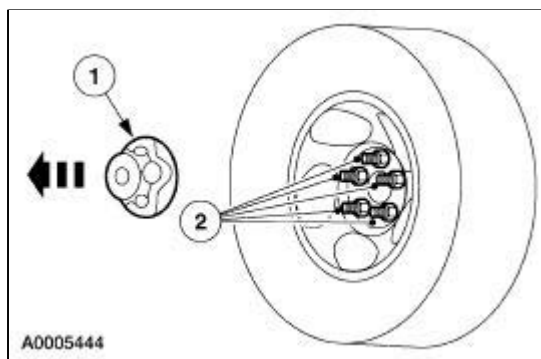
Wheel and Tire

Removal

1.  **CAUTION: Do not use heat to loosen a seized wheel nut (1012). Heat can damage the wheel and wheel bearings.**


Loosen the wheel nuts.

1. Remove the hub cap.
2. With the weight of the vehicle on the tires, loosen the wheel nuts.



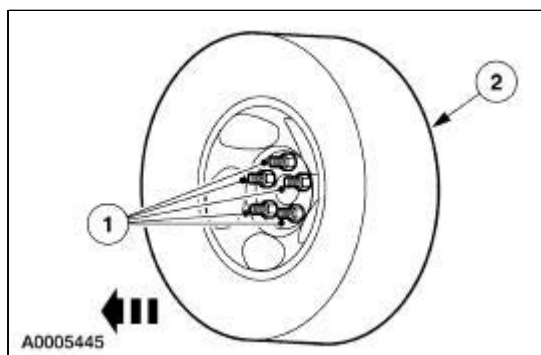
2.  **CAUTION: Never use the differential housing as a lifting point.**

Raise and support the vehicle. For additional information, refer to [Section 100-02](#).


3.  **CAUTION: Do not use heat to loosen a seized wheel because heat can damage the wheel and the wheel bearings. If the wheel cannot be removed by hand, use a wheel puller to remove the seized wheel.**

Remove the wheel and tire assembly.

1. Remove the wheel nuts.
2. Remove the wheel and tire assembly, using a side-to-side rocking motion.



Installation

1.  **WARNING: When a wheel is installed, always remove any corrosion, dirt or foreign material present on the mounting surfaces of the wheel and the surface of the wheel hub,**

brake drum or brake disc that contacts the wheel. Installing wheels without correct metal-to-metal contact at the wheel mounting surfaces can cause the wheel nuts to loosen and the wheel to come off while the vehicle is in motion, causing loss of control.

NOTE: If there is significant corrosion of the nut or stud threads, lubricate the threads with a drop of oil prior to installation.

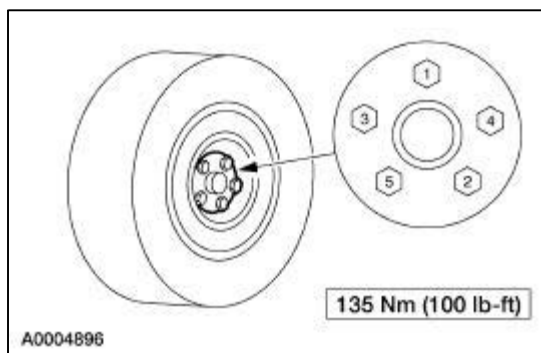
NOTE: When the wheel nuts are used to attach the mini-spare, and are correctly installed, the cone seat of the nut body will be in contact with the cone seat of the wheel. The washer on the nut will not be in contact with the wheel and will spin freely.

Clean the wheel and the wheel hub mounting surface.

2. Install the wheel and tire assembly.
 1. Position the wheel and tire assembly.
 2. Install the wheel nuts hand-tight, then lower the vehicle.

3.  **CAUTION: Failure to tighten the wheel nuts in a star pattern can result in high brake disc runout, which will speed up the development of brake roughness, shudder and vibration.**

Tighten the wheel nuts to specification in a star-pattern sequence.



General Specifications

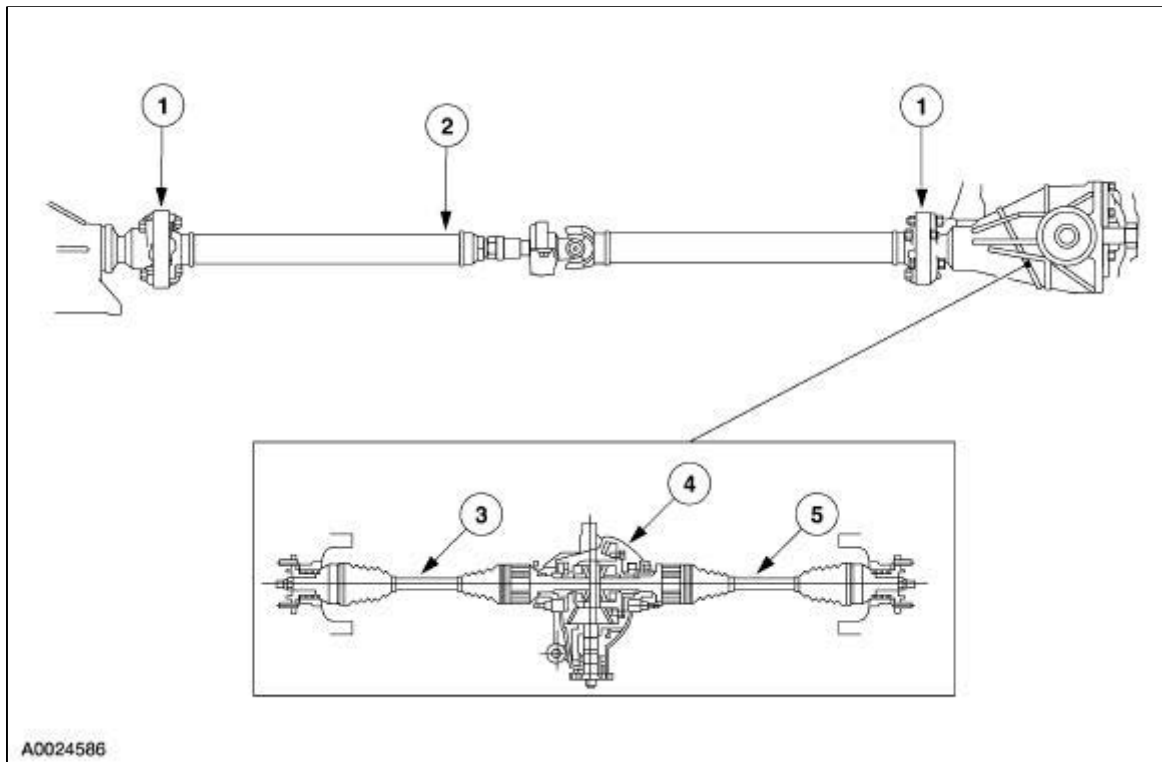
Item	Specification
SAE 75W-140 Synthetic Rear Axle Lubricant F1TZ-19580-B (in Canada CXY-75W140-16)	WSL-M2C192-A
Driveshaft Slip-Yoke	
Premium Long-Life Grease XG-1-C	ESA-M1C75-B
Capacities	
Rear axle	1.4L (3.0 pts)
Sealant	
Threadlock and Sealer E0AZ-19554-AA (in Canada CXC-76)	WSK-M2G351-A5
Stud and Bearing Mount E0AZ-19554-BA (in Canada CXC-70)	WSK-M2G349-A1

Driveshaft Angle Specifications

Transmission to Front Driveshaft	Front Driveshaft to Rear Driveshaft	Rear Driveshaft to Rear Axle Drive Pinion
(+1.0 degree) to (-0.0 degree)	(-0.4 degree) to (-1.4 degree)	(+1.0 degree) to (-0.0 degree)

Driveline System

Driveline Component Locations



A0024586

Item	Part Number	Description
1	4684	Flex coupling
2	4602	Driveshaft assembly
3	3B436	Halfshaft (RH)
4	4010	Rear axle housing
5	3B437	Halfshaft (LH)

The driveline transfers engine torque to the drive wheels. Power is transmitted through the transmission to the driveshaft (4602) and then to the axle which is connected to the halfshafts.

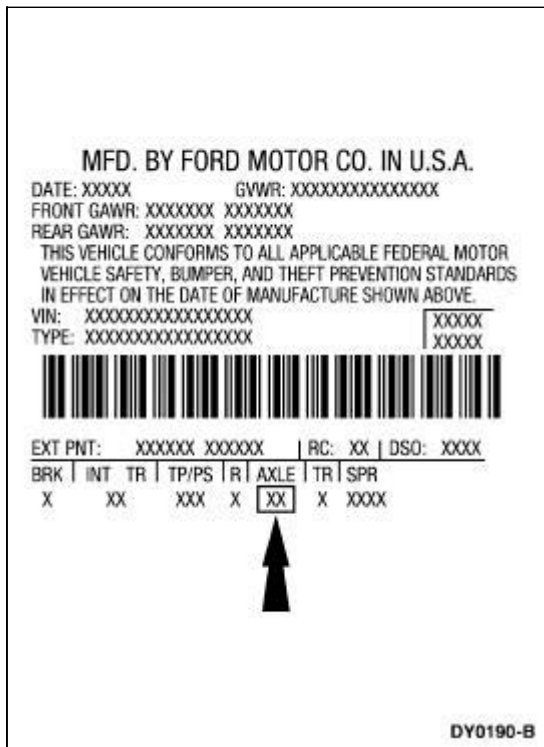
For additional information on the halfshaft, refer to [Section 205-05](#).

For additional information on the driveshaft, refer to [Section 205-01](#).

For additional information on the rear axle, refer to [Section 205-02](#).

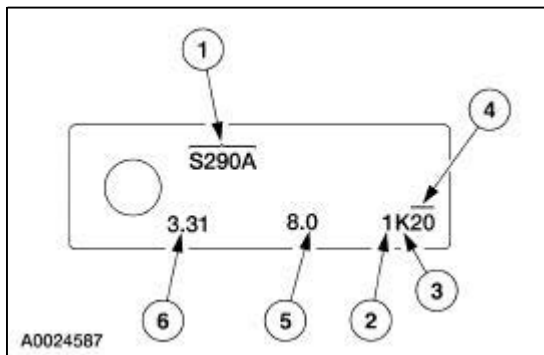
The engine angle is built into the engine mounts. If the engine angle is out of specification, the engine mounts must be inspected for damage. For additional information, refer to [Section 303-00](#).

Vehicle Certification (VC) Label Example



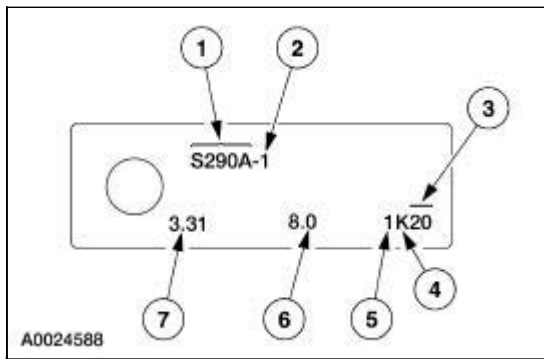
The vehicle certification (VC) label is located in the driver door jamb. The axle code is on the VC label. For additional information on the VC label, refer to [Section 100-01](#).

Axle Identification Tag



Item	Description
1	Plant code
2	Build year
3	Build month
4	Build day
5	Ring gear diameter (inch)
6	Axle ratio

Axle Identification Tag Denoting Interchangeability Affected Internally



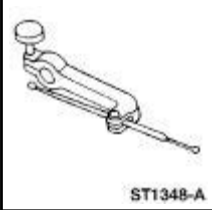

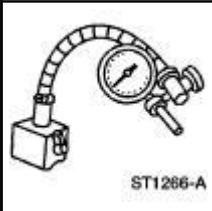
Item	Description
1	Plant code
2	Denotes interchangeability affected internally
3	Build day
4	Build month
5	Build year
6	Ring gear diameter (inch)
7	Axle ratio

⚠ CAUTION: The axle identification tag is the official identifier. Do not damage the tag. Always reinstall the tag after removing it for axle inspection/repair.

The plant code denotes a particular axle design and specific ratio. In addition, the plant code will not change as long as that particular axle assembly never undergoes an external design modification. If, however, an internal design modification takes place during the production life of the axle and that internal modification affects parts interchangeability, a dash and numerical suffix is added to the plant code. This means that, as an assembly, both axles are interchangeable; however, internally they are different. Therefore, each requires different internal parts at the time of repair.

Driveline System

Special Tool(s)

 <p>ST1348-A</p>	Gauge, Clutch Housing 308-021 (T75L-4201-A)
 <p>ST1214-A</p>	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 <p>ST1266-A</p>	Dial Indicator Gauge with Holding Fixture 100-D002 (D78P-4201-B) or equivalent

Inspection and Verification

Certain axle and driveline trouble symptoms are also common to the engine, transmission, wheel bearings, tires, and other parts of the vehicle. For this reason, be sure that the cause of the concern is in the axle before disassembling, adjusting or repairing the axle. For additional information, refer to [Section 100-04](#).

Certain driveshaft vibration symptoms are common to the accessory drive components, the engine, transmission or tires. Be sure the cause of the concern is the driveshaft before repairing or installing a new driveshaft. For additional information, refer to [Section 100-04](#).

Noise Acceptability

A gear-driven unit will produce a certain amount of noise. Some noise is acceptable and audible at certain speeds or under various driving conditions such as a newly paved blacktop road. Slight noise is not detrimental to the operation of the axle and is considered normal.

Flex Coupling Inspection

Check for visible reinforcing cords and signs of tearing, cracking or wear. If the flex couplings show signs of damage, inspect the rear axle mounts for cracking and tearing.

Driveshaft Center Universal Joint (U-Joint) Inspection

Place the vehicle on a frame hoist and rotate the driveshaft (4602) by hand. Check for rough operation or seized U-joint. The U-joint is not serviceable. If required, install a new complete driveshaft assembly. For additional information, refer to [Section 205-01](#).

Driveshaft Center Bearing

Rotate the driveshaft by hand. If the bearing shows signs of roughness or is noisy, install a new bearing assembly.

Analysis of Leakage

Clean up the leaking area enough to identify the exact source. An axle leak can be caused by the following:

- Axle lubricant level is too high.
- Worn or damaged axle shaft seals.
- Differential housing is cracked.
- Flange yoke seal is worn or damaged.
- Pinion flange is scored or damaged.
- Axle cover is not sealed.
- Vent is plugged.

Make sure the axle lubricant level for both nodular iron and aluminum housings is 3-5 mm (1/8-3/16 inch) below the bottom of the fill hole.

Axle Vent

NOTE: If a plugged vent cannot be cleared, install a new vent.

A plugged vent will cause excessive seal lip wear due to internal pressure buildup. If a leak occurs, check the vent. Make sure the vent hose is not kinked. Remove the hose from the vent nipple and clear the hose of any foreign material. While the hose is removed, pass a length of mechanics wire or a small diameter Allen wrench in and out of the vent to clean it. Connect the hose when done.

Flange Yoke Seal

Leaks at the axle drive pinion seal originate for the following reasons:

- Damaged seal.
- Worn seal journal surface.

Any damage to the seal bore (dings, dents, gouges, or other imperfections) will distort the seal casing and allow leakage past the outer edge of the axle drive pinion seal.

The axle drive pinion seal can be torn, cut, or gouged if it is not installed carefully. The spring that holds the axle drive pinion seal against the pinion flange may be knocked out and allow leakage past the lip.

Metal chips trapped at the sealing lip can cause oil leaks. These can cause a wear groove on the pinion flange and pinion seal wear.

A new pinion flange must be installed if any of these conditions exist.

If a seal leak occurs, install a new seal and check the vent and the vent hose to make sure they are clean and free of foreign material.

Differential Seals

Stub shaft pilot bearing housing seals are susceptible to the same kinds of damage as axle drive pinion seals if incorrectly installed. The seal bore must be clean and the lip handled carefully to avoid cutting or tearing it. The seal journal surface must be free of nicks, gouges and rough surface texture.

For additional information on differential seals, refer to [Section 205-02](#).

Analysis of Vibration

Few vibration conditions are caused by the rear axle. On a vibration concern, follow the diagnosis procedure in [Section 100-04](#) unless there is a good reason to suspect the axle.

Tires



WARNING: Do not balance the wheels and tires while they are mounted on the vehicle. Possible tire disintegration/differential/halfshaft failure can result, causing personal injury/extensive component damage. Use an off-vehicle wheel and tire balancer only.

Most vibration in the rear end is caused by tires or driveline angle.

Vibration is a concern with modern, high-mileage tires if they are not "true" both radially and laterally. They are more susceptible to vibration around the limits of radial and lateral runout of the tire and wheel assembly. They also require more accurate balancing. Wheel and tire runout checks, truing and balancing are normally done before axle inspection. For additional information, refer to [Section 204-04](#).

Driveline Angle

Driveline angularity is the angular relationship between the engine crankshaft (6303), the driveshaft and the rear axle pinion. Factors determining driveshaft center bearing height, rear axle and engine/transmission mounts.

An incorrect driveline (pinion) angle can often be detected by the driving condition in which the vibration occurs.

- A vibration during coasting from 72 to 56 km/h (45 to 35 mph) is often caused by a high axle pinion angle.
- A vibration during acceleration from 56 to 72 km/h (35 to 45 mph) may indicate a low pinion angle.

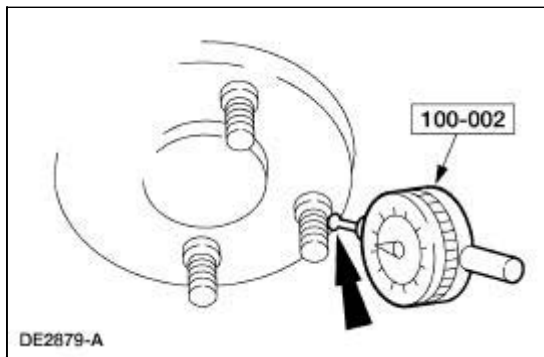
When these conditions exist, check the driveline angles.

If the tires and driveline angle are not the cause, carry out the NVH tests to determine if the concern is caused by a condition in the axle. For additional information, refer to [Section 100-04](#).

Wheel Hub Flange Bolt Circle Runout

NOTE: The brake discs must be removed to carry out all runout measurements.

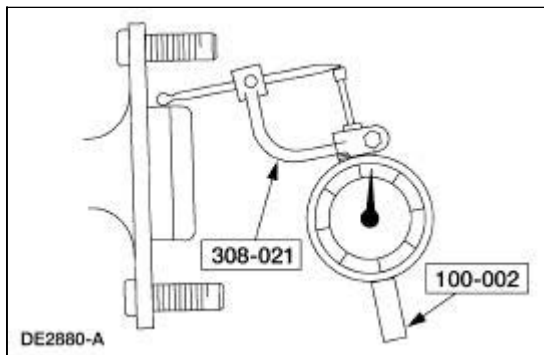
1. Position the special tool perpendicular to the wheel hub bolt, as close to the hub face as possible. Zero the indicator to allow the pointer to deflect either way.



2. Rotate the hub until the next bolt is contacted. Record the measurement and continue until each bolt is checked. The difference between the maximum and minimum contact readings will be the total wheel hub bolt pattern runout. The runout must not exceed 0.38 mm (0.015 inch).

Pilot Runout

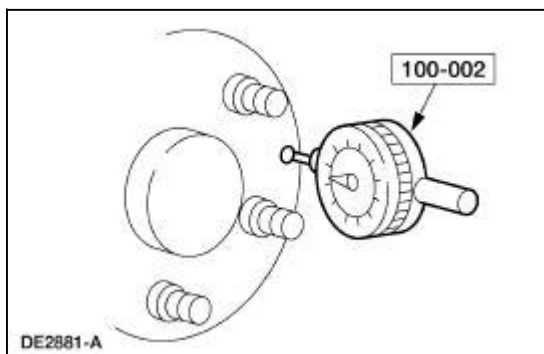
1. Position the special tools as close to the hub face as possible. Zero the indicator to allow the pointer to deflect either way.



2. Rotate the hub one full turn and note the maximum and minimum readings. The difference between the maximum and minimum readings will be the total pilot runout. Pilot runout must not exceed 0.15 mm (0.006 inch).

Wheel Hub Face Runout

1. Position the special tool on the wheel hub face, as close to the outer edge as possible. Zero the indicator to allow the pointer to deflect either way.



2. Rotate the hub one full turn and note the maximum and minimum readings. The difference between the maximum and minimum readings will be the total face runout. The runout must not exceed 0.254 mm (0.010 inch).

Drive Pinion Stem and Pinion Flange

Check the pinion flange runout when all other checks have failed to show the cause of vibration.

One cause of excessive pinion flange runout is incorrect installation of the axle drive pinion seal. Check to see if the spring on the seal lip has been dislodged before installing a new ring gear and pinion.

Halfshafts, Rear Wheel

NOTE: Install new constant velocity (CV) joints only if disassembly and inspection reveals unusual wear. For additional information, refer to [Section 205-05](#).

NOTE: While inspecting the boots, watch for indentations ("dimples") in the boot convolutions. Indentations must be removed.

- Inspect the boots for evidence of cracks, tears or splits.
- Inspect the underbody for any indication of grease splatter near the boots outboard and inboard locations. This is an indication of boot/clamp damage.

Component Tests

Driveline Vibration

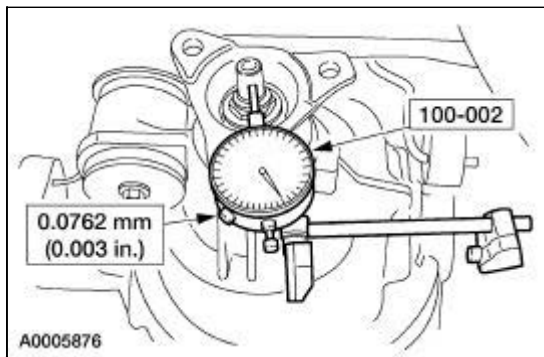
Driveline vibration exhibits a higher frequency and lower amplitude than does high-speed shake. Driveline vibration is directly related to the speed of the vehicle and is usually noticed at various speed ranges. Driveline vibration can be perceived as a tremor in the floorpan or is heard as a rumble, hum or boom. Driveline vibration can exist in all drive modes, but may exhibit different symptoms depending upon whether the vehicle is accelerating, decelerating, floating or coasting. Check the driveline angles if the vibration is particularly noticeable during acceleration or deceleration, especially at lower speeds. Driveline vibration can be duplicated on a hoist. When carrying out an on-hoist test, the suspension lower arms must be supported with jack stands to make sure the halfshafts maintain the correct ride height. The brakes may need to be applied lightly in order to simulate road resistance.

Pinion Flange Runout Check



CAUTION: Pinion bearing preload must be reset if the pinion nut has been loosened or removed for pinion flange reindexing or new component installation.

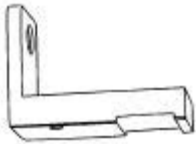
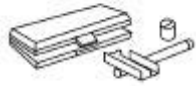
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the driveshaft. For additional information, refer to [Section 205-01](#).
3. Check the pinion flange for damage.



4. Check the runout using the special tool. Rotate the pinion until the runout is obtained. If the runout is still more than 0.0762 mm (0.003 inch), install a new gearset.
 5. If excessive runout is still evident after installation of a new pinion flange, install a new ring and pinion. Repeat the above checks until the runout is within specifications.
 6. Install the driveshaft. For additional information, refer to [Section 205-01](#).
-

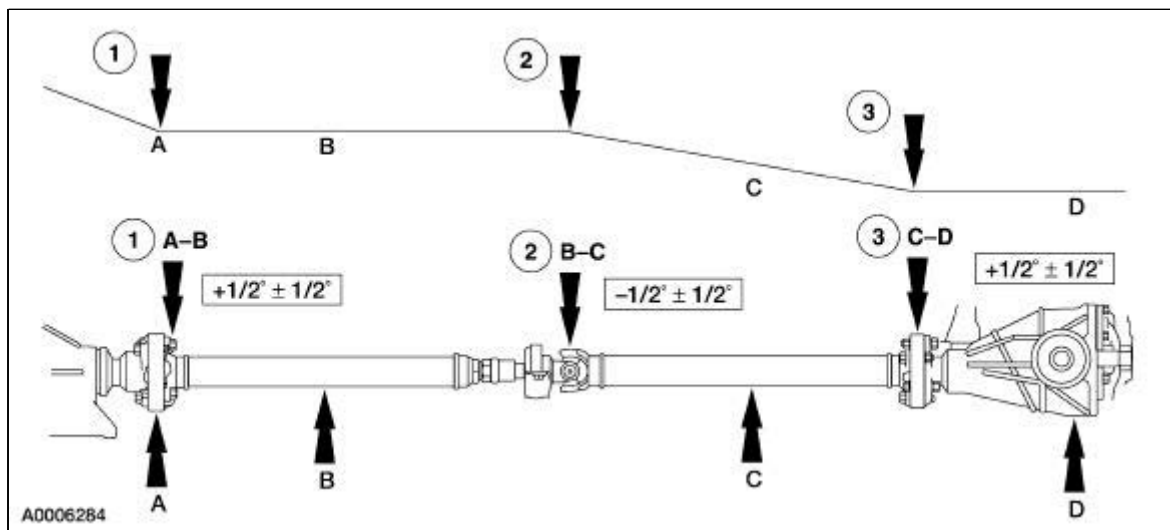
Driveline Angle Inspection

Special Tool(s)

 ST2456-A	Adapter, Driveline Angle 205-449
 ST2457-A	Gauge, Drive Pinion Angle 205-025 (T68P-4602-A)

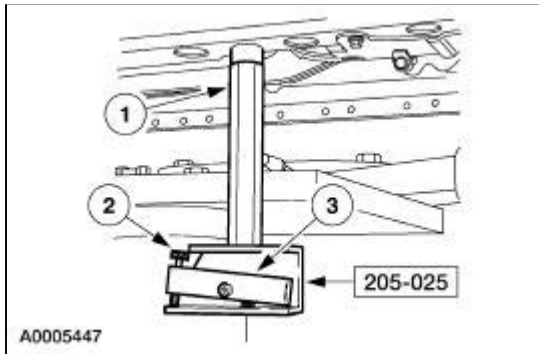
⚠ CAUTION: When carrying out operations which involve the removal and installation of the driveshaft, always check the joint angles and make the necessary adjustments.

NOTE: The following illustration will be referred to throughout the Driveline Angle Inspection procedure.



1. Park the vehicle on a level surface such as an alignment rack or a drive-on hoist.
2. Remove the exhaust heat shield fasteners and slide the exhaust heat shield as far forward as possible to expose the driveshaft-to-axle coupling. For additional information, refer to [Section 309-00](#).
3. Rotate the driveshaft several times by hand to neutralize the center support bearing and flex couplings.
4. Zero the special tool.
 1. Place the special tool on the left frame rail with the special tool facing the passenger

- side.
2. Zero the special tool using the thumbscrew.
 3. Mark the location where the special tool was zeroed with a paint pen.

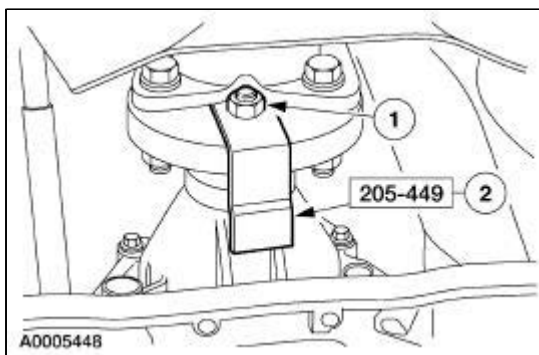


5. **NOTE:** The special tool contacts the flex coupling bolt sleeve to obtain an accurate reading.

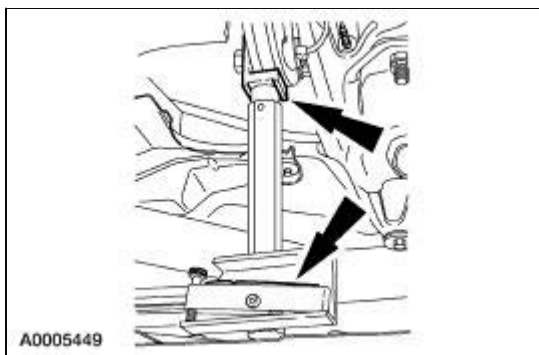
NOTE: The bolt should never be removed, only the nut.

Make preparations to measure the transmission angle (A) with respect to the frame rail.

1. Remove one of the nuts that attaches the flex coupling to the transmission flange.
2. Install the special tool onto the bolt on the rear of the flex coupling and tighten the nut.



6. Place the special tool in the bracket slot with the special tool facing the passenger side and record the reading.
 - Remove the special tools and tighten the fastener to specification. For additional information, refer to [Section 205-01](#).

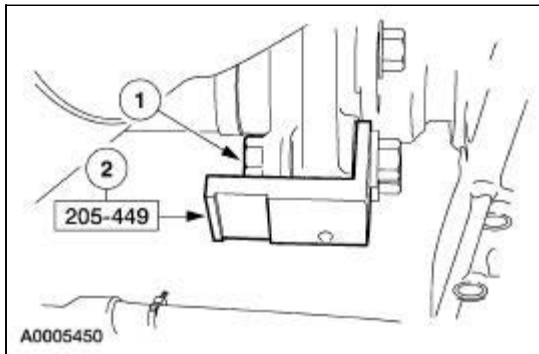


7. **NOTE:** The special tool must contact the flex coupling bolt sleeve to obtain an accurate reading.

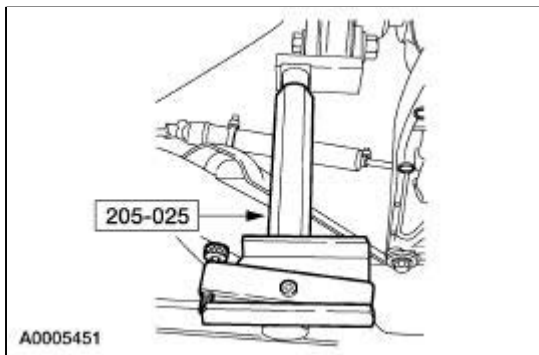
NOTE: The bolt should never be removed, only the nut.

Make preparations to measure the front driveshaft angle (B) with respect to the frame rail.

1. Remove one of the nuts that attaches the flex coupling to the front driveshaft.
2. Install the special tool onto the bolt on the front of the flex coupling and tighten the nut.



8. Place the special tool in the bracket slot with the special tool facing the passenger side and record the reading.
 - Remove the special tools and tighten the fastener to specification. For additional information, refer to [Section 205-01](#).

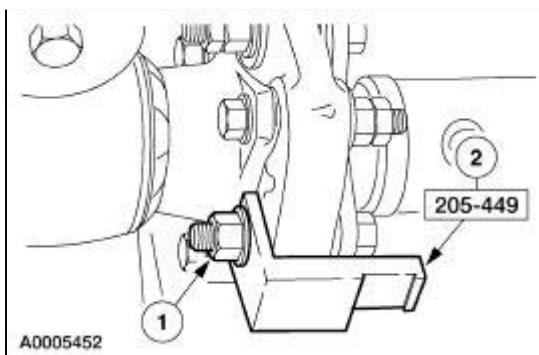


9. **NOTE:** The special tool must contact the flex coupling bolt sleeve to obtain an accurate reading.

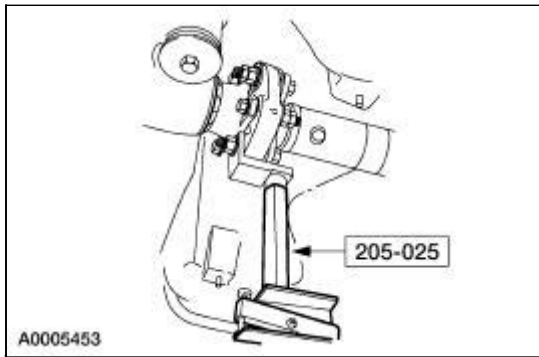
NOTE: The bolt should never be removed, only the nut.

Make preparations to measure the rear driveshaft angle (C) with respect to the frame rail.

1. Remove one of the nuts that attaches the flex coupling to the rear driveshaft.
2. Install the special tool onto the bolt on the rear of the flex coupling and tighten the nut.



10. Place the special tool in the bracket slot with the special tool facing the passenger side and record the reading.
 - Remove the special tools and tighten the fastener to specification. For additional information, refer to [Section 205-01](#).

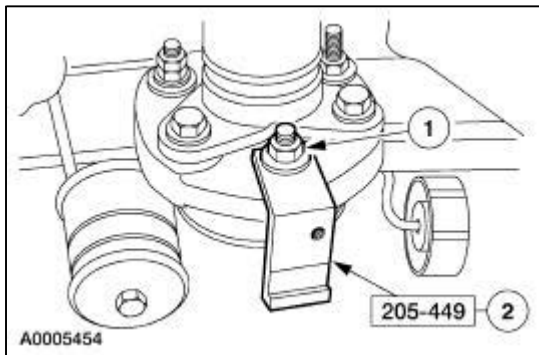


11. **NOTE:** The special tool must contact the flex coupling bolt sleeve to obtain an accurate reading.

NOTE: The bolt should never be removed, only the nut.

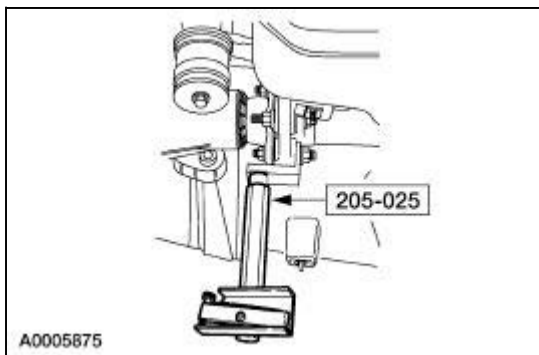
Make preparations to measure the differential pinion angle (D) with respect to the frame rail.

1. Remove one of the nuts that attaches the flex coupling to the pinion flange.
2. Install the special tool onto the front of the flex coupling and tighten the nut.



12. Place the special tool in the bracket slot with the special tool facing the passenger side and record the reading.

- Remove the special tools and tighten the fastener to specification. For additional information, refer to [Section 205-01](#).



13. Calculate the angles of joints 1, 2 and 3 as follows:

- A - B = Joint 1
- B - C = Joint 2
- C - D = Joint 3

14. **NOTE:** To adjust the center support bearing adjusting washers, the exhaust heat shield must be removed.

NOTE: Left and right washers should be the same thickness.

NOTE: Two washers should not be assembled together.

Adjust the joint angles if necessary by varying the center support bearing adjusting washers.

Part Number	mm	Inch
W704775	2.0	0.079
W704776	3.0	0.118
W704777	4.0	0.157
W704778	5.0	0.20
W704779	6.0	0.24
W704780	7.0	0.28

15. Install the exhaust heat shield. For additional information, refer to [Section 309-00](#).
-

Torque Specifications

Description	Nm	lb-ft
Driveshaft length adjustment nut	78	58
Flex coupling bolts	81	60
Center bearing bolts	43	32

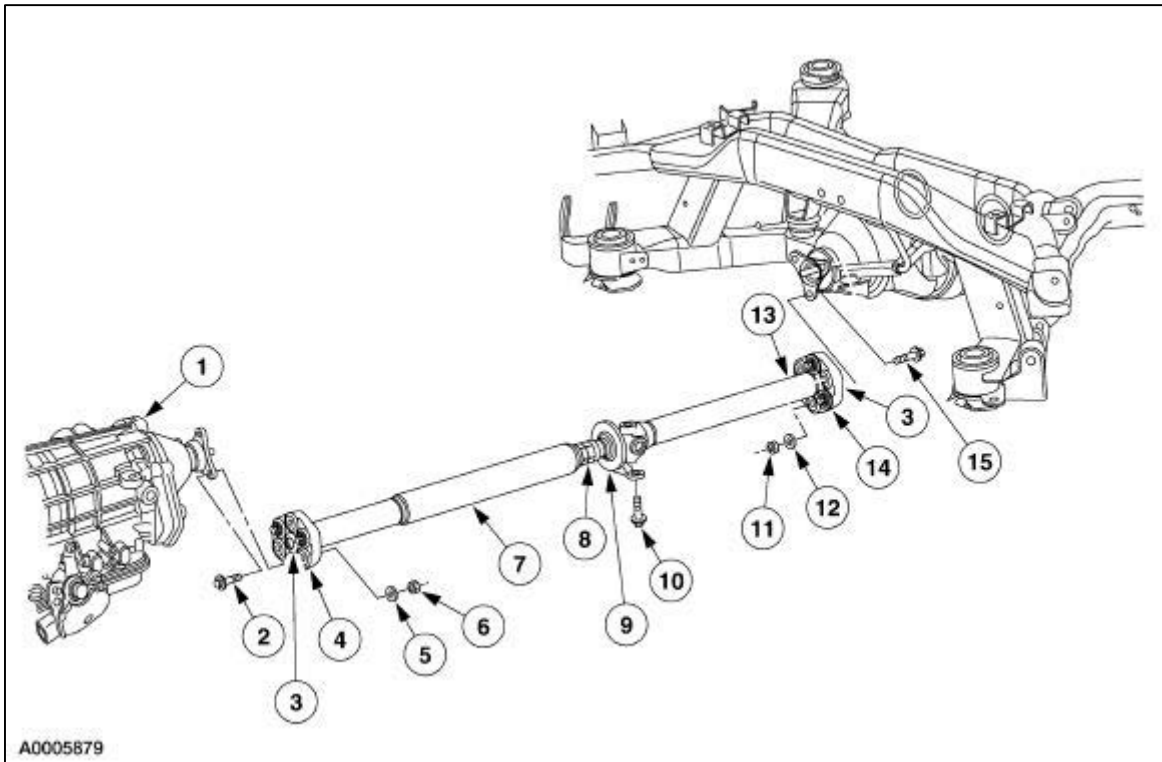
General Specifications

Item	Specification
Premium Long-Life Grease XG-1-C	ESA-M1C75-B
Threadlock 262 E2FZ-19554-B	WSK-M2G351-A6

Balance Nuts

Part Number	Color	Weight (grams)
XW4Z-4613-AA	Red	1.23
XW4Z-4613-AA	Silver	2.75
XW4Z-4613-AA	Green	5.6
XW4Z-4613-AA	Black	4.0

Driveshaft



A0005879

Item	Part Number	Description
1	7000	Transmission
2	W705098-S301	Bolt
3	4635	Alignment bushing
4	4684	Flex coupling
5	W705019-S100	Washer
6	W705575-S301	Nut
7	4817	Shaft assembly, front
8	4N273	Nut, length adjustment
9	4A499	Center bearing and bracket assembly
10	N897487-S56	Bolt
11	W705575-S301	Nut
12	W704773-S301	Washer
13	4602	Shaft assembly, rear
14	4684	Flex coupling
15	W704773	Bolt

⚠ CAUTION: All driveshaft assemblies (4602) are balanced. If undercoating the vehicle, protect the driveshaft to prevent overspray of any undercoating material.

The driveshaft is a two-piece design. A single center U-joint and a slip yoke connect the front shaft

assembly (4817) and the rear shaft assembly (4602). The front and rear shaft assemblies are separable at the slip yoke. However, the slip yoke has no blind spline or index marks so it is imperative to index-mark the assemblies before separation to prevent an imbalance condition. The driveshaft uses new design flex couplings (4684) at each end of the shaft that takes the place of traditional U-joints. The driveshaft has alignment bushings (4635) at each end of the shaft. These bushings align the driveshaft with the pilot stems on the transmission flange and the axle pinion flange. Only remove the flex couplings from the driveshaft if it is necessary to install new flex couplings/alignment bushings. Always install new alignment bushings and flex couplings as a pair.

The driveshaft, has traditional balance weights attached (spot-welded) by the manufacturer. The final driveshaft balance occurs with the complete drivetrain assembly at vehicle assembly by attaching weighted color-coded nuts to the axle flex coupling bolts. For this reason, the rear flex coupling bolts are longer than the front transmission flex coupling bolts. Always install the driveshaft flex coupling bolts with the head of the bolt seated against the flange, and the nuts seated against the flex coupling.

To adjust the driveshaft angle, selective thickness spacers sit between the body and the center support-bearing bracket. Driveshaft angle specification is one degree or less. If the driveshaft angle is above one degree, damage to the alignment bushings and flex couplings will occur.

Universal Joints

The single center U-joint is:

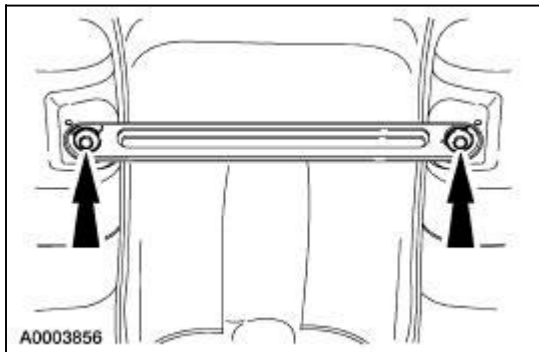
- a lubed-for-life design that requires no periodic lubrication.
 - equipped with nylon thrust washers, located at the base of each bearing cup, which control end play, position the needle bearings and improve grease movement.
 - staked to the yoke and not removable.
-

Driveshaft

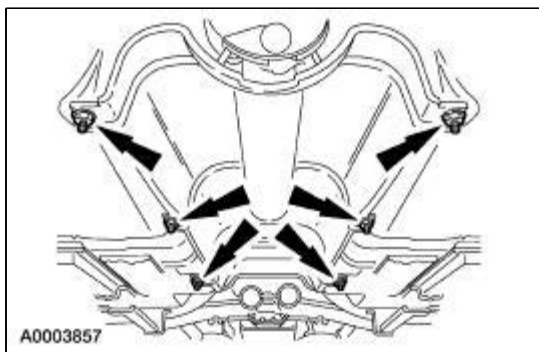
Refer to Section 205-00 .


Runout and Balance

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the body brace.

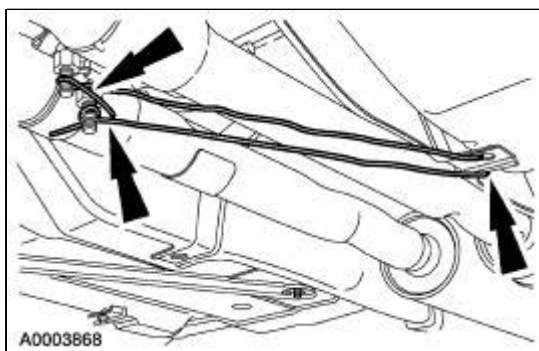



3. Remove the bolts retaining the heat shield to the vehicle.



4.  **WARNING:** Personal injury can result if the heat shield contacts the driveshaft during the balancing procedure. Secure the heat shield away from the driveshaft.

Move the heat shield forward and secure it with a wire.



5. Remove the rear wheel and tire assemblies. For additional information, refer to [Section 204-04](#).
6.  **WARNING:** Tighten the wheel nuts to prevent them from coming loose during the


balancing procedure and causing personal injury.

Install and tighten the wheel nuts. For additional information, refer to [Section 204-04](#).

7. Lower the vehicle.
8. Open the hood to provide additional cooling.
9. Turn off the traction control, if so equipped.
10. Have an assistant get in the driver seat.
11. Raise the vehicle.

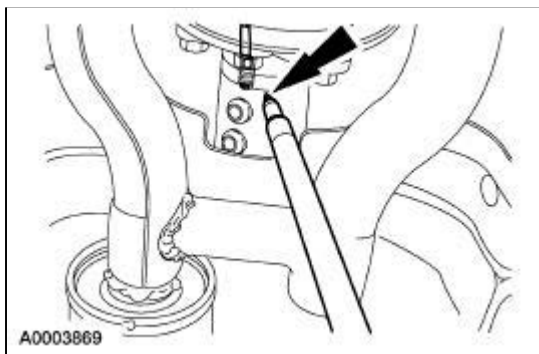
12.  **CAUTION: Do not exceed 70 mph.**

Have the assistant accelerate to the speed where the imbalance is most noticeable.

13.  **WARNING: Keep hands, hair, head and clothing clear of rotating parts and hot exhaust components.**

NOTE: The marker will contact the heavy side of the rotating driveshaft.

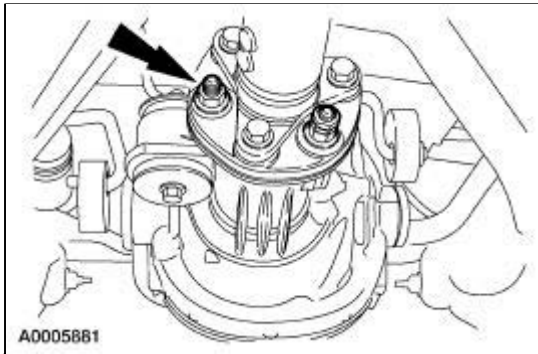
Insert a suitable marker into a 305-mm (12-inch) long piece of plastic pipe. Using the heat shield lip as a brace, move the scribe towards the driveshaft, in an area clear of the balance weld weights, until it just contacts and marks the driveshaft.




14. Have the assistant stop accelerating and shut off the engine.
15. With the driveshaft stationary, observe the mark on the driveshaft. A partial mark (less than 360 degrees) indicates the presence of an imbalance. A 360-degree mark indicates that there is no imbalance or that the pressure applied to the marker was too great. Proceed as follows if the mark indicates an imbalance. Otherwise, reinstall all components.
16. Locate the bolt in the flex coupling opposite the mark. Install a 2.75-gram weighted nut onto this bolt. This is the light side of the driveshaft. Refer to the following chart for balance nut weight and color code information.

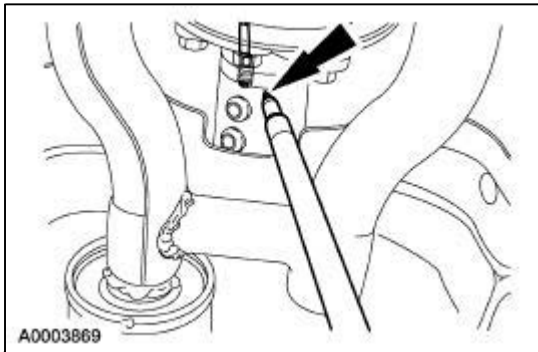
Balance Nuts


Part Number	Color	Weight (grams)
XW4Z-4613-AA	Red	1.23
XW4Z-4613-AA	Silver	2.75
XW4Z-4613-AA	Green	5.6



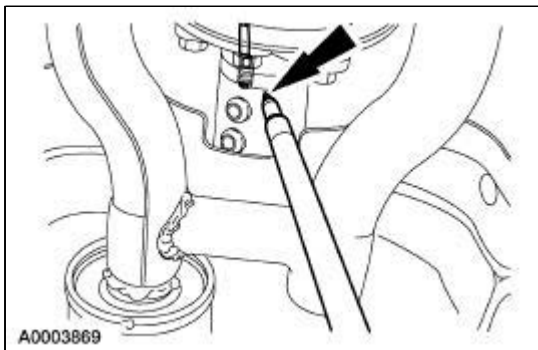
17.  **WARNING: Keep hands, hair, head and clothing clear of rotating parts and hot exhaust components.**

Repeat the marking procedure Steps 12 and 13.



18. Have the assistant stop accelerating and shut off the engine.
19. With the driveshaft stationary, observe the mark on the driveshaft. If the new mark is 360-degrees, reinstall all components and road test the vehicle. If the vibration is still apparent, remove the 2.75-gram weighted nut, install a 5.6-gram weighted nut in its place, and proceed as follows.
20.  **WARNING: Keep hands, hair, head and clothing clear of rotating parts and hot exhaust components.**

Repeat the marking procedure Steps 12 and 13.

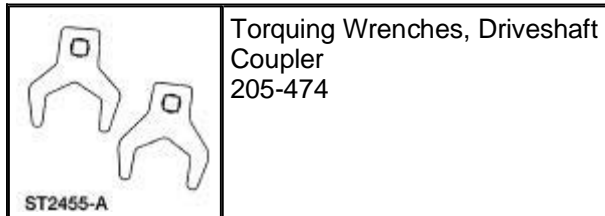


21. Have the assistant stop accelerating and shut off the engine.


22. With the driveshaft stationary, observe the mark on the driveshaft. If the new mark is 360-degrees, reinstall all components and road test the vehicle. If the vibration is still apparent, move the weighted nut to the adjacent bolts and repeat the marking procedure. If the condition does not improve, install a new driveshaft assembly. Retest using the marker and weighted nuts as necessary. When the best possible condition is met, reinstall all components and road test the vehicle.
-

Driveshaft


Special Tool(s)




Removal

 **CAUTION:** Only remove the flex couplings (4684) from the driveshaft (4602) if it is necessary to install new flex couplings/alignment bushings (4635). Install new alignment bushings and flex couplings as a pair. Balance the driveshaft with the flex couplings installed.

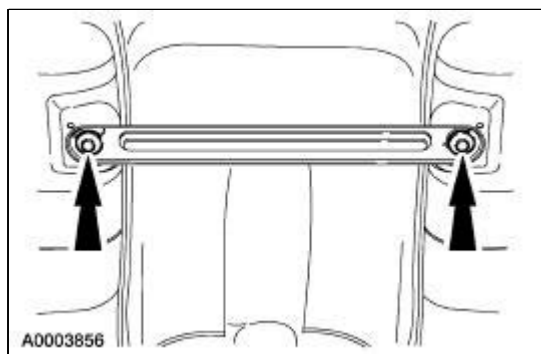
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).

2.  **WARNING:** The normal operating temperature of the exhaust system is very high. Never attempt to remove any part of the system until it has cooled. Be especially careful when working around the catalytic converters. The temperature of the converter rises to a high level after only a few minutes of engine operation. Failure to follow these instructions can result in personal injury.


 **CAUTION:** Do not allow the full weight of the exhaust to bear against the exhaust pipe manifold flanges. This will damage the flanges, and create exhaust leaks.

Remove the muffler and extension pipe assembly. For additional information, refer to [Section 309-00](#).

3. Remove the body brace.

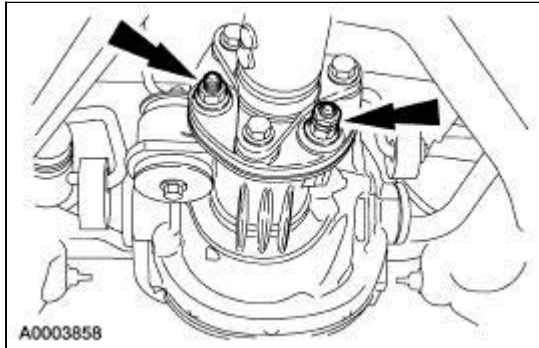



4. Remove the 8 retainers and the heat shield.

5.  **CAUTION:** To ensure assembly in the exact same location, index-mark the bolt, nut, washer, flex coupling and pinion flange with paint or marker. Using a different color paint

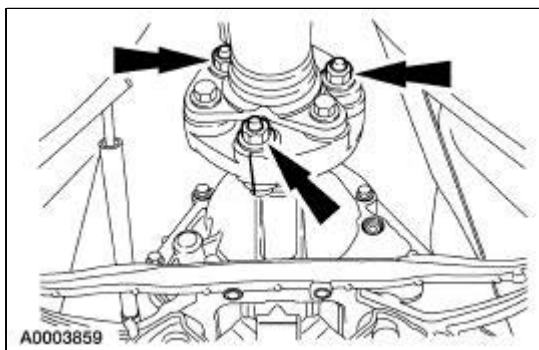
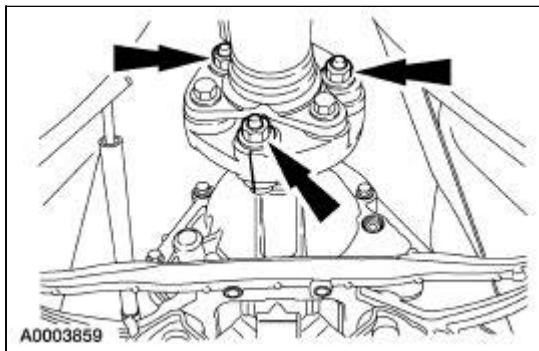
or marker, index-mark the second bolt, nut and washer that retain the driveshaft and flex coupling to the pinion flange. Do not index-mark the third bolt, nut, and washer that retain the driveshaft and flex coupling to the pinion flange. These fasteners are balance weights. Always assemble them in their original positions. Failure to do so can cause driveshaft NVH.


Index-mark the components.



6.  **CAUTION:** To ensure assembly in the exact same location, index-mark the bolt, nut, washer, flex coupling and transmission flange with paint or marker. Using a different color paint or marker, index-mark the second bolt, nut and washer that retain the driveshaft and flex coupling to the transmission flange. Do not index-mark the third bolt, nut, and washer that retain the driveshaft and flex coupling to the transmission flange. These fasteners are balance weights. Always assemble them in their original positions. Failure to do so can cause driveshaft NVH.

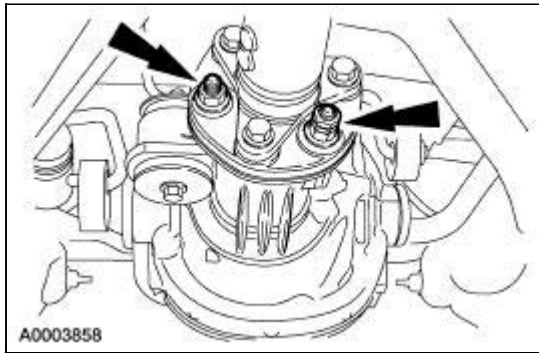
Index-mark the components.



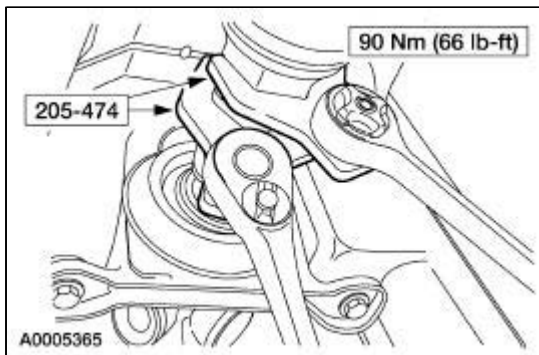
7.  **CAUTION:** Do not remove the bolts retaining the flex coupling to the driveshaft.

NOTE: The bolt heads are serrated. Hold the bolt and loosen the nut.

Remove the three nuts, washers and bolts.



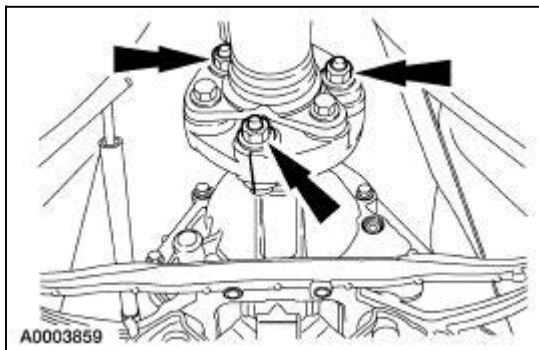
8. Using the special tools, loosen the nut.



9.  **CAUTION:** Do not remove the bolts retaining the flex coupling to the driveshaft.

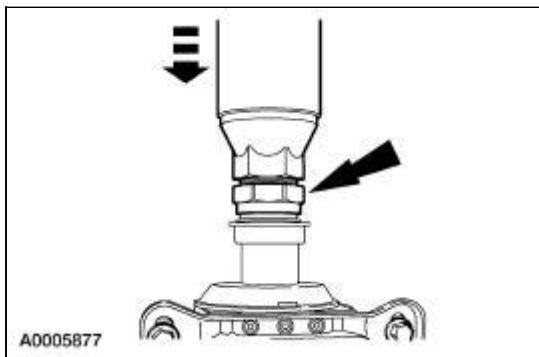
NOTE: The bolt heads are serrated. Hold the bolt and loosen the nut.


Remove the three nuts, washers and bolts.



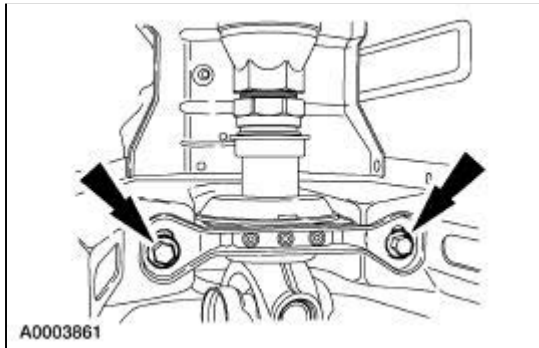
10. Slide the front shaft assembly rearward.

- Tighten the nut to prevent separation of the front and rear shaft assemblies.




11.  **CAUTION:** To ensure assembly in the exact same location, index-mark one bolt and the selective spacer(s) with paint or marker. Do not index-mark the other bolt and the selective spacer(s) on the opposite end of the mount. These parts maintain the driveshaft driveline angle. Always assemble them in their original positions. Failure to do so can cause driveshaft NVH.

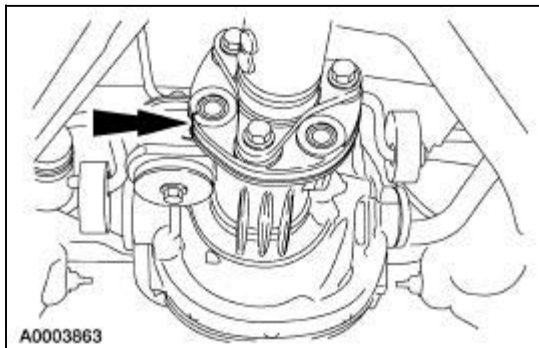
Remove the bolts and spacers, and the driveshaft assembly.



Installation

1. Add one gram of grease to both alignment bushing cavities.
 - Use Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B.
2.  **CAUTION:** Align the index marks or driveshaft NVH can occur.

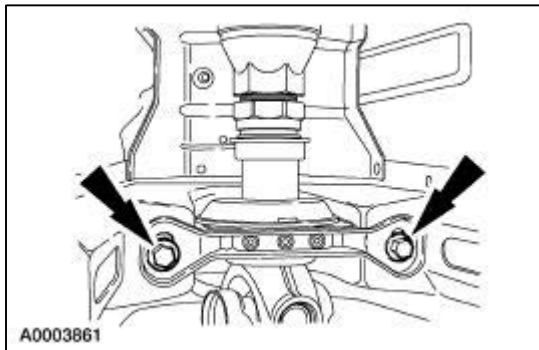
Align the index marks, and position the alignment bushing on the pinion flange piloting stem.



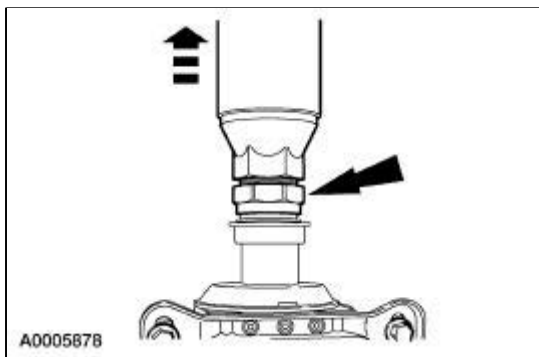
3.  **CAUTION:** Install the selective spacers and bolts in their original positions.

NOTE: Do not tighten the bolts at this time.

Install the spacers and the bolts hand tight.

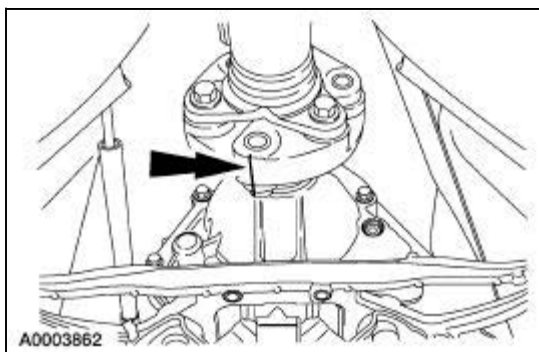



4. Loosen the nut and slide the front shaft assembly forward.



5.  **CAUTION:** Align the index marks or driveshaft NVH can occur.

Align the index marks, and position the alignment bushing on the transmission flange piloting stem.

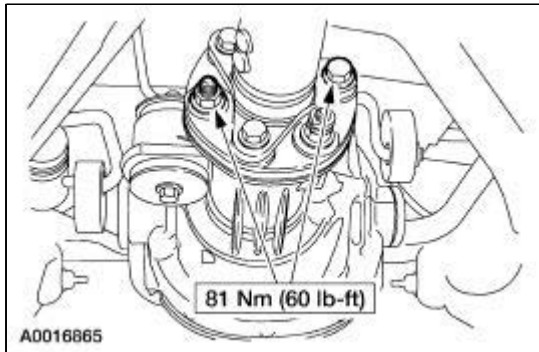
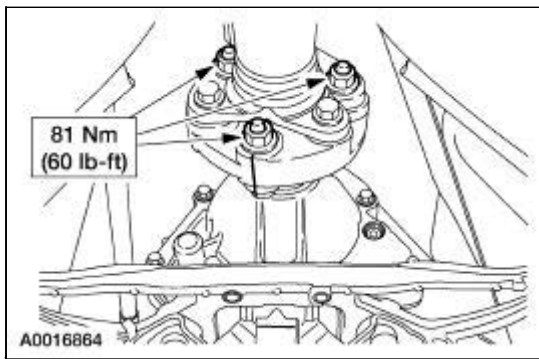



6.  **CAUTION:** Install the bolts, washers and nuts in their original positions or driveshaft NVH can occur. Install the driveshaft flex coupling bolts with the head of the bolt seated against the flange, and the nuts seated against the flex coupling. Install the short bolts in the front and the long bolts in the rear.

NOTE: The bolt heads are serrated. Hold the bolt and tighten the nut.

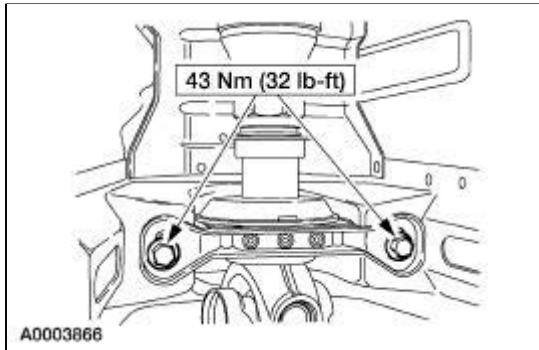
Install the bolts, washers and nuts.

- Coat the nut and bolt threads with Threadlock 262 E2FZ-19554-B or equivalent meeting Ford specification WSK-M2G351-A6.

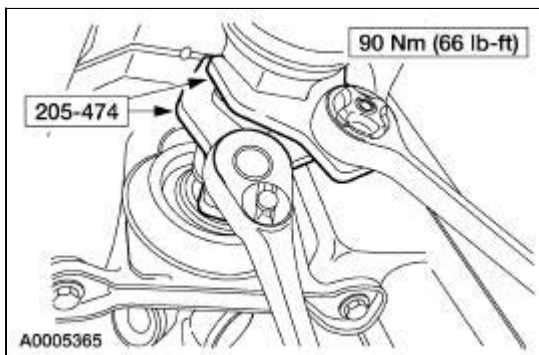


7.  **CAUTION:** Tighten the bolts evenly to avoid twisting the bracket.

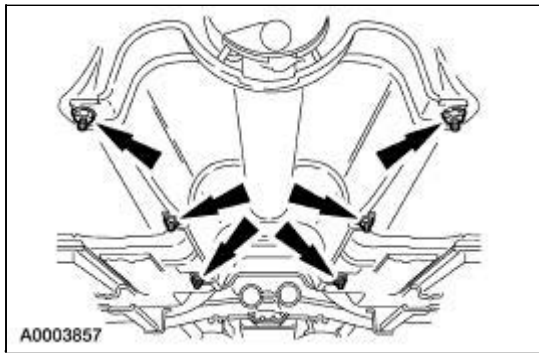
Tighten the bolts.




8. Using the special tools, tighten the nut.



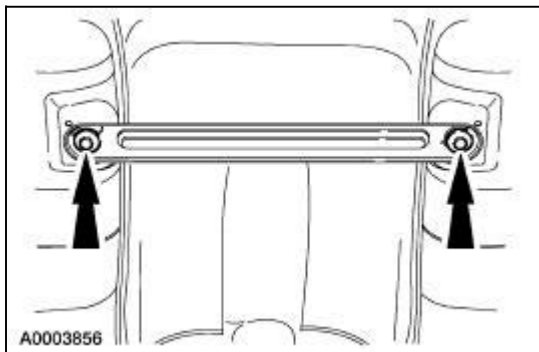
9. Install the heat shield.



10.  **CAUTION: Do not allow the full weight of the exhaust to bear against the exhaust pipe manifold flanges. This will damage the flanges, and create exhaust leaks.**

Install the muffler and extension pipe assembly. For additional information, refer to [Section 309-00](#).

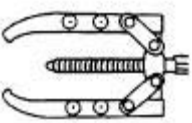
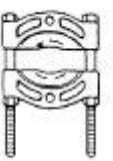

11. Install the body brace.




12. Lower the vehicle.
-

Center Bearing

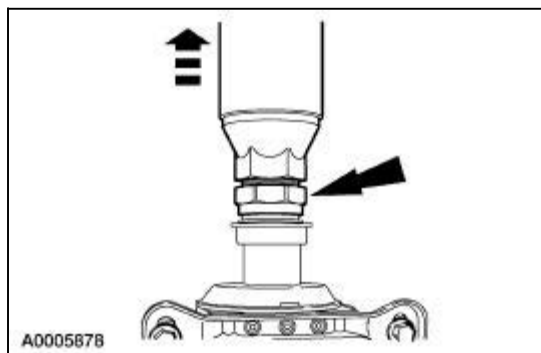
Special Tool(s)

 ST1260-A	2-Jaw Puller 205-D026 (D80L-1002-L) or Equivalent
 ST1368-A	Bearing Pulling 205-D064 (D84L-1123-A) or Equivalent
 ST2454-A	Driveshaft Alignment Bushing Remover Tube 205-D073 or Equivalent

Disassembly

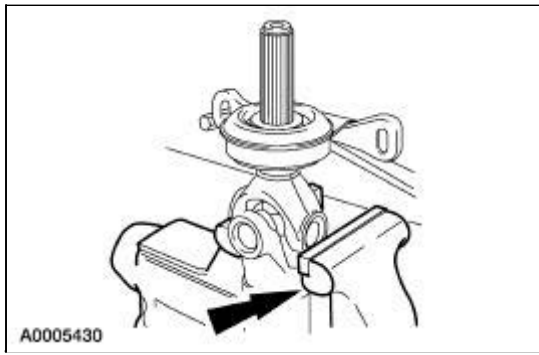
1. Remove the driveshaft (4602). For additional information, refer to [Driveshaft](#) in this section.
2.  **CAUTION: The slip yoke has no blind spline or index marks. Index-mark the assemblies before separation to prevent an imbalance condition.**

Loosen the nut and separate the front (4817) and rear shaft (4602) assemblies.

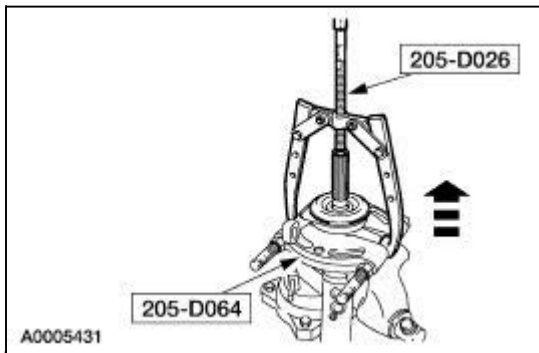


3.  **CAUTION: Do not clamp on the driveshaft tube as a fracture can result.**

Position and clamp the driveshaft at the weld yoke.

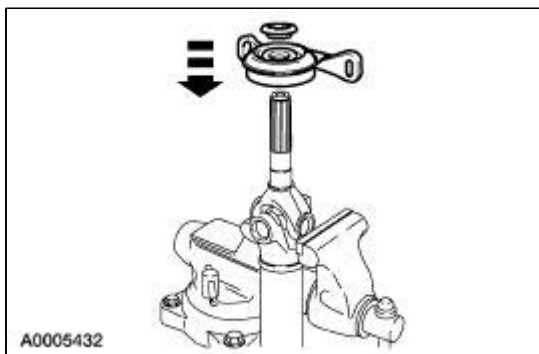


4. Using the special tools, remove the retaining ring and the center bearing and bracket assembly (4A499).

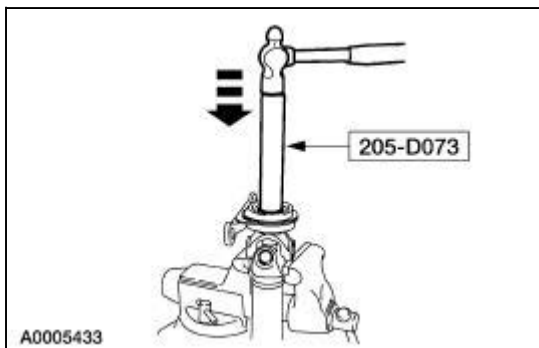


Assembly

1. Position the center bearing and bracket assembly and the retaining ring on the yoke.



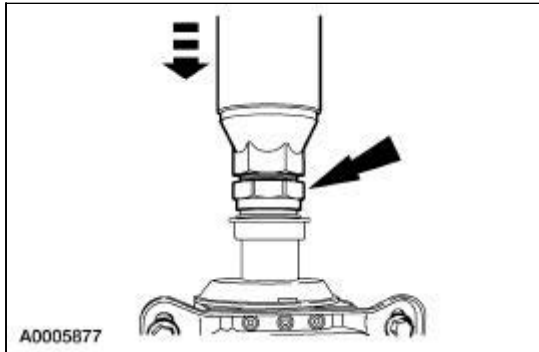
2. Using the special tool, drive the retaining ring and bearing assembly until fully seated on the yoke.



3.  **CAUTION: Align the index marks or driveshaft imbalance can occur.**

Assemble the front and rear shaft assemblies.





- Hand-tighten the nut to prevent separation of the front and rear shaft assemblies.



4. Install the driveshaft. For additional information, refer to [Driveshaft](#) in this section.
-

Driveshaft Alignment Bushing

Special Tool(s)

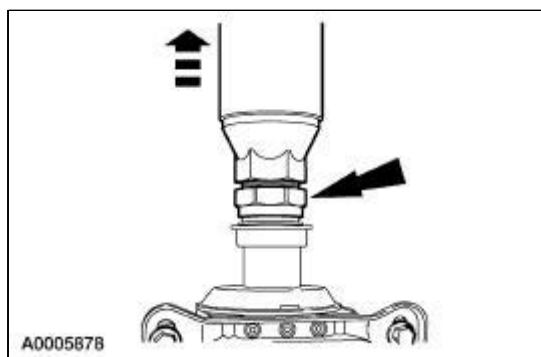
 ST1144-A	Blind Hole Puller Set 303-DS005 (D80L-100A) or Equivalent
 ST2454-A	Driveshaft Alignment Bushing Remover Tube 205-D073 or Equivalent
 ST1255-A	Handle 205-153 (T80T-4000-W)
 ST1508-A	Driveshaft Alignment Bearing Installer 205-D074 or Equivalent

Disassembly

1. Remove the driveshaft (4602). For additional information, refer to [Driveshaft](#) in this section.

2.  **CAUTION: The slip yoke has no blind spline or index marks. Index-mark the assemblies before separation to prevent an imbalance condition.**

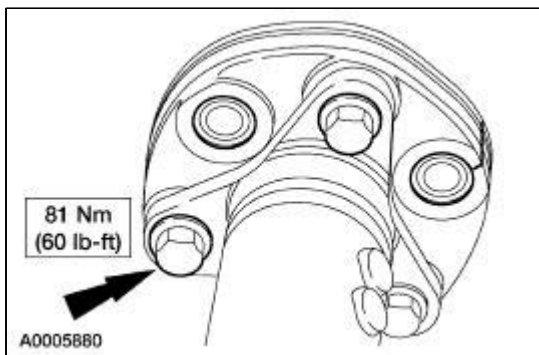
Loosen the nut and separate the front (4817) and rear shaft (4602) assemblies.



3. **NOTE:** The bolt heads are serrated. Hold the bolt and loosen the nut.

Remove the nuts and bolts and the flex coupling (4684).

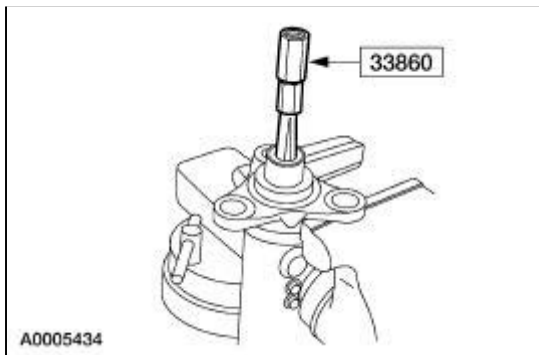
- Discard the flex coupling. Retain the nuts and bolts.



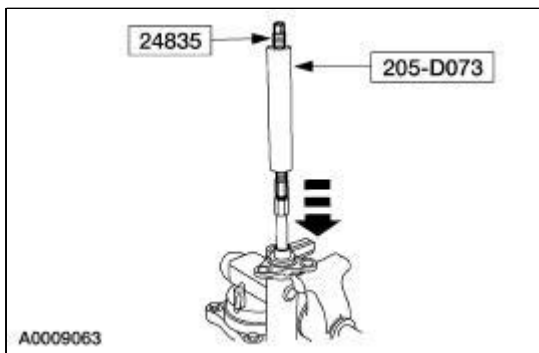
4.  **CAUTION:** Do not clamp the vise on the driveshaft tube as a fracture can result.

Position the driveshaft end yoke in the vise jaws.

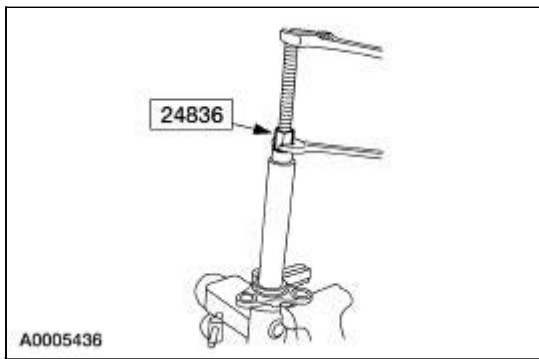
5. Insert the special tool inside the alignment bushing and expand the collet.



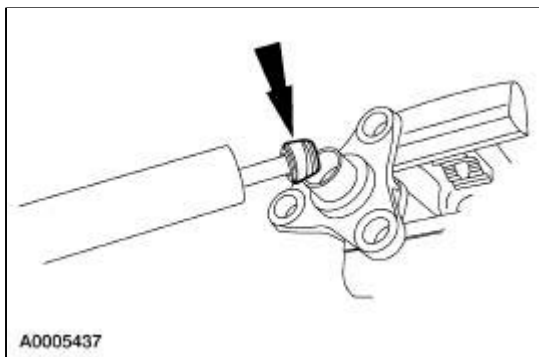
6. Install the special tools.



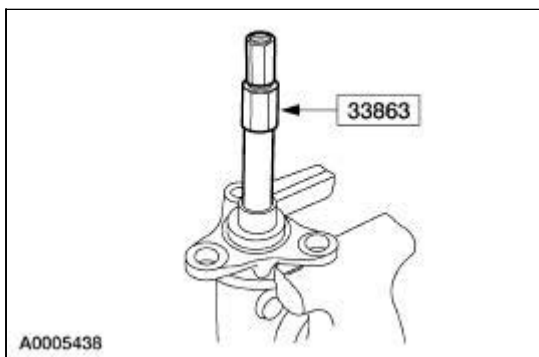
7. Hold the forcing screw, and tighten the forcing screw nut until removing the alignment bushing inner core.



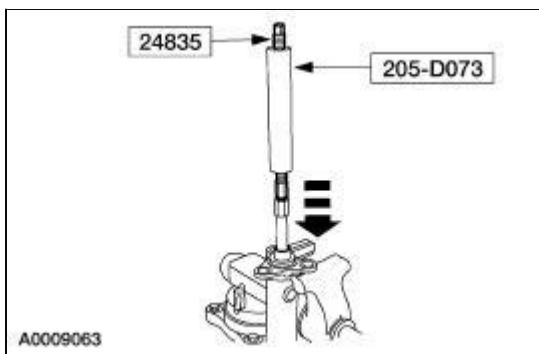
8. Discard the alignment bushing inner core.



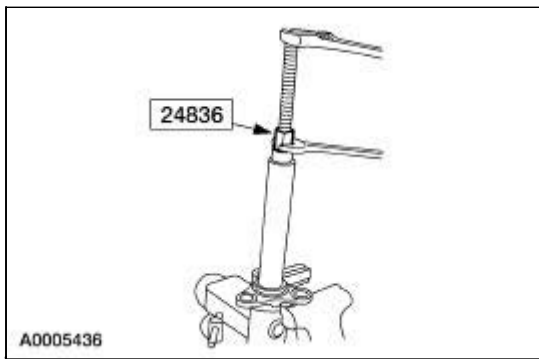
9. Insert the special tool and adjust it to seat behind the bushing shell.



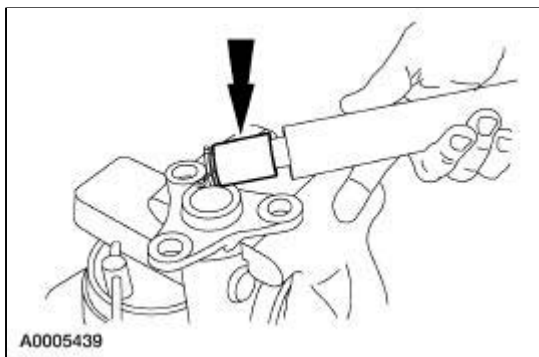
10. Install the special tools.



11. Hold the forcing screw, and tighten the forcing screw nut until removing the alignment bushing outer shell.



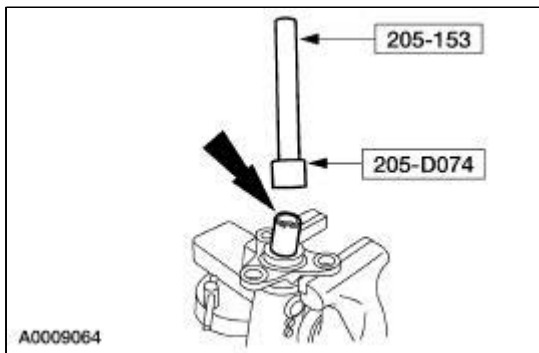
12. Discard the alignment bushing outer shell.



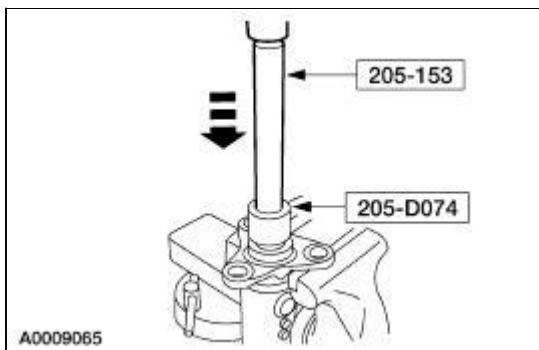
Assembly


1. **NOTE:** Install the alignment bushing (4635) with the seal facing outward.

Using the special tools, align the bushing with the driveshaft.




2. Using the special tools, drive the alignment bushing until the tool contacts the end yoke.

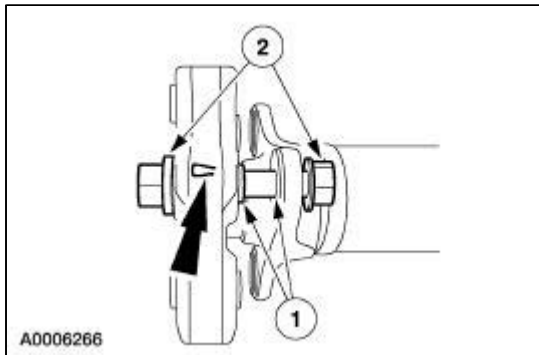


3.  **CAUTION:** There are six bushings in each flex coupling. Three of the bushings protrude from one side of the flex coupling and three protrude from the other side. The arrows on the side of the flex coupling point toward the protruding end of the bushing. When installing the flex coupling, the protruding end of the bushing must seat in the driveshaft flange counterbore or damage will occur to the flex coupling during driveshaft operation.

Install the flex coupling.

1. Position the protruding end of the bushing against the driveshaft flange.
2.  **CAUTION:** The bolt heads must seat against the driveshaft flange and the nuts against the flex coupling.

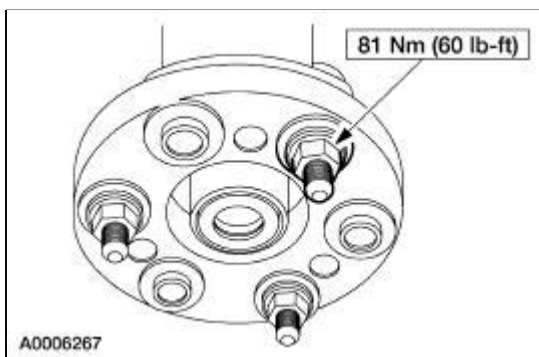
Install the three bolts and nuts.



4. **NOTE:** The bolt heads are serrated. Hold the bolt and tighten the nut.

Tighten the nuts.

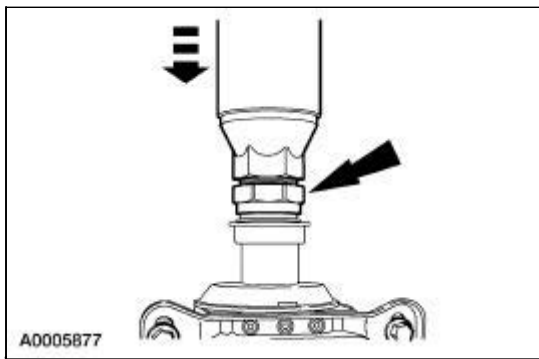
- Coat the bolt threads with Threadlock 262 E2FZ-19554-B or equivalent meeting Ford specification WSK-M2G351-A6.




5.  **CAUTION:** Align the index marks or driveshaft imbalance can occur.

Assemble the front and rear shaft assemblies.

- Hand-tighten the nut to prevent separation of the front and rear shaft assemblies.



6.  **CAUTION:** Add one gram of Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B to both alignment bushing cavities before installing the driveshaft.

Install the driveshaft (4602). For additional information, refer to [Driveshaft](#) in this section.

General Specifications

Description	mm	Inches
Clearance, Tolerance and Adjustments		
Maximum runout of backface of ring gear	0.0762	0.003
Maximum differential case runout	0.076	0.003
Maximum aluminum carrier spread	0.762	0.030
Backlash between ring gear and pinion teeth	0.203-0.330	0.008-0.013
Preferred backlash	0.254	0.010
Maximum backlash variation between teeth	0.1016	0.004
Maximum radial runout of rear axle pinion flange in assembly	0.25 TIR	0.010 TIR
Available drive pinion bearing adjustment shim in steps of: 0.0254 mm (0.001 inch) 8.8-inch axle	0.254-0.965	0.010-0.038
Lubricant deflector to differential housing cover	5.08-6.35	0.200-0.250

Lubricant Capacities

Liters	Pints
1.4	3.0 ¹

¹ Use SAE 75W140 Synthetic Rear Axle Lubricant F1TZ-19580-B or equivalent meeting Ford specification WSL-M2C192-A. Fill the rear axle 3-5 mm (1/8-3/16 inch) from the bottom of filler hole.

General Specifications

Item	Specification
Lubricants/Sealants	
Premium Long-Life Grease XG-1-C	ESA-M1C75-B
Threadlock® and Sealer E0AZ-19554-AA	WSK-M2G315-A5
SAE 75W-140 Synthetic Rear Axle Lubricant F1TZ-19580-B	WSL-M2C192-A
Silicone Rubber D6AZ-19562-AA	ESB-M4G92-A
Stud and Bearing Mount E0AZ-19554-BA	WSK-M2G349-A1
Pipe Sealant with Teflon® D8AZ-19554-A	WSK-M2G350-A2
SAE 5W-30 Super Premium Motor Oil XO-5W30-QSP	WSS-M2C153-G

Torque Specifications

Description	Nm	lb-ft	lb-in
Bearing cap bolt	105	77	—
Differential pinion shaft lock bolt	30	22	—
Ring gear bolt ^a	105	77	—
Differential housing cover retaining bolt	32	24	—
Filler plug	34	25	—
Rear differential front lower insulator nut	70	52	—
Rear axle differential front lower insulator nuts and bolts	70	52	—
Rear axle differential rear insulator bolt	103	76	—
Driveshaft yoke adjuster nut	90	66	—
Pinion bearing preload — (drive pinion collapsible spacer) used bearings ^b	0.9-1.16	—	8-10
Bearing preload tool torque	2.8		25
New bearings	1.8-3.2	—	16-28

^a Use Stud and Bearing Mount E0AZ-19554-BA or equivalent meeting Ford specification WSK-M2G349-A1.

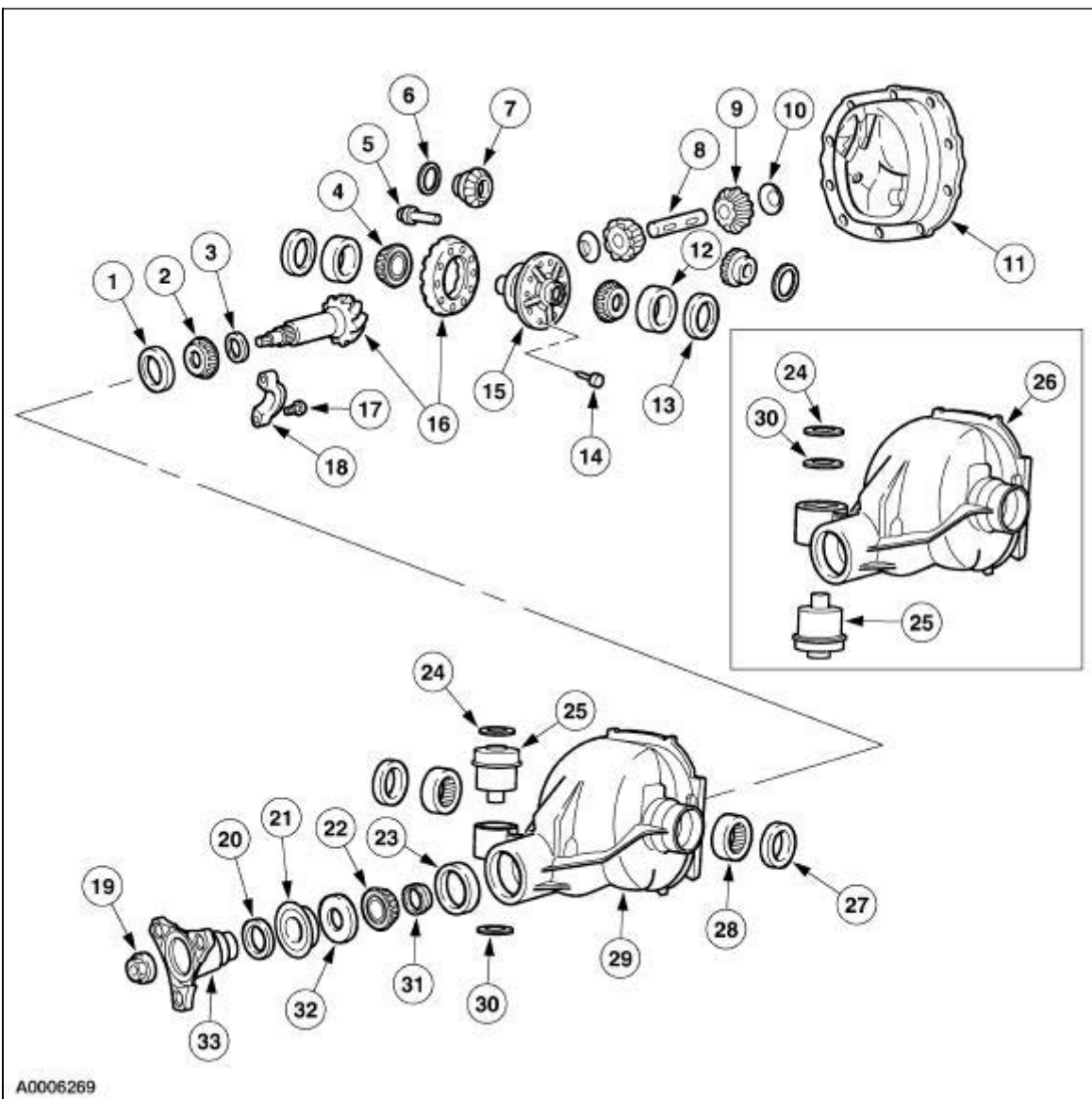
^b With pinion flange yoke seal.

Rear Drive Axle and Differential

The rear axle assembly contains the following features:

- integral-type housing hypoid gear design has the centerline of pinion set below the centerline of ring gear.
- hypoid ring gear and pinion which consists of a 203-mm (8.0-inch) diameter ring gear and an overhung drive pinion which is supported by two opposed tapered roller bearings.
- pinion bearing preload is maintained by a drive pinion collapsible spacer on the pinion shaft and adjusted by the pinion nut.
- rear axle housing (4010) assembly which consists of a cast aluminum center section and a cast-aluminum rear differential housing cover (4033).
- differential housing cover which uses a silicone sealant rather than a gasket.
- aluminum rear axle housing that must be spread in order to remove the differential case (4204).
- differential case which is a one-piece design with two openings to allow for assembly of internal components and lubricant flow.
- differential pinion shaft (4211) which is retained by a threaded differential pinion shaft lock bolt assembled to the differential case.
- differential case which is mounted in the rear axle housing between two opposed differential bearings (4221).
- differential bearings which are retained in the rear axle housing by removable bearing caps.
- differential bearing preload and ring gear backlash are adjusted by differential bearing shims (4067) located between the differential bearing cup (4222) and the rear axle housing.
- the use of a pinion depth gauge is required for correct differential ring gear and pinion adjustment.
- the halfshafts are held in the differential case by a driveshaft bearing retainer circlip (3Z498) that is located on the inboard CV joint stub shaft pilot bearing housing (4B413). When each halfshaft is installed, the driveshaft bearing retainer circlip engages a step in the differential side gear (4236).

Rear Axle-8.0-Inch Ring Gear



A0006269

Item	Part Number	Description
1	4628	Rear axle pinion bearing cup
2	4630	Pinion bearing
3	4663	Drive pinion bearing adjustment shim
4	4221	Differential bearing
5	4241	Differential pinion shaft lock bolt
6	4228	Differential side gear thrust washer
7	4236	Differential side gear
8	4211	Differential pinion shaft
9	4215	Differential pinion gear
10	4230	Differential pinion thrust washer
11	4033	Differential housing cover
12	4222	Differential bearing cup
13	4067	Differential bearing shim
14	4216	Rear axle ring gear case bolt

15	4204	Differential case
16	4209	Ring gear and pinion
17	56187-S	Bolt
18	—	Differential bearing cap (part of 4010)
19	389546-S100	Pinion nut
20	4859	Drive pinion oil seal deflector
21	4676	Rear axle drive pinion seal
22	4621	Pinion bearing
23	4616	Differential drive pinion bearing cup
24	4067	Front mount shim
25	4B424	Rear axle differential front lower insulator
26	4010	Rear axle housing (aluminum)
27	4B416	Inboard CV joint stub shaft pilot bearing housing seal
28	4B413	Inboard CV joint stub shaft pilot bearing housing
29	4010	Rear axle housing (nodular iron)
30	4B431	Rear axle differential front lower insulator cap
31	4662	Differential drive pinion collapsible spacer
32	4670	Rear axle drive pinion shaft oil slinger
33	4851	Rear axle pinion flange

The rear drive axle operates as follows:




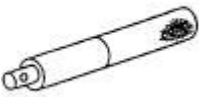


- The rear axle drive pinion receives power from the engine through the transmission and driveshaft (4602).
 - The pinion gear rotates the differential case when engaged with the ring gear, which is bolted to the differential case outer flange.
 - Inside the differential case, two differential pinion gears (4215) are mounted on a differential pinion shaft which is pinned to the differential case.
 - These differential pinion gears are engaged with the differential side gears to which the halfshafts are splined.
 - As the differential case turns, it rotates the halfshafts and rear wheels.
 - When it is necessary for one wheel and halfshaft to rotate faster than the other, the faster turning differential side gear causes the differential pinion gears to roll on the slower turning differential side gear. This allows differential action between the two halfshafts.
-

Rear Drive Axle and Differential

Refer to Section 205-00 .

Stub Shaft Pilot Bearing and Seal

Special Tool(s)

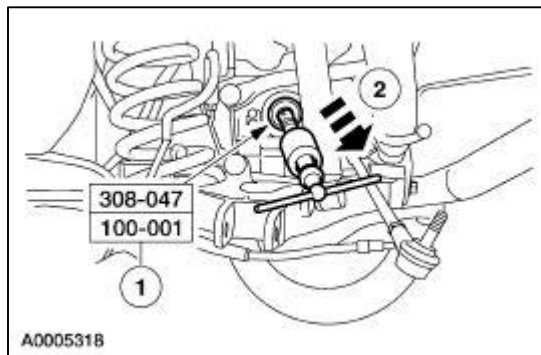
 ST1200-A	Bearing Cup Remover 308-047 (T77F-1102-A)
 ST2258-A	Differential Seal Protector 205-461
 ST1676-A	Differential Seal Replacer 205-293 (T89P-4850-A)
 ST1326-A	Handle 205-153 (T80T-4000-W)
 ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)
 ST1721-A	Needle Bearing Replacer 205-288 (T89P-1244-A)

Removal

1. Remove the halfshaft assembly. For additional information, refer to [Section 205-05](#) .
2. **NOTE:** If only a new inboard CV joint stub shaft pilot bearing housing seal (4B416) is to be installed, engage the bearing cup puller tangs on the inboard CV joint stub shaft pilot bearing housing seal.

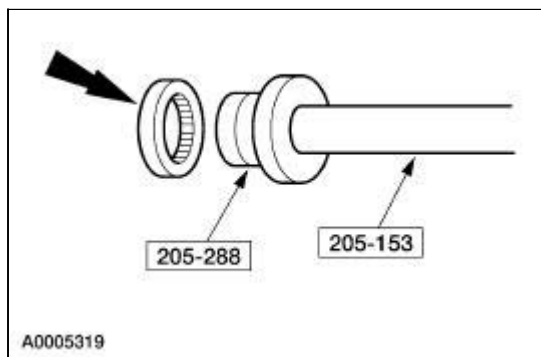
Remove the inboard CV joint stub shaft pilot bearing housing seal and inboard CV joint stub shaft pilot bearing (4B413).

1. Install the special tool with the tangs firmly engaged on the inboard CV joint stub shaft pilot bearing housing.
2. Remove the inboard CV joint stub shaft pilot bearing housing seal and inboard CV joint stub shaft pilot bearing.

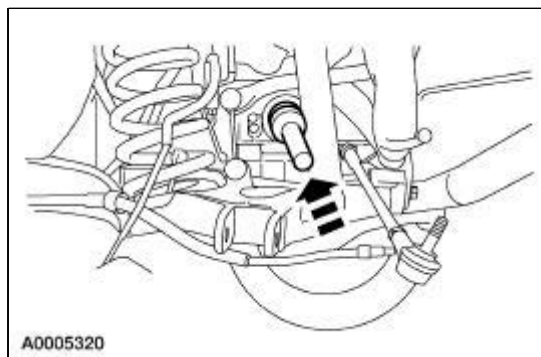


Installation

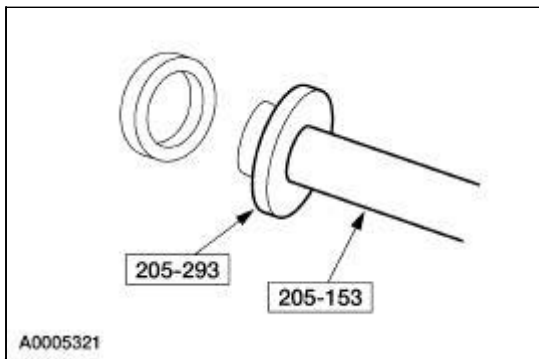
1. Lubricate the new inboard CV joint stub shaft pilot bearing with SAE 75W140 Synthetic Rear Axle Lubricant F1TZ-19580-B or equivalent meeting Ford specification WSL-M2C192-A. Place the inboard CV joint stub shaft pilot bearing onto the special tools.



2. Install the inboard CV joint stub shaft pilot bearing into the rear axle housing bore.

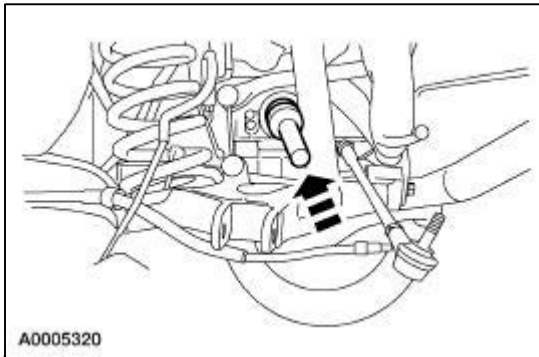


3. Lubricate the lip of the inboard CV joint stub shaft pilot bearing housing seal with Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B. Place the inboard CV joint stub shaft pilot bearing housing seal onto the special tools.



4. **⚠ CAUTION:** Installation of the inboard CV joint stub shaft pilot bearing housing seal or inboard CV joint stub shaft pilot bearing without the correct tool can result in an early inboard CV joint stub shaft pilot bearing housing seal or pilot bearing failure. If the inboard CV joint stub shaft pilot bearing becomes cocked in the bore during installation, remove it and install a new one.

Carefully align the inboard CV joint stub shaft pilot bearing housing seal with the housing bore and install the inboard CV joint stub shaft pilot bearing housing seal.






5. **⚠ CAUTION:** Use special tool 205-461 to avoid damaging seal with CV joint stub shaft.

⚠ CAUTION: Inspect the inboard CV joint seal journal for rust or nicks/scratches prior to installing the halfshaft. Polish the seal journal with fine crocus cloth, if required.

Install the halfshaft. For additional information, refer to [Section 205-05](#).

Drive Pinion Flange

Special Tool(s)

 ST2458-A	Holding Tool, Drive Pinion Flange 205-478
 ST1734-A	Installer, Drive Pinion Flange 205-479
 ST2452-A	Remover, Output Flange 307-408

Removal

-  **CAUTION: Do not allow the calipers to hang from the brake hoses.**

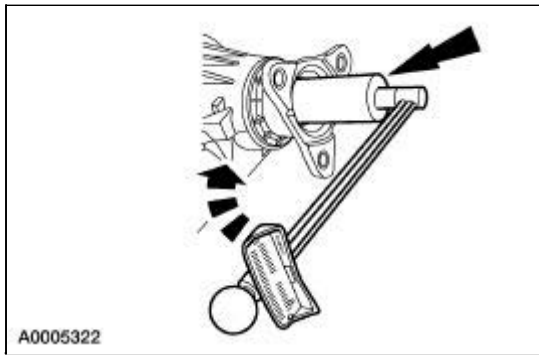
NOTE: Remove the rear wheels and the brake calipers to prevent drag during the drive pinion bearing preload adjustment.

Remove and secure the rear brake calipers aside. For additional information, refer to [Section 206-04](#).

-  **CAUTION: Do not disconnect the driveshaft before referring to [Section 205-01](#).**

Disconnect and position the driveshaft out of the way. For additional information, refer to [Section 205-01](#).

- Install a Nm (inch/pound) torque wrench on the pinion nut and record the torque necessary to maintain rotation of the drive pinion gear (4209) through several revolutions.

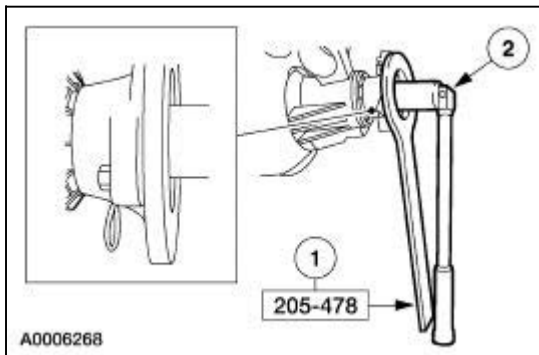


4.  **CAUTION:** After removing the pinion nut, discard it. Use a new nut for installation.

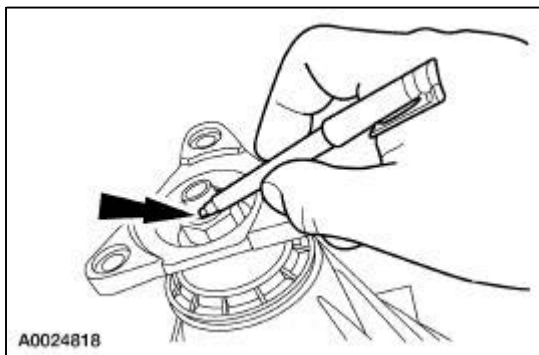
NOTE: Make sure to insert the cotter key on the special tool as shown.

Remove the pinion nut.

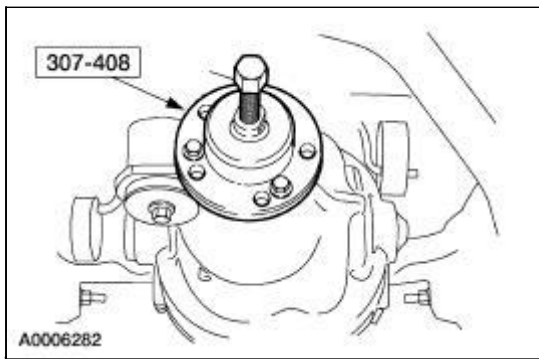
1. Install the special tool.
2. Install a suitable breaker bar and remove the nut.



5. Mark the pinion flange in relation to the drive pinion stem to ensure correct alignment during installation.



6. Using the special tool, remove the pinion flange.



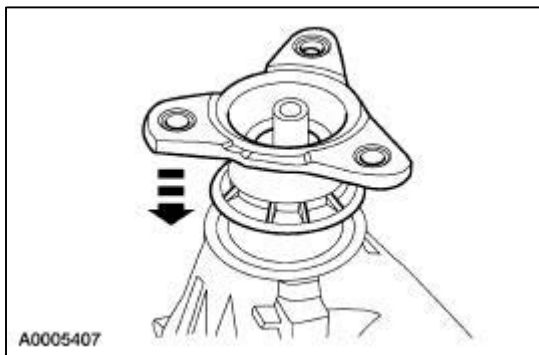
Installation

1. Lubricate the pinion flange splines.
 - Use SAE 75W140 Synthetic Rear Axle Lubricant F1TZ-19580-B or equivalent meeting Ford specification WSL-M2C192-A.

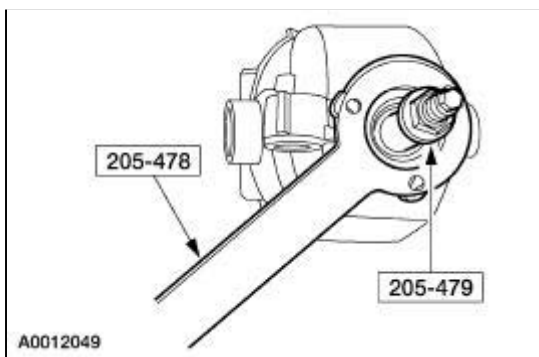
2.  **CAUTION:** Inspect the pinion flange seal journal for rust or nicks/scratches prior to installing the pinion flange. Polish the seal journal with fine crocus cloth, if required.

NOTE: Disregard the alignment marks if installing a new pinion flange.

Align the pinion flange with the drive pinion shaft.



3. Using the special tools, install the pinion flange.



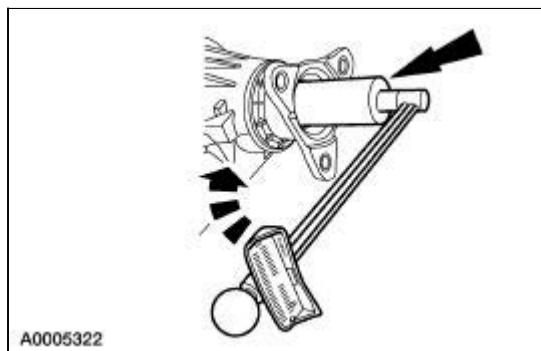
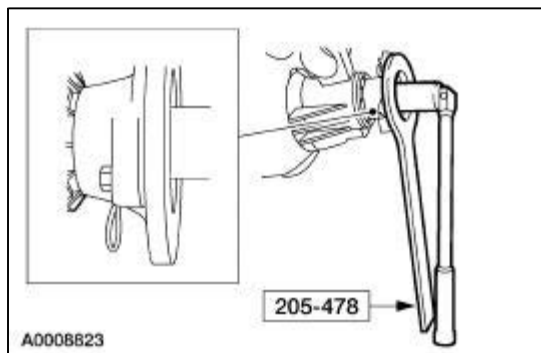
4.  **CAUTION:** Do not under any circumstance loosen the pinion nut to reduce preload. If it is necessary to reduce preload, install a new collapsible spacer and new pinion nut.

NOTE: Always install a new pinion nut.

NOTE: Make sure to insert the cotter key on the special tool as shown.

Use the special tool to hold the pinion flange while tightening the pinion nut.

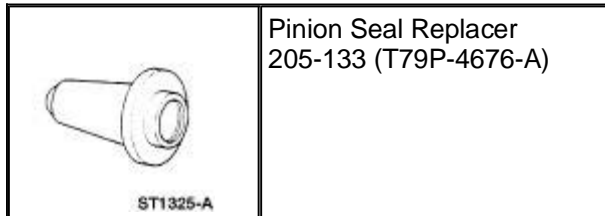
- Rotate the pinion occasionally to make sure the differential pinion bearings (4630) (4621) seat correctly. Take frequent differential pinion bearing torque preload readings by rotating the pinion with a Nm (inch/pound) torque wrench.
- If the preload recorded prior to disassembly is lower than the specification for used bearings, then tighten the pinion nut to specification. If the preload recorded prior to disassembly is higher than the specification for used bearings, then tighten the pinion nut to the original reading as recorded.
- Refer to the torque specification for pinion bearings in the Specifications portion of this section.



5. Connect the driveshaft. For additional information, refer to [Section 205-01](#).
 6. Install the rear brake calipers. For additional information, refer to [Section 206-04](#).
 7. Install the rear wheel and tire assemblies. For additional information, refer to [Section 204-04](#).
-

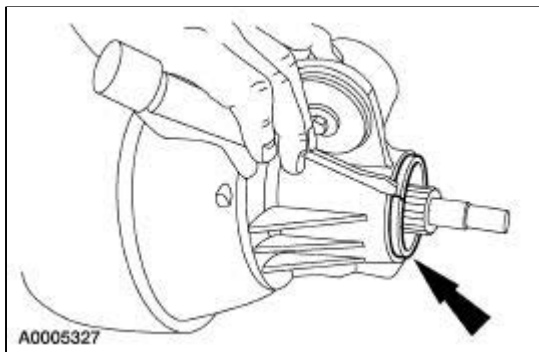
Pinion Seal

Special Tool(s)

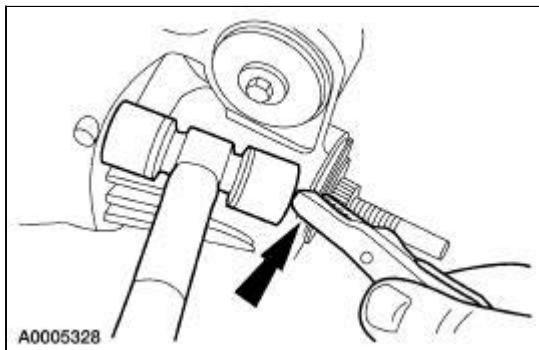


Removal

1. Remove the pinion flange (4851). For additional information, refer to [Drive Pinion Flange](#) in this section.
2. Force up the metal flange of the rear axle drive pinion seal (4676).



3. Strike the pliers with a hammer to remove the rear axle drive pinion seal.



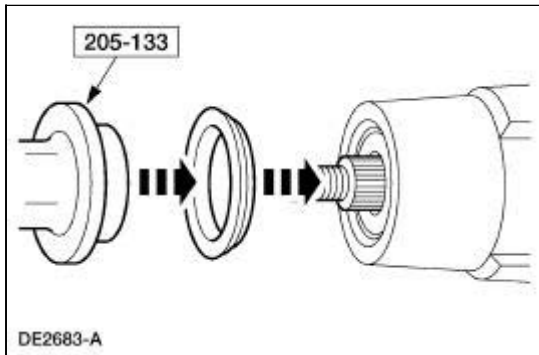
Installation

1. Lubricate the lips of the new rear axle drive pinion seal.
 - Use Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B.

2.  **CAUTION:** Installation without the correct tool can result in early seal failure.

 **CAUTION:** If the rear axle drive pinion seal becomes misaligned during installation, remove it and install a new one.

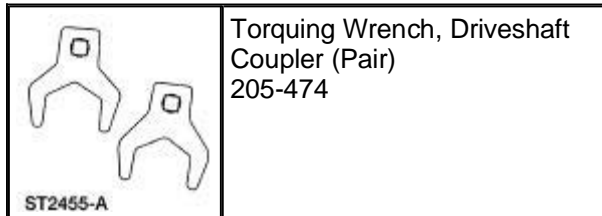
Using the special tool, install the rear axle drive pinion seal.



3. Install the pinion flange. For additional information, refer to [Drive Pinion Flange](#) in this section.
-


Axle Housing

Special Tool(s)

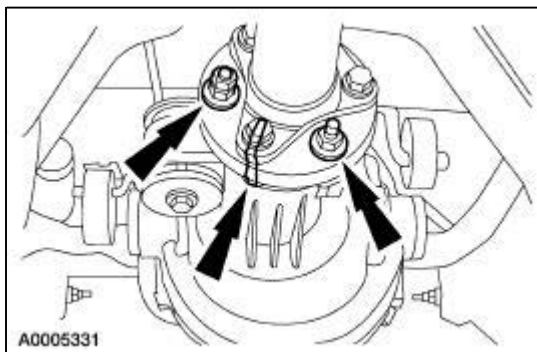


Removal and Installation

1. Remove the halfshafts. For additional information, refer to [Section 205-05](#).
2. Remove the heat shield underbody. For additional information, refer to [Section 309-00](#).

3.  **CAUTION: The driveshaft-to-pinion flange bolts, nuts and weighted nuts must be installed in the same locations from which they were removed.**

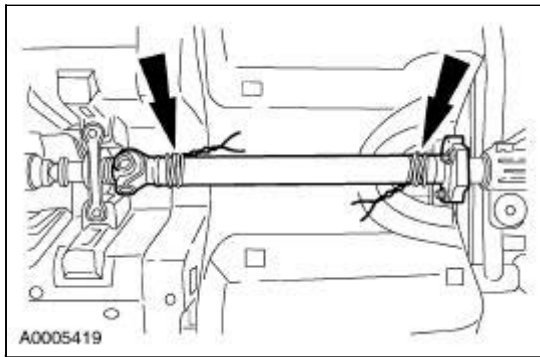
Mark the pinion flange, the driveshaft flexible coupling and each of the three driveshaft-to-pinion flange bolts, nuts and weighted nuts with different color paint so that the driveshaft and differential may be realigned during installation.



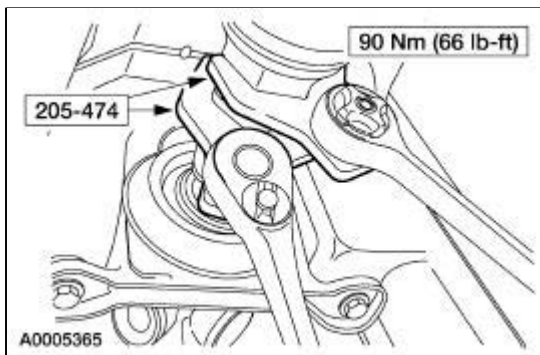
4.  **CAUTION: Do not remove the flex coupling on the driveshaft flange. Make sure to remove only the driveshaft-to-pinion flange bolts and nuts.**

Remove the three driveshaft-to-pinion flange bolts and nuts.

5. Support the driveshaft at the center and rear.



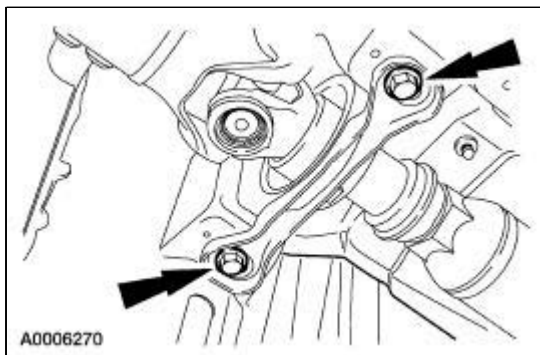
6. Loosen the driveshaft yoke adjuster nut.



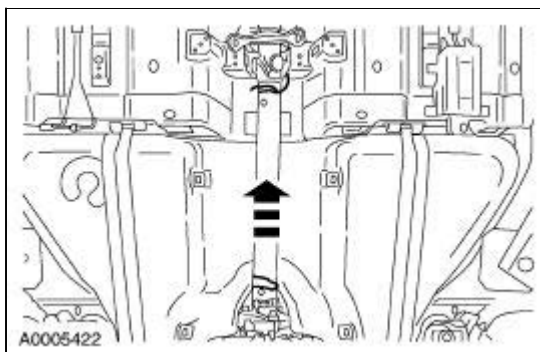
7. **NOTE:** There are shims between the center bearing mounting bracket and the body.

NOTE: The shims must be installed in their original locations.

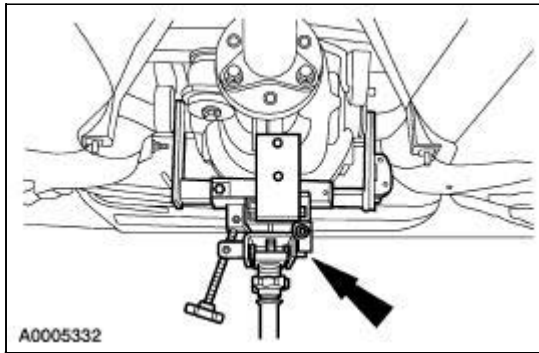
Remove the bolts and the shims.



8. Slide the rear driveshaft to the full forward position and tighten the adjuster nut.

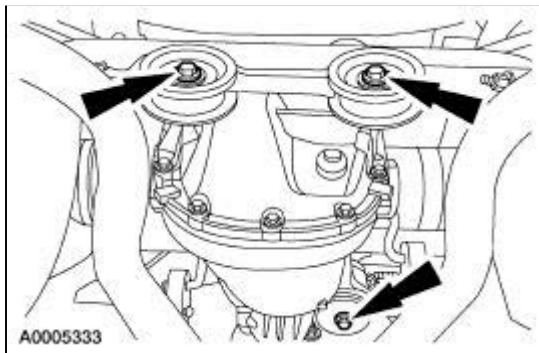


9. Position a suitable jack under the axle housing.



10. **NOTE:** The front mount has a nut and shim on the top.



Remove the three mounting bolts.



11. Lower the axle housing assembly from the vehicle.
 12. To install, reverse the removal procedure.
 - Make sure to position the shim on the front mount before raising the axle housing into position.
-

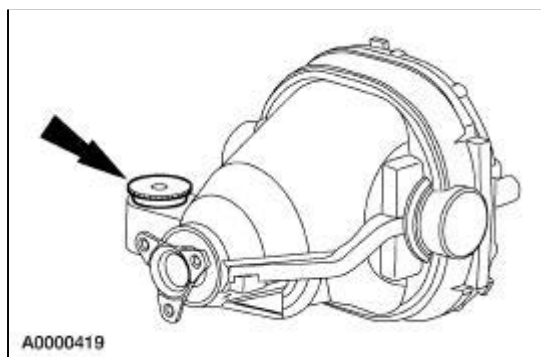
Axle Housing Bushing

Special Tool(s)

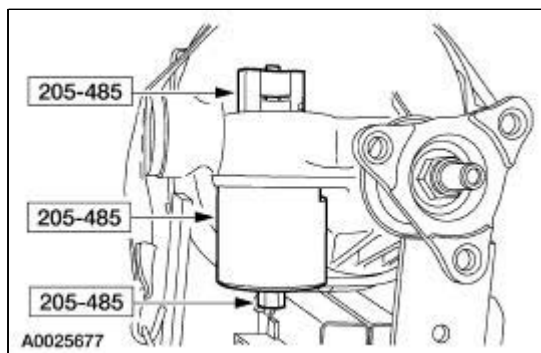
 ST2252-A	Bushings Replacer 204-091 (T85T-5638-A2)
 ST2543-A	Remover/Installer, Differential Bushings 205-485

Removal

1. Remove the axle housing assembly from the vehicle. For additional information, refer to [Axle Housing](#) in this section.
2. Remove the rear axle differential front upper insulator (4B424).

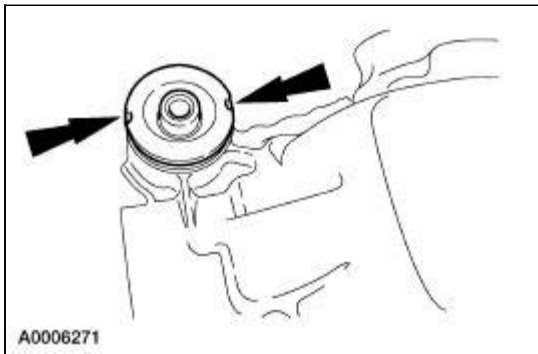


3. Using the special tools, remove the front axle differential front lower insulator (4B431).

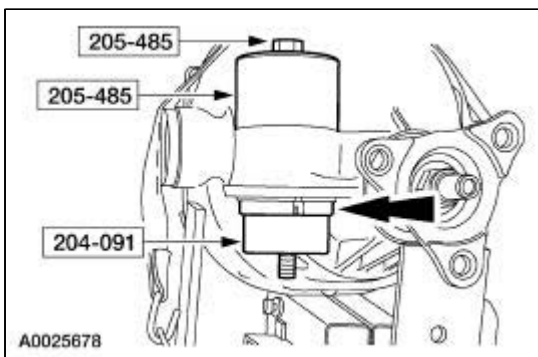


Installation

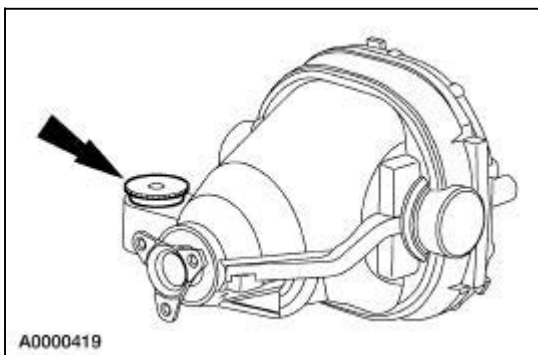
1. Insert the rear axle differential front lower insulator and make sure that the notches are aligned forward and aft.



2. Using the special tools, install the rear axle differential front lower insulator.





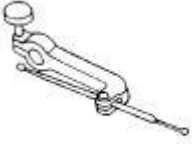




3. Install the rear axle differential front upper insulator.

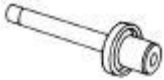


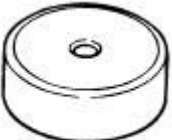
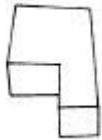
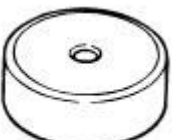




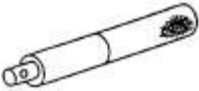

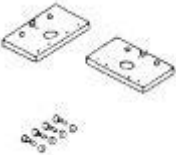

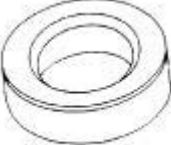


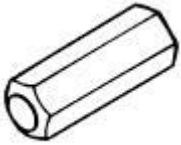
4. Install the rear axle housing. For additional information, refer to [Axle Housing](#) in this section.
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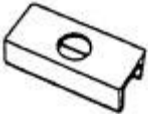


Axle —Aluminum

Special Tool(s)


 <p>ST2026-A</p>	<p>2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent</p>
 <p>ST1165-A</p>	<p>Preload Gauge, Bearing 205-S337 (T93P-4220-AR)</p>
 <p>ST1348-A</p>	<p>Gauge, Clutch Housing 308-021 (T75L-4201-A)</p>
 <p>ST1678-A</p>	<p>Installer, Drive Pinion Bearing Cup 205-054 (T71P-4616-A)</p>
 <p>ST1183-A</p>	<p>Dial Indicator Gauge 100-D005 (D78P-4201-G) or equivalent</p>
 <p>ST1214-A</p>	<p>Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent</p>
 <p>ST1259-A</p>	<p>Spreader, Differential Carrier 205-001 (TOOL-4000-E) or equivalent</p>
	<p>Installer, Differential Side Bearing 205-010 (T57L-4221-A2)</p>

 <p>ST1375-A</p>	
 <p>ST2458-B</p>	<p>Holding Tool, Drive Pinion Flange 205-478</p>
 <p>ST2452-A</p>	<p>Remover, Output Flange 307-408</p>
 <p>ST1743-A</p>	<p>Depth Gauge/Aligner, Depth Pinion 205-477</p>
 <p>ST1431-A</p>	<p>Adapter for 205-S127 205-110 (T76P-4020-A10)</p>
 <p>ST1743-A</p>	<p>Depth Gauge, Drive Pinion 205-476</p>
 <p>ST1434-A</p>	<p>Gauge Tube, Drive Pinion 205-336 (T93P-4020-A)</p>
 <p>ST1432-A</p>	<p>Adapter for 205-S127 205-111 (T76P-4020-A11)</p>
	<p>Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)</p>

 <p>ST1326-A</p>	
 <p>ST1186-A</p>	<p>Holding Fixture, Transmission 307-003 (T57L-500-B)</p>
 <p>ST1344-A</p>	<p>Spreader, Differential Housing (Plate) 205-335 (T93P-4000-A)</p>
 <p>ST1676-A</p>	<p>Installer, Drive Pinion Inner Bearing Cup 205-480</p>
 <p>ST1349-A</p>	<p>Gauge, Differential Bearing 205-338 (T93P-4222-A)</p>
 <p>ST1310-A</p>	<p>Remover, Bearing 205-055 (T71P-4621-B)</p>
 <p>ST1734-A</p>	<p>Installer, Drive Pinion Flange 205-479</p>
 <p>ST1744-A</p>	<p>Protector, Drive Pinion Thread 205-460</p>
	<p>Remover, Drive Pinion Inner Bearing Cup 205-481</p>

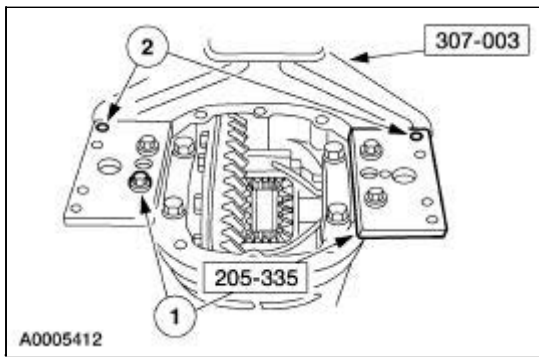
 <p>ST2320-A</p>	
 <p>ST2320-A</p>	<p>Remover, Drive Pinion Outer Bearing Cup 205-482</p>
 <p>ST1350-A</p>	<p>Gauge, Differential Bearing 205-339 (T93P-4222-B)</p>
 <p>ST1429-A</p>	<p>Adapter for 205-S127 205-109 (T76P-4020-A9)</p>
 <p>ST1254-A</p>	<p>Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)</p>
 <p>ST1725-A</p>	<p>Step Plate 205-D061 (D83T-4205-C2) or equivalent</p>
 <p>ST1367-A</p>	<p>Installer, Drive Pinion Bearing Cone 205-005 (T53T-4621-C)</p>

Disassembly

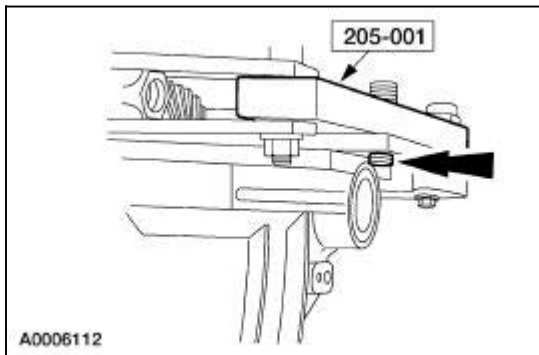
1. Remove the differential housing cover.
2.  **CAUTION: Extreme care must be taken not to damage aluminum rear axle housing (4010) while carrying out these procedures.**

Mount the rear axle housing on the Transmission Holding Fixture.

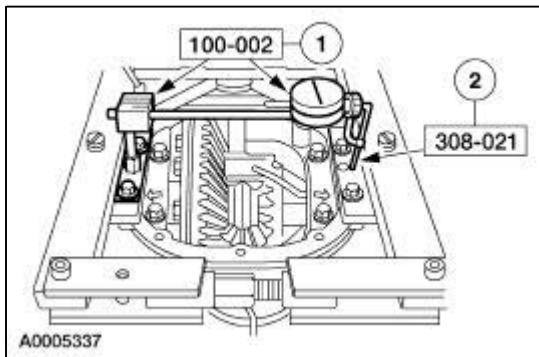
1. Attach the special tools to the rear axle housing with four cover bolts.
2. Attach the Differential Housing (Plates) Spreader to the Transmission Holding Fixture with two 3/8 inch x 1-1/2 inch bolts.




3. Install the Differential Carrier Spreader onto the Differential Housing (Plates) Spreader Adapters with the spreader pins aligned with the holes in the Housing Spreader Adapters.



4. Assemble the special tools.
 1. Install the Dial Indicator Gauge.
 2. Attach the Clutch Housing Gauge Adapter to the Dial Indicator Gauge with the tip positioned in the spreader adapter hole.

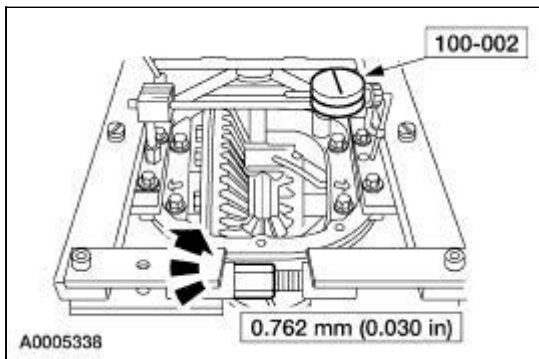


5.  **CAUTION: Overspreading can damage the rear axle housing.**

NOTE: Tighten and loosen the housing spreader adapter screw to normalize the Differential Housing (Plates) Spreader prior to the final Dial Indicator Gauge reading.

Adjust the dial indicator to zero and tighten the housing spreader screw until the rear axle housing is spread to specification.

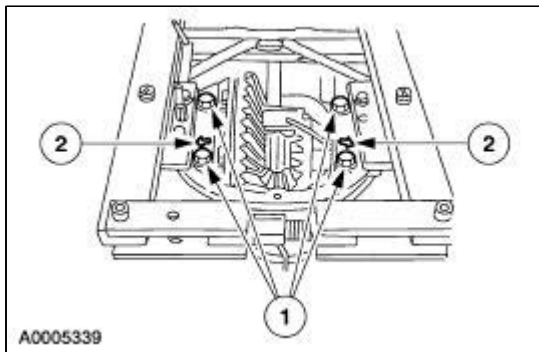
- Remove the Dial Indicator Gauge.




6. **NOTE:** Mark the position of the bearing caps as arrows may not be visible. The bearing caps must be installed in their identical locations and positions.

Remove the differential bearing caps.

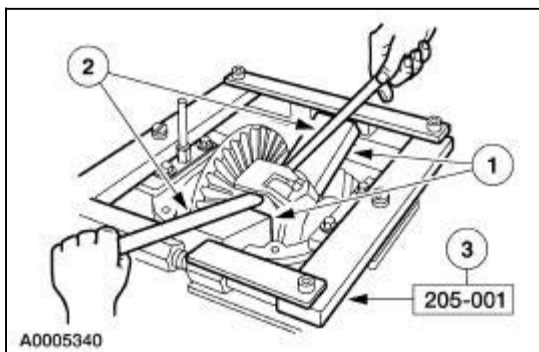
1. Remove the bearing cap retaining bolts.
2. Remove the differential bearing caps.



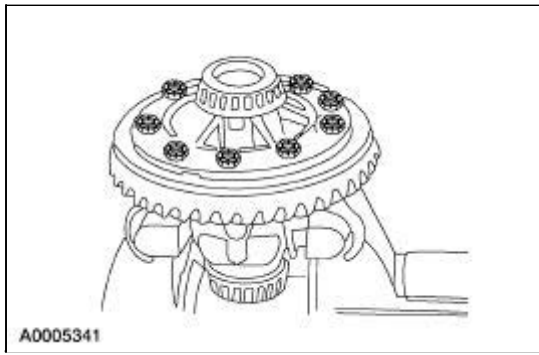
7.  **CAUTION: Wood blocks must be used to avoid rear axle housing damage.**

Remove the differential case (4204).

1. Position wood blocks on top and bottom of the differential (4026).
2. Pry the differential case and the differential bearing shims (4067) out of the rear axle housing.
3. Remove the special tool.

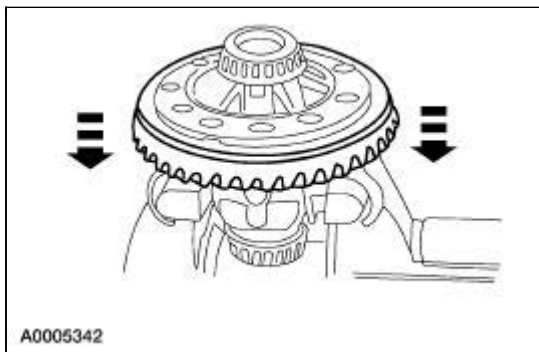


8. Remove the 10 ring gear bolts.

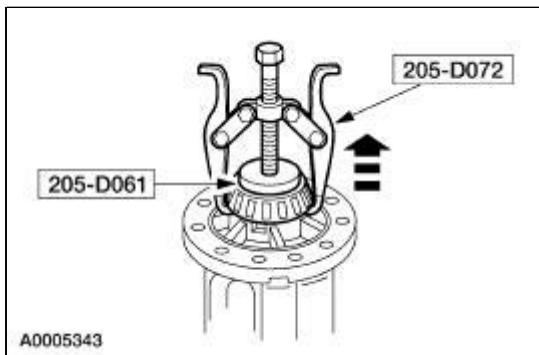


9.  **CAUTION:** Care should be taken not to damage the bolt hole threads.

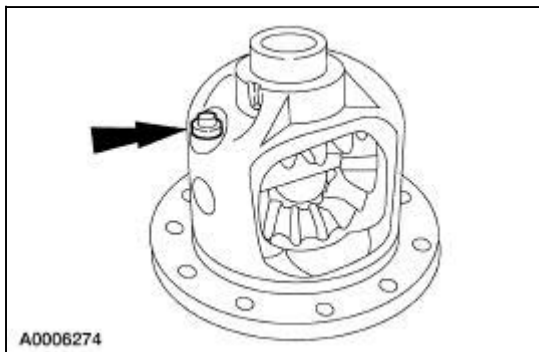
Insert a punch in the bolt holes and drive the ring gear off.



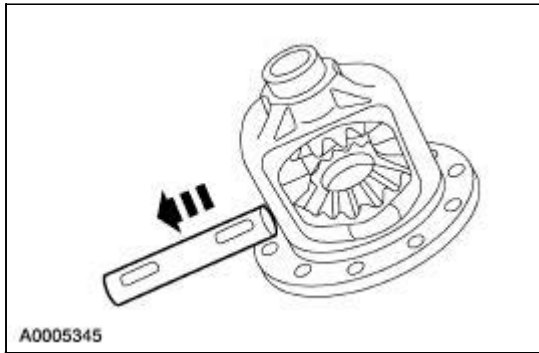
10. Using the special tools, remove the differential bearing (4221).
● Repeat for the other side.



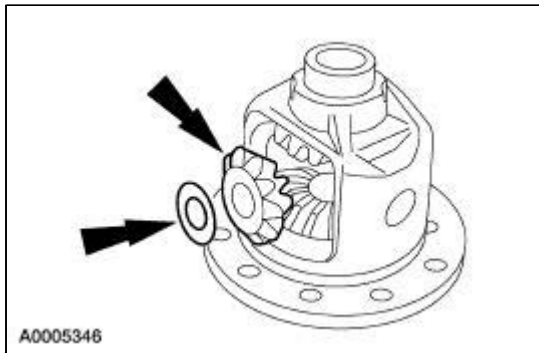
11. Remove the differential pinion shaft lock bolt.



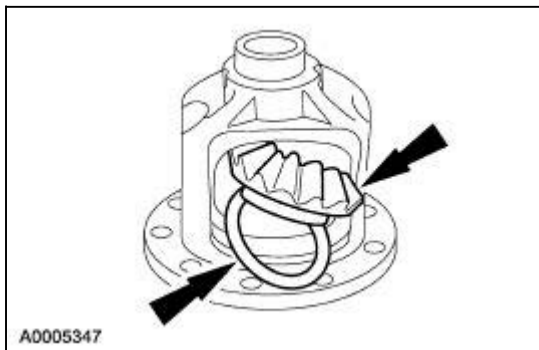
12. Remove the differential pinion shaft.



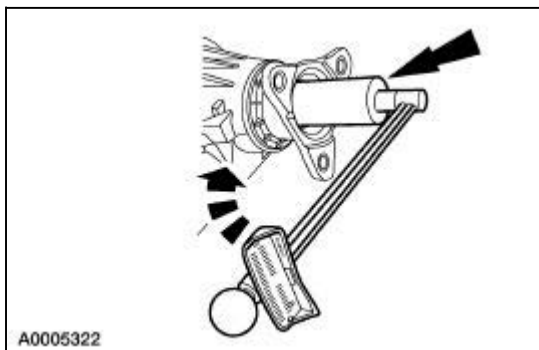
13. Remove the differential gears.



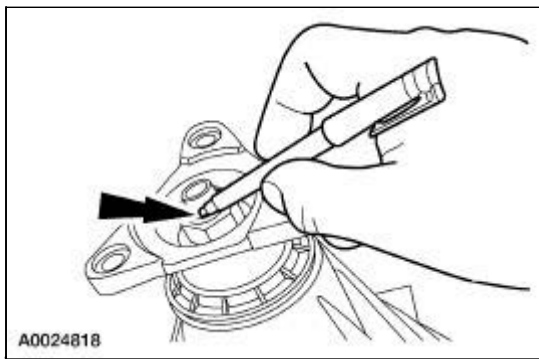
14. Remove the differential side gears.



15. Install a Nm (inch/pound) torque wrench on the pinion nut and record the torque necessary to maintain rotation of the drive pinion gear (4209) through several revolutions.



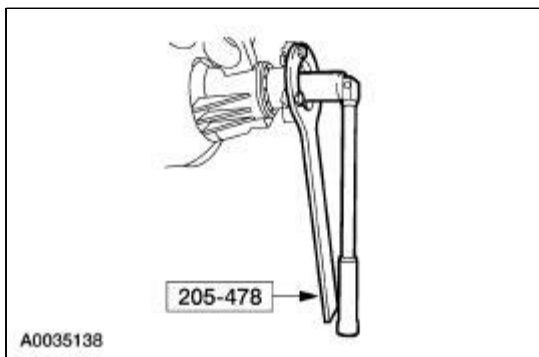
16. Mark the pinion flange in relation to the drive pinion stem to make sure of correct alignment during installation.



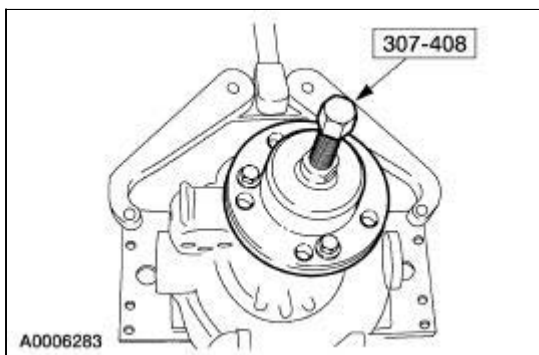
17.  **CAUTION:** After removing the pinion nut, discard it. Use a new nut for installation.

Remove the pinion nut.

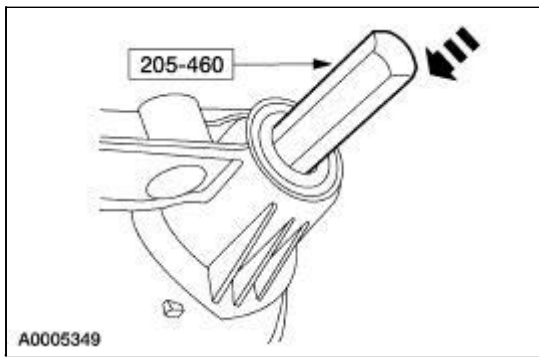
- Install the special tool.
- Install a suitable breaker bar and remove the nut.



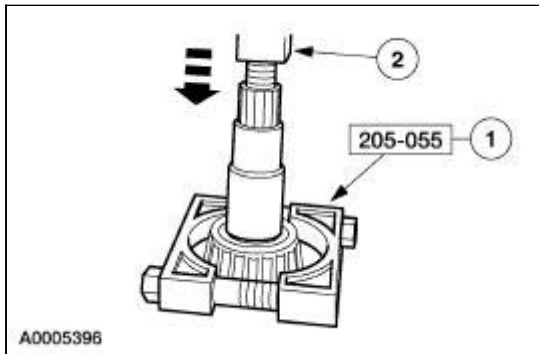
18. Using the special tool, remove the pinion flange.



19. Install the special tool and, with a soft-faced hammer, drive the pinion out of the front bearing cone and remove it through the rear of the housing.
- Remove the rear axle drive pinion shaft oil slinger (4670), the rear axle drive pinion seal (4676) and the collapsible spacer.

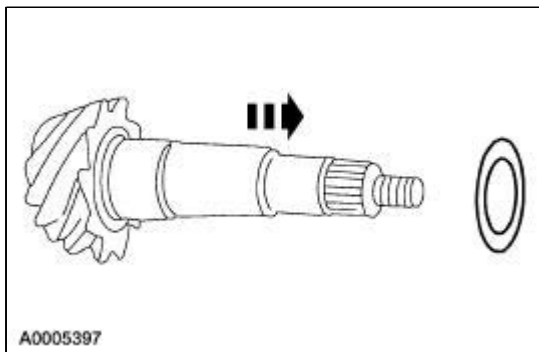


20. Remove the front pinion bearing.
 1. Position the special tool under the pinion bearing.
 2. Using a press, remove the pinion bearing.

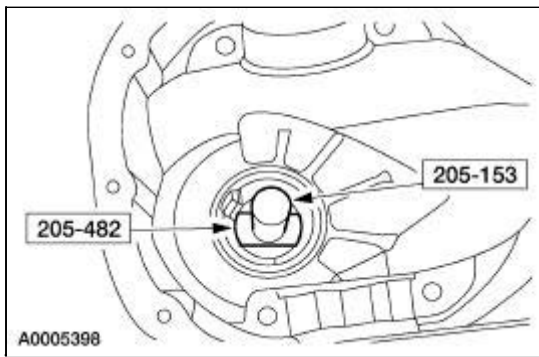


21. **NOTE:** Measure the drive pinion bearing adjustment shim (4663), which is found under the differential pinion bearing, with a micrometer and record the thickness. (Use this as a reference to compare the shim gauge reading prior to installing the differential pinion bearing.)

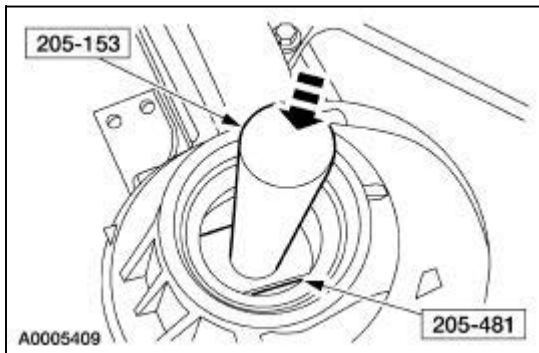
Remove the drive pinion bearing adjustment shim.



22. If required, remove damaged rear axle pinion bearing cup (4616) from the rear axle housing using the special tools.



23. If required, remove rear axle pinion bearing cup (4628) from the rear axle housing using the special tools.

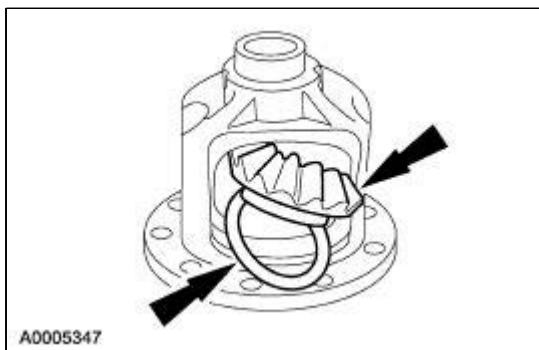


Assembly

All vehicles

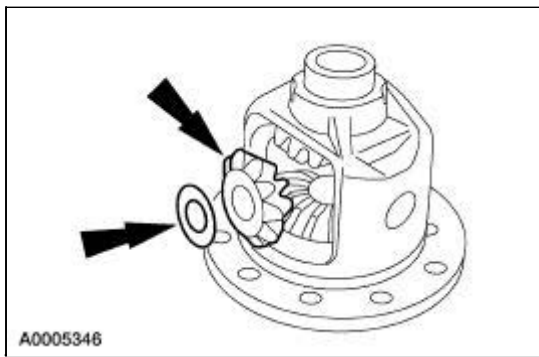
1.  **CAUTION:** Lubricate the differential side gear thrust washers with Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B prior to installation.

Install the differential side gears in the differential case.



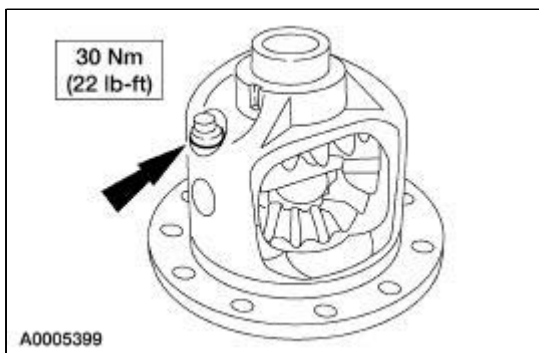
2.  **CAUTION:** Lubricate the differential pinion thrust washers with Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B prior to installation.

Install the differential pinion gears with the differential pinion thrust washers in the differential case.

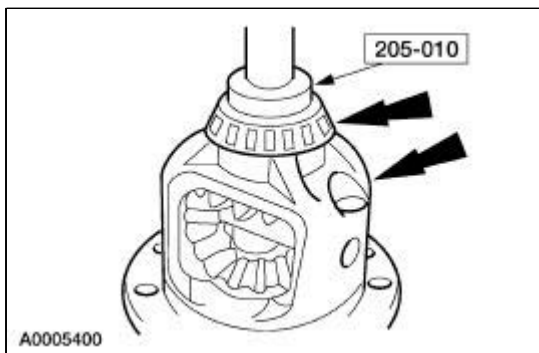


3. **NOTE:** If a new pinion shaft lock bolt is unavailable, coat the threads with Threadlock® and Sealer E0AZ-19554-AA or equivalent meeting Ford specifications WSK-M2G351-A5 prior to installation.

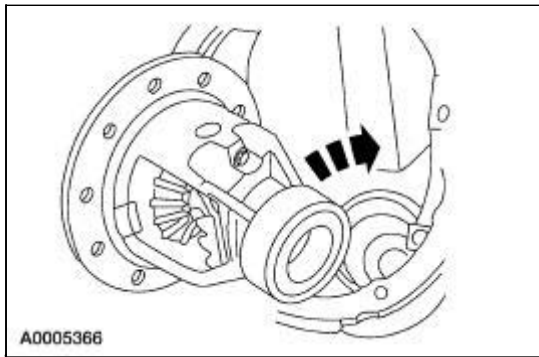
Install the differential pinion shaft and install a new differential pinion shaft lock bolt.



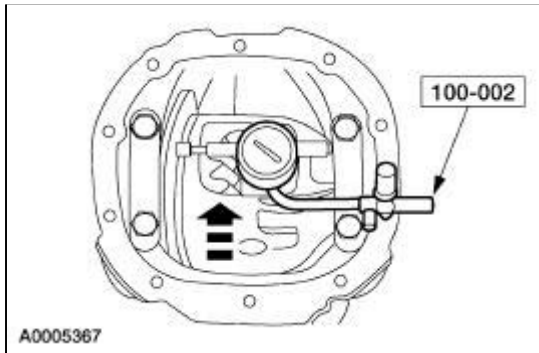
4. Use the special tool to install the differential bearing on the differential case. Repeat for the other side.



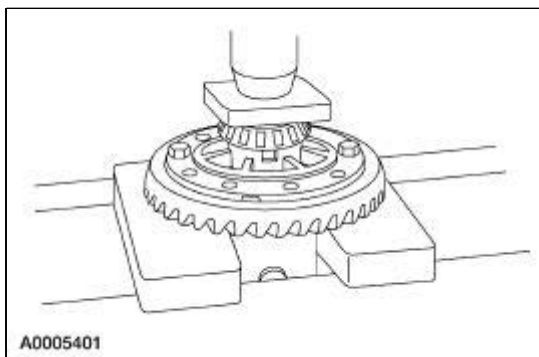
5. Install the differential case without the ring gear.
 - Rotate the differential case to correctly seat the differential bearings.



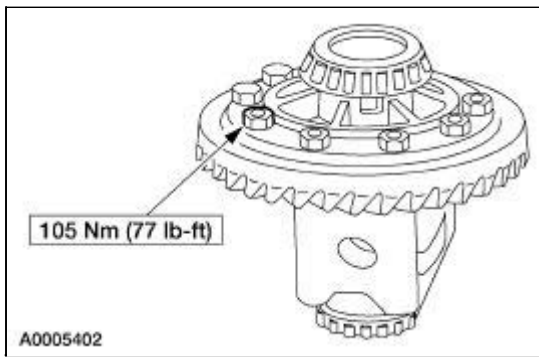
6. Check the differential case flange runout using the special tool.
 - If the runout is within specification, install a new ring gear and pinion. If the runout exceeds specification, the ring gear is true and the concern is due to either a damaged differential case or differential bearings.
 - Inspect the differential bearings. If the differential bearings are not damaged, install a new differential case and the differential bearings.
 - Recheck the runout with the new differential case and differential bearings.



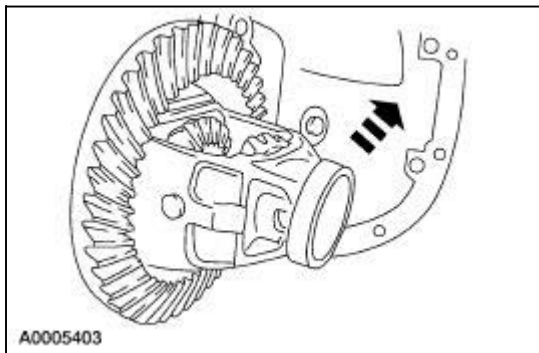
7. Remove the differential case.
8. Press the ring gear on the differential case.
 - Start two of the ring gear bolts through the differential case and into the ring gear to make sure the ring gear bolt holes align with the differential case bolt holes correctly.



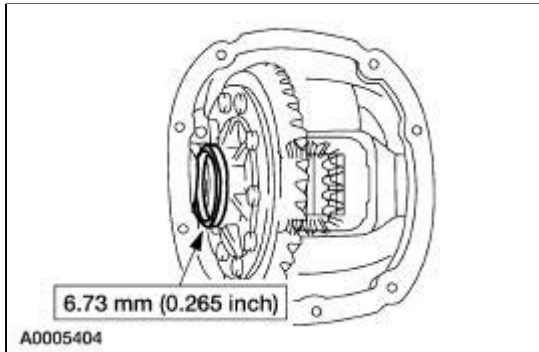
9. Install the ring gear bolts.
 - Apply Stud and Bearing Mount E0AZ-19554-BA or equivalent meeting Ford specification WSK-M2G349-A1 to the ring gear bolts.



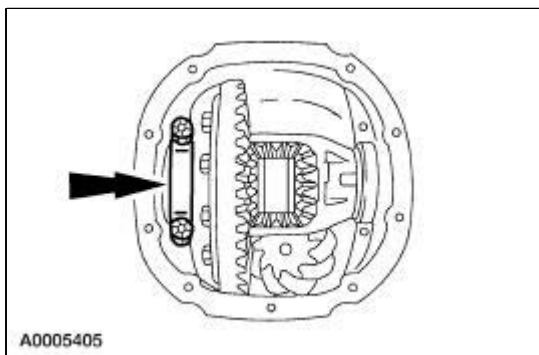
10. With the pinion removed, place the differential case/gear subassembly with the differential bearing and the rear axle pinion bearing cups in the rear axle housing.



11. Install a differential bearing shim of the thickness shown on the LH side of the differential case.

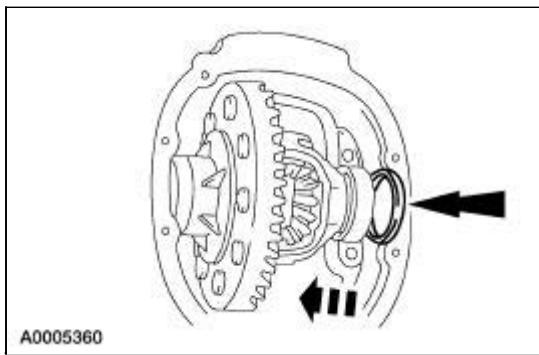


12. Install the LH bearing cap finger-tight.

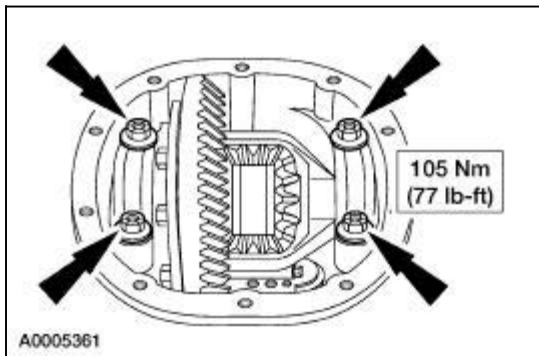


13. **NOTE:** Apply pressure toward the left side to fully seat the differential bearing cup (4222).

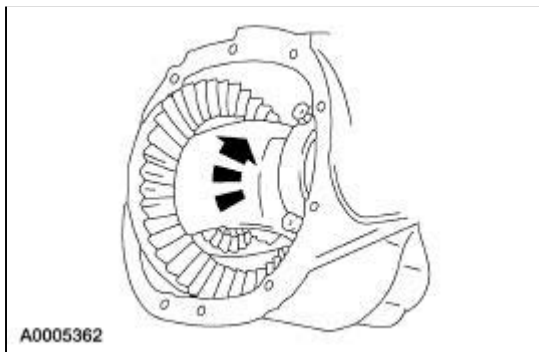
Install progressively larger differential bearing shims on the RH side until the largest differential bearing shim selected can be assembled with a slight drag feel.



14. Install the RH bearing cap.
 - Tighten both bearing caps to specification.

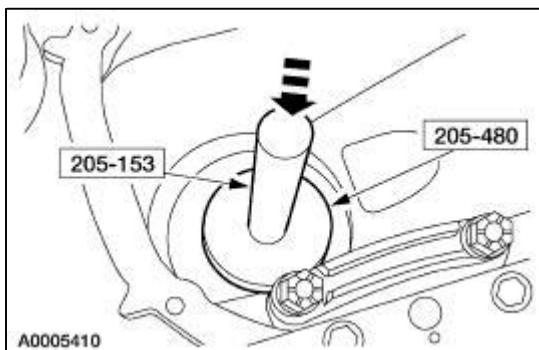


15. Rotate the differential assembly to make sure it rotates freely.

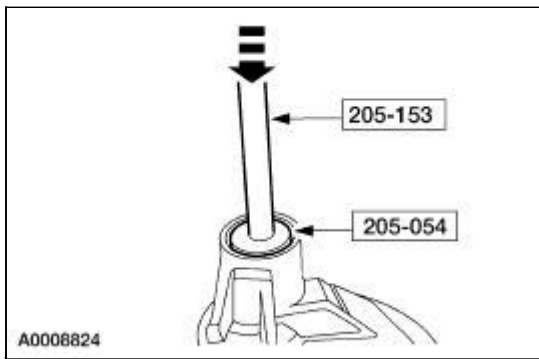


Pinion bearing cup installation with special tools 205-153, 205-480, and 205-054

16. Install a new inner rear axle pinion bearing cup in the rear axle housing.



17. Install a new outer rear axle pinion bearing cup in the rear axle housing.

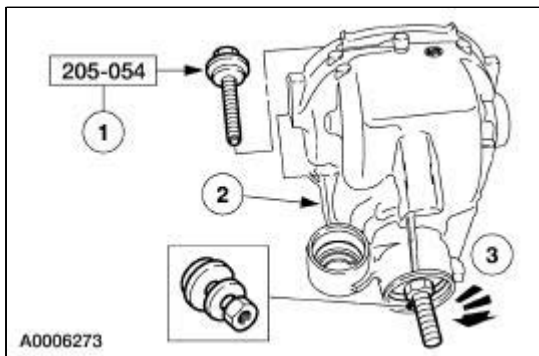


Pinion bearing cup installation with special tool 205-054

18. **NOTE:** Coat the new rear axle pinion bearing cup with SAE 5W-30 Super Premium Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.

Install the pinion bearing cup.

1. Position the rear axle pinion bearing cup on the special tool.
2. Position the bearing cup replacer in the rear axle housing.
3. Tighten the special tool to fully seat the rear axle pinion bearing cup in the bore.

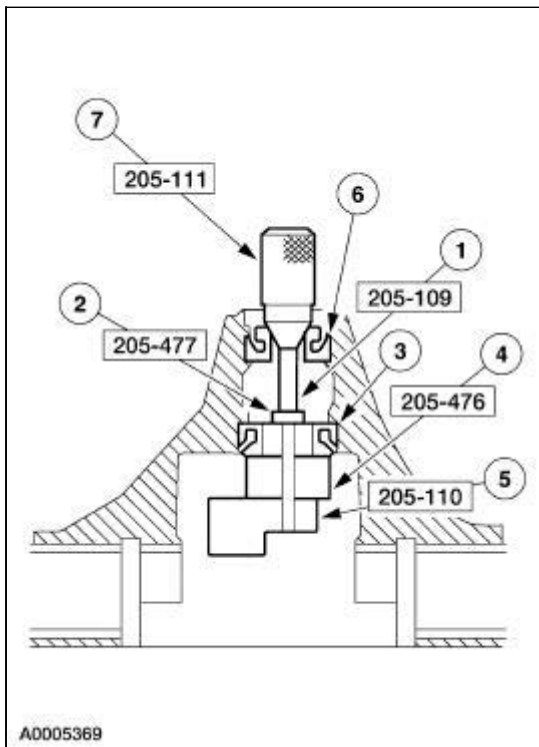


All vehicles

19. **NOTE:** A drive pinion bearing adjustment shim is used between the pinion bearing and the pinion head. The drive pinion bearing adjustment shim compensates for machining variations in the differential pinion and the pinion bearings. The correct drive pinion bearing adjustment shim size will locate the pinion for correct tooth contact with the ring gear. Selecting the correct drive pinion bearing adjustment shim can be done using a pinion depth gauge set.

NOTE: Apply a light film of SAE 75W-140 High Performance Rear Axle Lubricant F1TZ-19580-B or equivalent meeting Ford specification WSL-M2C192-A on the front differential pinion bearing and the rear differential pinion bearing assemblies.

Install the special tools.

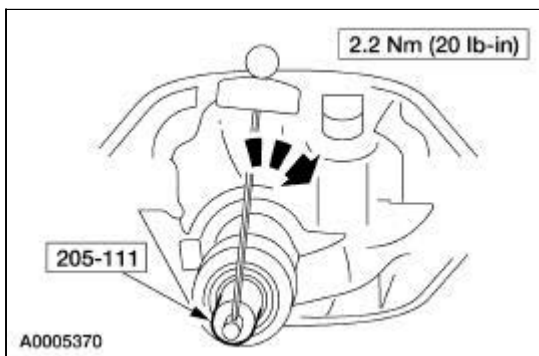


A0005369

Item	Part Number	Description
1	205-109	Adapter for 205-S127 (T76P-4020-A9)
2	205-477	Gauge aligner, depth pinion
3	4630	Rear (inner) pinion bearing
4	205-476	Gauge disc, drive pinion
5	205-110	Gauge block (1.7 inch thick) (T76P-4020-A10)
6	4621	Front (outer) pinion bearing
7	205-111	Adapter for 205-S127 (T76P-4020-A11)

20. **NOTE:** This step duplicates pinion bearing preload.

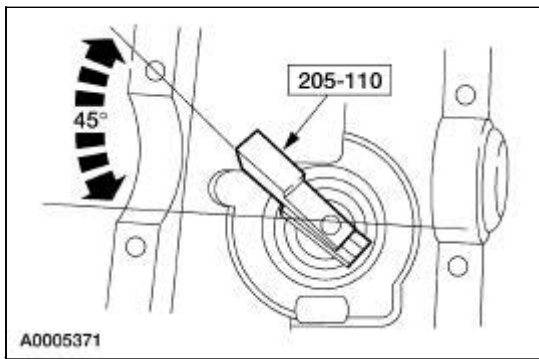
Thread the Handle onto the Screw and tighten to the specification shown.



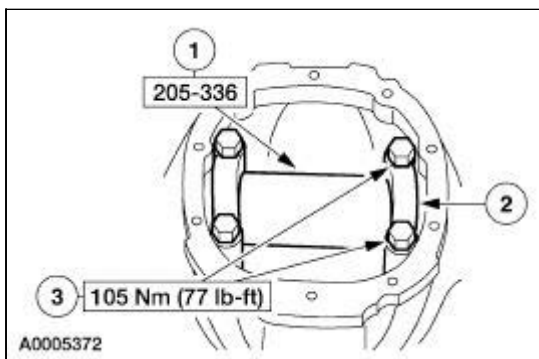
21. **NOTE:** The special tool must be offset to obtain an accurate reading.

NOTE: Rotate the special tool several half turns to correctly seat the pinion bearings.

Position the special tool 45 degrees as shown.



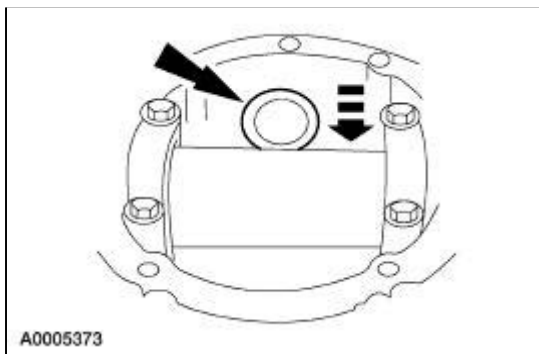
22. Install the special tool.
 1. Position the special tool on the differential bearing seat of the rear axle housing.
 2. Install the differential bearing caps.
 3. Install the differential bearing cap bolts and tighten to specification.



23. **NOTE:** A slight drag should be felt for the correct shim selection.

NOTE: Use a shim to determine shim thickness.

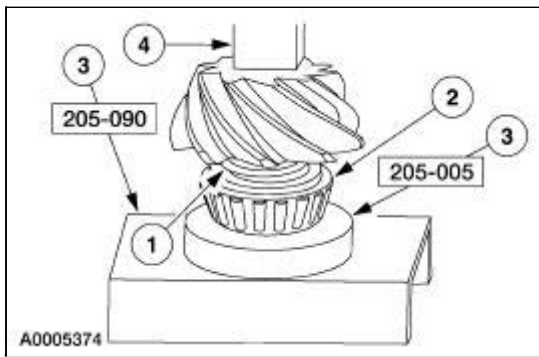
Select and check the correct shim size.



24. Remove the special tool.
25. **NOTE:** The same pinion bearings and drive pinion bearing adjustment shim used in the drive pinion shim selection procedure must be used in the final axle assembly.

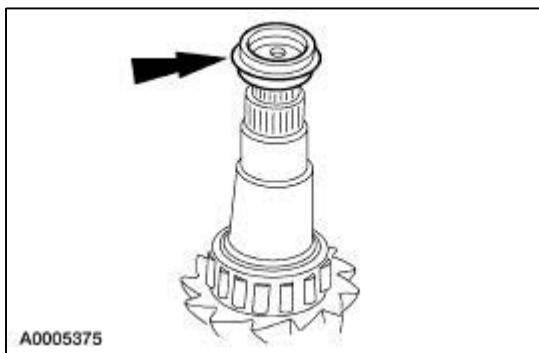
Install the rear pinion bearing.

1. Position the drive pinion bearing adjustment shim on the pinion stem.
2. Position the pinion bearing on the pinion stem.
3. Position the special tool on the pinion stem.
4. Using a press, firmly seat the drive pinion bearing adjustment shim and pinion bearing on the pinion stem.

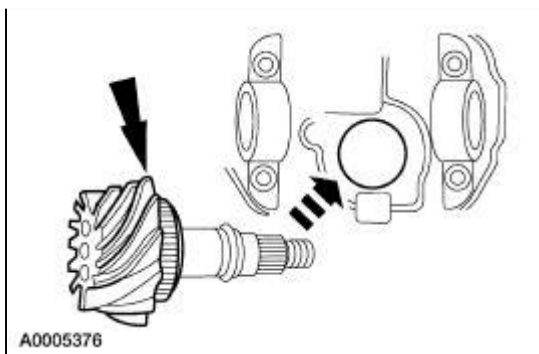


26. Install the front pinion bearing, the rear axle drive pinion shaft oil slinger and the rear axle drive pinion seal in the differential housing.
27. **NOTE:** Make sure the splines on the pinion stem are free of burrs. If burrs are evident, remove using a fine crocus cloth, working in a rotational motion.

Place a new drive pinion collapsible spacer on the pinion stem against the pinion stem shoulder.



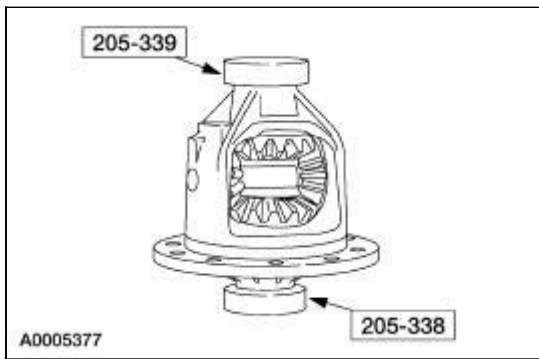
28. Install the drive pinion and the new drive pinion collapsible spacer into the rear axle housing.



29. **⚠ CAUTION:** Take extreme care not to damage aluminum rear axle housing while carrying out these procedures.

⚠ CAUTION: Master bearings are marked LH and RH and must be installed as shown.

Remove the differential bearings and install the special tools on the differential case.

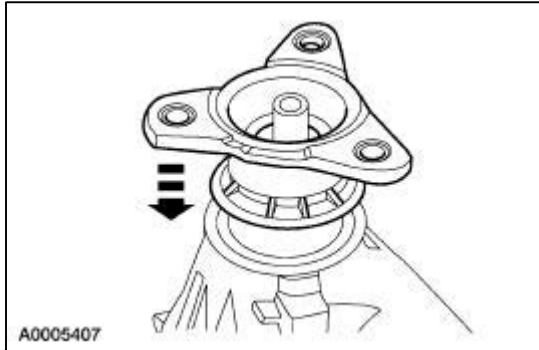


30. **NOTE:** Lubricate the rear axle pinion flange splines. Use SAE 75W-140 High Performance Rear Axle Lubricant F1TZ-19580-B or equivalent meeting Ford specification WSL-M2C192-A.

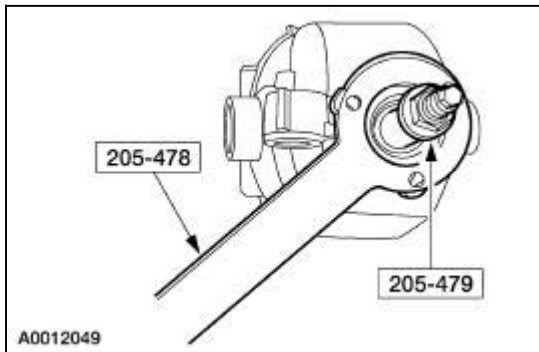
Install the rear axle pinion flange.

- **NOTE:** Disregard the scribe marks if a new rear axle pinion flange is being installed.

Align the rear axle pinion flange with the drive pinion shaft.



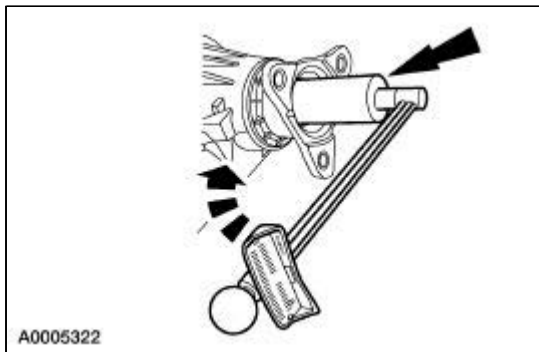
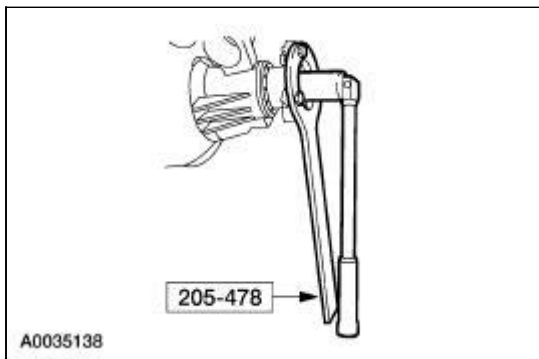
31. With the drive pinion in place in the rear axle housing, install the rear axle pinion flange using the special tools.



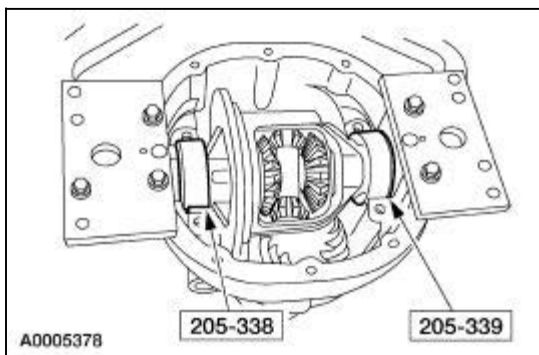
32. **CAUTION:** Do not under any circumstance loosen the pinion nut to reduce preload. If it is necessary to reduce preload, install a new collapsible spacer (4662) and new pinion nut.

Use the special tool to hold the pinion flange while tightening the new pinion nut.

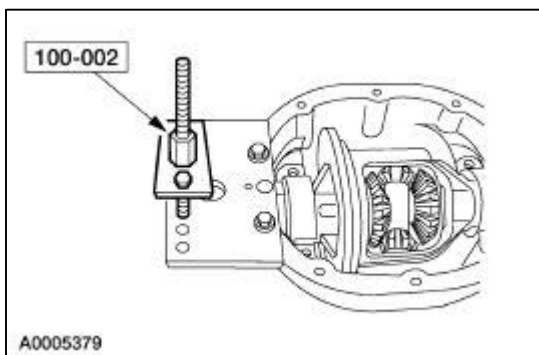
- Rotate the pinion occasionally to make sure the differential pinion bearings (4630) (4621) seat correctly. Take frequent differential pinion bearing torque preload readings by rotating the pinion with a Nm (inch/pound) torque wrench.
- Refer to the torque specification for pinion bearings in the Specifications portion of this section.



33. Place the differential case and the special tools into the rear axle housing.



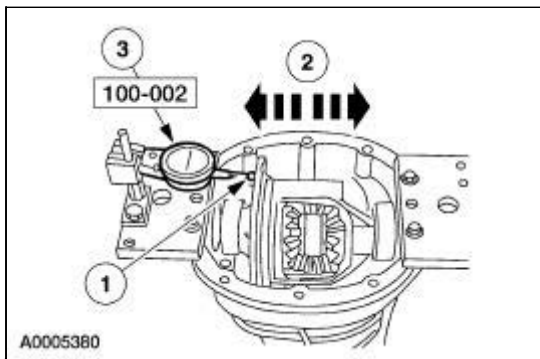
34. Position the special tool on the outside mounting hole.



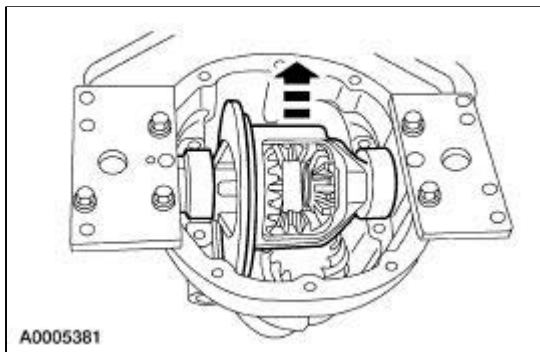
35. **NOTE:** Repeat this step until a consistent reading is obtained.

Measure the total end play.

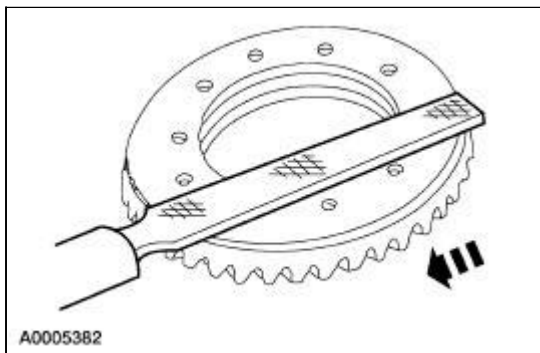
1. Attach the special tool with the indicator tip positioned on the machined surface of the differential case flange.
2. Move the differential case to the left and the right (as far as possible).
3. Record the reading on the differential bearing shim selection procedure line A.



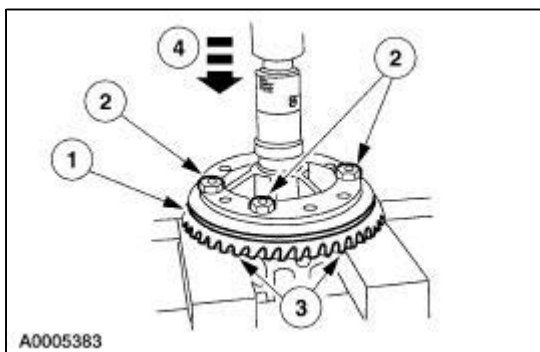
36. Remove the special tool and the differential case from the rear axle housing.



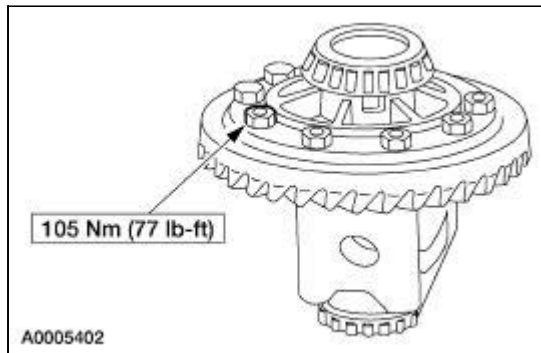
37. Draw-file the differential ring gear mounting surface to remove any nicks or burrs.



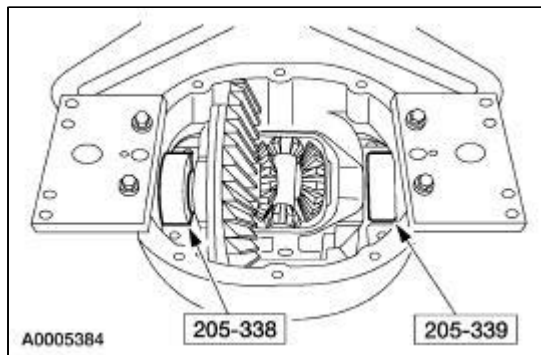
38. Install the ring gear.
1. Place the ring gear onto the differential case.
 2. Hand start three bolts to align the holes in the ring gear and the differential case.
 3. Place the differential case and ring gear onto the press bed blocks with the ring gear teeth facing down.
 4. Press the ring gear into place.



39. Install the remaining ring gear bolts and tighten to specification.



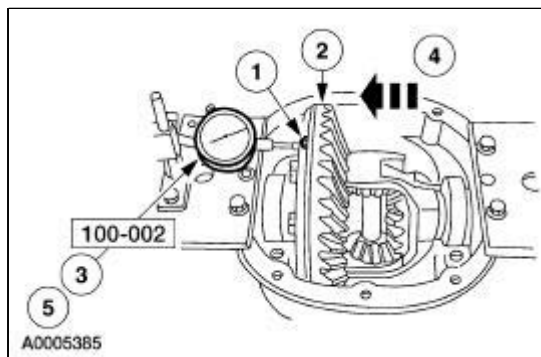
40. Place the differential case, special tools and the ring gear into the rear axle housing.



41. **NOTE:** The ring gear bolt heads inside the rear axle housing may interfere. If so, remove three to five bolts to provide clearance.

Measure the end play.

1. Attach the special tool with the indicator tip positioned on the machined surface of the differential case flange.
2. Rock the ring gear to allow full mesh with the pinion gear.
3. With the gears in full mesh, set the special tool to zero.
4. Move the differential case as far as possible to the left and note the reading.
5. Record the reading on the differential bearing shim selection procedure line B.



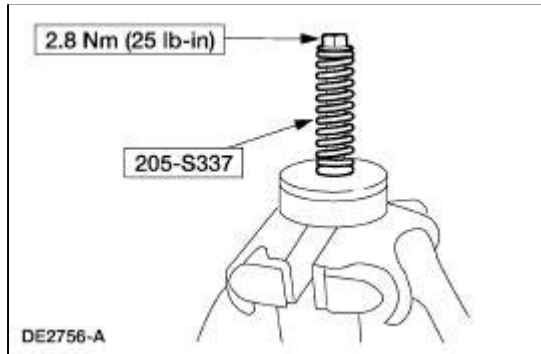
42. Remove the special tool and the differential case from the rear axle housing.

43. **NOTE:** The stand height of both differential bearing assemblies must be measured prior to installation.

Install the special tool.

1. Place the bearing preload gauge base in a soft-jawed vise with the bearing mounting surface above the vise jaws.

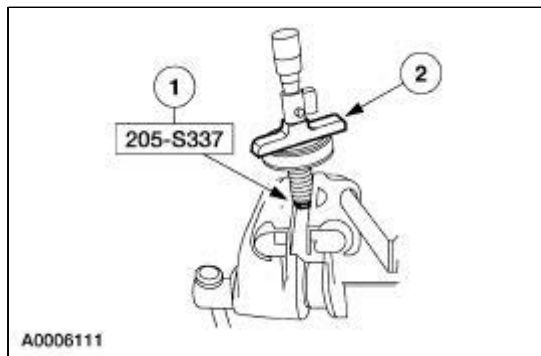
2. Position the differential bearing assembly on the bearing preload tool base.
3. Attach the bolt, spring, washers and spacer.
4. Tighten the bolt to specification shown.



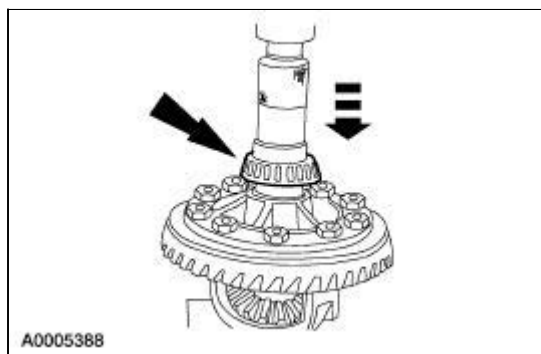
44. **NOTE:** Mark the differential bearing assemblies left and right before measuring.

Measure the differential bearing stand height.

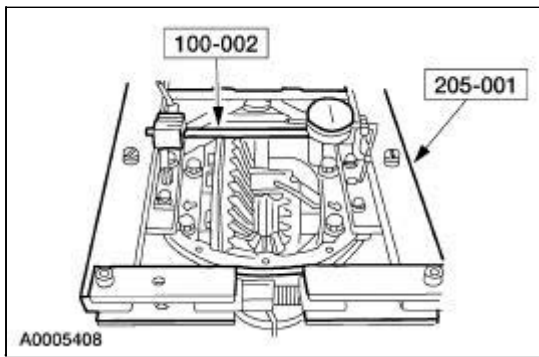
1. Invert the special tool and clamp the bolt head in a vise.
2. Position a depth micrometer flat on the differential bearing assembly.




45. Measure the stand height of both differential bearing assemblies and record on the differential bearing shim selection procedure line D.
46. Press the left and right differential bearing on the differential case.



47. Install the special tools.

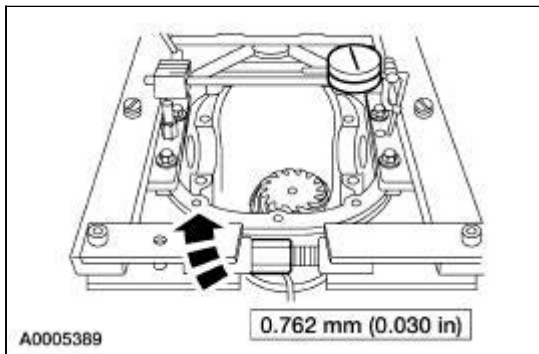


48.  **CAUTION: Overspreading can damage the rear axle housing.**

NOTE: Tighten and loosen the housing spreader adapter screw to normalize the Housing Spreader Adapters prior to the final Dial Indicator reading.

Adjust the Dial Indicator Gauge to zero and tighten the Differential Carrier Spreader screw to spread the rear axle housing to specification.

- Remove the Dial Indicator Gauge.

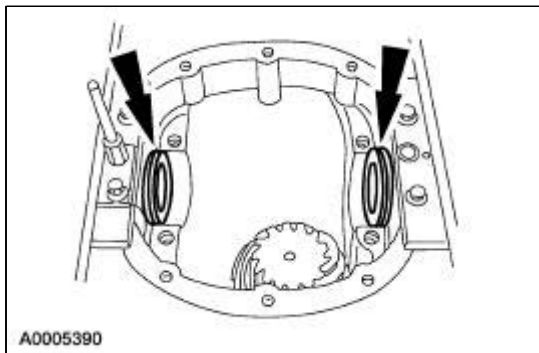


49. **NOTE:** Apply a light coating of Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B to the differential bearing shim to help hold in place.

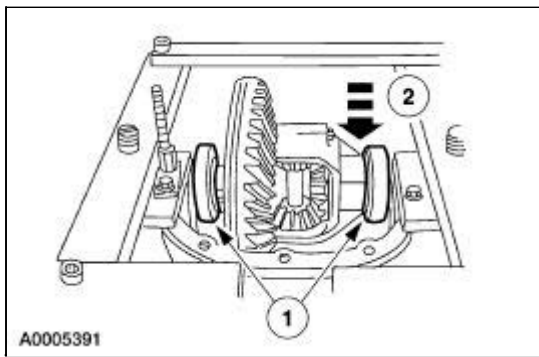
NOTE: Select the correct size differential bearing shims by using the differential bearing shim selection chart.

Install the differential bearing shims.

- Place the differential bearing shims in the rear axle housing.

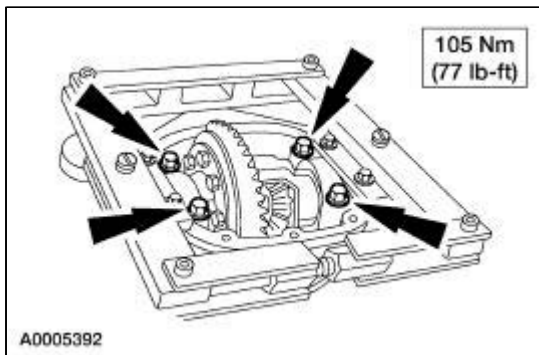


50. Install the differential case.
1. Position the differential bearing cups on the differential bearings.
 2. Lower the differential case in place between the differential bearing shims.

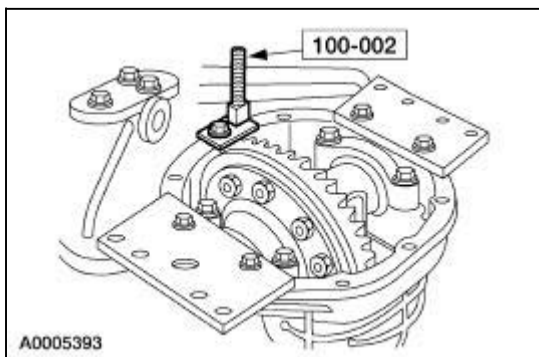


51. **NOTE:** Tighten the bearing cap bolts prior to releasing the housing spreader.

Install the bearing caps in their original positions and tighten the bolts to specification.



52. Remove the Differential Carrier Spreader and move the Dial Indicator Gauge to the 12 o'clock position.



53. **NOTE:** Measure the ring gear backlash at four places to obtain a consistent reading.

Measure the backlash.

1. Attach the special tool.
2. Position the indicator needle centrally on a drive tooth.
3. Zero the indicator.
 - Turn the ring gear without turning the pinion gear. Record the indicator reading.



54. If the backlash is not to specification, correct by increasing the thickness of one differential bearing shim and decreasing the thickness of the other differential bearing shim by the same amount. Refer to the following tables.

Differential Bearing Shim Selection Chart

8.0-inch Aluminum Axle	Example	Actual
Line A End play without ring gear	0.498	
Line B End play with ring gear (ring gear side)	-0.245	
Line C Subtract Line B from Line A, also record on Line C, below	0.253	

8.0-inch Aluminum Axle	Left Differential Bearing Height		Right Differential Bearing Height	
	Example	Actual	Example	Actual
Master bearing height	0.8695	0.8695	0.8695	0.8695
Line D Actual bearing height	-0.8478		-0.8491	
Line E Difference	0.0217		0.0204	

8.0-inch Aluminum Axle	Left Side		8.0-inch Aluminum Axle	Right Side	
	Example	Actual		Example	Actual
Line B End play Line E Bearing height	0.2450 +0.0217	+	Line C End play Line E Bearing height	0.2530 +0.0204	+
TOTAL Lines B and E Backlash (subtract)	0.2667 -0.0060	-0.006	TOTAL Lines C and E Backlash/preload (add)	0.2734 +0.020	+0.020
Initial thickness ^a	0.2607		Initial thickness	0.2934	

Final shim thickness — left	0.261		Final shim thickness — right	0.293	
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^a Round off initial thickness to the nearest shim thickness as in example for final shim thickness.

Backlash Change Required		Thickness Change Required	
mm	Inch	mm	Inch
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.355	0.014	0.457	0.018
0.381	0.015	0.508	0.020

Differential Shim Size Chart — 4067 —

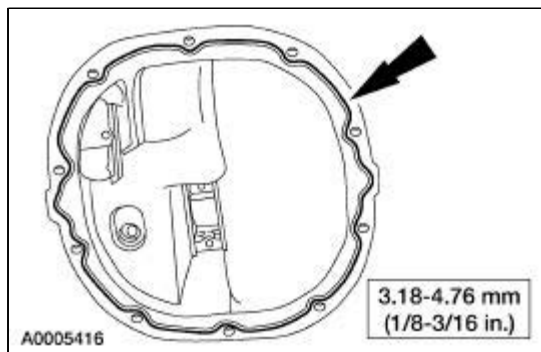
Numbers of Stripes and Color Code	Dimension A	
	mm	Inch
2—C-COAL	7.7978-7.8105	0.3070-0.3075
1—C-COAL	7.7470-7.7597	0.3050-0.3055
5—BLU	7.6962-7.7089	0.3030-0.3035
4—BLU	7.6454-7.6581	0.3010-0.3015
3—BLU	7.5946-7.6073	0.2990-0.2995
2—BLU	7.5458-7.5565	0.2970-0.2975
5—PINK	7.4422-7.4549	0.2930-0.2935
4—PINK	7.3914-7.4041	0.2910-0.2915
3—PINK	7.3406-7.3533	0.2890-0.2895
2—PINK	7.2898-7.3025	0.2870-0.2875
1—PINK	7.2390-7.2517	0.2850-0.2855
5—GRN	7.1882-7.2009	0.2830-0.2835
4—GRN	7.1374-7.1501	0.2810-0.2815
3—GRN	7.0866-7.0993	0.2790-0.2795
2—GRN	7.0358-7.0485	0.2770-0.2775
1—GRN	6.9850-6.9977	0.2750-0.2755

5—WH	6.9342-6.9469	0.2730-0.2735
4—WH	6.8834-6.8961	0.2710-0.2715
3—WH	6.8326-6.8453	0.2690-0.2695
2—WH	6.7818-6.7945	0.2670-0.2675
1—WH	6.7310-6.7437	0.2650-0.2655
5—YEL	6.6802-6.6929	0.2630-0.2635
4—YEL	6.6294-6.6421	0.2610-0.2615
3—YEL	6.5786-6.5913	0.2590-0.2595
2—YEL	6.5278-6.5405	0.2570-0.2575
1—YEL	6.4770-6.4897	0.2550-0.2555
5—ORNG	6.4262-6.4389	0.2530-0.2535
4—ORNG	6.3754-6.3881	0.2510-0.2515
3—ORNG	6.3246-6.3373	0.2490-0.2495
2—ORNG	6.2738-6.2865	0.2470-0.2475
1—ORNG	6.2223-6.2357	0.2450-0.2455
2—RED	6.1722-6.1849	0.2430-0.2435
1—RED	6.1214-6.1341	0.2410-0.2415

55.  **CAUTION: Make sure the machined surfaces on both the rear axle housing and the differential housing cover are clean and free of oil before installing the new silicone sealant. The inside of the rear axle (4001) must be covered when cleaning the machined surface to prevent contamination.**

If the backlash is within specification, install the differential housing cover.





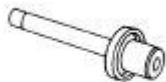


- Apply a new continuous bead of sealant to the differential housing cover. Use Silicone Rubber D6AZ-19562-AA or equivalent meeting Ford specifications ESB-M4G92-A.

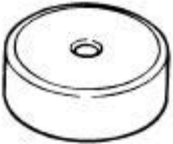
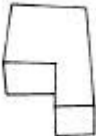
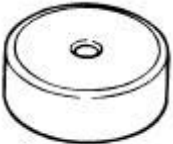
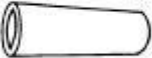
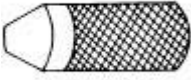
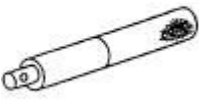







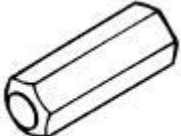



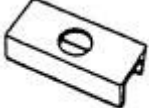
56. Install the rear axle. For additional information, refer to [Axle Housing](#) in this section.
57. Refill the rear axle (4001).
- Fill the rear axle 3-5 mm (1/8-3/16 inch) from the bottom of the filler hole with SAE 75W-140 High Performance Rear Axle Lubricant F1TZ-19580-B or equivalent meeting Ford specification WSL-M2C192-A.



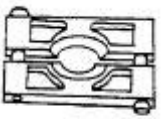
Axle —Nodular Iron

Special Tool(s)

 <p>ST2026-A</p>	<p>2-Jaw Puller 205-D072 (D97L-4221-A) or Equivalent</p>
 <p>ST1678-A</p>	<p>Installer, Drive Pinion Bearing Cup 205-054 (T71P-4616-A)</p>
 <p>ST1183-A</p>	<p>Dial Indicator Gauge 100-D005 (D78P-4201-G) or Equivalent</p>
 <p>ST1214-A</p>	<p>Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or Equivalent</p>
 <p>ST1375-A</p>	<p>Installer, Differential Side Bearing Replacer 205-010 (T57L-4221-A2)</p>
 <p>ST2458-B</p>	<p>Holding Tool, Drive Pinion Flange 205-478</p>
 <p>ST2452-A</p>	<p>Remover, Output Flange 307-408</p>
	<p>Depth Gauge/Aligner, Depth Pinion</p>

 <p>ST1743-A</p>	<p>205-477</p>
 <p>ST1431-A</p>	<p>Adapter for 205-S127 205-110 (T76P-4020-A10)</p>
 <p>ST1743-A</p>	<p>Depth Gauge, Drive Pinion 205-476</p>
 <p>ST1434-A</p>	<p>Gauge Tube, Drive Pinion 205-336 (T93P-4020-A)</p>
 <p>ST1432-A</p>	<p>Adapter for 205-S127 205-111 (T76P-4020-A11)</p>
 <p>ST1326-A</p>	<p>Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)</p>
 <p>ST1186-A</p>	<p>Holding Fixture, Transmission 307-003 (T57L-500-B)</p>
 <p>ST1344-A</p>	<p>Spreader, Differential Housing (Plate) 205-335 (T93P-4000-A)</p>
	<p>Installer, Drive Pinion Inner Bearing Cup 205-480</p>

 <p>ST1676-A</p>	
 <p>ST1367-A</p>	<p>Installer, Drive Pinion Bearing Cone 205-005 (T53T-4621-C)</p>
 <p>ST1734-A</p>	<p>Installer, Drive Pinion Flange 205-479</p>
 <p>ST1744-A</p>	<p>Protector, Drive Pinion Thread 205-460</p>
 <p>ST2320-A</p>	<p>Remover, Drive Pinion Inner Bearing Cup 205-481</p>
 <p>ST2320-A</p>	<p>Remover, Drive Pinion Outer Bearing Cup 205-482</p>
 <p>ST1429-A</p>	<p>Adapter for 205-S127 205-109 (T76P-4020-A9)</p>
 <p>ST1254-A</p>	<p>Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)</p>
	<p>Installer, Differential Shim 205-220 (T85L-4067-AH) 15-098</p>

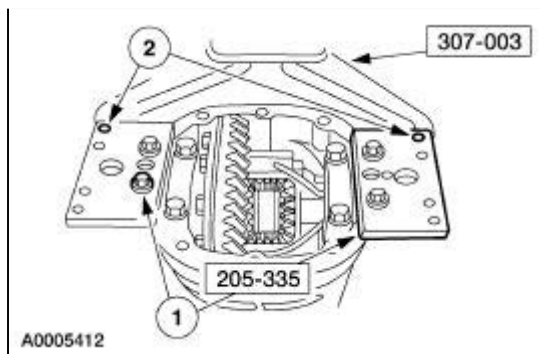
 <p>ST1485-A</p>	
 <p>ST1725-A</p>	<p>Step Plate 205-D061 (D83T-4205-C2) or Equivalent</p>
 <p>ST1310-A</p>	<p>Remover, Bearing 205-055 (T71P-4621-B)</p>

Disassembly

1. Remove the differential housing cover.
2. **NOTE:** The Differential Housing (Plate) Spreader is used here to give the rear axle housing stability. Do not spread the rear axle housing.

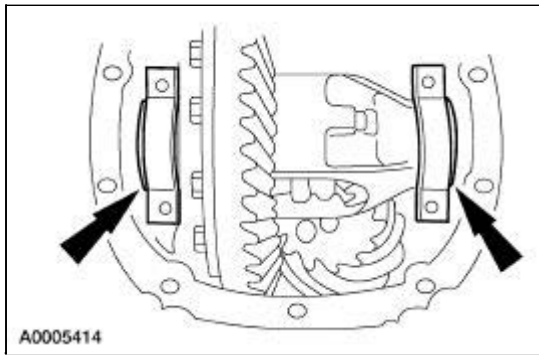
Mount the rear axle housing on the Transmission Holding Fixture.

1. Attach the Differential Housing (Plate) Spreader to the rear axle housing with four cover bolts.
2. Attach the Differential Housing (Plate) Spreader to the Transmission Holding Fixture with two 3/8 inch x 1-1/2 inch bolts.

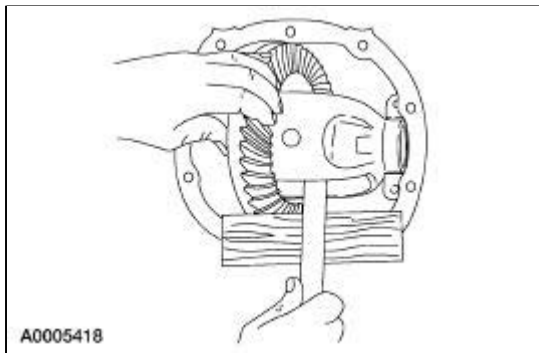


3. **NOTE:** Mark the position of the bearing caps as arrows may not be visible. The bearing caps must be installed in their identical locations and positions.

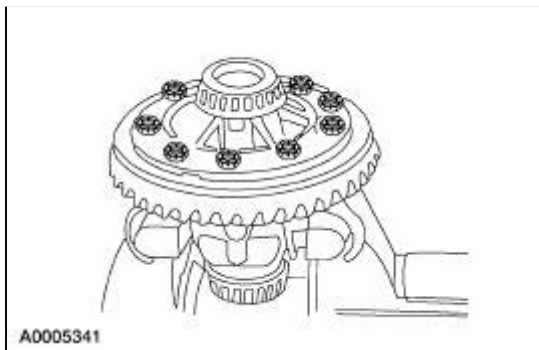
Remove the differential bearing caps.



4. Remove the differential case (4204).

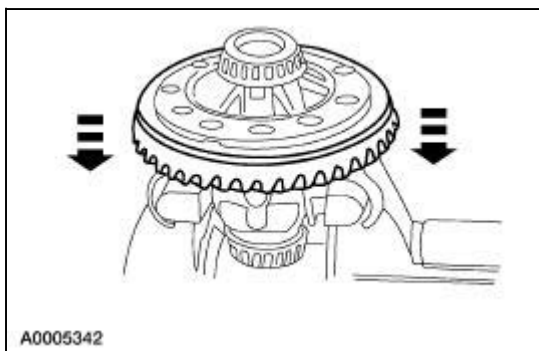


5. Remove the 10 ring gear bolts.



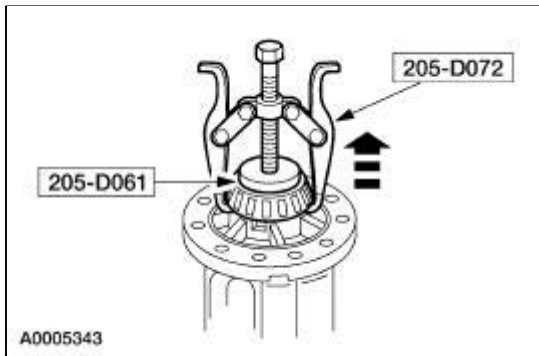
6.  **CAUTION:** Care should be taken not to damage the bolt hole threads.

Insert a punch in the bolt holes and drive the ring gear off.

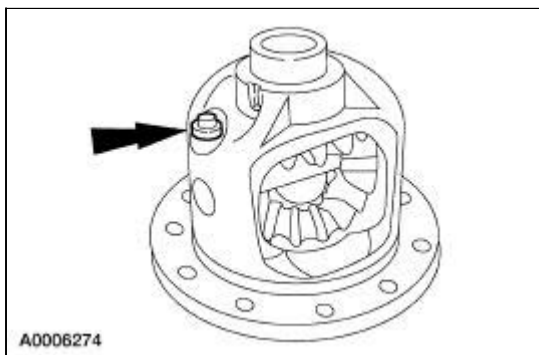


7. Using the special tools, remove the differential bearing (4221).

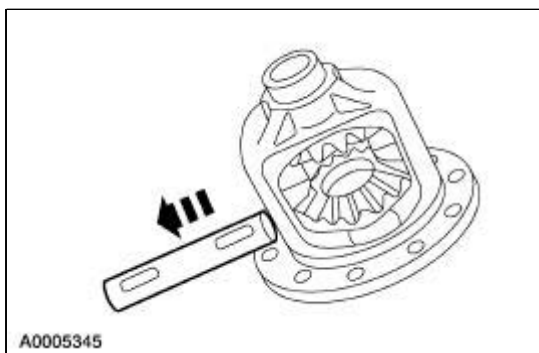
- Repeat for the other side.



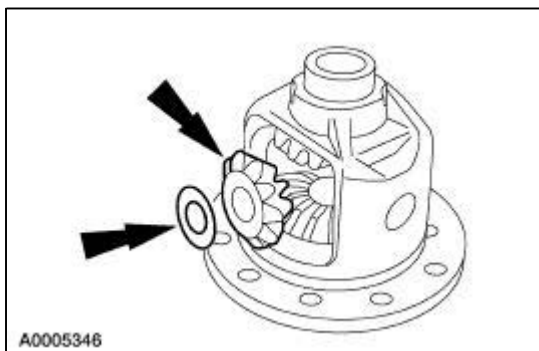
8. Remove the differential pinion shaft lock bolt.



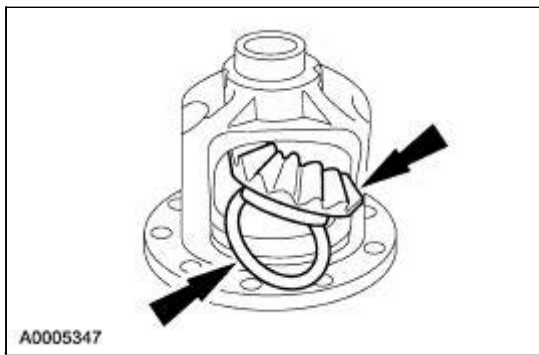
9. Remove the differential pinion shaft.



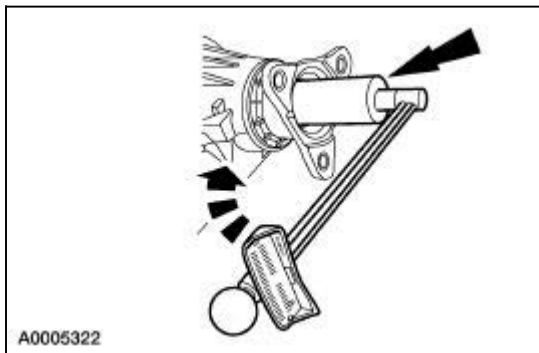
10. Remove the differential gears.



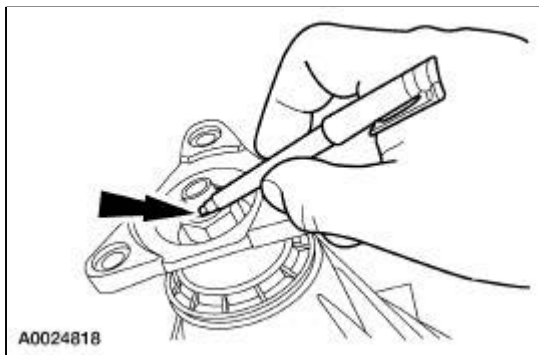
11. Remove the differential side gears.



12. Install a Nm (inch/pound) torque wrench on the pinion nut and record the torque necessary to maintain rotation of the drive pinion gear (4209) through several revolutions.



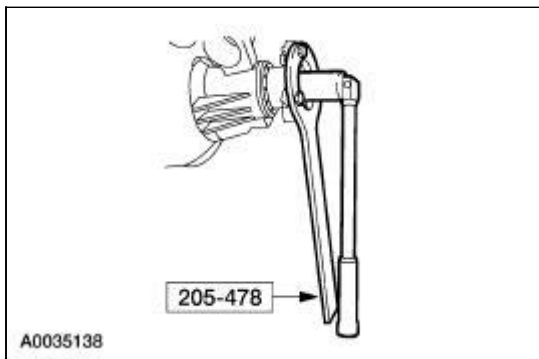
13. Mark the pinion flange in relation to the drive pinion stem to make sure of correct alignment during installation.



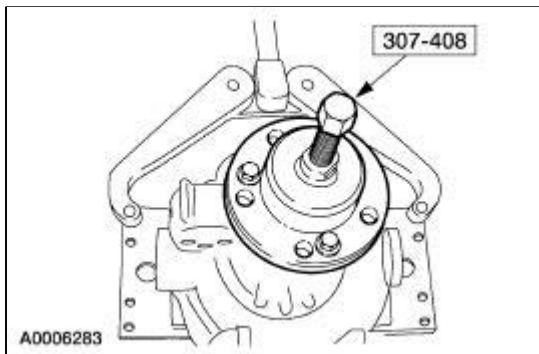
14.  **CAUTION: After removing the pinion nut, discard it. Use a new nut for installation.**

Remove the pinion nut.

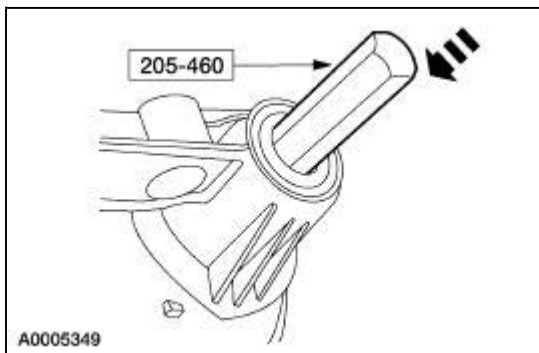
- Install the special tool.
- Install a suitable breaker bar and remove the nut.



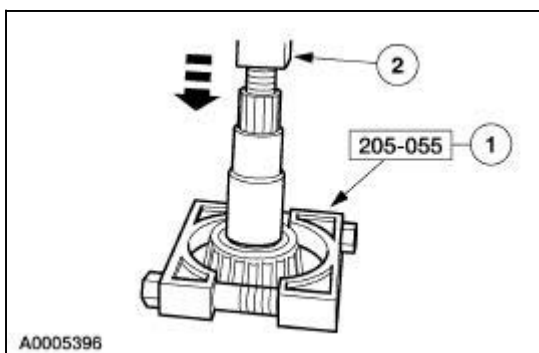
15. Using the special tool, remove the pinion flange.



16. Install the special tool and, with a soft-faced hammer, drive the pinion out of the front bearing cone and remove it through the rear of the housing.
- Remove the rear axle drive pinion shaft oil slinger (4670), the rear axle drive pinion seal (4676) and the collapsible spacer.

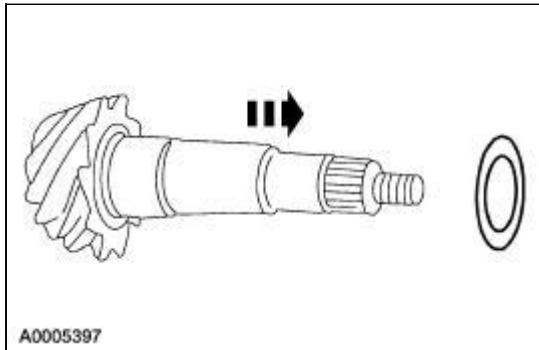


17. Remove the front pinion bearing.
1. Position the special tool under the pinion bearing.
 2. Using a press, remove the pinion bearing.

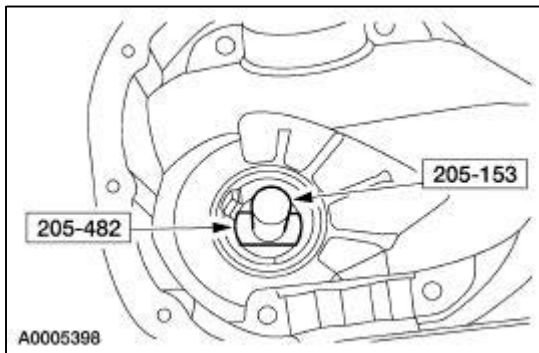


18. **NOTE:** Measure the drive pinion bearing adjustment shim (4663), which is found under the differential pinion bearing, with a micrometer and record the thickness (use this as a reference to compare the shim gauge reading prior to installing the differential pinion bearing).

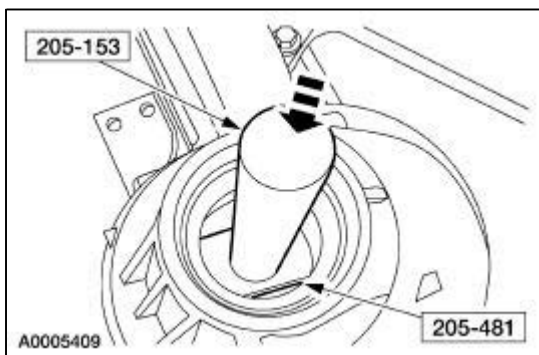
Remove the drive pinion bearing adjustment shim.



19. Remove damaged rear axle pinion bearing cup (4616) from the rear axle housing using the special tools.



20. Remove damaged rear axle pinion bearing cup (4628) from the rear axle housing using the special tools.

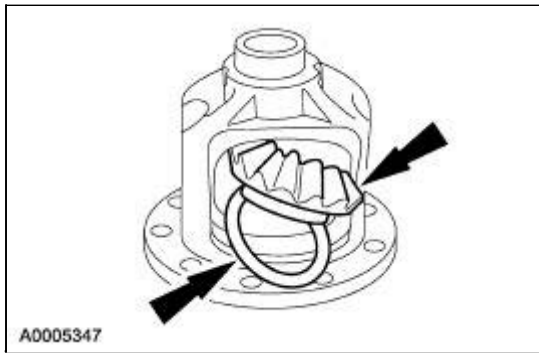



Assembly

All vehicles

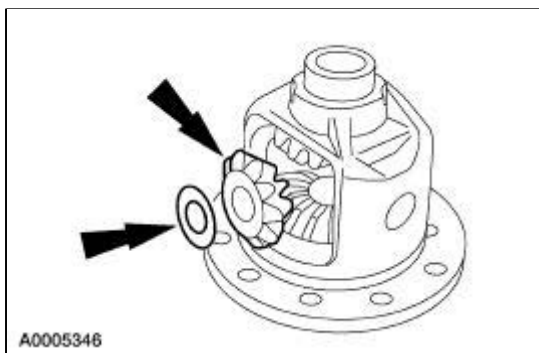
1.  **CAUTION:** Lubricate the differential side gear thrust washers with Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B prior to installation.

Install the differential side gears in the differential case.



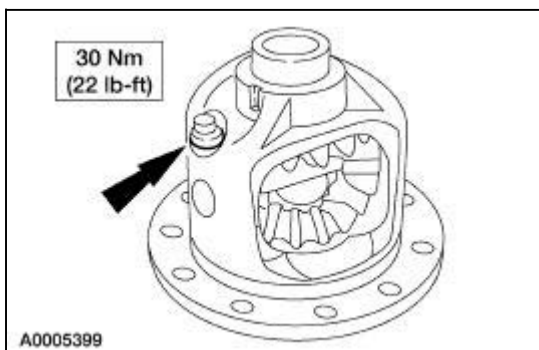
2.  **CAUTION:** Lubricate the differential pinion thrust washers with Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B prior to installation.

Install the differential pinion gears with the differential pinion thrust washers in the differential case.

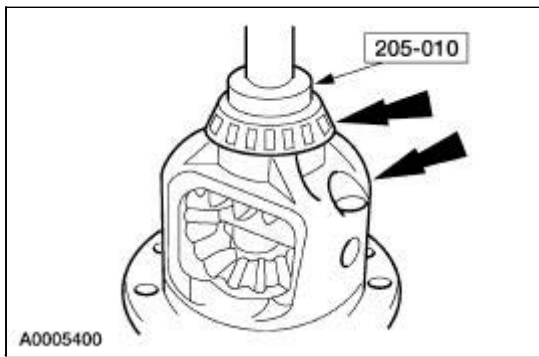


3. **NOTE:** If a new pinion shaft lock bolt is unavailable, coat the threads with Threadlock® and Sealer E0AZ-19554-AA or equivalent meeting Ford specifications WSK-M2G351-A5 prior to installation.

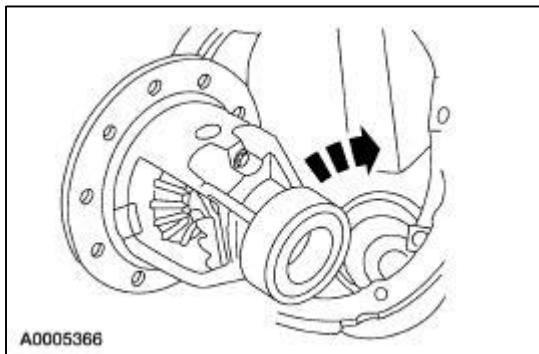
Install the differential pinion shaft and install a new differential pinion shaft lock bolt.



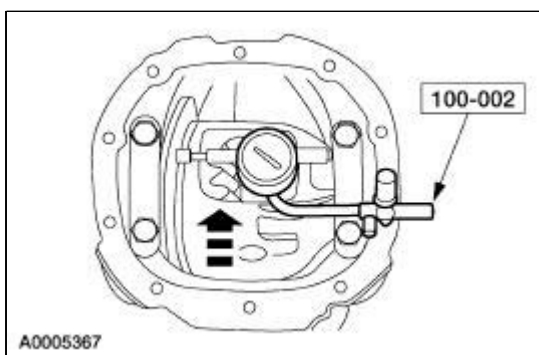
4. Use the special tool to install the differential bearing on the differential case. Repeat for the other side.



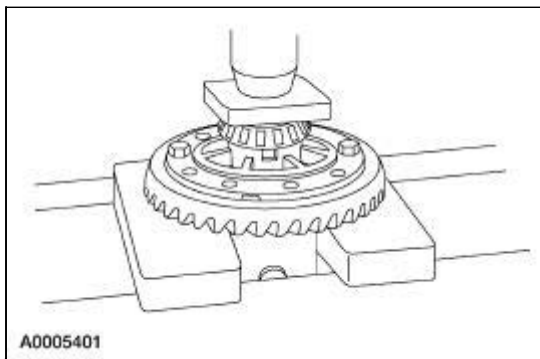
5. Install the differential case without the ring gear.
 - Rotate the differential case to correctly seat the differential bearings.



6. Check the differential case flange runout using the special tool.
 - If the runout is within specification, install a new ring gear and pinion. If the runout exceeds specification, the ring gear is true and the concern is due to either a damaged differential case or differential bearings.
 - Inspect the differential bearings. If the differential bearings are not damaged, install a new differential case and the differential bearings.
 - Recheck the runout with the new differential case and differential bearings.

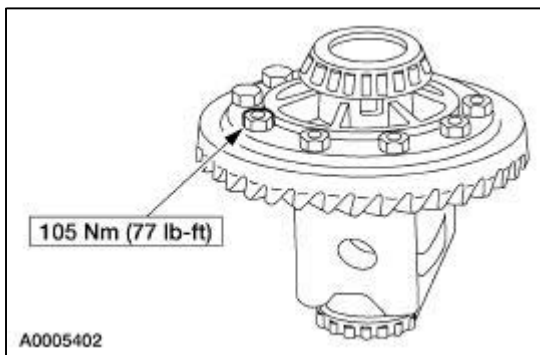


7. Remove the differential case.
8. Press the ring gear on the differential case.
 - Start two of the ring gear bolts through the differential case and into the ring gear to make sure the ring gear bolt holes align with the differential case bolt holes correctly.



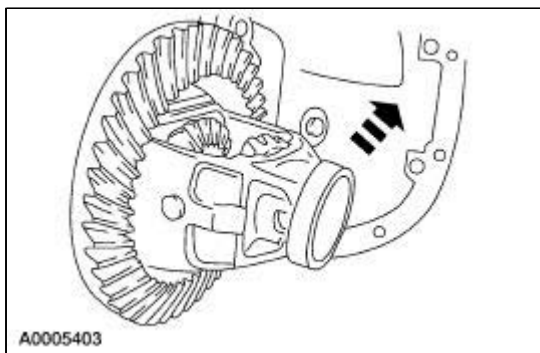
9. Install the ring gear bolts.

- Apply Stud and Bearing Mount E0AZ-19554-BA or equivalent meeting Ford specification WSK-M2G349-A1 to the ring gear bolts.

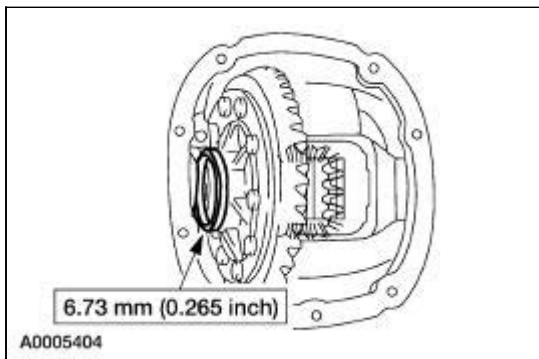


10. **NOTE:** If the ring gear runout check (carried out before disassembly) exceeds specification, the cause may be a warped ring gear, a damaged differential case or loss of differential bearing preload.

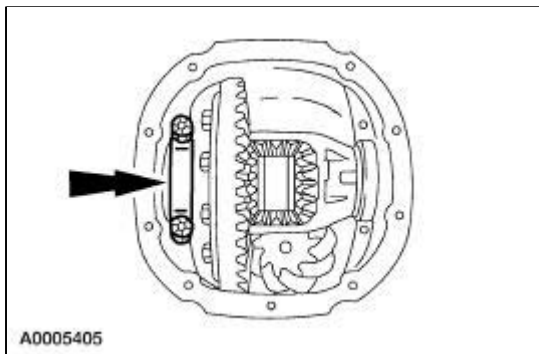
With the pinion removed, place the differential case/gear subassembly with the differential bearing and the rear axle pinion bearing cups in the rear axle housing.



11. Install a differential bearing shim of the thickness shown on the LH side of the differential case.

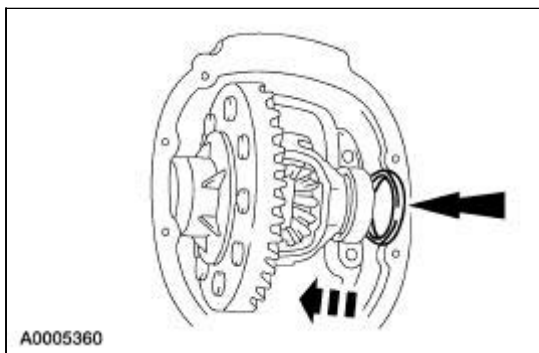


12. Install the LH bearing cap finger-tight.

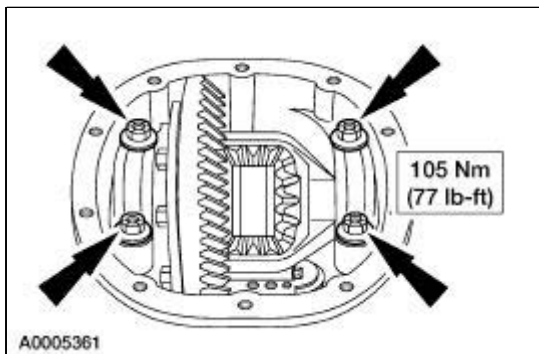


13. **NOTE:** Apply pressure toward the left side to fully seat the differential bearing cup (4222).

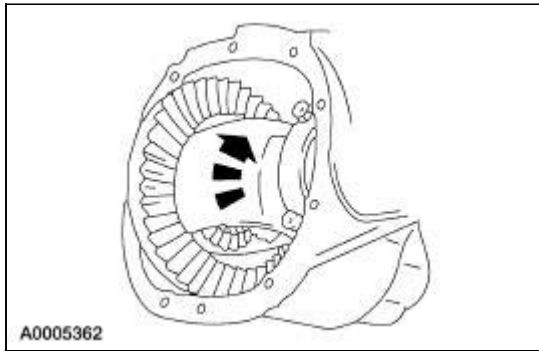
Install progressively larger differential bearing shims on the RH side until the largest differential bearing shim selected can be assembled with a slight drag feel.



14. Install the RH bearing cap.
 - Tighten both bearing caps to specification.



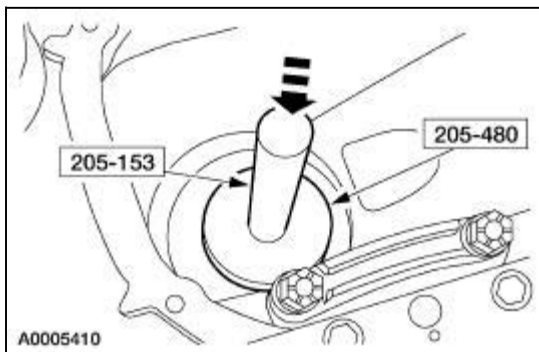
15. Rotate the differential assembly to make sure it rotates freely.



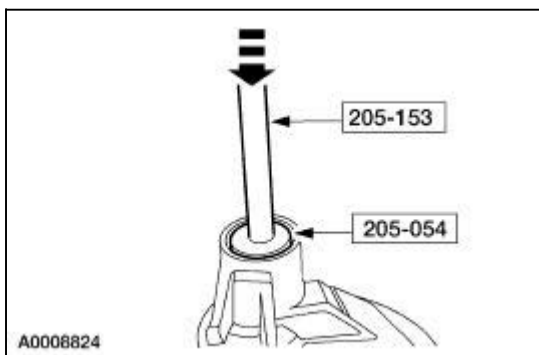
16. Remove the differential case.

Pinion bearing cup installation with special tool 205-153, 205-480, and 205-054

17. Install a new inner rear axle pinion bearing cup in the rear axle housing.



18. Install a new outer rear axle pinion bearing cup in the rear axle housing.

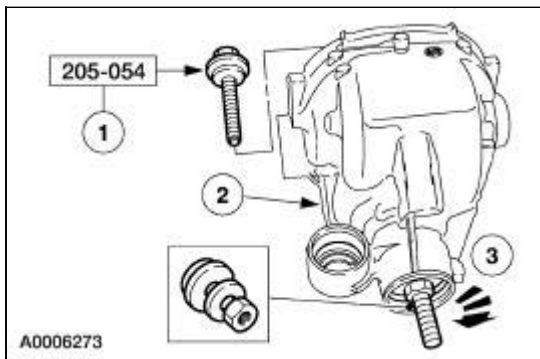


Pinion bearing cup installation with special tool 205-054

19. **NOTE:** Coat the new rear axle pinion bearing cup with SAE 5W-30 Super Premium Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.

Install the pinion bearing cup.

1. Position the rear axle pinion bearing cup on the special tool.
2. Position the bearing cup replacer in the rear axle housing.
3. Tighten the special tool to fully seat the rear axle pinion bearing cup in the bore.

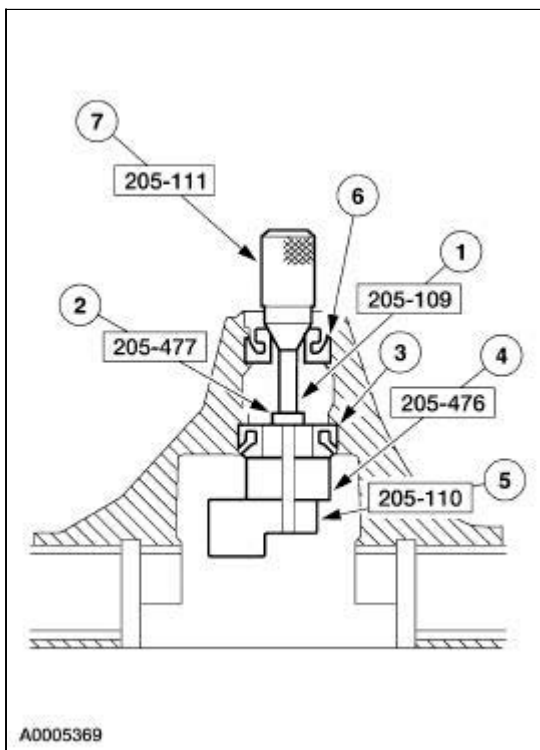


All vehicles

20. **NOTE:** A drive pinion bearing adjustment shim is used between the pinion bearing and the pinion head. The drive pinion bearing adjustment shim compensates for machining variations in the differential pinion and the pinion bearings. The correct drive pinion bearing adjustment shim size will locate the pinion for correct tooth contact with the ring gear. Selecting the correct drive pinion bearing adjustment shim can be done using a pinion depth gauge set.

NOTE: Apply a light film of SAE 75W-140 High Performance Rear Axle Lubricant F1TZ-19580-B or equivalent meeting Ford specification WSL-M2C192-A on the front differential pinion bearing and the rear differential pinion bearing assemblies.

Install the special tools.

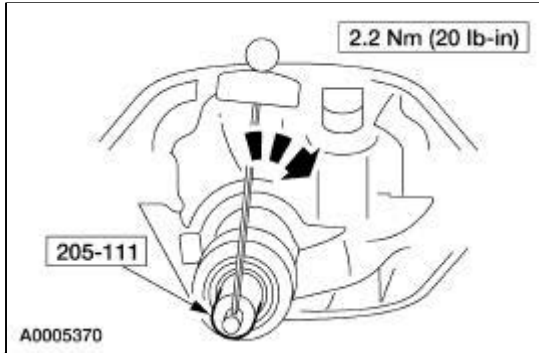


Item	Part Number	Description
1	205-109	Adapter for 205-S127 (T76P-4020-A9)
2	205-477	Gauge aligner, depth pinion
3	4630	Rear (inner) pinion bearing
4	205-476	Gauge disc, drive pinion
5	205-110	Gauge block (1.7 inch thick) (T76P-4020-A10)

6	4621	Front (outer) pinion bearing
7	205-111	Adapter for 205-S127 (T76P-4020-A11)

21. **NOTE:** This step duplicates pinion bearing preload.

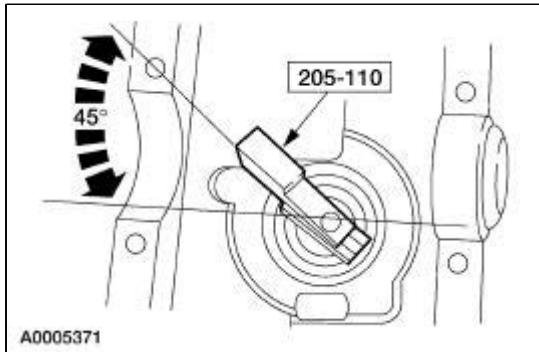
Thread the Handle onto the Screw and tighten to the specification shown.



22. **NOTE:** The special tool must be offset to obtain an accurate reading.

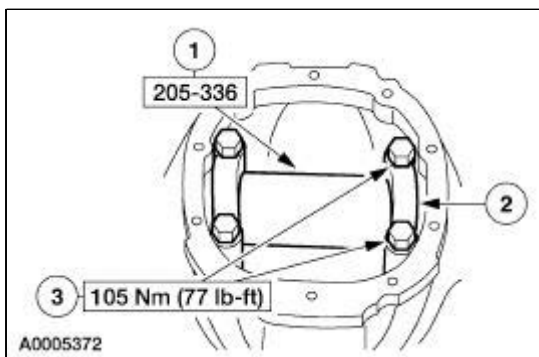
NOTE: Rotate the special tool several half turns to correctly seat the pinion bearings.

Position the special tool 45 degrees as shown.



23. Install the special tool.

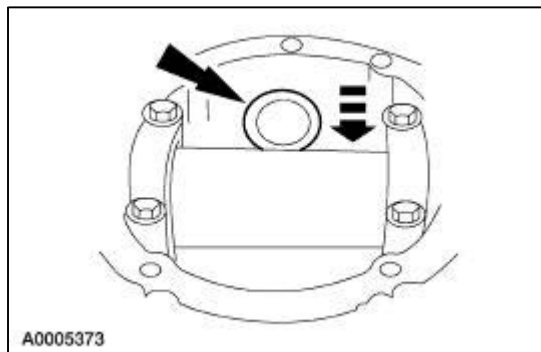
1. Position the special tool on the differential bearing seat of the rear axle housing.
2. Install the differential bearing caps.
3. Install the differential bearing cap bolts and tighten to specification.



24. **NOTE:** A slight drag should be felt for the correct shim selection.

NOTE: Use a shim to determine shim thickness.

Select and check the correct shim size.

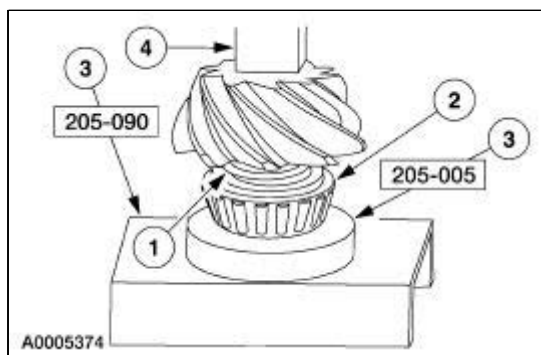


25. Remove the special tool.

26. **NOTE:** The same pinion bearings and drive pinion bearing adjustment shim used in the drive pinion shim selection procedure must be used in the final axle assembly.

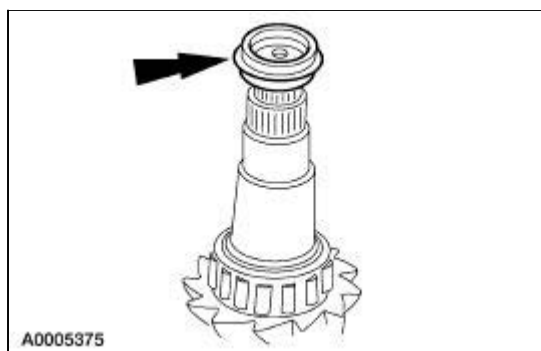
Install the inner pinion bearing.

1. Position the drive pinion bearing adjustment shim on the pinion stem.
2. Position the pinion bearing on the pinion stem.
3. Position the special tool on the pinion stem.
4. Using a press, firmly seat the drive pinion bearing adjustment shim and pinion bearing on the pinion stem.

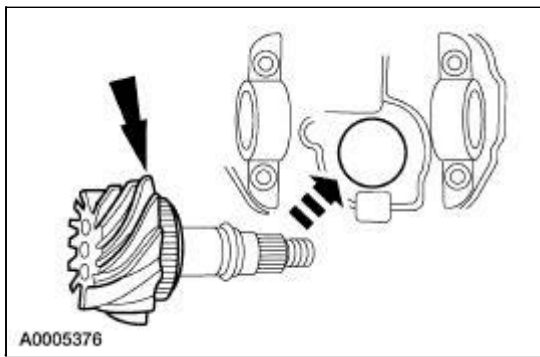


27. **NOTE:** Make sure the splines on the pinion stem are free of burrs. If burrs are evident, remove using a fine crocus cloth, working a rotational motion.

Place a new drive pinion collapsible spacer on the pinion stem against the pinion stem shoulder.



28. Install the drive pinion and drive pinion collapsible spacer into the rear axle housing.

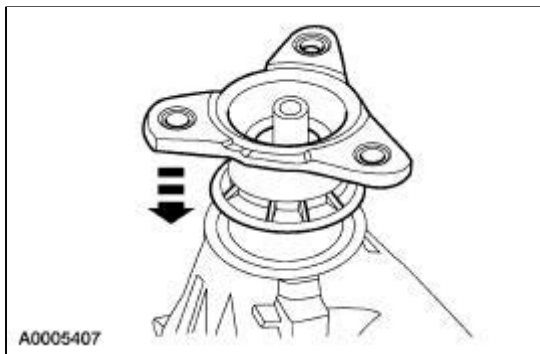


29. Install the outer pinion bearing, the rear axle drive pinion shaft oil slinger and the rear axle drive pinion seal.
30. **NOTE:** Lubricate the rear axle pinion flange splines. Use SAE 75W-140 High Performance Rear Axle Lubricant F1TZ-19580-B or equivalent meeting Ford specification WSL-M2C192-A.

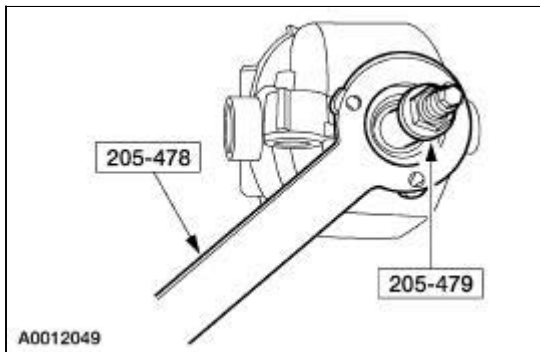
Install the rear axle pinion flange.

- **NOTE:** Disregard the scribe marks if a new rear axle pinion flange is being installed.

Align the rear axle pinion flange with the drive pinion shaft.



31. With the drive pinion in place in the rear axle housing, install the rear axle pinion flange using the special tools.



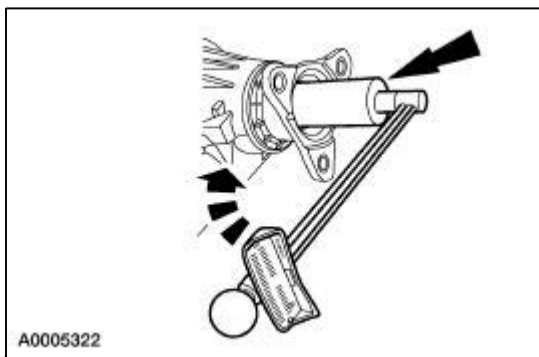
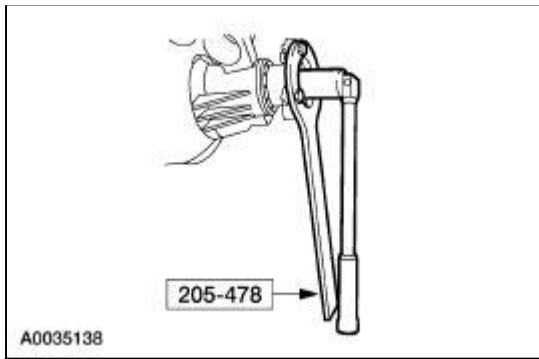
32. **CAUTION:** Do not under any circumstance loosen the pinion nut to reduce preload. If it is necessary to reduce preload, install a new collapsible spacer (4662) and pinion nut.

Use the special tool to hold the pinion flange while tightening the pinion nut.

- Rotate the pinion occasionally to make sure the differential pinion bearings (4630) (4621) seat correctly. Take frequent differential pinion bearing torque preload readings by

rotating the pinion with a Nm (inch/pound) torque wrench.

- Refer to the torque specification for new pinion bearings in the Specifications portion of this section.

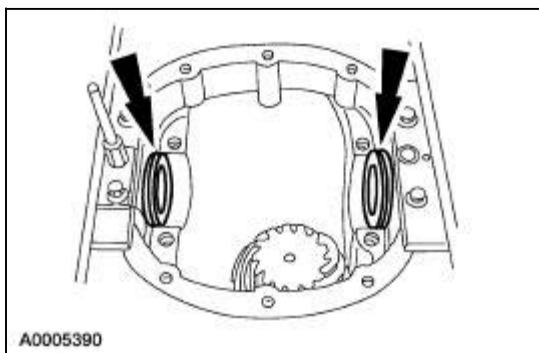


33. **NOTE:** Apply a light coating of Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B to the differential bearing shim to help hold in place.

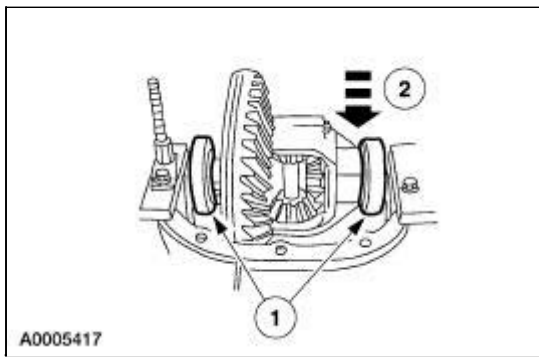
NOTE: Select the correct size differential bearing shims by using the differential bearing shim selection chart.

Install the differential bearing shims.

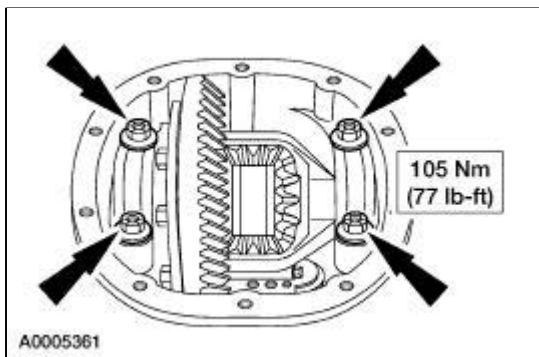
- Place the differential bearing shims in the rear axle housing.



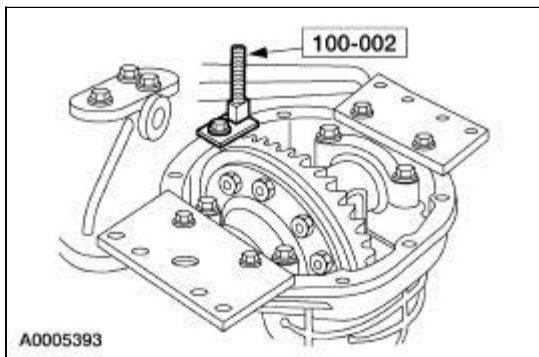
34. Install the differential case.
1. Position the differential bearing cups on the differential bearings.
 2. Lower the differential case in place between the differential bearing shims.



35. Install the bearing caps in their original positions and tighten the bolts to specification.



36. Move the Dial Indicator Gauge to the 12 o'clock position.



Measuring for backlash

37. **NOTE:** Measure the ring gear backlash at four places to obtain a consistent reading.

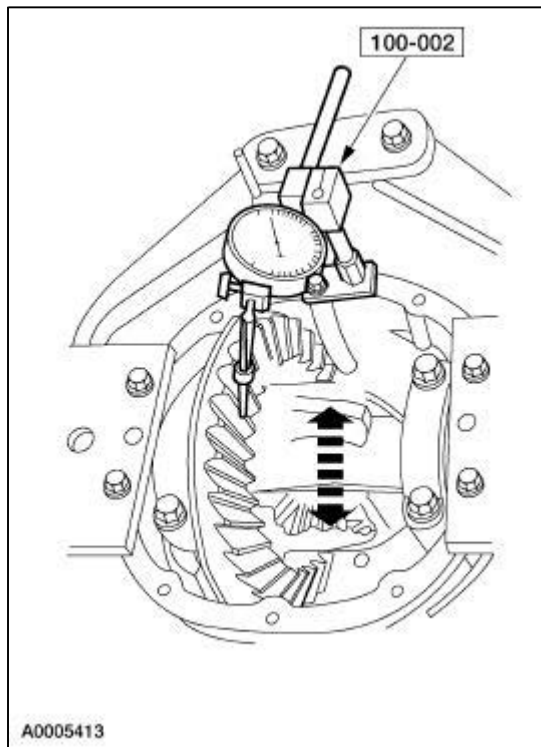
NOTE: Turn the ring gear without turning the pinion gear.

Measure the backlash.

- If the backlash is within specification, refer to Backlash within specification in this procedure.
- If a zero backlash condition occurs, refer to Zero backlash in this procedure.
- If the backlash is not within specification, refer to Backlash not within specification in this procedure.

Backlash Change Required		Thickness Change Required	
mm	Inch	mm	Inch
0.025	0.001	0.050	0.002

0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.355	0.014	0.457	0.018
0.381	0.015	0.508	0.020

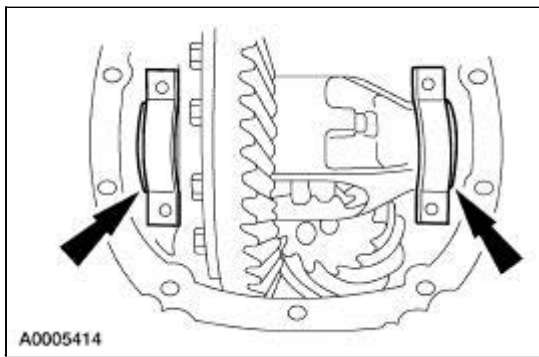


Zero backlash

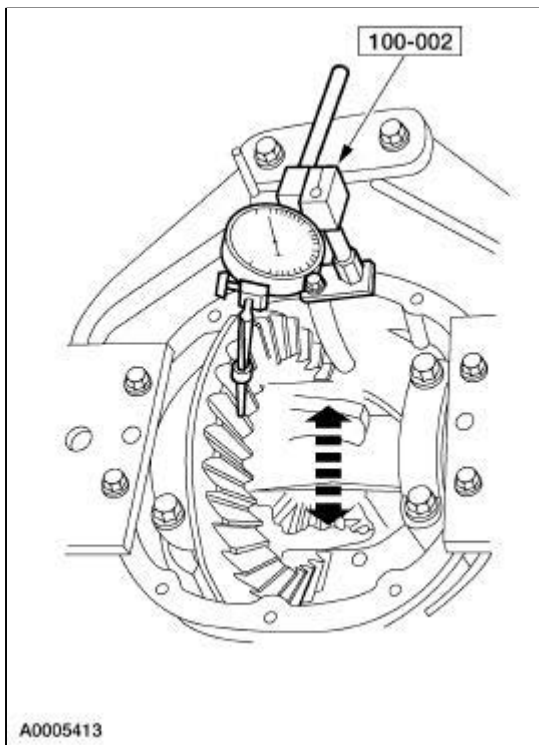
38. If a zero backlash condition occurs, add 0.51 mm (0.02 in) to the RH side and subtract 0.51 mm (0.02 in) from the LH side to allow backlash indication.
- Check the backlash. Repeat Measuring ring gear backlash in this procedure.

Backlash not within specification

39. To increase or decrease the backlash, remove the bearing caps and install a thicker shim or a thinner shim as shown.
- If the backlash is not within specification, correct by increasing the thickness of one differential bearing shim and decreasing the thickness of the other differential bearing shim by the same amount.

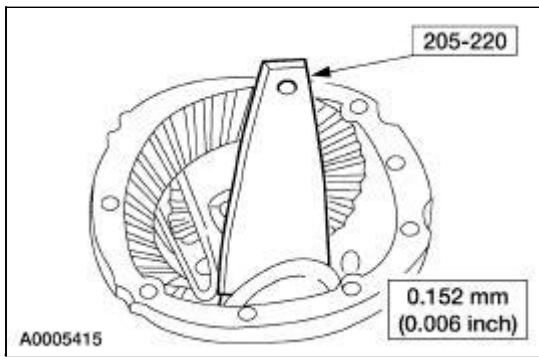


40. Rotate the differential several times to make sure the differential bearings are correctly seated.
 - Do not turn the pinion flange in order to rotate the differential.
41. Use the special tool to recheck the backlash
 - If the backlash is within specification, refer to Backlash within specification in this procedure. If the backlash is not within specification, repeat Measuring ring gear backlash in this procedure.

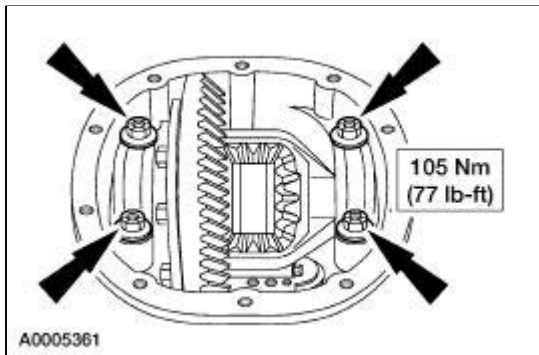


Backlash within specification

42. Remove the bearing caps and bolts.
 - To establish differential bearing preload, use the special tool to increase both left and right shim sizes by the specification shown.
 - Use the special tool to make sure that the differential bearing shims are fully seated and the assembly turns freely.

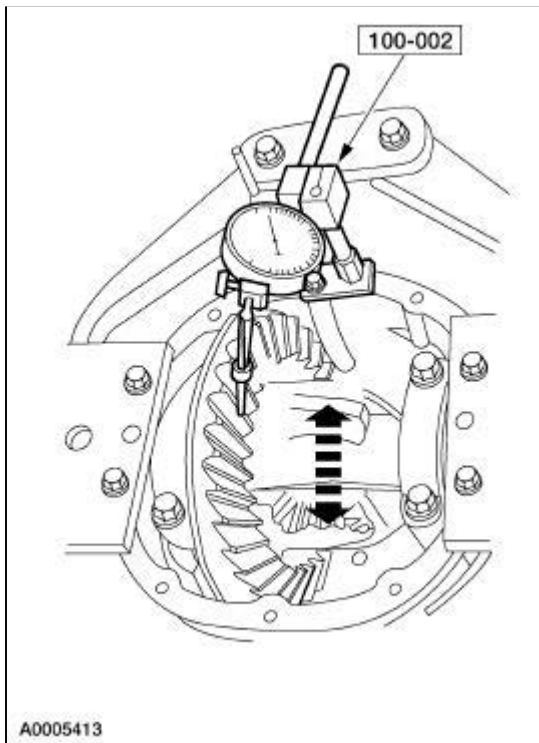



43. Install the bearing caps and bolts and tighten them to specification.



44. Use the special tool to recheck the backlash.

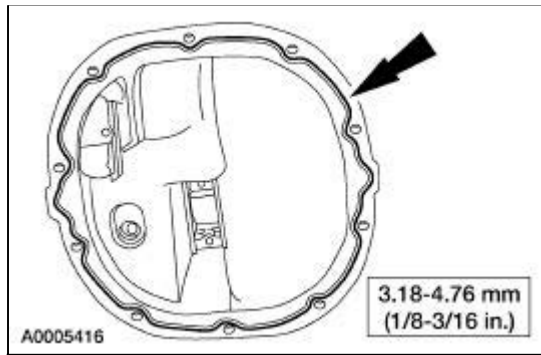
- For further adjustments, refer to [Section 205-00](#).



45.  **CAUTION:** Make sure the machined surfaces on both the rear axle housing and the differential housing cover are clean and free of oil before installing the new silicone sealant. The inside of the rear axle (4001) must be covered when cleaning the machined surface to prevent contamination.

Install the differential housing cover.

- Apply a new continuous bead of sealant to the differential housing cover. Use Silicone Rubber D6AZ-19562-AA or equivalent meeting Ford specifications ESB-M4G92-A.



46. Install the rear axle. For additional information, refer to [Axle Housing](#) in this section.

47. Refill the rear axle (4001).

- Fill the rear axle 3-5 mm (1/8-3/16 inch) from the bottom of the filler hole with SAE 75W-140 High Performance Rear Axle Lubricant F1TZ-19580-B or equivalent meeting Ford specification WSL-M2C192-A.
-

Torque Specifications

Description	Nm	lb-ft
Rear axle wheel hub retainer	300	221

Rear Drive Halfshafts



CAUTION: An inspection of the outer and inner boots is necessary so that if damage or grease leakage is evident, installation of a new halfshaft can take place immediately. Continued operation with damage or grease leakage will result in CV joint wear and noise due to contamination and loss of the CV joint grease.



CAUTION: Vehicles with V8 engines use a larger diameter halfshaft than vehicles with V6 engines. Do not install the smaller diameter halfshafts designed for vehicles with V6 engines on vehicles with V8 engines or vice-versa.

- The RH and LH halfshafts are different lengths, with the RH halfshaft being the longer of the two.
- Inboard and outboard CV joints connect to a splined shaft. A circlip stopper holds the cross groove inboard race assembly (inboard CV joint) together.
- An axle circlip (4B422) retains the splined inboard CV joint to the differential side gear. Install a new axle circlip every time you remove the halfshaft from the vehicle.
- A rear axle wheel hub retainer secures the side shaft assembly (interconnecting shaft and outboard CV joint) to the rear hub. Install a new rear axle wheel hub retainer every time you remove the halfshaft from the vehicle.

Halfshaft Handling



CAUTION: Never pick up or hold the halfshaft only by the inboard or outboard CV joint.

Handle all halfshaft components carefully during removal and installation procedures.

- The halfshaft assemblies are not repairable. Install a new assembly if worn/damaged.
- To separate the halfshaft from the rear hub, press the outboard CV joint from the rear hub.
- To separate the halfshaft from the differential, apply a load to the back face of the inboard CV joint assembly to overcome the axle circlip.
- Do not over-angle the CV joints.
- Damage will occur to an assembled inboard CV joint if it is over-plunged outward from the joint housing.
- Never use a hammer to remove or install the halfshafts.
- Never use the halfshaft assembly as a lever to position other components. Always support the free end of the halfshaft.
- Do not allow the boots to contact sharp edges or hot exhaust components.
- Handle the halfshaft only by the interconnecting shaft to avoid pull-apart and potential damage to the CV joints.
- Do not drop assembled halfshafts. The impact will cut the boots from the inside without evidence of external damage.

Wheel and Tire Balancing, Rear



WARNING: Do not balance the rear wheels and tires while mounted on the vehicle. Possible tire disintegration, differential or halfshaft failure can result, causing personal injury or extensive component damage. Use an off-vehicle wheel and tire balancer only.

Hoisting



CAUTION: Use a frame-contact hoist only. Vehicle or component damage can result if other types of hoists are used.

Never raise the vehicle using the halfshafts as lift points.

Undercoating and Rustproofing

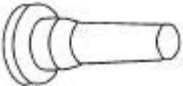


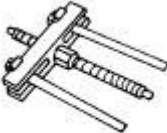


During undercoating and rustproofing procedures, protect the boots from the coating materials. Foreign materials on the rubber boots will cause extreme advanced wear.

Rear Drive Halfshafts


Refer to Section 205-00 .

Halfshaft

Special Tool(s)

 ST1712-A	Differential Plug 205-294 (T89P-4850-B)
 ST2258-A	Differential Seal Protector 205-461
 ST2309-A	Halfshaft Removal Tool 205-475
 ST1516-A	Hub Remover/Replacer 204-069 (T81P-1104-C)
 ST1517-A	Metric Hub Remover Adapter 205-237 (T86P-1104-A1)
 ST1518-A	Metric Hub Remover Adapters 204-085 (T83P-1104-BH)

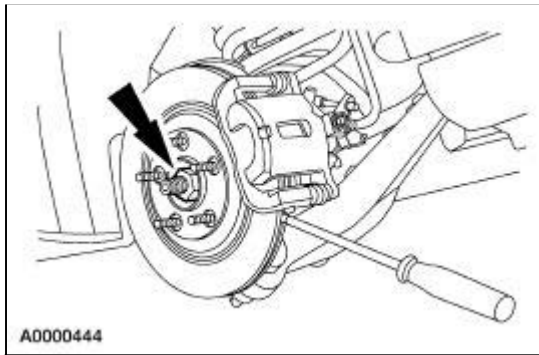
Removal

-  **CAUTION:** Do not begin this procedure unless:
 - a new rear axle wheel hub retainer is available.
 - a new axle circlip (4B422) is available.
 - you have read Halfshaft Handling in this section.

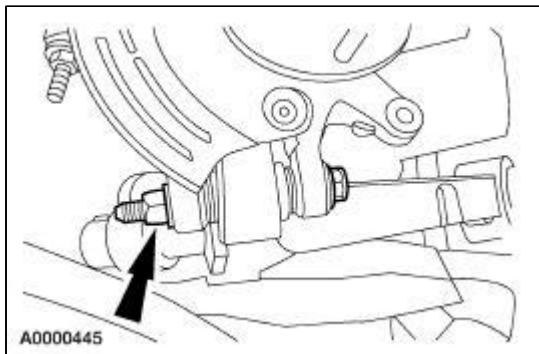
NOTE: This procedure applies to both the LH and RH halfshafts.

Raise and support the vehicle. For additional information, refer to [Section 100-02](#).

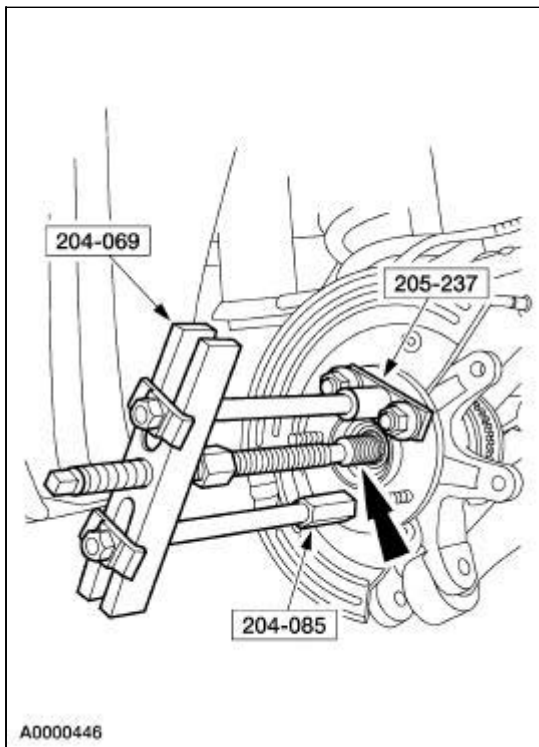
2. Remove the rear wheel and tire assembly. For additional information, refer to [Section 204-04](#).
3. Remove and discard the rear axle wheel hub retainer.



4. Remove the rear brake anti-lock sensor. For additional information, refer to [Section 206-09A](#).
5. Remove the brake disc. For additional information, refer to [Section 206-04](#).
6. Remove the nut and bolt.

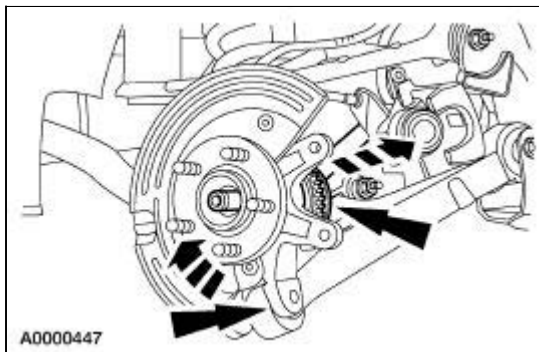


7. Using the special tools, press the outboard CV joint until it is loose in the hub.

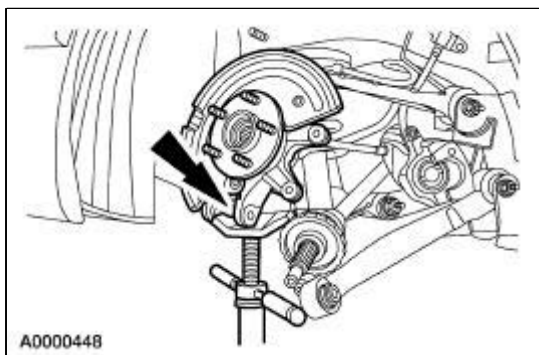



8.  **CAUTION: Do not over-angulate the outboard CV joint or damage the boot.**

While raising the knuckle, remove the CV joint from the hub.

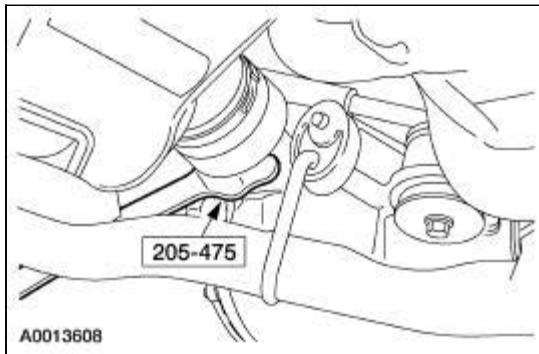


9. Position the knuckle to gain clear access for the halfshaft removal.



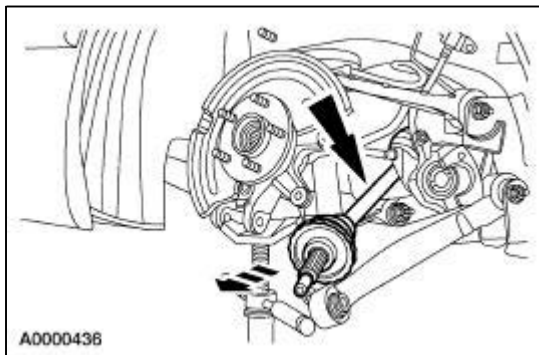
10.  **CAUTION: The crown of the tool forks must face away from the axle housing. Position the special tool correctly between the CV joint and the axle housing so as not to damage the differential seal.**

Using the special tool, exert enough pressure to overcome the axle circlip (4B422) and separate the CV joint from the differential side gear.

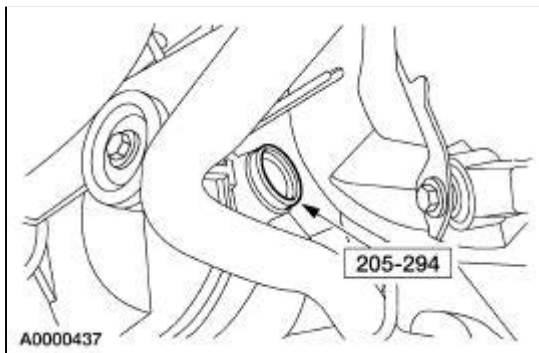


11.  **CAUTION: Do not damage the differential seal.**


Carefully remove the halfshaft with both hands.



12. Install the special tool.

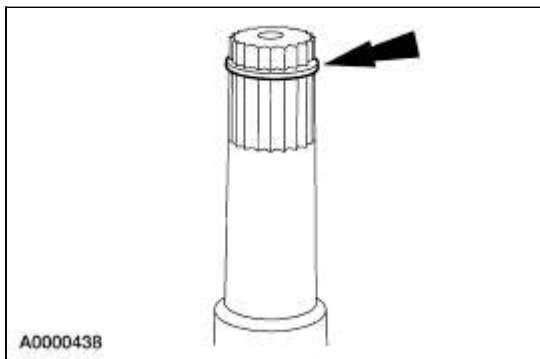


Installation

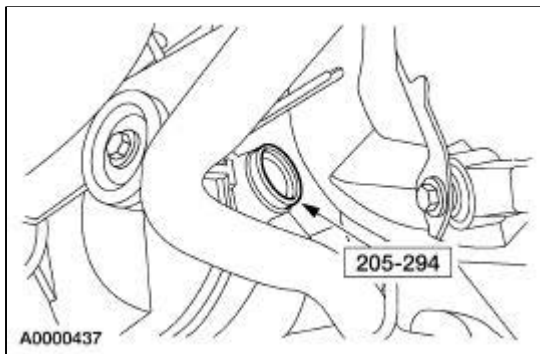
1.  **CAUTION: Vehicles with V8 engines use a larger diameter halfshaft than vehicles with V6 engines. Do not install the smaller diameter halfshafts designed for vehicles with V6 engines on vehicles with V8 engines or vice-versa.**


NOTE: This procedure applies to both the LH and RH halfshafts.

Install a new axle circlip.

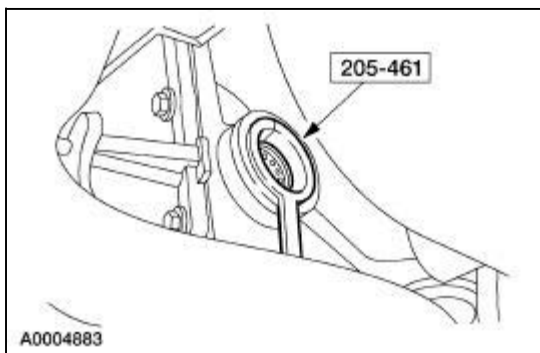


2. Remove the special tool.

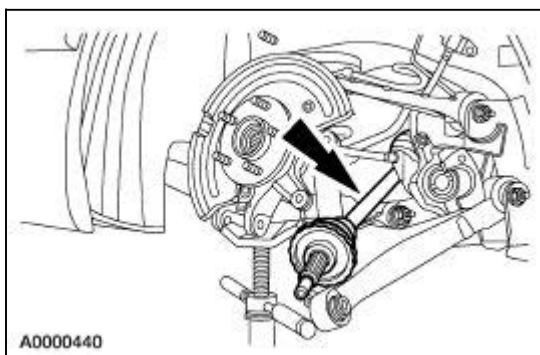


3.  **CAUTION:** Differential seal damage will occur if installing the halfshaft without the special tool installed.

Install the special tool.

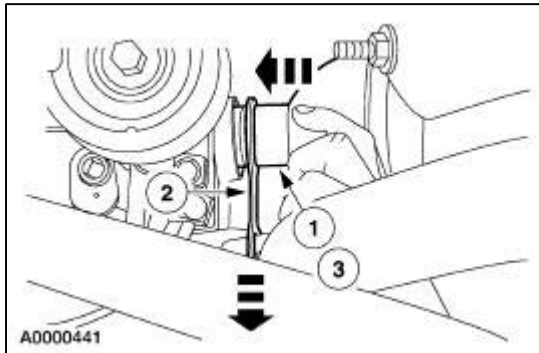


4. Position the halfshaft for installation.

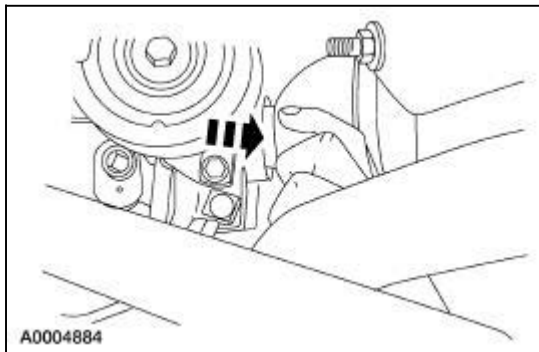


5. Seat the CV joint in the differential side gear.

1. Slide the CV joint into the axle housing until the shaft splines are past the differential seal.
2. Remove the special tool.
3. Align the CV joint and side gear splines, and slide the joint into the gear until it seats.
 - When seated, the axle circlip will lock the CV joint in the differential side gear.

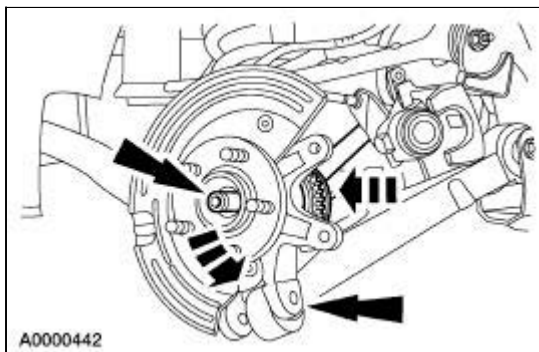


6. Check the axle circlip engagement by attempting to pull the inboard CV joint out of the differential side gear.
 - If the circlip is not seated, push the CV joint inward until the circlip is fully engaged in the differential side gear.



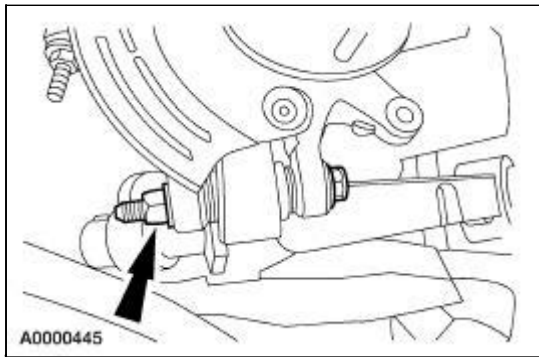
7.  **CAUTION: Do not over-angulate the outboard CV joint or damage the boot.**

While raising the knuckle, install the CV joint into the hub, then position the knuckle onto the lower control arm.

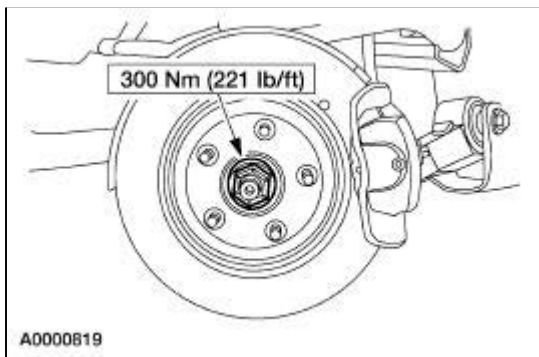


8.  **CAUTION: Position the suspension at curb ride height before tightening the bolt and nut.**

Install the bolt and nut. Refer to [Section 204-02](#) for tightening specifications.



9. Install the brakes. For additional information, refer to [Section 206-04](#) .
10. Install the rear brake anti-lock sensor. For additional information, refer to [Section 206-09A](#) .
11. Install the rear axle wheel hub retainer.



12. Install the rear wheel and tire assembly. For additional information, refer to [Section 204-04](#) .
 13. Lower the vehicle.
-

Halfshaft Joint

Disassembly

1. The halfshaft assemblies are not repairable. Install a new assembly if worn/damaged.
-

General Specifications

Item	Specification
Brake pads lining wear limit—front (above backing plate or rivets)	2 mm (0.08 in)
Brake pads lining wear limit—rear (above brake shoe or rivets)	1 mm (0.04 in)
Lubricant	
High Performance DOT 4 Brake Fluid	SAE-J1704-DOT 4
High Performance DOT 3 Brake Fluid C6AZ-19542-AB	ESA-M6C25-A (United States and Canada only)
High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA	ESE-M12A4-A
Brake disc	
Brake disc minimum thickness	Molded into the brake disc
Brake disc allowable runout on vehicle	0.102 mm (0.004 in)
Brake disc maximum thickness variation	0.01 mm (0.0004 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Brake master cylinder tube fitting, front	15-20	11-15	—
Brake master cylinder tube fitting, rear	15-20	11-15	—
Caliper bleeder screw, rear	7-13	5-10	—
Caliper bleeder screw, front	7-13	5-10	—

Brake System

Brake System, Hydraulic

This vehicle is equipped with a brake pedal-actuated hydraulic dual brake system. The system consists of the following:

- front disc brake calipers (2B120); refer to [Section 206-03](#).
- rear disc brake calipers (2553); refer to [Section 206-04](#).
- brake master cylinder (2140); refer to [Section 206-06](#).
- brake tubes and brake hoses

The ABS system will be one of the following types:

- a four wheel anti-lock control brake system (4WABS); refer to [Section 206-09A](#).
- a four wheel anti-lock control — traction control brake system; refer to [Section 206-09B](#).
- a four wheel anti-lock control — traction control and interactive vehicle dynamics (IVD); refer to [Section 206-09C](#).

The dual ABS hydraulic system is diagonally split with the LH front and RH rear making up one circuit and the RH front and LH rear making up the other circuit.

Master Cylinder, Dual

The brake master cylinder contains the following feature:

- a common plastic brake master cylinder reservoir (2K478) and low fluid level indicator combined in one assembly.

Booster, Power Brake

The power brake booster (2005) is a vacuum-operated, dual diaphragm type and is equipped with a separately serviceable power brake booster check valve (2365). Refer to [Section 206-07](#).

Brakes, Front Disc

The front disc brakes consist of the following features:

- a full-cast vented front brake disc (1125).
- hydraulically-activated pin slider-type front disc brake caliper assemblies.

Brakes, Rear Disc

The rear disc brakes consist of the following features:

- a full-cast vented rear brake disc (2C026).
- hydraulically-activated rear disc brake caliper assemblies with integral mechanically (cable) operated parking brake mechanisms.

Brake System, Parking

The parking brake system consists of the following features:

- the system is cable-actuated and controlled by a hand-operated parking brake control (2780).
- the parking brake control pulls a cable which actuates the rear disc brake calipers.
- the parking brake is self-adjusting.

Refer to [Section 206-05](#).

Brake Fluid



WARNING: Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.



WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.



CAUTION: Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

Use clean, fresh Ford High Performance DOT 3 Motor Vehicle Brake Fluid C6AZ-19542-AB or equivalent meeting Ford specification ESA-M6C25-A (United States and Canada only). If DOT 3 is not available, use Ford High Performance DOT 4 Brake Fluid or equivalent meeting Ford specification SAE-J-1704-DOT 4.

- Do not reuse brake fluid drained or bled from the system.
- Do not use brake fluid that has been stored in an open container.
- Do not use contaminated brake fluid.

Brake Tubing



WARNING: Copper tubing must not be used in a hydraulic system. When bending brake tubing to fit underbody, be careful not to kink or crack the tube.

If a section of the brake tubing becomes damaged, install a new section of tubing the same type, size, shape and length.

Brake Hose

Install a new flexible brake hose if it shows signs of softening, cracking or other damage.

Brake System

Refer to Wiring Diagrams Section [413-01](#) for schematic and connector information.

Inspection and Verification

Preliminary Checks

NOTE: Always check the fluid level in the brake master cylinder reservoir (2K478) before carrying out the test procedures. If the fluid level is not at the correct level, fill the reservoir using the specified DOT 3 or DOT 4 brake fluid.

NOTE: Prior to carrying out any diagnosis, make certain that the brake warning indicator is functional. Refer to [Section 413-01](#).

The first indication that something may be wrong in the brake system is a change in the feeling through the brake pedal (2455). The brake warning indicator in the instrument cluster and the brake fluid level in the brake master cylinder reservoir are also indicators of system concerns.

If a wheel (1007) is locked and the vehicle must be moved, open a bleeder screw at the locked wheel to let out enough fluid to relieve the pressure. Close the bleeder screw. This bleeding operation may release the brakes but will not correct the cause of trouble. If this does not relieve the locked wheel condition, repair the locked components before proceeding.

Brake Booster

Inspect all hoses and connections. All unused vacuum connectors should be capped. Hoses and their connections should be correctly secured and in good condition with no holes, soft or collapsed areas.

Road Test

Carry out a Road Test to compare actual vehicle braking performance with the performance standards expected by the driver. The ability of the test driver to make valid comparisons and detect performance deficiencies will depend on experience.

The driver should have a thorough knowledge of brake system operation and accepted general performance guidelines in order to make good comparisons and detect performance problems.

Select a road that is reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Avoid crowned roads.

A key factor in evaluating brake concerns is the deceleration rate. This varies from vehicle to vehicle and with changes in operating conditions. It is evident how well the brakes are working after just a few applications.

Avoid locking the brakes. Locked brakes are not an indicator of braking efficiency.

Visual Inspection Chart

Mechanical	Electrical
● Brake master cylinder	● Parking brake switch

<ul style="list-style-type: none"> ● Brake caliper piston ● Brake disc ● Wheel bearings ● Brake pads ● Power brake booster ● Brake pedal linkage ● Booster vacuum hose ● Tires ● Foreign material 	<ul style="list-style-type: none"> ● Damaged or corroded wiring harness ● Brake master cylinder fluid level switch
--	--

For low or spongy brake pedal concerns:

- Check and, if necessary, refill the brake master cylinder reservoir.
- Bleed the brake system and retest the brake pedal feel.

For slow or incomplete brake pedal return concern:

- Inspect for binding, damage, incorrect installation or interference at the brake pedal.
- Check the power brake booster for binding, damage and incorrect installation.

Vibration When Brakes Are Applied

For vibration concerns when brakes are applied, carry out the following procedure.

Visually inspect:

- The suspension condition and tire pressure.
- Suspension bushings and ball joints.

Correct as necessary.

1. Verify and isolate the concern. Brake roughness can be felt in:

- the steering wheel.
- the seat.
- the brake pedal.

2. After verifying the concern, check for related concerns in the:

- On-Line Automotive Service Information System (OASIS).
- Technical Service Bulletins.

3. Check wheel bearing end-play and correct as necessary.

4. **NOTE:** Begin at the front of the vehicle unless the vibration has been isolated to the rear.

Remove the tire and wheel.


5. Remove the brake caliper.

6. Measure and record the brake disc thickness. If the thickness before machining is not greater than 0.6 mm (0.024 in) above the minimum thickness specification molded into the brake disc,

install a new brake disc. Do not machine a new brake disc.

7. For vehicles with a two-piece hub and brake disc assembly:

- Match-mark before disassembly.
- Remove the brake disc.
- Using a die grinder with a mild abrasive disc (Scotch Brite® type), remove any rust or corrosion from the hub and brake disc mounting surfaces.
- Align match-marks and reinstall the brake disc on the hub.

8.  **CAUTION: Do not use a bench lathe to machine brake discs.**

NOTE: The depth of cut must be between 0.10 and 0.20 mm (0.004 and 0.008 in). Lighter cuts will cause heat and wear. Heavier cuts will cause poor brake disc surface finish.

Using a hub-mount brake lathe, machine the brake discs. Follow the manufacturer's instructions. After machining, make sure the brake disc still meets the thickness specification.

9. Using a dial indicator, verify that the brake disc lateral runout is now within vehicle specification.
10. Remove metal chips.
11. Remove the brake lathe hub adapter.
12. Remove any remaining metal chips from the machining operation.
13. For vehicles with a two-piece hub and brake disc assembly:
 - Remove the brake disc from the hub.
 - Remove any remaining metal chips from hub and brake disc mounting surfaces and from the ABS sensor.
 - Apply High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA or equivalent meeting Ford specification ESE-M12A4-A to the mounting surfaces.
 - Using the match-marks, mount the brake disc on the hub.
14. Install the caliper and check brake operation.

Symptom Chart

Symptom Chart

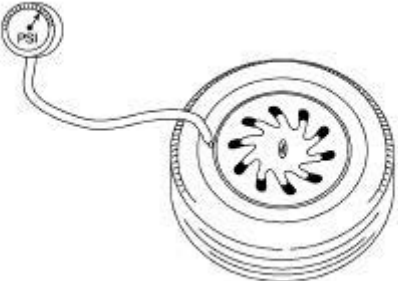
Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● The Brakes Pull or Drift 	<ul style="list-style-type: none"> ● Tire air pressure. ● Wheel alignment. ● Brake pads. ● Brake components. ● Suspension component. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test A</u>.

<ul style="list-style-type: none"> ● The Red Brake Warning Indicator Is Always On - Parking Brake 	<ul style="list-style-type: none"> ● Park brake switch. ● Circuit. ● Front Electronic Module (FEM). ● Instrument cluster module (IC). ● Telltale/indicator. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B .
<ul style="list-style-type: none"> ● The Red Brake Warning Indicator Is Always On - Low Brake Fluid Level 	<ul style="list-style-type: none"> ● Brake fluid level switch. ● Circuit. ● Front Electronic Module (FEM). ● Instrument cluster module (IC). ● Telltale/indicator. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test C .
<ul style="list-style-type: none"> ● The Pedal Goes Down Fast 	<ul style="list-style-type: none"> ● Brake fluid level. ● Air in system. ● Brake master cylinder. 	<ul style="list-style-type: none"> ● FILL the brake master cylinder reservoir. BLEED the system. ● BLEED the system. ● CARRY OUT the brake master cylinder component test in this section.
<ul style="list-style-type: none"> ● The Pedal Eases Down Slowly 	<ul style="list-style-type: none"> ● Air in system. ● Brake master cylinder. 	<ul style="list-style-type: none"> ● BLEED the system. REFER to Bleeding in this section. ● CARRY OUT the brake master cylinder component test in this section.
<ul style="list-style-type: none"> ● Brakes Lock Up During Light Brake Pedal Force 	<ul style="list-style-type: none"> ● Disc brake component. ● Parking brake component. ● Anti-lock brake control system. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D .
<ul style="list-style-type: none"> ● Excessive/Erratic Brake Pedal Travel 	<ul style="list-style-type: none"> ● Leak in hydraulic system. ● Air in system. ● Disc brake caliper. ● Brake master cylinder. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test E .
<ul style="list-style-type: none"> ● Brakes Drag 	<ul style="list-style-type: none"> ● Parking brake component. ● Disc brake caliper. 	<ul style="list-style-type: none"> ● REPAIR or INSTALL new components as necessary. REFER to Section 206-05 . ● REPAIR or INSTALL a new caliper as necessary. REFER to Section 206-03 or Section 206-04 .

	<ul style="list-style-type: none"> ● Brake master cylinder. 	<ul style="list-style-type: none"> ● CARRY OUT the brake master cylinder component test in this section.
<ul style="list-style-type: none"> ● Excessive Brake Pedal Effort 	<ul style="list-style-type: none"> ● Power brake booster. ● Power brake booster check valve. ● Power brake booster hose. 	<ul style="list-style-type: none"> ● CARRY OUT the brake booster component test in this section.
<ul style="list-style-type: none"> ● Red Brake Warning Indicator Inoperative 	<ul style="list-style-type: none"> ● Circuit. ● Bulb. 	<ul style="list-style-type: none"> ● REFER to <u>Section 413-01</u>.
<ul style="list-style-type: none"> ● Brake Noise 	<ul style="list-style-type: none"> ● Disc brake component. 	<ul style="list-style-type: none"> ● REFER to <u>Section 100-04</u>.
<ul style="list-style-type: none"> ● Brake Vibration/Shudder — Occurs When Brakes Are Applied 	<ul style="list-style-type: none"> ● Uneven disc wear. ● Uneven disc brake pad transfer. ● Suspension components. 	<ul style="list-style-type: none"> ● REFER to <u>Section 100-04</u>.

Pinpoint Tests

PINPOINT TEST A: THE BRAKES PULL OR DRIFT

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK THE TIRE PRESSURE	
<p>1</p>  <p>A0003832</p>	<p>1 Check for excessive wear and measure the air pressure in all four tires.</p> <ul style="list-style-type: none"> ● Are the tires good and the tire pressure within specifications? <p>→ Yes GO to <u>A2</u>.</p> <p>→ No ADJUST the tire pressure. ROTATE the tires front to rear. If tires are excessively worn, INSTALL new tires.</p>

A2 INSPECT THE BRAKE PADS

1



A0003837

1 Inspect the brake pads for contamination and wear concerns.

● **Are the brake pads OK?**

→ **Yes**
GO to A3.

→ **No**
INSTALL new brake pads. REFER to Section 206-03 (front) or Section 206-04 (rear).

A3 INSPECT THE BRAKE DISCS AND HUBS

1 Inspect the brake discs and hubs for damage.

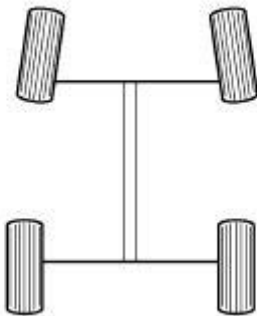
● **Are the brake discs or hubs damaged?**

→ **Yes**
REPAIR and INSTALL new brake disc or hub as necessary.

→ **No**
GO to A4.

A4 CHECK THE ALIGNMENT

1



A0003835


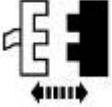
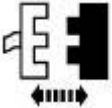
1 Check for correct camber, caster and toe-in settings. Refer to Section 204-00.

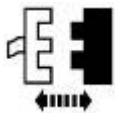
● **Is the alignment set to specification?**

→ **Yes**
INSTALL a new caliper at the affected

	<p>wheel. TEST the system for normal operation.</p> <p>→ No RESET the alignment and road test vehicle.</p>
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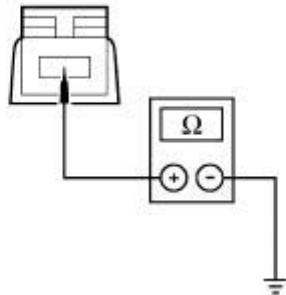
PINPOINT TEST B: THE RED BRAKE WARNING INDICATOR IS ALWAYS ON - PARKING BRAKE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 VERIFY SYMPTOM	
	<p>1 Verify that the red brake warning indicator is never on or always on.</p> <ul style="list-style-type: none"> ● Is the indicator always on? <p>→ Yes GO to <u>B2</u>.</p> <p>→ No GO to <u>B5</u>.</p>
B2 CHECK THE PARKING BRAKE INDICATOR	
<p>1</p>  <p>3</p>  <p>Parking Brake Switch C306</p>	<p>2 Wait past prove out time.</p> <ul style="list-style-type: none"> ● Did the indicator turn off? <p>→ Yes INSTALL a new parking brake switch. TEST the system for normal operation.</p> <p>→ No GO to <u>B3</u>.</p>
B3 CHECK CIRCUITS 31S-RP9 (BK/GN) FOR SHORTS TO GROUND	
<p>1</p>  <p>Parking Brake Switch C306</p> <p>2</p>	



FEM Connector J1

3



A0005312

3

Measure the resistance between the parking brake connector C306, circuit 31S-RP9 (BK/GN), and ground.

- Is the resistance greater than 10,000 ohms?

→ Yes

GO to B4.

→ No

REPAIR circuit 31S-RP9 (BK/GN). TEST the system for normal operation.

B4 INSTRUMENT CLUSTER DIAGNOSIS

1



1

NOTE: This pinpoint test step needs to be checked if the instrument cluster module (IC) has any DTCs and is functioning correctly, and if the telltale is OK.

Retrieve DTCs.

- Is the instrument cluster diagnosis check out OK?

→ Yes

INSTALL a new FEM. TEST the system for normal operation.

→ No

REPAIR or INSTALL a new instrument cluster and or associated circuits.

B5 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCs) - FEM

1

Make sure the parking brake is applied when running self-test. If the parking brake is not applied during self-test, this will cause a DTC of C1446.

2

Using recorded results from the front electronic module (FEM) self-test.

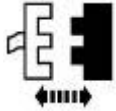
- Are any DTCs recorded?

→ **Yes**
For C1446, GO to B6.

→ **No**
GO to B11.

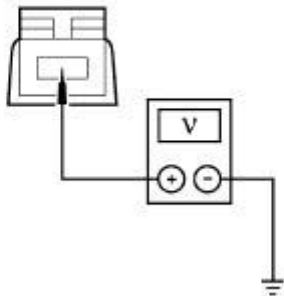
B6 CHECK CIRCUIT 31S-RP9 (BK/GN) FOR VOLTAGE

1



Parking Brake Switch C306

2



A0005310

2 Measure the voltage between parking brake switch, circuit 31S-RP9 (BK/GN) and chassis ground.

● **Is voltage greater than 10.0 volts?**

→ **Yes**
GO to B10.

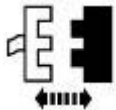
→ **No**
GO to B7.

B7 CHECK PARKING BRAKE INDICATOR

1



3

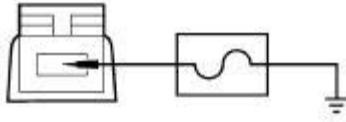


Parking Brake Switch C306

4

2 Wait past prove out time.

4 Jumper the parking brake switch connector C306, circuit 31S-RP9 (BK/GN) to chassis ground with a fused jumper wire.



A0005311

● **Did the indicator turn on?**

→ **Yes**
 INSTALL a new parking brake switch.
 TEST the system for normal operation.

→ **No**
 GO to B8.

B8 CHECK CIRCUIT 31S-RP9 (BK/GN) FOR OPENS

1



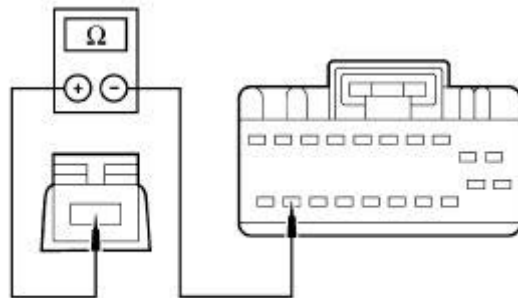
Parking Brake Switch C306

2



FEM Connector J1

3



A0005309

3 Measure the resistance between the parking brake switch, circuit 31S-RP9 (BK/GN), and FEM connector J1, pin 19, circuit 31S-RP9 (BK/GN).

● **Is resistance less than 5.0 ohms?**

→ **Yes**
 GO to B9.

→ **No**
 REPAIR circuit 31S-RP9 (BK/GN). TEST the system for normal operation.

B9 INSTRUMENT CLUSTER DIAGNOSIS

1

1 **NOTE:** This pinpoint test step needs to



be checked if the instrument cluster module (IC) has any DTCs and is functioning correctly, and if the telltale is OK.

Retrieve DTCs.

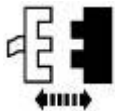
- **Is the instrument cluster diagnosis check out OK?**

→ **Yes**
INSTALL a new FEM. TEST the system for normal operation.

→ **No**
REPAIR or INSTALL a new instrument cluster or associated circuits.

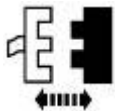
B10 CHECK CIRCUITS 31S-RP9 (BK/GN) FOR SHORTS TO B+

1



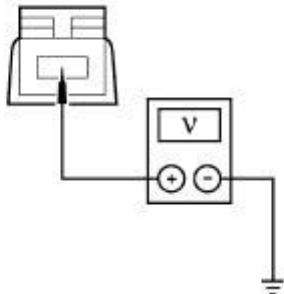
Parking Brake Switch C306

2



FEM Connector J1

3



A0005310

3 Measure the voltage between the parking brake switch, circuit 31S-RP9 (BK/GN), and chassis ground.

- **Is voltage greater than 10.0 volts?**

→ **Yes**
REPAIR circuit 31S-RP9 (BK/GN). TEST the system for normal operation.

→ **No**
INSTALL a new FEM. TEST the system for normal operation.

B11 INSTRUMENT CLUSTER DIAGNOSIS

1

1 **NOTE:** This pinpoint test step needs to be checked if the instrument cluster module (IC) has any DTCs and is functioning correctly, and if the telltale is



OK.


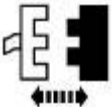
Retrieve DTCs.

- Is the instrument cluster diagnosis check out OK?

→ **Yes**
INSTALL a new FEM. TEST the system for normal operation.

→ **No**
REPAIR or INSTALL a new instrument cluster or associated circuits.

PINPOINT TEST C: THE RED BRAKE WARNING INDICATOR IS ALWAYS ON - LOW BRAKE FLUID LEVEL

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 VERIFY SYMPTOM	
	<p>1 Verify that the red brake warning indicator is never on or always on.</p> <ul style="list-style-type: none"> ● Is the indicator always on? <p>→ Yes GO to C2.</p> <p>→ No GO to C5.</p>
C2 CHECK FOR FAULTY LOW BRAKE FLUID LEVEL SENSOR	
<p>1</p>  <p>3</p>  <p>Low Brake Fluid Level Sensor C124</p>	<p>2 Wait past prove out time.</p> <ul style="list-style-type: none"> ● Did the indicator turn off? <p>→ Yes INSTALL a new low brake fluid level sensor. TEST the system for normal operation.</p>

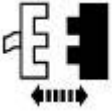
→ **No**
GO to C3.

C3 CHECK FOR FAULTY FEM

1

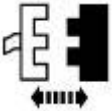


2



Low Brake Fluid Level Sensor

3



FEM Connector J3

● **Did the indicator turn off?**

→ **Yes**
GO to C4.

→ **No**
GO to C5.

C4 CHECK CIRCUIT 8–GC7 (WH/RD) FOR SHORTS TO GROUND

1



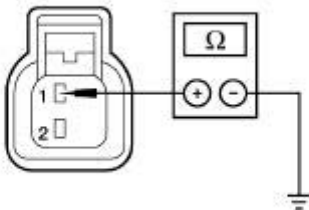
Low Brake Fluid Level Sensor C124

2



FEM Connector J3

3



A0003836

3 Measure the resistance between the low brake fluid level sensor connector C124, circuit 8–GC7 (WH/RD) and chassis ground.

● **Is resistance greater than 10.0 ohms?**

→ **Yes**
INSTALL a new FEM. TEST the system for normal operation.

→ **No**
REPAIR circuit 8–GC7 (WH/RD). TEST the system for normal operation.

C5 INSTRUMENT CLUSTER DIAGNOSIS

1



1 **NOTE:** This pinpoint test step needs to be checked if the instrument cluster module (IC) has any DTCs and is functioning correctly, and if the telltale is OK.

Retrieve DTCs.

2 Use recorded results from the front electronic module (FEM) self-test.

● **Is the instrument cluster diagnosis check out OK?**

→ **Yes**
INSTALL a new FEM. TEST the system for normal operation.

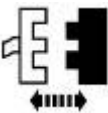
→ **No**
REPAIR or INSTALL a new instrument cluster or associated circuits.

C6 CHECK LOW BRAKE FLUID LEVEL SENSOR

1

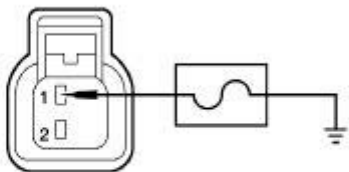


3



Low Brake Fluid Level Sensor C124

4



2 Wait past prove out time.

4 Jumper low brake fluid level sensor connector C124, circuit 8–GC7 (WH/RD) to chassis ground with a fused jumper wire.

A0003839

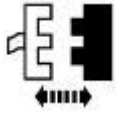
● **Did the indicator turn on?**

→ **Yes**
GO to C7.

→ **No**
GO to C8.

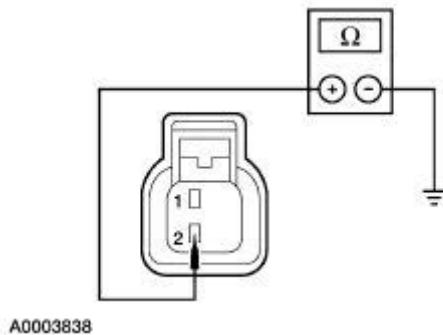
C7 CHECK CIRCUIT 31–GC7 (BK) FOR OPENS

1



Low Brake Fluid Level Sensor C124

2



2 Measure the resistance between the low brake fluid level sensor, circuit 31–GC7 (BK) and chassis ground.

● **Is resistance less than 5.0 ohms?**

→ **Yes**
INSTALL a new low brake fluid level sensor. TEST the system for normal operation.

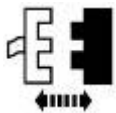
→ **No**
Repair circuit 31–GC7 (BK). TEST the system for normal operation.

C8 CHECK LOW BRAKE FLUID LEVEL PID

1



2

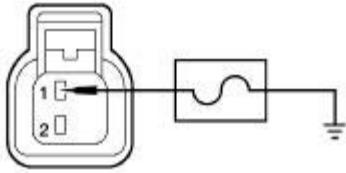


Low Brake Fluid Level Sensor C124

4

3 Access the low brake fluid level PID:
2909 Byte 1 - Bit 4.

4 View the PID while jumpering the low brake fluid level sensor connector, circuit 8–GC7 (WH/RD) to chassis ground with a fused jumper wire.



A0003839

- Did the PID read from off to on?

→ **Yes**
GO to C10.

→ **No**
GO to C9.

C9 CHECK CIRCUIT 8–GC7 (WH/RD) FOR OPENS

1



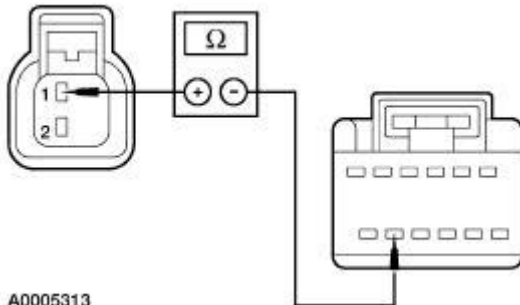
Low Brake Fluid Level Sensor C124

2



FEM Connector J3

3



A0005313


- 3 Measure the resistance between FEM connector J3, pin 11, circuit 8–GC7 (WH/RD) and the low brake fluid level sensor connector C124, circuit 8–GC7 (WH/RD).

- Is the resistance less than 5.0 ohms?

→ **Yes**
INSTALL a new FEM. TEST the system for normal operation.

→ **No**
REPAIR circuits 8–GC7 (WH/RD). TEST the system for normal operation.

C10 INSTRUMENT CLUSTER DIAGNOSIS



<p>1</p> 	<p>1 NOTE: This pinpoint test step needs to be checked if the instrument cluster module (IC) has any DTCs and is functioning correctly, and if the telltale—is OK.</p> <p>Retrieve DTCs.</p> <ul style="list-style-type: none"> ● Is the instrument cluster diagnosis check out OK? <p>→ Yes INSTALL a new FEM. TEST the system for normal operation.</p> <p>→ No REPAIR or INSTALL a new instrument cluster or associated circuits.</p>
--	---

PINPOINT TEST D: BRAKES LOCK UP DURING LIGHT BRAKE PEDAL FORCE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK FOR BINDING OR STICKING BRAKE COMPONENTS	
	<p>1 Check brake components for binding, damage and incorrect installation at each wheel.</p> <ul style="list-style-type: none"> ● Do any of the components bind or stick? <p>→ Yes REPAIR or INSTALL new components as necessary. TEST the system for normal operation.</p> <p>→ No GO to <u>D2</u>.</p>
D2 CHECK THE PARKING BRAKE COMPONENTS	
	<p>1 Check the parking brake components for damage, seized condition, and incorrect adjustment. Refer to <u>Section 206-05</u>.</p> <ul style="list-style-type: none"> ● Are the parking brake components OK? <p>→ Yes GO to <u>D3</u>.</p> <p>→ No REPAIR or INSTALL new components as necessary. REFER to <u>Section 206-05</u>. TEST the system for normal operation.</p>
D3 INSPECT THE BRAKE PADS	
	<p>1 Inspect brake pads for contamination, excessive wear or damage. Refer to <u>Section 206-03</u> for front disc brake inspection. Refer to <u>Section 206-04</u> for rear disc brake inspection.</p>

	<ul style="list-style-type: none"> ● Are the brake pads OK? <p>→ Yes GO to <u>D4</u>.</p> <p>→ No INSTALL new brake pads as necessary. TEST the system for normal operation.</p>
D4 CHECK FOR LOOSE BRAKE COMPONENT MOUNTINGS	
	<p>1 Check for loose or damaged caliper mounting bolts.</p> <ul style="list-style-type: none"> ● Are the component mountings OK? <p>→ Yes CHECK the 4-wheel anti-lock control brake system (4WABS).</p> <p>→ No REPAIR as necessary. TEST the system for normal operation.</p>

PINPOINT TEST E: EXCESSIVE/ERRATIC BRAKE PEDAL TRAVEL

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK FOR SPONGY PEDAL	
<p>1</p>  <p>2</p> 	<p>3 Operate the brake pedal and note pedal feel.</p> <ul style="list-style-type: none"> ● Does the brake pedal feel spongy? <p>→ Yes BLEED the brake system. REFER to <u>Bleeding— System</u> in this section. TEST the system for normal operation.</p> <p>→ No GO to <u>E2</u>.</p>
E2 CHECK THE BRAKE PEDAL	
	<p>1 Inspect the brake pedal and bracket for binding, obstruction or damage.</p> <ul style="list-style-type: none"> ● Is the brake pedal OK? <p>→ Yes GO to <u>E3</u>.</p>

	<p>→ No REPAIR or INSTALL a new brake pedal as necessary. TEST the system for normal operation.</p>
E3 CHECK BRAKE COMPONENTS	
	<p>1 Inspect the calipers and brake pads for binding, damage, incorrect installation and contamination.</p> <p>● Are the calipers and brake pads OK?</p> <p>→ Yes GO to <u>E4</u>.</p> <p>→ No REPAIR or INSTALL new components as necessary. TEST the system for normal operation.</p>
E4 CHECK POWER BRAKE BOOSTER	
	<p>1 Carry out the brake booster component test.</p> <p>● Is the power brake booster OK?</p> <p>→ Yes INSTALL a new brake master cylinder. TEST the system for normal operation.</p> <p>→ No INSTALL a new power brake booster. TEST the system for normal operation.</p>

Component Tests

Brake Booster

1. Check the hydraulic brake system for leaks or insufficient fluid.
2. With the transmission (7003) in NEUTRAL, stop the engine (6007) and apply the parking brake control (2780). Apply the brake pedal several times to exhaust all vacuum in the system.
3. Apply the brake pedal and hold it in the applied position. Start the engine. If the vacuum system is operating, the brake pedal will tend to move downward under constant foot pressure. If no motion is felt, the power brake booster system is not functioning. Continue the test with the following steps.
4. Remove the vacuum booster hose (2A047) from the check valve connection. Manifold vacuum must be available at the check valve end of the vacuum booster hose with the engine at idle speed and the transmission in NEUTRAL. If the manifold vacuum is available to the power brake booster, connect the vacuum booster hose to the power brake booster check valve (2365) and repeat Steps 2 and 3 above.
5. Check and if no downward movement of the brake pedal is felt, install a new power brake booster.
6. Operate the engine a minimum of 10 seconds at fast idle. Stop the engine, and let the vehicle stand for 10 minutes. Then apply the brake pedal with approximately 89 N (20 lbs) of force. The brake pedal feel should be the same as that noted with the engine operating. If the brake pedal

feels hard (no power assist), install a new check valve and retest. If the brake pedal feels spongy, bleed the hydraulic system to remove air. Refer to Bleeding in this section.

Check Valve

The function of the power brake booster check valve is to allow manifold vacuum to enter the power brake booster and prevent the escape of vacuum in the event manifold vacuum is lost during sustained full throttle operation.

To test the function of the power brake booster check valve:

- Start and run the engine for at least 10 seconds.
- Operate the brake pedal to check for power assist.
- Disconnect the vacuum booster hose from the power brake booster. Do not remove the power brake booster check valve from the power brake booster.
- There should be enough vacuum retained in the power brake booster for at least one more power-assisted brake operation.

Brake Master Cylinder

Normal Conditions

The following conditions are considered normal.

Condition 1: During normal operation of the brake master cylinder, the fluid level in the brake master cylinder reservoir will rise during brake application and fall during release. The net fluid level (after brake application and release) will remain unchanged.

Condition 2: A trace of brake fluid will exist on the booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore and seal.

Condition 3: Fluid level will decrease with pad wear.

Abnormal Conditions

Changes in brake pedal feel or travel are indicators that something could be wrong in the brake system. Refer to the Symptom Chart for abnormal condition diagnosis.

Bypass Condition Test

1. Disconnect the brake lines at the brake master cylinder.
2. Plug the outlet ports of the brake master cylinder.
3. Apply the brakes. If brake pedal height cannot be maintained, the brake master cylinder has an internal leak and a new master cylinder must be installed.

Compensator Port Check

The purpose of the compensator ports in the brake master cylinder is to supply any additional brake fluid required by the system due to brake pad wear and to allow brake fluid returning from the brake lines to the brake master cylinder to enter the brake master cylinder reservoir.

The returning brake fluid will cause a slight turbulence in the brake master cylinder reservoir. Turbulence seen in the brake master cylinder reservoir upon release of the brake pedal is normal and shows that the compensating ports are not plugged.

Bleeding — System

Manual



WARNING: Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.



WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.



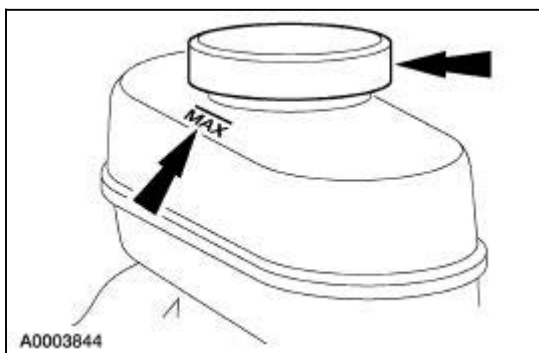
CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.



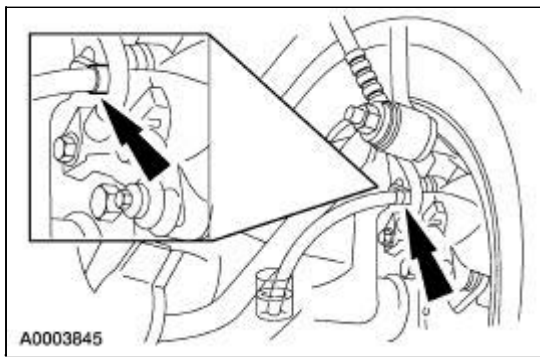
CAUTION: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with the specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

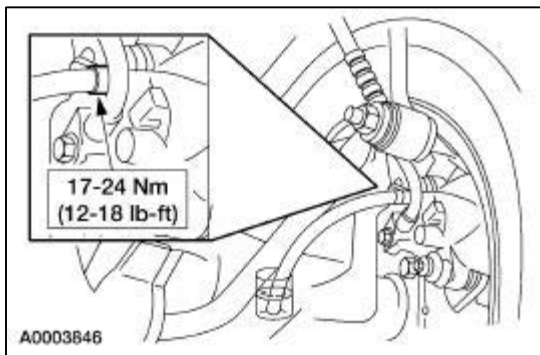
1. Connect the NGS DCL cable adapter into the vehicle data link connector (DLC) under the dash and follow the NGS instructions.
2. Clean all dirt from and remove the brake master cylinder filler cap and fill the brake master cylinder reservoir with the specified brake fluid.



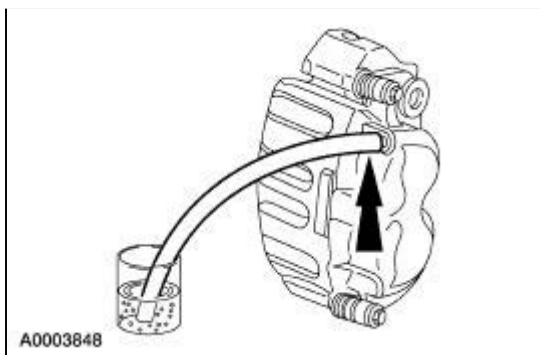
3. Place a box end wrench on the RH rear bleeder screw. Attach a rubber drain tube to the RH rear bleeder screw and submerge the free end of the tube in a container partially filled with clean brake fluid.



4. Have an assistant hold firm pressure on the brake pedal.
5. Loosen the RH rear bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the RH rear bleeder screw.
 - Repeat until clear, bubble-free fluid comes out.
 - Refill the brake master cylinder reservoir as necessary.
6. Tighten the RH rear bleeder screw.



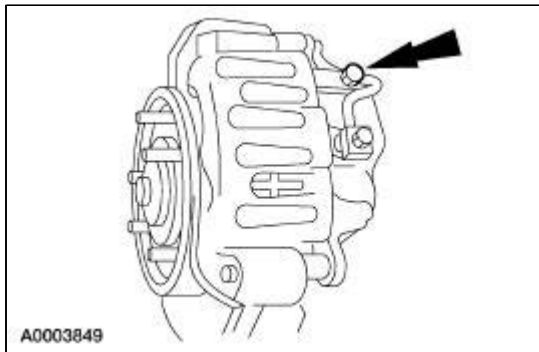
7. Repeat Steps 3, 4, 5 and 6 for the LH rear bleeder screw.
8. Place a box end wrench on the RH front disc brake caliper bleeder screw. Attach a rubber drain tube to the RH front disc brake caliper bleeder screw, and submerge the free end of the tube in a container partially filled with clean brake fluid.



9. Have an assistant hold firm pressure on the brake pedal.
10. Loosen the RH front disc brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the RH front disc brake caliper bleeder screw.
 - Repeat until clear, bubble-free fluid comes out.

- Refill the brake master cylinder reservoir as necessary.

11. Tighten the RH front disc brake caliper bleeder screw. For additional information, refer to Specifications.



12. Repeat Steps 8, 9, 10 and 11 for the LH front disc brake caliper bleeder screw.

Pressure



WARNING: Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.



WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

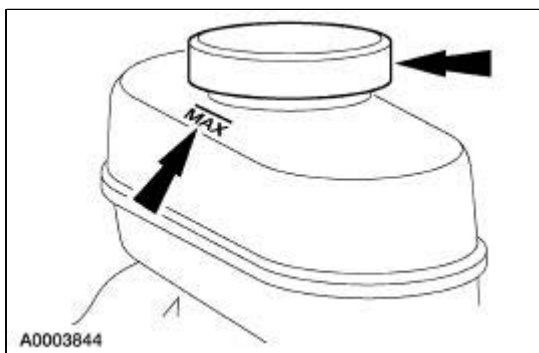


CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.



CAUTION: Do not allow the master cylinder to run dry during the bleeding operation. Keep the master cylinder reservoir filled with the specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

1. Clean all dirt from and remove the brake master cylinder filler cap and fill the brake master cylinder reservoir with the specified brake fluid.

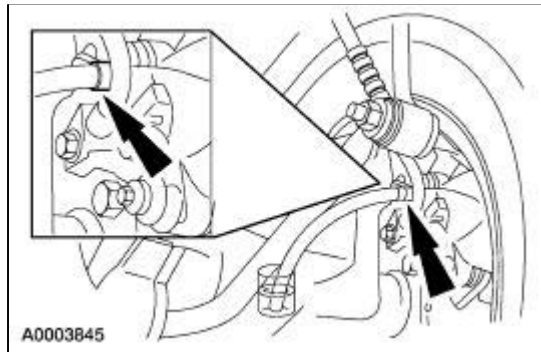


2. **NOTE:** Master cylinder pressure bleeder adapter tools are available from various manufacturers of pressure bleeding equipment. Follow the instructions of the manufacturer when installing the adapter.

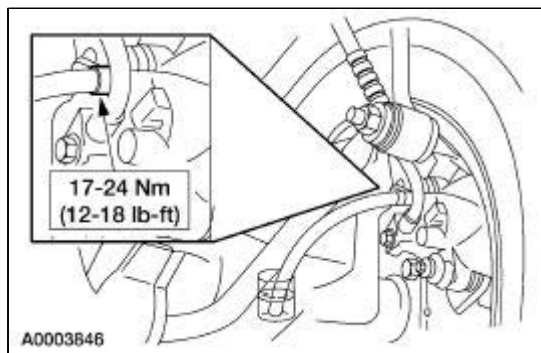
Install the bleeder adapter to the brake master cylinder reservoir, and attach the bleeder tank hose to the fitting on the adapter.

3. **NOTE:** Bleed the longest line first. Make sure the bleeder tank contains enough specified brake fluid to complete the bleeding operation.

Place a box end wrench on the RH rear bleeder screw. Attach a rubber drain tube to the RH rear bleeder screw, and submerge the free end of the tube in a container partially filled with clean brake fluid.



4. Open the valve on the bleeder tank.
5. Loosen the RH rear bleeder screw. Leave open until clear, bubble-free brake fluid flows, then tighten the RH rear bleeder screw and remove the rubber hose.



6. Continue bleeding the rear of the system, going in order from the LH rear bleeder screw to the RH front disc brake caliper bleeder screw ending with the LH front disc brake caliper bleeder screw.
 7. Close the bleeder tank valve. Remove the tank hose from the adapter, and remove the adapter.
-

Hydraulic Leak Check

1. **NOTE:** Brake fluid is water soluble and it is possible that all evidence of fluid leakage has been washed off if the vehicle has been operated in the rain or snow.

Make sure the brake master cylinder reservoir (2K478) is full.

2. Apply the brakes several times and make sure the brake pedal (2455) feel is not spongy. If necessary, bleed the system. For additional information, refer to Bleeding— System in this section.
 3. Verify that the reservoir level is dropping.
 4. If the reservoir level is dropping, inspect the brake components, fittings and lines to locate the source of the leak.
-

General Specifications

Item	Specification
Brake Disc	
Minimum thickness ^a	28.00 mm (1.12 in)
Pad	
Minimum thickness above metal backing plate or rivets	2 mm (0.079 in)
Fluid	
High Performance DOT 3 Brake Fluid C6AZ-19542-AB	ESA-M6C25-A (United States and Canada only)
High Performance DOT 4 Brake Fluid	SAE-J1704-DOT 4 (All Vehicles)
Lubricant	
Silicone Brake Caliper Grease and Dielectric Compound D7AZ-19A331-A	ESE-M1C171-A
High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA	ESE-M12A4-A
Rust Penetrant and Inhibitor F2AZ-19A501-A	ESR-M99C56-A
Cleaners	
Brake Parts Cleaner F6AZ-2C410-AB	—

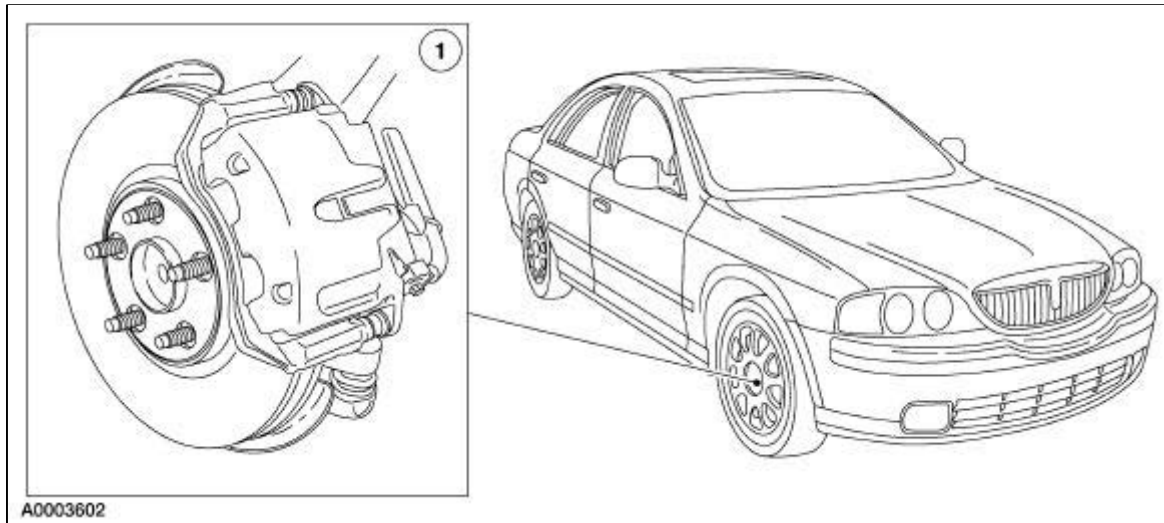
^a Minimum safe thickness is shown on each brake disc.

Torque Specifications

Description	Nm	lb-ft
Caliper bolts	35	26
Caliper flow bolt	47	35
Anchor plate bolts	103	76

Front Disc Brake

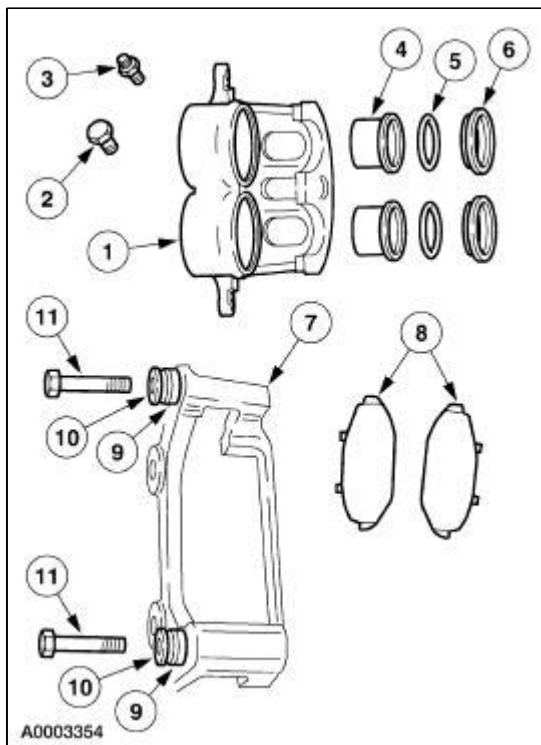
Front Disc Brake



A0003602

Item	Part Number	Description
1	2B120	Front disc brake caliper assy

Disc Brake Caliper Components



A0003354

Item	Part Number	Description
1	2B120	Disc brake caliper

2	2L126	Bleeder screw cap
3	2208	Bleeder screw
4	2196	Caliper piston
5	2B115	Piston seal
6	2207	Piston dust boot
7	2B292	Front disc brake caliper anchor plate
8	2001	Brake pads
9	2A492	Guide pin boot
10	2B296	Guide pin
11	2N386	Caliper bolt

The front disc brake caliper (2B120):

- bolts to the front disc brake caliper anchor plate (2B292), which bolts to the front wheel spindle (3105).
- is a disc brake caliper locating pin, dual piston design one piston is 38mm the other piston is 45mm.
- has a fluid inlet at the bottom of the caliper housing.

The front brake discs (1125):

- are of a ventilated full-cast design, with non-directional cooling fins.
- are serviced with the disc brake caliper and front disc brake caliper anchor plate removed.

The front brake disc shield (2K005):

- is riveted to the front wheel spindle.
- protects the front wheel bearings and inboard surface of the front brake disc.

The pads (2001):

- are housed in the front disc brake caliper anchor plate.
- are of a non-asbestos, non-metallic composition.

Brake Fluid



WARNING: Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.



WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.



CAUTION: Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled

onto a painted or plastic surface, immediately wash it with water.

Use clean, fresh Ford High Performance DOT 3 Motor Vehicle Brake Fluid C6AZ-19542-AB or equivalent meeting Ford specification ESA-M6C25-A (United States and Canada only). If DOT 3 is not available, use Ford High Performance DOT 4 Brake Fluid or equivalent meeting Ford specification SAE-J-1704-DOT 4.

- Do not reuse brake fluid drained or bled from the system.
 - Do not use brake fluid that has been stored in an open container.
 - Do not use contaminated brake fluid.
-


Front Disc Brake

Refer to Section 206-00 .

Pads


Removal


 **WARNING:** Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.

 **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

 **CAUTION:** Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

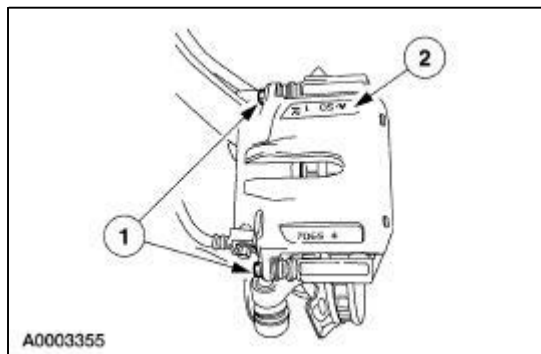
1. Remove brake master cylinder filler cap. Check brake fluid level in brake master cylinder reservoir (2K478). Remove fluid until the reservoir is half full.
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).

4.  **CAUTION:** Do not pry in caliper sight hole to retract pistons as this can damage the pistons and boots.

 **CAUTION:** When removing the caliper (2B120), never allow it to hang from the brake hose. Provide a suitable support.

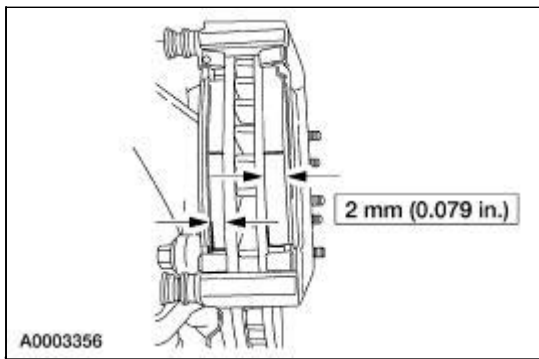
Remove the brake caliper (2B120).

1. Remove the caliper bolts.
2. Lift the caliper off the caliper anchor plate (2B292).

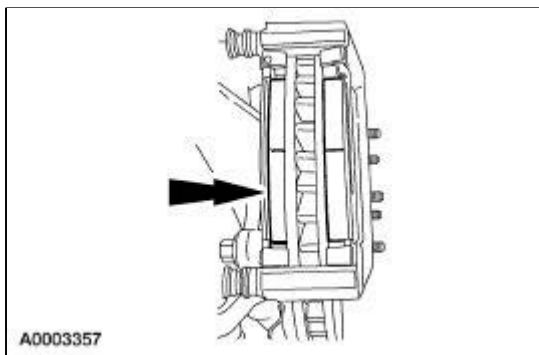


5.  **CAUTION:** Install new pads if worn to or past the specified thickness above the metal backing plate or rivets. Install new pads in complete axle sets.

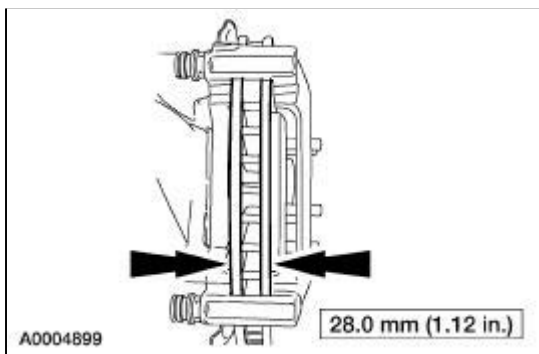
Inspect the pads (2100) for wear and contamination.



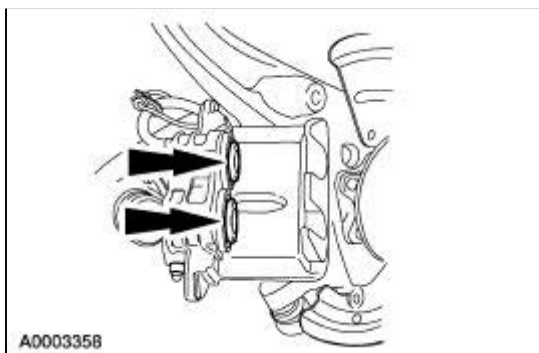
6. Remove the pads.



7. Measure the brake disc thickness.
 - Install a new brake disc (1125) if not within specification.

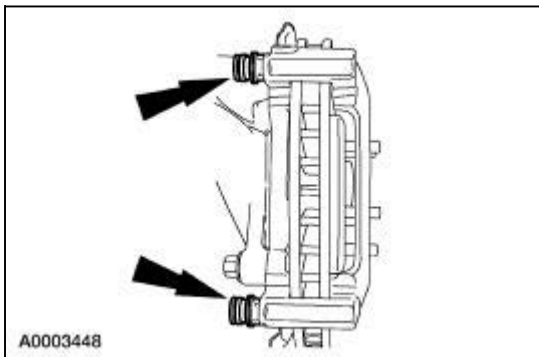


8. Inspect the caliper.
 - If leaks or damaged boots are found, disassembly is required. For additional information, refer to [Caliper](#) in this section.



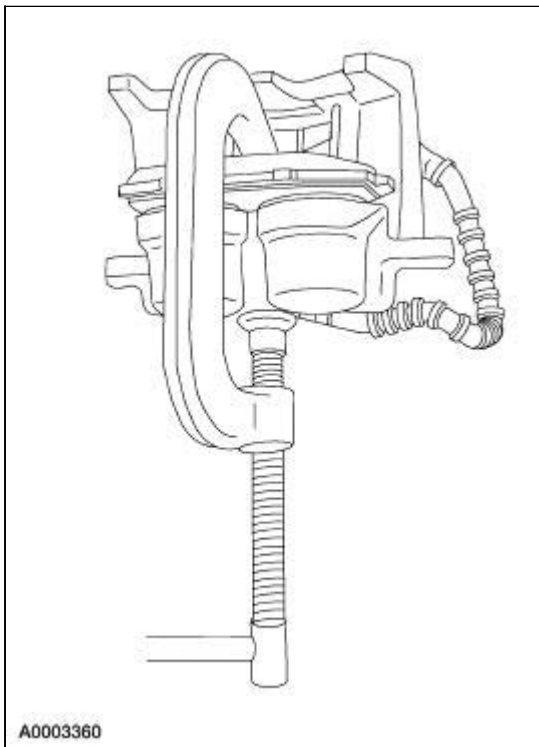
9. Inspect the anchor plate assembly.

- Check the guide pin boots for damage.
- Check the guide pins for binding and damage.
- Install new pins if worn or damaged.



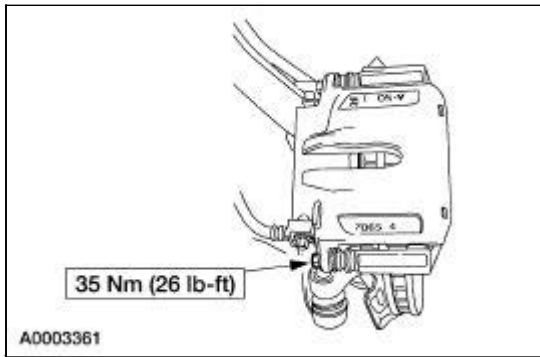
10. **NOTE:** Use a wood block or used pad to protect pistons and boots.

Compress the caliper pistons.



Installation


1. To install, reverse the removal procedure.
 - Fill the brake master cylinder reservoir with clean High Performance DOT 4 Brake Fluid or equivalent DOT 4 fluid meeting Ford specification SAE-J1704-DOT 4. If DOT 4 is not available use DOT 3 Brake Fluid (United States) C6AZ-19542-AB meeting Ford specification ESA-M6C25-A.



Caliper

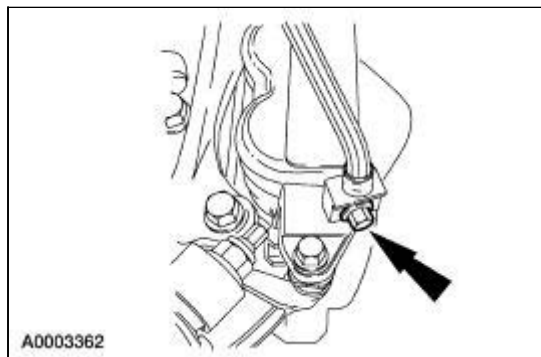
Removal

 **WARNING:** Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.

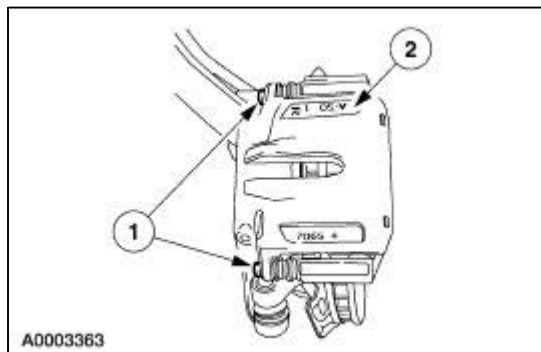
 **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

 **CAUTION:** Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
3. Remove the caliper flow bolt.
 - Discard the copper washers.

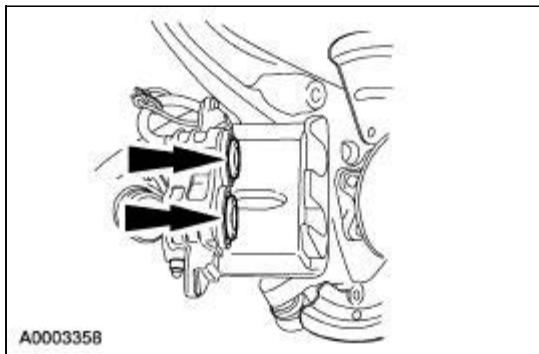


4. Remove the caliper (2B120).
 1. Remove the caliper bolts.
 2. Lift the caliper off the caliper anchor plate (2B292).



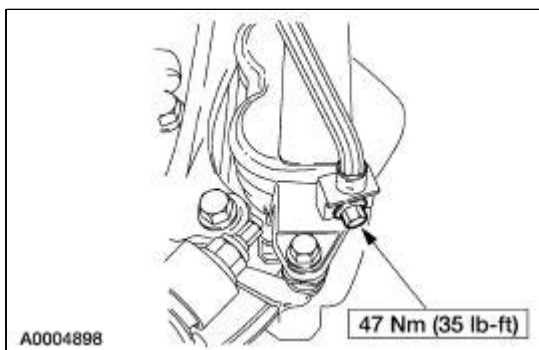
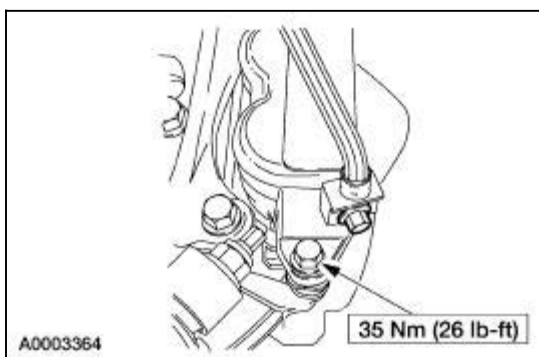
5. Inspect the caliper.

- If leaks or damaged boots are found, disassembly is required. For additional information, refer to [Caliper](#) in this section.



Installation

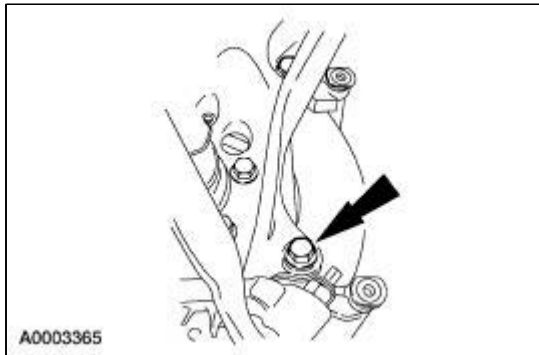
1. To install, reverse the removal procedure.
 - Install new copper washers.
 - Bleed the caliper. For additional information, refer to [Section 206-00](#).



Brake Caliper Anchor Plate

Removal

1. Remove the pads (2100). For additional information, refer to [Pads](#) in this section.
2. Remove the caliper anchor plate bolts.

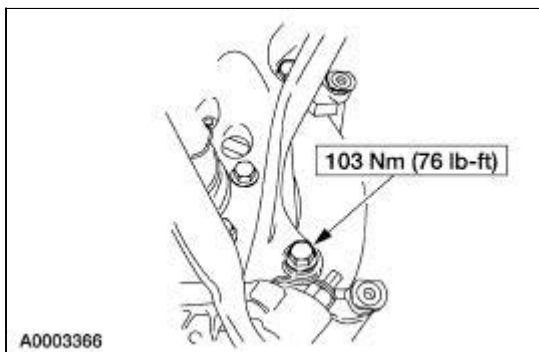


Installation

1.  **CAUTION: Use correct type and length bolts.**

To install, reverse the removal procedure.

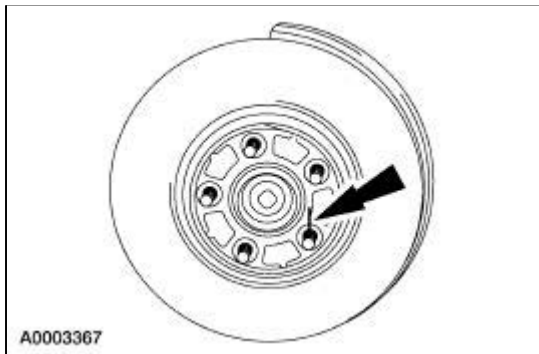
- Install new anchor plate bolts.




Disc

Removal

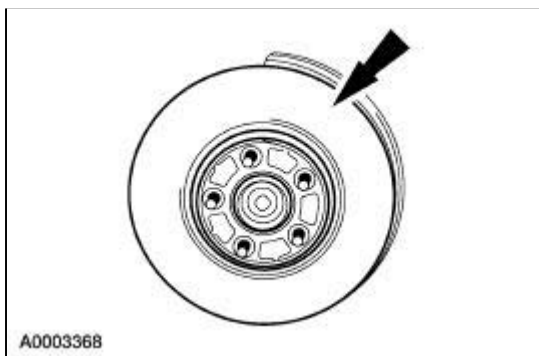
1. Remove the caliper anchor plate (2B292). For additional information, refer to [Brake Caliper Anchor Plate](#) in this section.
2. Mark the brake disc (1125) and a wheel bolt.
 - This ensures the lowest brake disc runout is maintained during reassembly.



3.  **CAUTION:** If excessive force must be used during brake disc removal, the brake disc total indicated runout (TIR) must be checked at installation. For additional information, refer to [Section 206-00](#).

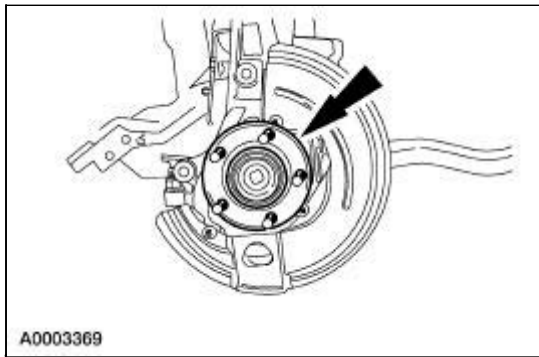
NOTE: If the brake disc cannot be removed easily, apply Rust Penetrant and Inhibitor F2AZ-19A501-A or equivalent meeting Ford specification ESR-M99C56-A on brake disc to wheel hub mating surfaces.

Remove the brake disc.

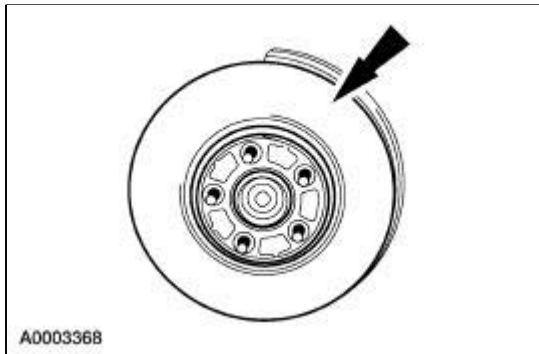


Installation

1. Clean any rust or foreign material from the brake disc and wheel hub.
 - Use Brake Parts Cleaner F6AZ-2C410-AB or equivalent to clean the brake disc and hub surfaces.
2. Apply High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA or equivalent meeting Ford specification ESE-M12A4-A to the hub flange.




3. Align the hub and brake disc marks and position the brake disc to the wheel hub (1104).



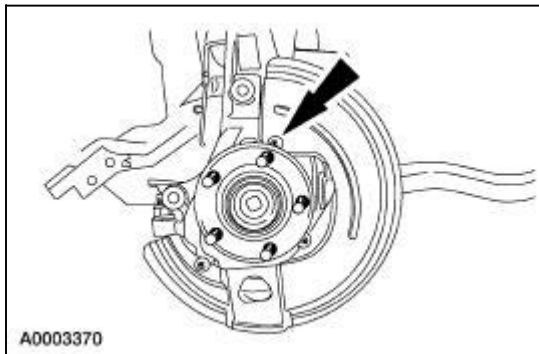
4. Install the caliper anchor plate. For additional information, refer to [Brake Caliper Anchor Plate](#) in this section.
 5. Check total indicated runout (TIR). For additional information, refer to [Section 206-00](#).
-

Shield

Removal

1. Remove the brake disc (1125). For additional information, refer to [Disc](#) in this section.
2.  **CAUTION: Use a 5.5 mm (0.22 in) drill DO NOT exceed past a 6 mm (0.24 in) drill.**

Drill out the shield rivets.




Installation

1. To install, reverse the removal procedure.
-

Caliper

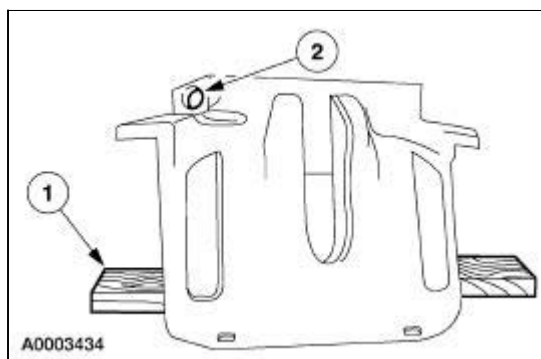
Disassembly

 **WARNING:** Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.

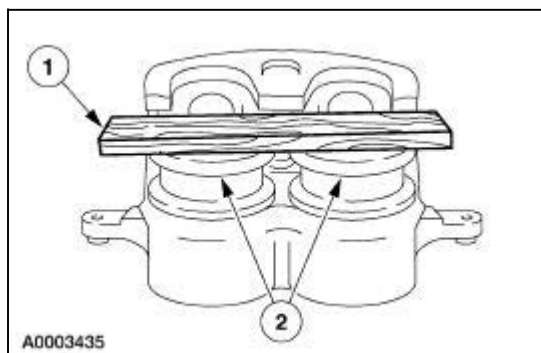
 **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

 **CAUTION:** Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

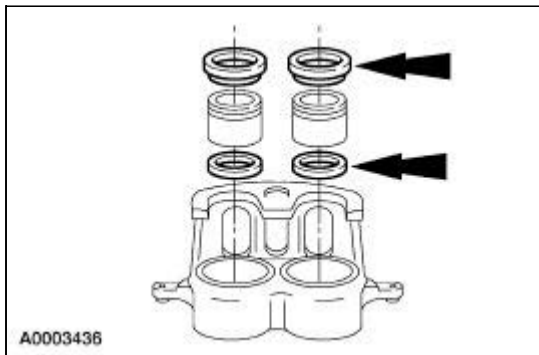
1. Remove the caliper (2B120). For additional information, refer to [Caliper](#) in this section.
2. Drain the remaining brake fluid from caliper.
3. Apply low air pressure to the fluid port in the caliper.
 1. Place a block of wood between the caliper bridge and the caliper pistons (2196).
 2. Apply low air pressure to the fluid port in the caliper and force out the caliper pistons to the block of wood.



4. Remove the caliper pistons.
 1. Remove the block of wood.
 2. Remove the caliper pistons.




5. Remove and discard the piston seals (2B115) and boots (2207).



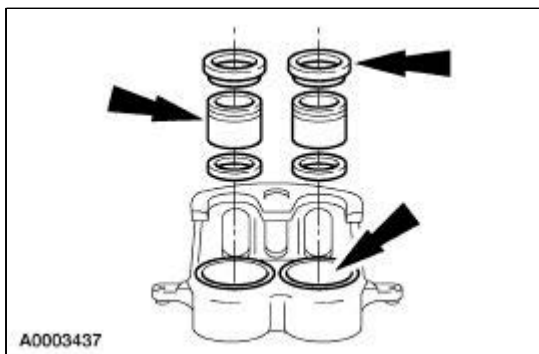
6. Remove and discard the bleed screw (2208) and cap.

Assembly

1.  **CAUTION: Do not hone the caliper bores. Caliper pistons are not available for honed caliper bores.**

Clean and inspect the caliper pistons and the caliper.

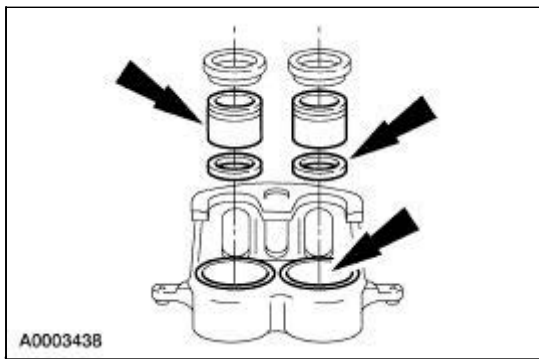
- Remove dirt and debris.
- Examine the caliper pistons for surface irregularities, scoring or wear. Install new caliper pistons if necessary.
- Clean the caliper bores with Brake Parts Cleaner F6AZ-2C410-AB. If the caliper bores are corroded or excessively scored, install a new caliper.
- Lubricate the caliper pistons and piston seals before assembly.



2.  **CAUTION: Never reuse piston seals and dust boots.**


NOTE: Never reuse brake fluid that has been drained from the hydraulic system or has been allowed to stand in an open container for an extended period of time.

Lubricate the caliper piston, piston seal and caliper bores with clean High Performance DOT 4 Brake Fluid or equivalent DOT 4 fluid meeting Ford specification SAE-J1704-DOT 4. If DOT 4 is not available use DOT 3 Brake Fluid (United States only) C6AZ-19542-AB meeting Ford specification ESA-M6C25-A.



3.  **CAUTION: Pistons are not the same diameter.**

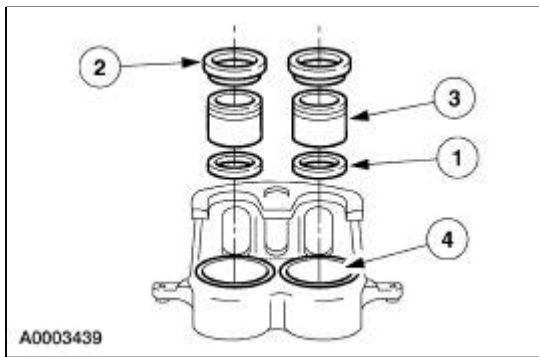
Install the caliper piston.

1. Install the piston seal.
2. Install the piston boot on the piston.
3.  **CAUTION: Be careful not to damage or dislodge the piston seal.**

Insert the caliper piston.

4.  **CAUTION: Be careful not to cock the caliper piston.**

Press the caliper piston into the bore.



4. Install a new bleed screw and cap.
 5. Install the caliper. For additional information, refer to [Caliper](#) in this section.
-

General Specifications

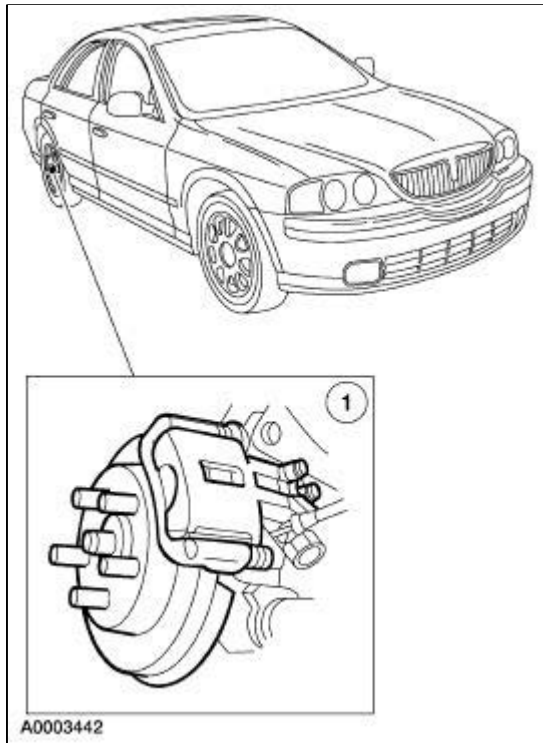
Item	Specification
Lining wear limit (from shoe surface)	1.0 mm (0.039 in)
Brake disc minimum thickness	18.50 mm (0.74 in)
Brake disc allowable runout on vehicle	0.102 mm (0.004 in)
Brake disc maximum thickness variation	0.01 mm (0.0004 in)
Fluids/Lubricants/Adhesives	
High Performance DOT 3 Brake Fluid C6AZ-19542-AB	ESA-M6C25-A (United States and Canada only)
High Performance DOT 4 Brake Fluid	SAE-J-1704-DOT 4 (All Vehicles)

Torque Specifications

Description	Nm	lb-ft
Caliper flow bolt	48	36
Support bracket bolts	103	76
Caliper bolts	33	25

Rear Disc Brake

Rear Disc Brake



Item	Part Number	Description
1	2B120	Rear disc brake caliper assy

The rear disc brake system consists of:

- solid, full-cast rear brake disc (1125).
- hydraulically activated rear disc brake caliper (2B120).

Brake Fluid

⚠ WARNING: Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.

⚠ WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

⚠ CAUTION: Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

Use clean, fresh Ford High Performance DOT 3 Motor Vehicle Brake Fluid C6AZ-19542-AB or

equivalent meeting Ford specification ESA-M6C25-A (United States and Canada only). If DOT 3 is not available, use Ford High Performance DOT 4 Brake Fluid or equivalent meeting Ford specification SAE-J-1704-DOT 4.

- Do not reuse brake fluid drained or bled from the system.
 - Do not use brake fluid that has been stored in an open container.
 - Do not use contaminated brake fluid.
-


Rear Disc Brake

Refer to Section 206-00 .

Caliper

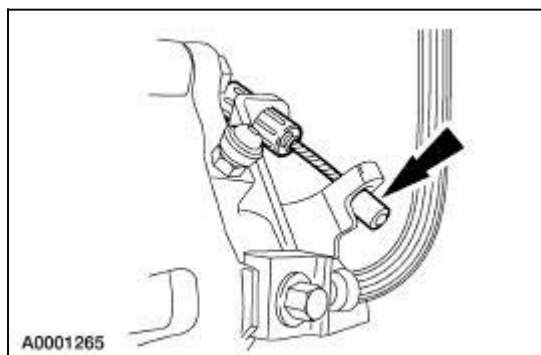
Removal

 **WARNING:** Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.

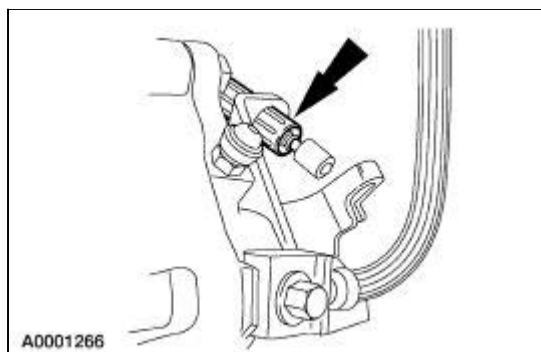
 **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

 **CAUTION:** Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

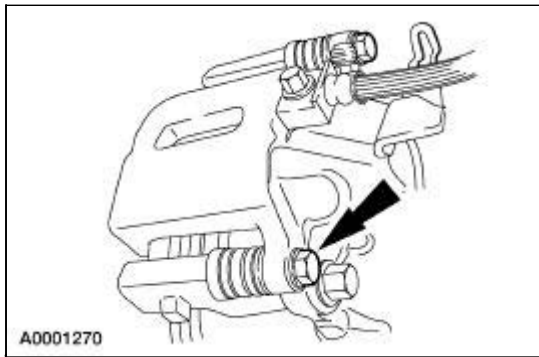
1. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
2. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
3. Disengage the parking brake cable end from the parking brake lever arm.



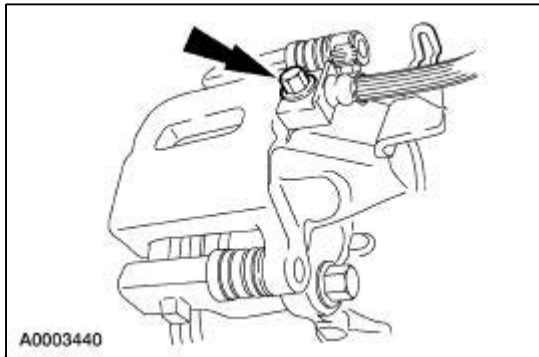
4. Remove the parking brake cable and conduit.



5. Remove the caliper bolts.

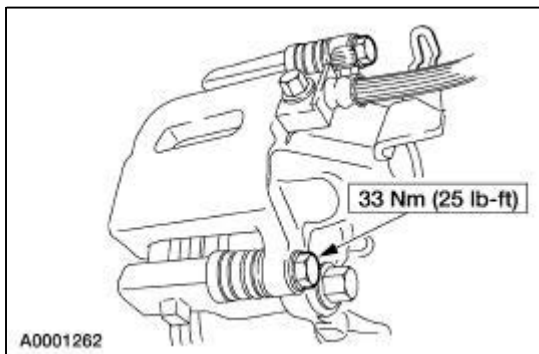
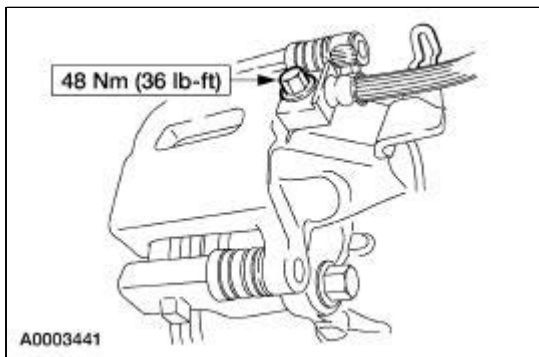


6. Remove the caliper flow bolt and remove the caliper (2B120).
 - Discard the copper washers.



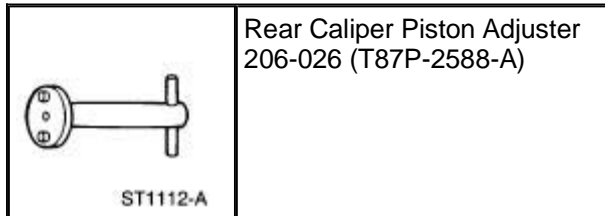
Installation

1. To install, reverse the removal procedure.
 - Use new copper washers.
 - Bleed the brake system. For additional information, refer to [Section 206-00](#).



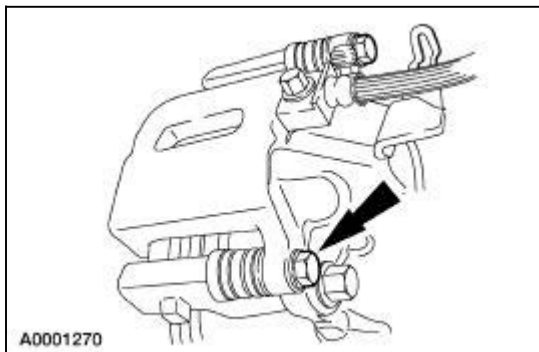
Pads

Special Tool(s)



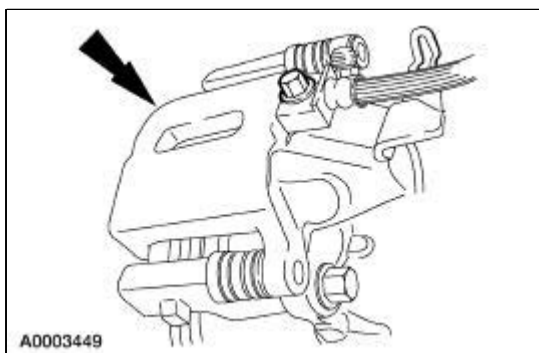
Removal

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
3. Remove the caliper bolts.

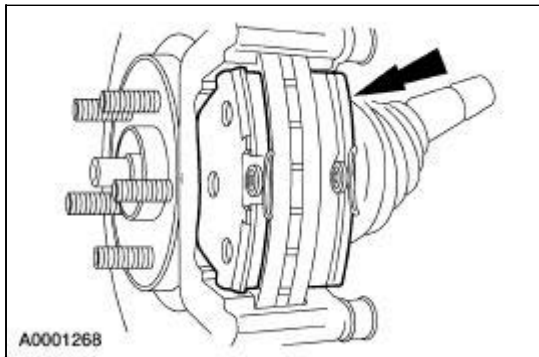


4.  **CAUTION: Do not allow the caliper to hang from the brake hose.**

Remove the caliper (2B120).

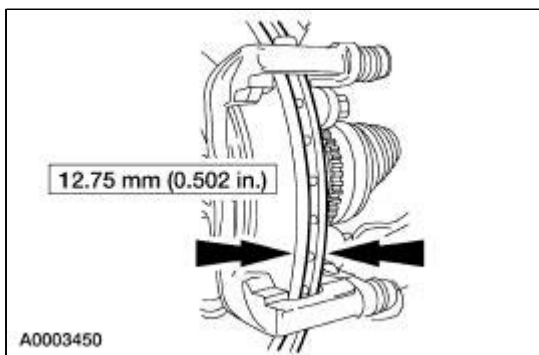


5. Remove the brake pads (2100).

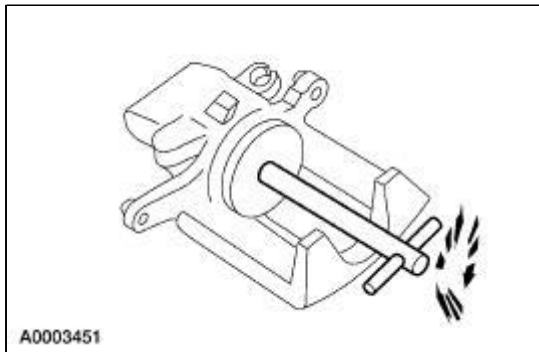


6.  **CAUTION:** Use a hub-mount brake lathe if necessary to machine the brake disc.

Measure the brake disc (1125), and resurface as necessary. Install a new brake disc if beyond specification.

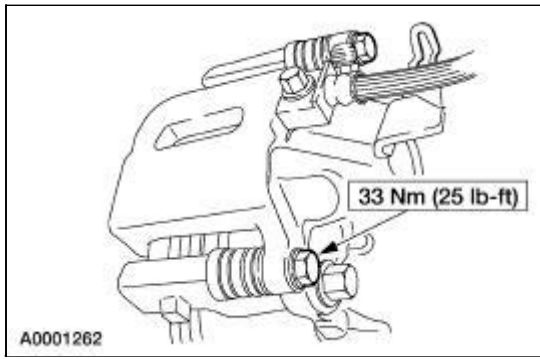


7. Compress the disc brake piston and adjuster into the disc brake caliper using Rear Caliper Piston Adjuster.



Installation

1. To install, reverse the removal procedure.

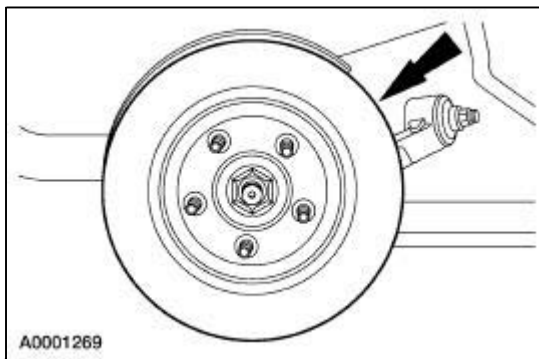


Disc

Removal

1. Remove the support bracket (2B511). For additional information, refer to [Brake Caliper Support Bracket](#) in this section.
2. **NOTE:** Remove and discard the pushnuts, if so equipped.

Remove the brake disc (1125).



Installation

1. To install, reverse the removal procedure.
-

Brake Caliper Support Bracket

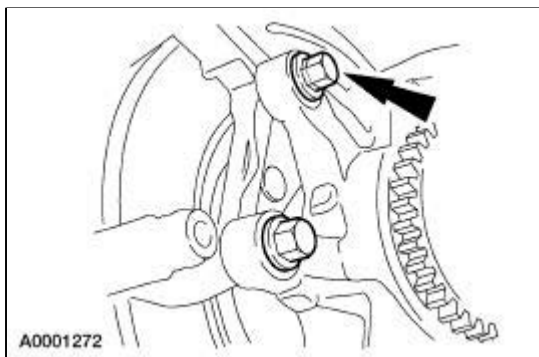
Removal

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the tire and wheel assembly. For additional information, refer to [Section 204-04](#).

3.  **CAUTION: Do not allow the caliper to hang from the brake hose**

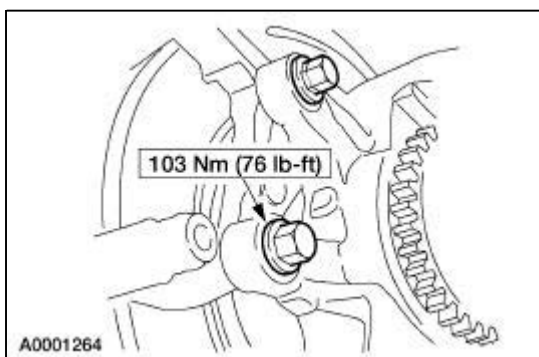
Remove brake pads (2100). For additional information, refer to [Pads](#) in this section.

4. Remove the support bracket bolts.




Installation

1. To install, reverse the removal procedure.

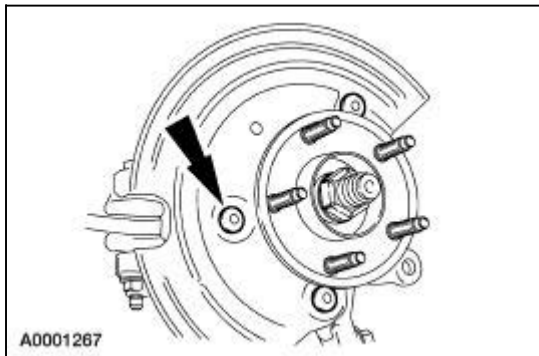


Shield

Removal

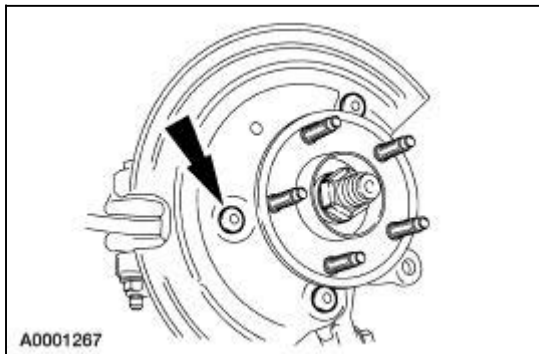
1. Remove the brake disc (1125). For additional information, refer to [Disc](#) in this section.
2.  **CAUTION:** Use a 5.5mm (0.22in) drill DO NOT exceed past a 6mm (0.24in) drill.

Drill out the shield rivets.



Installation

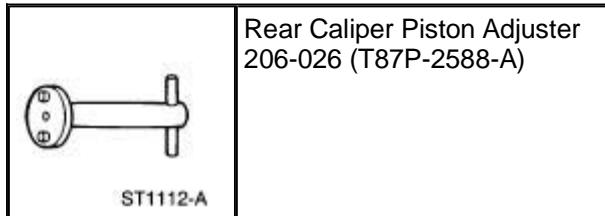
1. Install new rivets.



2. Install the brake disc. For additional information, refer to [Disc](#) in this section.
-


Caliper

Special Tool(s)



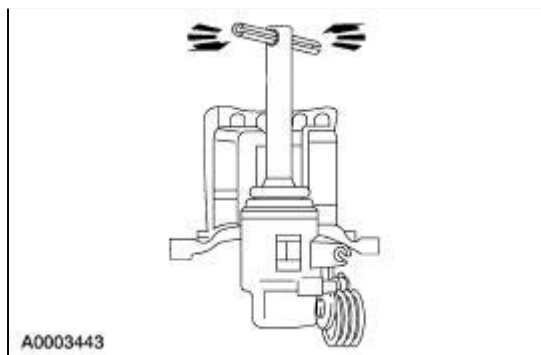
Disassembly

 **WARNING:** Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.

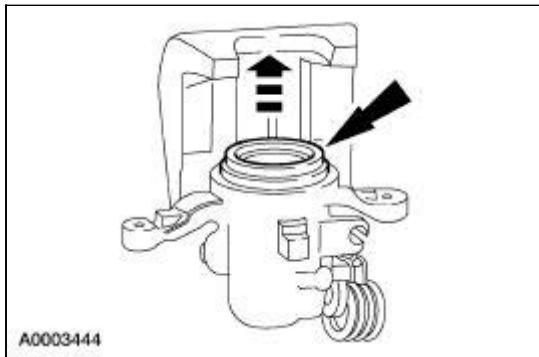
 **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

 **CAUTION:** Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the brake caliper (2B120). For additional information, refer to [Caliper](#) in this section.
2. Drain the brake fluid from the brake caliper.
3. Secure the brake caliper in a vise.
4. Turn the brake piston counterclockwise with Rear Caliper Piston Adjuster.




5. Remove the brake piston from the caliper bore.



6. Remove and discard the piston dust boot and piston seal from the caliper bore.

Assembly

1.  **CAUTION: Do not reuse piston seals or dust boots. Install new seals and dust boots or damage to the vehicle can occur.**

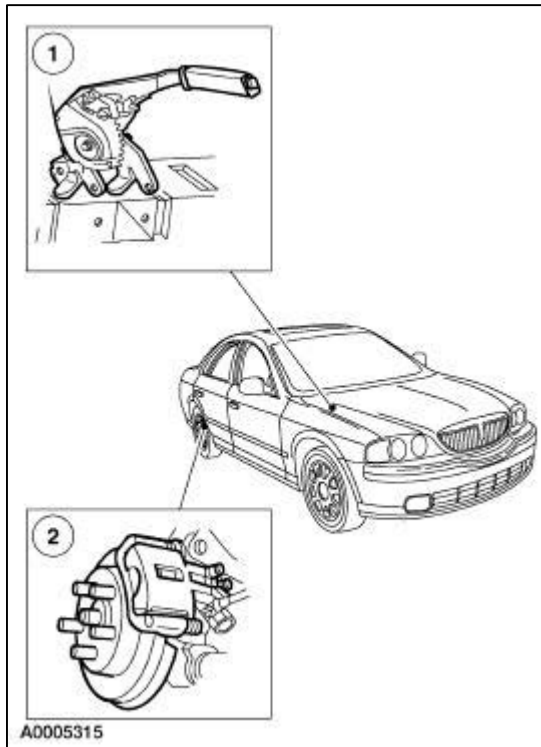
NOTE: Use new brake fluid when assembling and bleeding the brake system.

To install, reverse the disassembly procedure.

Torque Specifications

Description	Nm	lb-ft
Parking brake control bolts/nuts	30	22
Parking brake control bolts/nuts	18	13
Brake hose clip mounting bolt	12	9

Parking Brake



Item	Part Number	Description
1	2780	Parking brake control
2	2552	Rear disc brake caliper

The parking brake system is cable-actuated and controlled by an independent hand-operated parking brake control. To apply parking brake, pull parking brake control upward.

The parking brake system is an AUTO-ADJUST system. The spring in the parking brake control continuously adjusts the cable tension in the system.

Brake Warning System

A brake warning indicator:

- is located in the instrument panel.
- illuminates to signal the driver the parking brake is applied.
- remains lit when a brake malfunction has occurred.

Parking Brake

Inspection and Verification

Check the operation of the parking brake system with the vehicle on a hoist and the parking brake control fully released. Check for any damaged cables and install new components as necessary. Check the rear brake adjustment or perform brake system diagnosis.

Check the parking brake by pulling up on the parking brake control. The parking brake must hold the vehicle on an incline, set by pulling up on the parking brake control before it reaches full travel. If not as specified, check the parking brake system for correct rear brake adjustment, cable operation and parking brake control operation.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Parking Brake Will Not Apply 	<ul style="list-style-type: none"> ● Parking brake cable. ● Parking brake control. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test A.</u>
<ul style="list-style-type: none"> ● Parking Brake Will Not Release 	<ul style="list-style-type: none"> ● Parking brake cable. ● Parking brake control. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test B.</u>

Pinpoint Tests

PINPOINT TEST A: PARKING BRAKE WILL NOT APPLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
	A1 CHECK THE PARKING BRAKE CABLE
	<p>① At the parking brake cable equalizer pull the parking brake rear cable and conduit forward.</p> <ul style="list-style-type: none"> ● Can the parking brake be operated? <p>→ Yes REPAIR the binding condition in the front parking brake cable and conduit or the parking brake control. TEST the system for normal operation.</p> <p>→ No REPAIR the binding condition in the parking brake rear cable and conduit or</p>

the caliper. TEST the system for normal operation.

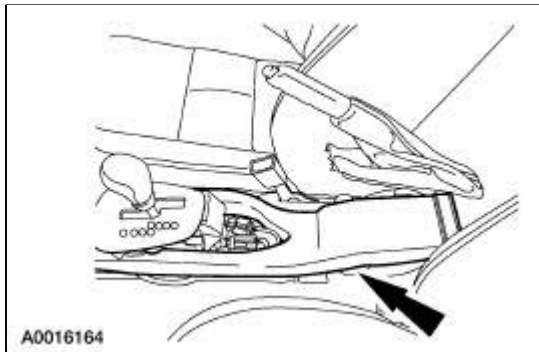
PINPOINT TEST B: PARKING BRAKE WILL NOT RELEASE


CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK THE PARKING BRAKE CABLE	
	<p>1 Disconnect the parking brake cable at the parking brake lever.</p> <ul style="list-style-type: none"><li>● Does the parking brake release? <p>→ Yes REPAIR the binding condition in the parking brake cable or the parking brake control. TEST the system for normal operation.</p> <p>→ No REPAIR the binding condition in the parking brake components of the caliper. TEST the system for normal operation.</p>

Control

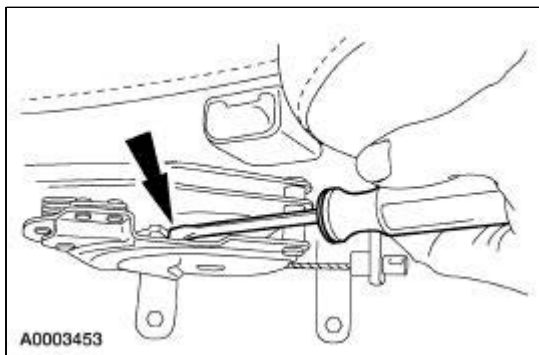
Removal

1. Position the right front seat into the full forward position.
2. Remove the console. For additional information, refer to [Section 501-12](#).
3. Remove the transfer duct.

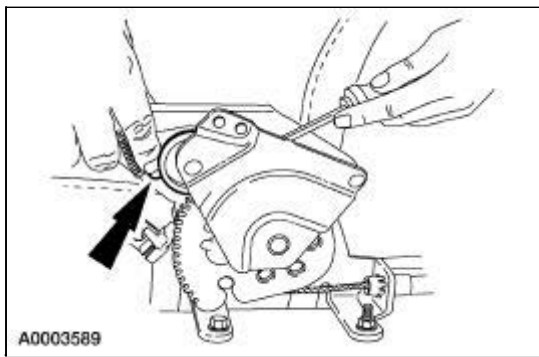


4.  **WARNING:** The parking brake control will have spring tension on the tension arm and, if released inadvertently, can cause injury. Use care when working on or around the parking brake control when the tension arm is in the locked position. Failure to follow these instructions can cause personal injury.

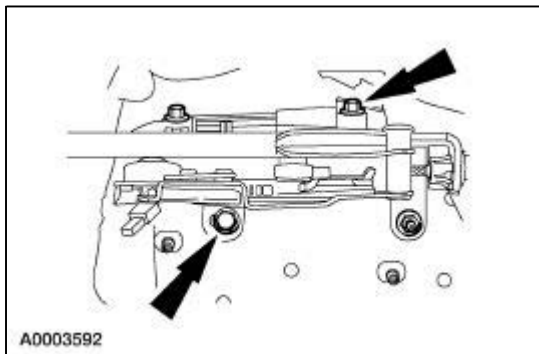
Using a screwdriver, push down on the tension arm until it is fully depressed.



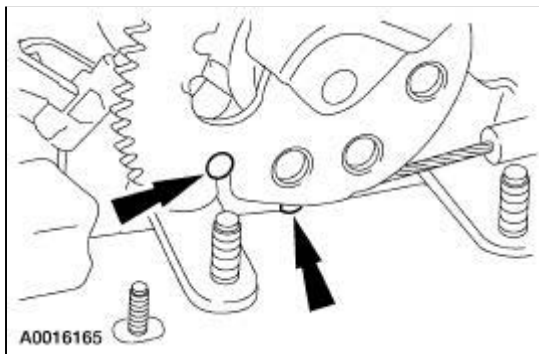
5. Move the tension arm down and release the screwdriver.



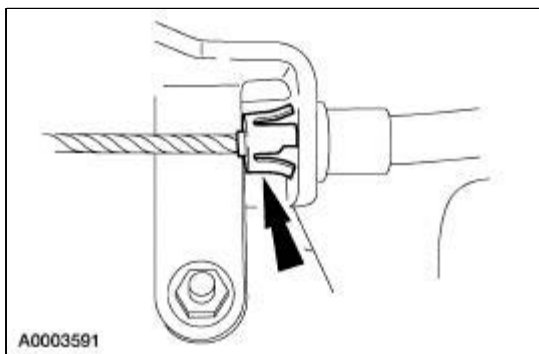
6. Remove the control retainers.
 - Disconnect the parking brake switch connector.



7. Bend the retaining tab out of the way and remove the cable anchor pin.

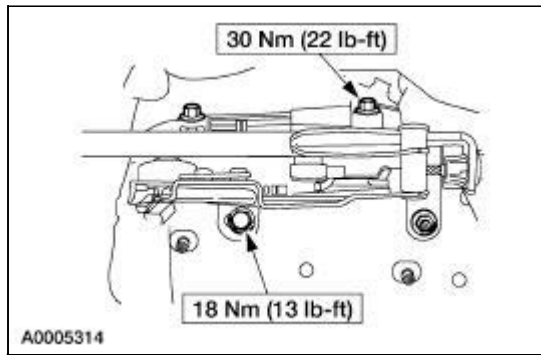


8. Using a 13mm line wrench, depress the conduit retaining prongs to remove the parking brake cable and conduit from the control. Remove the parking brake control.



Installation

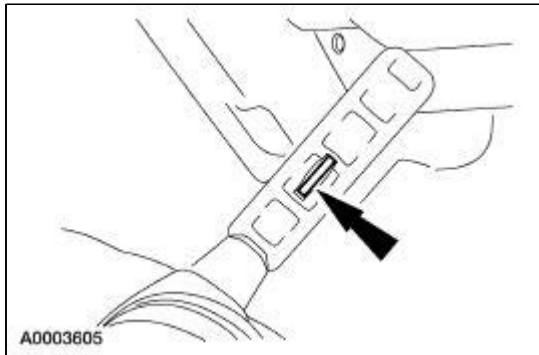
1. To install, reverse the removal procedure.



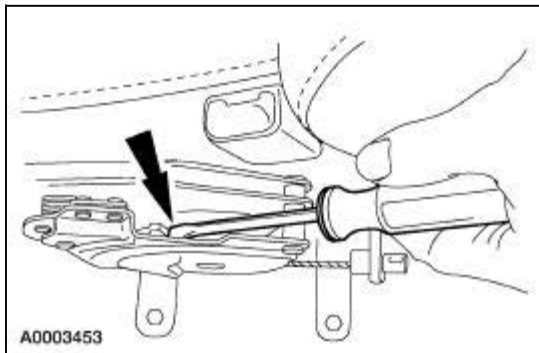
Cable and Conduit —Front

Removal

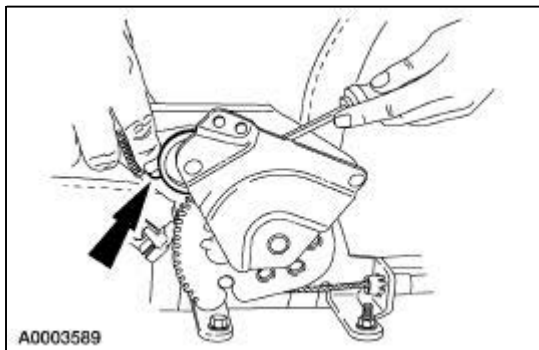
1. Remove the console. For additional information, refer to [Section 501-12](#).
2. Pull tab slide handle up.



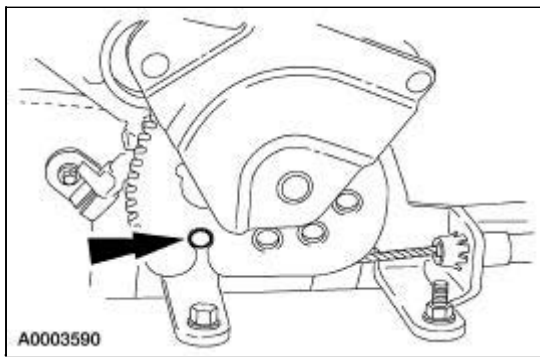
3. Using a screwdriver, push down on the tension arm until it is fully depressed.



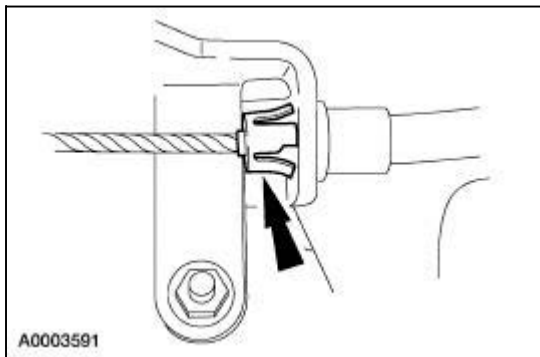
4. Move the tension arm down and release the screwdriver.



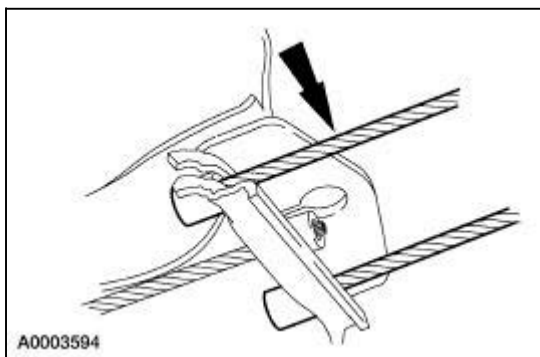
5. Remove the cable anchor pin.



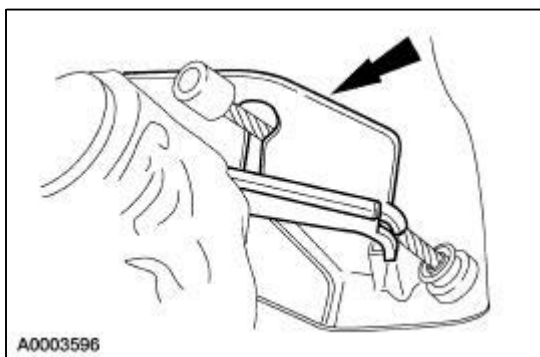
6. Using a 13mm box-end wrench, depress the conduit retaining prongs and remove the parking brake cable and conduit from the control.



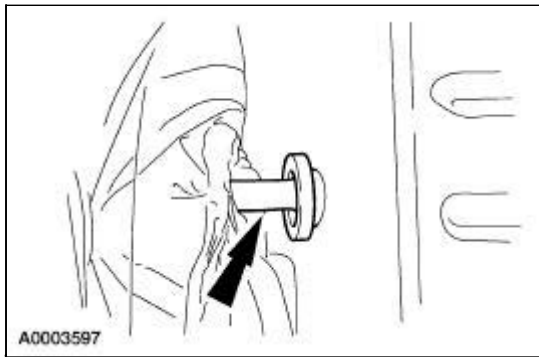
7. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
8. Disconnect the rear parking brake cables.



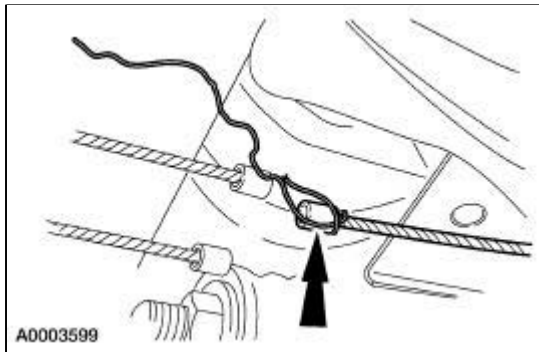
9. Remove the equalizer.



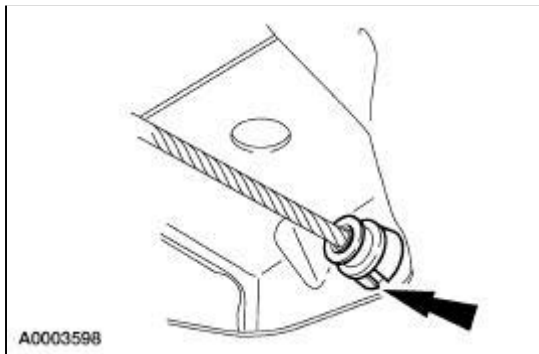
10. Snap the front cable grommet out of the floor and remove the cable.



11. Tie mechanics wire to the old cable and conduit to make installation of new cable easier.



12. Using a 13mm box-end wrench, depress the conduit retaining prongs and remove the parking brake cable and conduit.



Installation

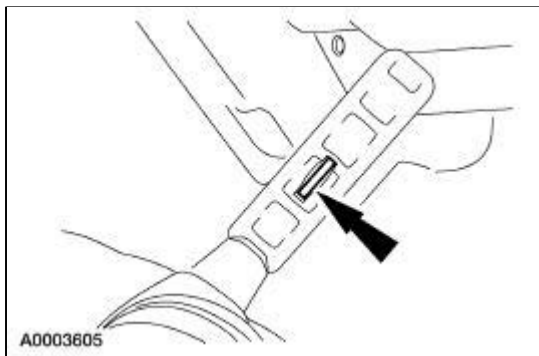
1. To install, reverse the removal procedure.
-

Cable and Conduit —Rear

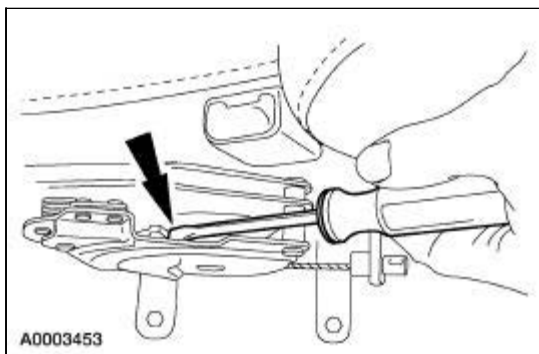
Removal

NOTE: The RH rear is shown, the LH is similar.

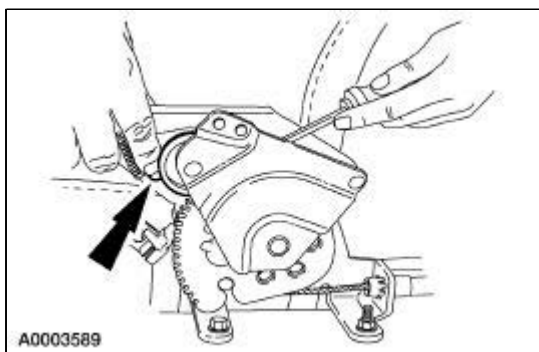
1. Remove the console. For additional information, refer to [Section 501-12](#).
2. Pull tab slide handle up.



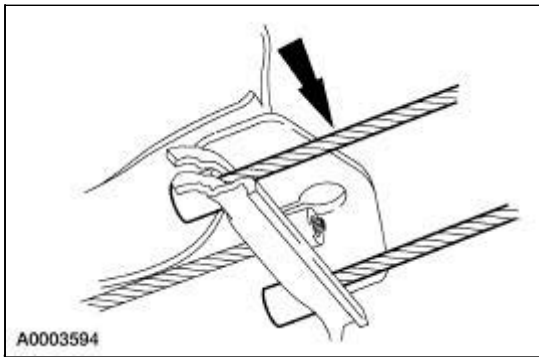
3. Using a screwdriver, push down on the tension arm until it is fully depressed.



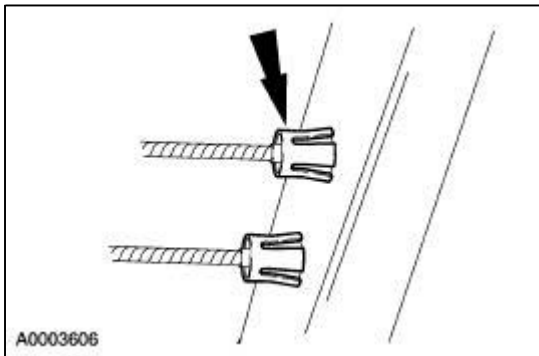
4. Move the tension arm down and release the screwdriver.



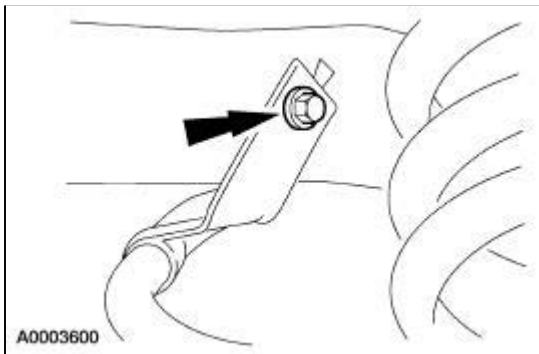
5. Disconnect the rear parking brake cables from the equalizer.



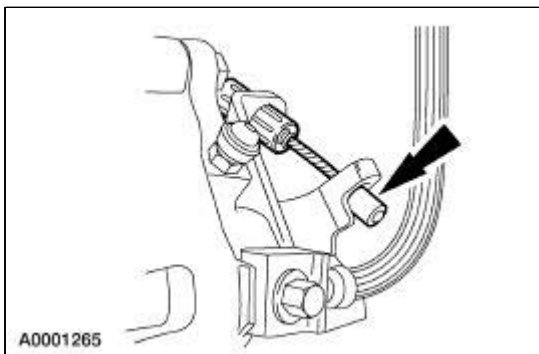
6. Using a 13mm box-end wrench, depress the conduit retaining prongs and remove the parking brake rear cable and conduit.



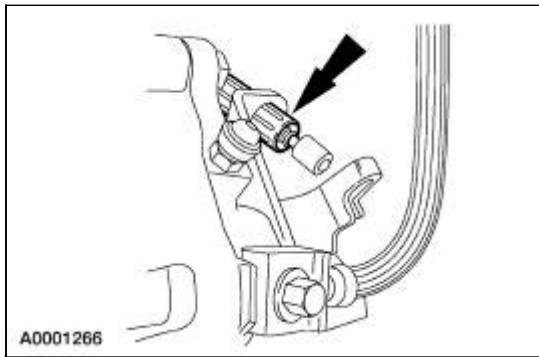
7. Remove the parking brake rear cable and conduit routing clip bolts.



8. Disconnect the parking brake rear cable and conduit from the parking brake lever.

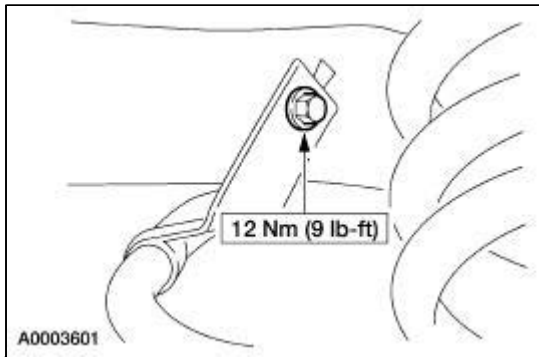


9. Using a 13mm box-end wrench, depress the conduit retaining prongs and remove the parking brake rear cable and conduit.



Installation

1. To install, reverse the removal procedure.



Bulb

For additional information, refer to [Section 413-01](#).

General Specifications

Item	Specification
High Performance DOT 3 Brake Fluid PM-1 (Canada CXC-31)	ESA-M6C25-A
High Performance DOT 4 Brake Fluid	FMVSS No. 116

Torque Specifications

Description	Nm	lb-ft
Brake master cylinder nuts	30	22
Brake pedal bracket nuts	30	22
Strut tower brace nuts	28	21
Master cylinder brake tubes	13	10
Brake pedal bracket bolts	25	18

Hydraulic Brake Actuation

This vehicle is equipped with a brake pedal actuated dual brake system. The system consists of the following:

- power brake booster (2005)
- brake master cylinder (2140)
- disc brake calipers (2B120)
- rear disc brake calipers (2553)
- brake tubes and hoses
- anti-lock brake system (ABS) components

The dual ABS hydraulic system is diagonally split, with the LH front and RH rear making up one circuit and the RH front and LH rear making up the other circuit.

Brake Fluid



WARNING: Use of any other than approved DOT 3 or DOT 4 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.



WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.



CAUTION: Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

Use clean, fresh Ford High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 (Canada CXC-31) or equivalent meeting Ford specification ESA-M6C25-A.

If DOT 3 is not available, use Ford High Performance DOT 4 brake fluid or equivalent meeting FMVSS No. 116.

- Do not reuse brake fluid drained or bled from the system.
- Do not use brake fluid that has been stored in an open container.
- Do not use contaminated brake fluid.

Brake Master Cylinder

The brake master cylinder is a dual piston type. The brake master cylinder operates as follows:

- When the brake pedal (2455) is depressed, pressure is applied by mechanical linkage to the primary and secondary piston.

- Brake master cylinder pistons apply hydraulic pressure to the two opposed hydraulic circuits.
- Brake master cylinder cannot be overhauled, install a new master cylinder only.

The brake master cylinder consists of:

- brake master cylinder reservoir (2K478)
- brake master cylinder body

Brake Master Cylinder Reservoir

NOTE: Whenever the brake master cylinder reservoir is removed from the brake master cylinder, new grommets must be installed.

The brake master cylinder reservoir:

- is mounted to the brake master cylinder.
- holds fluid supply for each brake master cylinder hydraulic piston.
- provides visual fluid level markings.
- contains the brake master cylinder fluid level sensor.

Brake Tubes and Hoses



CAUTION: Never use copper tubing. It is subject to fatigue, cracking and corrosion, which could result in brake tube failure.

If a section of brake tube is damaged, install a new section of tube the same type, size, shape and length.

When installing hydraulic brake tubing, hoses, or connectors, tighten all connections securely. After installation, bleed the brake system. For additional information, refer to [Section 206-00](#).

Hydraulic Brake Actuation

Refer to Section 206-00 .

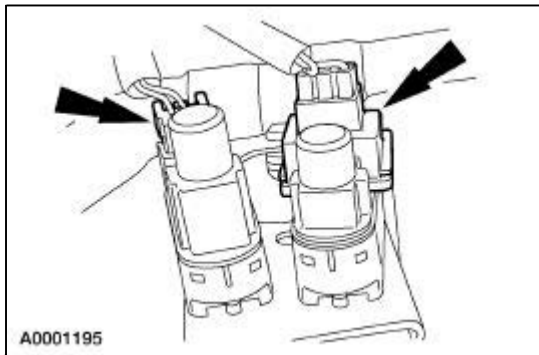
Brake Pedal And Bracket

Removal

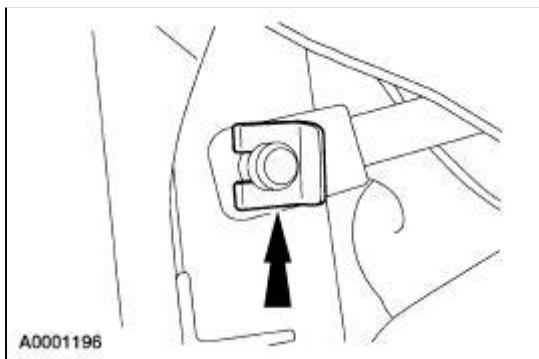
1. **NOTE:** LH shown, RH similar.

Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).

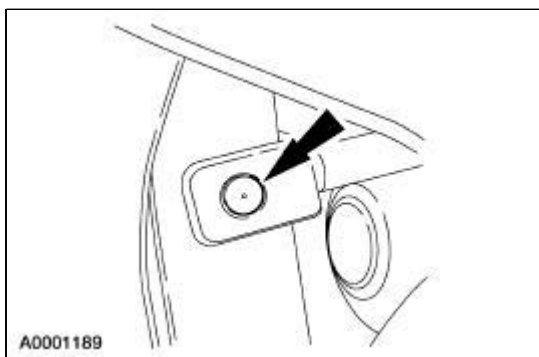
2. Disconnect the stoplight and cruise switch electrical connectors.



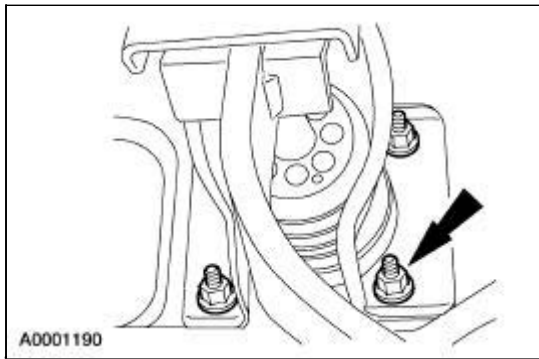
3. Remove the brake pedal pin clip.



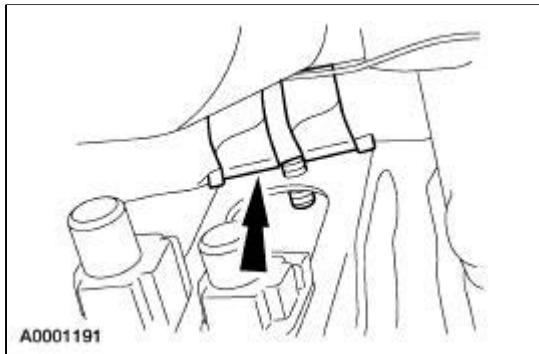
4. Remove the brake pedal pin.



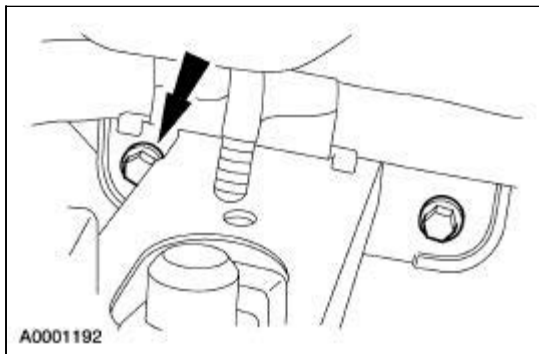
5. Remove the four brake pedal bracket nuts.



6. Remove the wiring harness pushpin.

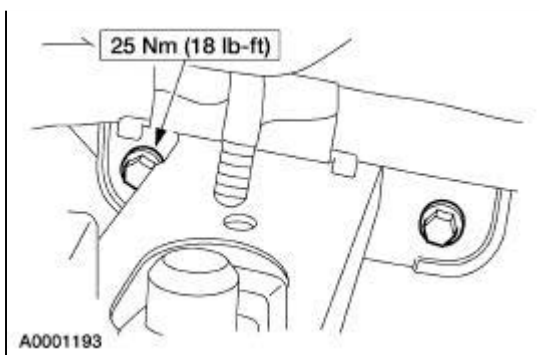


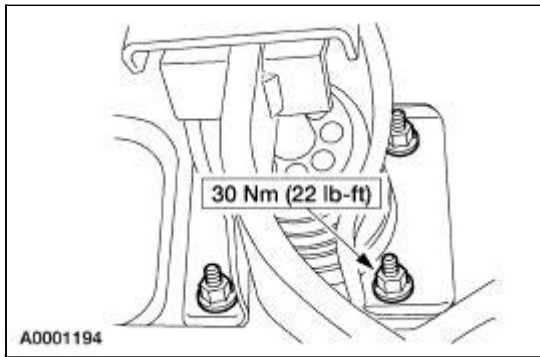
7. Remove the brake pedal bracket bolts and remove the brake pedal and bracket (2455).



Installation

1. To install, reverse the removal procedure.






Brake Master Cylinder

Removal and Installation

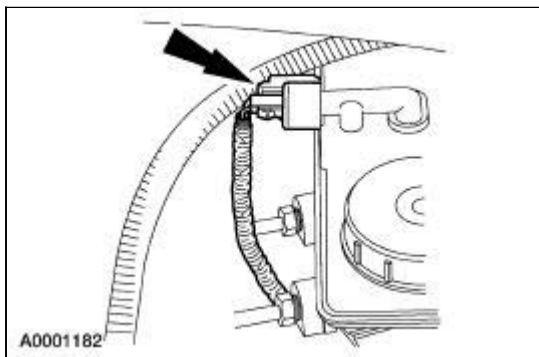
All vehicles

 **WARNING:** Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.

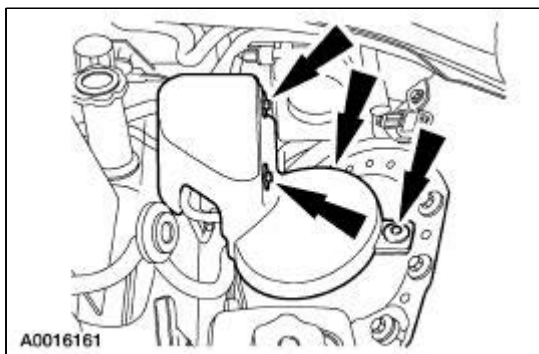
 **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

 **CAUTION:** Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

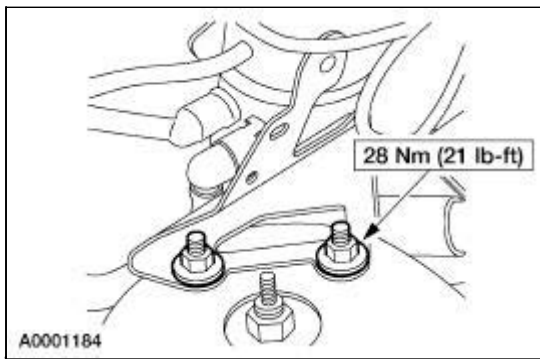
1. Disconnect the fluid level sensor connector.



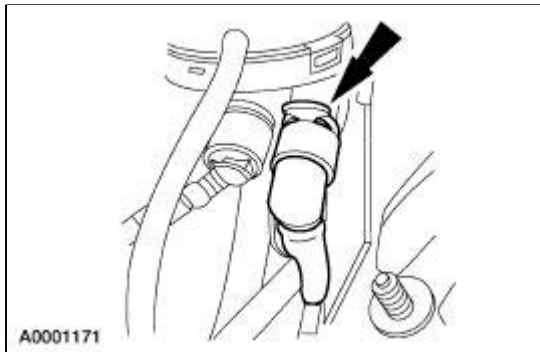
2. Remove the retainers and left upper shock mount cover.



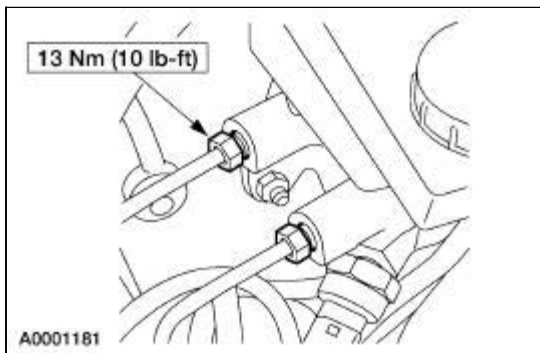
3. Remove the vapor management valve (VMV) nuts.



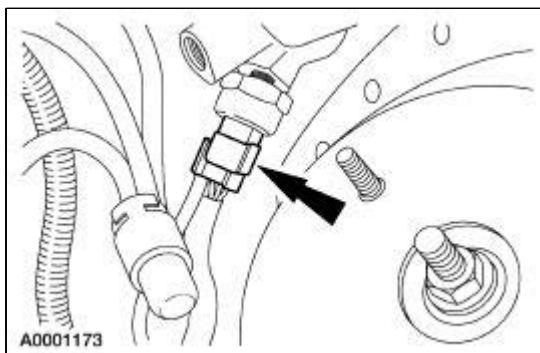
4. Disconnect the (VMV) hose and position valve aside.



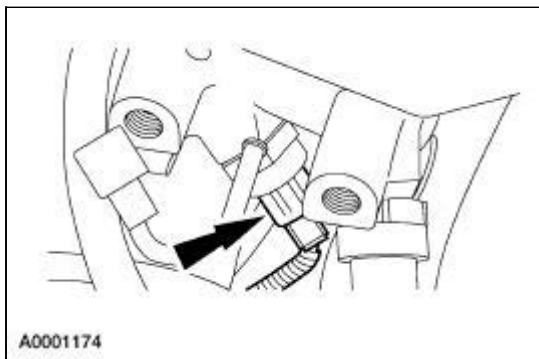
5. Disconnect the brake tubes.



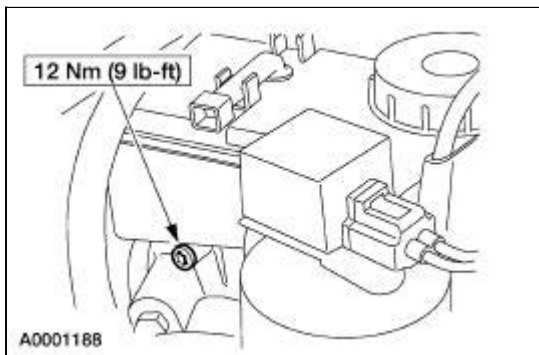
6. Disconnect the brake master cylinder IVD transducer electrical connector (as applicable).



7. Disconnect the brake master cylinder IVD transducer electrical connector (as applicable).

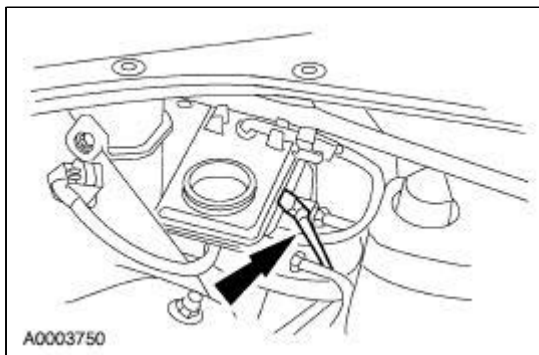


8. Use a suitable suction device to drain the brake master cylinder reservoir.
9. Remove the reservoir bolt.



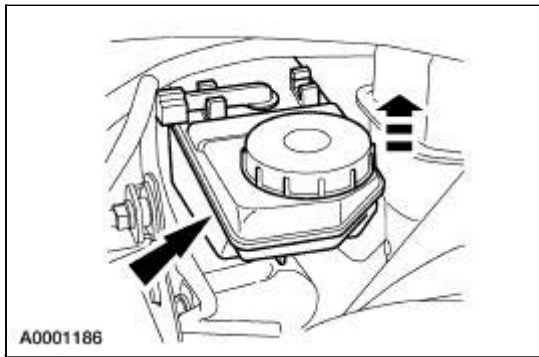
Vehicles with manual transmission

10. Remove the hose at the clutch master cylinder reservoir.

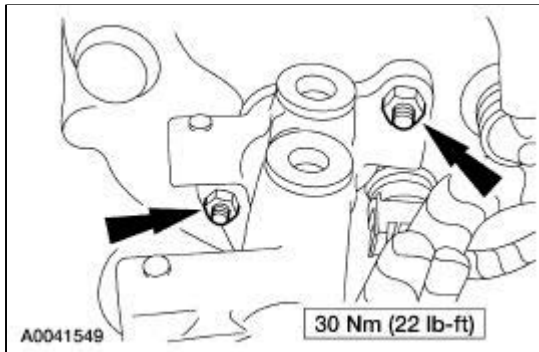


All vehicles

11. Remove the reservoir.



12. Remove the brake master cylinder nuts and remove the brake master cylinder.




13. To install, reverse the removal procedure.
 - Bleed the brake system. For additional information, refer to [Section 206-00](#).
-

Brake Fluid Reservoir

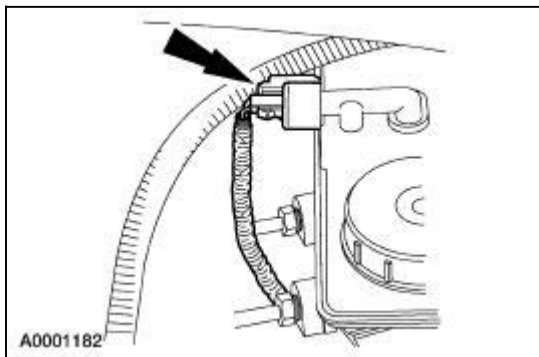
Removal and Installation

 **WARNING:** Use of any other than approved DOT 4 or DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.

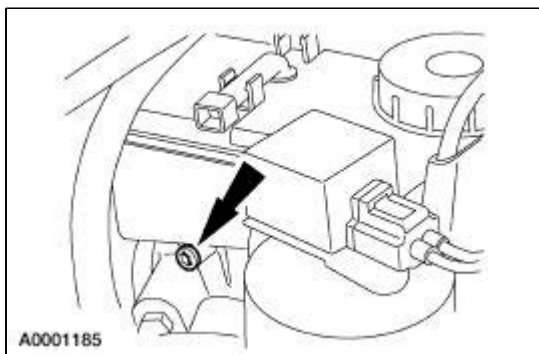
 **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

 **CAUTION:** Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

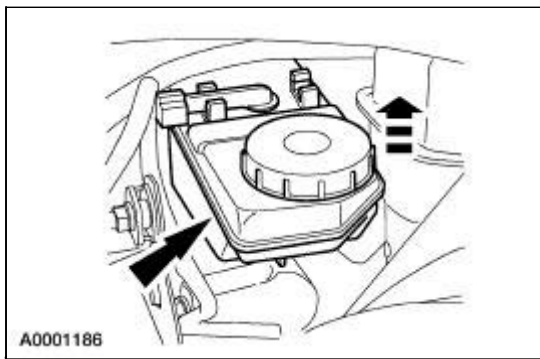
1. Disconnect the brake master cylinder fluid level sensor connector.



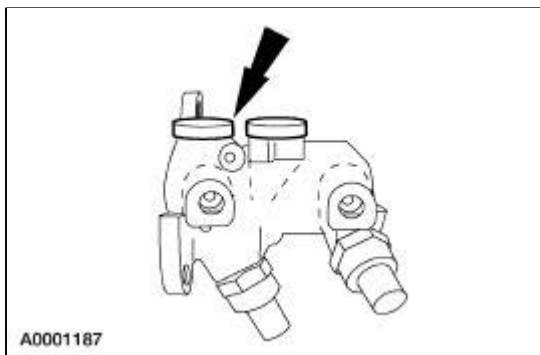
2. Use a suitable suction device to drain the brake master cylinder reservoir (2K478).
3. Remove the reservoir screw.



4. Remove the reservoir.



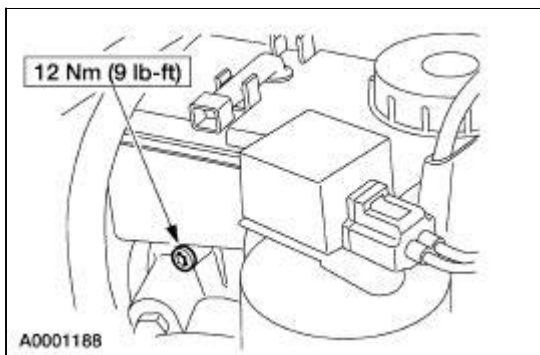
5. Remove the reservoir grommets.



6. **NOTE:** Whenever installing a new brake master cylinder reservoir, install new grommets.

To install, reverse the removal procedure.

- Use clean, fresh Ford High Performance DOT 3 Motor Vehicle Brake Fluid C6AZ-19542-AB or equivalent meeting Ford specification ESA-M6C25-A (United States and Canada only). If DOT 3 is not available, use Ford High Performance DOT 4 Brake Fluid or equivalent meeting Ford specification SAE-J-1704-DOT 4.

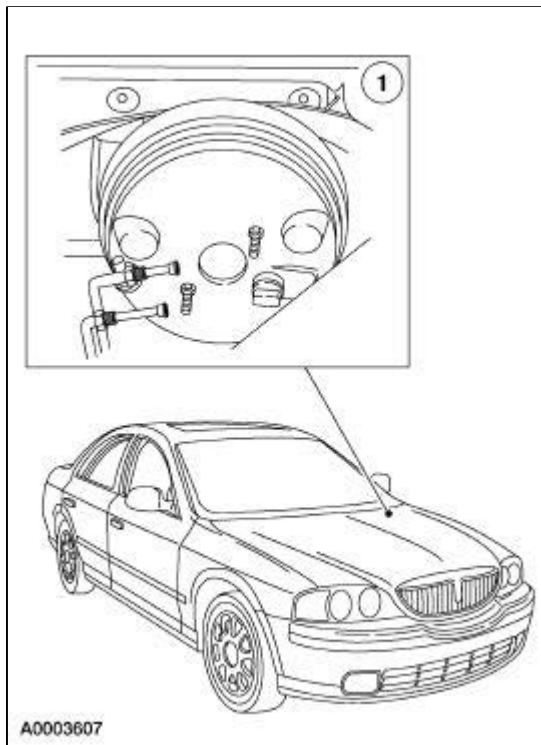


Torque Specifications

Description	Nm	lb-ft
Coolant reservoir bolts	15	11
Cowl brace end bolts	20	15
Cowl brace nuts	20	15
Power brake booster nuts	30	22
Vacuum hose bracket nut	15	11
Wiper arm nuts	35	26

Brake Booster

Power Brake Booster



Item	Part Number	Description
1	2005	Brake vacuum booster

The power brake booster (2005):

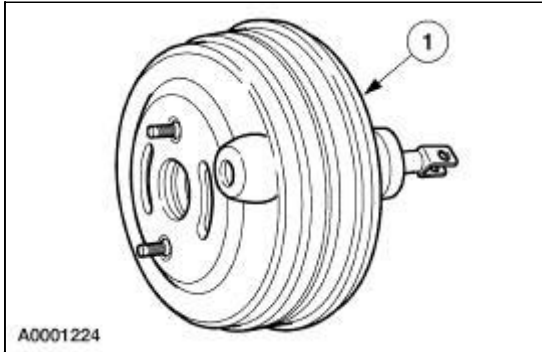
- is a dual diaphragm, vacuum assisted power brake booster.
- reduces brake pedal pressure and travel distance.
- is located on the bulkhead in the engine compartment, between the brake pedal and brake master cylinder (2140).
- is divided into separate chambers by the diaphragm.
- will not operate if vacuum is restricted or if any of the vacuum related power brake components fail.
- is installed as an assembly.

If the power assist fails, the brake system will continue to operate with increased brake pedal effort.

Hose and Check Valve

The power brake booster check valve:

- is located on the front of the power brake booster.
- is positioned between the power brake booster and the power brake booster hose.
- closes when the engine is turned off.
- in the closed position, traps engine vacuum in the power brake booster.
- retains vacuum to provide several power assisted brake applications with the engine off.



Item	Part Number	Description
1	2005	Brake vacuum booster

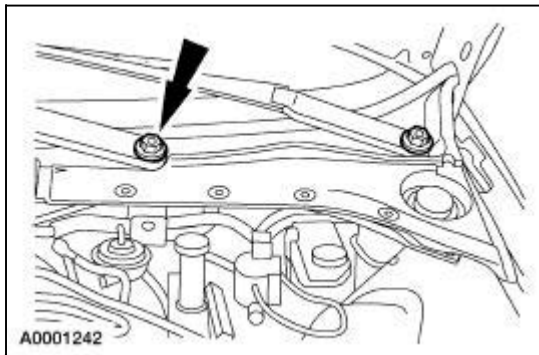
Power Brake System

Refer to Section 206-00 .

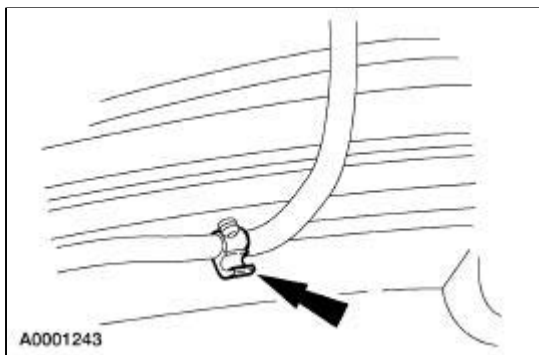
Brake Booster

Removal

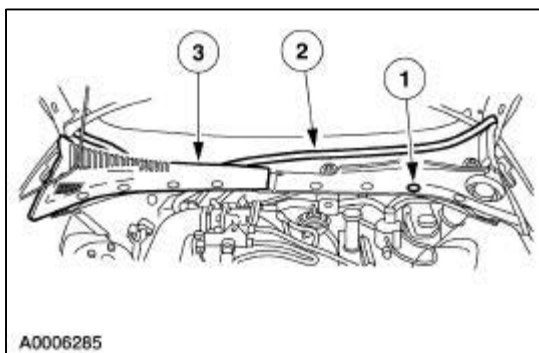
1. Remove the wiper arm nuts and remove wiper arms.



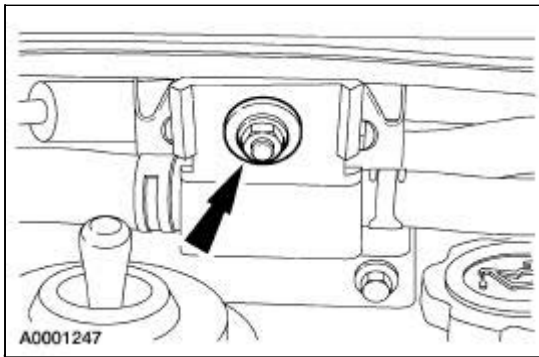
2. Disconnect the washer hose.



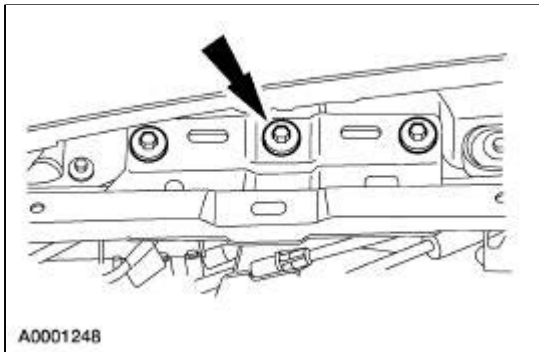
3. Remove the cowl cover.
 1. Remove the cowl cover pushpins.
 2. Remove the cowl cover rubber trim.
 3. Remove the cowl cover.



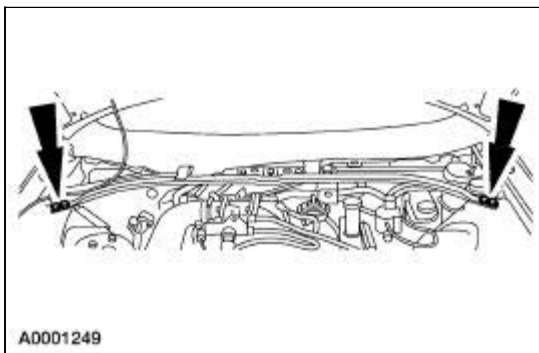
4. Remove the vacuum hose bracket nut and position bracket aside.



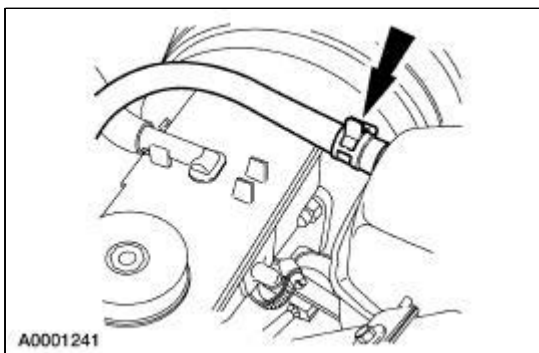
5. Remove the cowl brace center bolts.



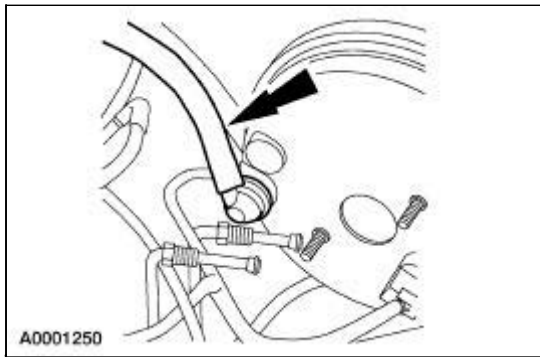
6. Remove the cowl brace end bolts and remove the bracket.



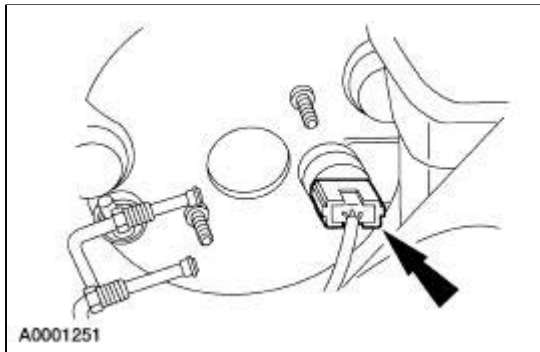
7. Disconnect the coolant reservoir return hose.



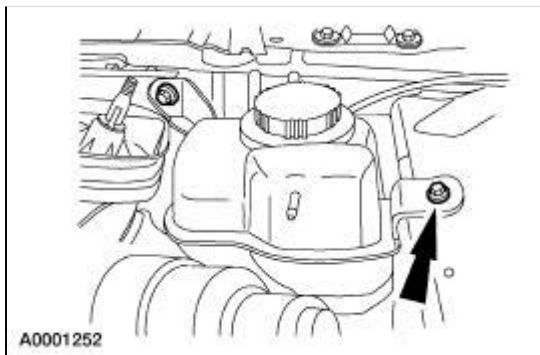
8. Remove the brake master cylinder. For additional information, refer to [Section 206-06](#)
9. Disconnect the power brake booster check valve.



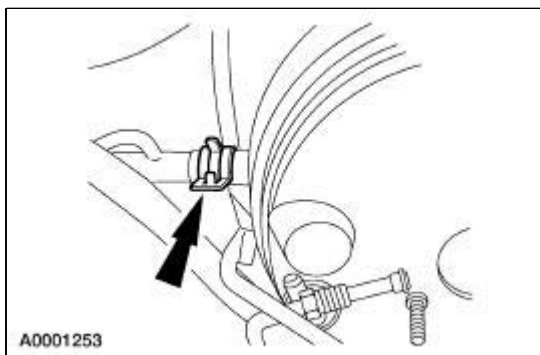
10. Disconnect the power brake booster electrical connector (as applicable).



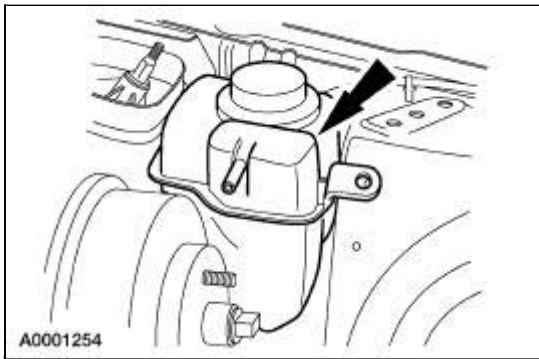
11. Remove the coolant reservoir bolts.



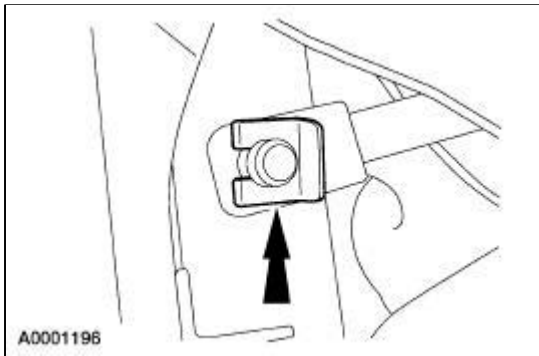
12. Disconnect the coolant reservoir hose.



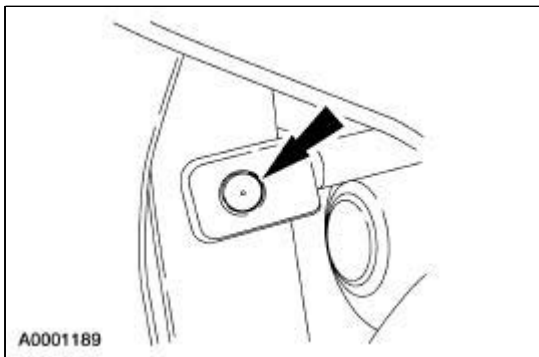
13. Remove the coolant reservoir.



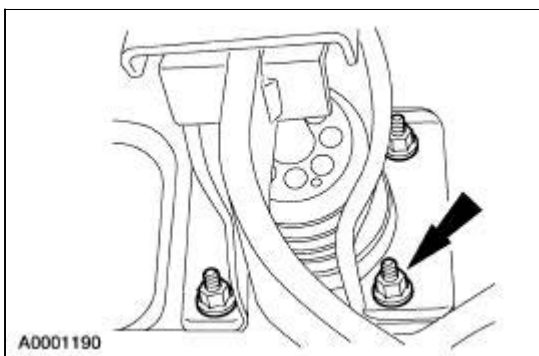
14. Remove the brake pedal pin clip.



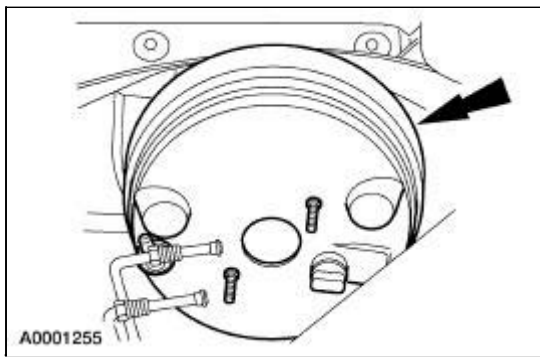
15. Remove the brake pedal pin.



16. Remove the booster nuts.

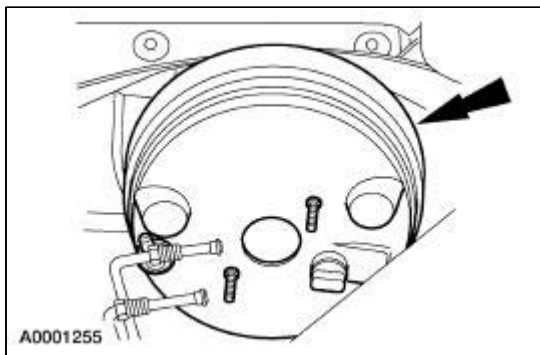


17. Remove the power brake booster.

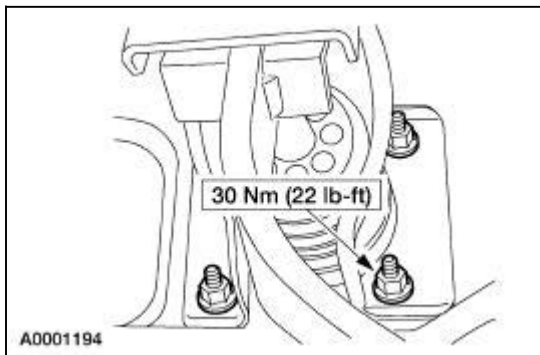


Installation

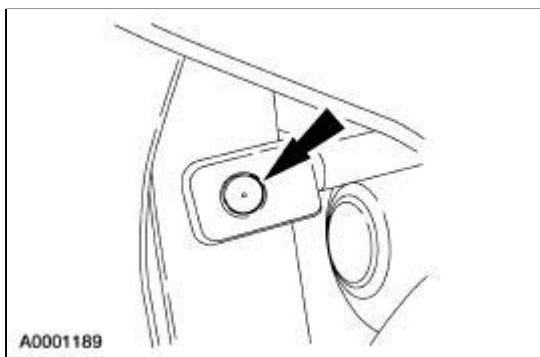
1. Install the power brake booster.



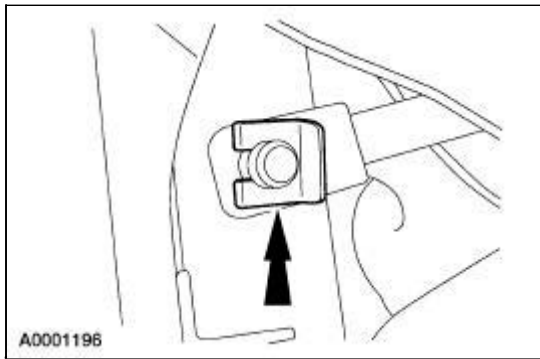
2. Install the booster nuts.



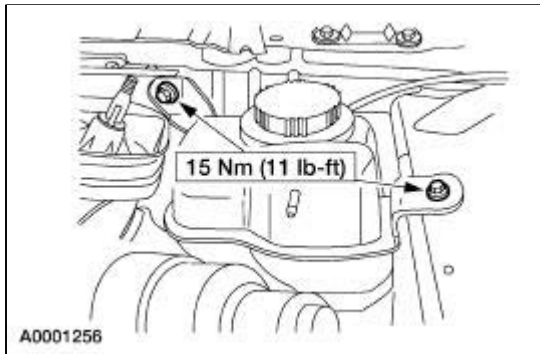
3. Install the brake pedal pin.



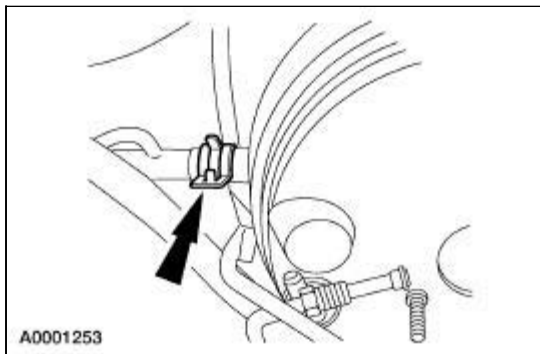
4. Install the brake pedal pin clip.



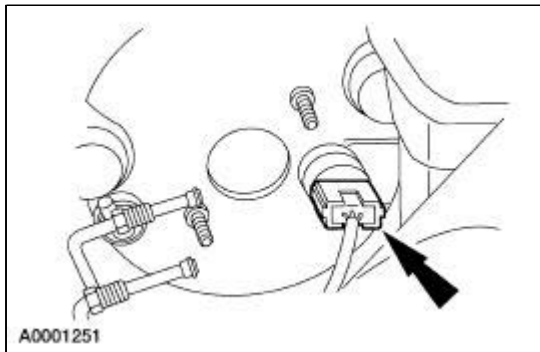
5. Install the radiator coolant recovery reservoir bolts.



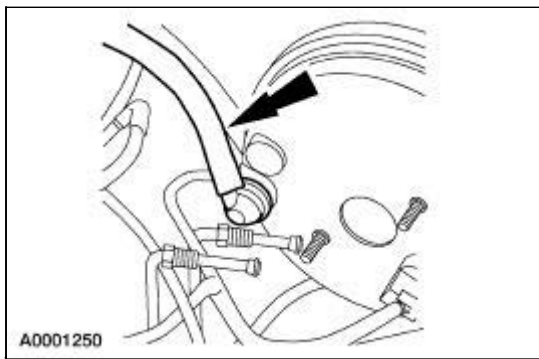
6. Install the coolant reservoir hose.



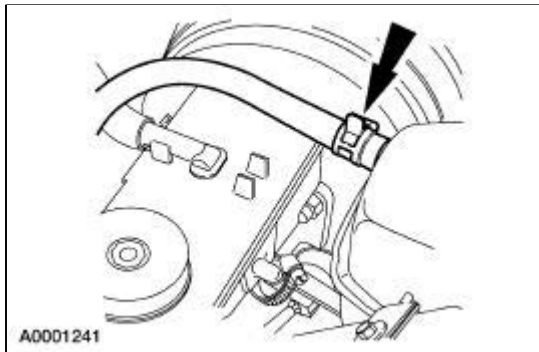
7. Connect the power brake booster electrical connector (as applicable).



8. Connect the power brake booster check valve.

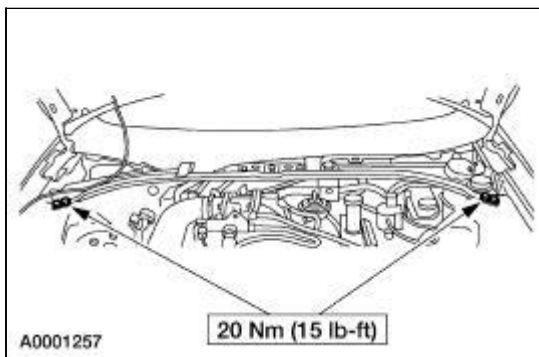


9. Connect the coolant reservoir return hose.

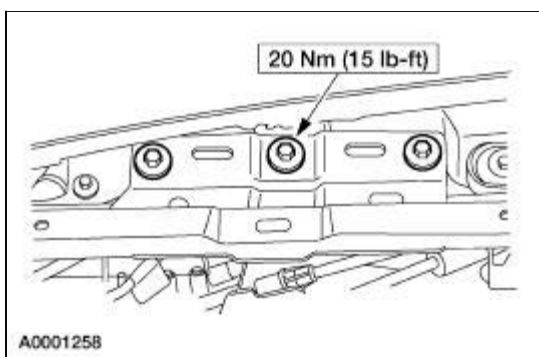


10. Install the brake master cylinder. For additional information, refer to [Section 206-06](#)

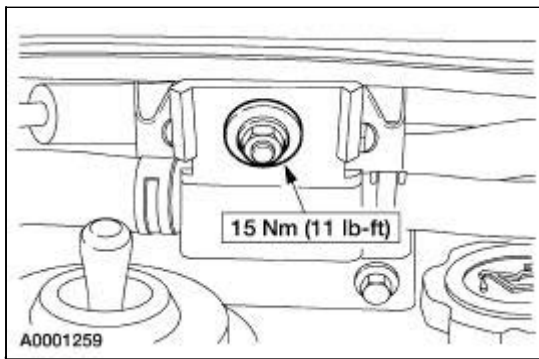
11. Install the cowl brace end bolts.



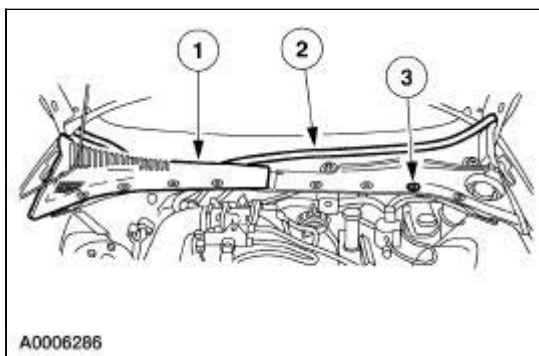
12. Install the cowl brace center bolts.



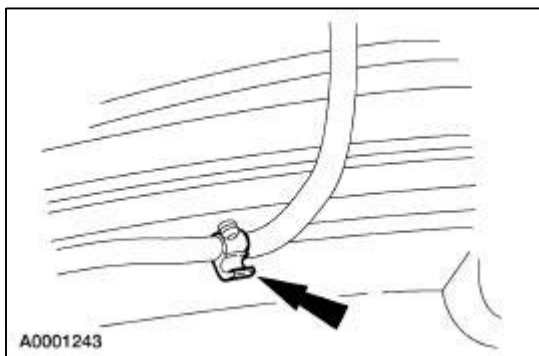
13. Install the vacuum hose bracket nut.



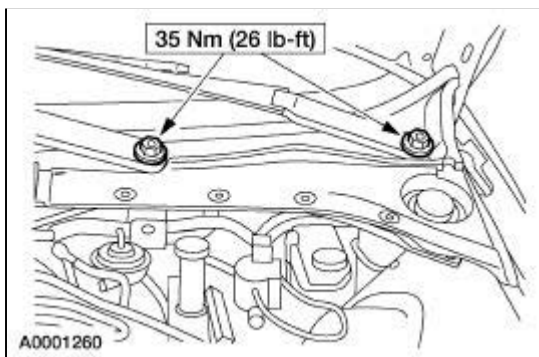
14. Install the cowl cover.
 1. Install the cowl cover.
 2. Install the cowl cover rubber trim.
 3. Install the cowl cover pushpins.



15. Connect the washer hose.



16. Install the wiper arm nuts.



17. Bleed brake system. For additional information, refer to [Section 206-00](#).

General Specifications

Item	Specification
High Temperature 4X4 Front Axle and Wheel Bearing Grease E8TZ-19590-A	ESA-M1C198-A
RTV Silicone Sealant F5TZ-19G204-AB (Canada CXC-114A)	NAVSTR Sealer

Torque Specifications

Description	Nm	lb-ft	lb-in
Anti-lock brake control module bolts	2	—	18
Brake line to (HCU) nuts	18	13	—
Electronic hydraulic control unit bolts	11	8	—
Rear anti-lock brake sensor bolt	9	—	80

Anti-Lock Control

The four wheel anti-lock brake system (4WABS) consists of the following components:

- anti-lock brake module
- front anti-lock brake sensors
- front anti-lock brake sensor indicators
- hydraulic control unit (HCU)
- rear anti-lock brake sensors
- rear anti-lock brake sensor indicators
- yellow anti-lock brake warning indicator




For removal and installation of the front anti-lock brake sensor indicators, refer to [Section 204-01](#).

For removal and installation of the rear anti-lock brake sensor indicators, refer to [Section 205-05](#).

Anti-Lock Control

Refer to Wiring Diagrams Section [206-09A](#) for schematic and connector information.

Special Tool(s)

 ST1137-A	73 III Automotive Meter 105-R0057 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025B

Principles of Operation

The anti-lock-brake control module receives wheel speed readings from each anti-lock brake sensor and processes this information to determine if an ABS event is necessary. The anti-lock brake sensor electrically senses each tooth of the anti-lock brake sensor indicators as it passes through the anti-lock brake sensor magnetic field.

The anti-lock brake control module continuously monitors and compares the rotational speed of each wheel and, when it detects an impending wheel lock, modulates brake pressure to the appropriate brake caliper. This is accomplished by triggering the hydraulic control unit (HCU) to open and close the appropriate solenoid valves. Once the affected wheel returns to normal speed, the anti-lock brake control module returns the solenoid valves to their normal position, and normal (base) braking resumes.

The anti-lock brake control module is self-monitoring. When the ignition switch is turned to the RUN position, the anti-lock brake control module will do a preliminary electrical check, and at approximately 20 km/h (12 mph) the pump motor is turned on for approximately one half-second. Any malfunction of the ABS will cause the ABS to shut off and the yellow anti-lock brake warning indicator to illuminate; normal power assisted braking, however, remains.

Inspection and Verification

1. Verify the customer concern by applying the brakes under different conditions.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Anti-lock brake sensor indicator ● Base brake concerns ● HCU ● Tire pressure ● Tire size or mismatched tires 	<ul style="list-style-type: none"> ● Underhood auxiliary junction box (AJB) Maxifuses: <ul style="list-style-type: none"> ■ 114 (30A) ■ 122 (30A) ● Central junction box (CJB) Fuse: <ul style="list-style-type: none"> ■ 203 (5A) ● Anti-lock brake control module ● Anti-lock brake sensors ● Brake pedal position (BPP) switch ● Circuitry ● Connectors or connections ● EVAC and fill connector ● Wire harness routing

3. If the fault is not visually evident, connect the scan tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the scan tool menu. If the scan tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the scan tool still does not communicate with the vehicle, refer to the New Generation STAR Tester manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the scan tool responds with:
 - CKT914, CKT915, or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for anti-lock brake control module, go to Pinpoint Test A.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the anti-lock brake control module.
6. If the DTCs retrieved are related to the concern, go to Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart.

Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index

Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	Anti-Lock Brake Control	INSTALL a new anti-lock brake control module; REFER to Anti-Lock Brake System (ABS) Module .

		Module	
B1485	Brake Pedal Input Circuit Battery Short	Anti-Lock Brake Control Module	<u>Go To Pinpoint Test B .</u>
B1676	Battery Pack Voltage Out of Range	Anti-Lock Brake Control Module	<u>Go To Pinpoint Test C .</u>
B2477	Module Configuration Failure	Anti-Lock Brake Control Module	CONFIGURE the anti-lock brake control module; REFER to <u>Section 418-01 .</u> CLEAR the DTCs. REPEAT the self-test. If DTC B2477 is retrieved again, INSTALL a new anti-lock brake control module; REFER to <u>Anti-Lock Brake System (ABS) Module .</u> REPEAT the self-test.
C1095	Hydraulic Pump Motor Circuit Failure	Anti-Lock Brake Control Module	<u>Go To Pinpoint Test D .</u>
C1145	Speed Wheel Sensor RF Input Circuit Failure	Anti-Lock Brake Control Module	<u>Go To Pinpoint Test E .</u>
C1155	Speed Wheel Sensor LF Input Circuit Failure	Anti-Lock Brake Control Module	<u>Go To Pinpoint Test E .</u>
C1165	Speed Wheel Sensor RR Input Circuit Failure	Anti-Lock Brake Control Module	<u>Go To Pinpoint Test E .</u>
C1175	Speed Wheel Sensor LR Input Circuit Failure	Anti-Lock Brake Control Module	<u>Go To Pinpoint Test E .</u>
C1233	Speed Wheel LF Input Signal Missing	Anti-Lock Brake Control Module	<u>Go To Pinpoint Test F .</u>
C1234	Speed Wheel RF Input Signal Missing	Anti-Lock Brake Control Module	<u>Go To Pinpoint Test F .</u>
C1235	Speed Wheel RR Input Signal Missing	Anti-Lock Brake Control Module	<u>Go To Pinpoint Test F .</u>
C1236	Speed Wheel LR Input Signal Missing	Anti-Lock Brake Control Module	<u>Go To Pinpoint Test F .</u>

Symptom Chart



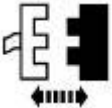


NOTE: Refer to the wiring diagrams for connector numbers stated in the pinpoint tests.

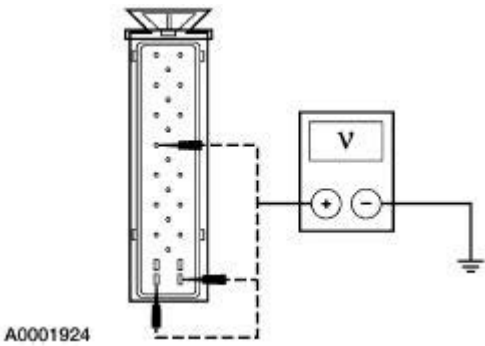
Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the anti-lock brake control module 	<ul style="list-style-type: none"> Underhood AJB Maxifuses 114 (30 A) and 122 (30A). CJB Fuse 203 (5A). Circuitry. Anti-Lock brake control module. 	<ul style="list-style-type: none"> Go To Pinpoint Test A.
<ul style="list-style-type: none"> The yellow anti-lock brake warning indicator does not self-check 	<ul style="list-style-type: none"> Anti-lock brake control module. Circuitry. Instrument cluster. Indicator bulb. 	<ul style="list-style-type: none"> Go To Pinpoint Test G.
<ul style="list-style-type: none"> Spongy brake pedal with no warning indicator 	<ul style="list-style-type: none"> Air in brake hydraulic system. 	<ul style="list-style-type: none"> REFER to Section 206-00.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE ANTI-LOCK BRAKE CONTROL MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS						
 CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.							
A1 CHECK VOLTAGE TO THE ANTI-LOCK BRAKE CONTROL MODULE							
<div style="display: flex; flex-direction: column; gap: 10px;"> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">1</div>  </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">2</div>  </div> <div style="text-align: center; margin: 5px 0;">Anti-Lock Brake Control Module C135</div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">3</div>  </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">4</div>  </div> </div>	<div style="display: flex; align-items: flex-start; gap: 20px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">4</div> <p>Measure the voltage between anti-lock brake control module C135 pins, and ground as follows:</p> </div> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Pin</th> <th>Circuit</th> </tr> </thead> <tbody> <tr> <td>25</td> <td>30-CF6A (RD)</td> </tr> <tr> <td>20</td> <td>20-CF6A (PK/YE)</td> </tr> </tbody> </table>	Pin	Circuit	25	30-CF6A (RD)	20	20-CF6A (PK/YE)
Pin	Circuit						
25	30-CF6A (RD)						
20	20-CF6A (PK/YE)						



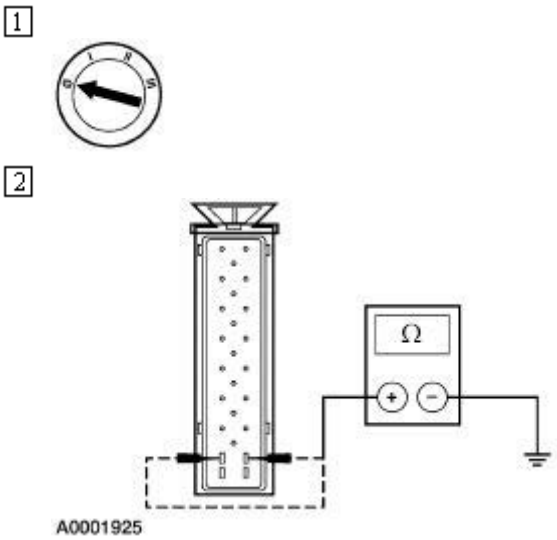
9	30-CF13 (RD)
---	--------------

- Are the voltages greater than 10 volts?

→ **Yes**
GO to A2.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

A2 CHECK ANTI-LOCK BRAKE MODULE GROUNDS



2 Measure the resistance between anti-lock brake control module C135 pin 8, circuit 31-CF6B (BK/YE), harness side and ground; and between anti-lock brake control module C135 pin 24, circuit 31-CF6A (BK/YE), harness side and ground.

- Are the resistances less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

PINPOINT TEST B: DTC B1485 , BRAKE PEDAL INPUT CIRCUIT BATTERY SHORT

CONDITIONS	DETAILS/RESULTS/ACTIONS



CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

B1 CHECK THE STOPLAMP OPERATION

1 Press the brake pedal.

- Do the stoplamps operate correctly?

→ **Yes**
GO to B2.

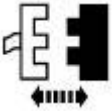
→ **No**
REFER to Section 417-01.

B2 CHECK CIRCUIT 29S-CF58 (OG/GN) FOR OPEN

1



2

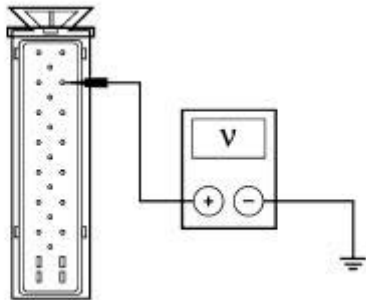


Anti-Lock Brake Control Module C135

3



4



A0001926



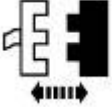

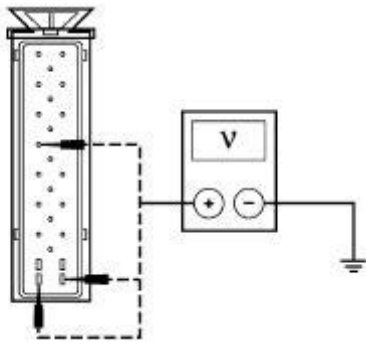
4 Measure the voltage between anti-lock brake control module pin 2 circuit 29S-CF58 (OG/GN), harness side and ground, while depressing the brake pedal.

- Is the voltage greater than 10 volts?

→ **Yes**
INSTALL a new anti-lock brake control module; REFER to Anti-Lock Brake System (ABS) Module. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST C: DTC B1676, BATTERY PACK VOLTAGE OUT OF RANGE

CONDITIONS	DETAILS/RESULTS/ACTIONS								
<p> CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.</p>									
<p>C1 CHECK THE BATTERY VOLTAGE</p>									
<p>1</p> 	<p>2 Measure the voltage between positive and negative battery posts.</p> <ul style="list-style-type: none"> ● Is the voltage between 10 and 17 volts? <p>→ Yes GO to <u>C2</u>.</p> <p>→ No REFER to <u>Section 414-00</u>.</p>								
<p>C2 CHECK VOLTAGE TO THE ANTI-LOCK BRAKE CONTROL MODULE</p>									
<p>1</p>  <p>Anti-Lock Brake Control Module C135</p> <p>2</p>  <p>3</p>  <p>A0001924</p>	<p>3 Measure the voltage between anti-lock brake control module C135 pins, and ground as follows:</p> <table border="1"> <thead> <tr> <th>Pin</th> <th>Circuit</th> </tr> </thead> <tbody> <tr> <td>25</td> <td>30-CF6A (RD)</td> </tr> <tr> <td>20</td> <td>20-CF6A (PK/YE)</td> </tr> <tr> <td>9</td> <td>30-CF13 (RD)</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ● Are the voltages greater than 10 volts? <p>→ Yes GO to <u>C3</u>.</p>	Pin	Circuit	25	30-CF6A (RD)	20	20-CF6A (PK/YE)	9	30-CF13 (RD)
Pin	Circuit								
25	30-CF6A (RD)								
20	20-CF6A (PK/YE)								
9	30-CF13 (RD)								

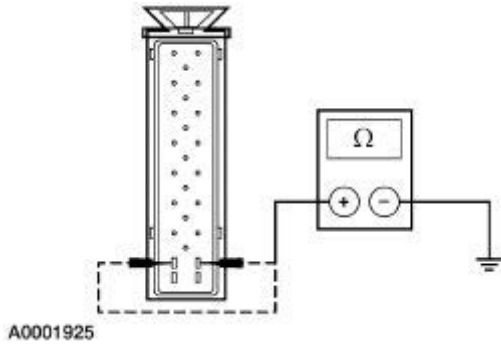
→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C3 CHECK THE ANTI-LOCK BRAKE CONTROL MODULE GROUNDS

1



2





2 Measure the resistance between anti-lock control module pin 24, circuit 31-CF6A (BK/YE), harness side and ground; and between anti-lock control module pin 8, circuit 31-CF6B (BK/YE), harness side and ground.

- Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new anti-lock brake control module; REFER to Anti-Lock Brake System (ABS) Module. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST D: DTC C1095, HYDRAULIC PUMP MOTOR CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
 CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.	
<p>D1 CHECK ABS PUMP MOTOR</p>	
<p>1</p> 	<ul style="list-style-type: none"> • Is the ABS pump motor running all the time? <p>→ Yes INSTALL a new anti-lock brake control</p>

module; REFER to Anti-Lock Brake System (ABS) Module. REPEAT the self-test.

→ **No**
GO to D2.

D2 CHECK PUMP MOTOR OPERATION

1



2 Trigger the anti-lock brake control module active command PMP MOTOR ON.

● **Does the ABS pump motor run for approximately three seconds?**

→ **Yes**

CLEAR the DTCs. CHECK the yellow ABS warning indicator while driving the vehicle (brakes must not be applied) above 32 km/h (20 mph). If the yellow ABS warning indicator illuminates, RETRIEVE continuous DTCs. If DTC C1095 is retrieved again, INSTALL a new anti-lock brake control module; REFER to Anti-Lock Brake System (ABS) Module. REPEAT the self-test.

If the yellow anti-lock brake warning indicator does not illuminate, the system is OK.

→ **No**

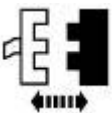
TRIGGER the anti-lock brake control module active command PMP MOTOR OFF. GO to D3.

D3 CHECK CIRCUIT 30-CF6A (RD) AND CIRCUIT 30-CF13 (RD) FOR OPEN

1



2



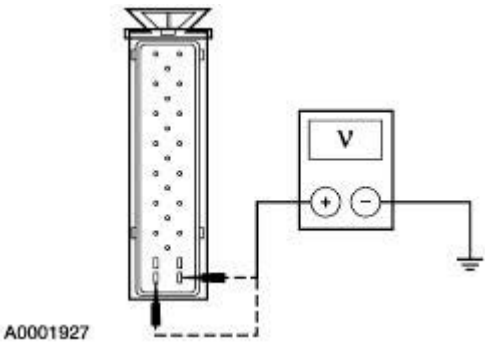
Anti-Lock Brake Control Module

3



4

4 Measure the voltage between anti-lock



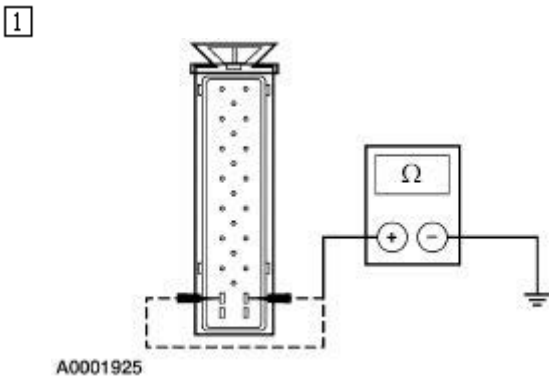
brake control module C135 pin 25 circuit 30-CF6A (RD), harness side and ground; and between anti-lock brake control module C135 pin 9 circuit 30-CF13 (RD), harness side and ground.

- Are the voltages greater than 10 volts?

→ **Yes**
GO to D4.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D4 CHECK CIRCUIT 31-CF6A (BK/YE) AND 31-CF6B (BK/YE) FOR AN OPEN



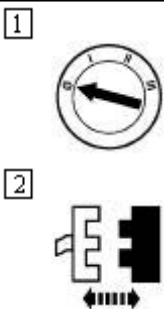
1 Measure the resistance between anti-lock brake control module C135 pin 24, circuit 31-CF6A (BK/YE), harness side and ground; and between anti-lock brake control module C135 pin 8, circuit 31-CF6B (BK/YE), harness side and ground.

- Are the resistances less than 5 ohms?

→ **Yes**
GO to D5.

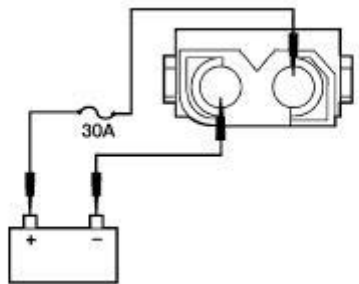
→ **No**
REPAIR circuit 31-CF6A (BK/YE) or circuit 31-CF6B (BK/YE). CLEAR the DTCs. REPEAT the self-test.

D5 CHECK THE PUMP MOTOR FOR OPERATION



Pump Motor Connector

3



GH1811-A

3

Using a heavy gauge wire, make a connection between the negative battery post and the pump motor connector brown wire (HCU side); momentarily connect a fused (30A) jumper wire between the positive battery post and the pump motor connector red wire (HCU side).

● Does the pump motor run?




→ Yes

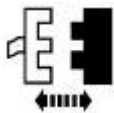
INSTALL a new anti-lock brake control module; REFER to Anti-Lock Brake System (ABS) Module . CLEAR the DTCs. REPEAT the self-test.

→ No

INSTALL a new HCU; REFER to Hydraulic Control Unit (HCU) . CLEAR the DTCs REPEAT the self-test.

PINPOINT TEST E: DTC C 1145 (RF), DTC C1155 (LF), DTC C1165 (RR), DTC C1175 (LR), ANTI-LOCK BRAKE SENSOR CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p> CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.</p> <p>NOTE: Any time an anti-lock brake sensor is removed, thoroughly clean the mounting surfaces, apply High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A or equivalent meeting Ford specification ESA-M1C198-A.</p>	
<p>E1 CHECK FOR SHORT TO POWER</p>	
<p>NOTE: Both circuits must be checked for each DTC.</p>	
<p>1</p>  <p>2</p>  <p>Anti-Lock Brake Control Module C135</p> <p>3</p>	

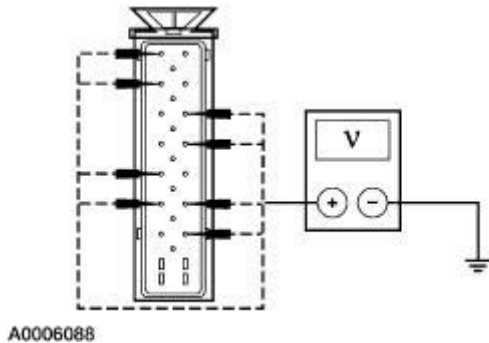


Suspect Anti-Lock Brake Sensor

4



5



5 Measure the voltage between anti-lock brake control module C135 pin, harness side and ground as follows:

DTC	Anti-Lock Brake Control Module C135	Circuit
C1145 (RF)	Pin 3	8-CF38 (WH/RD)
C1145 (RF)	Pin 4	7-CF38 (YE/RD)
C1155 (LF)	Pin 17	8-CF32 (WH)
C1155 (LF)	Pin 18	7-CF32 (YE)
C1165 (RR)	Pin 7	8-CF40 (WH/GN)
C1165 (RR)	Pin 6	7-CF40 (YE/GN)
C1175 (LR)	Pin 21	8-CF34 (WH/BU)
C1175 (LR)	Pin 22	7-CF34 (YE/BU)

● Is any voltage present?

→ **Yes**

If DTC C1145, REPAIR circuit 8-CF38 (WH/RD), or circuit 7-CF38 (YE/RD). CLEAR the DTCs. REPEAT the self-test.

If DTC C1155, REPAIR circuit 8-CF32 (WH), or circuit 7-CF32 (YE). CLEAR the DTCs. REPEAT the self-test.

If DTC C1165, REPAIR circuit 8-CF40 (WH/GN), or circuit 7-CF40 (YE/GN). CLEAR the DTCs. REPEAT the self-test.

If DTC C1175, REPAIR circuit 8-CF34 (WH/BU), or circuit 7-CF34 (YE/BU). CLEAR the DTCs. REPEAT the self-test.

→ **No**

GO to E2.

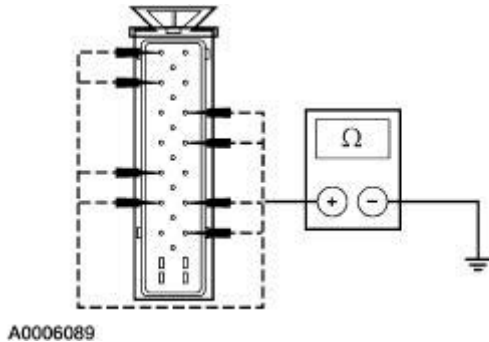
E2 CHECK FOR SHORT TO GROUND

NOTE: Both circuits must be checked for each DTC.

1



2



2

Measure the resistance between anti-lock brake control module C135 pin, harness side and ground as follows:

DTC	Anti-Lock Brake Control Module C135	Circuit
C1145 (RF)	Pin 3	8-CF38 (WH/RD)
C1145 (RF)	Pin 4	7-CF38 (YE/RD)
C1155 (LF)	Pin 17	8-CF32 (WH)
C1155 (LF)	Pin 18	7-CF32 (YE)
C1165 (RR)	Pin 7	8-CF40 (WH/GN)
C1165 (RR)	Pin 6	7-CF40 (YE/GN)
C1175 (LR)	Pin 21	8-CF34 (WH/BU)
C1175 (LR)	Pin 22	7-CF34 (YE/BU)

● **Is the resistance greater than 10,000 ohms?**

→ **Yes**
GO to E3.

→ **No**
If DTC C1145, REPAIR circuit 8-CF38 (WH/RD), or circuit 7-CF38 (YE/RD). CLEAR the DTCs. REPEAT the self-test.

If DTC C1155, REPAIR circuit 8-CF32 (WH), or circuit 7-CF32 (YE). CLEAR the DTCs. REPEAT the self-test.

If DTC C1165, REPAIR circuit 8-CF40 (WH/GN), or circuit 7-CF40 (YE/GN). CLEAR the DTCs. REPEAT the self-test.

If DTC C1175, REPAIR circuit 8-CF34 (WH/BU), or circuit 7-CF34 (YE/BU). CLEAR the DTCs. REPEAT the self-test.

E3 CHECK FOR AN OPEN

NOTE: Both circuits must be checked for each DTC.

1 Measure the resistance between anti-lock brake control module C135 pins, harness side and suspect anti-lock brake sensor connector, harness side as follows:

DTC	Anti-Lock Brake Control Module C135 Pin	Anti-Lock Brake Sensor	Circuit
C1145 (RF)	3	C160 pin 2	8-CF38 (WH/RD)
C1145 (RF)	4	C160 pin 1	7-CF38 (YE/RD)
C1155 (LF)	17	C150 pin 2	8-CF32 (WH)
C1155 (LF)	18	C150 pin 1	7-CF32 (YE)
C1165 (RR)	7	C426 pin 1	8-CF40 (WH/GN)
C1165 (RR)	6	C426 pin 2	7-CF40 (WH/GN)
C1175 (LR)	21	C440 pin 2	8-CF34 (WH/BU)
C1175 (LR)	22	C440 pin 1	7-CF34 (YE/BU)

● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to E4.

→ **No**
If DTC C1145, REPAIR circuit 8-CF38 (WH/RD), or circuit 7-CF38 (YE/RD). CLEAR the DTCs. REPEAT the self-test.

If DTC C1155, REPAIR circuit 8-CF32 (WH), or circuit 7-CF32 (YE). CLEAR the DTCs. REPEAT the self-test.

If DTC C1165, REPAIR circuit 8-CF40 (WH/GN), or circuit 7-CF40 (YE/GN). CLEAR the DTCs. REPEAT the self-test.

If DTC C1175, REPAIR circuit 8-CF34 (WH/BU), or circuit 7-CF34 (YE/BU). CLEAR the DTCs. REPEAT the self-test.

E4 CHECK THE ANTI-LOCK BRAKE CONTROL MODULE OUTPUT

1

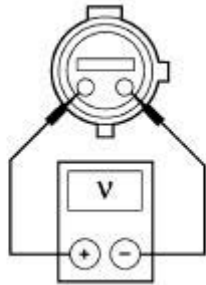


Anti-Lock Brake Control Module C135

2



3



A0006087


3 Measure the voltage between suspect anti-lock brake sensor connector pins, harness side.

• Is the voltage greater than 9 volts?

→ **Yes**
 INSTALL a new anti-lock brake sensor; REFER to Front Wheel Speed Sensor , or Rear Wheel Speed Sensor . CLEAR the DTCs. TEST the system for normal operation.

→ **No**
 INSTALL a new anti-lock brake control module; REFER to Anti-Lock Brake System (ABS) Module . CLEAR the DTCs. TEST the system for normal operation.

PINPOINT TEST F: DTCS C1233, C1234, C1235 AND C1236 — ANTI-LOCK BRAKE SENSOR OUTPUT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Any time an anti-lock brake sensor is removed, thoroughly clean the mounting surfaces. On front anti-lock brake sensors, apply High-Temperature 4x4 Front Axle and Wheel Bearing Grease.</p>	
<p>F1 CHECK FOR DTCS</p>	
<p>1</p>  <p>2</p>	



3 Retrieve DTCs.

- Is DTC C1145, C1155, C1165 or C1175 present?

→ Yes
Go To Pinpoint Test E .

→ No
GO to F2.

F2 CHECK THE ANTI-LOCK BRAKE SENSOR PIDS

1



2



2 Monitor the anti-lock brake control module PIDS LF_WSPD, RF_WSPD, LR_WSPD and RR_WSP while driving the vehicle at a constant speed.

- Are the anti-lock brake sensor PIDS consistent?

→ Yes
CLEAR the DTCs. DRIVE the vehicle. RETRIEVE DTCs. If DTC C1233, C1234, C1235 or C1236 is present, INSTALL a new anti-lock brake control module. REFER to Anti-Lock Brake System (ABS) Module . REPEAT the self-test.

→ No
GO to F3.


F3 CHECK FOR ANTI-LOCK BRAKE SENSOR DAMAGE AND LOOSENESS

NOTE: Any time an anti-lock brake sensor is removed, thoroughly clean the mounting surfaces. On front anti-lock brake sensors, apply High-Temperature 4x4 Front Axle and Wheel Bearing Grease.

1



2 Raise and support the vehicle. Refer to Section 100-02 .

3  **CAUTION:** Examine the anti-lock brake sensor wire carefully with good light. Failure to verify damage in the anti-lock brake sensor wire can lead to the unnecessary installation of a

new component.

Inspect the anti-lock brake sensor mounting for looseness. If the anti-lock brake sensor is suspected, inspect the sensor for corrosion on the anti-lock brake sensor mounting flange. Clean as necessary.

● **Is the anti-lock brake sensor OK?**

→ **Yes**
GO to F4.

→ **No**
If the anti-lock brake sensor mounting is loose or corroded, REMOVE the anti-lock brake sensor, PLUG the opening, and thoroughly CLEAN the mounting surfaces. On the front anti-lock brake sensors, APPLY High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A or equivalent meeting Ford Specification ESA-M1C198-A. REPEAT the self-test.

If the anti-lock brake sensor is damaged, INSTALL a new anti-lock brake sensor.


For the front anti-lock brake sensor, REFER to Front Wheel Speed Sensor. CLEAR the DTCs. REPEAT the self-test.

For the rear anti-lock brake sensor, REFER to Rear Wheel Speed Sensor. CLEAR the DTCs. REPEAT the self-test.

F4 CHECK FOR ANTI-LOCK BRAKE SENSOR INDICATOR DAMAGE

NOTE: Any time an anti-lock brake sensor is removed, thoroughly clean the mounting surfaces. On front anti-lock brake sensors, apply High Temperature 4x4 Front Axle and Wheel Bearing Grease.

1 Remove the anti-lock brake sensor.

2  **CAUTION: Examine the anti-lock brake sensor indicator carefully with good light. Failure to verify damage in the anti-lock brake sensor indicator can lead to the unnecessary installation of a new component.**

Inspect the anti-lock brake sensor indicator for damaged or missing teeth. Rotate the wheel to verify that no teeth are missing.

● **Is the wheel speed sensor indicator OK?**

→ **Yes**

GO to F5.

→ **No**
INSTALL a new wheel speed sensor indicator.

For the front wheel speed sensor indicator, REFER to Front Wheel Speed Sensor. CLEAR the DTCs. REPEAT the self-test.

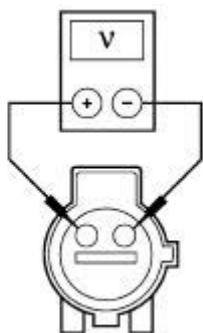
For the rear wheel speed sensor indicator, REFER to Rear Wheel Speed Sensor. CLEAR the DTCs. REPEAT the self-test.

F5 CHECK THE ANTI-LOCK BRAKE CONTROL MODULE OUTPUT

1



2



GH2097-A

2 Measure the voltage between the suspect anti-lock brake sensor as follows:

DTC	Suspect Anti-Lock Brake Sensor Circuit	Suspect Anti-Lock Brake Sensor Circuit
C1234 (RF)	514 (YE/RD)	516 (YE/BK)
C1233 (LF)	521 (TN/OG)	522 (TN/BK)
C1235 (RR)	523 (RD/PK)	524 (PK/BK)
C1236 (LR)	518 (LG/RD)	519 (LG/BK)


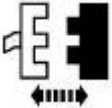




● Is the voltage greater than 9 volts?

→ **Yes**
INSTALL a new wheel speed sensor. REFER to Front Wheel Speed Sensor or Rear Wheel Speed Sensor. CLEAR the DTCs. TEST the system for normal operation.

→ **No**
INSTALL a new anti-lock brake control module. REFER to Anti-Lock Brake System (ABS) Module. TEST the system for normal operation.

PINPOINT TEST G: THE YELLOW ANTI-LOCK BRAKE WARNING


INDICATOR DOES NOT SELF-CHECK

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE YELLOW ANTI-LOCK BRAKE WARNING INDICATOR	
<p>1 </p> <p>2  Anti-Lock Brake Control Module C135</p> <p>3 </p>	<p>● Is the yellow anti-lock warning indicator illuminated?</p> <p>→ Yes GO to <u>G2</u>.</p> <p>→ No REFER to <u>Section 413-01</u>.</p>
G2 CHECK PROVE OUT	
<p>1 </p> <p>2  Anti-Lock Brake Control Module C135</p> <p>3 </p>	<p>● Does the yellow anti-lock brake warning indicator prove out for three seconds and then turn off?</p> <p>→ Yes The yellow anti-lock brake warning indicator operation is OK.</p> <p>→ No INSTALL a new anti-lock brake control module; REFER to <u>Anti-Lock</u></p>

Brake System (ABS) Module . TEST the system for normal operation.

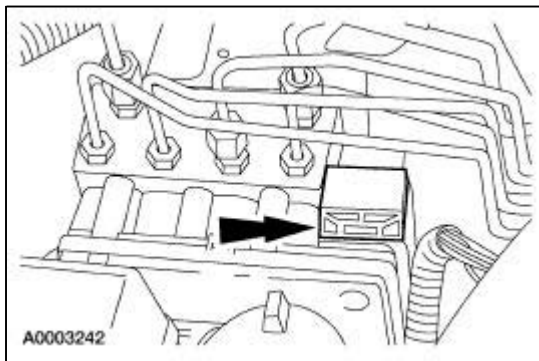
Hydraulic Control Unit (HCU)

Removal and Installation

 **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

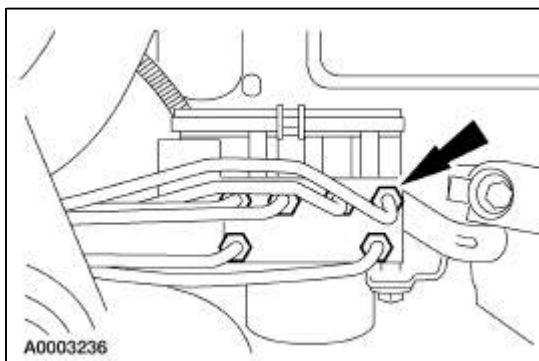
 **CAUTION:** Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the electrical connector by lifting up on the release tab.

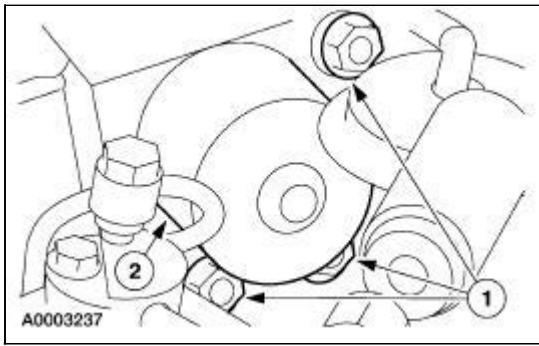



3. **NOTE:** Plug each open port to prevent any brake fluid from spilling.


Disconnect the brake lines from the hydraulic control unit (HCU).




4. Remove the HCU.
 1. Remove the bolts.
 2. Remove the HCU.



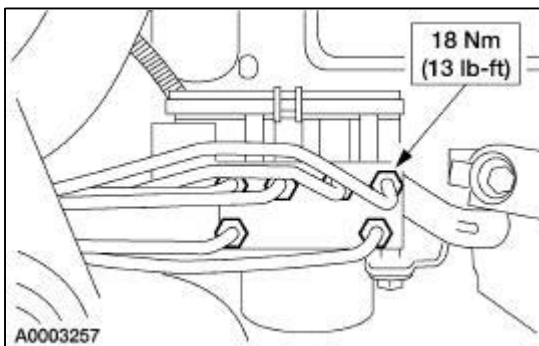
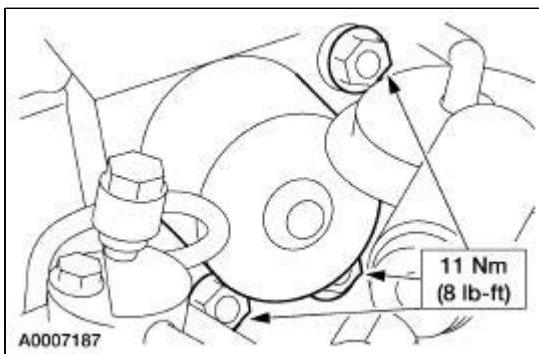
5.  **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

 **CAUTION:** Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

 **CAUTION:** After the HCU is installed, it is necessary to bleed the hydraulic brake system. For additional information, refer to [Section 206-00](#).

NOTE: When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 mi) or more to relearn the strategy.

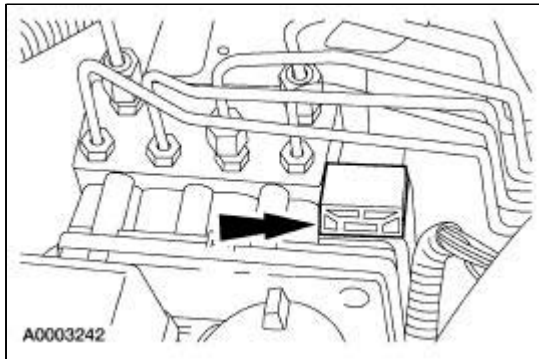
To install, reverse the removal procedure.



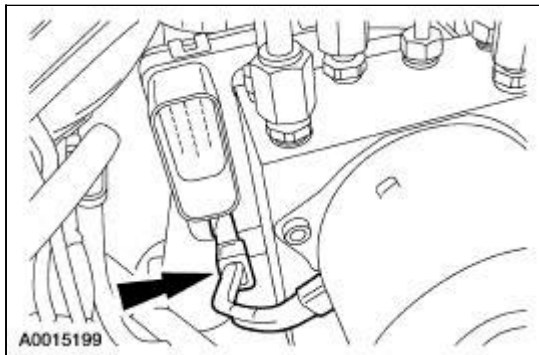
Anti-Lock Brake System (ABS) Module

Removal and Installation

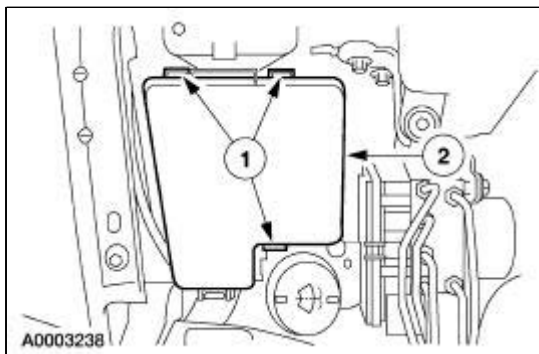
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the anti-lock brake control module electrical connector.



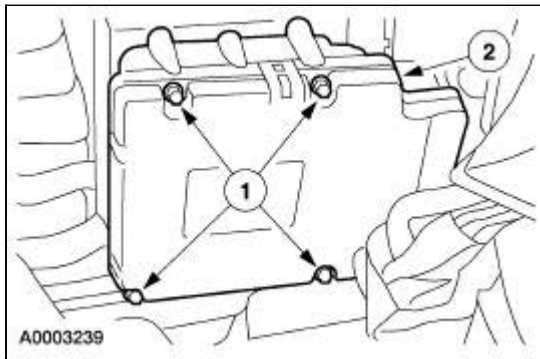
3. Disconnect the anti-lock brake pump motor electrical connector.




4. Position the underhood auxiliary junction box (AJB) aside.
 1. Release the underhood AJB clips.
 2. Position the underhood AJB aside.



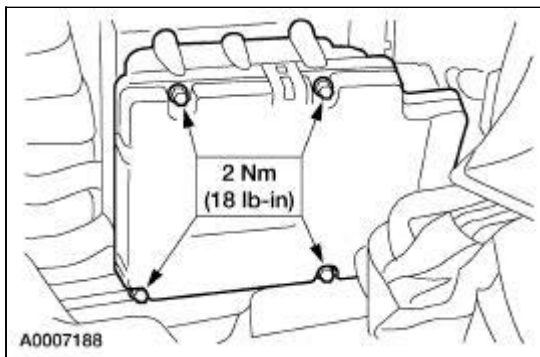
5. Remove the anti-lock brake control module.
 1. Remove the bolts.
 2. Remove the control module.



6.  **CAUTION:** Once the new module is installed, it is necessary to download the module configuration information from the scan tool into the module. For additional information, refer to [Section 418-01](#) .

NOTE: When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 mi) or more to relearn the strategy.

To install, reverse the removal procedure.



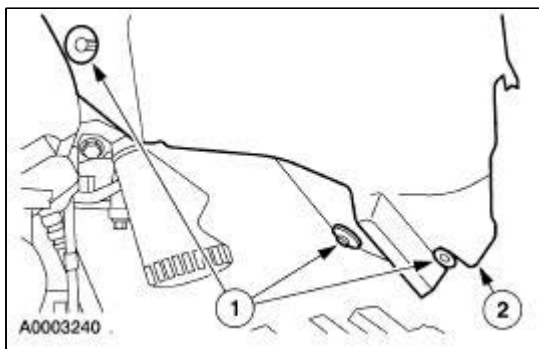
Front Wheel Speed Sensor

Material

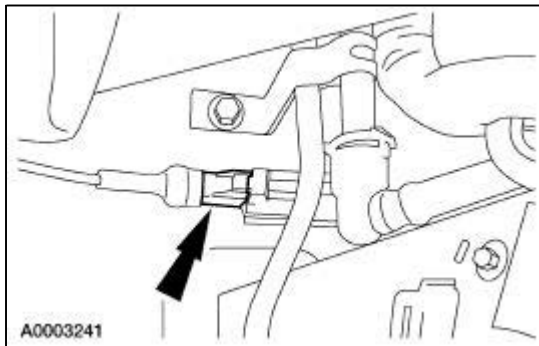
Item	Specification
RTV Silicone Sealant FSTZ-19G204-AB (Canada CXC-114A)	NAVSTR Sealer

Removal and Installation

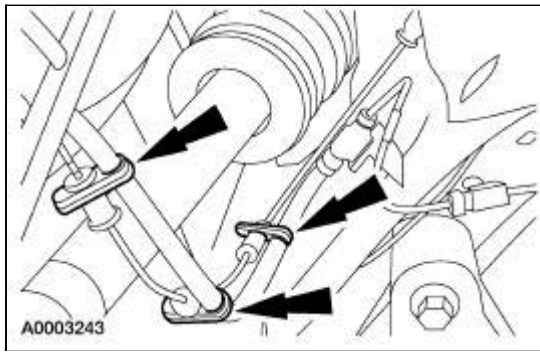
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Position the inner splash shield aside.
 1. Remove the pin-type retainers.
 2. Position the inner splash shield aside.



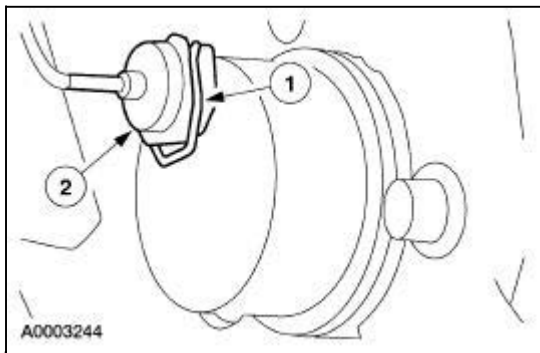
3. Disconnect the anti-lock brake sensor electrical connector.



4. Remove the anti-lock brake sensor harness from the brake hose clips.



5. Remove the anti-lock brake sensor.
 1. Remove the anti-lock brake sensor clip.
 2. Remove the anti-lock brake sensor.



6. **NOTE:** Make sure the anti-lock brake sensor is fully seated before installation of the new clip.

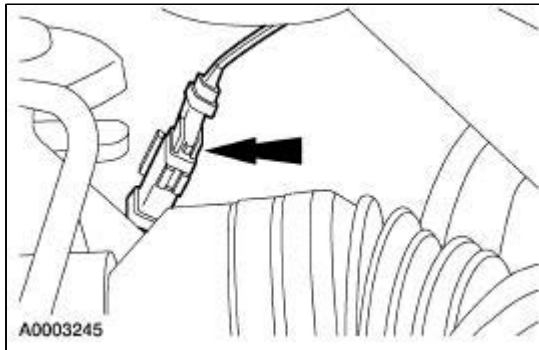
To install, reverse the removal procedure.

- Apply a 2.5 mm (0.1 in) bead of silicone sealant to the outside diameter of the anti-lock brake sensor.
-

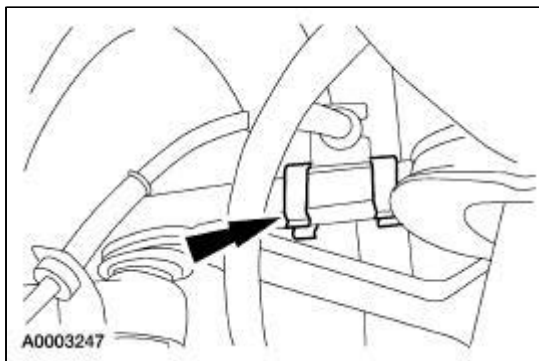
Rear Wheel Speed Sensor

Removal and Installation

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Disconnect the rear anti-lock brake sensor electrical connector.



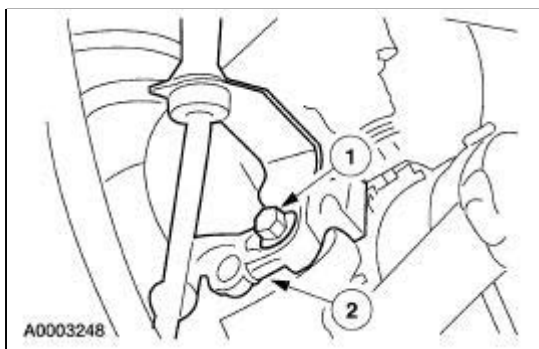
3. Remove the rear anti-lock brake sensor harness from the control arm clips.



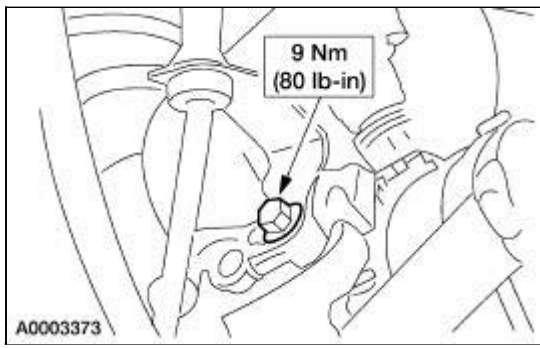
4. **NOTE:** Clean off dirt and foreign material that may have collected around the rear anti-lock brake sensor before removal.

Remove the rear anti-lock brake sensor.

1. Remove the anti-lock brake sensor bolt.
2. Remove the anti-lock brake sensor.



5. To install, reverse the removal procedure.



General Specifications

Item	Specification
High Temperature 4X4 Front Axle and Wheel Bearing Grease E8TZ-19590-A	ESA-M1C198-A
RTV Silicone Sealant F5TZ-19G204-AB	NAVSTR Sealer

Torque Specifications

Description	Nm	lb-ft	lb-in
Anti-lock brake control module bolts	2	—	18
Brake line to (HCU) nuts	18	13	—
Electronic hydraulic control unit bolts	11	8	—
Rear anti-lock brake sensor bolt	9	—	80

Anti-Lock Control —Traction Control

The four wheel anti-lock brake system (4WABS) with traction control consists of the following components:



- anti-lock brake control module
- front anti-lock brake sensors
- front anti-lock brake sensor indicators
- hydraulic control unit (HCU)
- rear anti-lock brake sensors
- rear anti-lock brake sensor indicators
- traction control event indicator
- traction control switch
- yellow anti-lock brake warning indicator

For removal and installation of the front anti-lock brake sensor indicators, refer to [Section 204-01](#) .

For removal and installation of the rear anti-lock brake sensor indicators, refer to [Section 205-05](#) .

Anti-Lock Control —Traction Control

Special Tool(s)

 ST1217-A	New Generation STAR (NGS) Tester or equivalent 418-F048 (007-00500)
 ST1137-A	73III Automotive Meter 105-R0057

Refer to Wiring Diagrams Section 206-09B-00, Anti-Lock Brake Control—Traction Control for schematic and electrical information.

Principles of Operation

The anti-lock-brake control module receives wheel speed readings from each anti-lock brake sensor and processes this information to determine if an ABS event is necessary. The anti-lock brake sensor electrically senses each tooth of the anti-lock brake sensor indicators as it passes through the anti-lock brake sensor magnetic field.

The anti-lock brake control module continuously monitors and compares the rotational speed of each wheel and, when it detects an impending wheel lock, modulates brake pressure to the appropriate brake caliper. This is accomplished by triggering the hydraulic control unit (HCU) to open and close the appropriate solenoid valves. Once the affected wheel returns to normal speed, the anti-lock brake control module returns the solenoid valves to their normal position, and normal (base) braking resumes.

The anti-lock brake control module is self-monitoring. When the ignition switch is turned to the RUN position, the anti-lock brake control module will do a preliminary electrical check, and at approximately 20 km/h (12 mph) the pump motor is turned on for approximately one half-second. Any malfunction of the ABS will cause the ABS or anti-lock brake system/traction control (ABS/TC) to shut off and the yellow anti-lock brake warning indicator to illuminate, however the power assist braking system functions normally.

The anti-lock brake control module and traction control communicates with the powertrain control module (PCM) to assist with traction control. At speeds under 40 km/h (25 mph) the anti-lock brake control module requests the PCM to reduce engine torque, while simultaneously applying and releasing the appropriate brake to restore traction when one or both drive wheels lose traction and begin to spin. The PCM accomplishes this by minor incremental timing changes and fewer fuel injector pulses until the anti-lock brake control module ends the request (when driven wheel speed returns to normal). After the vehicle speed exceeds 40 km/h (25 mph), the traction control is accomplished only through the PCM torque control.

If the traction control system is cycled excessively, the brake portion of the system will shut down to

prevent the rear brakes from overheating. A limited traction control function using only engine torque reduction will still control the wheels from over-spinning. When the rear brakes have cooled down the system will again function normally. Anti-lock braking is not affected by this condition and will function normally during the cool down period.

The traction control system can be disabled by depressing the traction control switch. The traction control system will reset and return to normal traction assist when the ignition switch is cycled or when the traction control switch is depressed again.

Inspection and Verification

NOTE: The anti-lock brake control module must be reconfigured upon replacement; refer to [Section 418-01](#).

1. Verify the customer concern by applying the brakes under different conditions.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Anti-lock brake sensor indicator ● Base brake concerns ● HCU ● Tire pressure ● Tire size or mismatched tires 	<ul style="list-style-type: none"> ● Underhood auxiliary junction box (AJB) Maxi Fuses: <ul style="list-style-type: none"> ■ 114 (30A) ■ 122 (30A) ● Central junction box (CJB) Fuses: <ul style="list-style-type: none"> ■ 205 (5A) ■ 203 (5A) ● Anti-lock brake control module ● Anti-lock brake sensors ● Brake pedal position (BPP) switch ● Circuitry ● Connectors or connections ● EVAC and fill connector ● Traction control switch ● Wire harness routing

3. If the fault is not visually evident, connect the New Generation STAR (NGS) to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the NGS menu. If the NGS does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the NGS still does not communicate with the vehicle, refer to the New Generation STAR Tester manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the NGS responds with:
 - CKT914, CKT915, or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for anti-lock brake control module, go to Pinpoint Test A.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the anti-lock brake

control module.

6. If the DTCs retrieved are related to the concern, go to Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart.

Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	Anti-Lock Brake Control Module	INSTALL a new anti-lock brake control module; REFER to Module—Anti-Lock Brake Control .
B1485	Brake Pedal Input Circuit Battery Short	Anti-Lock Brake Control Module	GO to Pinpoint Test B .
B1676	Battery Pack Voltage Out of Range	Anti-Lock Brake Control Module	GO to Pinpoint Test C .
B2477	Module Configuration Failure	Anti-Lock Brake Control Module	CONFIGURE the anti-lock brake control module; REFER to Section 418-01 . CLEAR the DTCs. REPEAT the self-test. If DTC B2477 is retrieved again, INSTALL a new anti-lock brake control module; REFER to Module—Anti-Lock Brake Control . REPEAT the self-test.
C1095	Hydraulic Pump Motor Circuit Failure	Anti-Lock Brake Control Module	GO to Pinpoint Test D .
C1145	Speed Wheel Sensor RF Input Circuit Failure	Anti-Lock Brake Control Module	GO to Pinpoint Test E .
C1155	Speed Wheel Sensor LF Input Circuit Failure	Anti-Lock Brake Control Module	GO to Pinpoint Test E .
C1165	Speed Wheel Sensor RR Input Circuit Failure	Anti-Lock Brake Control Module	GO to Pinpoint Test E .
C1175	Speed Wheel Sensor LR Input Circuit Failure	Anti-Lock Brake Control Module	GO to Pinpoint Test E .
C1233	Speed Wheel LF Input Signal Missing	Anti-Lock Brake Control Module	GO to Pinpoint Test F .
C1234	Speed Wheel RF Input Signal Missing	Anti-Lock Brake	GO to Pinpoint Test F .

		Control Module	
C1235	Speed Wheel RR Input Signal Missing	Anti-Lock Brake Control Module	GO to <u>Pinpoint Test F.</u>
C1236	Speed Wheel LR Input Signal Missing	Anti-Lock Brake Control Module	GO to <u>Pinpoint Test F.</u>
P0112	IAT Circuit Low Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0122	TP Sensor A Circuit Low Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0123	TP Sensor A Circuit High Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0500	Vehicle Speed Sensor Malfunction	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0501	Vehicle Speed Sensor Range/Performance	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0502	Vehicle Speed Sensor Low Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0503	Vehicle Speed Sensor Intermittent	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1120	TP Sensor Out Of Range Low (Ratch Too Low)	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1183	Engine Oil Temperature Circuit Malfunction	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1184	Engine Oil Temperature Out Of Self Test Range	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1009	SCP (J1850) Invalid or Missing Data for Engine Torque	ABS/TC	CARRY OUT the PCM self-test.
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	ABS/TC	CARRY OUT the PCM self-test.
U1262	SCP (J1850) Communication Bus Fault	ABS/TC	REFER to <u>Section 418-00.</u>

Anti-Lock Brake Control Module Parameter Identification (PID) Index

PID	Description	Expected Value
CONTABS	Number of Continuous DTCs on ABS	one count per bit
BOO_ABS	Brake Switch Input	ON, OFF
ABSLF_I	Left Front ABS Inlet Valve	Off--, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On--, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG

ABSLF_O	Left Front ABS Outlet Valve	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
ABSLR_I	Left Rear ABS Inlet Valve	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
ABSLR_O	Left Rear ABS Outlet Valve	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
ABSRF_I	Right Front ABS Inlet Valve	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
ABSRF_O	Right Front ABS Outlet Valve	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
ABSRR_I	Right Rear ABS Inlet Valve	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
ABSRR_O	Right Rear ABS Outlet Valve	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LF_WSPD	Left Front Wheel Speed Sensor	0-255 KPH
LR_WSPD	Left Rear Wheel Speed Sensor	0-255 KPH
RF_WSPD	Right Front Wheel Speed Sensor	one count per bit
RR_WSPD	Right Rear Wheel Speed Sensor	0-255 KPH
TC_LVAL	Left Rear Traction Control Output State	ON, OFF
TC_RVAL	Right Rear Traction Control Output State	ON, OFF
TC/YC_SW	TC or TC/YC Switch, push button, input status	ON, OFF
TC/YC_FNC	TC or TC/YC function available state, status	ON, OFF

Anti-Lock Brake Control Module Active Command Index

Active Command	Display	Action
ABS Output Control	PMP MOTOR	ON, OFF
	LF INLET	ON, OFF
	RF INLET	ON, OFF
	LR INLET	ON, OFF
	RR INLET	ON, OFF
	LF OUTLET	ON, OFF

	RF OUTLET	ON, OFF
	LR OUTLET	ON, OFF
	RR OUTLET	ON, OFF
TC OUTPUT CONTROL	LR TC VLV	ON, OFF
	RR TC VLV	ON, OFF

Symptom Chart

NOTE: Refer to the wiring diagrams for connector numbers stated in the pinpoint tests.


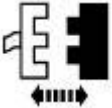

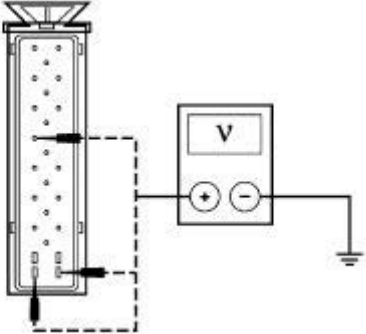


Symptom Chart

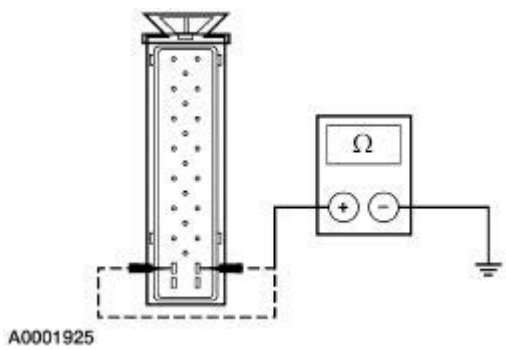
Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the anti-lock brake control module 	<ul style="list-style-type: none"> Underhood AJB Maxi Fuses 114 (30 A) and 122 (30A). CJB Fuses 203 (5A) and 205 (5A). Circuitry. Anti-lock brake control module. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> The yellow anti-lock brake warning indicator does not self-check 	<ul style="list-style-type: none"> Anti-lock brake control module. Circuitry. Instrument cluster. Indicator bulb. 	<ul style="list-style-type: none"> GO to Pinpoint Test G.
<ul style="list-style-type: none"> Spongy brake pedal with no warning indicator 	<ul style="list-style-type: none"> Air in brake hydraulic system. 	<ul style="list-style-type: none"> GO to Section 206-00.
<ul style="list-style-type: none"> The traction control is inoperative 	<ul style="list-style-type: none"> Circuitry. Traction control switch. Anti-lock brake control module. Hydraulic control unit (HCU). Base brake system. 	<ul style="list-style-type: none"> GO to Pinpoint Test H. REFER to Section 206-00.
<ul style="list-style-type: none"> The traction control cannot be disabled 	<ul style="list-style-type: none"> Circuitry. Traction control switch. Anti-lock brake control module. 	<ul style="list-style-type: none"> GO to Pinpoint Test I.
<ul style="list-style-type: none"> The traction control switch is never/always on 	<ul style="list-style-type: none"> Circuitry. Traction control switch. Anti-lock brake control module. 	<ul style="list-style-type: none"> GO to Pinpoint Test J.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE ANTI-LOCK

BRAKE CONTROL MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS								
A1 CHECK VOLTAGE TO THE ANTI-LOCK BRAKE CONTROL MODULE									
<p>1 </p> <p>2  Anti-Lock Brake Control Module C135</p> <p>3 </p> <p>4  A0001924</p>	<p>4 Measure the voltage between anti-lock brake control module C135 pins, and ground as follows:</p> <table border="1"> <thead> <tr> <th>Pin</th> <th>Circuit</th> </tr> </thead> <tbody> <tr> <td>25</td> <td>30-CF6A (RD)</td> </tr> <tr> <td>20</td> <td>20-CF6A (PK/YE)</td> </tr> <tr> <td>9</td> <td>30-CF13 (RD)</td> </tr> </tbody> </table> <p>• Are the voltages greater than 10 volts?</p> <p>→ Yes GO to <u>A2</u> .</p> <p>→ No REPAIR the circuit in question. TEST the system for normal operation.</p>	Pin	Circuit	25	30-CF6A (RD)	20	20-CF6A (PK/YE)	9	30-CF13 (RD)
Pin	Circuit								
25	30-CF6A (RD)								
20	20-CF6A (PK/YE)								
9	30-CF13 (RD)								
A2 CHECK ANTI-LOCK BRAKE MODULE GROUNDS									
<p>1 </p> <p>2 </p>	<p>2 Measure the resistance between anti-lock brake control module C135 pin 8, circuit 31-CF6B (BK/YE), harness side and ground; and between anti-lock brake control module C135 pin 24, circuit 31-CF6A (BK/YE), harness side and ground.</p>								



- Are the resistances less than 5 ohms?


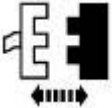

→ **Yes**

REFER to Section 418-00.

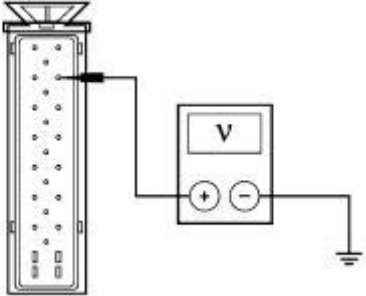
→ **No**

REPAIR the circuit in question. TEST the system for normal operation.

PINPOINT TEST B: DTC B1485 , BRAKE PEDAL INPUT CIRCUIT BATTERY SHORT

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK THE STOPLAMP OPERATION	
	<p>1 Press the brake pedal.</p> <ul style="list-style-type: none"> ● Do the stoplamps operate correctly? <p>→ Yes GO to <u>B2</u>.</p> <p>→ No REFER to <u>Section 417-01</u>.</p>
B2 CHECK CIRCUIT 29S-CF58 (OG/GN) FOR OPEN	
<p>1</p>  <p>2</p>  <p>Anti-Lock Brake Control Module C135</p> <p>3</p> 	

4



A0001926


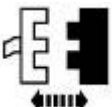
4 Measure the voltage between anti-lock brake control module pin 2 circuit 29S-CF58 (OG/GN), harness side and ground, while depressing the brake pedal.

- Is the voltage greater than 10 volts?

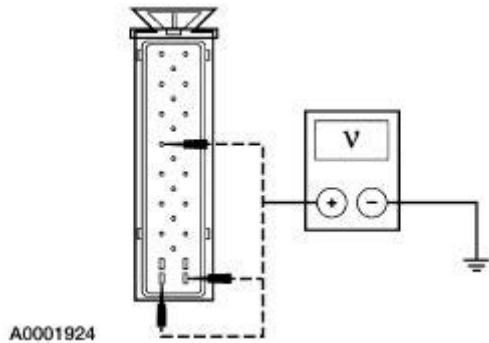
→ **Yes**
 INSTALL a new anti-lock brake control module; REFER to Module—Anti-Lock Brake Control . CLEAR the DTCs. REPEAT the self-test.

→ **No**
 REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST C: DTC B1676, BATTERY PACK VOLTAGE OUT OF RANGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE BATTERY VOLTAGE	
<p>1</p> 	<p>2 Measure the voltage between positive and negative battery posts.</p> <ul style="list-style-type: none"> • Is the voltage between 10 and 14 volts? <p>→ Yes GO to <u>C2</u> .</p> <p>→ No REFER to <u>Section 414-00</u> .</p>
C2 CHECK VOLTAGE TO THE ANTI-LOCK BRAKE CONTROL MODULE	
<p>1</p>  <p>Anti-Lock Brake Control Module C135</p>	

2



2 Measure the voltage between anti-lock brake control module C135 pins, and ground as follows:

Pin	Circuit
25	30-CF6A (RD)
20	20-CF6A (PK/YE)
9	30-CF13 (RD)

- Are the voltages greater than 10 volts?

→ **Yes**
GO to C3.

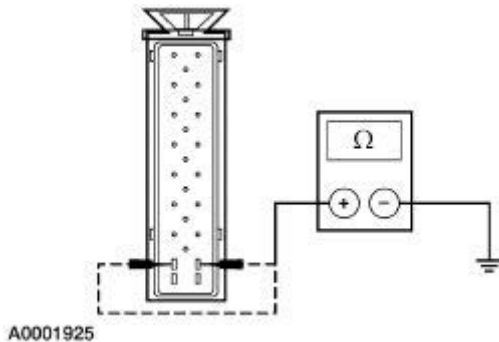
→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C3 CHECK THE ANTI-LOCK BRAKE CONTROL MODULE GROUNDS

1



2






2 Measure the resistance between anti-lock control module pin 24, circuit 31-CF6A (BK/YE), harness side and ground; and between anti-lock control module pin 8, circuit 31-CF6B (BK/YE), harness side and ground.

- Are the resistances less than 5 ohms?

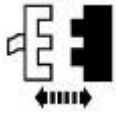
→ **Yes**
INSTALL a new anti-lock brake control module; REFER to Module—Anti-Lock Brake Control. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST D: DTC C1095, HYDRAULIC PUMP MOTOR CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK ABS PUMP MOTOR	
<p>1</p> 	<ul style="list-style-type: none"> ● Is the ABS pump motor running all the time? <p>→ Yes INSTALL a new anti-lock brake control module; REFER to <u>Module—Anti-Lock Brake Control</u>. REPEAT the self-test.</p> <p>→ No GO to <u>D2</u>.</p>
D2 CHECK PUMP MOTOR OPERATION	
<p>1</p> 	<p>2 Trigger the anti-lock brake control module active command PMP MOTOR ON.</p> <ul style="list-style-type: none"> ● Does the ABS pump motor run for approximately three seconds? <p>→ Yes CLEAR the DTCs. CHECK the yellow anti-lock brake warning indicator while driving the vehicle (brakes must not be applied) above 32 km/h (20 mph). If the yellow anti-lock brake warning indicator illuminates, RETRIEVE continuous DTCs. If DTC C1095 is retrieved again, INSTALL a new anti-lock brake control module; REFER to <u>Module—Anti-Lock Brake Control</u>. REPEAT the self-test.</p> <p>If the yellow anti-lock brake warning indicator does not illuminate, the system is OK.</p> <p>→ No TRIGGER the anti-lock brake control module active command PMP MOTOR OFF. GO to <u>D3</u>.</p>
D3 CHECK CIRCUIT 30-CF6A (RD) AND CIRCUIT 30-CF13 (RD) FOR OPEN	
<p>1</p> 	

2

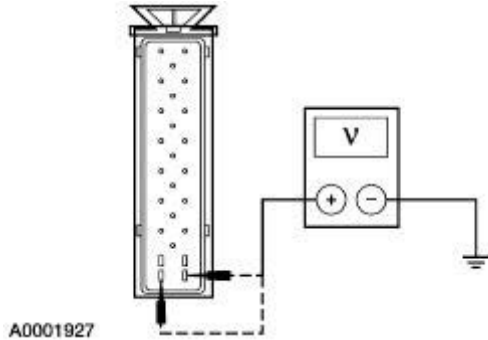


Anti-Lock Brake Control Module

3



4



4

Measure the voltage between anti-lock brake control module C135 pin 25 circuit 30-CF6A (RD), harness side and ground; and between anti-lock brake control module C135 pin 9 circuit 30-CF13 (RD), harness side and ground.

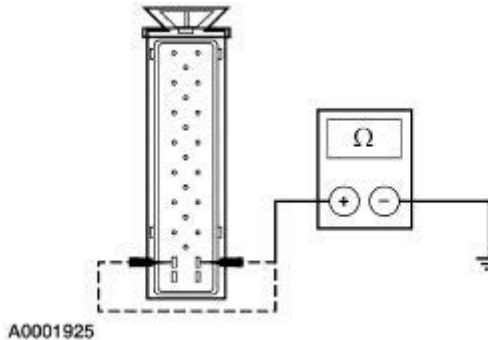
- Are the voltages greater than 10 volts?

→ **Yes**
GO to D4.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D4 CHECK CIRCUIT 31-CF6A (BK/YE) AND 31-CF6B (BK/YE) FOR AN OPEN

1



1

Measure the resistance between anti-lock brake control module C135 pin 24, circuit 31-CF6A (BK/YE), harness side and ground; and between anti-lock brake control module C135 pin 8, circuit 31-CF6B (BK/YE), harness side and ground.

- Are the resistances less than 5 ohms?

→ **Yes**
GO to D5.

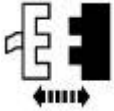
→ **No**
REPAIR circuit 31-CF6A (BK/YE) or circuit 31-CF6B (BK/YE). CLEAR the DTCs. REPEAT the self-test.

D5 CHECK THE PUMP MOTOR FOR OPERATION

1

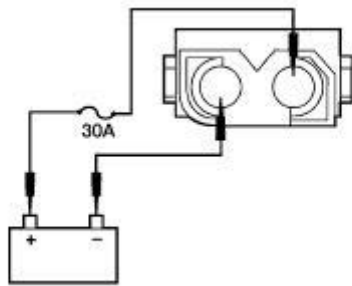


2



Pump Motor Connector

3



GH1811-A

3

Using a heavy gauge wire, make a connection between the negative battery post and the pump motor connector brown wire (HCU side); momentarily connect a fused (30A) jumper wire between the positive battery post and the pump motor connector red wire (HCU side).

● Does the pump motor run?


→ Yes

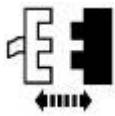
INSTALL a new anti-lock brake control module; REFER to Module—Anti-Lock Brake Control. CLEAR the DTCs. REPEAT the self-test.

→ No

INSTALL a new HCU; REFER to Hydraulic Control Unit—(HCU). CLEAR the DTCs. REPEAT the self-test.

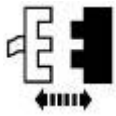
PINPOINT TEST E: DTC C 1145 (RF), DTC C1155 (LF), DTC C1165 (RR), DTC C1175 (LR), ANTI-LOCK BRAKE SENSOR CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Any time an anti-lock brake sensor is removed, thoroughly clean the mounting surfaces, apply High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A or equivalent meeting Ford specification ESA-M1C198-A.</p>	
<p>E1 CHECK FOR SHORT TO POWER</p>	
<p>NOTE: Both circuits must be checked for each DTC.</p>	
<p>1</p>  <p>2</p>	



Anti-Lock Brake Control Module C135

3

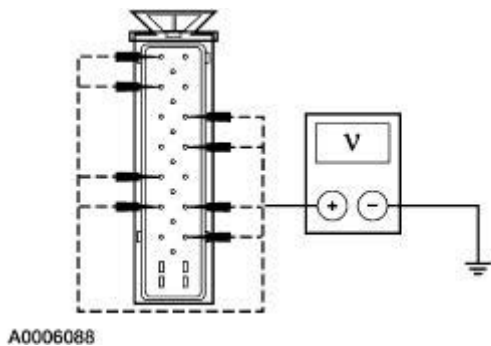


Suspect Anti-Lock Brake Sensor

4



5



- 5 Measure the voltage between anti-lock brake control module C135 pin, harness side and ground as follows:

DTC	Anti-Lock Brake Control Module C135	Circuit
C1145 (RF)	Pin 3	8-CF38 (WH/RD)
C1145 (RF)	Pin 4	7-CF38 (YE/RD)
C1155 (LF)	Pin 17	8-CF32 (WH)
C1155 (LF)	Pin 18	7-CF32 (YE)
C1165 (RR)	Pin 7	8-CF40 (WH/GN)
C1165 (RR)	Pin 6	7-CF40 (YE/GN)
C1175 (LR)	Pin 21	8-CF34 (WH/BU)
C1175 (LR)	Pin 22	7-CF34 (YE/BU)

● Is any voltage present?

→ Yes

If DTC C1145, REPAIR circuit 8-CF38 (WH/RD), or circuit 7-CF38 (YE/RD). CLEAR the DTCs. REPEAT the self-test.

If DTC C1155, REPAIR circuit 8-CF32 (WH), or circuit 7-CF32 (YE). CLEAR the DTCs. REPEAT the self-test.

If DTC C1165, REPAIR circuit 8-CF40 (WH/GN), or circuit 7-CF40 (YE/GN). CLEAR the DTCs. REPEAT the self-test.

If DTC C1175, REPAIR circuit 8-CF34 (WH/BU), or circuit 7-CF34 (YE/BU). CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to E2.

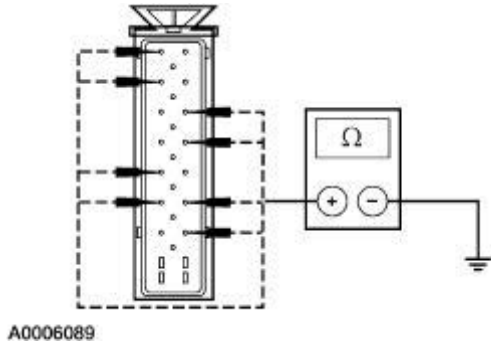
E2 CHECK FOR SHORT TO GROUND

NOTE: Both circuits must be checked for each DTC.

1



2



2 Measure the resistance between anti-lock brake control module C135 pin, harness side and ground as follows:

DTC	Anti-Lock Brake Control Module C135	Circuit
C1145 (RF)	Pin 3	8-CF38 (WH/RD)
C1145 (RF)	Pin 4	7-CF38 (YE/RD)
C1155 (LF)	Pin 17	8-CF32 (WH)
C1155 (LF)	Pin 18	7-CF32 (YE)
C1165 (RR)	Pin 7	8-CF40 (WH/GN)
C1165 (RR)	Pin 6	7-CF40 (YE/GN)
C1175 (LR)	Pin 21	8-CF34 (WH/BU)
C1175 (LR)	Pin 22	7-CF34 (YE/BU)

● **Is the resistance greater than 10,000 ohms?**

→ **Yes**
GO to E3.

→ **No**
If DTC C1145, REPAIR circuit 8-CF38 (WH/RD), or circuit 7-CF38 (YE/RD). CLEAR the DTCs. REPEAT the self-test.

If DTC C1155, REPAIR circuit 8-CF32 (WH), or circuit 7-CF32 (YE). CLEAR the DTCs. REPEAT the self-test.

If DTC C1165, REPAIR circuit 8-CF40 (WH/GN), or circuit 7-CF40 (YE/GN).

CLEAR the DTCs. REPEAT the self-test.

If DTC C1175, REPAIR circuit 8-CF34 (WH/BU), or circuit 7-CF34 (YE/BU).
CLEAR the DTCs. REPEAT the self-test.

E3 CHECK FOR AN OPEN

NOTE: Both circuits must be checked for each DTC.

- 1 Measure the resistance between anti-lock brake control module C135 pins, harness side and suspect anti-lock brake sensor connector, harness side as follows:

DTC	Anti-Lock Brake Control Module C135 Pin	Anti-Lock Brake Sensor	Circuit
C1145 (RF)	3	C160 pin 2	8-CF38 (WH/RD)
C1145 (RF)	4	C160 pin 1	7-CF38 (YE/RD)
C1155 (LF)	17	C150 pin 2	8-CF32 (WH)
C1155 (LF)	18	C150 pin 1	7-CF32 (YE)
C1165 (RR)	7	C426 pin 1	8-CF40 (WH/GN)
C1165 (RR)	6	C426 pin 2	7-CF40 (WH/GN)
C1175 (LR)	21	C440 pin 2	8-CF34 (WH/BU)
C1175 (LR)	22	C440 pin 1	7-CF34 (YE/BU)

- Is the resistance less than 5 ohms?

→ **Yes**
GO to E4.

→ **No**
If DTC C1145, REPAIR circuit 8-CF38 (WH/RD), or circuit 7-CF38 (YE/RD).
CLEAR the DTCs. REPEAT the self-test.

If DTC C1155, REPAIR circuit 8-CF32 (WH), or circuit 7-CF32 (YE). CLEAR the DTCs. REPEAT the self-test.

If DTC C1165, REPAIR circuit 8-CF40 (WH/GN), or circuit 7-CF40 (YE/GN).
CLEAR the DTCs. REPEAT the self-test.

If DTC C1175, REPAIR circuit 8-CF34 (WH/BU), or circuit 7-CF34 (YE/BU). CLEAR the DTCs. REPEAT the self-test.

E4 CHECK THE ANTI-LOCK BRAKE CONTROL MODULE OUTPUT

1

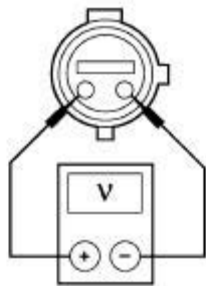


Anti-Lock Brake Control Module C135

2



3



A0006087

3

Measure the voltage between suspect anti-lock brake sensor connector pins, harness side.

• Is the voltage greater than 9 volts?

→ **Yes**

INSTALL a new anti-lock brake sensor; REFER to Sensor—Front, or Sensor—Rear. CLEAR the DTCs. TEST the system for normal operation.

→ **No**


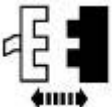

INSTALL a new anti-lock brake control module; REFER to Module—Anti-Lock Brake Control. CLEAR the DTCs. TEST the system for normal operation.

PINPOINT TEST F: DTC C1233 (LF), DTC C1234 (RF), DTC C1235 (RR), DTC C1236 (LR) — ANTI-LOCK BRAKE SENSOR INPUT SIGNAL MISSING




CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Any time an anti-lock brake sensor is removed, thoroughly clean the mounting surfaces, apply High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A or equivalent meeting Ford specification ESA-M1C198-A.</p>	
<p>F1 CHECK THE ANTI-LOCK BRAKE SENSOR</p>	
	<p>1 Check the suspect anti-lock brake sensor mounting. Check the suspect anti-lock brake sensor for excessive dirt buildup, metal obstructions, incorrect harness routing, and chafing.</p>

	<ul style="list-style-type: none"> ● Is the suspect anti-lock brake sensor OK? <p>→ Yes GO to <u>F2</u>.</p> <p>→ No REPAIR as necessary. CLEAR the DTCs. TEST the system for normal operation.</p>
F2 CHECK THE ANTI-LOCK BRAKE SENSOR INDICATOR	
	<p>1 Check the suspect anti-lock brake sensor indicator for corrosion, nicks, damaged teeth, incorrect mounting, alignment, and consistent air gap.</p> <ul style="list-style-type: none"> ● Is the suspect anti-lock brake sensor indicator OK? <p>→ Yes INSTALL a new anti-lock brake sensor; REFER to <u>Sensor—Front</u>, or <u>Sensor—Rear</u>. CLEAR the DTCs. TEST the system for normal operation.</p> <p>→ No REPAIR as necessary. CLEAR the DTCs. TEST the system for normal operation.</p>


PINPOINT TEST G: THE YELLOW ANTI-LOCK BRAKE WARNING INDICATOR DOES NOT SELF-CHECK

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE YELLOW ANTI-LOCK BRAKE WARNING INDICATOR	
<p>1 </p> <p>2  Anti-Lock Brake Control Module C135</p> <p>3 </p>	<ul style="list-style-type: none"> ● Is the yellow anti-lock brake warning indicator illuminated? <p>→ Yes GO to <u>G2</u>.</p> <p>→ No REFER to <u>Section 413-01</u>.</p>

G2 CHECK PROVE OUT

<p>1 </p> <p>2  Anti-Lock Brake Control Module C135</p> <p>3 </p>	<ul style="list-style-type: none"> ● Does the yellow anti-lock brake warning indicator prove out for three seconds and then turn off? <p>→ Yes The yellow anti-lock brake warning indicator operation is OK.</p> <p>→ No INSTALL a new anti-lock brake control module; REFER to <u>Module— Anti-Lock Brake Control</u>. TEST the system for normal operation.</p>
--	--

PINPOINT TEST H: THE TRACTION CONTROL IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK FOR DTCs	
<p>1 </p> <p>NGS</p>	<p>2 Retrieve and document continuous DTCs.</p> <ul style="list-style-type: none"> ● Are any DTCs retrieved? <p>→ Yes GO to Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>H2</u>.</p>
H2 CHECK THE ABS OPERATION	
	<p>1 Test drive the vehicle and carry out several anti-lock stops.</p>

● Does the ABS operate normally?

→ **Yes**
GO to H3.

→ **No**
GO to Symptom Chart.

H3 CHECK THE TRACTION CONTROL OFF INPUT TO THE ANTI-LOCK BRAKE CONTROL MODULE FOR SHORT TO POWER

1



2

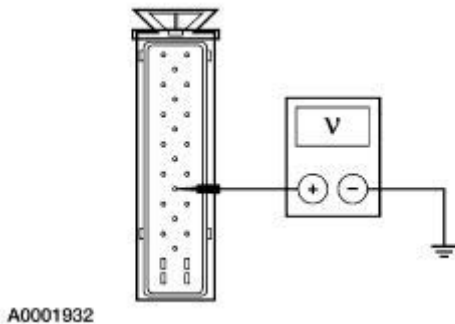


Anti-Lock Brake Control Module C135

3



4



4 Measure the voltage between anti-lock brake control module C135 pin 14, circuit 8-CF54 (WH/VT), harness side and ground.

● Is any voltage present?

→ **Yes**
GO to H4.

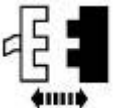
→ **No**
INSTALL a new anti-lock brake control module; REFER to Module—Anti-Lock Brake Control. TEST the system for normal operation.

H4 CHECK CIRCUIT 8-CF54 (WH/VT) FOR A SHORT TO POWER

1




2

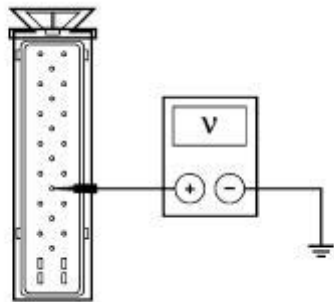


Traction Control Switch C308

3



4



A0001932




4 Measure the voltage between anti-lock brake control module C135 pin 14, circuit 8-CF54 (WH/VT), harness side and ground.

- Is any voltage present?

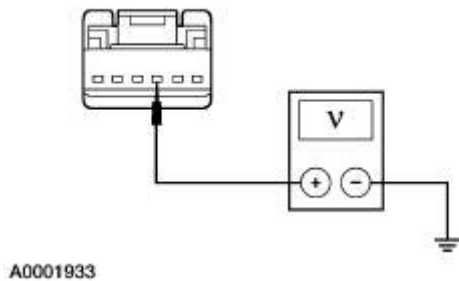
→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new traction control switch;
REFER to Switch—Traction Control.
TEST the system for normal operation.

PINPOINT TEST I: THE TRACTION CONTROL CANNOT BE DISABLED

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 CHECK CIRCUIT 15-CF54 (GN/WH) FOR AN OPEN	
<p>1</p>  <p>2</p>  <p>Traction Control Switch C308</p> <p>3</p> 	

4



4

Measure the voltage between traction control switch C308, circuit 15-CF54 (GN/WH), harness side and ground.

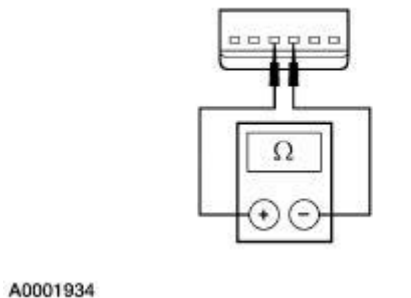
● Is any voltage present?

→ **Yes**
GO to 12.

→ **No**
REPAIR the circuit 15-CF54 (GN/WH) or circuit 15-DA5 (GN/OG). TEST the system for normal operation.

12 CHECK THE TRACTION CONTROL SWITCH

1



1

Measure the resistance between traction control switch, pin 4 and pin 3 (component side) while depressing the traction control switch.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to 13.

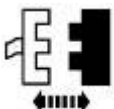
→ **No**
INSTALL a new traction control switch; REFER to Switch—Traction Control. TEST the system for normal operation.

13 CHECK CIRCUIT 8-CF54 (WH/VT) FOR AN OPEN

1

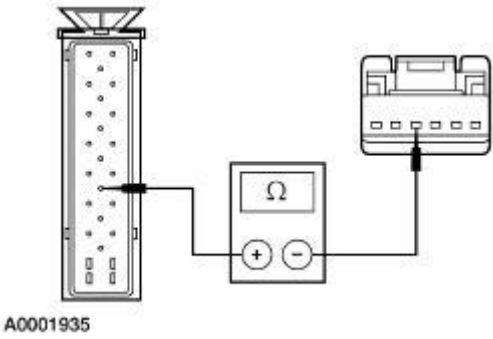


2



Anti-Lock Brake Control Module C135

3



A0001935


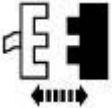
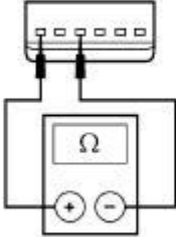
3 Measure the resistance between anti-lock brake control module C135 pin 14, circuit 8-CF54 (WH/VT), harness side and traction control switch C308 pin 4, circuit 8-CF54 (WH/VT), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
 INSTALL a new anti-lock brake control module; REFER to Module—Anti-Lock Brake Control. TEST the system for normal operation.

→ **No**
 REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST J: THE TRACTION CONTROL SWITCH INDICATOR IS NEVER/ALWAYS ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 CHECK THE TRACTION CONTROL SWITCH	
<p>1</p>  <p>2</p>  <p>Traction Control Switch C308</p> <p>3</p>  <p>A0002337</p>	<p>3 Measure the resistance between traction control switch pin 1 and pin 3 (component side).</p> <ul style="list-style-type: none"> ● Is the resistance approximately 32

ohms?

→ **Yes**

GO to J2.

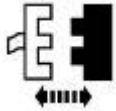
→ **No**

INSTALL a new traction control switch;
REFER to Switch—Traction Control.

TEST the system for normal operation.

J2 CHECK CIRCUIT 31S-CF45 (BK/GN) FOR SHORT TO POWER

1

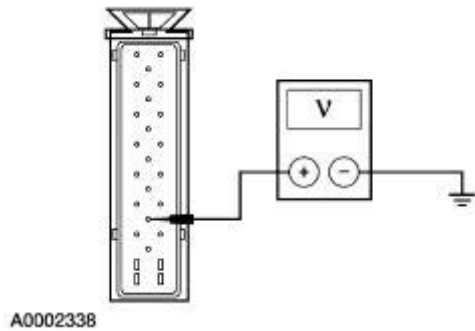


Anti-Lock Brake Control Module 135

2



3



3

Measure the voltage between anti-lock brake control module C135 pin 15, circuit 31S-CF45 (BK/GN), harness side and ground.

● **Is any voltage present?**

→ **Yes**

REPAIR the circuit. TEST the system for normal operation.

→ **No**

GO to J3.

J3 CHECK CIRCUIT 31S-CF45 (BK/GN)

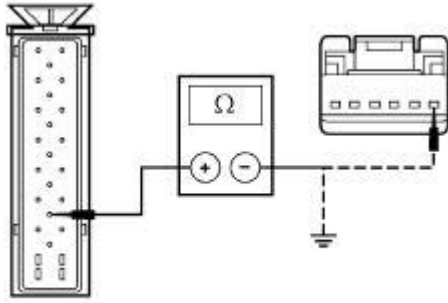
1



2

2

Measure the resistance between anti-lock brake control module C135 pin 15, circuit 31S-CF45 (BK/GN), harness side and traction control switch C308 pin 1, circuit 31S-CF45 (BK/GN), harness side; and between anti-lock brake control module C135 pin 15, circuit 31S-CF45 (BK/GN), harness side and ground.



A0002339

- Is the resistance less than 5 ohms between the anti-lock brake control module and traction control switch; and greater than 10,000 ohms between anti-lock brake control module and ground?

→ **Yes**


INSTALL a new anti-lock brake control module; REFER to Module—Anti-Lock Brake Control. TEST the system for normal operation.

→ **No**

REPAIR the circuit. TEST the system for normal operation.

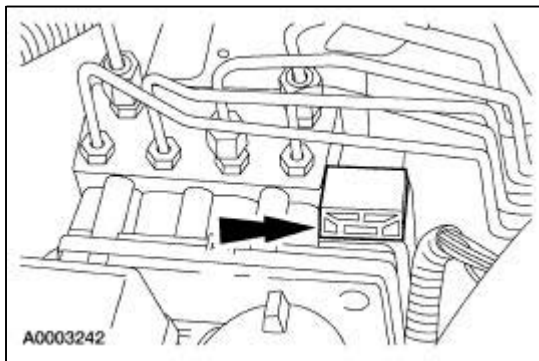
Hydraulic Control Unit —(HCU)

Removal

 **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

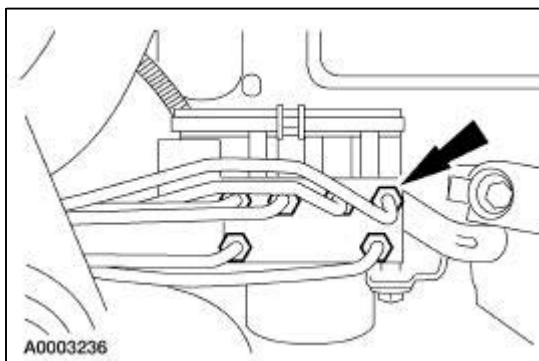
 **CAUTION:** Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the electrical connector by lifting up on the release tab.

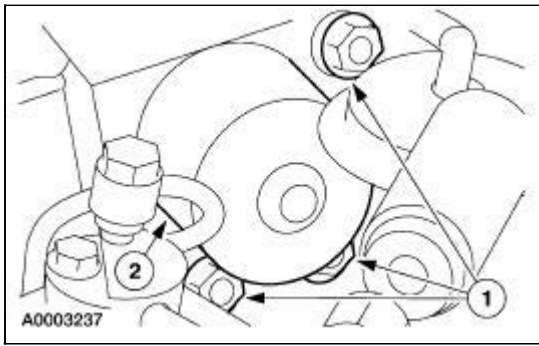


3. **NOTE:** Plug each open port to prevent any brake fluid from spilling.


Disconnect the brake lines from the hydraulic control unit (HCU).





4. Remove the HCU.
 1. Remove the bolts.
 2. Remove the HCU.



Installation

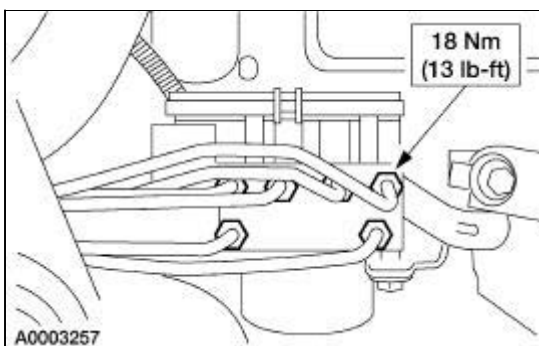
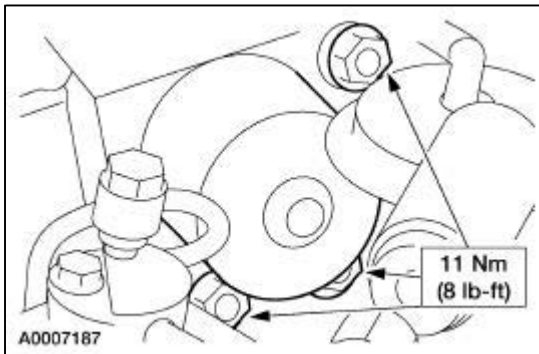
1.  **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

 **CAUTION:** Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

 **CAUTION:** After the HCU is installed, it is necessary to bleed the hydraulic brake system. For additional information, refer to [Section 206-00](#).

NOTE: When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 mi) or more to relearn the strategy.

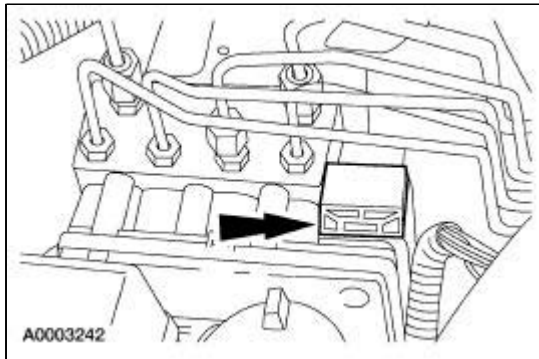
To install, reverse the removal procedure.



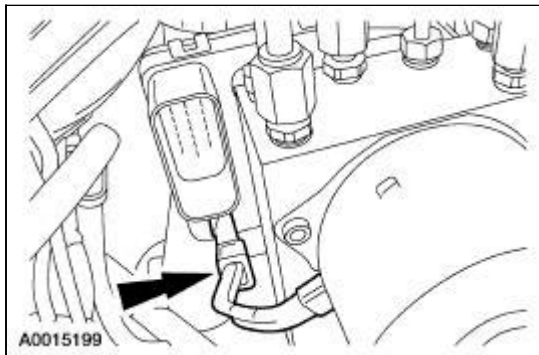
Module —Anti-Lock Brake Control

Removal

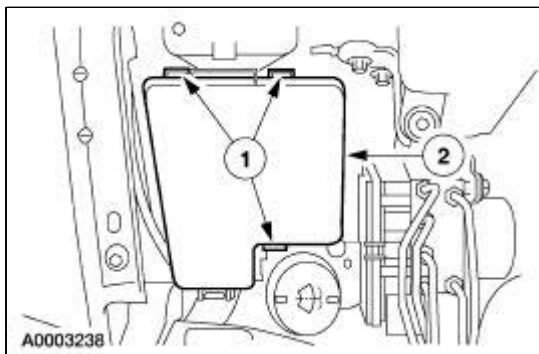
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the anti-lock brake control module electrical connector.



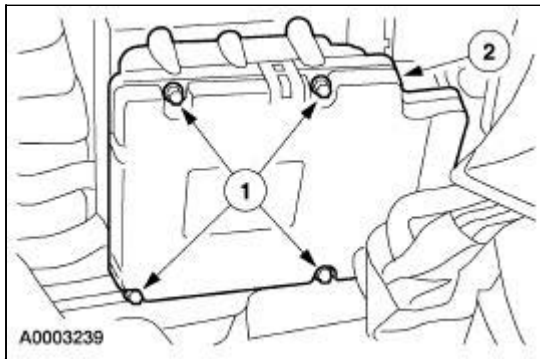
3. Disconnect the anti-lock brake pump motor electrical connector.




4. Position the underhood auxiliary junction box (AJB) aside.
 1. Release the underhood AJB clips.
 2. Position the underhood AJB aside.



5. Remove the anti-lock brake control module.
 1. Remove the bolts.
 2. Remove the control module.

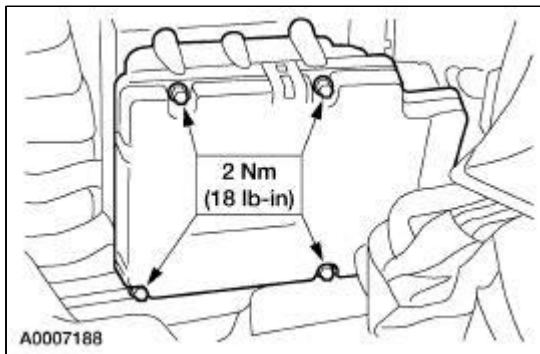


Installation

1.  **CAUTION:** Once the new module is installed, it is necessary to download the module configuration information from the New Generation STAR (NGS) Tester into the module. For additional information, refer to [Section 418-01](#).

NOTE: When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 mi) or more to relearn the strategy.

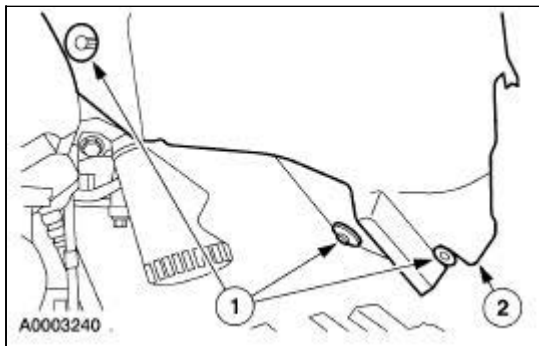
To install, reverse the removal procedure.



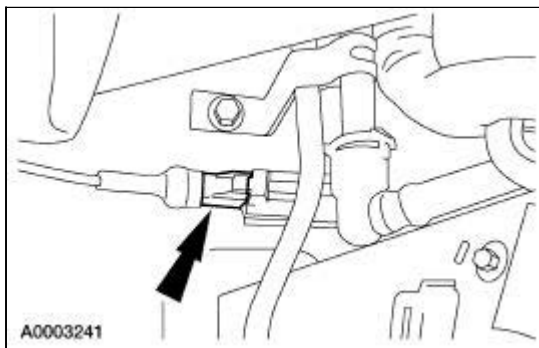
Sensor —Front

Removal and Installation

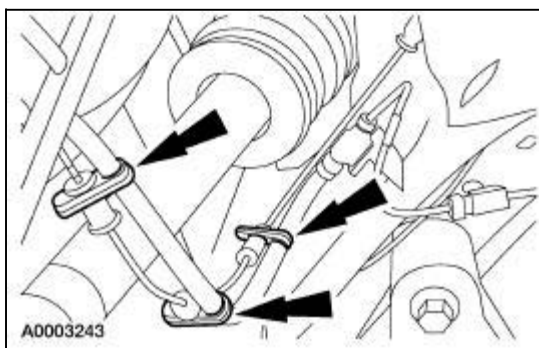
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Position the inner splash shield aside.
 1. Remove the pin-type retainers.
 2. Position the inner splash shield aside.



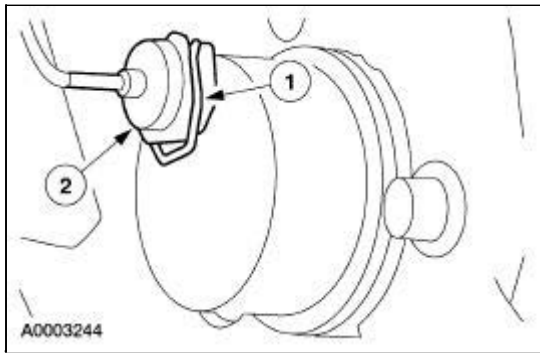
3. Disconnect the anti-lock brake sensor electrical connector.



4. Remove the anti-lock brake sensor harness from the brake hose clips.



5. Remove the anti-lock brake sensor.
 1. Remove the anti-lock brake sensor clip.
 2. Remove the anti-lock brake sensor.



6. **NOTE:** Make sure the anti-lock brake sensor is fully seated before installation of the new clip.

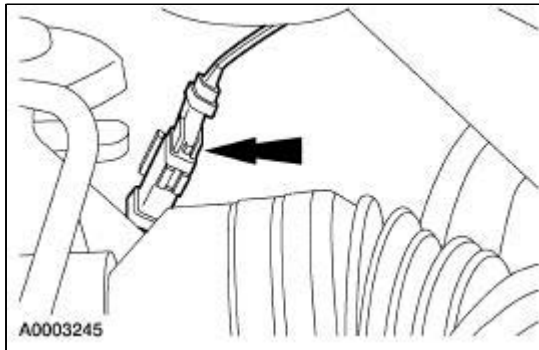
To install, reverse the removal procedure.

- Apply a 2.5 mm (0.1 in) bead of RTV Silicone Sealant F5TZ-19G204-AB meeting Ford specification NAVSTR Sealer to the outside diameter of the anti-lock brake sensor.
-

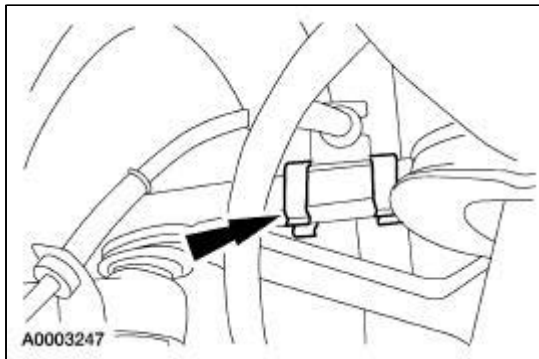
Sensor —Rear

Removal

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Disconnect the rear anti-lock brake sensor electrical connector.



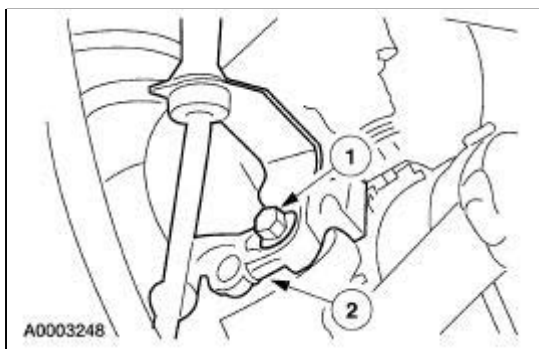
3. Remove the rear anti-lock brake sensor harness from the control arm clips.



4. **NOTE:** Clean off dirt and foreign material that may have collected around the rear anti-lock brake sensor before removal.

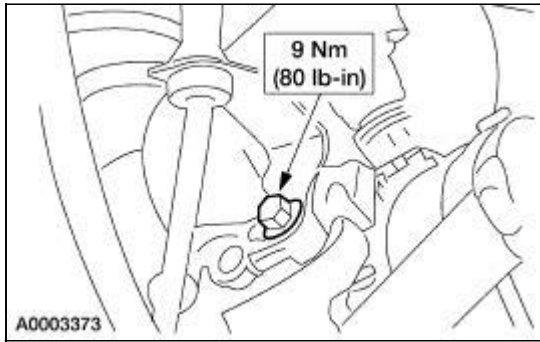
Remove the rear anti-lock brake sensor.

1. Remove the anti-lock brake sensor bolt.
2. Remove the anti-lock brake sensor.



Installation

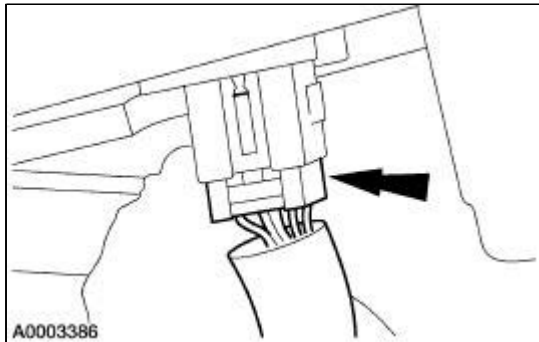
1. To install, reverse the removal procedure.



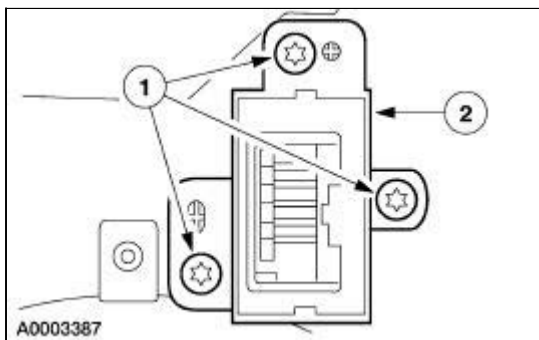
Switch —Traction Control

Removal

1. Remove the console panel assembly. For additional information, refer to [Section 501-12](#).
2. Remove the traction control switch electrical connector.



3. Remove the traction control switch.
 1. Remove the traction control switch screws.
 2. Remove the traction control switch.



Installation

1. To install, reverse the removal procedure.

SPECIFICATIONS

Torque Specifications

Description	Nm	lb-ft	lb-in
Stability assist module bolts	2	—	18
Brake line to (HCU) nuts	18	13	—
Electronic hydraulic control unit bolts	11	8	—
Rear anti-lock brake sensor bolt	9	—	80
Accelerometer bolts	9	—	80
Yaw rate sensor bolts	9	—	80

DESCRIPTION AND OPERATION

Anti-Lock Control — Traction Control and Stability Assist

The four wheel anti-lock brake system (4WABS) with traction control and stability assist system consists of the following components:

- active brake booster with integral solenoid
- brake booster release switch
- front anti-lock brake sensors
- front anti-lock brake sensor indicators
- hydraulic control unit (HCU)
- stability assist event indicator
- stability assist module
- lateral accelerometer
- rear anti-lock brake sensors
- rear anti-lock brake sensor indicators
- steering wheel position sensor
- two brake pressure transducers
- Advance Trac control switch
- yaw rate sensor
- yellow anti-lock brake warning indicator

For removal and installation of the brake booster release switch, refer to [Section 206-07](#).

For removal and installation of the front anti-lock brake sensor indicators, refer to [Section 204-01](#).



For removal and installation of the rear anti-lock brake sensor indicator, refer to [Section 205-05](#).

For removal and installation of the steering wheel position sensor, refer to [Section 211-04](#).

Anti-Lock Control — Traction Control and Stability Assist

Refer to Wiring Diagrams Section [206-09C](#) for schematic and connector information.

Special Tool(s)

 ST1217-A	New Generation STAR (NGS) Tester 418-F048 (007-00500) or equivalent
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

The stability assist module executes control of the anti-lock brakes, full speed traction control and stability assist functions to enhance the drivers control of the vehicle. The stability assist manages the interactions between the anti-lock, traction control, and engine control systems to optimize the vehicle traction during deceleration and acceleration. In addition, stability assist function modulates brake pressure during braking and nonbraking conditions as required to counteract excessive vehicle rotation while cornering.

The stability assist module is operational with the ignition switch in the RUN or START positions.

The stability assist module continuously monitors and compares the rotational speed of each wheel. The wheel speeds are measured by the anti-lock brake sensors which electrically sense each tooth of the anti-lock sensor indicator as they pass through the sensors magnetic field. When stability assist detects an impending wheel lock, wheel spin or vehicle motion that is inconsistent with the drivers commands, it modulates brake pressure to the appropriate brake caliper(s). This is accomplished by triggering the hydraulic control unit (HCU) to open and close the appropriate solenoid valves. Once the affected wheel returns to the desired speed, the stability assist module returns the solenoid valves to their normal position, and normal base brake operation resumes.

The stability assist module is self-monitoring. When the ignition switch is turned to the RUN position, the stability assist module will do a preliminary electrical check, and at approximately 20 km/h (12 mph) the pump motor is turned on for approximately one half-second. Any malfunction of the anti-lock brake control system will cause the ABS/TC/Stability Assist to shut off and anti-lock brake warning indicator to illuminate, however the power assist braking system will function normally.

The stability assist module communicates with the powertrain control module (PCM) to assist with traction control. At speeds under 40 km/h (25 mph) the stability assist module requests the PCM to reduce engine torque, while simultaneously applying and releasing the appropriate brake to restore traction when one or both drive wheels lose traction and begin to spin. The PCM accomplishes this by minor incremental timing changes and fewer fuel injector pulses until the stability assist module ends the request (when the driven wheel speed returns to normal). After the vehicle speed exceeds 40 km/h

(25 mph), the traction control is accomplished only through the PCM torque control.

An all new stability assist system helps maintain vehicle stability at the limits of tire adhesion. System effectiveness varies with vehicle speed, road conditions, and steering inputs.

The stability assist system constantly monitors vehicle motion relative to the driver's intended course. This is done by using added sensors to compare the steering inputs from the driver with the actual motion of the vehicle.

The driver's steering input is measured from a steering wheel rotation sensor. The motion of the vehicle is determined from a yaw rate sensor (measures rotation about the vehicle's vertical axis, caused by steering left/right), a lateral accelerometer (measures the acceleration generated from the vehicle sliding sideways), and the wheel speeds used for anti-lock brake system (ABS) and traction control function. When there is a discrepancy between the driver's inputs and the vehicle motion, the stability assist changes the force at each tire to help control the vehicle. If the vehicle is beginning to rotate excessively left or right, spin out, or slide sideways, the system will attempt to correct the excessive motion. If the vehicle is not responding to steering inputs, the system will attempt to increase the turning response of the vehicle.

The stability assist system defaults to ON when the engine is started. The system does not activate when the vehicle is traveling in reverse. In reverse, ABS and traction control will continue to function as usual. The system uses ABS and traction control (including control of the engine) as well as its more advanced controls to enhance vehicle stability. The stability assist/traction control switch (ATS) allows the driver to control use of the stability assist system. This is independent of the ABS function, which cannot be switched off by the driver. The stability assist system status is indicated by a stability assist warning light in the stability assist/traction control switch. The illuminated stability assist/traction control switch indicates stability assist system is switched off. In vehicles with a message center, the message "ADVANCETRAC OFF" is displayed.

During a stability assist event you may experience any of the following behaviors, which are normal:

- a rumble or grinding sound much like ABS or traction control
- a small deceleration or a reduction in the acceleration of the vehicle
- the stability assist indicator will flash
- if your foot is on the brake pedal, you will feel a vibration in the pedal much like ABS. As with any vehicle equipped with four-wheel anti-lock brakes, do not pump the brakes, but instead, press firmly on the pedal.
- if the event is severe and your foot is not on the brake, the brake pedal will move to apply higher brake forces. A whoosh sound may also be heard from under the instrument panel in an event this severe. All of these behaviors are normal during a stability assist event.

The stability assist system continually monitors and checks all of the sensors and actuators used to improve the stability of the vehicle. Some drivers may notice a slight movement of the brake pedal when the system checks itself. If the brake system has not been bled correctly, the brake pedal movement may become more significant. The brake pedal moves when an active test of the brake booster is run. During this test a small amount of pressure will be generated at the master cylinder, but no pressure will be generated in the calipers. This test will occur above 48 km/h (30 mph) after the vehicle has been running approximately 8 minutes. The test will only be run if the vehicle is stable, the driver is not braking and the accelerator pedal is depressed at least a small amount. If a failure is detected somewhere in the stability assist system which affects either the yaw control or traction control functions, the stability assist indicator will be illuminated. The anti-lock brake function will continue to work as designed unless the yellow anti-lock brake warning indicator is also illuminated. The normal brake function will always occur, unless the red brake warning indicator is illuminated.

Yaw Rate Sensor

The yaw rate sensor measures the rotation rate of the vehicle as it turns left and right.

Lateral Accelerometer

The lateral accelerometer measures the acceleration which corresponds to the force required to slide the vehicle sideways. This acceleration comes in two forms. The first is the centrifugal acceleration which is generated when an object travels around in a circle. The second is the acceleration due to gravity. The accelerometer only measures the acceleration along the lateral (or sideways) direction of the vehicle, so on level ground there is no contribution from this acceleration. However, if the vehicle is parked sideways on a bank or incline, the sensor will measure some lateral acceleration due to gravity even though the vehicle is stationary.

Steering Wheel Rotation Sensor

The steering wheel rotation sensor scans the steering wheel rotation sensor ring in the steering column which has holes punched in it at regular intervals. The steering wheel rotation sensor uses two signal lines to tell the stability assist module whether the steering wheel is being turned left or right and how far it is being turned. The steering wheel rotation sensor does not tell the stability assist module the position of the steering wheel relative to straight ahead. The stability assist system learns this by comparing the steering wheel position with other signals and remembering the position it has learned. The stability assist system confirms this position and modifies it as necessary during every new driving cycle of the vehicle.

Brake Booster

The brake booster is a normal brake booster which has the added function that it can be actuated electrically by the stability assist module. This is sometimes necessary in severe stability assist events, to make sure that the hydraulic control unit can generate enough brake pressure to improve vehicle stability. The help from the brake booster is especially needed in cold weather when the hydraulic control unit cannot draw the brake fluid from the reservoir when it becomes very thick and viscous at cold temperatures. Within the booster is a solenoid for electrical actuation and a release switch to indicate when the driver is stepping on the brake. The solenoid provides electrical actuation of the brake booster. Without the force of the input rod, the air valve is directly opened due to the movement of the energized solenoid. With increasing current applied to the solenoid, the air valve opens and output force is created. With decreasing current applied to the solenoid, the air valve is closed and the vacuum valve opens reducing output force.

The release switch indicates when the brake pedal has been depressed. It is integrated into the booster key that normally sits against the rear shell of the boot in its rest position and it adjoins the valve body when in its balance position. The switch itself provides indication from two positions. In its rest position, it supplies two signals, normally open (NO) and normally closed (NC). Upon application of sufficient force to initiate movement of the key away from the valve body, the brake booster switch changes state, signifying a driver application. When the stability assist module is activating the brake booster, the brake pedal is pulled forward as the valve body moves. The release switch is held in position by the input rod spring and remains against the valve body. Although the brake pedal position (BPP) switch changes state when the brake pedal drops, the release switch remains inactive until such time as it encounters an external force from the driver, whether in a stability assist event controlled by the stability assist module, or in a standard mechanical braking event.

The master cylinder attached to the booster functions the same as on vehicles not equipped with the stability assist system. It differs in that there are two pressure transducers that are installed in spare outlet ports. The values measured by each pressure transducer should be similar. The pressure transducer is a diaphragm type unit. When a pressure is seen the diaphragm is stretched, causing a voltage to be output. As the pressure increases or decreases, the voltage also increases or decreases with it. The configuration of the pressure transducers, which transducer is connected to the primary port and which is connected to the secondary port, is not known by the stability assist module. The harness connectors can be connected to either transducer, therefore, diagnosis of pressure faults requires some care to identify exactly which transducer is failed.

Modules which are normally connected to the BPP switch are connected to a signal from the stability

assist module. This signal is called driver brake application. This signal only changes state when the driver has applied the brake. If the ignition switch is in the RUN position, the brake booster is not electrically actuated, and no failure has been detected, the driver brake application signal will indicate a brake applied when either the BPP switch or the release switch built into the brake booster indicate that the driver has applied the brake pedal. If the ignition switch is in the OFF position, the driver brake application signal will indicate a brake apply only when the BPP switch indicates that the driver is applying the brake pedal. When the ignition switch is in the OFF position, failures cannot be detected. If there are failures, several layers of redundancy will try to keep the driver brake application signal accurate. If the stability assist system detects faults on the driver brake application signal line it will also attempt to maintain correct stoplamp operation by communicating on the standard corporate protocol (SCP) network. Control of the stoplamp operation is also required because the BPP switch can change states during a stability assist event when the driver is not applying the brake pedal. The switch can also change states during the system check of the brake booster. Only the stability assist system can interpret these state changes and determine which ones are actually due to the driver applying the brake. Similarly, the stability assist system can take advantage of its other sensors to detect failures in the BPP switch.

DTC C1963

This Diagnostic Trouble Code (DTC) is stored if the stability assist warning indicator has been turned ON because the system could not confirm the straight ahead position for more than 30 seconds above 18 km/h (11 mph). This condition will most likely occur if there is some other DTC. If there is another DTC logged with this DTC, the repair procedure is to follow the procedure for the other DTC. This DTC can be stored if:

- PRNDL or Reverse switch has failed (check operation of PRNDL display and back-up lights)
- Chassis modifications have been made that were not authorized by Ford.

In very rare circumstances this DTC may be stored by itself without the occurrence of any actual component failure. Two conditions can cause the DTC C1963 to set with no other DTC:

- The steering wheel has been turned while the ignition is off and then the vehicle is started, and either the vehicle is driven continuously in a circle or the vehicle is driven with continuous swerving, sliding or tire spinning.
- A new stability assist module may have been installed in the vehicle and was not calibrated.

Stability Assist Module Calibration

The stability assist module needs to be recalibrated whenever a component specific to the stability assist system is disconnected, moved, or a new component is installed; for additional information regarding the DTCs that require the recalibration procedure, refer to the stability assist Calibration List. If a DTC is logged for any component of the stability assist system, the DTC must be cleared before carrying out the recalibration procedure. The need to re-calibrate the stability assist module is also indicated by the active/fail lamp flashing. The lamp will flash after the clearing of DTC's that are indicated on the stability assist calibration list. If a DTC is retrieved after recalibration; refer to the Stability Assist Module Diagnostic Trouble Code (DTC) Index. If installing a new stability assist module, the calibration procedures as well as the configuration procedure must be carried out. For additional information regarding the module configuration procedure, refer to [Section 418-01](#).

When carrying out the lateral accelerometer or yaw rate calibration on the NGS Tester, the vehicle must be on a level surface, not moving, with ignition switch in the RUN position. When carrying out the booster learn cycle on the NGS Tester, the ignition switch must be in the RUN position with the engine running and the brake pedal must not be applied. When carrying out the steering wheel rotation sensor calibration on the NGS Tester, the ignition switch must be in the RUN position with the engine running and the steering wheel must be rotated back and forth from lock position to lock position.

Inspection and Verification

NOTE: The stability assist module must be reconfigured upon replacement; refer to [Section 418-01](#).

1. Verify the customer's concern by operating the vehicle to duplicate the condition.
2. Verify the stoplamps operate correctly by depressing and releasing the brake pedal with the ignition switch in the OFF position. If the stoplamps do not operate correctly, refer to [Section 417-01](#). If the stoplamps operate correctly, proceed to the next step.
3. Verify the PRNDL operates correctly on the instrument cluster. If the PRNDL does not operate correctly, refer to [Section 413-01](#). If the PRNDL operates correctly, proceed to the next step.
4. Inspect to determine if one of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Anti-lock brake sensor indicator. ● HCU. ● Incorrectly inflated tires. ● Mismatched wheels or tires on vehicle. ● Base brake concern. ● Brake booster vacuum hose. ● Ford specified steering components, suspension components and tire size. ● Steering wheel rotation ring. 	<ul style="list-style-type: none"> ● Underhood auxiliary junction box (AJB) Fuse: <ul style="list-style-type: none"> ■ 114 (30A) ■ 122 (30A) ● Battery junction box (BJB) Fuse: <ul style="list-style-type: none"> ■ 405 (10A) ● Central junction box (CJB) Fuse: <ul style="list-style-type: none"> ■ 203 (5A) ■ 205 (5A) ■ 235 (5A) ● Stability assist module. ● EVAC and fill connector. ● Anti-lock brake sensor. ● Stability assist/traction control switch. ● BPP switch. ● Steering wheel rotation sensor. ● Brake booster solenoid. ● Brake booster release switch. ● Primary/main pressure transducer. ● Secondary/redundant pressure transducer. ● Yaw rate sensor. ● Lateral accelerometer. ● Wiring harness. ● Connectors or connections. ● Circuitry.

5. If the concern remains after the inspection, connect the NGS Tester to the data link connector (DLC) located beneath the instrument panel, and select the vehicle to be tested from the NGS Tester menu. If the NGS Tester does not communicate with the vehicle:
 - Check that the program card is correctly installed.
 - Check the connection of the data link connector to the vehicle.
 - Check that the ignition switch is in the RUN position.
6. If the NGS Tester still does not communicate with the vehicle, refer to the New Generation STAR Tester manual.

7. Carry out the DATA LINK DIAGNOSTIC TEST. If NGS Tester responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for stability assist module, go to Pinpoint Test A.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the stability assist module.
8. If the DTCs retrieved are related to the concern, go to Stability Assist Module Diagnostic Trouble Code (DTC) Index to continue diagnostics.
9. If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue diagnostics.

Stability Assist Module Diagnostic Trouble Code (DTC) Index

NOTE: The need to re-calibrate the stability assist module is indicated by the active/fail lamp flashing. There are other service actions that may require re-calibration where there is no flashing lamp. Refer to the section Stability Assist Module Calibration. The lamp will flash after the clearing of DTC's that are indicated on the stability assist calibration list.

NOTE: Stability assist may be referred to as interactive vehicle dynamics (IVD) in the NGS Tester.

Stability Assist Module Diagnostic Trouble Code (DTC) Index

NOTE: DTC C1730 (Reference Voltage Out Of Range) must be repaired before DTC C1279, C1280, C1281, C1282, C1288, C1289.

DTC	Description	Source	Action
B1255	Air Temperature External Sensor Circuit Open	DATC	REFER to Section 412-00 .
B1257	Air Temperature External Sensor Circuit Short to Ground	DATC	REFER to Section 412-00 .
B1342	ECU Is Defective	Stability Assist	CLEAR the DTCs. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist . REPEAT the self-test.
B1485	Brake Pedal Input Circuit Battery Short	Stability Assist	GO to Pinpoint Test B .
B1676	Battery Pack Voltage Out of Range	Stability Assist	GO to Pinpoint Test C .
B2477	Module Configuration Failure	Stability Assist	REFER to Section 418-01 .
C1095	ABS Hydraulic Pump Motor Circuit Failure	Stability Assist	GO to Pinpoint Test D .
C1145	Speed Wheel Sensor RF Input Circuit Failure	Stability Assist	GO to Pinpoint Test E .
C1155	Speed Wheel Sensor LF Input Circuit Failure	Stability Assist	GO to Pinpoint Test E .

C1165	Speed Wheel Sensor RR Input Circuit Failure	Stability Assist	GO to Pinpoint Test E .
C1175	Speed Wheel Sensor LR Input Circuit Failure	Stability Assist	GO to Pinpoint Test E .
C1233	Speed Wheel LF Input Signal Missing	Stability Assist	GO to Pinpoint Test F .
C1234	Speed Wheel RF Input Signal Missing	Stability Assist	GO to Pinpoint Test F .
C1235	Speed Wheel RR Input Signal Missing	Stability Assist	GO to Pinpoint Test F .
C1236	Speed Wheel LR Input Signal Missing	Stability Assist	GO to Pinpoint Test F .
C1277	Steering Wheel Angle 1 and 2 Circuit Failure	Stability Assist	GO to Pinpoint Test G .
C1278	Steering Wheel Angle 1 and 2 Signal Faulted	Stability Assist	GO to Pinpoint Test G .
C1279	Yaw Rate Sensor Circuit Failure	Stability Assist	GO to Pinpoint Test H .
C1280	Yaw Rate Sensor Signal Fault	Stability Assist	GO to Pinpoint Test H .
C1281	Lateral Accelerometer Circuit Failure	Stability Assist	GO to Pinpoint Test I .
C1282	Lateral Accelerometer Signal Fault	Stability Assist	GO to Pinpoint Test I .
C1285	Booster Solenoid Circuit Failure	Stability Assist	GO to Pinpoint Test J .
C1286	Booster Mechanical Failure	Stability Assist	GO to Pinpoint Test K .
C1287	Booster Pedal Force Switch Circuit Failure	Stability Assist	GO to Pinpoint Test L .
C1288	Pressure Transducer Main/Primary Input Circuit Failure	Stability Assist	GO to Pinpoint Test M .
C1289	Pressure Transducer Redundant/Secondary Input Circuit Failure	Stability Assist	GO to Pinpoint Test N .
C1730	Reference Voltage Out of Range (+5 V)	Stability Assist	GO to Pinpoint Test O .
C1805	Mismatched PCM and/or stability assist module	Stability Assist	Check for correct component and configuration for the PCM and stability assist module, INSTALL a new as necessary. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist or Section 303-14 as necessary. CLEAR the DTC. REPEAT the self-test.
C1960	Driver Brake Apply Circuit Fault	Stability Assist	GO to Pinpoint Test P .
C1963	Stability Control Inhibit Warning	Stability Assist	This DTC is for information only; GO to the Principles of Operation. CLEAR the DTC. REPEAT the self-test.
C1969	TC/YC Switch Lamp Circuit Fault	Stability Assist	GO to Pinpoint Test S .

P0112	IAT Circuit Low Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0117	ECT Circuit Low Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0118	ECT Circuit High Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0122	TP Sensor A Circuit Low Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0123	TP Sensor A Circuit High Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0500	Vehicle Speed Sensor Malfunction	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0501	Vehicle Speed Sensor Range/Performance	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0502	Vehicle Speed Sensor Low Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0503	Vehicle Speed Sensor Intermittent	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0707	Transmission Range Sensor Circuit Low Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0708	Transmission Range Sensor Circuit High Input	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1120	TP Sensor Out Of Range Low (Ratch Too Low)	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1183	Engine Oil Temperature Circuit Malfunction	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1184	Engine Oil Temperature Out of Self-Test Range	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1009	SCP (J1850) Invalid or Missing Data for Engine Torque	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1243	SCP (J1850) Invalid or Missing Data for Exterior Environment	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1262	SCP (J1850) Communication Bus Fault	Network Fault	REFER to Section 418-00 .

Stability Assist Module Parameter Identification (PID) Index

Stability Assist Module Parameter Identification (PID) Index

PID	Description	Expected Value
ABSLF_I	Left Front ABS Inlet Valve	Off---, On---
ABSLF_O	Left Front ABS Outlet Valve	Off---, On---

ABSLR_I	Rear or Left Rear ABS Inlet Valve	Off---, On---
ABSLR_O	Left Rear ABS Outlet Valve	Off---, On---
ABSRF_I	Right Front ABS Inlet Valve	Off---, On---
ABSRF_O	Right Front ABS Outlet Valve	Off---, On---
ABSRR_I	Right Rear ABS Inlet Valve	Off---, On---
ABSRR_O	Right Rear ABS Outlet Valve	Off---, On---
BLNMDSC	Booster Learn Cycle Successful	No, Yes
BMECFAL	Booster Mechanical Failure	No, Yes
BOO	Brake Switch Input	Off, On
BSABNCR	Booster Solenoid Abnormal Current	No, Yes
BSBOOFL	Booster Solenoid Brake Switch Failure	No, Yes
BSCIRFL	Booster Solenoid Circuit Failure	No, Yes
BSNCFL	Booster Solenoid Output Normally Closed Switch Failure (Brake Booster Pedal Force)	No, Yes
BSNOFL	Booster Solenoid Output Normally Open Switch Failure (Brake Booster Pedal Force)	No, Yes
BSTSOST	Booster Solenoid Output State	No, Yes
CCNT	Number of Continuous DTCs in Module	one count per bit
DUMP_PT	Booster Non-Volatile Memory Dump Rise Point	#####
FAILCNT	Booster Non-Volatile Memory Failure Count	#####
LAT_ACC	Lateral Acceleration Value	#####
LF_WSPD	Left Front Wheel Speed Sensor	one count per bit
LR_WSPD	Left Rear Wheel Speed Sensor	one count per bit
MPRETDR	Main Brake Pressure Transducer	#####
MPRTDRF	Main Brake Pressure Transducer Failure	No, Yes
PDFCENO	Brake Booster Pedal Force Switch Normally Open (State)	Closed, Open
PDFCENC	Brake Booster Pedal Force Switch Normally Closed (State)	Closed, Open
PRMLPRE	Low Pressure Feedback Primary State	ACTIVE, notACT
RF_WSPD	Right Front Wheel Speed Sensor	one count per bit
RISE_PT	Booster Non-Volatile Memory Rise Point	#####
RISECHG	Booster Non-Volatile Memory Change In Rise Point	#####
RPRETDR	Redundant Brake Pressure Transducer	#####
RR_WSPD	Right Rear Wheel Speed Sensor	one count per bit

SECLPRE	Low Pressure Feedback Secondary State	ACTIVE, notACT
SENVBAT	stability assist Sensor Supply Voltage	#####
SGOTSTA	Switch Test Signal Output State	No, Yes
SPRTDRF	Redundant Brake Pressure Transducer Failure	No, Yes
SWA_POS	Steering Wheel Angle	#####
SWA_CCW	CCW Steering Wheel Angle Position From Start	#####
SWA_CW	CW Steering Wheel Angle Position From Start	#####
SWA1	Steering Wheel Angle # 1	Off---, OffO--, Off-B-, Off--G, OffO-G, OffOB-, Off-BG, OffOBG, On---, OnO--, On-B-, On--G, OnO-G, OnOB-, On-BG, OnOBG
SWA2	Steering Wheel Angle # 2	Off---, OffO--, Off-B-, Off--G, OffO-G, OffOB-, Off-BG, OffOBG, On---, OnO--, On-B-, On--G, OnO-G, OnOB-, On-BG, OnOBG
TC_LVAL	Left T/A Control Valve Output Status	Off---, On---
TC_RVAL	Right T/A Control Valve Output Status	Off---, On---
TC/YC_SW	TC or TC/YC (Stability Assist) Switch, Push Button Input Status	Off, On
TC/YC_FNC	TC or TC/YC (Stability Assist) Function Status	Off, On
YAW_IN	Yaw Rate Sensor Input	Off---, Off-B-, Off--G, On---, On-B-, On--G
YAWRATE	Yaw Rate Value	#####
YAWOUT or LAT_IN	Lateral Accelerometer Input	Off---, Off-B-, Off--G, On---, On-B-, On--G

Stability Assist Module Active Command Index

Stability Assist Module Active Command Index

Active Command	Display	Action
ABS OUTPUT CONTROL	LF INLET	Off, On
	LF OUTLET	Off, On
	LR INLET	Off, On
	LR OUTLET	Off, On
	PMP MOTOR	Off, On
	R INLET (Low Pressure Feed Valve)	Off, On
	R OUTLET (Low Pressure Feed Valve)	Off, On
	RF INLET	Off, On
	RF OUTLET	Off, On
	RR INLET	Off, On
	RR OUTLET	Off, On

TRACTION CONTROL	LR TC VLV	Off, On
	RR TC VLV	Off, On
YAW OUTPUT CONTROL COMMAND	BOOST SOL	Off, On
	PRI LP VLV	Off, On
	SEC LP VLV	Off, On
	LAT INIT	Off, On
	YAW INIT	Off, On
	SW TST SG	Off, On

Stability Assist Calibration List

NOTE: The need to re-calibrate the stability assist module is indicated by the active/fail lamp flashing. Refer to the section Stability Assist Module Calibration for other service actions requiring re-calibration. The lamp will flash after the clearing of DTC's that are indicated on the stability assist calibration list.

Stability Assist Calibration List

DTC	Description	Stability Assist Calibration
C1277	Steering Wheel Angle 1 and 2 Circuit Failure	YES
C1278	Steering Wheel Angle 1 and 2 Signal Faulted	YES
C1279	Yaw Rate Sensor Circuit Failure	YES
C1280	Yaw Rate Sensor Signal Fault	YES
C1281	Lateral Accelerometer Circuit Failure	YES
C1282	Lateral Accelerometer Signal Fault	YES
C1283	Switch Test Signal Failure	YES
C1285	Booster Solenoid Circuit Failure	YES
C1286	Booster Mechanical Failure	YES
C1287	Booster Pedal Force Switch Circuit Failure	YES
C1288	Pressure Transducer Main / Primary Input Circuit Failure	YES
C1289	Pressure Transducer Redundant / Secondary Input Circuit Failure	YES
C1730	Reference Voltage Out of Range (+5 V)	YES
C1960	Driver Brake Apply Circuit Fault	NO
C1963	Stability Control Inhibit Warning	NO

Symptom Chart

NOTE: Refer to the wiring diagrams for connector numbers stated in the pinpoint tests.

Symptom Chart

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Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the stability assist module 	<ul style="list-style-type: none"> Underhood AJB Fuse 114 (30A) or 122 (30A). CJB Fuse 203 (5A). Circuitry. Stability assist module. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> The yellow ABS warning indicator does not self-check 	<ul style="list-style-type: none"> Circuitry. Stability assist module. 	<ul style="list-style-type: none"> GO to Pinpoint Test Q.
<ul style="list-style-type: none"> Spongy brake pedal with no warning indicator 	<ul style="list-style-type: none"> Air in brake hydraulic system. 	<ul style="list-style-type: none"> REFER to Section 206-00.
<ul style="list-style-type: none"> The traction control is inoperative 	<ul style="list-style-type: none"> Circuitry. Stability assist/traction control switch. Stability assist module. Base brake system. Thermal model. 	<ul style="list-style-type: none"> GO to Pinpoint Test R. REFER to Section 206-00. Wait for brakes to cool down, the thermal model will reset automatically.
<ul style="list-style-type: none"> The stability assist/traction control switch indicator is never/always on 	<ul style="list-style-type: none"> Circuitry. Stability assist/traction control switch. Stability assist module. 	<ul style="list-style-type: none"> GO to Pinpoint Test S.
<ul style="list-style-type: none"> The stability assist system cannot be disabled 	<ul style="list-style-type: none"> Circuitry. Traction control switch. Stability assist module. 	<ul style="list-style-type: none"> GO to Pinpoint Test T.
<ul style="list-style-type: none"> The stability assist indicator does not self-check 	<ul style="list-style-type: none"> Circuitry. Stability assist module. 	<ul style="list-style-type: none"> GO to Pinpoint Test U.

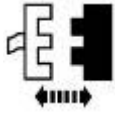
Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE STABILITY ASSIST MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK THE VOLTAGE TO THE STABILITY ASSIST MODULE	
1	



2

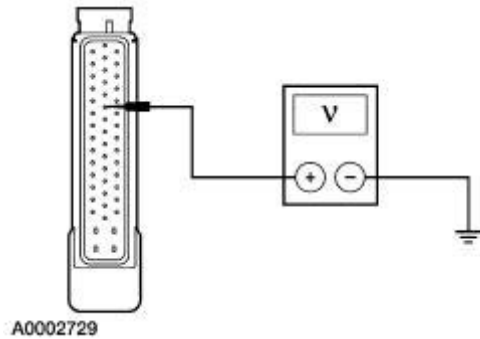


Stability Assist Module C155

3



4



4 Measure the voltage between stability assist module C155 pin 22, circuit 20-CF6A (PK/YE), harness side, and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to A2.

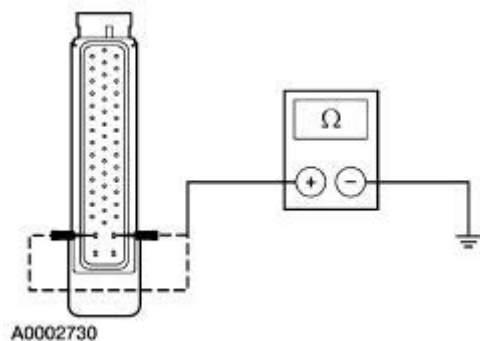
→ **No**
REPAIR circuit 20-CF6A (PK/YE) or circuit 20-CF6 (PK/YE). REPEAT the self-test.

A2 CHECK THE STABILITY ASSIST MODULE GROUNDS

1



2


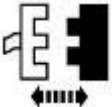
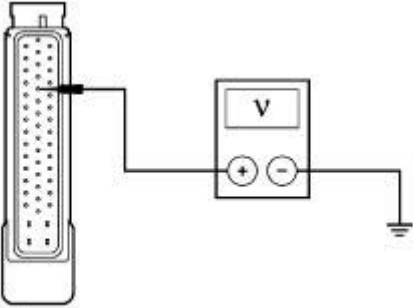


2 Measure the resistance between stability assist module C155 pin 15, circuit 31-CF6A (BK/YE), harness side, and ground; and between stability assist module C155 pin 32, circuit 31-CF6B (BK/YE), harness side, and ground.


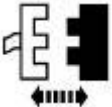

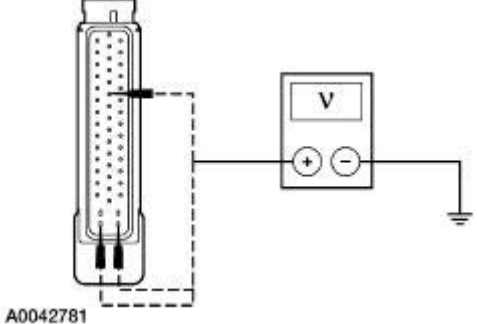
• Are the resistances less than 5

	<p>ohms?</p> <p>→ Yes Section 418-00.</p> <p>→ No REPAIR circuit 31-CF6B (BK/YE) or circuit 31-CF6A (BK/YE). REPEAT the self-test.</p>
--	---

PINPOINT TEST B: DTC B1485 — BRAKE PEDAL INPUT CIRCUIT BATTERY SHORT


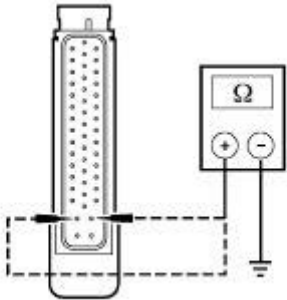
CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CIRCUIT 29S-CF1 (OG/YE) FOR AN OPEN	
<p>1 </p> <p>2  Stability Assist Module C155</p> <p>3  A0002731</p>	<p>3 Measure the voltage between stability assist module C155 pin 21, circuit 29S-CF1 (OG/YE), harness side, and ground, while depressing and releasing the brake pedal.</p> <ul style="list-style-type: none"> ● Is the voltage greater than 10 volts with the brake pedal depressed, and zero volts with the brake pedal released? <p>→ Yes INSTALL a new stability assist module. REFER to <u>Anti-Lock Brake System (ABS) Module—Stability Assist</u> . REPEAT the self-test.</p> <p>→ No REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST C: DTC B1676 — BATTERY PACK VOLTAGE OUT OF RANGE


CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE BATTERY VOLTAGE	
	<p>1 Measure the battery voltage between the positive and negative battery posts with the key ON engine OFF (KOEO), and with the engine running.</p> <ul style="list-style-type: none"> ● Is the battery voltage between 10 and 13 volts with KOEO, and between 11 and 17 volts with the engine running? <p>→ Yes GO to <u>C2</u>.</p> <p>→ No REFER to <u>Section 414-00</u>. TEST the system for normal operation.</p>
C2 CHECK VOLTAGE TO THE STABILITY ASSIST MODULE	
<p>1</p>  <p>2</p>  <p>Stability Assist Module C155</p> <p>3</p>  <p>4</p>  <p>A0042781</p>	<p>4 Measure the voltage between stability assist module C155 pin 16, circuit 30-CF6A (RD), C155 pin 22, circuit 20-CF6A (PK/YE), harness side and ground; and between stability assist module C155 pin 33, circuit 30-CF13 (RD), harness side and ground.</p> <ul style="list-style-type: none"> ● Are the voltages greater than 10 volts? <p>→ Yes</p>

	<p>GO to <u>C3</u>.</p> <p>→ No REPAIR circuit 20-CF6A (PK/YE) or circuit 30-CF13 (RD). CLEAR the DTCs. REPEAT the self-test.</p>
--	--

C3 CHECK CIRCUIT 31-CF6A (BK/YE) AND CIRCUIT 31-CF6B (BK/YE)

<p>1</p>  <p>2</p>  <p>A0043709</p>	<p>2</p> <p>Measure the resistance between the stability assist module C155 pin 15, circuit 31-CF6A (BK/YE), harness side and ground; and between C155 pin 32, circuit 31-CF6B (BK/YE), harness side and ground.</p> <ul style="list-style-type: none"> • Are the resistances less than 5 ohms? <p>→ Yes INSTALL a new stability assist module. REFER to <u>Anti-Lock Brake System (ABS) Module—Stability Assist</u> in this section. REPEAT the self-test.</p> <p>→ No REPAIR circuit 31-CF6A (BK/YE) or circuit 31-CF6B (BK/YE). REPEAT the self-test.</p>
---	---

PINPOINT TEST D: DTC C1095 — ABS HYDRAULIC PUMP MOTOR CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK ABS PUMP MOTOR	
<p>1</p> 	<ul style="list-style-type: none"> • Is the ABS pump motor running all the time? <p>→ Yes</p>

INSTALL a new stability assist module. REFER to [Anti-Lock Brake System \(ABS\) Module—Stability Assist](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to [D2](#).

D2 CHECK PUMP MOTOR OPERATION

1



2 Trigger the stability assist module active command PMP MOTOR ON.

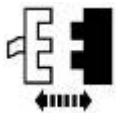
- Does the ABS pump motor run for approximately three seconds?

→ **Yes**
CLEAR the DTC. CHECK the yellow ABS warning indicator while driving the vehicle (brakes must not be applied) above 32 km/h (20 mph). If the yellow ABS warning indicator illuminates, RETRIEVE the DTCs. If DTC C1095 is retrieved, INSTALL a new HCU. REFER to [Hydraulic Control Unit \(HCU\)](#). CLEAR the DTCs. REPEAT the self-test. If the yellow ABS warning indicator does not illuminate, system is OK.

→ **No**
TRIGGER the stability assist module active command PMP MOTOR OFF. GO to [D3](#).

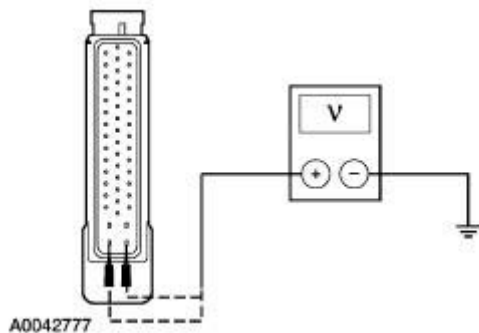
D3 CHECK CIRCUIT 30-CF13 (RD) FOR AN OPEN

1



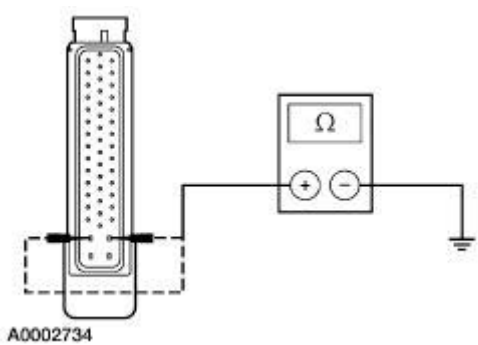
Stability Assist Module C155

2


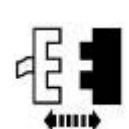


2 Measure the voltage between stability assist module C155 pin 33, circuit 30-CF13 (RD) and C155 pin 16, circuit 30-CF6A (RD), harness side, and ground.

- Is the voltage greater than 10 volts?

	<p>→ Yes GO to <u>D4</u>.</p> <p>→ No REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.</p>
<p>D4 CHECK CIRCUIT 31-CF6A (BK/YE) AND 31-CF6B (BK/YE) FOR AN OPEN</p>	
<p>1</p>  <p>A0002734</p>	<p>1 Measure the resistance between stability assist module C155 pin 15, circuit 31-CF6A (BK/YE), harness side, and ground; and between stability assist module C155 pin 32, circuit 31-CF6B (BK/YE), harness side, and ground.</p> <p>• Are the resistances less than 5 ohms?</p> <p>→ Yes INSTALL a new HCU. REFER to <u>Hydraulic Control Unit (HCU)</u>. REPEAT the self-test.</p> <p>→ No REPAIR circuit 31-CF6B (BK/YE) or circuit 31-CF6A (BK/YE). CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST E: DTC C1145 (RF), DTC C1155 (LF), DTC C1165 (RR), DTC C1175 (LR) — ANTI-LOCK BRAKE SENSOR INPUT CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Any time an anti-lock brake sensor is removed, thoroughly clean the mounting surfaces and apply High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A or equivalent meeting Ford specification ESA-M1C198-A.</p>	
<p>E1 CHECK FOR SHORT TO POWER</p>	
<p>NOTE: Both circuits must be checked for each DTC.</p>	
<p>1</p>  <p>2</p> 	

Stability Assist Module C155

3

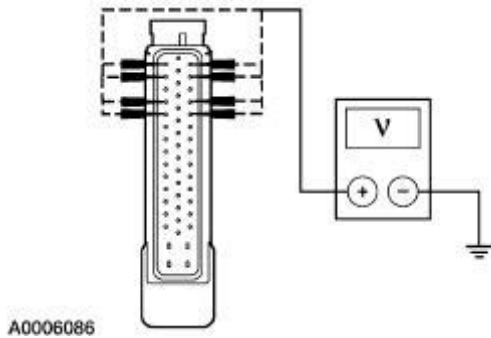


Suspect Anti-lock Brake Sensor

4



5



A0006086

5

Measure the voltage between stability assist module C155 pin, harness side, and ground, as follows:

DTC	Stability Assist Module C155	Circuit
C1145 (RF)	Pin 35	7-CF38 (YE/RD)
C1145 (RF)	Pin 34	8-CF38 (WH/RD)
C1155 (LF)	Pin 1	7-CF32 (YE)
C1155 (LF)	Pin 2	8-CF32 (WH)
C1165 (RR)	Pin 38	7-CF40 (YE/GN)
C1165 (RR)	Pin 37	8-CF40 (WH/GN)
C1175 (LR)	Pin 5	7-CF34 (YE/BU)
C1175 (LR)	Pin 4	8-CF34 (WH/BU)

● Is voltage present?

→ Yes

If DTC C1145, REPAIR circuit 7-CF38 (YE/RD) or circuit 8-CF38 (YE/BK). CLEAR the DTCs. REPEAT the self-test.

If DTC C1155, REPAIR circuit 7-CF32 (YE) or circuit 8-CF32 (WH). CLEAR the DTCs. REPEAT the self-test.

If DTC C1165, REPAIR circuit 7-CF40 (YE/GN) or circuit 8-CF40 (WH/GN). CLEAR the DTCs. REPEAT the self-test.

If DTC C1175, REPAIR circuit 7-CF34 (YE/BU) or circuit 8-CF34 (WH/BU). CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to E2.

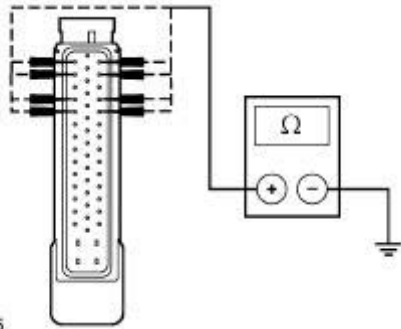
E2 CHECK FOR SHORT TO GROUND

NOTE: Both circuits must be checked for each DTC.

1



2



A0006085

2 Measure the resistance between stability assist module C155 pin, harness side, and ground, as follows:

DTC	Stability Assist Module C155	Circuit
C1145 (RF)	Pin 35	7-CF38 (YE/RD)
C1145 (RF)	Pin 34	8-CF38 (WH/RD)
C1155 (LF)	Pin 1	7-CF32 (YE)
C1155 (LF)	Pin 2	8-CF32 (WH)
C1165 (RR)	Pin 38	7-CF40 (YE/GN)
C1165 (RR)	Pin 37	8-CF40 (WH/GN)
C1175 (LR)	Pin 5	7-CF34 (YE/BU)
C1175 (LR)	Pin 4	8-CF34 (WH/BU)

● **Are the resistances greater than 10,000 ohms?**

→ **Yes**
GO to E3.

→ **No**
If DTC C1145, REPAIR circuit 7-CF38 (YE/RD) or circuit 8-CF38 (YE/BK). CLEAR the DTCs. REPEAT the self-test.

If DTC C1155, REPAIR circuit 7-CF32 (YE) or circuit 8-CF32 (WH). CLEAR the DTCs. REPEAT the self-test.

If DTC C1165, REPAIR circuit 7-CF40 (YE/GN) or circuit 8-CF40 (WH/GN). CLEAR the DTCs. REPEAT the self-test.

If DTC C1175, REPAIR circuit 7-CF34 (YE/BU) or circuit 8-CF34 (WH/BU).

CLEAR the DTCs. REPEAT the self-test.

E3 CHECK FOR AN OPEN

NOTE: Both circuits must be checked for each DTC.

1 Measure the resistance between stability assist module C155 pins, harness side, and suspect anti-lock brake sensor connector, harness side, as follows:

DTC	Stability Assist Module C155	Anti-lock Brake Sensor	Circuit
C1145 (RF)	Pin 35	C160 Pin 1	7-CF38 (YE/RD)
C1145 (RF)	Pin 34	C160 Pin 2	8-CF38 (YE/BK)
C1155 (LF)	Pin 1	C150 Pin 1	7-CF32 (YE)
C1155 (LF)	Pin 2	C150 Pin 2	8-CF32 (WH)
C1165 (RR)	Pin 38	C426 Pin 1	7-CF40 (YE/GN)
C1165 (RR)	Pin 37	C426 Pin 2	8-CF40 (WH/GN)
C1175 (LR)	Pin 5	C440 Pin 1	7-CF34 (YE/BU)
C1175 (LR)	Pin 4	C440 Pin 2	8-CF34 (WH/BU)

● Is the resistance less than 5 ohms?

→ **Yes**
GO to E4.

→ **No**
If DTC C1145, REPAIR circuit 7-CF38 (YE/RD) or circuit 8-CF38 (YE/BK). CLEAR the DTCs. REPEAT the self-test.


If DTC C1155, REPAIR circuit 7-CF32 (YE) or circuit 8-CF32 (WH). CLEAR the DTCs. REPEAT the self-test.

If DTC C1165, REPAIR circuit 7-CF40 (YE/GN) or circuit 8-CF40 (WH/GN). CLEAR the DTCs. REPEAT the self-test.


If DTC C1175, REPAIR circuit 7-CF34 (YE/BU) or circuit 8-CF34 (WH/BU). CLEAR the DTCs. REPEAT the self-test.

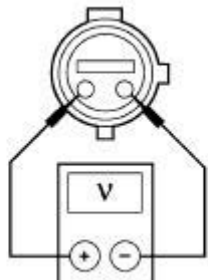
E4 CHECK THE STABILITY ASSIST MODULE OUTPUT

1



Stability Assist Module C155

2 

3 

A0006087

3 Measure the voltage between suspect anti-lock brake sensor pins, harness side.

● Is the voltage less than 9 volts?

→ **Yes**
 INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. CLEAR the DTCs. REPEAT the self-test.




→ **No**
 INSTALL a new wheel speed sensor. REFER to Front Wheel Speed Sensor or Rear Wheel Speed Sensor. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST F: DTC C1233 (LF), DTC C1234 (RF), DTC C1235 (RR), DTC C1236 (LR) — ANTI-LOCK BRAKE SENSOR INPUT SIGNAL MISSING

CONDITIONS	DETAILS/RESULTS/ACTIONS
	<p>NOTE: Any time an anti-lock brake sensor is removed, thoroughly clean the mounting surfaces and apply High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A or equivalent meeting Ford specification ESA-M1C198-A.</p>
	<p>F1 CHECK THE ANTI-LOCK BRAKE SENSOR</p> <p>1 Check the suspect anti-lock brake sensor mounting. Check the suspect anti-lock brake sensor for excessive dirt buildup, metal obstructions, incorrect harness routing, and chafing.</p> <p>● Is the suspect anti-lock brake sensor OK?</p> <p>→ Yes GO to <u>F2</u>.</p>

	<p>→ No REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.</p>
F2 CHECK THE ANTI-LOCK BRAKE SENSOR INDICATOR	
<p>1 Check the suspect anti-lock brake sensor indicator for corrosion, nicks, damaged teeth, correct mounting, alignment, and consistent air gap.</p> <p>● Is the suspect anti-lock brake sensor indicator OK?</p>	<p>→ Yes INSTALL a new anti-lock brake sensor; REFER to <u>Front Wheel Speed Sensor</u> or <u>Rear Wheel Speed Sensor</u>. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST G: DTC C1277 — STEERING WHEEL ANGLE 1 AND 2 CIRCUIT FAILURE, DTC C1278 — STEERING WHEEL ANGLE 1 AND 2 CIRCUIT FAULTED

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CARRY OUT THE RECALIBRATION PROCEDURE	
<p>1</p>  <p>2</p>  <p>Clear the DTC</p> <p>4</p>  <p>Retrieve DTCs</p>	<p>3 Carry out the steering wheel angle recalibration procedure using the NGS Tester.</p> <p>● Are any DTCs retrieved or does the recalibration procedure indicate a fault?</p> <p>→ Yes If DTC C1277 or C1278 is retrieved or recalibration procedure indicates a fault, GO to <u>G2</u>.</p>

If any other DTC, GO to the Stability Assist Module Diagnostic Trouble Code (DTC) Index.

→ **No**
The stability assist system is operating correctly.

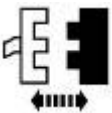
The DTC C1278 was meant for detection of steering wheel rotation sensor harness wiring problems at vehicle assembly time. The steering wheel rotation sensor circuit is checked for swapped wires (channel A and B). This DTC should not occur during repair unless the harness wiring to the steering wheel rotation sensor was changed or the PRNDL position indicator is not operating correctly. The DTC will occur only after driving a few feet and making a turn if the wiring problem or PRNDL problem exists.

G2 CHECK THE VOLTAGE TO THE STEERING WHEEL ROTATION SENSOR

1



2

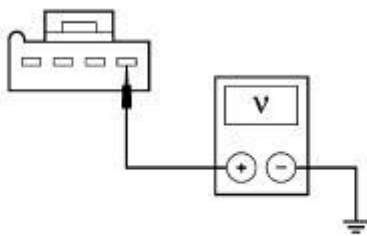


Steering Wheel Rotation Sensor C226

3



4



A0002737

4 Measure the voltage between steering wheel rotation sensor C226 pin 4, circuit 15-CC16 (GN/OG), harness side, and ground.

● **Is the voltage greater than 10 volts?**

→ **Yes**
GO to G3.

→ **No**
REPAIR the circuit. CLEAR the DTCs.

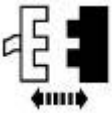
RECALIBRATE the stability assist module. REPEAT the self-test.

G3 CHECK THE STEERING WHEEL ROTATION SENSOR CIRCUITRY FOR SHORT TO POWER

1



2

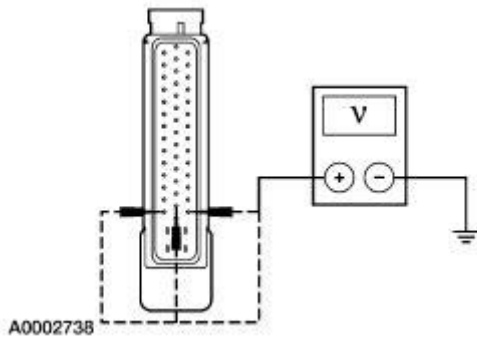


Stability Assist Module C155

3



4



4 Measure the voltage between stability assist module C155 pins, harness side and ground as follows:

Stability Assist Module C155	Circuit
Pin 30	9-CC16 (BN/YE)
Pin 47	8-CC18 (WH/RD)
Pin 14	10-CC17 (GY)

• Is any voltage present?

→ **Yes**
REPAIR the circuit in question. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

→ **No**
GO to G4.

G4 CHECK THE STEERING WHEEL ROTATION SENSOR CIRCUITRY FOR SHORT TO GROUND

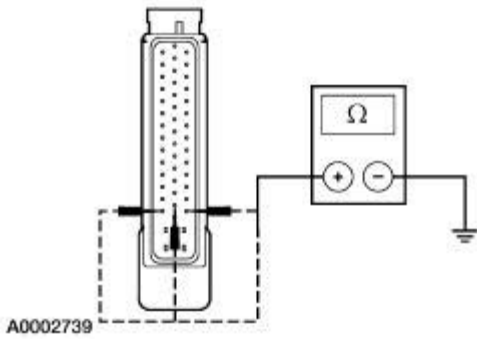
1



2

2 Measure the resistance between stability assist module C155 pins, harness side and ground as follows:

Stability Assist	



Module C155	Circuit
Pin 30	9-CC16 (BN/YE)
Pin 47	8-CC18 (WH/RD)
Pin 14	10-CC17 (GY)

- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to G5.

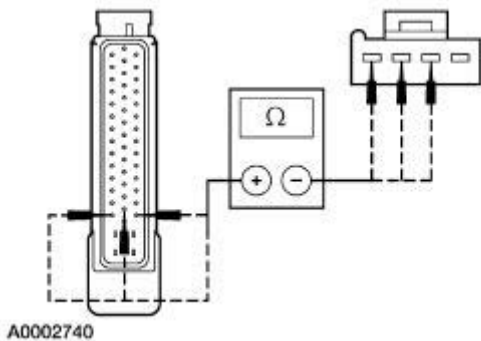
→ **No**
REPAIR the circuit in question. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

G5 CHECK THE STEERING WHEEL ROTATION SENSOR CIRCUITRY FOR AN OPEN

1



2



2

Measure the resistance between stability assist module C155 pins, harness side, and steering wheel rotation sensor C226 pins, harness side, as follows:

Stability Assist Module C155	Steering Wheel Rotation Sensor C226	Circuit
Pin 30	Pin 1	9-CC16 (BN/YE)
Pin 47	Pin 2	8-CC18 (WH/RD)
Pin 14	Pin 3	10-CC17 (GY)

- Is the resistance less than 5 ohms?

→ **Yes**
GO to G6.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

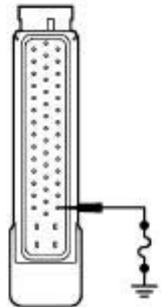
G6 CHECK THE STEERING WHEEL ROTATION SENSOR OUTPUT

1



Steering Wheel Rotation Sensor C226

2

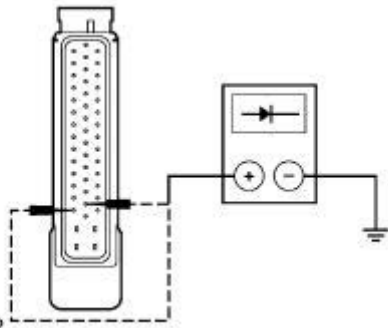


A0002741

3



4



A0002742

2

Connect a fused (5A) jumper wire between stability assist module C155-30, circuit 9-CC16 (BN/YE), harness side, and ground.

4

NOTE: The WDS scan tool can also be used to monitor steering wheel rotation sensor output PIDs.

Connect 73III Automotive Meter leads between stability assist module C155-14, circuit 10-CC17 (GY), harness side, and ground; and between stability assist module C155-47, circuit 8-CC18 (WH/RD), harness side, and ground.

- While turning the steering wheel in each direction, is the voltage switching from 0 to 2 volts \pm 0.5 volt?

→ Yes

INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist . REPEAT the self-test.

→ No

INSTALL a new steering wheel rotation sensor. REFER to Section 211-02 . CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST H: DTC C1279 — YAW RATE SENSOR CIRCUIT FAILURE, DTC C1280 — YAW RATE SENSOR SIGNAL FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
------------	-------------------------

H1 CARRY OUT THE RECALIBRATION PROCEDURE

1



2



Clear DTC

4



Retrieve DTCs

3 Carry out the yaw rate sensor recalibration procedure using the NGS Tester.

● **Are any DTCs retrieved or does the recalibration procedure indicate a fault?**

→ **Yes**

If DTC C1279 or C1280 is retrieved, or yaw rate portion of the recalibration procedure indicates failed, GO to H2.

If any other DTC, GO to the Stability Assist Module Diagnostic Trouble Code (DTC) Index.

→ **No**

The stability assist system is operating correctly.

H2 CHECK THE STABILITY ASSIST MODULE PID YAWRATE

1 Monitor the stability assist module PID YAWRATE.

● **Is the stability assist module PID YAWRATE value between 479 and 545?**

→ **Yes**

CLEAR DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

→ **No**

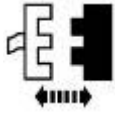
GO to H3.

H3 CHECK THE RETURN SIGNAL VOLTAGE

1

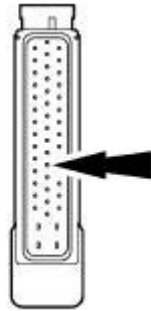


2



Stability Assist Module C155

3



A0002747

4

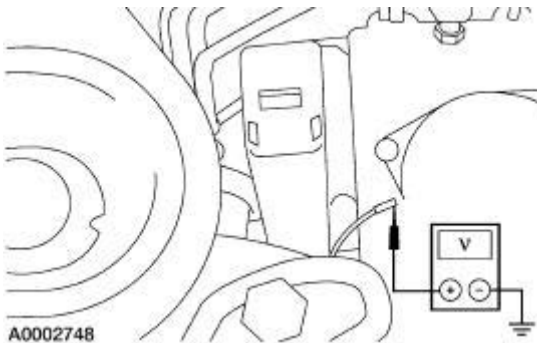


Stability Assist Module C155

5



6



A0002748

3

Back out the stability assist module C155 pin 27, circuit 8-CF67 (WH/RD), harness side.

6

Measure the voltage between stability assist module C155 pin 27, circuit 8-CF67 (WH/RD), harness side, and ground.

- Is the voltage approximately 2.5 volts?

→ **Yes**
RECONNECT the backed out pin. GO to H4.

→ **No**
GO to H5.

H4 REVERIFY THE STABILITY ASSIST MODULE PID YAWRATE

1 Monitor the stability assist module PID

YAWRATE.

- Is the stability assist module PID YAWRATE value between 479 and 545?

→ **Yes**

Check the stability assist module connector for loose or corroded pins. CLEAR the DTCs. REPEAT the self-test.

→ **No**

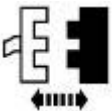
INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. REPEAT the self-test.

H5 CHECK YAW RATE SENSOR CIRCUITRY FOR SHORT TO POWER

1

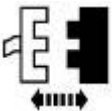


2



Stability Assist Module C155

3

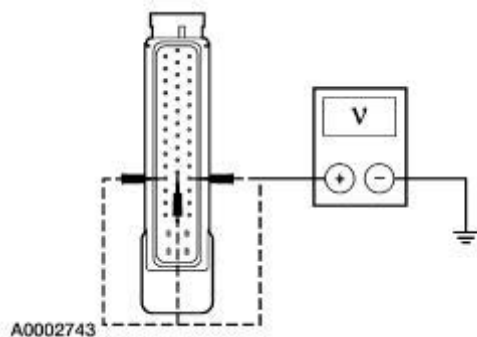


Yaw Rate Sensor C245

4



5



5

Measure the voltage between stability assist module C155 pins, harness side, and ground as follows:

Stability Assist Module C155	Circuit
Pin 27	8-CF67 (WH/RD)
Pin 11	9-CF67 (BN/RD)
Pin 44	7-CF67 (YE/RD)

- Is any voltage present?

→ **Yes**

REPAIR the circuit in question. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

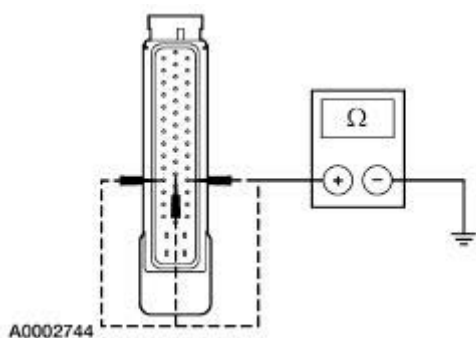
→ **No**
GO to H6.

H6 CHECK YAW RATE SENSOR CIRCUITRY FOR SHORT TO GROUND

1



2



2

Measure the resistance between stability assist module C155 pins, harness side, and ground as follows:

Stability Assist Module C155	Circuit
Pin 27	8-CF67 (WH/RD)
Pin 11	9-CF67 (BN/RD)
Pin 44	7-CF67 (YE/RD)

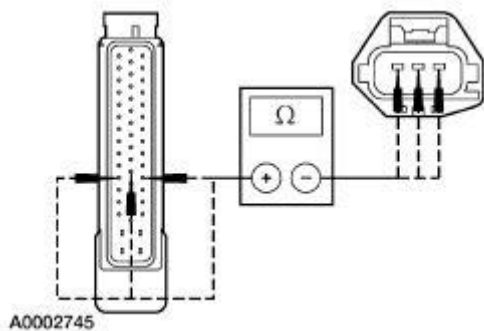
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to H7.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

H7 CHECK YAW RATE SENSOR CIRCUITRY FOR AN OPEN

1



1

Measure the resistance between stability assist module C155 pins, harness side, and yaw rate sensor C245 pins, harness side as follows:

Stability Assist Module C155	Yaw Rate Sensor C245	Circuit
Pin 27	Pin 1	8-CF67 (WH/RD)
Pin 11	Pin 2	9-CF67 (BN/RD)
Pin 44	Pin 3	7-CF67 (YE/RD)

● Is the resistance less than 5 ohms?

→ **Yes**
GO to H8.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

H8 CHECK THE VOLTAGE FROM THE STABILITY ASSIST MODULE

1

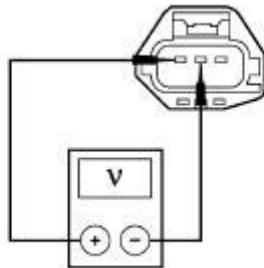


Stability Assist Module C155

2



3



A0002746

3 Measure the voltage between yaw rate sensor C245 pin 3, circuit 7-CF67 (YE/RD), harness side, and yaw rate sensor C245 pin 2, circuit 9-CF67 (BN/RD), harness side.

● **Is the voltage approximately 5 volts?**

→ **Yes**
INSTALL a new yaw rate sensor. REFER to Yaw Rate Sensor. CLEAR the DTCs. REPEAT the self-test.

→ **No**
INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST I: DTC C1281 — LATERAL ACCELEROMETER CIRCUIT FAILURE, DTC C1282 — LATERAL ACCELEROMETER SIGNAL FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 CARRY OUT THE RECALIBRATION PROCEDURE	
1	



2



Clear DTC

4



Retrieve DTCs

3 Carry out the lateral accelerometer recalibration procedure using the NGS Tester.

● **Are any DTCs retrieved or does the recalibration procedure indicate a fault?**

→ **Yes**

If DTC C1281 or C1282 is retrieved, or lateral accelerometer portion of the recalibration procedure indicates failed, GO to 12.

If any other DTC, GO to the Stability Assist Module Diagnostic Trouble Code (DTC) Index.

→ **No**

The stability assist system is operating correctly.

12 CHECK THE STABILITY ASSIST MODULE PID LAT_ACC

1 Monitor the stability assist module PID LAT_ACC.

● **Is the stability assist module PID LAT_ACC value between 547 and 681?**

→ **Yes**

INSTALL a new lateral accelerometer. REFER to Accelerometer. CLEAR DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

→ **No**

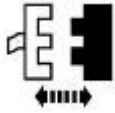
GO to 13.

13 CHECK THE RETURN SIGNAL VOLTAGE

1

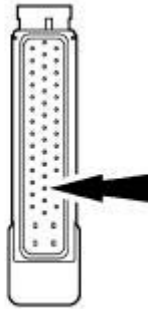


2



Stability Assist Module C155

3



A0002753

4

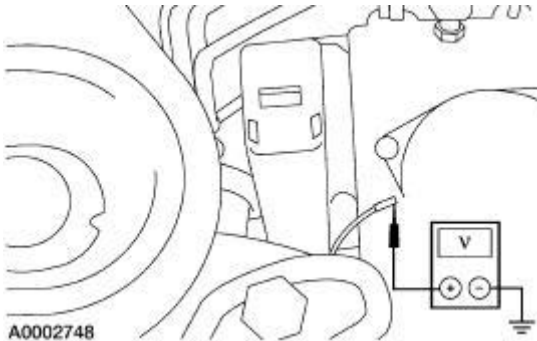


Stability Assist Module C155

5



6



A0002748

3

Back out the stability assist module C155 pin 29, circuit 8-CF66 (WH/BU), harness side.

6

Measure the voltage between stability assist module C155 pin 29, circuit 8-CF66 (WH/BU), harness side, and ground.

● Is the voltage approximately 3 volts?

→ **Yes**
RECONNECT the backed out pin. GO to 14.

→ **No**
GO to 15.

14 REVERIFY THE STABILITY ASSIST MODULE PID LAT_ACC

1 Monitor the stability assist module PID

LAT_ACC.

- Is the stability assist module PID LAT_ACC value between 547 and 681?

→ **Yes**

Check the stability assist module connector for loose or corroded pins. CLEAR the DTCs. REPEAT the self-test.

→ **No**

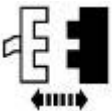
INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. REPEAT the self-test.

15 CHECK LATERAL ACCELEROMETER CIRCUITRY FOR SHORT TO POWER

1

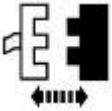


2



Stability Assist Module C155

3

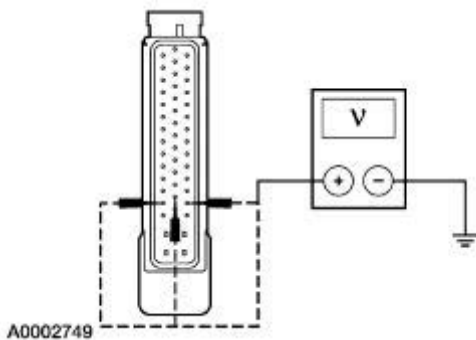


Lateral Accelerometer C244

4



5



5

Measure the voltage between stability assist module C155 pins, harness side, and ground, as follows:

Stability Assist Module C155	Circuit
Pin 13	9-CF66 (BN/BU)
Pin 29	8-CF66 (WH/BU)
Pin 46	7-CF66 (YE/BU)

- Is any voltage present?

→ **Yes**

REPAIR the circuit in question. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

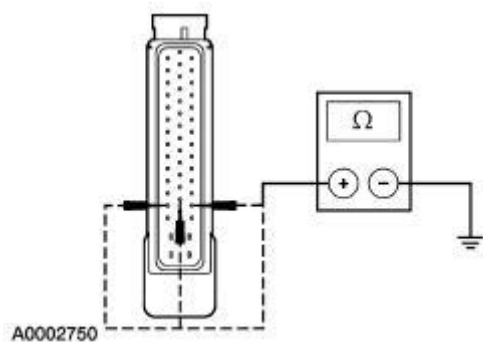
→ **No**
GO to 16.

16 CHECK LATERAL ACCELEROMETER CIRCUITRY FOR SHORT TO GROUND

1



2



2

Measure the resistance between stability assist module C155 pins, harness side, and ground as follows:

Stability Assist Module C155	Circuit
Pin 13	9-CF66 (BN/BU)
Pin 29	8-CF66 (WH/BU)
Pin 46	7-CF66 (YE/BU)

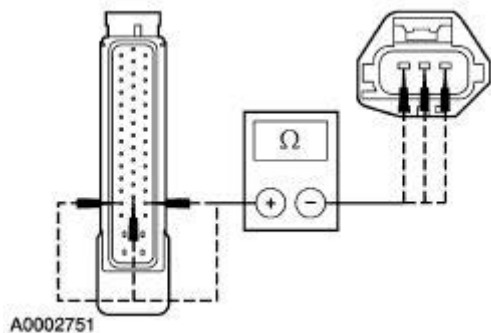
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to 17.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

17 CHECK LATERAL ACCELEROMETER CIRCUITRY FOR AN OPEN

1



1

Measure the resistance between stability assist module C155 pins, harness side, and lateral accelerometer C244 pin, harness side as follows:

Stability Assist Module C155	Lateral Accelerometer C244	Circuit
Pin 13	Pin 1	9-CF66 (BN/BU)
Pin 29	Pin 2	8-CF66 (WH/BU)
Pin 46	Pin 3	7-CF66 (YE/BU)

● Is the resistance less than 5 ohms?

→ **Yes**
GO to 18.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

18 CHECK THE VOLTAGE FROM THE STABILITY ASSIST MODULE

1

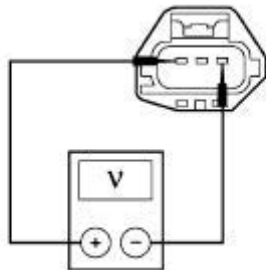


Stability Assist Module C155

2



3



A0002752

3 Measure the voltage between lateral accelerometer C244 pin 3, circuit 7-CF66 (YE/BU), harness side, and lateral accelerometer C244 pin 1, circuit 9-CF66 (BN/BU), harness side.

● **Is the voltage approximately 5 volts?**

→ **Yes**
INSTALL a new lateral accelerometer. REFER to Accelerometer. CLEAR the DTCs. REPEAT the self-test.

→ **No**
INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST J: DTC C1285—BRAKE BOOSTER SOLENOID OUTPUT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 CARRY OUT THE RECALIBRATION PROCEDURE	
1	



2



Clear DTC

4



Retrieve DTCs

3 Carry out the brake booster recalibration procedure using the NGS Tester.

• **Are any DTCs retrieved or does the recalibration procedure indicate a fault?**

→ **Yes**

If DTC C1285 is retrieved, or brake booster portion of the recalibration procedure indicates failed, GO to J2.

If any other DTC, GO to the Stability Assist Module Diagnostic Trouble Code (DTC) Index.

→ **No**

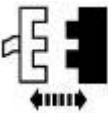
The stability assist system is operating correctly.

J2 CHECK THE BRAKE BOOSTER SOLENOID

1



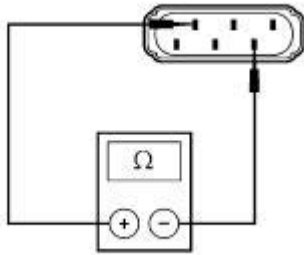
2



Brake Booster C149

3

3 Measure the resistance between brake booster pin 3 (component side) and brake booster solenoid pin 4 (component side).



A0002754

- Is the resistance between 1 and 2 ohms?

→ **Yes**
GO to J3.

→ **No**
INSTALL a new brake booster. REFER to Section 206-07. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

J3 CHECK THE BRAKE BOOSTER SOLENOID CIRCUITRY FOR SHORT TO POWER

1

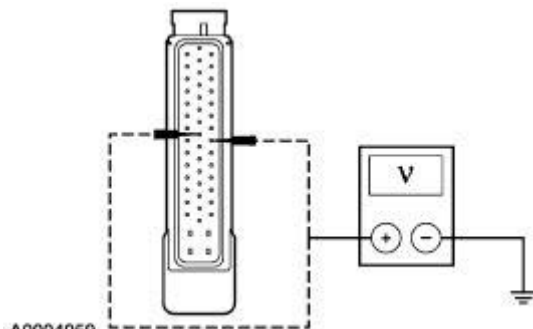


Stability Assist Module C155

2



3



A0004059

- 3 Measure the voltage between stability assist module C155 pin 8, circuit 8-CF68 (WH/RD), harness side, and ground; and stability assist module C155 pin 24, circuit 9-CF68 (BN/RD), harness side, and ground.

- Is the any voltage present?

→ **Yes**
REPAIR the circuit in question. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

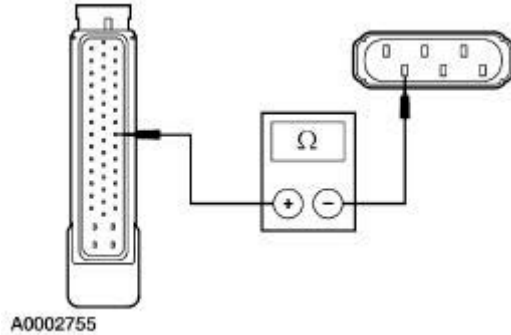
→ **No**
GO to J4.

J4 CHECK CIRCUIT 8-CF68 (WH/RD)

1



2



2

Measure the resistance between stability assist module C155 pin 8, circuit 8-CF68 (WH/RD), harness side, and brake booster C149 pin 4, circuit 8-CF68 (WH/RD), harness side; and stability assist module C155 pin 8, circuit 8-CF68 (WH/RD), harness side, and ground.

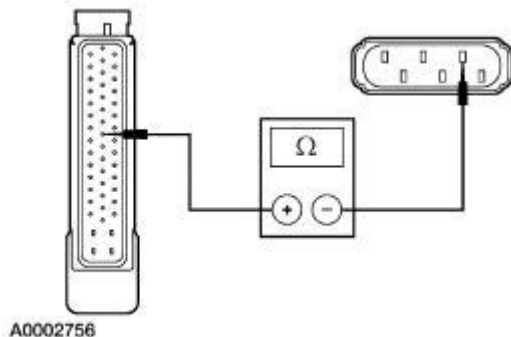
- **Is the resistance less than 5 ohms between stability assist module and brake booster; and greater than 10,000 ohms between stability assist module and ground?**

→ **Yes**
GO to J5.

→ **No**
REPAIR the circuit. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

J5 CHECK CIRCUIT 9-CF68 (BN/RD)

1



1

Measure the resistance between stability assist module C155 pin 24, circuit 9-CF68 (BN/RD), harness side, and brake booster C149 pin 3, circuit 9-CF68 (BN/RD), harness side; and stability assist module C155 pin 24, circuit 9-CF68 (BN/RD), harness side and ground.

- **Is the resistance less than 5 ohms between stability assist module and brake booster; and greater than 10,000 ohms between stability assist module and ground?**

→ **Yes**
GO to J6.

→ **No**

REPAIR the circuit. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

J6 CHECK THE BRAKE BOOSTER SOLENOID FOR CORRECT OPERATION

1

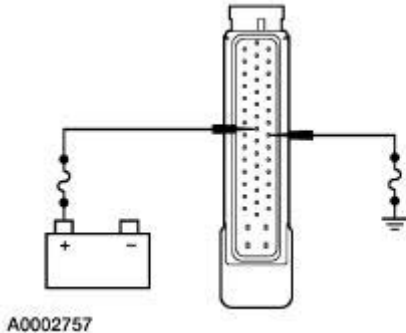


Brake Booster C149

2



4



3 Wait a few minutes to create engine vacuum in the brake booster and then place the ignition switch in the OFF position.


4 Connect a fused (10A) jumper wire between stability assist module pin 8, circuit 8-CF68 (WH/RD), harness side, and ground; and connect a fused (10A) jumper wire for several seconds between stability assist module pin 24, circuit 9-CF68 (WH/RD), harness side, and the positive battery post, while observing the brake pedal for movement.

● Does the brake pedal move?

→ **Yes**
 INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. REPEAT the self-test.

→ **No**
 INSTALL a new brake booster. REFER to Section 206-07. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

PINPOINT TEST K: DTC C1286—BOOSTER MECHANICAL FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 CARRY OUT THE RECALIBRATION PROCEDURE	
<p>1</p> 	

2



Clear DTC

4



Clear DTC

5



Retrieve DTCs

3 Carry out the brake booster recalibration procedure using the NGS Tester.

• Are any DTCs retrieved or does the recalibration procedure indicate a fault?

→ Yes

If DTC C1286 is retrieved or recalibration procedure indicate a fault, GO to K2.

If any other DTC, GO to the Stability Assist Module Diagnostic Trouble Code (DTC) Index.

→ No

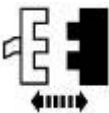
The stability assist system is operating correctly.

K2 CHECK THE BRAKE BOOSTER SOLENOID

1



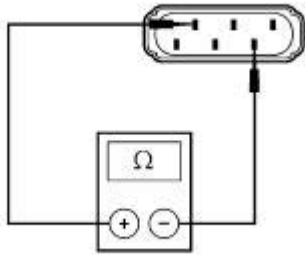
2



Brake Booster C149

3

3 Measure the resistance between brake booster pin 3 (component side) and brake booster solenoid pin 4 (component side).



A0002754

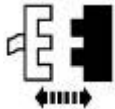
- Is the resistance between 1 and 2 ohms?

→ **Yes**
GO to K3.

→ **No**
INSTALL a new brake booster. REFER to Section 206-07. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

K3 CHECK THE BRAKE BOOSTER SOLENOID CIRCUITRY FOR SHORT TO POWER

1

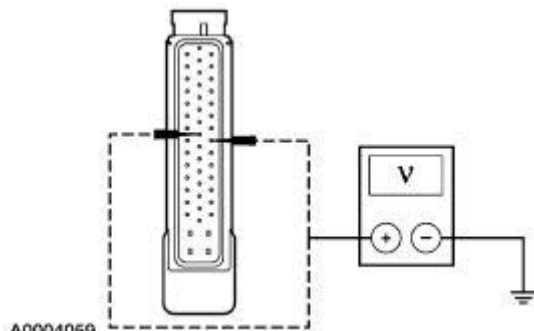


Stability Assist Module C155

2



3



A0004059

- 3 Measure the voltage between stability assist module C155 pin 8, circuit 8-CF68 (WH/RD), harness side and ground; and stability assist module C155 pin 24, circuit 9-CF68 (BN/RD), harness side and ground.

- Is the any voltage present?

→ **Yes**
REPAIR the circuit in question. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

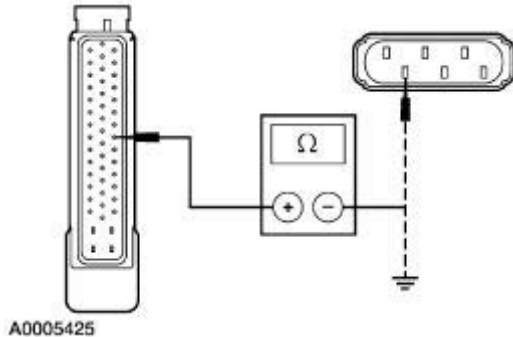
→ **No**
GO to K4.

K4 CHECK CIRCUIT 8-CF68 (WH/RD)

1



2



2 Measure the resistance between stability assist module C155 pin 8, circuit 8-CF68 (WH/RD), harness side, and brake booster C149 pin 4, circuit 8-CF68 (WH/RD), harness side; and stability assist module C155 pin 8, circuit 8-CF68 (WH/RD), harness side, and ground.

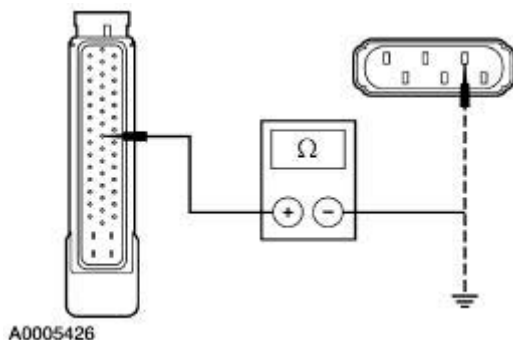
- Is the resistance less than 5 ohms between stability assist module and brake booster; and greater than 10,000 ohms between stability assist module and ground?

→ **Yes**
GO to K5.

→ **No**
REPAIR the circuit. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

K5 CHECK CIRCUIT 9-CF68 (BN/RD)

1



1 Measure the resistance between stability assist module C155 pin 24, circuit 9-CF68 (BN/RD), harness side, and brake booster C149 pin 3, circuit 9-CF68 (BN/RD), harness side; and stability assist module C155 pin 24, circuit 9-CF68 (BN/RD), harness side, and ground.

- Is the resistance less than 5 ohms between stability assist module and brake booster; and greater than 10,000 ohms between stability assist module and ground?

→ **Yes**
GO to K6.

→ **No**
REPAIR the circuit. CLEAR the DTCs.

RECALIBRATE the stability assist module. REPEAT the self-test.

K6 CHECK THE BRAKE BOOSTER SOLENOID FOR CORRECT OPERATION

1

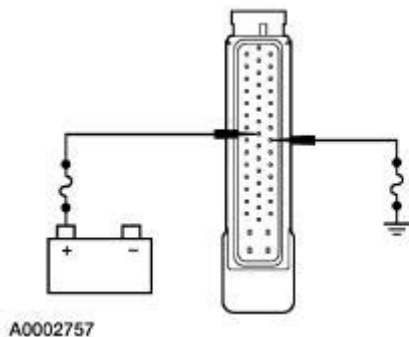


Brake Booster C149

2



4



3 Wait a few minutes to create engine vacuum in the brake booster and then place the ignition switch in the OFF position.


4 Connect a fused (10A) jumper wire between stability assist module pin 8, circuit 8-CF68 (WH/RD), harness side, and ground; and connect a fused (10A) jumper wire for several seconds between stability assist module pin 24, circuit 9-CF68 (BN/RD), harness side, and the positive battery post, while observing the brake pedal for movement.

● Does the brake pedal move?

→ **Yes**
 INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. REPEAT the self-test.

→ **No**
 INSTALL a new brake booster. REFER to Section 206-07. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

PINPOINT TEST L: DTC C1287 — BOOSTER PEDAL FORCE SWITCH CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1 CARRY OUT THE RECALIBRATION PROCEDURE	
<p>1</p> 	

2



Clear DTC

4



Retrieve DTCs

3

Carry out the brake booster recalibration procedure using the NGS Tester.

● Are any DTCs retrieved or does the recalibration procedure indicate a fault?

→ Yes

If DTC C1287 is retrieved or recalibration procedure indicates a fault, GO to L2.

If any other DTC, GO to the Stability Assist Module Diagnostic Trouble Code (DTC) Index.

→ No

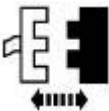
The stability assist system is operating correctly.

L2 CHECK THE NORMALLY CLOSED RELEASE SWITCH

1

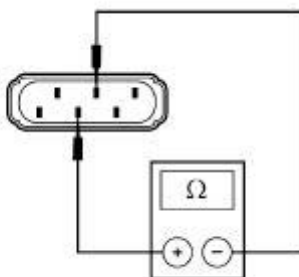


2



Brake Booster C149

3



A0002759

3

Measure the resistance between brake booster pin 2 (component side) and brake booster pin 5 (component side), while depressing and releasing the brake pedal.

● Is the resistance less than 5 ohms when the brake pedal is pressed

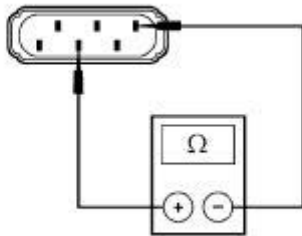
and greater than 10,000 ohms when the brake pedal is released?

→ **Yes**
GO to L3.

→ **No**
INSTALL a new brake booster. REFER to Section 206-07. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

L3 CHECK THE NORMALLY OPEN RELEASE SWITCH

1



A0002758

1

Measure the resistance between brake booster pin 1 (component side) and brake booster pin 5 (component side), while depressing and releasing the brake pedal.

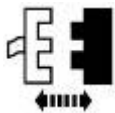
- Is the resistance less than 5 ohms with the brake pedal depressed and greater than 10,000 ohms with the brake pedal released?

→ **Yes**
GO to L4.

→ **No**
INSTALL a new brake booster. REFER to Section 206-07. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

L4 CHECK THE BRAKE BOOSTER CIRCUITRY FOR SHORT TO POWER

1



Stability Assist Module C155

2

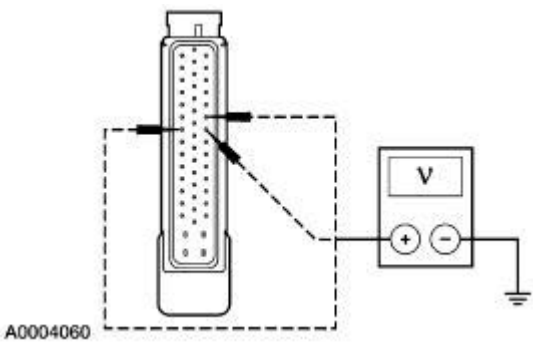


3

3

Measure the voltage between stability assist module C155 pins, harness side, and ground, as follows:

Stability Assist Module C155	Circuit



A0004060

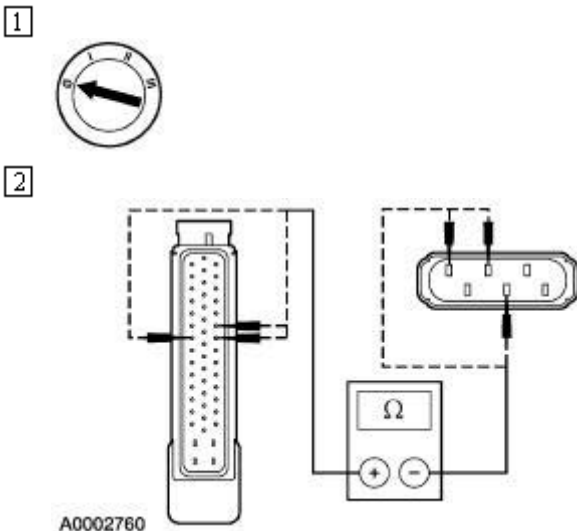
Pin 40	9-CF51 (BN/GN)
Pin 7	10-CF51 (GY/OG)
Pin 6	8-CF51 (WH/GN)

● **Is any voltage present?**

→ **Yes**
REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the stability assist module. REPEAT the self-test.

→ **No**
GO to L5.

L5 CHECK THE BRAKE BOOSTER CIRCUITRY



A0002760

2 Measure the resistance between stability assist module C155 pins, harness side, and brake booster C149 pins, harness side, as follows:


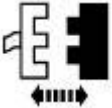
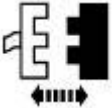

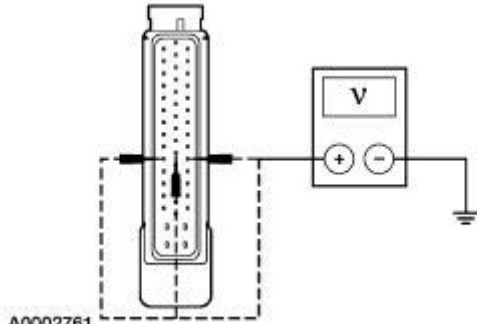
Stability Assist Module C155	Brake Booster C149	Circuit
Pin 40	Pin 5	9-CF51 (BN/GN)
Pin 7	Pin 2	10-CF51 (GY/OG)
Pin 6	Pin 1	8-CF51 (WH/GN)

● **Are the resistances less than 5 ohms?**

→ **Yes**
INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. REPEAT the self-test.

→ **No**
REPAIR the circuit in question. CLEAR the DTC. RECALIBRATE the stability assist module. REPEAT the self-test.

PINPOINT TEST M: DTC C1288—PRESSURE TRANSDUCER MAIN/PRIMARY INPUT CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS								
<p>NOTE: When diagnosing this DTC, the main/primary pressure transducer is the C147 pin 1, Circuit 9-CF64 (BN/YE). The pressure transducer connectors can be connected to either the main or the redundant pressure transducer and still operate correctly, therefore the wire color must be looked at before continuing diagnostics.</p>									
<p>M1 CHECK MAIN/PRIMARY PRESSURE TRANSDUCER CIRCUITRY FOR SHORT TO POWER</p>									
<p>1 </p> <p>2  Stability Assist Module C155</p> <p>3  Main/Primary Pressure Transducer C147</p> <p>4 </p> <p>5  A0002761</p>	<p>5 Measure the voltage between stability assist module C155 pins, harness side, and ground as follows:</p> <table border="1"> <thead> <tr> <th>Stability Assist Module C155</th> <th>Circuit</th> </tr> </thead> <tbody> <tr> <td>Pin 43</td> <td>9-CF64 (BN/YE)</td> </tr> <tr> <td>Pin 26</td> <td>8-CF64 (WH/BK)</td> </tr> <tr> <td>Pin 10</td> <td>7-CF64 (YE/BK)</td> </tr> </tbody> </table> <p>• Is any voltage present?</p> <p>→ Yes REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No</p>	Stability Assist Module C155	Circuit	Pin 43	9-CF64 (BN/YE)	Pin 26	8-CF64 (WH/BK)	Pin 10	7-CF64 (YE/BK)
Stability Assist Module C155	Circuit								
Pin 43	9-CF64 (BN/YE)								
Pin 26	8-CF64 (WH/BK)								
Pin 10	7-CF64 (YE/BK)								

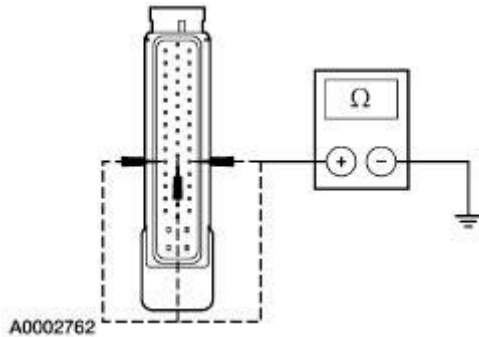
GO to M2.

M2 CHECK MAIN/PRIMARY PRESSURE TRANSDUCER CIRCUITRY FOR SHORT TO GROUND

1



2



2

Measure the resistance between stability assist module C155 pins, harness side, and ground, as follows:

Stability Assist Module C155	Circuit
Pin 43	9-CF64 (BN/YE)
Pin 26	8-CF64 (WH/BK)
Pin 10	7-CF64 (YE/BK)

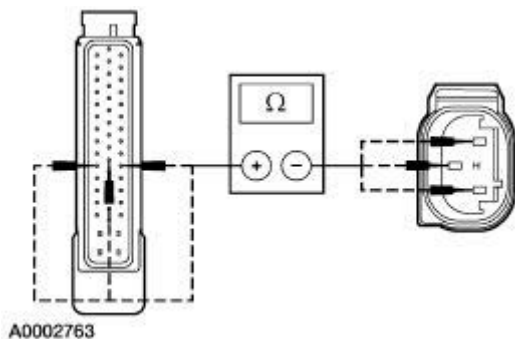
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to M3.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

M3 CHECK MAIN/PRIMARY PRESSURE TRANSDUCER CIRCUITRY FOR AN OPEN

1



1

Measure the resistance between stability assist module C155 pins, harness side, and main/primary pressure transducer C147 pins, harness side, as follows:

Stability Assist Module C155	Main/Primary Pressure Transducer C147	Circuit
Pin 43	Pin 1	9-CF64 (BN/YE)
Pin 26	Pin 2	8-CF64 (WH/BK)
Pin 10	Pin 3	7-CF64 (YE/BK)

● Is the resistance less than 5 ohms?

→ **Yes**
GO to M4.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

M4 CHECK THE STABILITY ASSIST MODULE OUTPUT

1

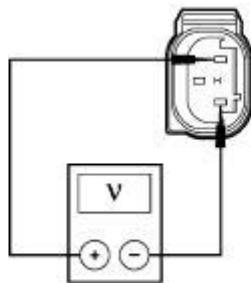


Stability Assist Module C155

2



3



A0002764

3 Measure the voltage between main/primary pressure transducer C147 pin 3, circuit 7-CF64 (YE/BK), harness side, and main/primary pressure transducer C147 pin 1, circuit 9-CF64 (BN/YE), harness side.

- Is the voltage approximately 5 volts?

→ **Yes**
GO to M5.

→ **No**
INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. REPEAT the self-test.

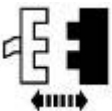
M5 CHECK THE MAIN/PRIMARY PRESSURE TRANSDUCER OUTPUT

1



Main/Primary Pressure Transducer C147

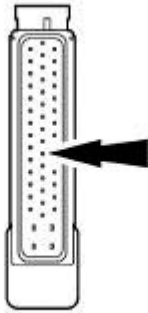
2



Stability Assist Module C155

3

3 Back out the stability assist module C155 pin 26, circuit 8-CF64 (WH/BK), harness side.



A0002765

4

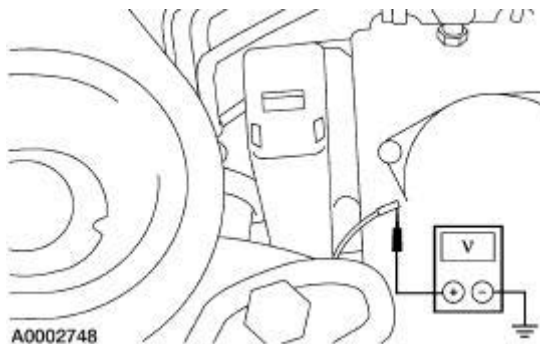


Stability Assist Module C155

5



6



A0002748

6 Measure the voltage between stability assist module back out pin 26, circuit 8-CF64 (WH/BK), harness side, and ground, while depressing and releasing the brake pedal.

- Is the voltage between 0.125 and 0.375 volt with the brake pedal released and between 0.125 and 5 volts with the brake pedal depressed?

→ **Yes**
INSTALL a new stability assist module. REFER to [Anti-Lock Brake System \(ABS\) Module—Stability Assist](#). REPEAT the self-test.

→ **No**
INSTALL a new main/primary pressure transducer. REFER to [Transducer—Primary](#). CLEAR the DTC. RECALIBRATE the stability assist module. REPEAT the self-test.

PINPOINT TEST N: DTC C1289—PRESSURE TRANSDUCER REDUNDANT/SECONDARY INPUT CIRCUIT FAILURE

CONDITIONS

DETAILS/RESULTS/ACTIONS

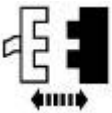
NOTE: When diagnosing this DTC, the main/primary pressure transducer is the C148 pin 1, circuit 9-CF65 (BN/WH). The pressure transducer connectors can be connected to either the main or the redundant pressure transducer and still operate correctly, therefore the wire color must be looked at before continuing diagnostics.

N1 CHECK REDUNDANT/SECONDARY PRESSURE TRANSDUCER CIRCUITRY FOR SHORT TO POWER

1

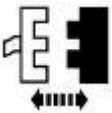


2



Stability Assist Module C155

3

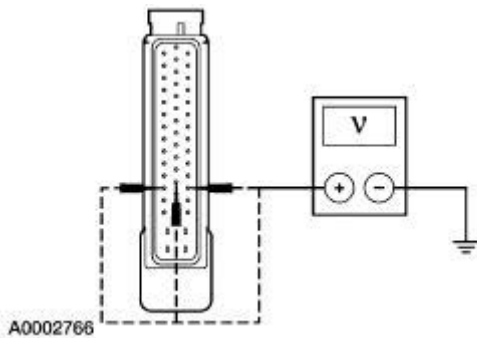


Redundant/Secondary Pressure Transducer C148

4



5



5 Measure the voltage between stability assist module C155 pins, harness side, and ground, as follows:

Stability Assist Module C155	Circuit
Pin 45	9-CF65 (BN/WH)
Pin 28	8-CF65 (WH/VT)
Pin 12	7-CF65 (YE/VT)

● Is any voltage present?

→ **Yes**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

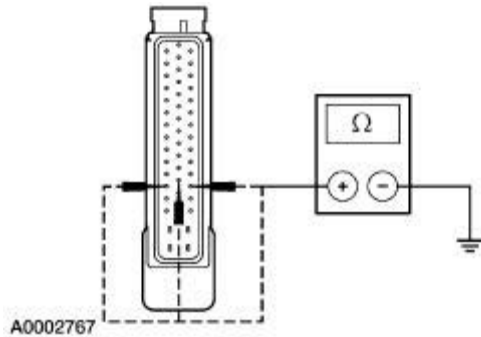
→ **No**
GO to N2.

N2 CHECK REDUNDANT/SECONDARY PRESSURE TRANSDUCER CIRCUITRY FOR SHORT TO GROUND

1



2



2

Measure the resistance between stability assist module C155 pins, harness side, and ground, as follows:

Stability Assist Module C155	Circuit
Pin 45	9-CF65 (BN/WH)
Pin 28	8-CF65 (WH/VT)
Pin 12	7-CF65 (YE/VT)

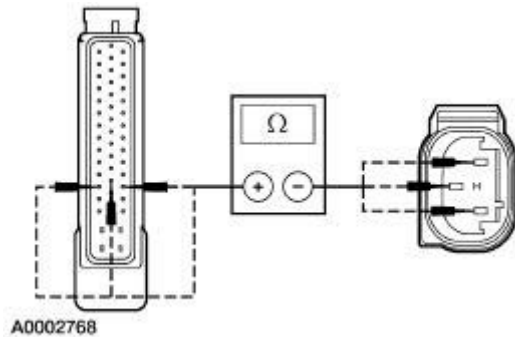
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to N3.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

N3 CHECK REDUNDANT/SECONDARY PRESSURE TRANSDUCER CIRCUITRY FOR AN OPEN

1



1

Measure the resistance between stability assist module C155 pins, harness side and redundant/secondary pressure transducer C148 pins, harness side as follows:

Stability Assist Module C155	Redundant/Secondary-Pressure-Transducer-C148	Circuit
Pin 45	Pin 1	9-CF65 (BN/WH)
Pin 28	Pin 2	8-CF65 (WH/VT)
Pin 12	Pin 3	7-CF65 (YE/VT)

● Is the resistance less than 5 ohms?

→ **Yes**
GO to N4.

→ **No**
REPAIR the circuit in question. CLEAR

the DTCs. REPEAT the self-test.

N4 CHECK THE STABILITY ASSIST MODULE OUTPUT

1

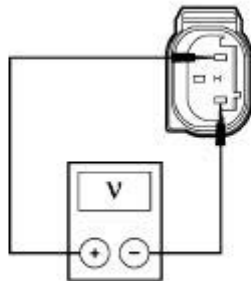


Stability Assist Module C155

2



3



A0002764

3 Measure the voltage between redundant/secondary pressure transducer C148 pin 3, circuit 7-CF65 (YE/VT), harness side, and redundant/secondary pressure transducer C148 pin 1, circuit 9-CF65 (BN/WH), harness side.

● Is the voltage approximately 5 volts?

→ Yes
GO to N5.

→ No
INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. REPEAT the self-test.

N5 CHECK THE REDUNDANT/SECONDARY PRESSURE TRANSDUCER OUTPUT

1



Redundant/Secondary Pressure Transducer C148

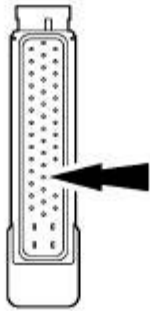
2



Stability Assist Module C155

3

3 Back out the stability assist module C155 pin 28, circuit 8-CF65 (WH/VT), harness side.



A0002769

4

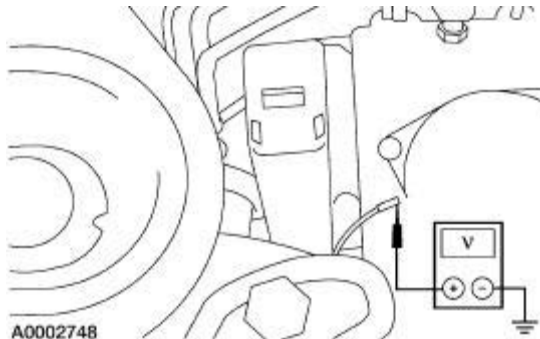


Stability Assist Module C155

5



6



A0002748


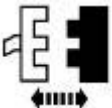
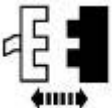

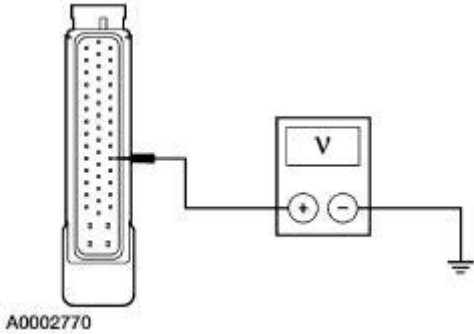


6 Measure the voltage between stability assist module back out pin 28, circuit 8-CF65 (WH/VT), harness side, and ground, while depressing and releasing the brake pedal.

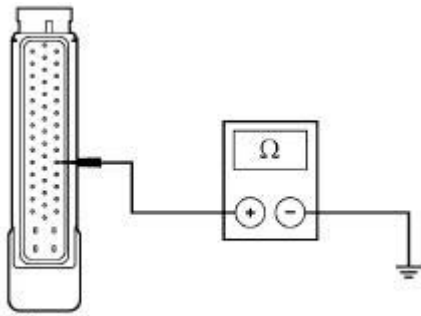
- Is the voltage between 0.125 and 0.375 volt with the brake pedal released and between 0.125 and 5 volts with the brake pedal depressed?

→ **Yes**
INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. REPEAT the self-test.

→ **No**
INSTALL a new secondary pressure transducer. REFER to Transducer—Secondary. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.

PINPOINT TEST O: DTC C1730 — REFERENCE VOLTAGE OUT OF RANGE (+5 V)

CONDITIONS	DETAILS/RESULTS/ACTIONS
O1 CHECK CIRCUIT 7-CF64 (YE/BK) FOR SHORT TO BATTERY	
<p>1 </p> <p>2  Stability Assist Module C155</p> <p>3  Main/Primary Pressure Transducer C147</p> <p>4 </p> <p>5  A0002770</p>	<p>5 Measure the voltage between stability assist module C155 pin 10, circuit 7-CF64 (YE/BK), harness side, and ground.</p> <p>● Is any voltage present?</p> <p>→ Yes REPAIR the circuit. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.</p> <p>→ No GO to <u>O2</u>.</p>
O2 CHECK CIRCUIT 7-CF64 (YE/BK) FOR SHORT TO GROUND	
<p>1 </p> <p>2 </p>	<p>2 Measure the resistance between stability assist module C155 pin 10, circuit 7-CF64 (YE/BK), harness side, and ground.</p>



A0002771

- Is the resistance greater than 10,000 ohms?

- **Yes**
GO to Q3.
- **No**
REPAIR the circuit. CLEAR the DTC. RECALIBRATE the stability assist module. REPEAT the self-test.

Q3 CHECK CIRCUIT 7-CF65 (YE/VT) FOR SHORT TO BATTERY

1

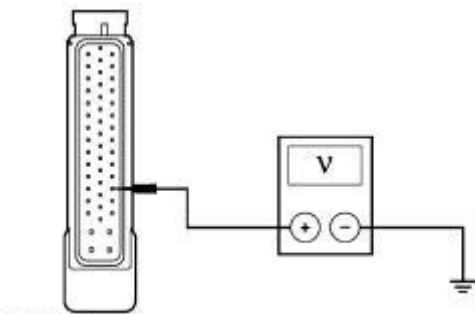


Redundant/Secondary Pressure Transducer C148

2



3



A0002772

- 3 Measure the voltage between stability assist module C155 pin 12, circuit 7-CF65 (YE/VT), harness side, and ground.

- Is any voltage present?

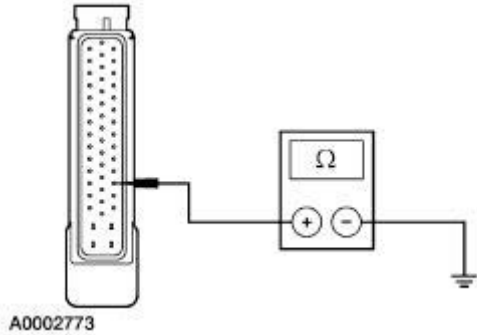
- **Yes**
REPAIR the circuit. CLEAR the DTC. RECALIBRATE the stability assist module. REPEAT the self-test.
- **No**
GO to Q4.

Q4 CHECK CIRCUIT 7-CF65 (YE/VT) FOR SHORT TO GROUND

1



2



2

Measure the resistance between stability assist module C155 pin 12, circuit 7-CF65 (YE/VT), harness side, and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to O5.

→ **No**
REPAIR the circuit. CLEAR the DTC. RECALIBRATE the stability assist module. REPEAT the self-test.

O5 CHECK CIRCUIT 7-CF66 (YE/BU) FOR SHORT TO BATTERY

1

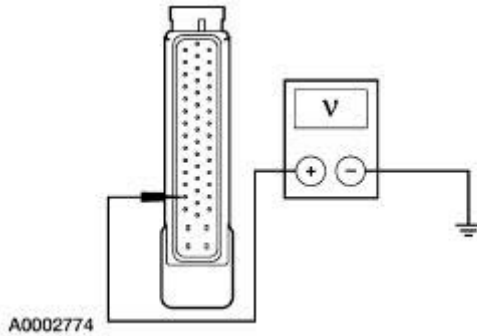


Lateral Accelerometer C244

2



3



3

Measure the voltage between stability assist module C155 pin 46, circuit 7-CF66 (YE/BU), harness side, and ground.

- Is any voltage present?

→ **Yes**
REPAIR the circuit. CLEAR the DTC.

RECALIBRATE the stability assist module. REPEAT the self-test.

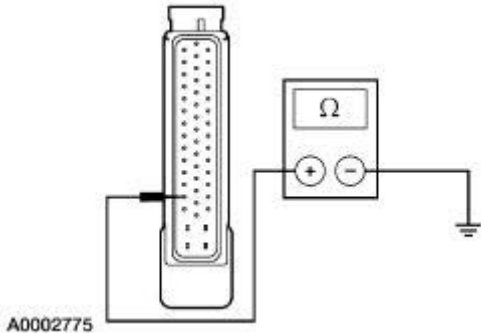
→ **No**
GO to O6.

O6 CHECK CIRCUIT 7-CF66 (YE/BU) FOR SHORT TO GROUND

1



2



2 Measure the resistance between stability assist module C155 pin 46, circuit 7-CF66 (YE/BU), harness side, and ground.

● **Is the resistance greater than 10,000 ohms?**

→ **Yes**
GO to O7.

→ **No**
REPAIR the circuit. CLEAR the DTC. RECALIBRATE the stability assist module. REPEAT the self-test.

O7 CHECK CIRCUIT 7-CF67 (YE/RD) FOR SHORT TO BATTERY

1



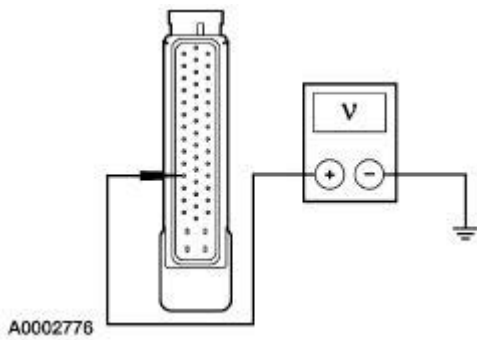
Yaw Rate Sensor C245

2



3

3 Measure the voltage between stability assist module C155 pin 44, circuit 7-CF67 (YE/RD), harness side, and ground.

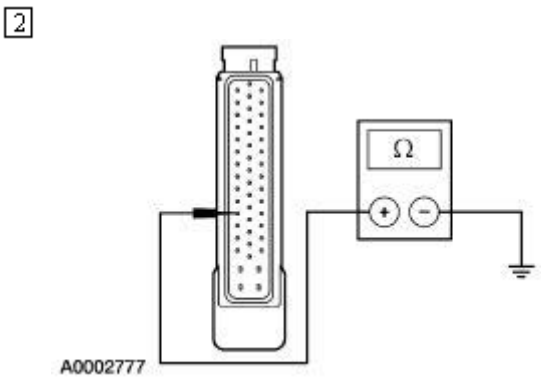
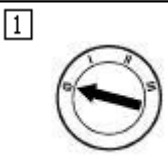


● Is any voltage present?

→ **Yes**
REPAIR the circuit. CLEAR the DTC. RECALIBRATE the stability assist module. REPEAT the self-test.

→ **No**
GO to O8.

O8 CHECK CIRCUIT 7-CF66 (YE/BU) FOR SHORT TO GROUND



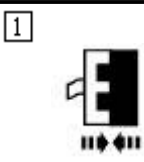
2 Measure the resistance between stability assist module C155 pin 44, circuit 7-CF67 (YE/RD), harness side, and ground.

● Is the resistance greater than 10,000 ohms?




→ **Yes**
GO to O9.

→ **No**
REPAIR the circuit. CLEAR the DTC. RECALIBRATE the stability assist module. REPEAT the self-test.

O9 CHECK THE STABILITY ASSIST MODULE



Stability Assist Module C155




<p>2 </p> <p>3 </p> <p>Clear DTCs</p> <p>4 </p> <p>Retrieve DTCs</p>	<ul style="list-style-type: none"> ● Is DTC C1730 retrieved? <p>→ Yes INSTALL a new stability assist module. REFER to <u>Anti-Lock Brake System (ABS) Module—Stability Assist</u>. REPEAT the self-test.</p> <p>→ No GO to <u>O10</u>.</p>
---	--

O10 CHECK THE STABILITY ASSIST COMPONENTS




	<p>1 Reconnect the lateral accelerometer C244, yaw rate sensor C245, main/primary pressure transducer C147, and redundant/secondary pressure transducer C148 one at a time while clearing the DTCs and retrieving the DTCs in between each component being reconnected.</p> <ul style="list-style-type: none"> ● Is DTC C1730 retrieved? <p>→ Yes INSTALL a new component as necessary. CLEAR the DTCs. RECALIBRATE the stability assist module. REPEAT the self-test.</p> <p>→ No System is OK.</p>
--	--




PINPOINT TEST P: DTC C1960 — DRIVER BRAKE APPLY CIRCUIT FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
P1 CHECK FOR OTHER DTCs	


<p>1 </p> <p>2  Clear DTCs</p> <p>3  Retrieve DTCs</p>	<p>● Is DTC C1960 retrieved?</p> <p>→ Yes INSTALL a new REM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No If a different DTC is retrieved, GO to the Stability Assist Module Diagnostic Trouble Code (DTC) Index.</p> <p>If no DTCs are retrieved, system is OK.</p>
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PINPOINT TEST Q: THE YELLOW ABS WARNING INDICATOR DOES NOT SELF-CHECK

CONDITIONS	DETAILS/RESULTS/ACTIONS
Q1 CHECK THE YELLOW ANTI-LOCK BRAKE WARNING INDICATOR	
<p>1 </p> <p>2  Stability Assist Module C155</p> <p>3 </p>	<p>● Is the yellow anti-lock brake warning indicator illuminated?</p>

	<p>→ Yes GO to <u>Q2</u>.</p> <p>→ No REFER to <u>Section 413-01</u>.</p>
Q2 CHECK PROVE OUT	
<p>1 </p> <p>2  Stability Assist Module C162</p> <p>3 </p>	<p>● Does the yellow anti-lock brake warning indicator prove out for three seconds and then turn off?</p> <p>→ Yes The yellow anti-lock brake warning indicator is working correctly. TEST the system for normal operation.</p> <p>→ No INSTALL a new stability assist module. REFER to <u>Anti-Lock Brake System (ABS) Module—Stability Assist</u>. TEST the system for normal operation.</p>

PINPOINT TEST R: THE TRACTION CONTROL IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
R1 CHECK FOR DTCS	
<p>1  NGS Tester</p>	<p>2 Retrieve and document continuous DTCs.</p> <p>● Are any DTCs retrieved?</p> <p>→ Yes GO to the Stability Assist Module Diagnostic Trouble Code (DTC) Index.</p>

→ **No**
GO to R2.

R2 CHECK THE ABS OPERATION

- 1 Test drive the vehicle and carry out several anti-lock stops.
- **Does the ABS operate correctly?**
- **Yes**
GO to R3.
- **No**
GO to the Symptom Chart.

R3 CHECK THE TRACTION CONTROL OFF INPUT TO THE STABILITY ASSIST MODULE FOR SHORT TO POWER

1



2

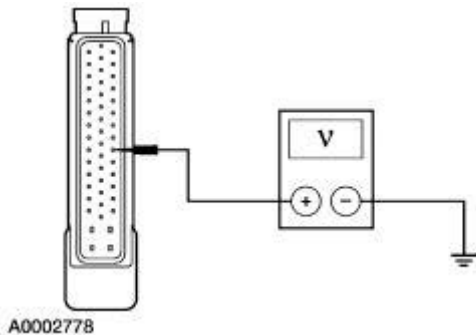


Stability Assist Module C155

3



4




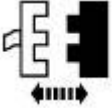

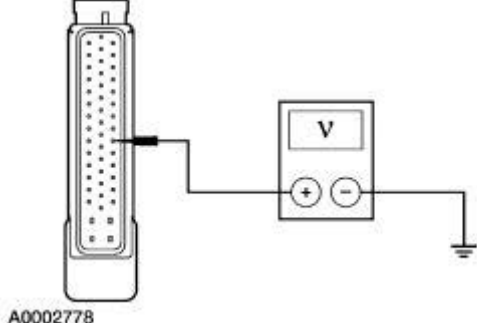
- 4 Measure the voltage between stability assist module C155 pin 9, circuit 8-CF54 (BK/GN), harness side, and ground.

- **Is any voltage present?**


→ **Yes**
GO to R4.

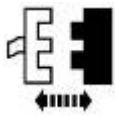
→ **No**
INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist . TEST the system for normal operation.

R4 CHECK CIRCUIT 8-CF54 (BK/GN) FOR SHORT TO POWER

<p>1 </p> <p>2  Traction Control Switch C308</p> <p>3 </p> <p>4  A0002778</p>	<p>4 Measure the voltage between stability assist module C155 pin 9, circuit 8-CF54 (BK/GN), harness side, and ground.</p> <ul style="list-style-type: none"> • Is any voltage present? <p>→ Yes REPAIR the circuit. TEST the system for normal operation.</p> <p>→ No INSTALL a new traction control actuator. REFER to <u>Traction Control Actuator—Advance Trac.</u> TEST the system for normal operation.</p>
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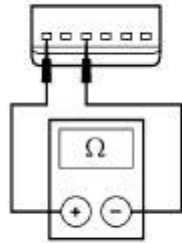
PINPOINT TEST S: THE STABILITY ASSIST/TRACTION CONTROL SWITCH INDICATOR IS NEVER/ALWAYS ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>S1 CHECK THE TRACTION CONTROL SWITCH</p> <p>1 </p> <p>2</p>	



Traction Control Switch C308

3



A0002337

3

Measure the resistance between traction control switch pin 1 (component side), and traction control switch pin 3 (component side).

● Is the resistance approximately 32 ohms?

→ **Yes**
GO to S2.

→ **No**
INSTALL a new traction control actuator. REFER to Traction Control Actuator—Advance Trac . CLEAR the DTC. REPEAT the self-test.

S2 CHECK CIRCUIT 31S-CF45 (BK/GN) FOR SHORT TO POWER

1

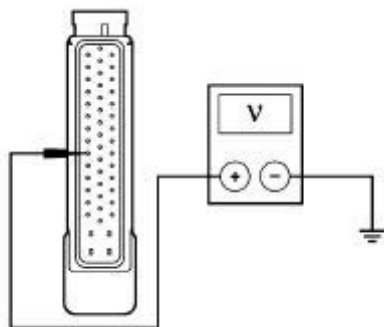


Stability Assist Module 155

2



3



A0002779

3

Measure the voltage between stability assist module C155 pin 42, circuit 31S-CF45 (BK/GN), harness side, and ground.

● Is any voltage present?

→ **Yes**

REPAIR the circuit. CLEAR the DTC.
REPEAT the self-test.

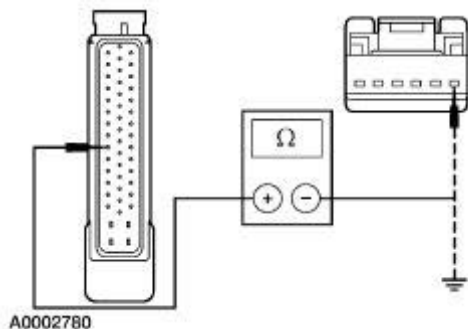
→ **No**
GO to S3.

S3 CHECK CIRCUIT 31S-CF45 (BK/GN)

1



2



2


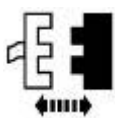
Measure the resistance between stability assist module C155 pin 42, circuit 31S-CF45 (BK/GN), harness side and traction control switch C308 pin 1, circuit 31S-CF45 (BK/GN), harness side; and between stability assist module C155 pin 42, circuit 31S-CF45 (BK/GN), harness side and ground.

- **Is the resistance less than 5 ohms between the stability assist module and traction control switch; and greater than 10,000 ohms between stability assist module and ground?**

→ **Yes**
INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. CLEAR the DTC. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTC. REPEAT the self-test.

PINPOINT TEST T: THE STABILITY ASSIST SYSTEM CANNOT BE DISABLED

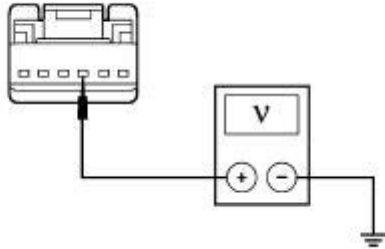
CONDITIONS	DETAILS/RESULTS/ACTIONS
T1 CHECK CIRCUIT 15-CF54 (GN/WH) FOR AN OPEN	
<p>1</p>  <p>2</p> 	

Traction Control Switch C308

3



4



A0001933

4 Measure the voltage between traction control switch C308 pin 3, circuit 15-CF54 (GN/WH), harness side, and ground.

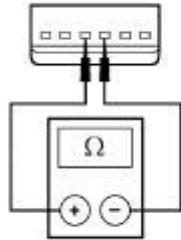
• Is the voltage greater than 10 volts?

→ **Yes**
GO to T2.

→ **No**
REPAIR circuit 15-CF54 (GN/WH) or circuit 15-DA5 (GN/OG). TEST the system for normal operation.

T2 CHECK THE TRACTION CONTROL SWITCH

1



A0001934

1 Measure the resistance between traction control switch pin 3 (component side), and traction control switch pin 4 (component side), while depressing the traction control switch.

• Is the resistance less than 5 ohms?

→ **Yes**
GO to T3.

→ **No**
INSTALL a new traction control actuator. REFER to Traction Control Actuator—Advance Trac. TEST the system for normal operation.

T3 CHECK CIRCUIT 8-CF54 (WH/VT) FOR AN OPEN

1

2

Stability Assist Module C155

3

A0002781


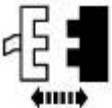
3 Measure the resistance between stability assist module pin 9, circuit 8-CF54 (WH/VT), harness side, and traction control switch C308 pin 4, circuit 8-CF54 (WH/VT), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
 INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. TEST the system for normal operation.

→ **No**
 REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST U: THE STABILITY ASSIST INDICATOR DOES NOT SELF-CHECK

CONDITIONS	DETAILS/RESULTS/ACTIONS
U1 CHECK THE STABILITY ASSIST INDICATOR	
<p>1</p>  <p>2</p>  <p>Stability Assist Module C155</p> <p>3</p>	



● Is the stability assist indicator illuminated?

→ **Yes**
GO to U2.

→ **No**
REFER to Section 413-01.

U2 CHECK PROVE OUT

1



2



Stability Assist
Module C162

3




● Does the stability assist indicator prove out for three seconds and then turn off?

→ **Yes**
The stability assist indicator is working correctly. TEST the system for normal operation.

→ **No**
INSTALL a new stability assist module. REFER to Anti-Lock Brake System (ABS) Module—Stability Assist. TEST the system for normal operation.

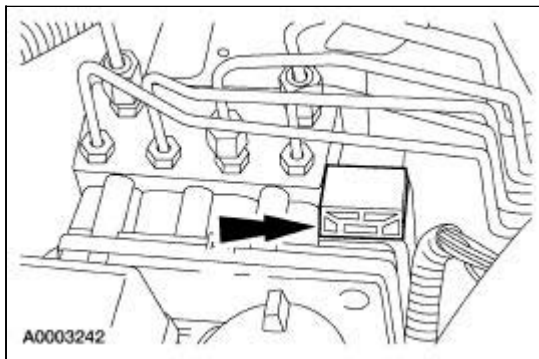
Hydraulic Control Unit (HCU)

Removal and Installation

 **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

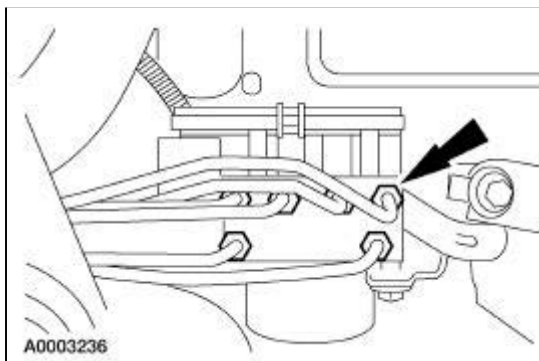
 **CAUTION:** Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the electrical connector by lifting up on the release tab.

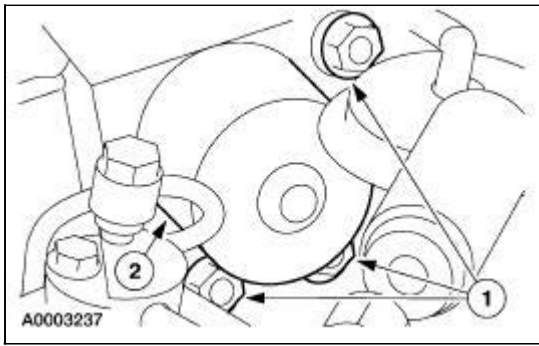



3. **NOTE:** Plug each open port to prevent any brake fluid from spilling.

Disconnect the brake lines from the hydraulic control unit (HCU).




4. Remove the HCU.
 1. Remove the bolts.
 2. Remove the HCU.



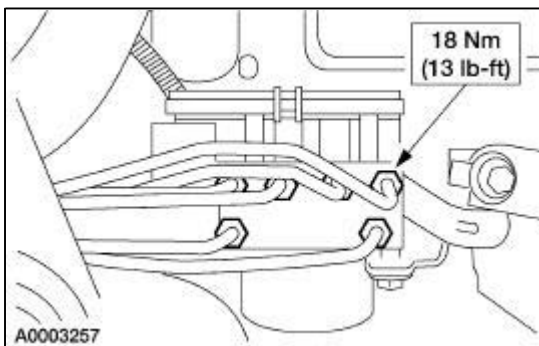
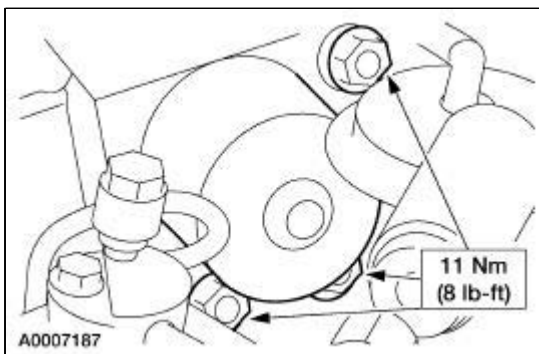
5.  **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

 **CAUTION:** Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

 **CAUTION:** After the HCU is installed, it is necessary to bleed the hydraulic brake system. For additional information, refer to [Section 206-00](#).

NOTE: When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 mi) or more to relearn the strategy.

To install, reverse the removal procedure.



REMOVAL AND INSTALLATION

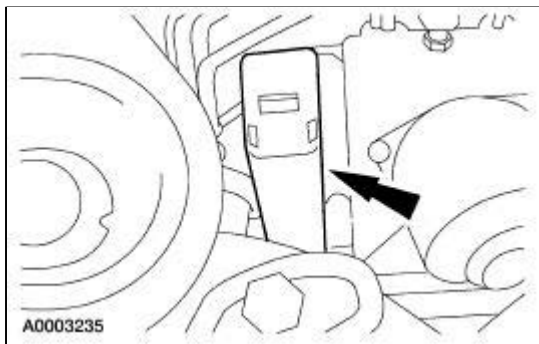
Anti-Lock Brake System (ABS) Module — Stability Assist

Removal

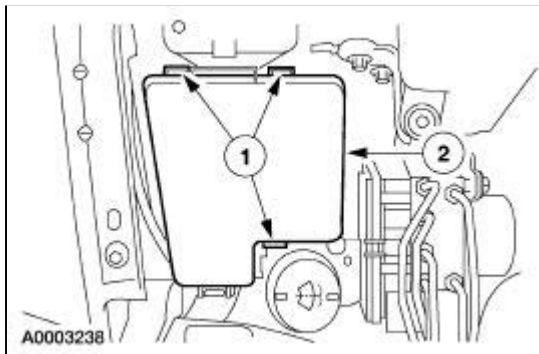


CAUTION: Before the module is removed, it is necessary to upload the module configuration information to the New Generation STAR (NGS) tester. For additional information, refer to [Section 418-01](#).

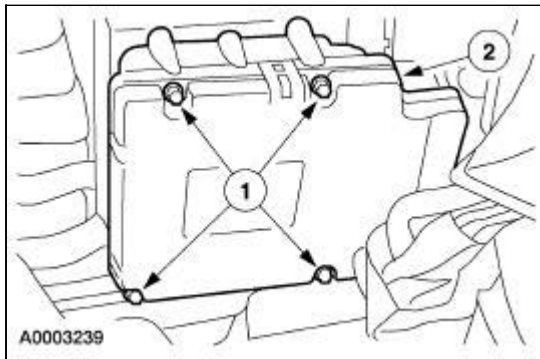
1. Disconnect the battery ground cable.
2. Disconnect the anti-lock brake control module electrical connector by lifting up on the release tab.



3. Position aside the underhood auxiliary junction box (AJB).
 1. Release the underhood AJB clips.
 2. Position the underhood AJB aside.



4. Remove the stability assist control module.
 1. Remove the bolts.
 2. Remove the control module.

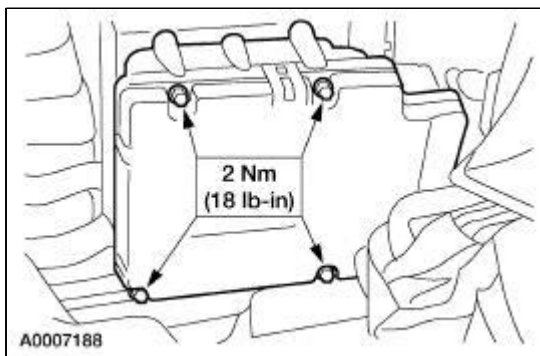


Installation

⚠ CAUTION: Once the new module is installed, it is necessary to download the module configuration information from the New Generation STAR (NGS) Tester into the module. For additional information, refer to [Section 418-01](#).

NOTE: When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 mi) or more to relearn the strategy.

1. To install, reverse the removal procedure.



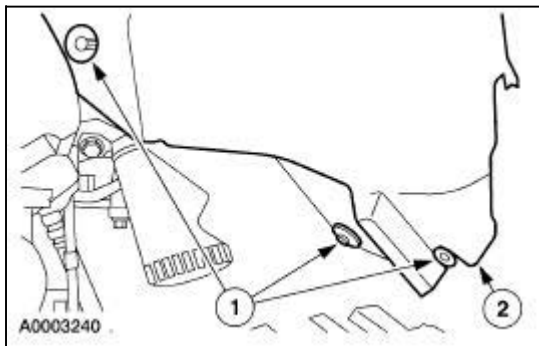
Front Wheel Speed Sensor

Material

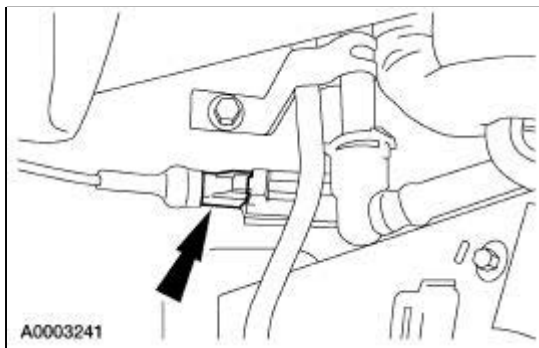
Item	Specification
RTV Silicone Sealant FSTZ-19G204-AB (Canada CXC-114A)	NAVSTR Sealer

Removal and Installation

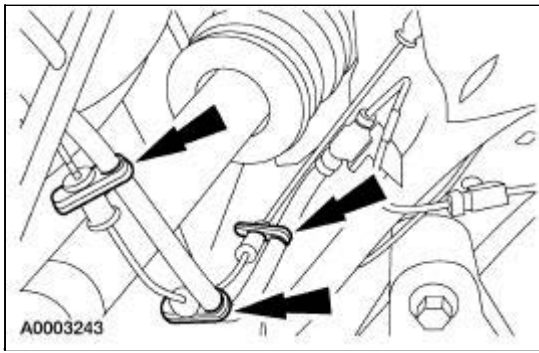
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Position the inner splash shield aside.
 1. Remove the pin-type retainers.
 2. Position the inner splash shield aside.



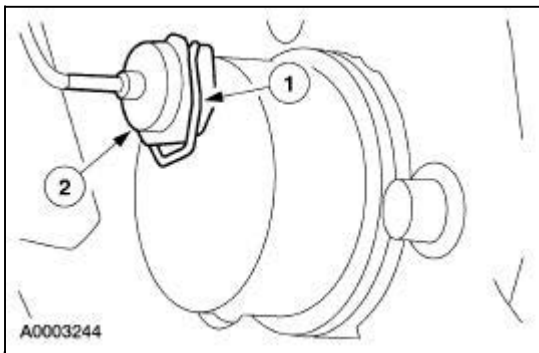
3. Disconnect the anti-lock brake sensor electrical connector.



4. Remove the anti-lock brake sensor harness from the brake hose clips.



5. Remove the anti-lock brake sensor.
 1. Remove the anti-lock brake sensor clip.
 2. Remove the anti-lock brake sensor.



6. **NOTE:** Make sure the anti-lock brake sensor is fully seated before installation of the new clip.

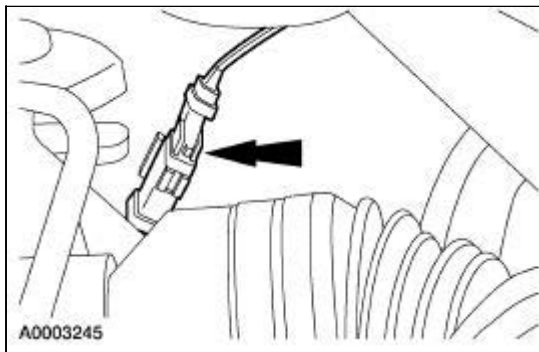
To install, reverse the removal procedure.

- Apply a 2.5 mm (0.1 in) bead of silicone sealant to the outside diameter of the anti-lock brake sensor.
-

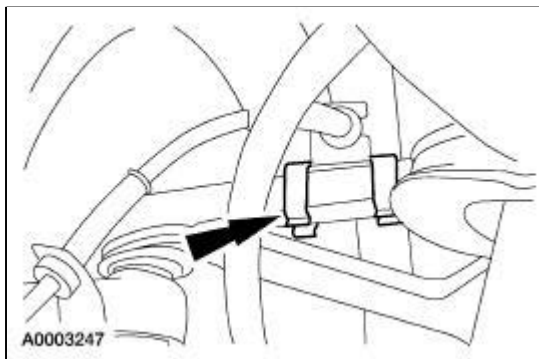
Rear Wheel Speed Sensor

Removal and Installation

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Disconnect the rear anti-lock brake sensor electrical connector.



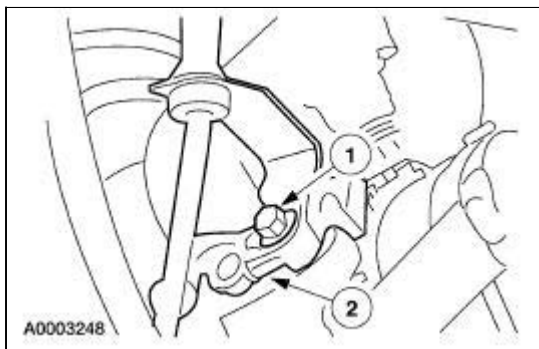
3. Remove the rear anti-lock brake sensor harness from the control arm clips.



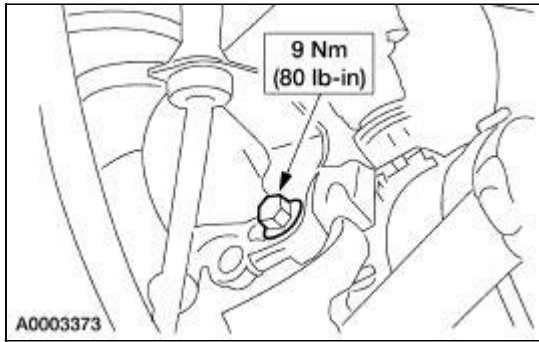
4. **NOTE:** Clean off dirt and foreign material that may have collected around the rear anti-lock brake sensor before removal.

Remove the rear anti-lock brake sensor.

1. Remove the anti-lock brake sensor bolt.
2. Remove the anti-lock brake sensor.



- To install, reverse the removal procedure.

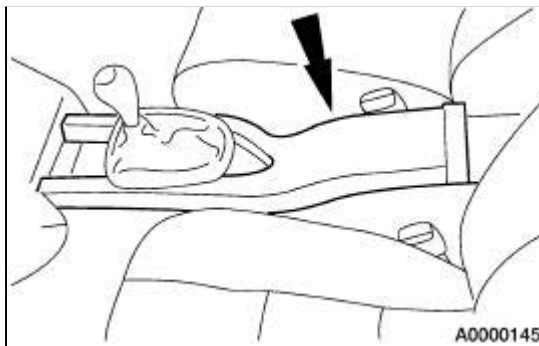


Yaw Rate Sensor

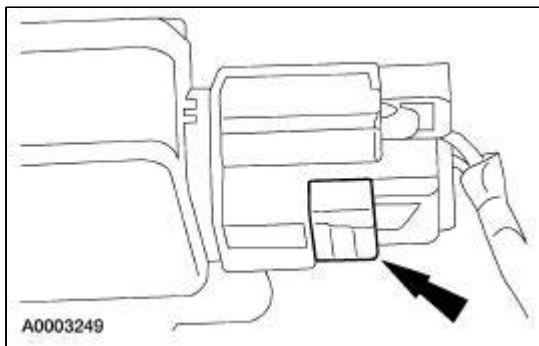
Removal

NOTE: The stability assist module needs to be recalibrated whenever a component is disconnected, moved, or a new component is installed. For additional information regarding the recalibration procedure and when the recalibration procedure should be carried out, refer to Principles of Operation. For additional information regarding the module configuration procedure, refer to [Section 418-01](#).

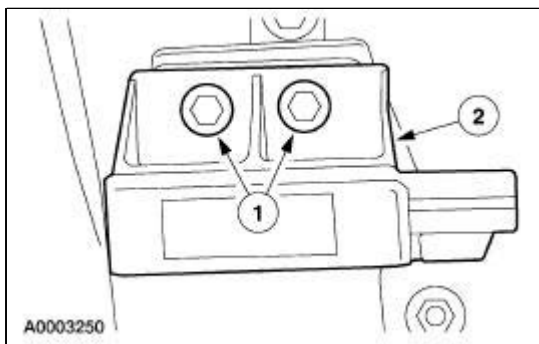
1. Remove the floor console. For additional information, refer to [Section 501-12](#).
2. Remove the center A/C duct.



3. Disconnect the yaw rate sensor electrical connector.



4. Remove the yaw rate sensor.
 1. Remove the yaw rate sensor bolts.
 2. Remove the yaw rate sensor.

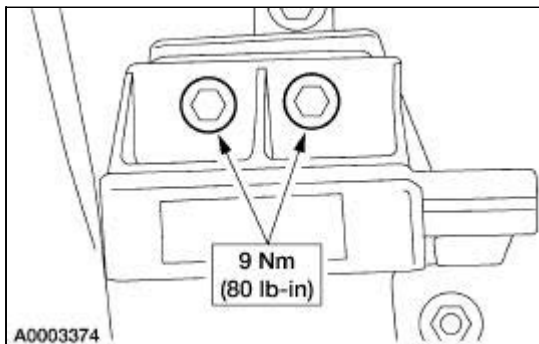


Installation

NOTE: The stability assist module needs to be recalibrated whenever a component is disconnected, moved, or a new component is installed. For additional information regarding the recalibration procedure and when the recalibration procedure should be carried out, refer to Principles of Operation. For additional information regarding the module configuration procedure, refer to [Section 418-01](#).

NOTE: The yaw rate sensor is positioned with the connector pointed to the left side of the vehicle. Be sure to mount the sensor in this orientation during the installation procedure.

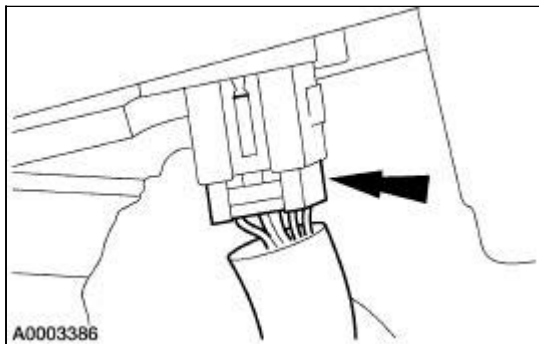
1. To install, reverse the removal procedure.



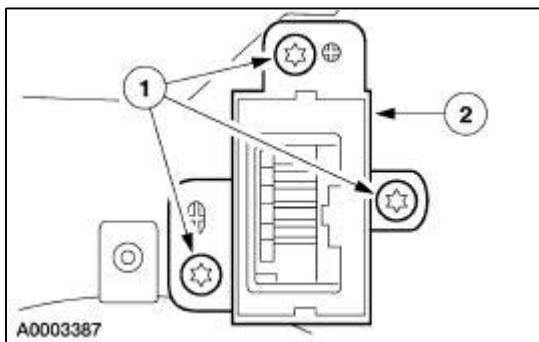
Traction Control Actuator —Advance Trac

Removal

1. Remove the floor console finish panel. For additional information, refer to [Section 501-12](#).
2. Disconnect the Advance Trac control switch electrical connector.



3. Remove the Advance Trac control switch.
 1. Remove the Advance Trac control switch screws.
 2. Remove the Advance Trac control switch.



Installation

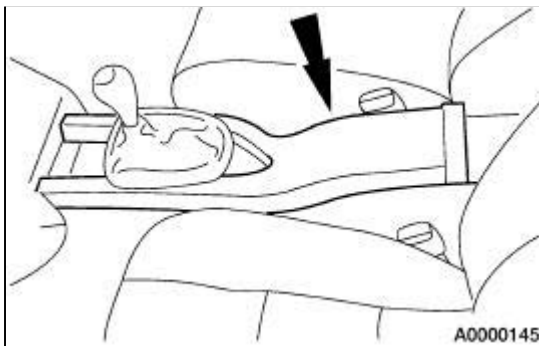
1. To install, reverse the removal procedure.

Accelerometer

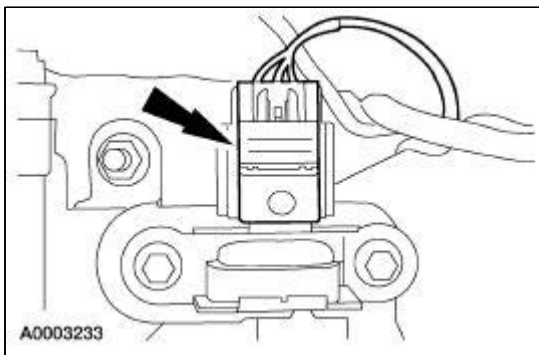
Removal

NOTE: The stability assist module needs to be recalibrated whenever a component is disconnected, moved, or a new component is installed. For additional information regarding the recalibration procedure and when the recalibration procedure should be carried out, refer to Principles of Operation. For additional information regarding the module configuration procedure, refer to [Section 418-01](#).

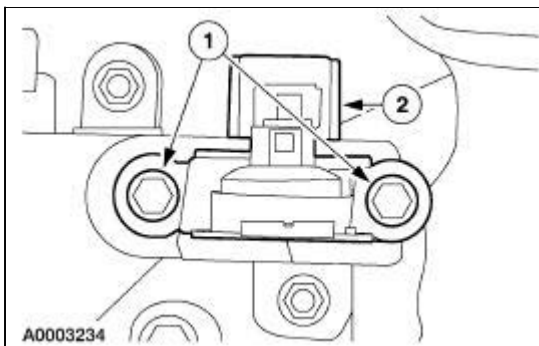
1. Remove the floor console. For additional information, refer to [Section 501-12](#).
2. Remove the console A/C duct.



3. Disconnect the lateral accelerometer electrical connector.



4. Remove the lateral accelerometer.
 1. Remove the lateral accelerometer bolts.
 2. Remove the lateral accelerometer.

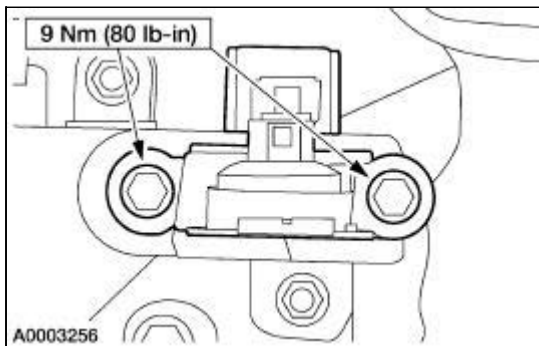


Installation

NOTE: The stability assist module needs to be recalibrated whenever a component is disconnected, moved, or a new component is installed. For additional information regarding the recalibration procedure and when the recalibration procedure should be carried out, refer to Principles of Operation. For additional information regarding the module configuration procedure, refer to [Section 418-01](#).

NOTE: The accelerometer is positioned with the connector pointed to the left side of the vehicle. Be sure to mount the accelerometer in this orientation during the installation procedure.

1. To install, reverse the removal procedure.

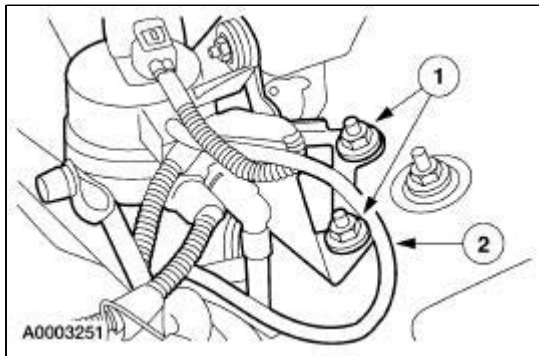


Transducer —Primary

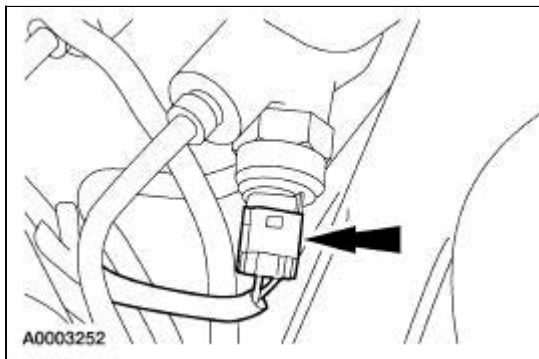
Removal

NOTE: The stability assist module needs to be recalibrated whenever a component is disconnected, moved, or a new component is installed. For additional information regarding the recalibration procedure and when the recalibration procedure should be carried out, refer to Principles of Operation. For additional information regarding the module configuration procedure, refer to [Section 418-01](#).

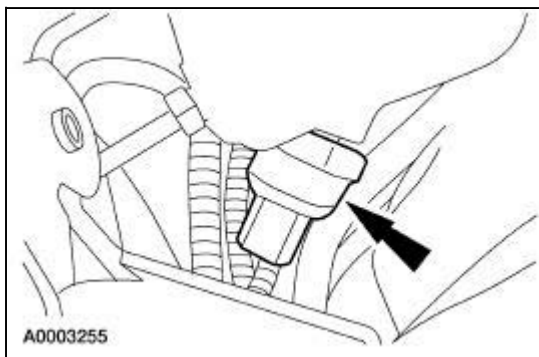
1. Position the vapor management valve aside.
 1. Remove the vapor management valve bracket bolts.
 2. Position the vapor management valve aside.



2. Disconnect the main pressure transducer electrical connector.



3. Remove the main pressure transducer.



Installation

NOTE: The stability assist module needs to be recalibrated whenever a component is disconnected, moved, or a new component is installed. For additional information regarding the recalibration procedure and when the recalibration procedure should be carried out, refer to Principles of Operation. For additional information regarding the module configuration procedure, refer to Section 418-01 .

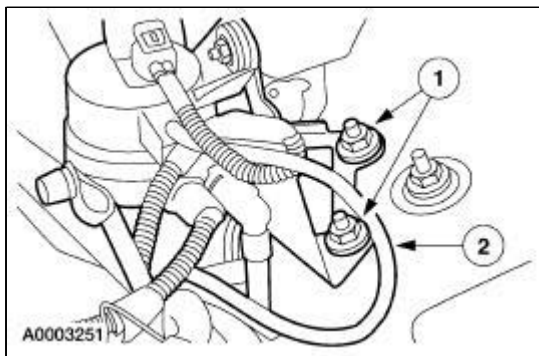
1. To install, reverse the removal procedure.
-

Transducer —Secondary

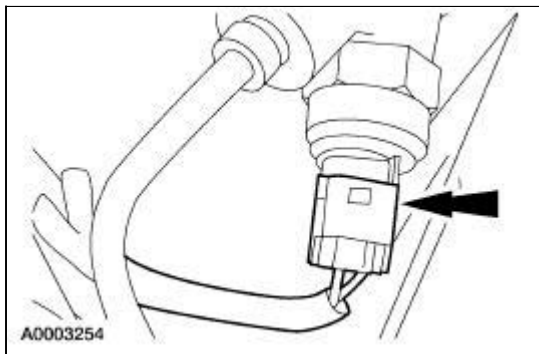
Removal

NOTE: The stability assist module needs to be recalibrated whenever a component is disconnected, moved, or a new component is installed. For additional information regarding the recalibration procedure and when the recalibration procedure should be carried out, refer to Principles of Operation. For additional information regarding the module configuration procedure, refer to [Section 418-01](#).

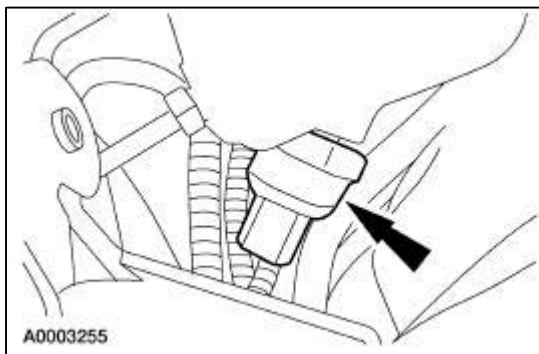
1. Position the vapor management valve aside.
 1. Remove the vapor management valve bracket bolts.
 2. Position the vapor management valve aside.



2. Disconnect the redundant pressure transducer electrical connector.



3. Remove the redundant pressure transducer.



Installation

NOTE: The stability assist module needs to be recalibrated whenever a component is disconnected, moved, or a new component is installed. For additional information regarding the recalibration procedure and when the recalibration procedure should be carried out, refer to Principles of Operation. For additional information regarding the module configuration procedure, refer to Section 418-01 .

1. To install, reverse the removal procedure.
-

General Specifications

Item	Specification
Belt Tension ¹	
Limit mm (in)	16 (0.63)
New belt mm (in)	8-10 (0.31-0.39)
Used belt mm (in)	10-12 (0.39-0.47)
Power Steering Gear Operational Specifications	
Type	Rack and Pinion
Ratio	18:1
Static steering wheel turning effort Nm (lb-in)	3.7 (33)
Turning effort kg (lbs)	1.9 (4.1)
Turns of steering wheel ^a	2.9
Power Steering Reservoir	
Air purge vacuum kPa (in-Hg)	68-85 (20-25)
Power Steering Pump	
Flow	2.4 ± 0.2 gpm @ 50 psi & 1,500 rpm
Minimum capacity	1.4 gpm @ 750 psi @ 500 rpm
Relief pressure psi	1,400–1,530
Lubricants	
Motorcraft MERCON® Multi-Purpose (ATF) Transmission Fluid XT-2-QDX	MERCON®

¹ Power Steering Pump Belt Deflection (98 N [22 lb] Applied Force)

^a Lock to Lock-Linkage Disconnected

Steering System





The power steering system consists of the following components:

- power steering pressure lower hose (3F524)
 - power steering pressure hose (3E576)
 - power steering pump (3A674)
 - power steering pump reservoir (3R700)
 - power steering reservoir pump hose (3E525)
 - power steering return hose (3A713)
 - steering gear (3504)
-

Steering System

Refer to Wiring Diagrams Section [211-00](#) for schematic and connector information.

Special Tool(s)

 <p>ST2332-A</p>	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool
 <p>ST1477-A</p>	Power Steering Analyzer 014-00207 or equivalent
 <p>ST1396-A</p>	Dial Thermometer 0-220°F 023-R0007 or equivalent
 <p>ST1137-A</p>	73 III Automotive Meter 105-R0057 or equivalent

Principles of Operation

Variable Assist Power Steering (VAPS)

The VAPS system controls the level of power assistance available to the driver based on vehicle speed. Below 3.2 km/h (2 mph), full power steering assist is provided to lessen steering efforts and increase maneuverability. Between 3.2 km/h (2 mph) and 191 km/h (119 mph), steering assist will decrease gradually at a calibrated rate to raise steering efforts for increased directional stability and greater road feel. Above 191 km/h (119 mph), steering assist is constant.

The front electronic module (FEM) outputs a pulse-width-modulated (PWM) current to the control valve actuator. The control valve actuator controls the hydraulic valve that determines the amount of hydraulic assist provided to the steering gear. The amount of assistance provided varies with the control valve actuator current, which is based on vehicle speed according to a look-up table internal to the FEM. The FEM pulse-width modulates the control valve actuator current to provide the desired amount of assistance. The amount of hydraulic steering assistance provided by the VAPS subsystem is proportional to the average control valve current.

The vehicle speed is provided to the FEM through the standard corporate protocol (SCP) network from the anti-lock brake system (ABS).

The engine rpm is provided to the FEM through the SCP network from the powertrain control module (PCM). The FEM uses the engine rpm to determine if the engine is running. The FEM will only output control valve actuator current when the engine is running to minimize noise, vibration, or harshness when the engine is off. The FEM will assume the engine is running only if the engine rpm is greater than 100 rpm.

Upon engine start, the FEM will provide a 200 millisecond full-on pulse followed by a 150 millisecond full-off pulse to the control valve actuator. Normal VAPS system operation will begin after this cleaning stroke is complete. In an event that the rpm signal is invalid from the PCM (less than 100 rpm), and the vehicle speed is less than 1.6 km/h (1 mph), the VAPS system will not carry out the cleaning stroke or apply current to the control valve actuator. When the engine speed exceeds 100 rpm, the system carries out the cleaning stroke and begins applying calibrated current to the actuator.

Inspection and Verification



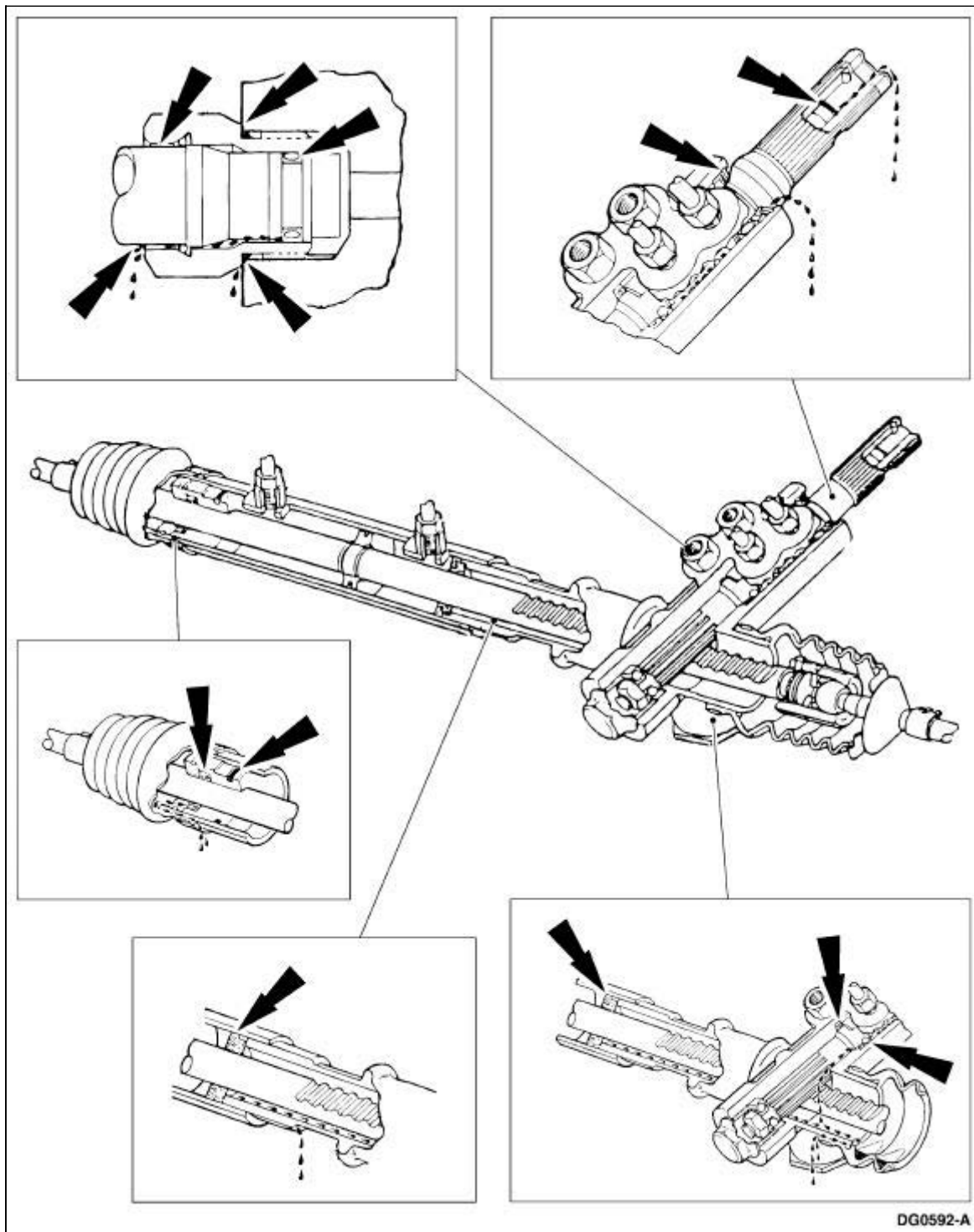
CAUTION: Do not hold the steering wheel (3600) at the stops for an extended amount of time. Damage to the power steering pump (3A674) can result.

NOTE: Make the following preliminary checks before repairing the steering system:

NOTE: The FEM must be reconfigured upon replacement; refer to [Section 418-01](#).

1. Verify the customer concern by operating the steering system.
2. Inspect Tires
 - Check the tire pressure. For additional information, refer to the Vehicle Certification (VC) label.
 - Verify that all tires are sized to specification. For additional information, refer to [Section 204-04](#).
 - Check the tires for damage or uneven wear. For additional information, refer to [Section 204-04](#).
3. Belt and Tensioner Check
 - Refer to [Section 303-05](#) for diagnosis and testing of the accessory drive system.
4. Fluid Level Check
 - Verify that the power steering fluid level is within the appropriate hot or cold range on the dipstick. Add MERCON® Multi-Purpose (ATF) Transmission Fluid XT-02-QDX or MERCON® equivalent.
5. Air Bleeding
 - Verify that there is no air in the power steering system. Run the engine (6007) until it reaches normal operating temperature. Turn the steering wheel to the left and right several times without hitting the stops. If any air bubbles are present, refer to Purging in this section.

External Leak Check — Typical Power Rack-and-Pinion Steering Gear



6. External Leak Check

- With the ignition switch at OFF, wipe off the power steering pump, power steering pressure hose (3A719), power steering return hose (3A713), power steering fluid cooler and hose assembly and steering gear (3504).
- With the engine running, turn the steering wheel from stop-to-stop several times. Do not hold steering wheel at stops. Check for leaks. Repair as necessary if leaks are observed.

7. Turning Effort Check

- Refer to Turning Effort Test under Component Tests in this section.

8. Visually inspect for obvious signs of mechanical damage. For additional information, refer to the

following chart.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Loose tie-rod ends ● Loose suspension components ● Loose steering column shaft universal joints ● Loose column intermediate shaft bolts ● Steering gear ● Binding or misaligned steering column ● Power steering pump ● Bent or pinched power steering hoses 	<ul style="list-style-type: none"> ● Wiring ● Connectors

9. If an obvious cause for an observed or reported malfunction is found, correct the cause (if possible) before proceeding to the next step.
10. If the concern remains after the inspection, connect the Scan Tool to the data link connector (DLC) located beneath the instrument panel, and select the vehicle to be tested from the Scan Tool menu. If the Scan Tool does not communicate with the vehicle:
 - Check that the program card is correctly installed.
 - Check the connections to the vehicle.
 - Check the ignition switch position.
11. If the Scan Tool still does not communicate with the vehicle, refer to the tester manual.
12. Carry out the DATA LINK DIAGNOSTIC TEST. If Scan Tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for FEM, refer to [Section 418-00](#).
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the FEM.
13. If the DTCs retrieved are related to the concern, go to Diagnostic Trouble Code (DTC) Index to continue diagnostics.
14. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.
15. If the fault is not visually evident, determine the symptom and proceed to the symptom chart.

Diagnostic Trouble Code (DTC) Index

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	Go To Pinpoint Test A.
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	Go To Pinpoint Test B.
U1027	SCP (J1850) Invalid or Missing Data for Engine rpm	PCM	GO to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	GO to Section 418-

			<u>01.</u>
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	GO to <u>Section 418-01.</u>
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	GO to <u>Section 418-01.</u>
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	GO to <u>Section 418-01.</u>
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	ICM	GO to <u>Section 418-01.</u>

Steering System Symptom Definitions

Drift/Pull

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel.

- A vehicle-related drift/pull, on a flat road, can cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull can be induced by conditions external to the vehicle (i.e., wind, road camber).

Excessive Steering Wheel Play

Excessive steering wheel play is a condition in which there is too much steering wheel movement before the wheels move. A small amount of steering wheel free play is considered normal.

Feedback

Feedback is a roughness felt in the steering wheel when the vehicle is driven over rough pavement.

Hard Steering or Lack of Assist

Hard steering or lack of assist is experienced when the steering wheel effort exceeds specifications. Hard steering can remain constant through the full turn or occur near the end of a turn. It is important to know the difference between hard steering/lack of assist and binding.

Hard steering or lack of assist can result from either hydraulic or mechanical conditions. It is extremely important to know if this concern occurs during driving, during very heavy or static parking maneuvers.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces and observed by the driver as small rotational oscillations of the steering wheel.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe the poor return of the steering wheel to center after a turn or the steering correction is completed.

Shimmy

Shimmy, as observed by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tire contacts pot holes or irregularities in the road surface.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the front electronics module 	<ul style="list-style-type: none"> Circuit. Module. 	<ul style="list-style-type: none"> REFER to Section 418-00.
<ul style="list-style-type: none"> Hard Steering or Lack of Assist 	<ul style="list-style-type: none"> Seized lower steering column shaft U-joints. Damaged, fractured steering column bearing(s). Power steering pump. Suspension components. Steering gear internal leakage. 	<ul style="list-style-type: none"> INSTALL a new lower steering column shaft. REFER to Section 211-04. REPAIR the steering column. REFER to Section 211-04. GO to Pump Flow and Pressure Test Component Test in this section. REFER to Section 204-00 for suspension system diagnosis and testing. GO to Pump Flow and Pressure Test Component Test in this section.
<ul style="list-style-type: none"> Excessive Steering Pump Noise 	<ul style="list-style-type: none"> Power steering pump. 	<ul style="list-style-type: none"> GO to Pump Flow and Pressure Test Component Test in this section.
<ul style="list-style-type: none"> Excessive Steering Wheel Play 	<ul style="list-style-type: none"> Damaged, loose, or worn tie-rod end (3290). Loose, worn or damaged tie-rod (3280). Damaged/worn steering gear. Loose, worn or damaged steering 	<ul style="list-style-type: none"> GO to the Steering Linkage Component Test. GO to the Tie-Rod Articulation Torque Component Test. INSTALL a new steering gear. REFER to Section 211-02. INSTALL new steering column


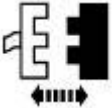
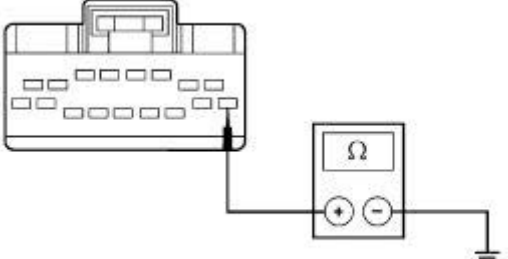
	<p>column bearing(s).</p> <ul style="list-style-type: none"> ● Loose, worn or damaged lower steering column shaft U-joint(s). 	<p>bearing(s). REFER to Section 211-04 .</p> <ul style="list-style-type: none"> ● INSTALL a new lower steering column shaft. REFER to Section 211-04 .
<ul style="list-style-type: none"> ● Wander 	<ul style="list-style-type: none"> ● Unevenly loaded or overloaded vehicle. ● Loose, worn or damaged tie-rod. ● Loose, worn or damaged tie-rod ends. ● Loose or damaged steering gear mounting bolts. ● Loose lower steering column shaft U-joint bolts. ● Loose, worn or damaged lower steering column shaft U-joints. ● Loose, worn or damaged steering column bearing(s). ● Suspension components. 	<ul style="list-style-type: none"> ● INFORM the customer of incorrect vehicle loading. ● GO to the Tie-Rod Articulation Torque Component Test. ● GO to the Steering Linkage Component Test. ● INSTALL new bolts or TIGHTEN the bolts. REFER to Section 211-02 . ● TIGHTEN the bolts. REFER to Section 211-04 . ● INSTALL a new lower steering column shaft. REFER to Section 211-04 . ● INSTALL new steering column bearings. REFER to Section 211-04 . ● REFER to Section 204-00 for suspension system diagnosis and testing.
<ul style="list-style-type: none"> ● Drift/Pull 	<ul style="list-style-type: none"> ● Unevenly loaded or overloaded vehicle. ● Wheel alignment. ● Loose, worn or damaged tie-rod. ● Loose, worn or damaged tie-rod ends. ● Suspension components. ● The steering gear 	<ul style="list-style-type: none"> ● INFORM the customer of incorrect vehicle loading. ● ADJUST as required. REFER to Section 204-00 . ● GO to the Tie-Rod Articulation Torque Component Test. ● GO to the Steering Linkage Component Test. ● REFER to Section 204-00 for suspension system diagnosis and testing. ● GO to Steering Gear

	<ul style="list-style-type: none"> valve effort out of balance. ● Check the brake system for correct operation. ● Incorrect frame/underbody alignment. 	<p>Valve Component Test in this section.</p> <ul style="list-style-type: none"> ● REFER to Section 206-00. ● CORRECT as required. REFER to Frame Dimension Manual.
<ul style="list-style-type: none"> ● Feedback 	<ul style="list-style-type: none"> ● Loose, worn or damaged tie-rod. ● Loose, worn or damaged tie-rod ends. ● Loose or damaged steering gear insulators or bolts. ● Loose lower steering column shaft U-joint bolts. ● Loose suspension bushings, fasteners or ball joints. ● Worn or damaged steering column bearing(s). 	<ul style="list-style-type: none"> ● GO to the Tie-Rod Articulation Torque Component Test. ● GO to the Steering Linkage Component Test. ● INSTALL new bolts or TIGHTEN the retaining bolts. REFER to Section 211-02. ● TIGHTEN the bolts. REFER to Section 211-04. ● INSTALL new as necessary. REFER to Section 204-01. ● INSTALL new steering column bearing(s). REFER to Section 211-04.
<ul style="list-style-type: none"> ● Poor Returnability/Sticky Steering 	<ul style="list-style-type: none"> ● Binding lower steering column shaft U-joints. ● Loose, worn or damaged front wheel spindle tie-rod. ● Loose, worn or damaged tie-rod ends. ● Suspension components. ● Binding steering column bearing(s). 	<ul style="list-style-type: none"> ● INSTALL a new lower steering column shaft. REFER to Section 211-04. ● GO to the Tie-Rod Articulation Torque Component Test. ● GO to the Steering Linkage Component Test. ● REFER to Section 204-00 for suspension system diagnosis and testing. ● INSTALL new steering column bearing(s). REFER to Section 211-04.
<ul style="list-style-type: none"> ● Shimmy 	<ul style="list-style-type: none"> ● Loose, worn or damaged tie-rod end. ● Loose, worn or damaged tie-rod. 	<ul style="list-style-type: none"> ● GO to the Steering Linkage Component Test. ● GO to the Tie-Rod Articulation Torque Component Test.

	<ul style="list-style-type: none"> ● Suspension components. 	<ul style="list-style-type: none"> ● REFER to Section 204-00 for suspension system diagnosis and testing.
<ul style="list-style-type: none"> ● Power steering pump noisy 	<ul style="list-style-type: none"> ● Low fluid level and possible leakage. ● Plugged reservoir filter. ● Power steering pump. 	<ul style="list-style-type: none"> ● FILL reservoir to specified level. CHECK for leaks. REPAIR as necessary. ● INSTALL a new reservoir; REFER to Section 211-02. ● INSTALL a new power steering pump; REFER to Section 211-02.

Pinpoint Tests

PINPOINT TEST A: DTC C1924 — VAPS SOLENOID ACTUATOR OUTPUT CIRCUIT SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK THE VAPS CIRCUITRY FOR SHORT TO GROUND	
<p>1</p>  <p>2</p>  <p>FEM C201a</p> <p>3</p>  <p>A0002785</p>	<p>3 Measure the resistance between FEM C201a pin 9, circuit 8-CE9 (WH/GN), harness side and ground.</p> <ul style="list-style-type: none"> ● Is the resistance greater than 10,000 ohms? <p>→ Yes GO to A2</p>

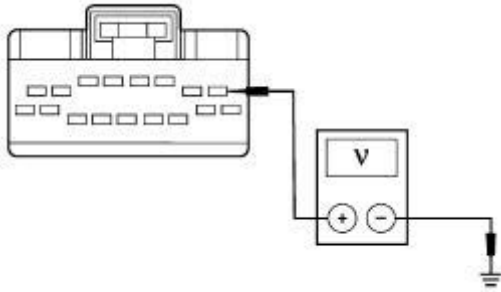
→ **No**
GO to A3.

A2 CHECK CIRCUIT 29S-DK21 (OG/WH)

1



2



A0006017

2 Measure the voltage between FEM C201a pin 1, circuit 29S-DK21 (OG/WH), harness side and ground.

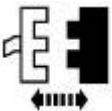
● **Is the voltage greater than 10 volts?**

→ **Yes**
INSTALL a new FEM; REFER to Section 419-10. REPEAT the self-test.

→ **No**
REPAIR the circuit. REPEAT the self-test.

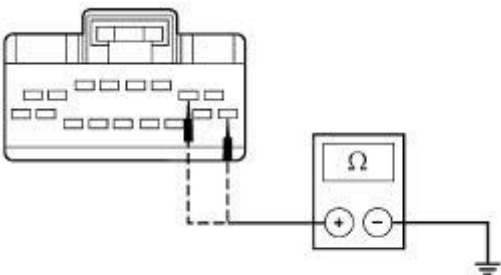
A3 CHECK CIRCUIT 8-CE9 (WH/GN) AND 9-CE9 (BN/GN) FOR A SHORT TO GROUND

1



Control Valve Actuator C120

2



A0002786


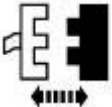

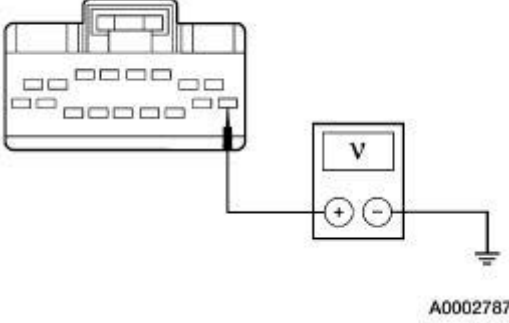

2 Measure the resistance between FEM C201a pin 9, circuit 8-CE9 (WH/GN), harness side and ground, and between FEM C201a pin 2, circuit 9-CE9 (BN/GN), harness side and ground.

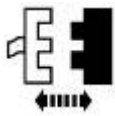
● **Is the resistance greater than 10,000 ohms?**

→ **Yes**
INSTALL a new control valve actuator; REFER to Section 211-02. CLEAR the

	<p>DTCs. REPEAT the self-test.</p> <p>→ No REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</p>
--	---

PINPOINT TEST B: DTC C1925 — VAPS SOLENOID ACTUATOR RETURN CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK VAPS FOR SHORT TO POWER	
<p>1 </p> <p>2  FEM C201a</p> <p>3 </p> <p>4 </p>	<p>4 Measure the voltage between FEM C201a pin 9, circuit 8-CE9 (WH/GN), harness side and ground.</p> <p>• Is any voltage present?</p> <p>→ Yes GO to <u>B2</u>.</p> <p>→ No GO to <u>B3</u>.</p>
B2 CHECK CIRCUIT 8-CE9 (WH/GN) FOR A SHORT TO POWER	
<p>1 </p> <p>2</p>	

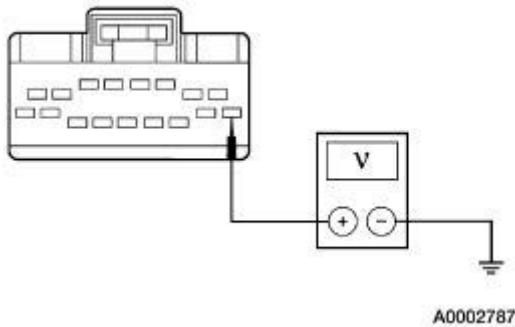


Control Valve Actuator C120

3



4



4 Measure the voltage between FEM C201a pin 9, circuit 8-CE9 (WH/GN), harness side and ground.

• Is any voltage present?

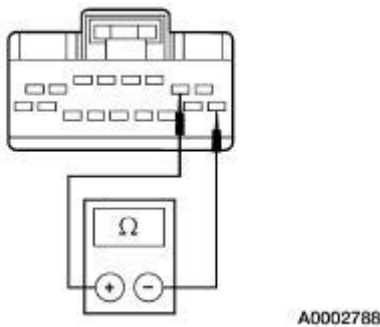
- **Yes**
REPAIR the circuit 8-CE9 (WH/GN).
CLEAR the DTCs. REPEAT the self-test.
- **No**
REPAIR the circuit 9-CE9 (BN/GN).
CLEAR the DTCs. REPEAT the self-test.

B3 CHECK THE VAPS SYSTEM FOR AN OPEN

1



2



2 Measure the resistance between FEM C201a pin 9, circuit 8-CE9 (WH/GN), harness side and FEM C201a pin 2, circuit 9-CE9 (BN/GN), harness side.

• Is the resistance between 4 and 85 ohms?

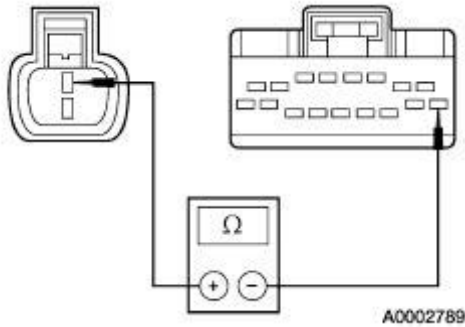
- **Yes**
INSTALL a new control valve actuator;
REFER to Section 211-02. CLEAR the

DTCs. REPEAT the self-test. If DTC C1925 is retrieved, INSTALL a new FEM; REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
GO to [B4](#).

B4 CHECK CIRCUIT 8-CE9 (WH/GN) FOR AN OPEN

1



1

Measure the resistance between FEM C201a pin 9, circuit 8-CE9 (WH/GN), harness side and control valve actuator C120 pin 1, circuit 8-CE9 (WH/GN), harness side.

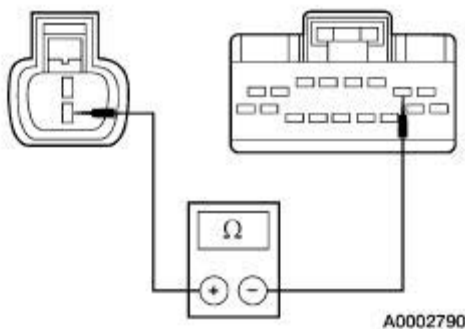
● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to [B5](#).

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B5 CHECK CIRCUIT 9-CE9 (BN/GN) FOR AN OPEN

1



1

Measure the resistance between FEM C201a pin 2, circuit 9-CE9 (BN/GN), harness side and control valve actuator C120 pin 2, circuit 9-CE9 (BN/GN), harness side.

● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new control valve actuator; REFER to [Section 211-02](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Steering Linkage

1. With the parking brake applied, carry out the following:
 1. **NOTE:** Excessive vertical or horizontal motion of the stud relative to the steering linkage ball sockets may indicate excessive wear.

Have an assistant rotate the steering wheel back and forth 360 degrees and watch for relative motion of the studs in the steering linkage ball sockets.

2. Watch for a loose steering gear attachment to the frame.
2. Another method is to raise the front tires off the ground, grasp the tire at the front and rear and watch for excessive play in the joints while trying to pivot the wheels by hand.
3. **NOTE:** Incorrect separation of the tapered stud from its seat will cause premature failure of the ball socket.

Joints can be checked for excessive wear by measuring the torque it takes to turn the stud.

1. Separate the tapered stud from its seat and thread the attaching nut back onto the stud.
2. **NOTE:** Some joint turning torques will be as little as 0.2 Nm (2 lb-in) within the first 1,000 miles and will remain there for the life of the joint.

Turn the stud with an inch-pound torque wrench and note the torque required to turn the stud.

Torque Required to Turn Stud in Socket	Nm	Lb-In
New joints	2.0-5.0	18-47
Used joints	0.2-3	2-26
Joints with excessive play	Less than 0.2	Less than 0.2

3. **NOTE:** Only install a new ball joint if the stud torque is less than 0.2 Nm (2 lb-in) and the joint has any play when moved by hand.

Install new ball joints as necessary; refer to [Section 204-01](#).

Pump Flow and Pressure Test



WARNING: Do not touch the flowmeter during the test procedure or severe burns and serious injury may occur.


1.  **CAUTION:** Make sure that the connection point will not interfere with any of the engine accessory drive components or drive belts.

Install the Power Steering Analyzer at the high pressure port of the power steering pump. Make sure the power steering analyzer gate valve is fully open.

- On some vehicles, the power steering pump high pressure port is inaccessible and the power steering analyzer should then be installed either at the steering gear or at a point in the high pressure line between the power steering pump and the steering gear.
2. Place a Dial Thermometer in the power steering pump reservoir.
 3. Check the power steering fluid level. If necessary, add power steering fluid.

- Use Motorcraft MERCON® Multi-Purpose (ATF) Transmission Fluid XT-2-QDX or equivalent meeting Ford specification MERCON®.

4. Install the digital tachometer.

5.  **CAUTION: Do not hold the steering wheel against the stops for more than three to five seconds at a time. Damage to the power steering pump will occur.**

Start the engine. Place the transmission in N (neutral). Set the parking brake. Raise the power steering fluid temperature to 74-80°C (165-175°F) by rotating the steering wheel fully to the left and right several times.

6. Set the engine speed to idle. Record the flow rate and pressure readings.
- If the flow rate is below the idle flow rate specification, the power steering pump may require repair. Continue with the test procedure.
 - If the pressure reading is above the idle pressure specification, then check power steering hoses for kinks and restrictions.

7. Partially close the gate valve to obtain 5102 kPa (740 psi). Record the flow rate.
- If the flow rate is less than the specified flow rate, replace the power steering pump.

8.  **CAUTION: Do not allow the gate valve to remain closed for more than five seconds.**

Completely close and partially open the gate valve three times. Record the pressure relief valve actuation pressure reading.

- If the pressure does not meet the relief pressure specification, install a new power steering pump.

9. Set the engine speed to 1,500 rpm. Record the flow rate.
- If the flow rate varies more than 3.785 liters/minute (1 gallon/minute) from initial flow rate reading, install a new power steering pump.

10.  **CAUTION: Do not hold the steering wheel against the stops for more than three to five seconds at a time. Damage to the power steering pump will occur.**

Set the engine speed at idle. Turn (or have an assistant turn) the steering wheel to the left and right stops. Record flow rate and pressure readings at the stops.

- The pressure reading at both stops should be nearly the same as the maximum pump relief pressure.
- The flow rate should drop below 1.9 liters/minute (0.5 gallon/minute).
- If the pressure does not reach the maximum pump relief pressure or the flow rate does not drop below the specified value, excessive internal leakage is occurring. Repair or install a new steering gear as necessary; refer to [Section 211-02](#).

11. Turn (or have an assistant turn) the steering wheel slightly in both directions and release it quickly while watching the pressure gauge.
- The pressure reading should move from the normal backpressure reading and snap back as the steering wheel is released.
 - If the pressure returns slowly or sticks, the rotary valve in the steering column is binding. Check the steering column and linkage before repairing the steering gear.

Turning Effort Test

NOTE: Make sure front wheels are correctly aligned and tire pressure is correct before checking turning effort.

1. Park vehicle on dry concrete and set parking brake.
2. Idle engine for two to three minutes. Turn steering wheel to the left and right several times to warm fluid to 43-49°C (110-120°F).
3. With engine running, attach a pull scale to rim of steering wheel. Measure pull required to turn one complete revolution in each direction. Refer to Specifications for Static Steering Wheel Turning Efforts for acceptable measurements.

Steering Gear Insulator

1. With the wheel normally loaded (on the ground), check the steering gear housing for excessive lateral movement.
 - If the steering gear housing moves more than 1.5 mm (0.05 in), the steering gear insulators may have deteriorated or the steering gear mounting nuts may have loosened. Tighten the steering gear mounting nuts.
 - If the steering gear housing movement is still excessive after tightening the gear mounting nuts, install new steering gear insulators.

Steering Gear Valve

NOTE: For vehicles with a steering pull.

1. With the vehicle in motion, place the transmission in N (neutral) and turn the engine OFF.
 - If the vehicle does not pull with the engine OFF, repair or install a new steering gear; refer to [Section 211-02](#).
 - If the vehicle pull direction does not change, check the front suspension components and wheel alignment; refer to [Section 204-00](#) and [Section 204-01](#).

Tie-Rod Articulation Torque

1. **NOTE:** This check can be done with the steering gear on or off the vehicle.

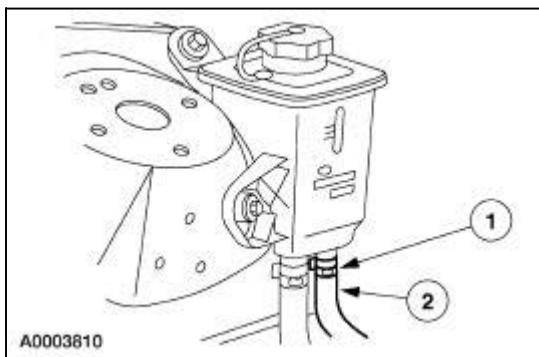
Disconnect the tie-rod end from the front wheel spindle. For additional information, refer to [Section 211-02](#).

2. Move the tie-rod back and forth three times.
3. Hook the Spring Scale over the tie-rod end or the threaded portion of the tie-rod and measure the force required to move the front wheel spindle tie-rod. For additional information, refer to Tie-Rod Articulation Torque in General Specifications in this section.
4. If the force required to move the front wheel spindle tie-rod does not meet the specifications, install a new tie-rod.

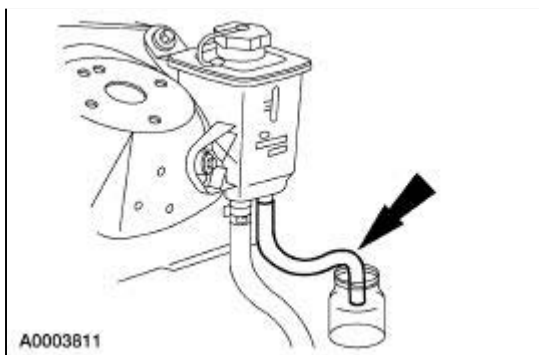
Power Steering System Flushing


 **WARNING: Do not mix fluid types. Any mixture of an unapproved fluid could lead to seal deterioration and leaks. A leak could ultimately cause loss of fluid, which could result in a loss of power steering assist.**

1. Remove the coil on plug (COP) Fuse 12 in the underhood auxiliary junction box (AJB) to disable the engine from starting.
2. Disconnect the power steering return hose.
 1. Compress and move the hose clamp.
 2. Disconnect the power steering return hose and plug the fitting to the reservoir.



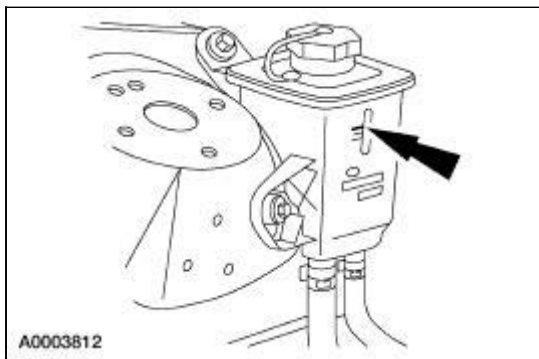
3. Attach an extension hose between the power steering reservoir port and an empty container.




4.  **WARNING: Do not mix fluid types. Any mixture of an unapproved fluid could lead to seal deterioration and leaks. A leak could ultimately cause loss of fluid, which could result in a loss of power steering assist.**

Fill the power steering fluid reservoir.

- Use Motorcraft MERCON® Multi-Purpose (ATF) Transmission Fluid XT-2-QDX or equivalent meeting Ford specification MERCON®.




5. Raise the front wheels off the ground. For additional information, refer to [Section 100-02](#).

6.  **CAUTION: Do not operate the starter motor for more than 10 seconds at a time. Damage to the starter motor could result.**

Turn the steering wheel from stop to stop while cranking the engine until the fluid exiting the extension hose is clean.

7. Lower the vehicle.

8. Disconnect the extension hose from the power steering return hose and attach the power steering return hose to the power steering fluid reservoir.

9.  **WARNING: Do not mix fluid types. Any mixture of an unapproved fluid could lead to seal deterioration and leaks. A leak could ultimately cause loss of fluid, which could result in a loss of power steering assist.**

 **CAUTION: Do not overfill the power steering fluid reservoir.**

Fill the power steering fluid reservoir.

- Use Motorcraft MERCON® Multi-Purpose (ATF) Transmission Fluid XT-2-QDX or equivalent meeting Ford specification MERCON®.

10. Install the COP fuse.

11.  **CAUTION: Do not hold the steering wheel against the stops for more than three to five seconds at a time. Damage to the power steering pump will occur.**

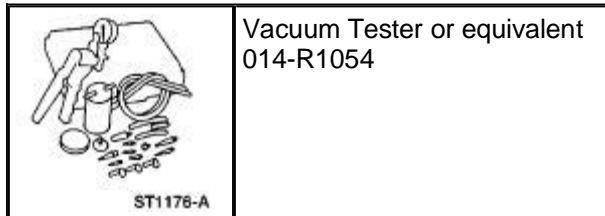
Start the engine and turn the steering wheel from stop to stop.

12. **NOTE:** If power steering is noisy and accompanied by evidence of aerated fluid, it will be necessary to purge the power steering system. Refer to [Power Steering System Purging](#).

Check the power steering fluid level.

Power Steering System Purging

Special Tool(s)



CAUTION: If the air is not purged from the power steering system correctly, pump failure could result. This condition can occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that had steering component repairs.

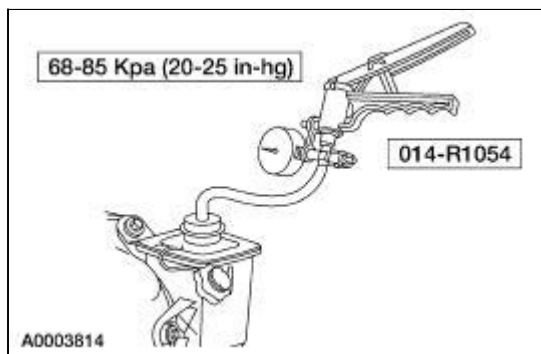
- WARNING:** Do not mix fluid types. Any mixture of an unapproved fluid could lead to seal deterioration and leaks. A leak could ultimately cause loss of fluid, which could result in a loss of power steering assist.

CAUTION: Do not overfill the power steering fluid reservoir.

NOTE: A whine heard from the power steering pump may be caused by air in the system. The power steering purge procedure must be carried out prior to any component repair for which power steering noise complaints are accompanied by evidence of aerated fluid and after installation of any new power steering system components (gear, hose, etc.).

Remove the fluid reservoir cap and check the fluid.

- Using the special tool, tightly insert the stopper into the fluid reservoir.
 - Start the vehicle.
- Apply maximum vacuum for a minimum of three minutes at idle. Maintain maximum vacuum with the source.



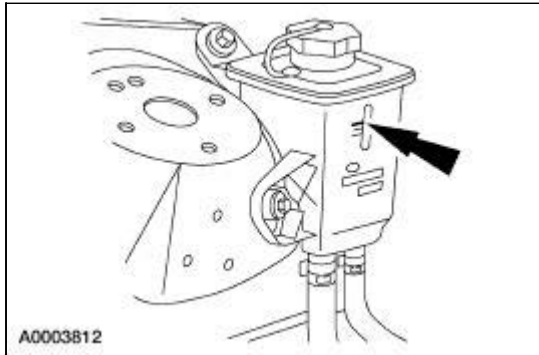
- Remove the special tool.

- WARNING:** Do not mix fluid types. Any mixture of an unapproved fluid could lead to

seal deterioration and leaks. A leak could ultimately cause loss of fluid, which could result in a loss of power steering assist.

Add fluid to the appropriate level.

- Use Motorcraft MERCON® Multi-Purpose (ATF) Transmission Fluid XT-2-QDX or equivalent meeting Ford specification MERCON®.




5. Using the special tool, apply and maintain maximum vacuum.

6.  **CAUTION: Do not hold the steering wheel against the stops for more than three to five seconds. Damage to the power steering pump will occur.**


Cycle the steering wheel from stop to stop every 30 seconds for approximately five minutes.

7. Remove the special tool and install the fluid reservoir cap.

8.  **WARNING: Do not mix fluid types. Any mixture of an unapproved fluid could lead to seal deterioration and leaks. A leak could ultimately cause loss of fluid, which could result in a loss of power steering assist.**

Check the fluid level and for leaks at all connections. If the power steering still shows signs of aeration, repeat this procedure.


Power Steering System Filling

1.  **WARNING: Do not mix fluid types. Any mixture of an unapproved fluid could lead to seal deterioration and leaks. A leak could ultimately cause loss of fluid, which could result in a loss of power steering assist.**

Fill the power steering reservoir to the appropriate level.

- Use Motorcraft MERCON® Multi-Purpose (ATF) Transmission Fluid XT-2-QDX or equivalent meeting Ford specification MERCON®.

2. Remove the coil on plug (COP) Fuse 12 in the underhood auxiliary junction box (AJB) to disable the engine from starting.
3. Raise the front wheels off the floor. For additional information, refer to [Section 100-02](#).

4.  **CAUTION: Do not operate the starter motor for more than 10 seconds at a time. Damage to the starter motor could result.**

Turn the steering wheel from stop to stop while cranking the engine.

5. Lower the vehicle.

6.  **CAUTION: Do not overfill the power steering fluid reservoir.**

Fill the power steering fluid reservoir to the appropriate level.

- Use Motorcraft MERCON® Multi-Purpose (ATF) Transmission Fluid XT-2-QDX or equivalent meeting Ford specification MERCON®.

7. Install the COP fuse.
8. **NOTE:** If the power steering is noisy and accompanied by evidence of aerated fluid, it will be necessary to purge the power steering system. For additional information, refer to [Power Steering System Purging](#).

Clear the diagnostic trouble codes (DTCs). For additional information, refer to Section 2 in the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

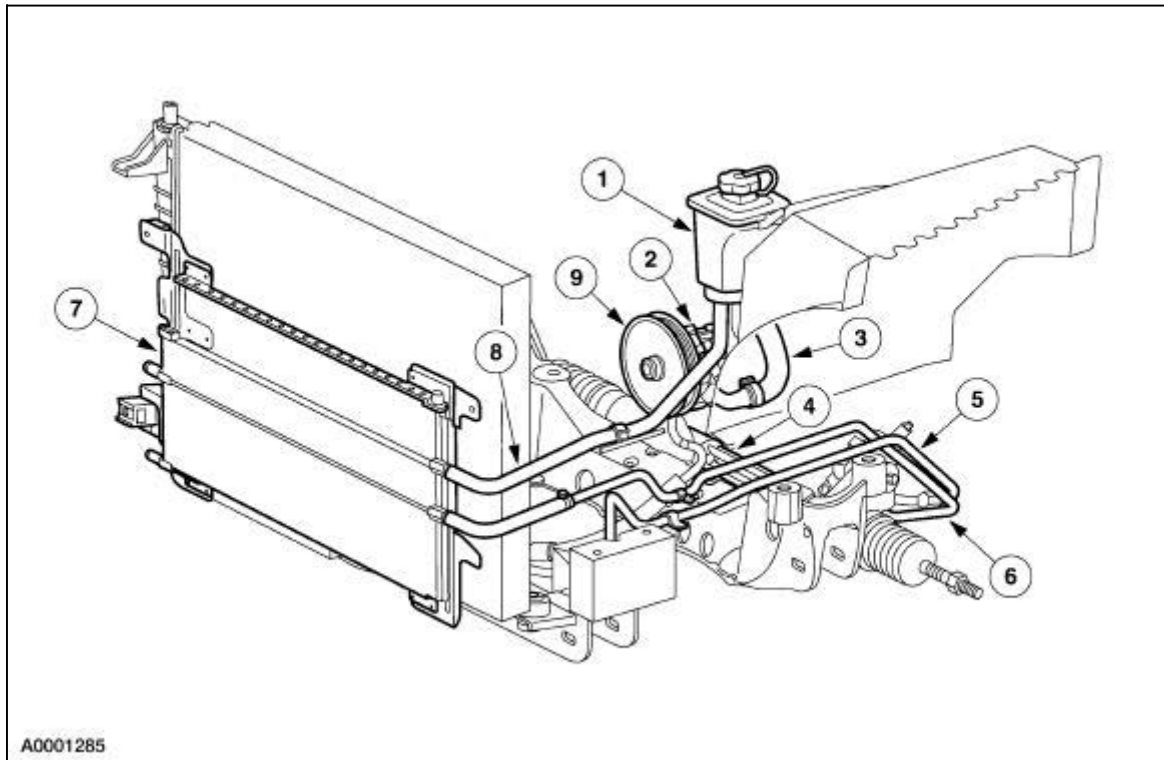
- Run the vehicle and check the system for leaks.
-

Torque Specifications

Description	Nm	lb-ft	lb-in
Power steering pump bolts	25	18	—
Power steering reservoir top bolt	6	—	53
Power steering reservoir side bolt	12	9	—
Power steering pressure hose-to-pump fitting	31	23	—
Power steering pressure hose-to-gear fitting	31	23	—
Power steering return hose-to-gear fitting	31	23	—
Power steering pressure hose bracket-to-frame bolt	10	—	89
Power steering hose bracket-to-steering gear housing bolt	10	—	89
Steering gear nuts	103	76	—
Power steering pressure hose bracket-to-pump bolt	10	—	89
Power steering pressure switch	11	8	—
Cooler-to-radiator bolts	10	—	89
Intermediate shaft bolt	25	18	—
Intermediate shaft-to-gear pinch bolt	35	26	—
Steering column shaft-to-intermediate shaft pinch bolt	35	26	—
Steering column lock nuts	40	30	—
A/C compressor bolts	25	18	—
Radiator tube-to-engine bolts	10	—	89
Wheel nuts	135	100	—
Tie-rod-to-rack	120	88	—
Tie-rod end-to-knuckle nut	100	74	—
Control valve actuator	30	22	—
Steering column opening reinforcement bolts	20	15	—
I-brace bolts (front)	55	41	—
I-brace bolts (rear)	30	22	—

Power Steering

System View



A0001285

Item	Part Number	Description
1	3E764	Power steering fluid reservoir
2	3A674	Power steering pump
3	3691	Power steering reservoir-to-pump hose
4	3504	Power steering gear
5	3A719	Power steering pressure hose
6	3A713	Power steering return hose
7	3D746	Power steering fluid cooler
8	—	Power steering cooler-to-reservoir hose
9	3A733	Power steering pump pulley

The power steering system consists of the following components:

- power steering pump (3A674)
- power steering fluid reservoir (3E764)
- power rack and pinion gear (3504)

- power steering fluid cooler (3D746) incorporated into an automatic transmission fluid cooler and hydraulic cooling fan fluid cooler
 - hoses connecting the various components
-

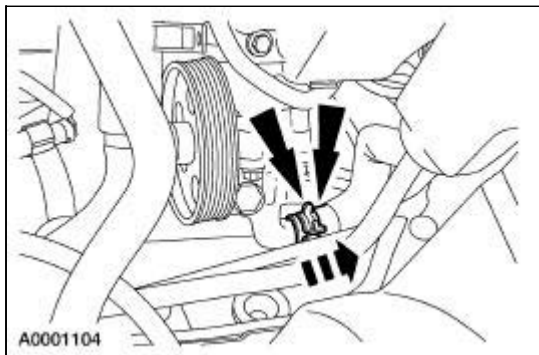
Power Steering

Refer to Section 211-00 .

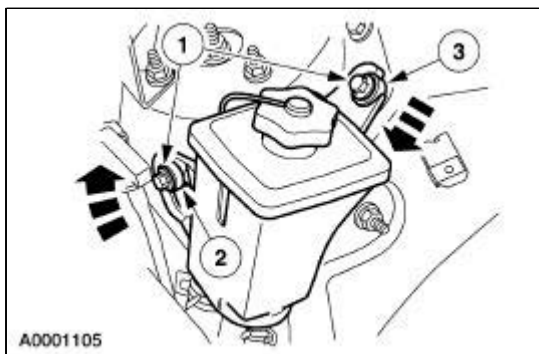
Reservoir

Removal

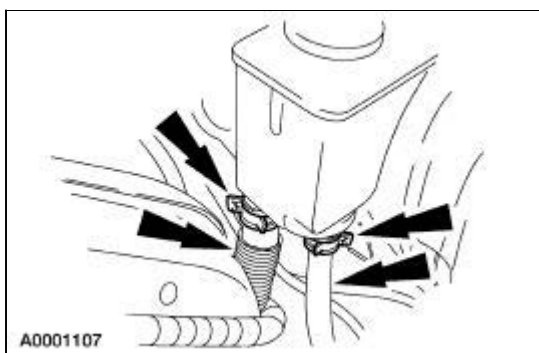
1. Remove the air cleaner. For additional information, refer to [Section 303-12](#).
2. Unclamp and disconnect the power steering reservoir-to-pump hose (3691) and drain the reservoir into a suitable container. Plug the pump inlet fitting.



3. Disconnect the reservoir (3E764).
 1. Loosen the bolts.
 2. Rotate the reservoir from the insulator.
 3. Pull the reservoir down from the insulator.



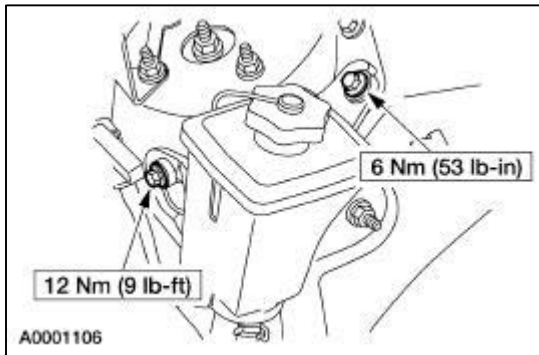
4. Unclamp and disconnect the hoses.



5. Remove the reservoir.

Installation

1. To install, reverse the removal procedure.



2. Fill and leak check the system. For additional information, refer to [Section 211-00](#).
-

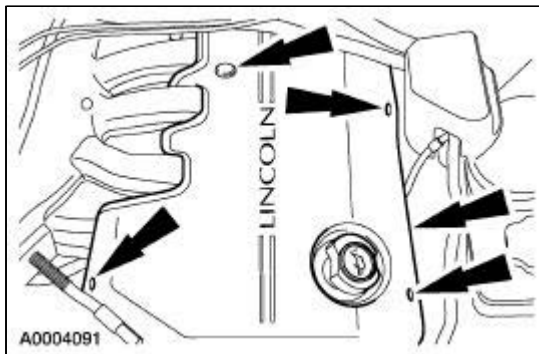
Pump —3.9L

Special Tool(s)

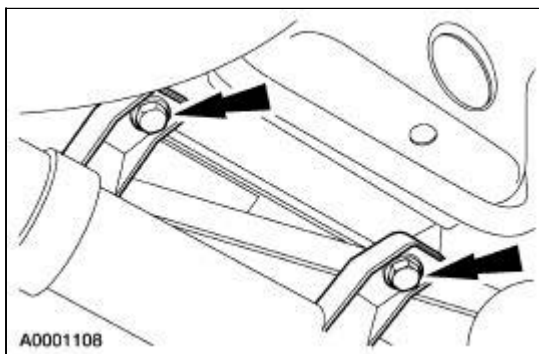


Removal

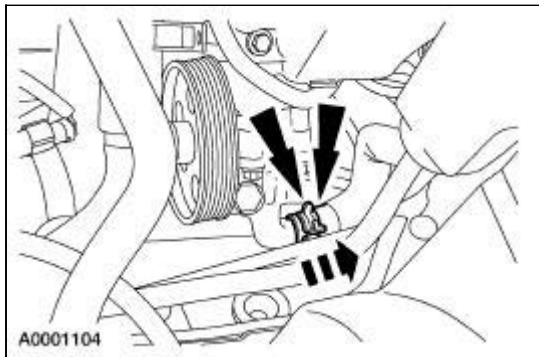
1. Remove four pushpins and the engine cover.



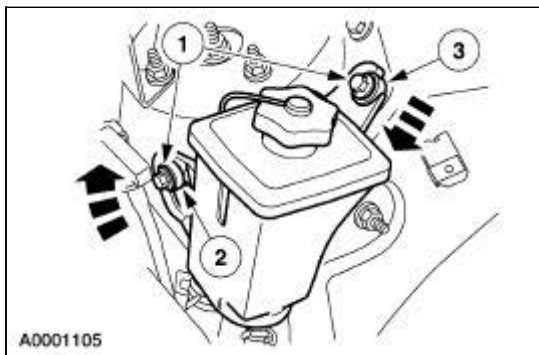
2. Remove the air cleaner and the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
3. Remove the bolts.



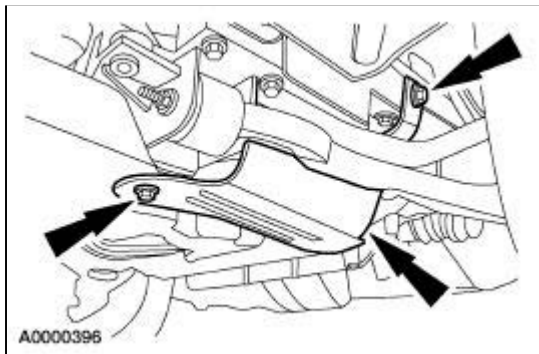
4. Remove the accessory drive belt. For additional information, refer to [Section 303-05](#).
5. Unclamp and disconnect the power steering reservoir-to-pump hose (3691) and drain the reservoir (3E764) into a suitable container.



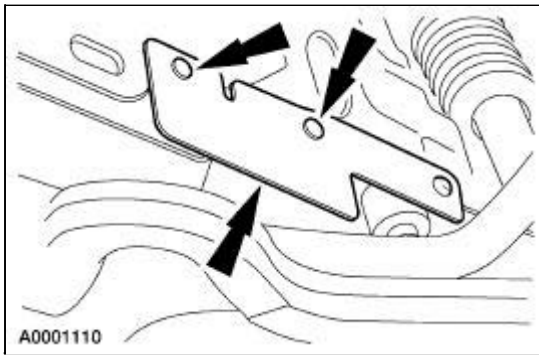
6. Position the power steering reservoir out of the way.
 1. Loosen the bolts.
 2. Rotate the reservoir from the insulator.
 3. Pull the reservoir down from the insulator and position the reservoir out of the way.



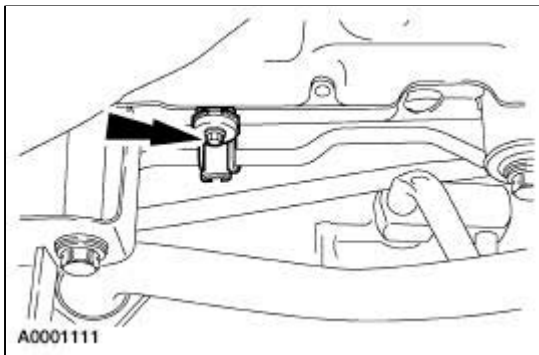
7. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
8. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
9. Remove two bolts, one pushpin and the shield.



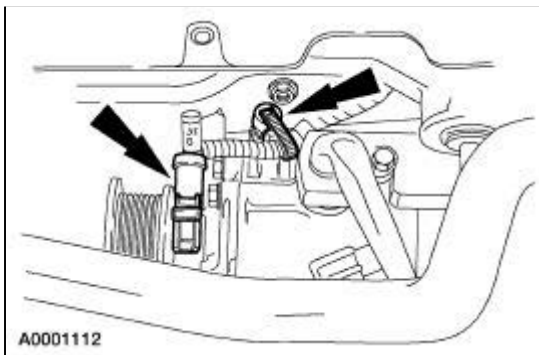
10. Remove two pushpins and the shield.



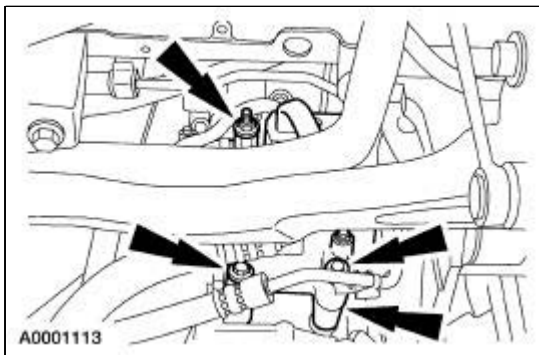
11. Remove the bolt.



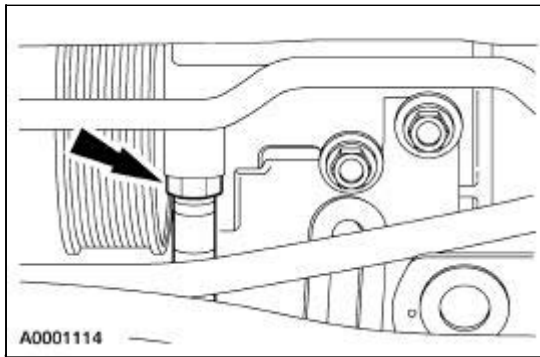
12. Disconnect the electrical connector and the wire retainer.



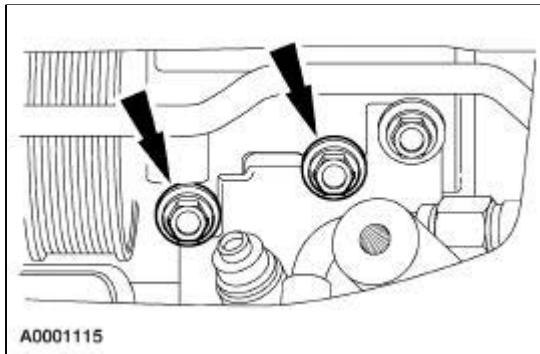
13. Remove four bolts and position the A/C compressor out of the way.



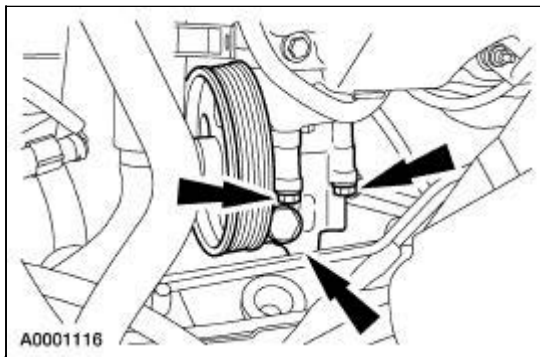
14. Disconnect the power steering pressure hose (3A714).



15. Remove the bolts.

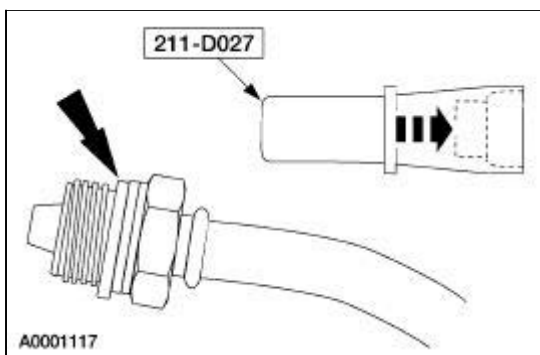


16. Lower the vehicle.
17. Remove the bolts and the pump (3A674).



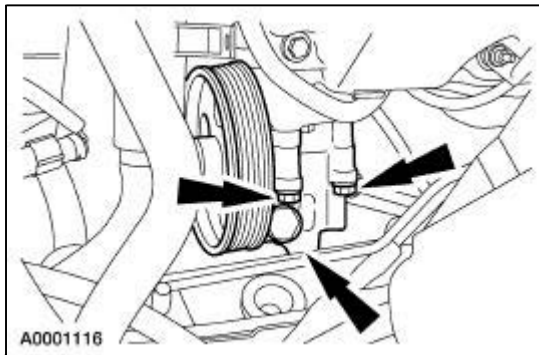
Installation

1. Using the appropriate special tool, install a new O-ring on the power steering pressure hose fitting.

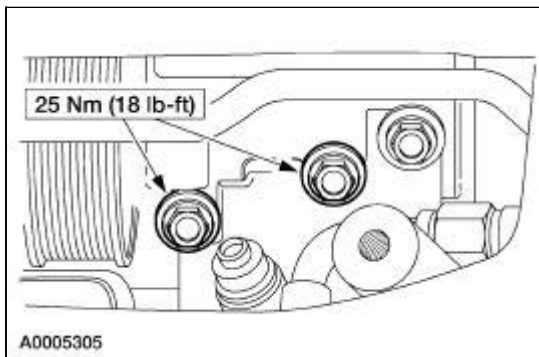


2. **NOTE:** Do not tighten the upper bolts until the lower bolts are installed.

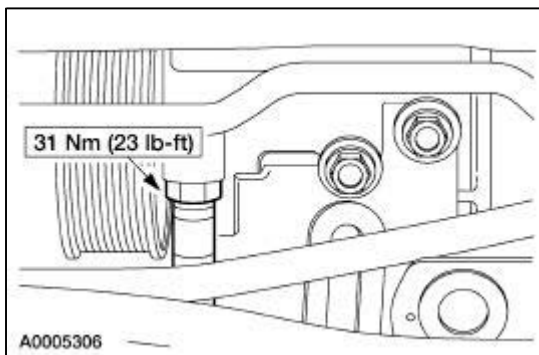
Position the pump and install the bolts.



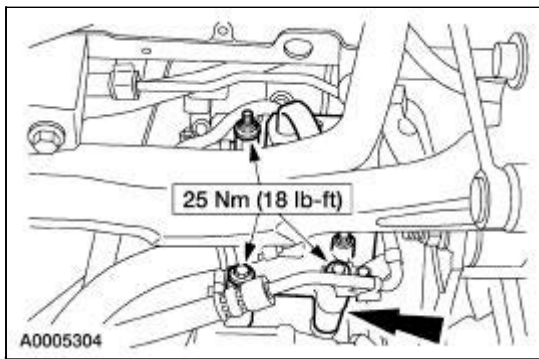
3. Raise the vehicle.
4. Install the bolts.



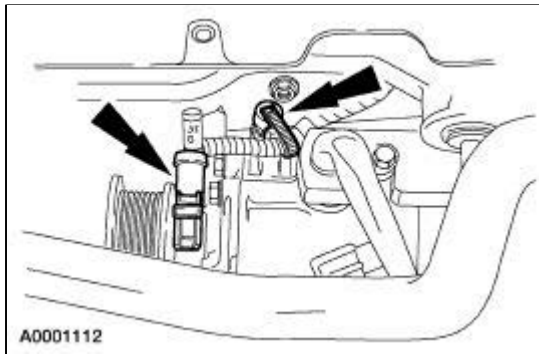
5. Connect the power steering pressure hose.



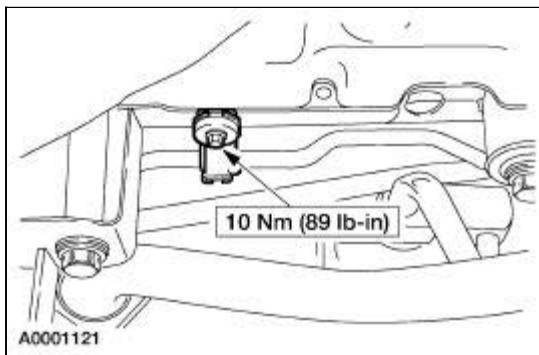
6. Position the A/C compressor and install four bolts.



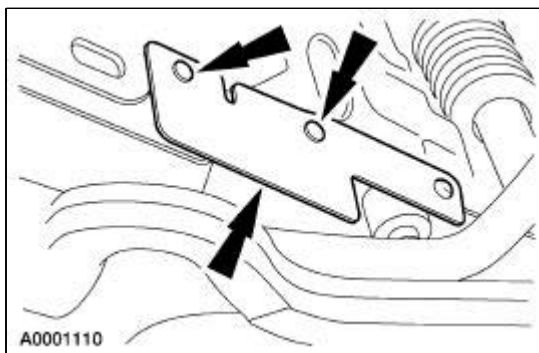
7. Connect the wire retainer and the electrical connector.



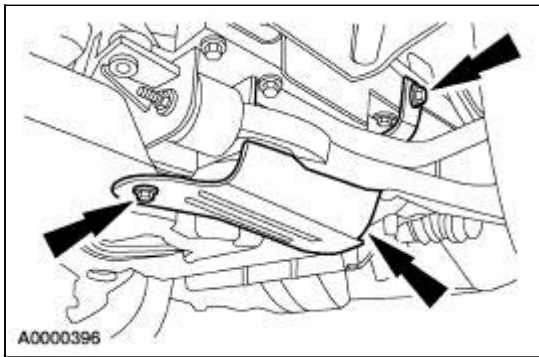
8. Install the bolt.



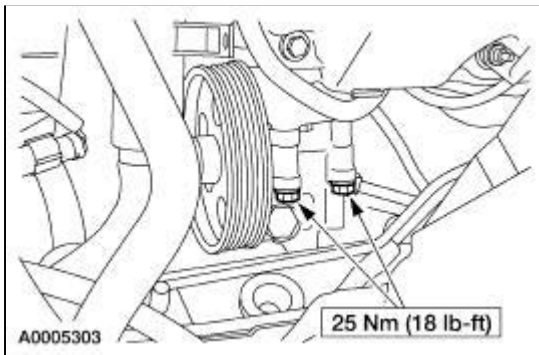
9. Install the shield and two pushpins.



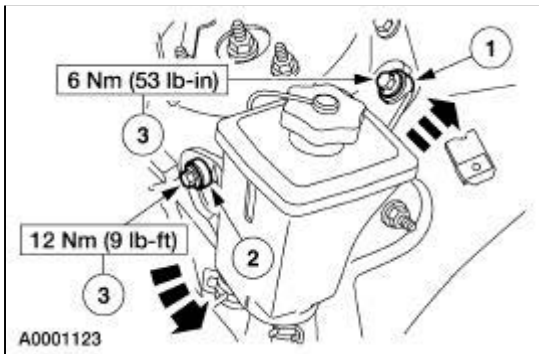
10. Install the shield, one pushpin and two bolts.



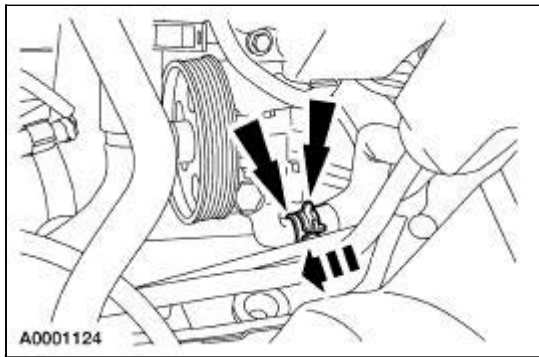
11. Install the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
12. Lower the vehicle.
13. Tighten the bolts.



14. Connect the reservoir.
 1. Push the reservoir up on the insulator.
 2. Rotate the reservoir on the insulator.
 3. Tighten the bolts.

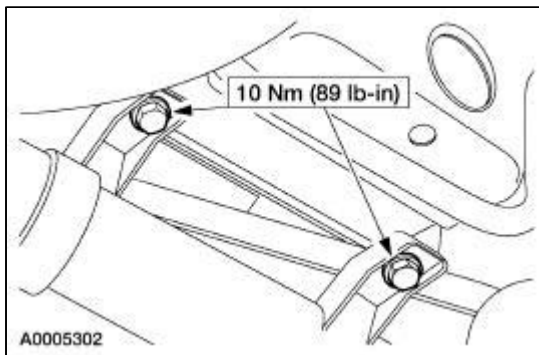


15. Connect and clamp the power steering reservoir-to-pump hose.



16. Install the accessory drive belt. For additional information, refer to [Section 303-05](#).

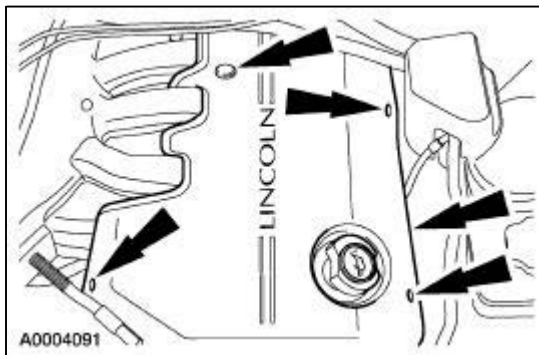
17. Install the bolts.



18. Install the air cleaner outlet tube and the air cleaner. For additional information, refer to [Section 303-12](#).

19. **NOTE:** Inspect the pushpins for cracks or other damage. Install new pushpins if necessary.

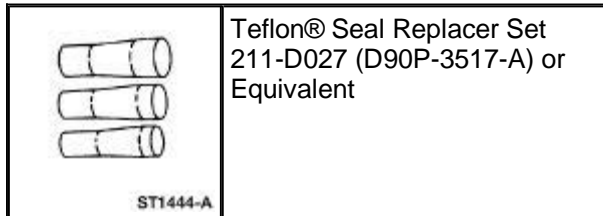
Install the engine cover and four pushpins.



20. Fill and leak check the system. For additional information, refer to [Section 211-00](#).

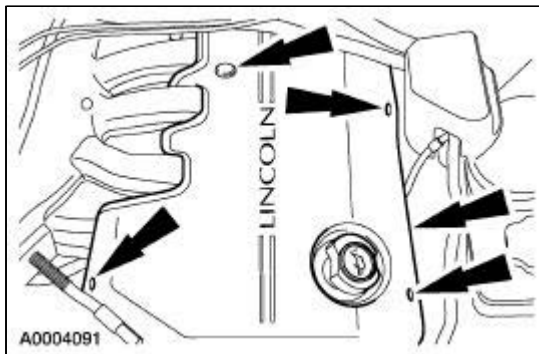
Pump —3.0L

Special Tool(s)

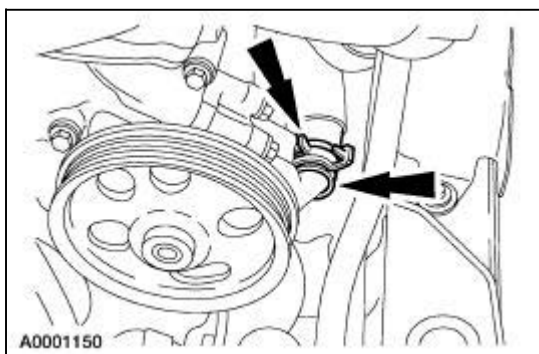


Removal

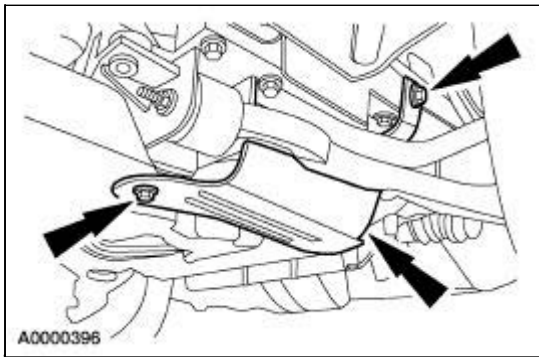
1. Remove four pushpins and the engine cover.



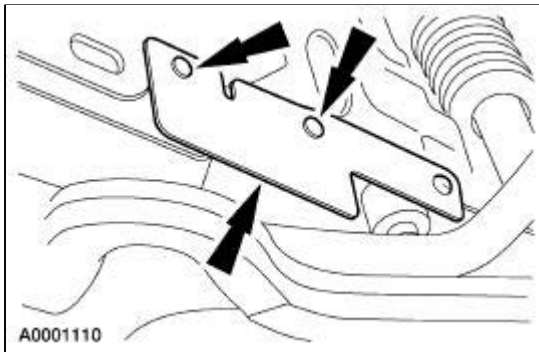
2. Remove the air cleaner and the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
3. Remove the accessory drive belt. For additional information, refer to [Section 303-05](#).
4. Unclamp and disconnect the power steering reservoir-to-pump hose (36911) and drain the reservoir into a suitable container.



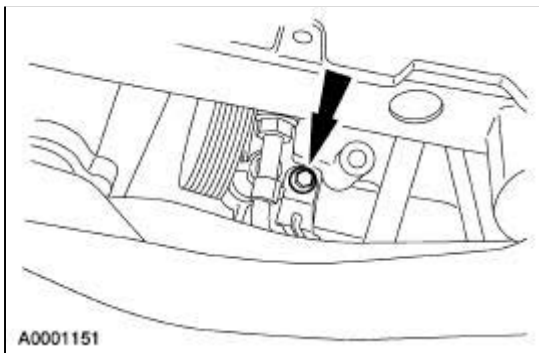
5. Raise the vehicle on a hoist. For additional information, refer to [Section 100-02](#).
6. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
7. Remove two bolts, one pushpin and the shield.



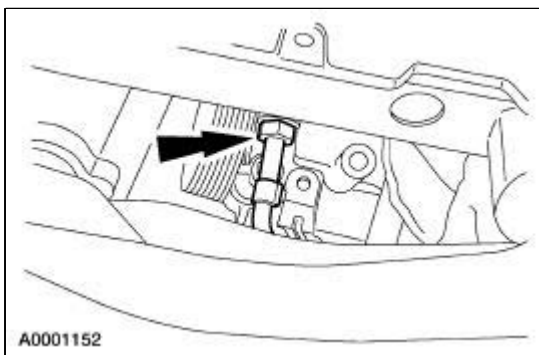
8. Remove two pushpins and the shield.



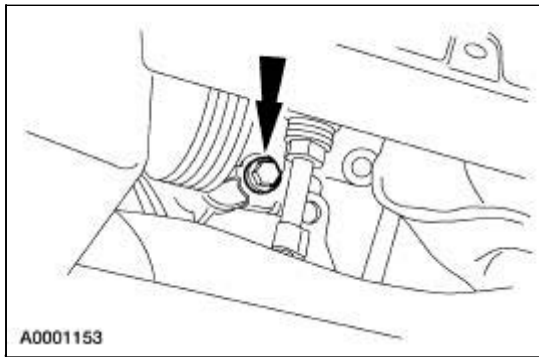
9. Remove the bolt.



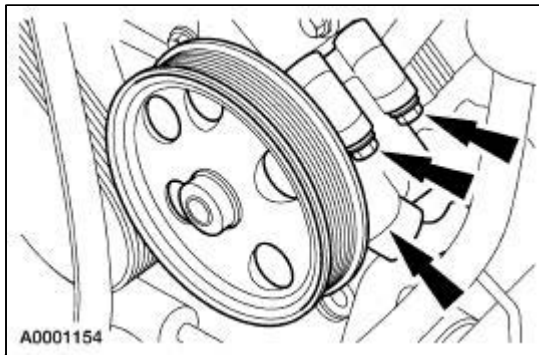
10. Disconnect the power steering pressure hose (3A714).



11. Remove the bolt.

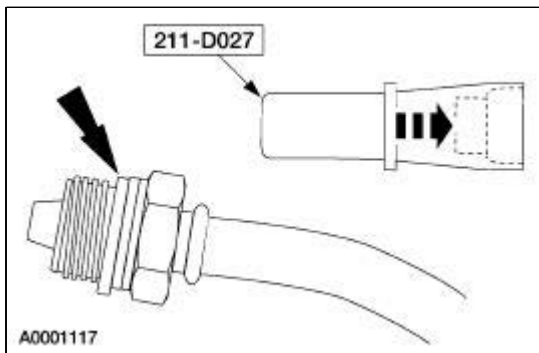


12. Lower the vehicle.
13. Remove the bolts and the pump (3A674).



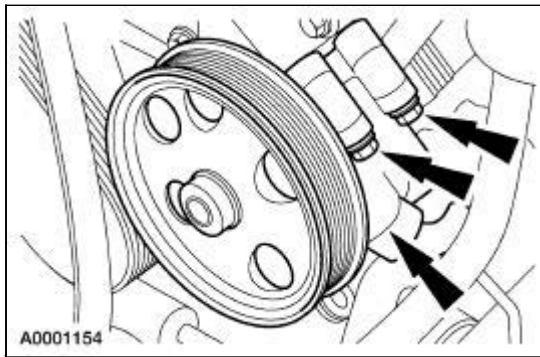
Installation

1. Install a new O-ring on the power steering pressure hose fitting.

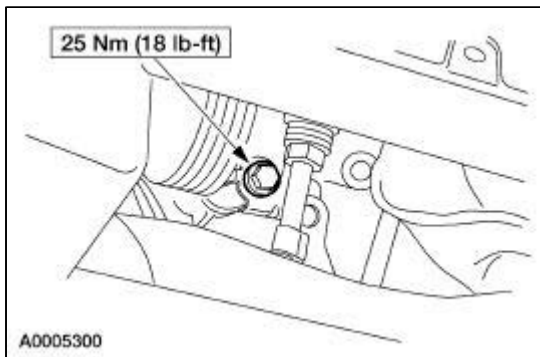


2. **NOTE:** Do not tighten the upper bolts until the lower bolts are installed.

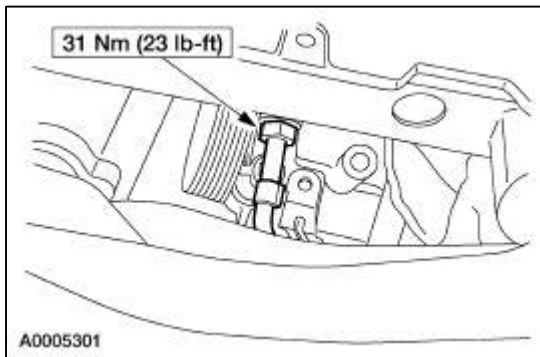
Install the pump and the bolts.



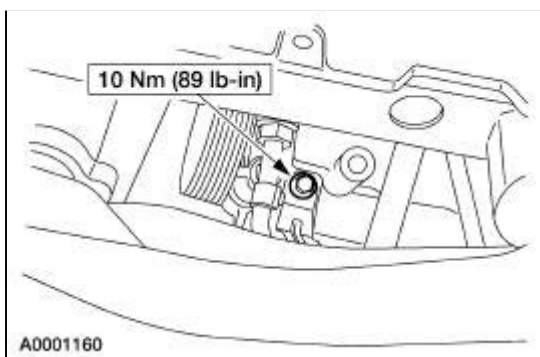
3. Raise the vehicle.
4. Install the bolt.



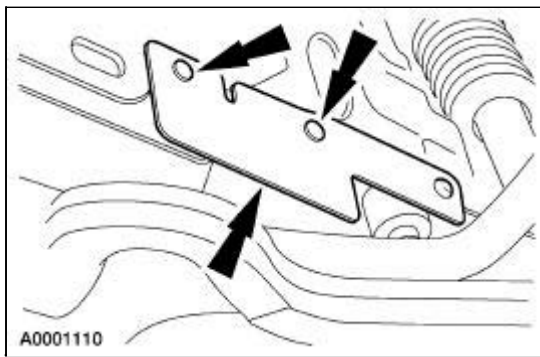
5. Connect the power steering pressure hose.



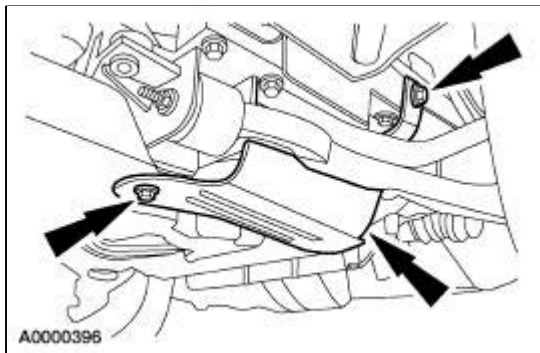
6. Install the bolt.



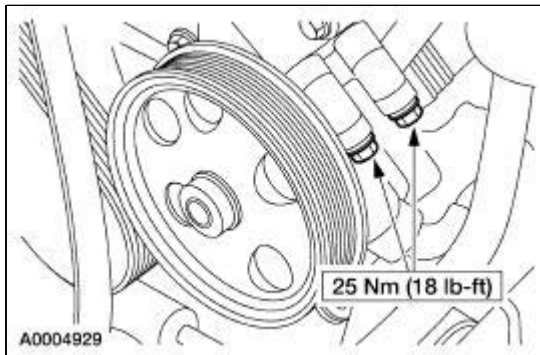
7. Install the shield and two pushpins.



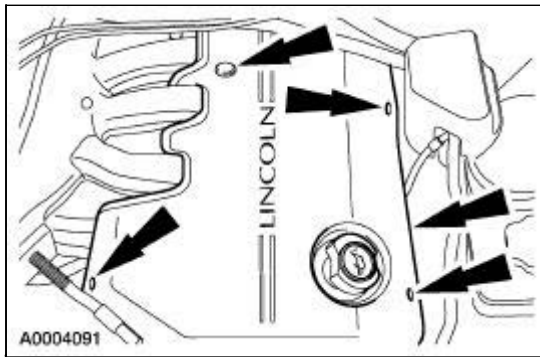
8. Install the shield, one pushpin and two bolts.



9. Install the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
10. Lower the vehicle.
11. Tighten the bolts.





12. Install the accessory drive belt. For additional information, refer to [Section 303-05](#).
13. Install the air cleaner outlet tube and the air cleaner cover. For additional information, refer to [Section 303-12](#).
14. **NOTE:** Inspect the pushpins for cracks or other damage. Install new pushpins if necessary.
Install the engine cover and four pushpins.



15. Fill and leak check the system. For additional information, refer to [Section 211-00](#).
-

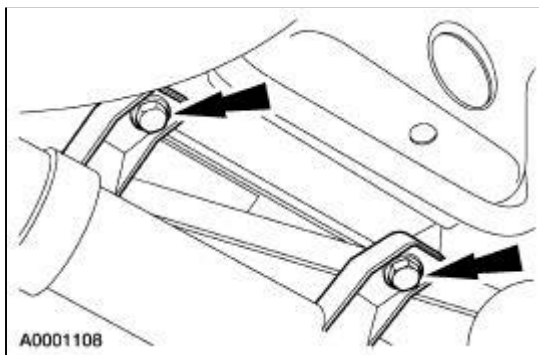
Pulley — Pump, 3.9L

Special Tool(s)

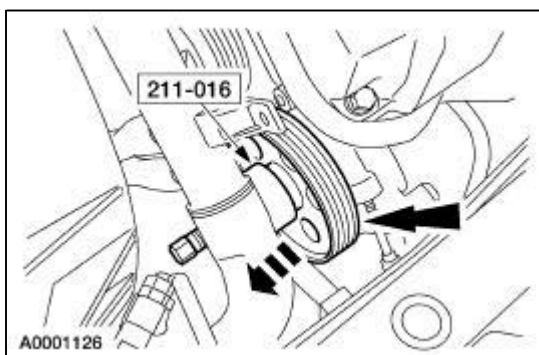
	Pump Pulley Remover 211-016 (T69L-10300-B)
	Steering Pump Pulley Replacer 211-185 (T91P-3A733-A)

Removal

1. Remove the air cleaner and the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
2. Remove the bolts.

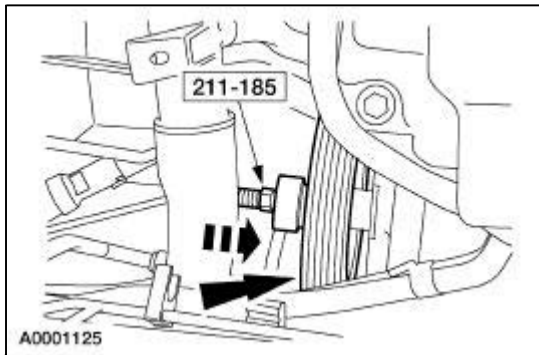


3. Remove the accessory drive belt. For additional information, refer to [Section 303-05](#).
4. Using the special tool, remove the pulley (3A733).

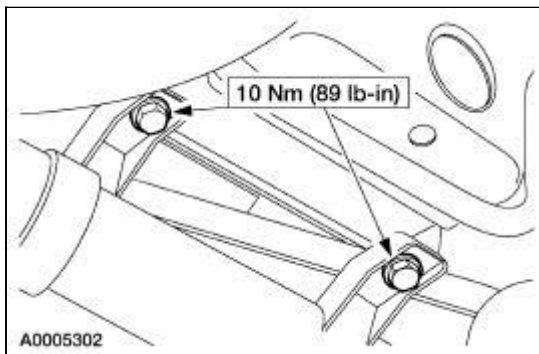


Installation

1. Using the special tool, install the pulley.





2. Install the accessory drive belt. For additional information, refer to [Section 303-05](#).
3. Install the bolts.



4. Install the air cleaner outlet tube and the air cleaner. For additional information, refer to [Section 303-12](#).
-

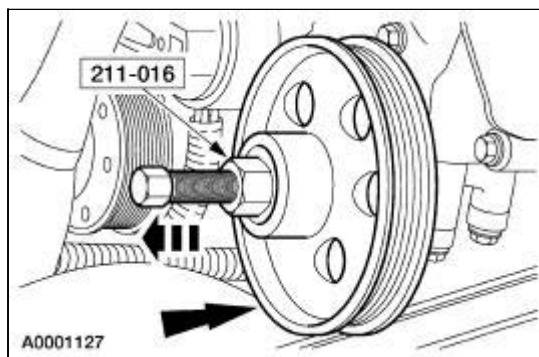
Pulley —Pump, 3.0L

Special Tool(s)

	Pump Pulley Remover 211-016 (T69L-10300-B)
	Pump Pulley Replacer 211-185 (T91P-3A733-A)

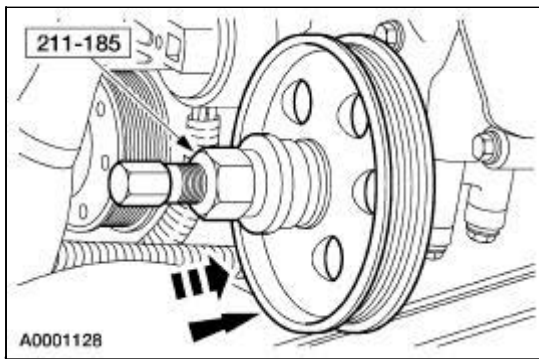
Removal

1. Remove the air cleaner cover and the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
2. Remove the accessory drive belt. For additional information, refer to [Section 303-05](#).
3. Using the special tool, remove the pulley (3A733).



Installation

1. Using the special tool, install the pulley.



2. Install the accessory drive belt. For additional information, refer to [Section 303-05](#).
 3. Install the air cleaner outlet tube and the air cleaner cover. For additional information, refer to [Section 303-12](#).
-

Power Steering Pump to Steering Gear Pressure Line

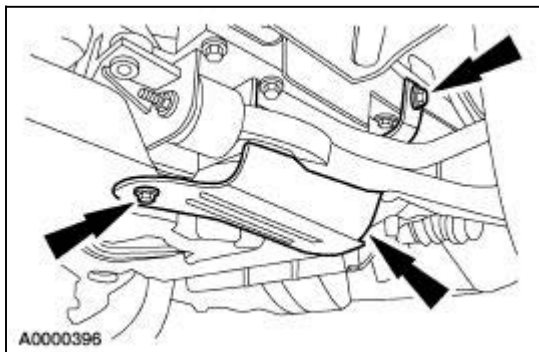
Special Tool(s)



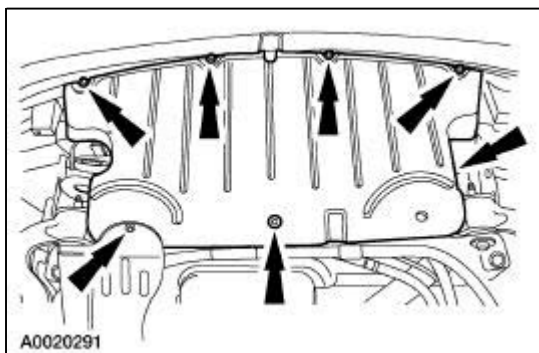
Removal and Installation

All vehicles

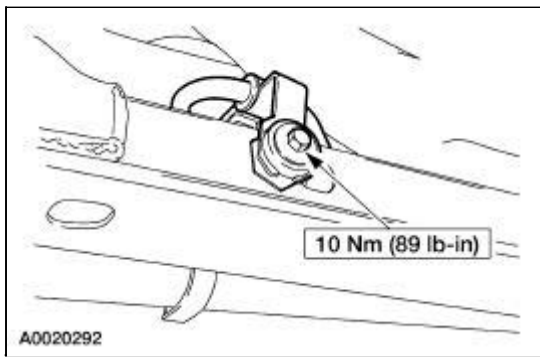
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the screw, pushpin and the air deflector.



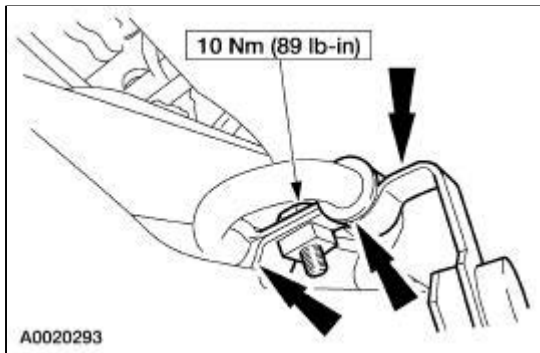
3. Remove the screws and the air deflector.



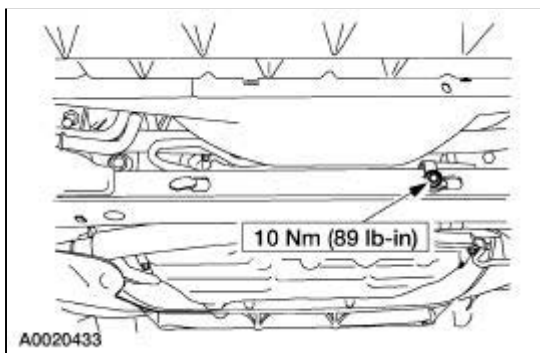
4. Remove the bolt.



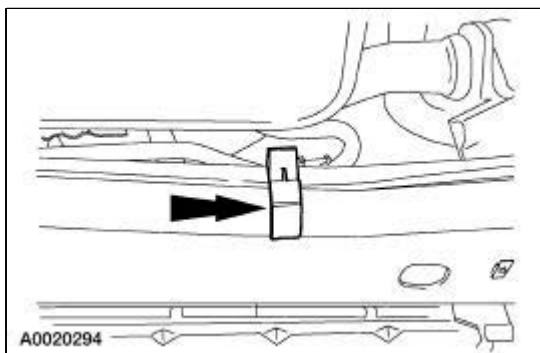
5. Remove the bolt, bracket and bushings.



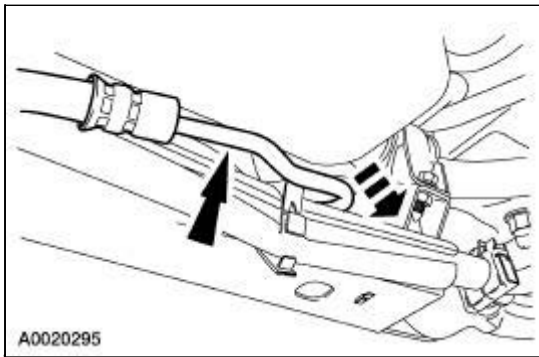
6. Remove the bolt.



7. Unclip the retainer.

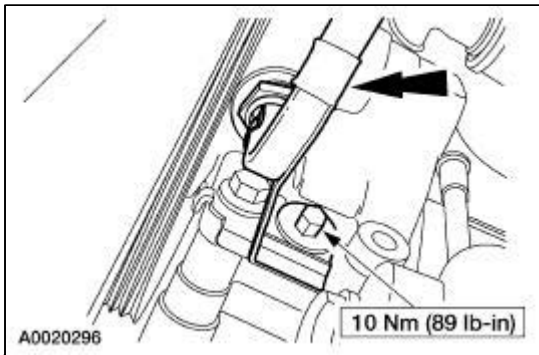


8. Pull the hose rearward between the oil pan and the radiator support crossmember.

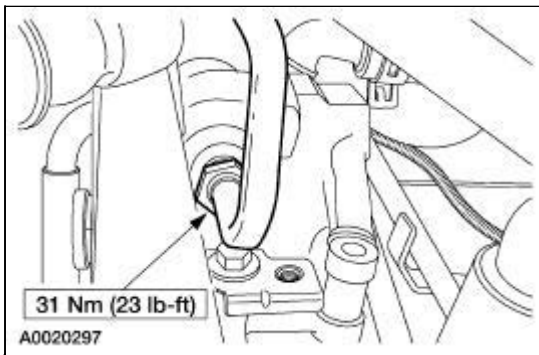


3.0L engine

9. Remove the bolt and the bracket.

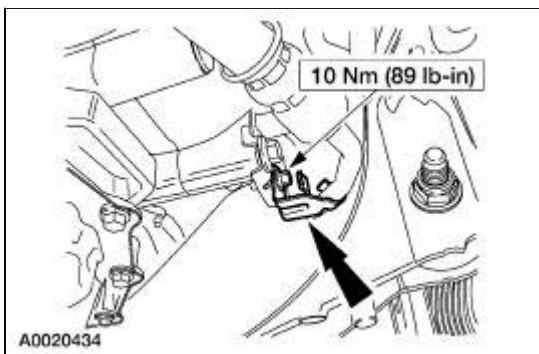


10. Disconnect the hose (3A719) at the pump.

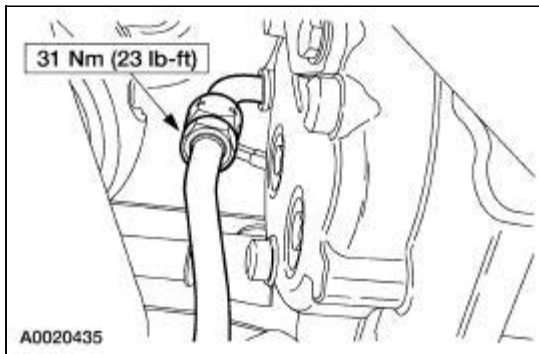


3.9L engine

11. Remove the bolt and the bracket.

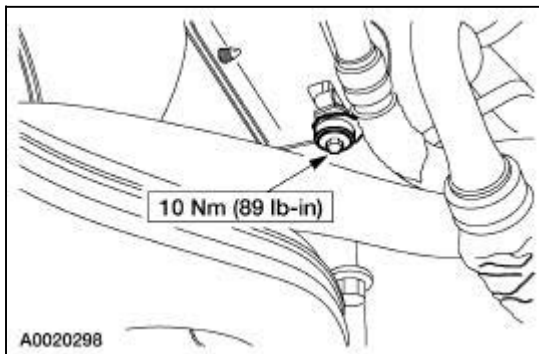


12. Disconnect the hose (3A719) at the pump.
 - Drain the fluid into a suitable container.

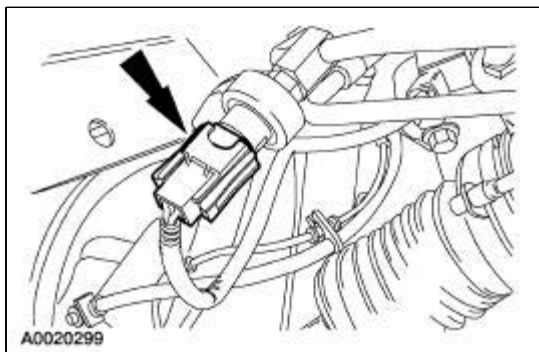


All vehicles

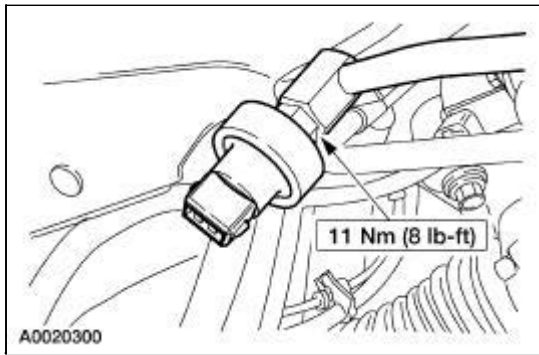
13. Remove the bolt.



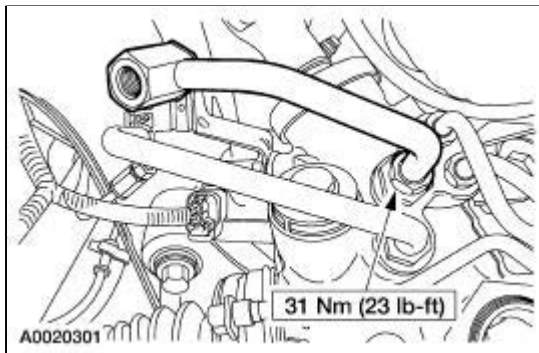
14. Disconnect the wiring at the pressure switch (3N824).



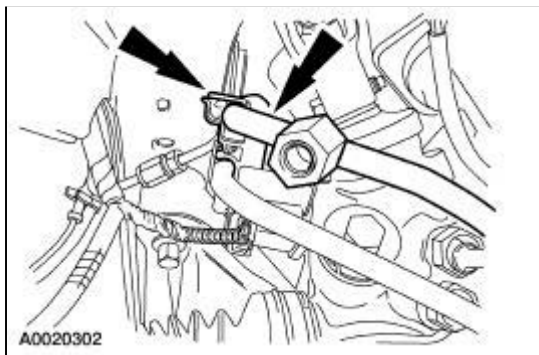
15. Remove the pressure switch.
 - Drain the fluid into a suitable container.



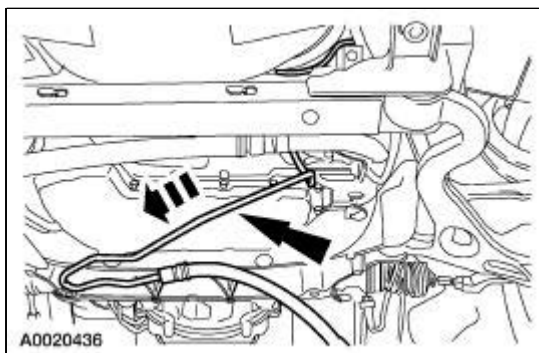
16. Disconnect the hose at the steering gear.



17. Unclip the retainer and detach the hose.

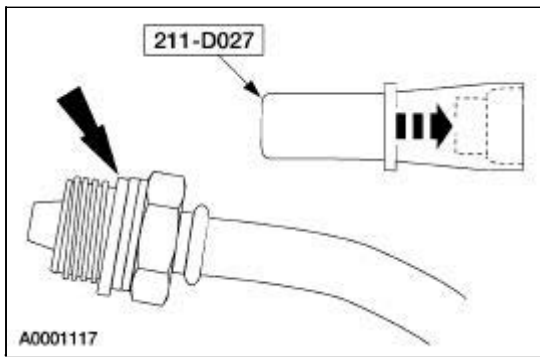


18. Remove the hose.



19. To install, reverse the removal procedure.

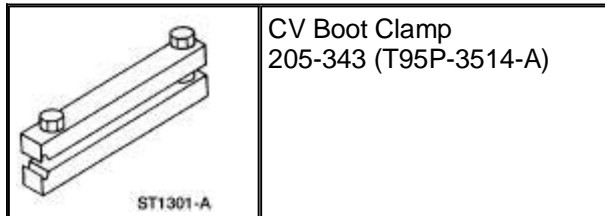
- Install a new seal using the special tool.



20. Fill and leak check the system. For additional information, refer to [Section 211-00](#).

Cooler —Fluid

Special Tool(s)

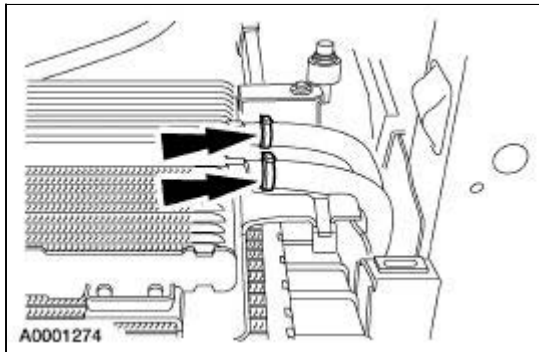


Removal

1. Remove the A/C condenser core. For additional information, refer to [Section 412-03](#).

NOTE: There are four hoses attached to the cooler on a vehicle equipped with a manual transmission. A vehicle equipped with an automatic transmission has six hoses attached to the cooler.

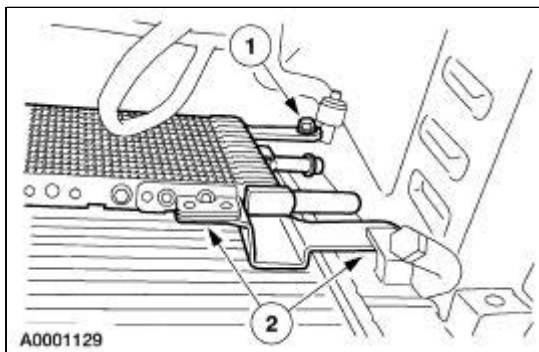
2. Remove and discard the clamps.



3. **NOTE:** Position a drain pan under the vehicle to catch any fluid that may spill.

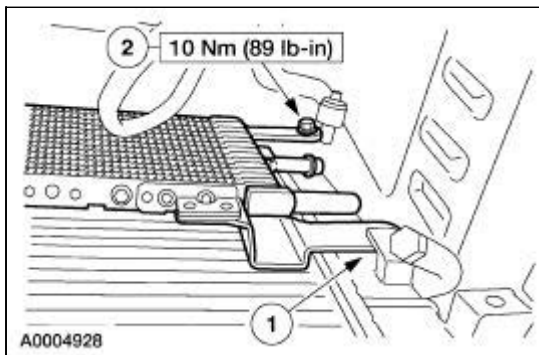
Disconnect the hoses. Plug the hoses and the cooler (3D746).

4. Remove the cooler.
 1. Remove two bolts.
 2. Lift the cooler from the retainers and remove the cooler.

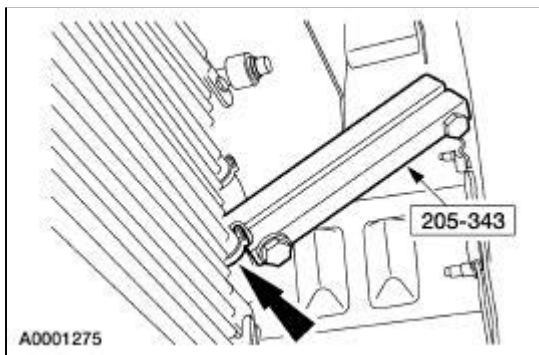


Installation

1. Install the cooler.
 1. Position the cooler on the retainers.
 2. Install two bolts.



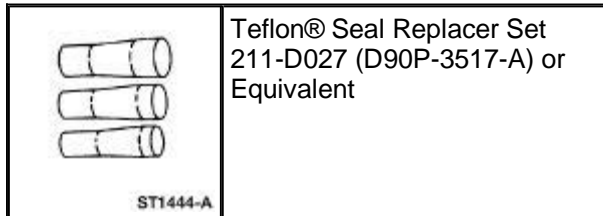
2. Position new clamps on the hoses.
3. Unplug the hoses and the cooler. Connect the hoses.
4. Using the special tool, tighten the clamps.



5. Install the A/C condenser. For additional information, refer to [Section 412-03](#).
 6. Fill and leak check the system. For additional information, refer to [Section 211-00](#).
 7. If the vehicle is equipped with an automatic transmission, check and fill the transmission. For additional information, refer to [Section 307-01](#).
 8. Fill the cooling fan reservoir. For additional information, refer to [Section 303-03](#).
-

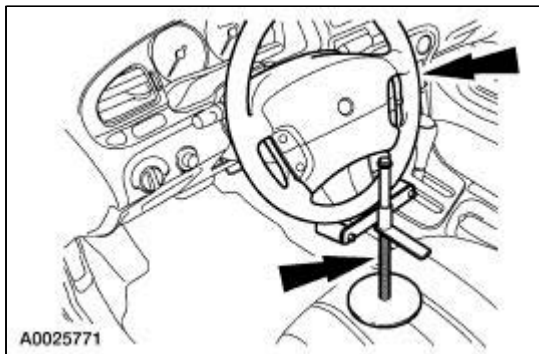
Steering Gear

Special Tool(s)

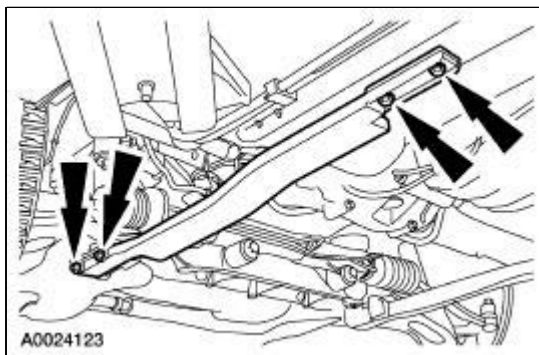


Removal

1. Hold the steering wheel in the straight-ahead position using a suitable holding device.

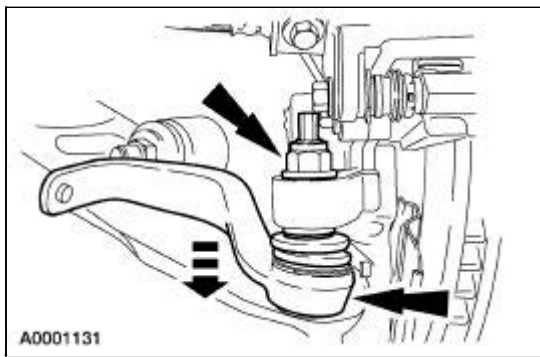


2. Remove the wheel and tire assemblies. For additional information, refer to [Section 204-04](#).
3. If equipped, remove the eight bolts and the two I-braces.
 - Discard the bolts.

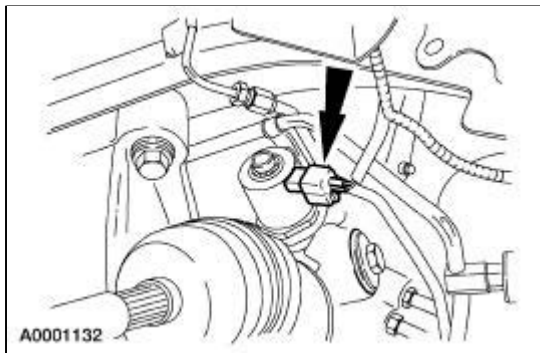


4. **NOTE:** To remove the nuts, first loosen the nut, and then use the hex holding feature to prevent the tie-rod end ball joint from turning.

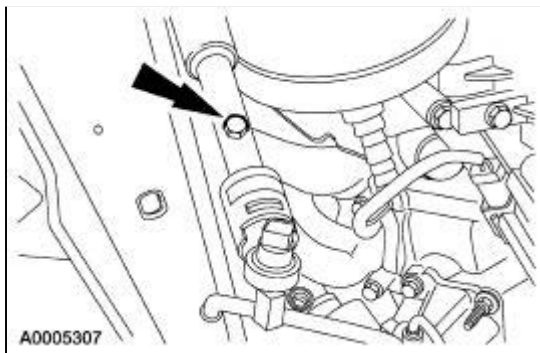
Remove the nuts and disconnect the tie-rod ends (3A130). Discard the nuts.




5. Disconnect the electrical connector.

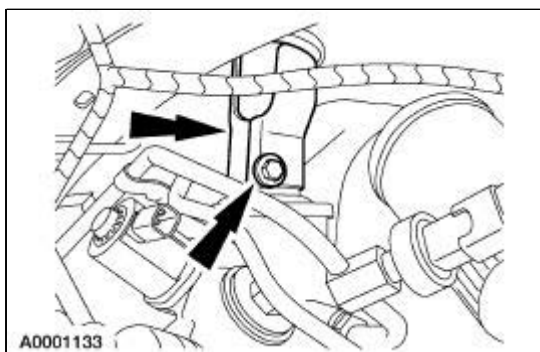


6. Loosen the bolt.

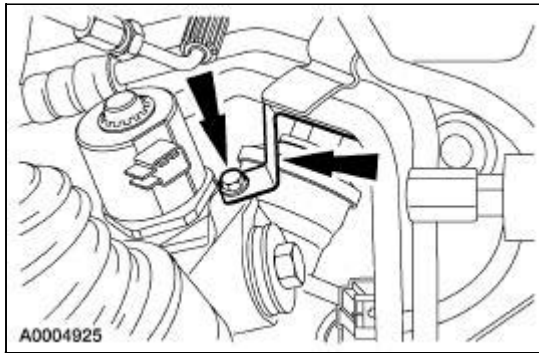


7.  **CAUTION:** Do not allow the steering wheel to rotate while the steering column intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the wheel has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B.

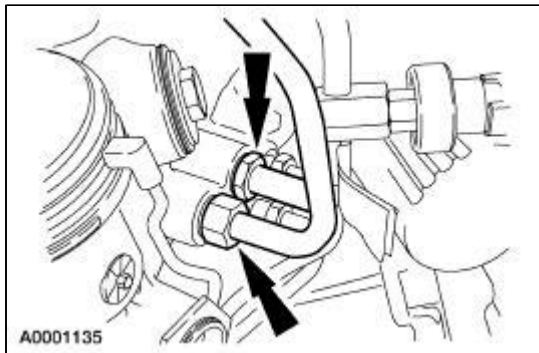
Remove the pinch bolt and disconnect the intermediate shaft (3A525).



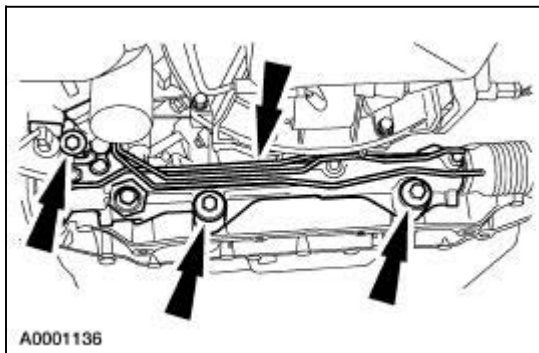
8. Remove the bolt and disconnect the power steering hose bracket.



9. Disconnect the power steering hoses. Plug the hose ends and the gear.

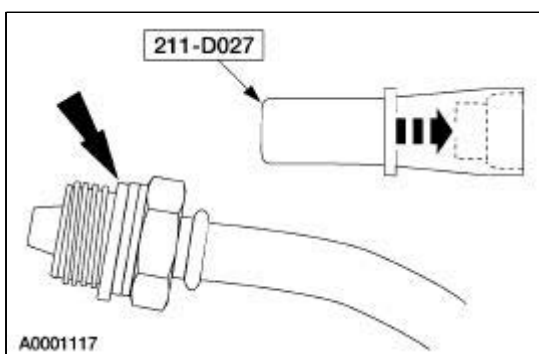


10. Remove the nuts, bolts and the power steering gear (3504). Discard the nuts.

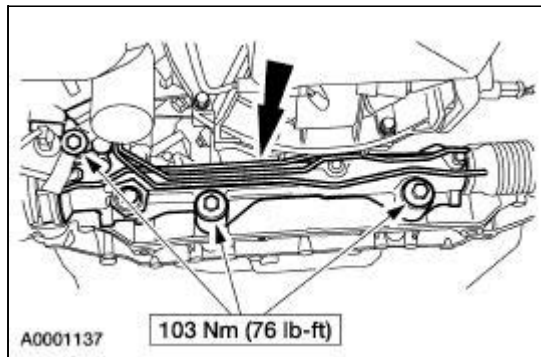


Installation

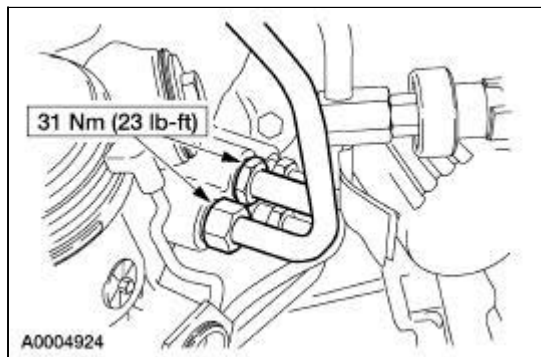
1. Using the appropriate special tool, install new O-rings on the power steering pressure and return hose fittings.



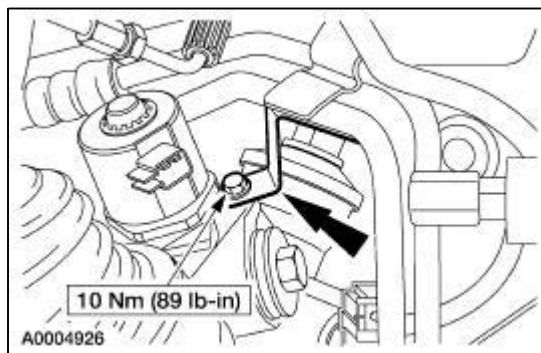
2. Position the power steering gear and install the bolts and new nuts.




3. Remove the plugs and connect the power steering hoses.

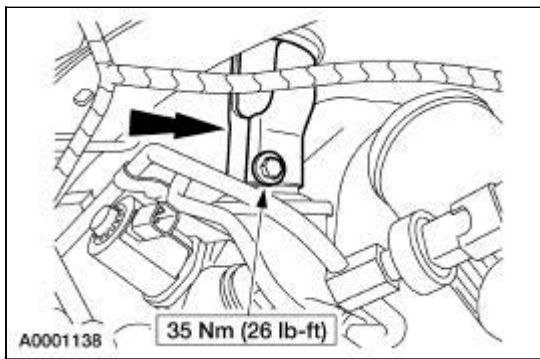


4. Connect the power steering hose bracket and install the bolt.

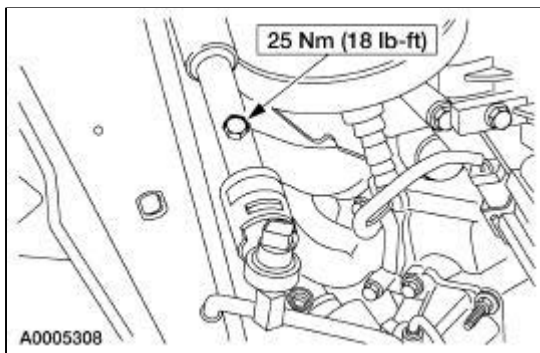


5.  **CAUTION:** Do not allow the steering wheel to rotate while the steering column intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence that the wheel has rotated, the clockspring must be removed and recentered. For additional information, refer to [Section 501-20B](#).

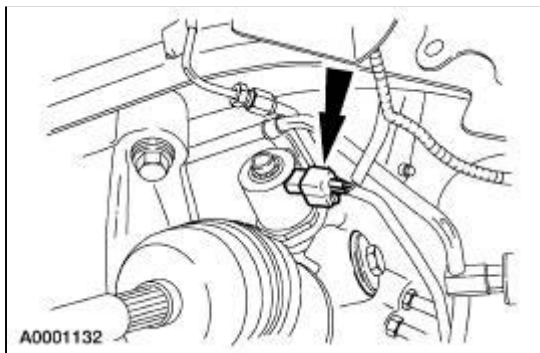
Connect the intermediate shaft and install the bolt.



6. Tighten the bolt.

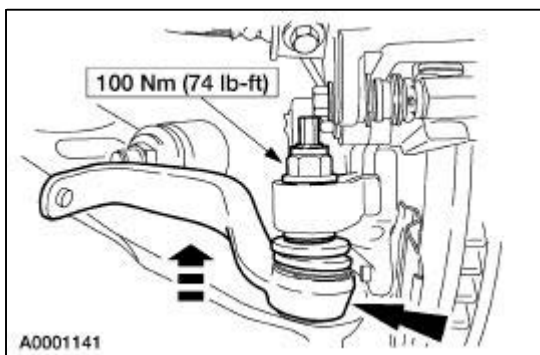


7. Connect the electrical connector.



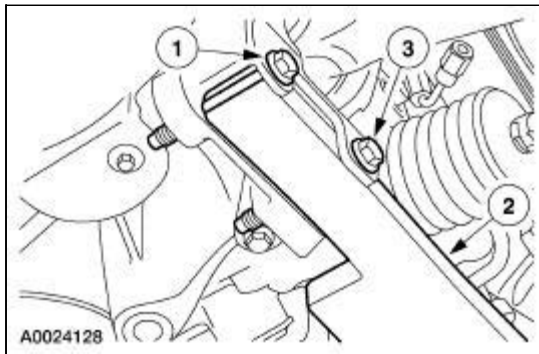
8. **NOTE:** To install the nuts, use the hex holding feature to prevent the tie-rod end ball joint from turning. Final tighten using a socket and a torque wrench.

Connect the tie-rod ends and install new nuts.

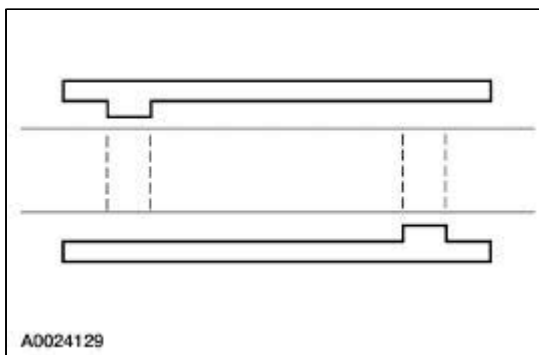


9. If equipped, position the two I-braces and loosely install the bolts.
 1. Loosely install the front bolts.

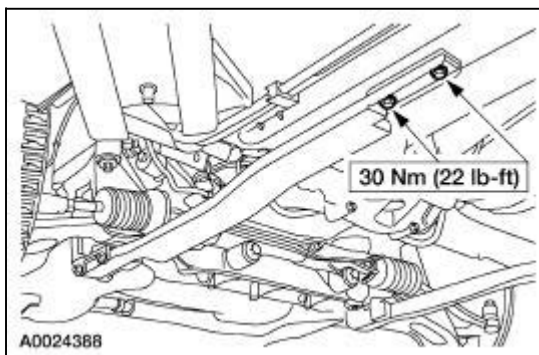
2. Position the I-braces.
3. Loosely install the rear bolts.



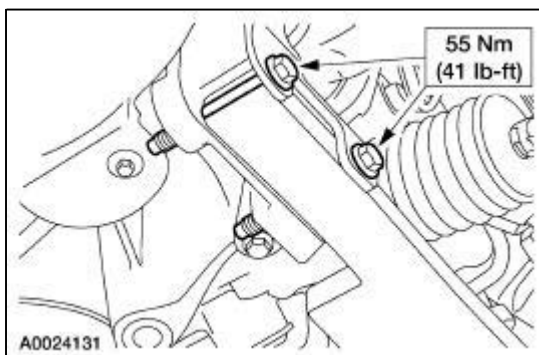
10. If equipped, make sure that the I-brace insulators are correctly positioned.



11. If equipped, install the I-brace bolts.

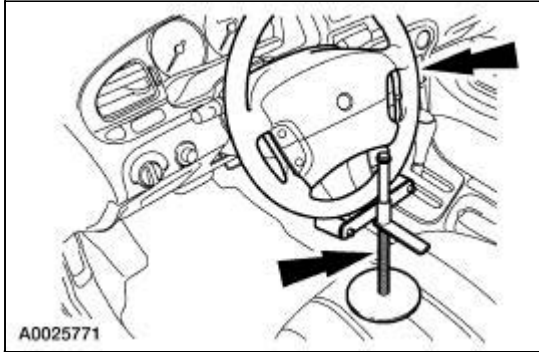


12. If equipped, tighten the I-brace bolts.



13. Install the wheel and tire assemblies. For additional information, refer to [Section 204-04](#).

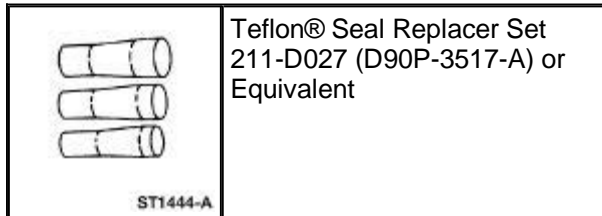
14. Remove the steering wheel holding device.



15. Fill and leak check the system. For additional information, refer to [Section 211-00](#).
 16. Check wheel alignment. Adjust as necessary. For additional information, refer to [Section 204-00](#).
-

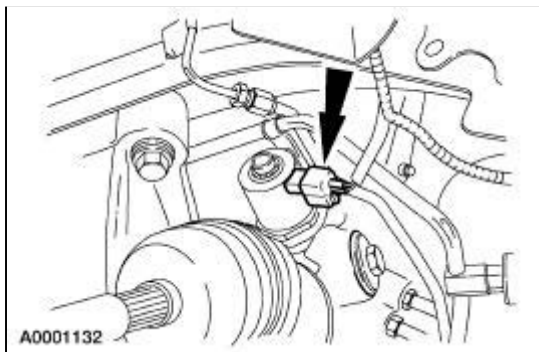
Power Steering Control Valve Actuator

Special Tool(s)

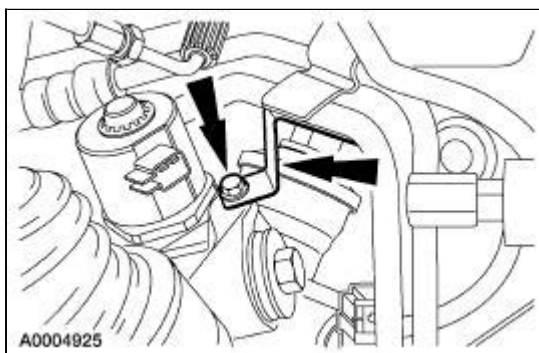


Removal

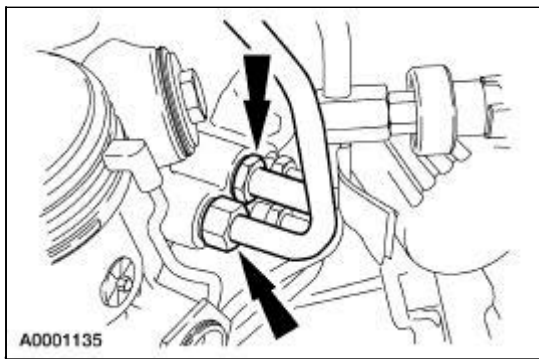
1. Raise the vehicle on a hoist. For additional information, refer to [Section 211-00](#).
2. Disconnect the electrical connector.



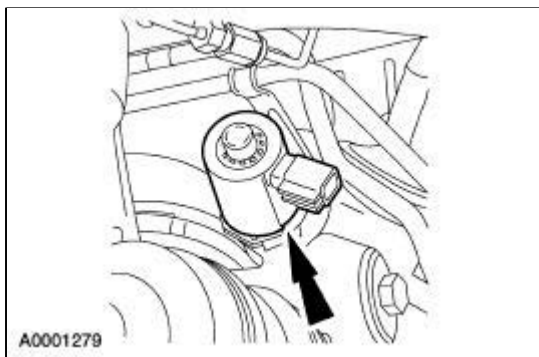
3. Remove the bolt and disconnect the power steering hose bracket.



4. Disconnect the power steering hoses. Plug the hose ends and the gear.

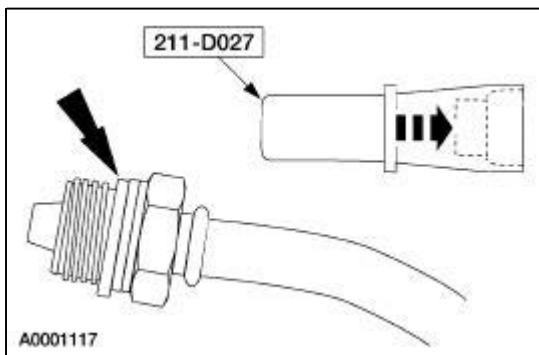


5. Remove the control valve actuator.

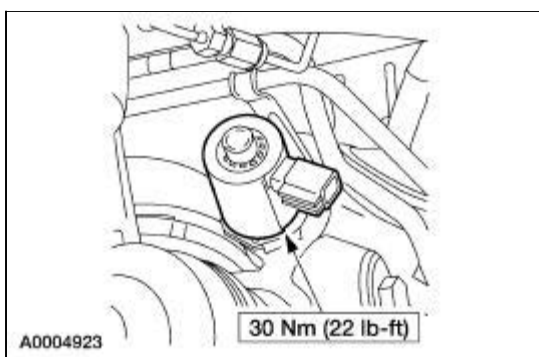


Installation

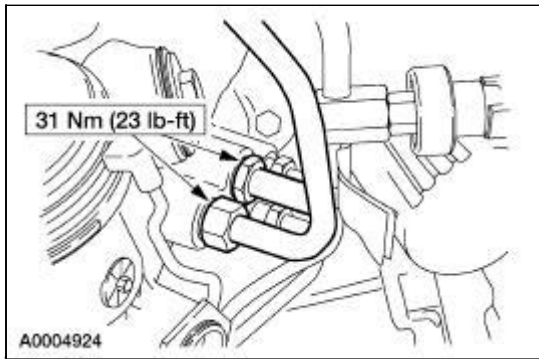
1. Using the appropriate special tool, install new O-rings on the power steering hose fittings.



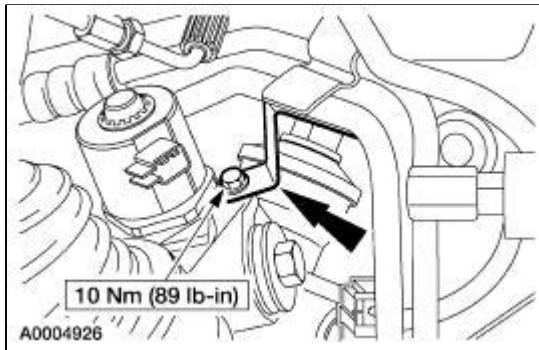
2. Install the control valve actuator.



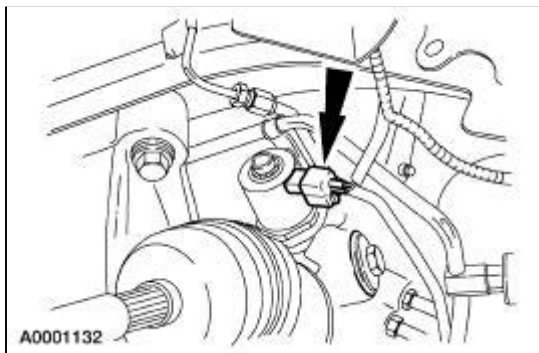
3. Remove the plugs and connect the power steering hoses.



4. Connect the power steering hose bracket and install the bolt.



5. Connect the electrical connector.

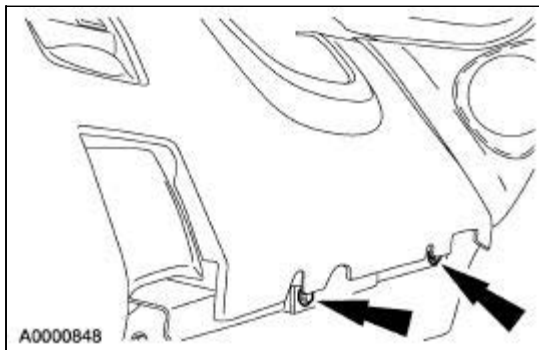


6. Lower the vehicle.
-

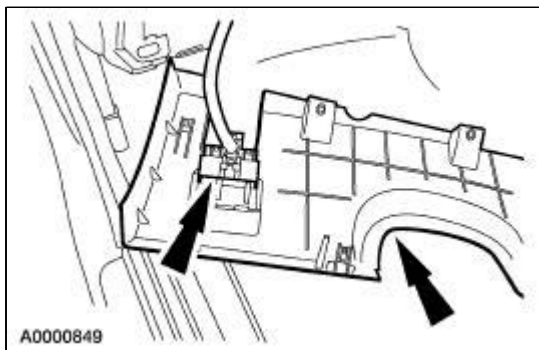
Steering Wheel Rotation Sensor

Removal and Installation

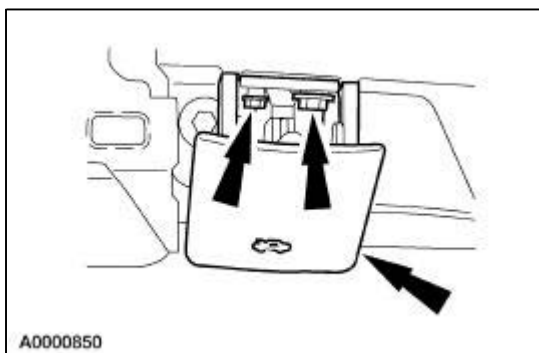
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the screws and pull the lower steering column opening finish panel out far enough to access the electrical connectors.



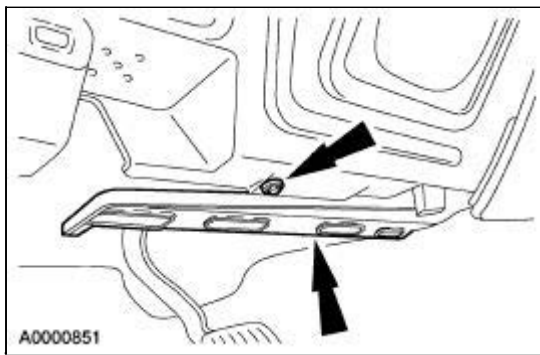
3. Disconnect the electrical connectors and remove the finish panel.



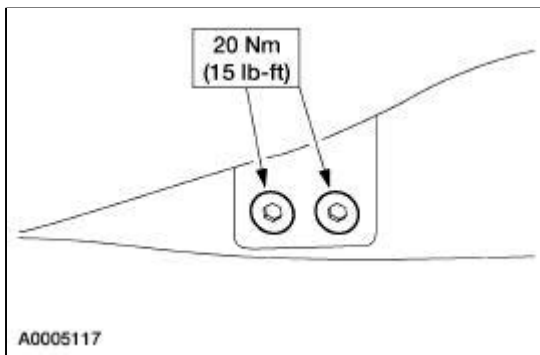
4. Remove the screws and disconnect the hood release assembly.



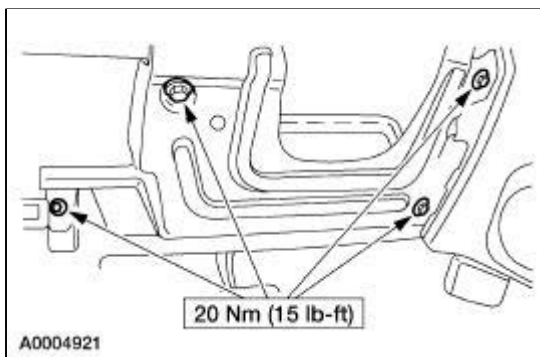
5. Remove the screw and the heater duct.



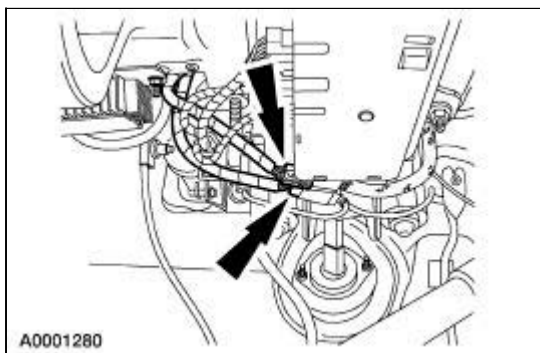
6. Pull the carpet away from the console tunnel and loosen the bolts.



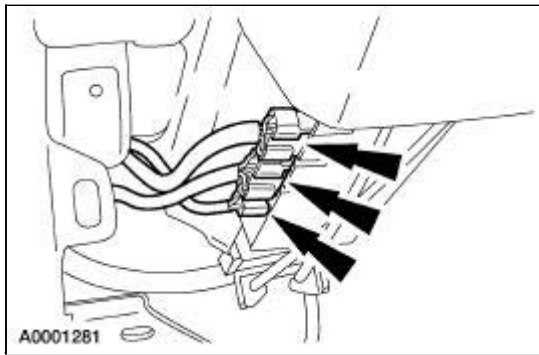
7. Remove four screws and the steering column opening reinforcement.



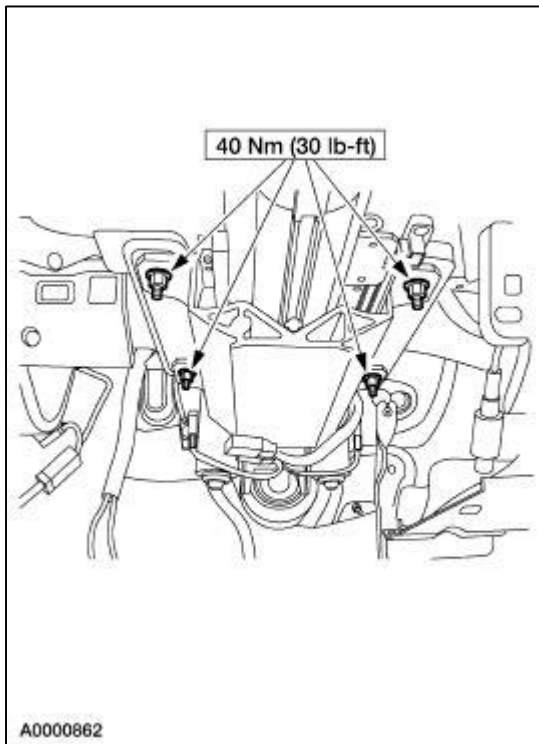
8. Disconnect the steering wheel rotation sensor and the electric tilt/telescoping motor electrical connectors.



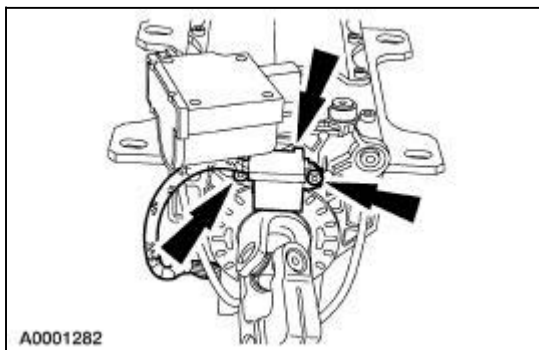
9. Disconnect the electrical connectors.



10. While supporting the steering column, remove the lock nuts and the steering column.
 - Discard the nuts.



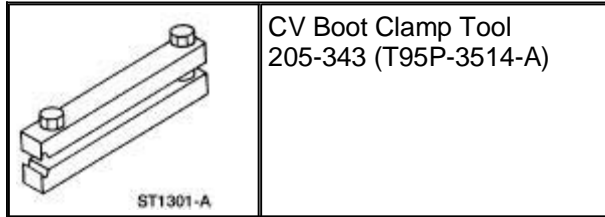
11. Remove the screws. Detach the electrical connector from the steering column and remove the sensor.



12. To install, reverse the removal procedure.
-

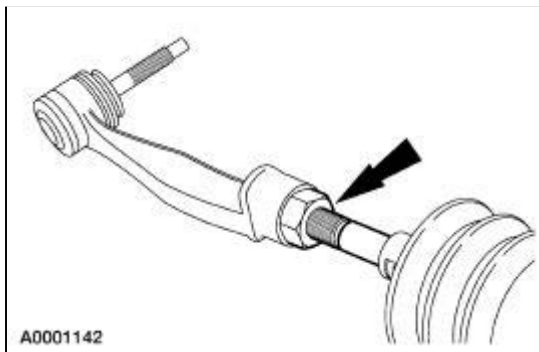
Gear

Special Tool(s)

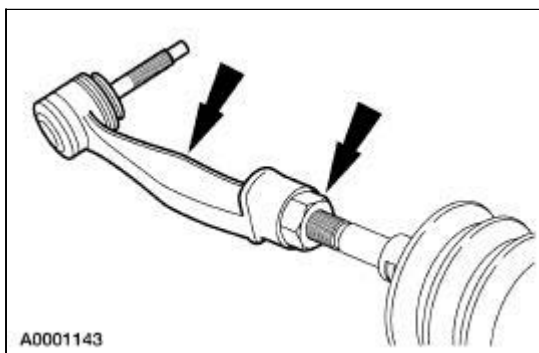


Disassembly

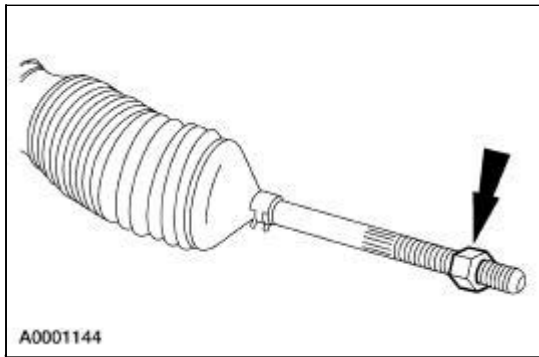
1. Position the power steering gear (3504) in a soft-jawed vice.
2. Mark the jam nuts and the tie-rods for installation reference.



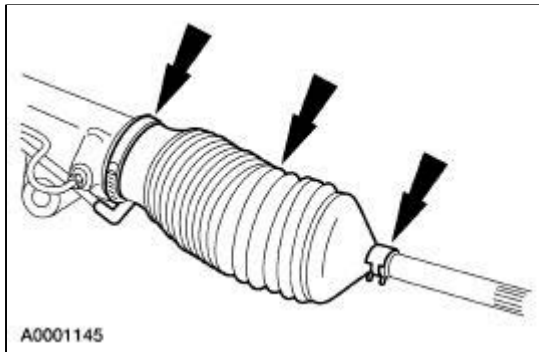
3. Loosen the jam nuts and remove the tie-rod ends (3A130).



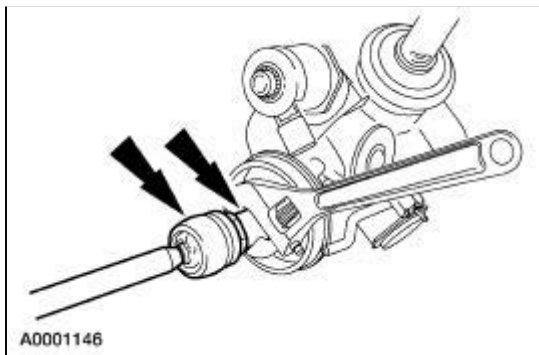
4. Remove the jam nuts.



5. Remove the boot clamps and the boots.

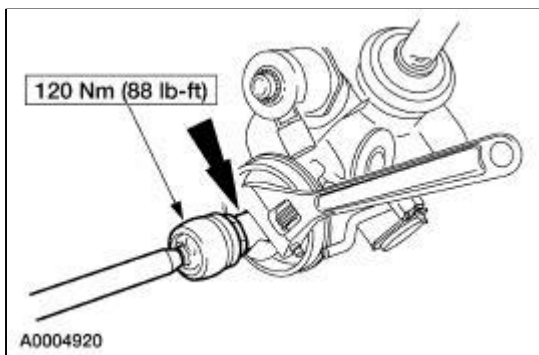


6. While holding the rack, remove the tie-rods.

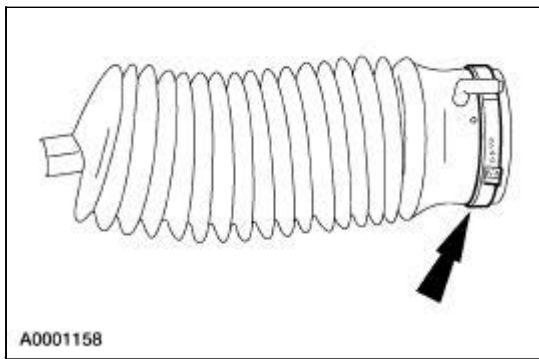


Assembly

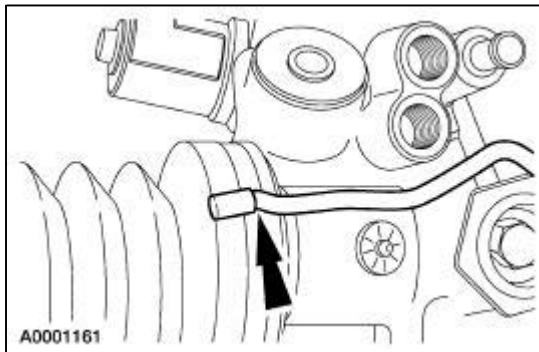
1. While holding the rack, install the tie-rods.



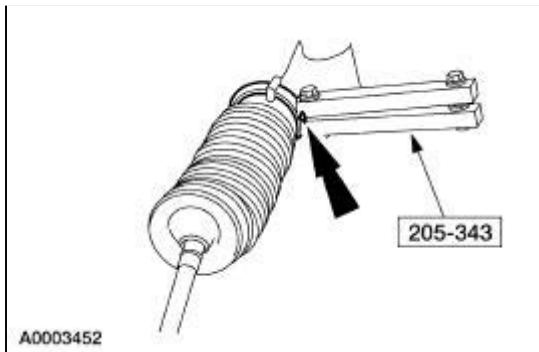
2. Position new inner clamps on the boots.



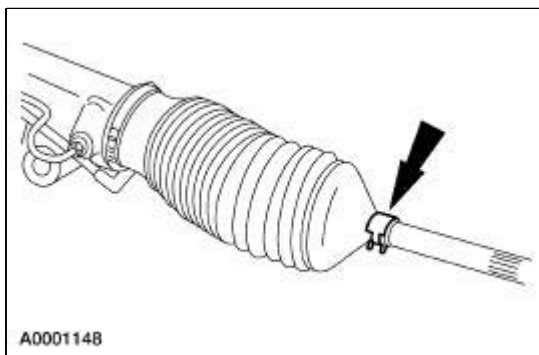
3. Position the boots on the gear, making sure the air tube is correctly installed in the boots and aligned between the locating marks on the gear housing.



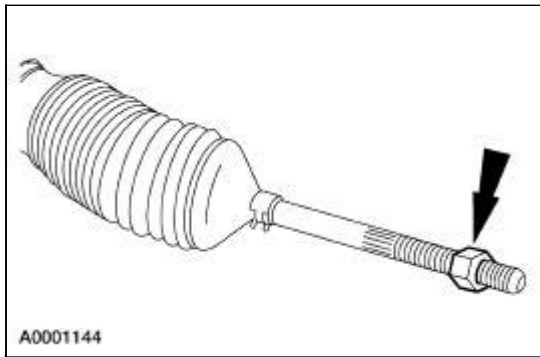
4. Using the special tool, tighten the clamps.



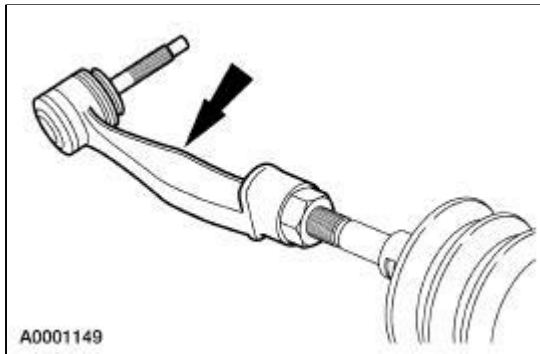
5. Install the clamp.



6. Install the jam nuts to the marks made during installation.



7. Install the tie-rod ends.



Torque Specifications

Description	Nm	lb-ft	lb-in
Steering column mounting nuts	17	13	—
Steering column release motor assembly mounting screws	3	—	27
Steering column-to-intermediate shaft pinch bolt	30	22	—
Intermediate shaft-to-gear pinch bolt	35	26	—
Steering sensor screws	3	—	27
Steering wheel bolt	38	38	—

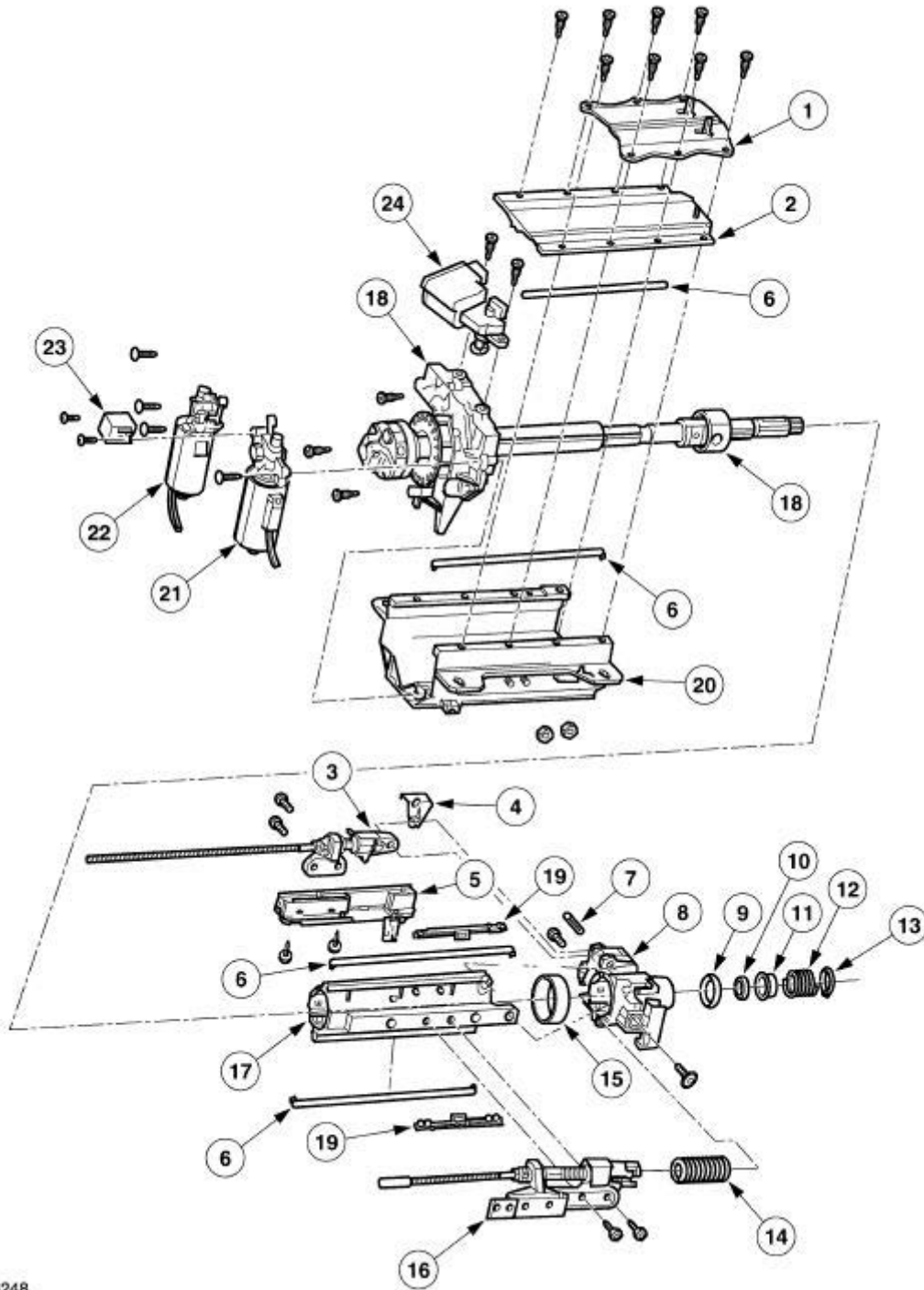
Steering Column

NOTE: All fasteners are important in that they can affect the performance of vital parts and systems, and their failure can result in major repair expenses. New fasteners of the same part number must be installed if the installation of new fasteners becomes necessary. Do not install a part of lesser quality or substitute design. Torque values must be used as specified during assembly to make sure these parts function correctly.

The vehicle is equipped with a power tilt/telescopic steering column that allows the steering wheel angle and length to be adjusted to suit the driver.

Power Tilt/Telescopic Steering Column

Exploded View— Power Tilt/Telescopic Steering Column



A0006248

Item	Part Number	Description
1	3F790	Steering column outer housing plate
2	3F789	Steering column outer housing
3	3F797	Steering column actuator assembly (tilt)
4	3A517	Steering column connector link
5	14A605	Steering column potentiometer assembly
6	3B628	Steering column track
7	3D545	Steering column release pin

8	3511	Steering column tube flange
9	3517	Steering column tube bearing assembly
10	3L539	Steering column upper bearing tolerance ring
11	3518	Steering column bearing sleeve
12	3520	Steering column upper bearing spring
13	97663	Steering column upper bearing retainer
14	3D655	Steering column position spring
15	3517	Steering column tube bearing assembly
16	3F797	Steering column actuator assembly (telescopic)
17	3F791	Steering column inner housing
18	3524	Steering column upper shaft assembly
19	3F795	Steering column inner track bearing retainer assembly
20	3B718	Steering column support assembly
21	3D538	Steering column release motor assembly (telescopic)
22	3D538	Steering column release motor assembly (tilt)
23	18B015	Steering wheel absorber electronic steering sensor
24	3K772	Steering wheel lock actuator (manual transmission only)

The power tilt/telescopic steering column is of modular construction that features easy to service electrical switches.

The power tilt/telescopic steering columns are equipped with an electric tilt and telescopic mechanisms that allow the steering wheel angle and length to be adjusted to suit the driver. Vehicles with the memory package, the steering wheel position is stored in memory in the same way as the driver seat position and retrieved as a personality feature. The steering column is controlled by the instrument cluster module.

Before carrying out work on or around any supplemental air bag system component, observe all supplemental air bag system conditions and warnings to avoid unnecessary air bag deployment and possible injury. Refer to [Section 501-20B](#) for supplemental air bag system.

Ignition Switch

The ignition lock cylinder and switch are two components. When the lock cylinder ignition key is turned to different positions, it is aligning electrical contacts in the ignition switch. Electrical contacts are made in the ACC (Accessory), RUN and START positions. In the OFF position the switch is open and the key can be removed.

The ignition switch and lock cylinder assembly is mounted to the right of the steering column in the instrument panel. An opening in the instrument panel provides key access to the lock cylinder.



Steering Column

Refer to Section 211-00 .

Steering Column —Tilt/Telescopic Motors

Refer to Wiring Diagrams Section [211-04](#) for schematic and connector information.

Special Tool(s)

 ST1137-A	77 III Automotive Meter 105-R0056 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224 New Generation STAR (NGS) Tester 418-F052 or equivalent scan tool

Inspection and Verification

1. Verify the customer's concern by operating the steering column switch to duplicate the condition.
2. Inspect to determine if one of the following apply:

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Binding steering column 	<ul style="list-style-type: none"> ● Damaged fuse central power distribution box fuse 19 (15A) ● Damaged multi-function switch ● Circuitry open/shorted ● Loose/corroded electrical connectors

3. If inspection reveals obvious concern(s) that can be readily identified, repair as required.
4. If the concern remains after the inspection, connect scan tool to the data link connector (DLC) located beneath the instrument panel to carry out DATA LINK DIAGNOSTIC TEST. Refer to [Section 418-00](#) . If the scan tool responds with NO RESPONSE/NOT EQUIPPED for instrument cluster module (ICM), refer to [Section 413-01](#) . If the DATA LINK DIAGNOSTIC TEST is passed for the ICM, retrieve continuous diagnostic trouble codes (DTCs) and execute Self Test Diagnostics for the ICM. Refer to [Section 418-00](#) .
5. If the self test is passed and no diagnostic trouble codes (DTCs) are retrieved, GO to [Symptom Chart](#) to continue diagnostics.
6. If diagnostic trouble codes (DTCs) are retrieved, go to the Instrument Cluster Module (ICM) Diagnostic Trouble Code (DTC) Index to continue diagnostics.

7. If the instrument cluster module (ICM) cannot be accessed by the scan tool, refer to [Section 413-01](#).

Instrument Cluster Module (ICM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B2328	Steering Column Reach Feedback Potentiometer Circuit Failure	ICM	Go To Pinpoint Test A .
B2332	Steering Column Tilt Feedback Potentiometer Circuit Failure	ICM	Go To Pinpoint Test B .
B2328 and B2332	B2328 and B2332 Steering Column Feedback Potentiometers Circuit Failure	ICM	Go To Pinpoint Test D .
B2351	Steering Column Switch Signal Circuit Failure	ICM	Go To Pinpoint Test C .


Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the instrument cluster module (ICM) 	<ul style="list-style-type: none"> Instrument cluster module (ICM). Circuitry. 	<ul style="list-style-type: none"> REFER to Section 413-00.
<ul style="list-style-type: none"> The tilt and telescope are inoperative 	<ul style="list-style-type: none"> Instrument cluster module (ICM). Multi-function switch. Circuitry. Steering column potentiometer assembly (14A605). 	<ul style="list-style-type: none"> Go To Pinpoint Test D.

Pinpoint Tests

PINPOINT TEST A: DTC B2328: STEERING COLUMN REACH FEEDBACK POTENTIOMETER CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK CONTINUOUS DTCs	
<p>1</p>  <p>Instrument Cluster Module (ICM) Continuous DTCs</p>	<ul style="list-style-type: none"> Is DTC B2328 present?

→ **Yes**
GO to A2.

→ **No**
GO to A11.

A2 CHECK FOR MOTION FAULTS

2



Instrument Cluster Module CLEAR DTCs

5



Instrument Cluster Module SELF-TEST

1 Disconnect and reconnect the battery.

3 Actuate the steering column to the full in position.

4 Actuate the steering column to the full out position.

● **Is DTC B2328 present?**

→ **Yes**
GO to A3.

→ **No**
System was deactivated due to ICM registering an excessive number of motion faults. NOTIFY owner that concern has been corrected. REPEAT the self-test. CLEAR the DTCs.

A3 CHECK STEERING COLUMN BEARINGS

1 Remove the steering column shrouds.

2 Check the steering column bearings to make sure that they are fully seated back against the stops.

● **Are the steering column bearings correctly seated back against the stops?**

→ **Yes**
GO to A4.

→ **No**
SEAT the steering column bearings back against the stops. REPEAT the self-test. CLEAR the DTCs.

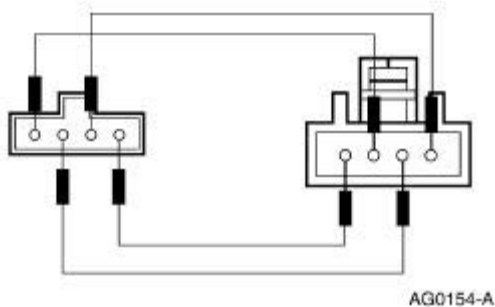
A4 ISOLATE THE POTENTIOMETERS

1



Steering Column Potentiometer Assembly C222

2



2

Connect a jumper wire between the steering column potentiometer assembly C222-1, circuit 9-AL17 (PK/OG), harness side and the steering column potentiometer assembly terminal 1.

3

Connect a jumper wire between the steering column potentiometer assembly C222-4, circuit 7-AL17 (DG/WH), harness side and the steering column potentiometer assembly terminal 4.

4

Connect a jumper wire between the steering column potentiometer assembly C222-2, circuit 8-AL17 (DB/YE) and the steering column potentiometer assembly terminal 3.

5

Connect a jumper wire between the steering column potentiometer assembly C222-3, circuit 8-AL16 (PK/LB) and the steering column potentiometer assembly terminal 2.

6



Instrument Cluster Module Self-Test

● Is DTC B2332 retrieved?

→ **Yes**

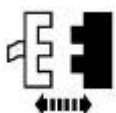
INSTALL a new steering column potentiometer assembly. REPEAT the self-test. CLEAR the DTCs.

→ **No**

GO to A5.

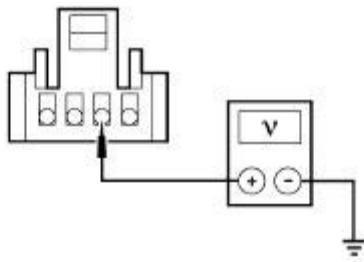
A5 CHECK CIRCUIT 8-AL16 (PK/LB) FOR A SHORT TO B+

1



Retractor Box C218

2



A0044054

2

Measure the voltage at the steering column potentiometer C222-3, circuit 8-AL16 (PK/LB), harness side.

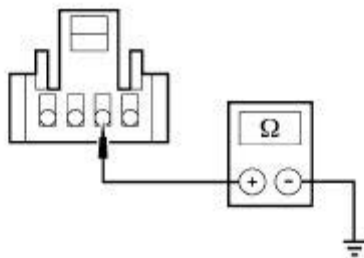
● Is voltage present?

→ **Yes**
REPAIR circuit 8-AL16. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to A6.

A6 CHECK CIRCUIT 8-AL16 (PK/LB) FOR A SHORT TO GROUND

1



A0043712

1

Measure the resistance between the steering column potentiometer C222-3, circuit 8-AL16 (PK/LB), harness side and ground.

● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to A7.

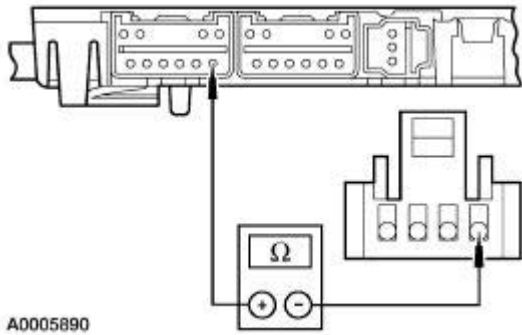
→ **No**
REPAIR circuit 8-AL16. REPEAT the self-test. CLEAR the DTCs.

A7 CHECK CIRCUIT 8-AL16 (PK/LB) FOR AN OPEN

1

1

Measure the resistance between the steering column potentiometer assembly C222-4, circuit 8-AL16 (PK/LB), harness side and the retractor box C218-6, circuit 8-AL16 (PK/LB).



● Is the resistance less than 5 ohms?

→ **Yes**
GO to A8.

→ **No**
REPAIR circuit 8-AL16. REPEAT the self-test. CLEAR the DTCs.

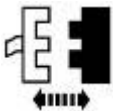
A8 CHECK CIRCUIT 8-AL16 (WH/BK) FOR A SHORT TO B+

1



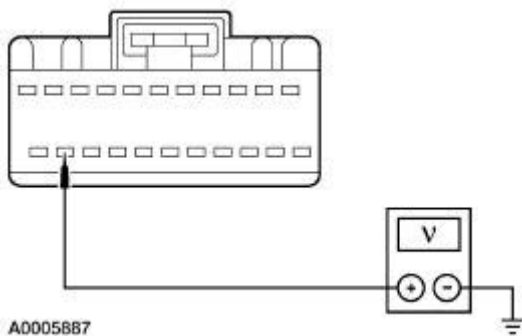
Steering Column Potentiometer Assembly C222

2



Instrument Cluster Module C220c

3



3 Measure the voltage at instrument cluster module C220c-21, circuit 8-AL16 (WH/BK), harness side.

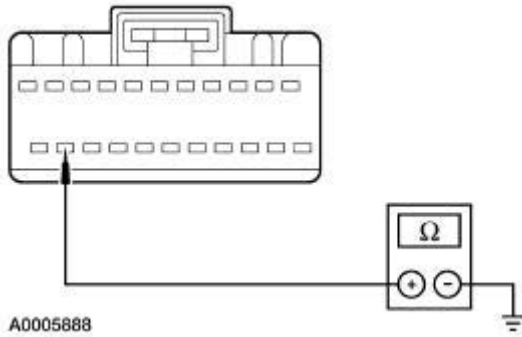
● Is voltage present?

→ **Yes**
REPAIR circuit 8-AL16. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to A9.

A9 CHECK CIRCUIT 8-AL16 (WH/BK) FOR A SHORT TO GROUND

1



1

Measure the resistance between the instrument cluster module C220c-21, circuit 8-AL16 (WH/BK), harness side and ground.

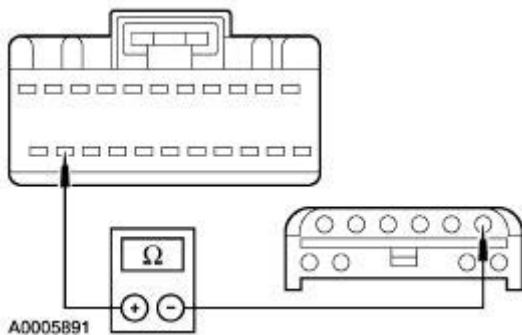
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to A10.

→ **No**
REPAIR circuit 8-AL16. REPEAT the self-test. CLEAR the DTCs.

A10 CHECK CIRCUIT 8-AL16 (WH/BK) FOR AN OPEN

1



1

Measure the resistance between the retractor box C218-6, circuit 8-AL16 (WH/BK), harness side and the instrument cluster C220c-21, circuit 8-AL16 (WH/BK), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL an instrument cluster module. REFER to Section 413-01. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR circuit 8-AL16. REPEAT the self-test. CLEAR the DTCs.

A11 CHECK FOR STEERING COLUMN MOVEMENT

NOTE: This active command will only power motors for one second.

1



Instrument Cluster Module Active Command STEERING COLUMN CONTROL

2



Trigger TELES CP IN On, Then TELSCPOUT On

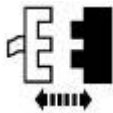
● Does the steering column telescope in and out?

→ Yes
GO to A12.

→ No
GO to A14.

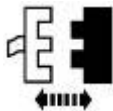
A12 CHECK CIRCUIT 8-AL16 (PK/LB) FOR AN OPEN

1



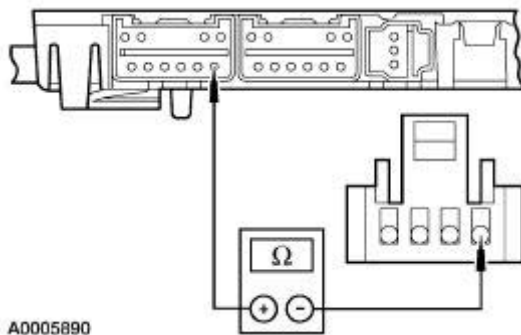
Steering Column Potentiometer C222

2



Retractor Box C218

3



3 Measure the resistance between the steering column potentiometer assembly C222-4, circuit 8-AL16 (PK/LB), harness side and the retractor box C218-6, circuit 8-AL16 (PK/LB).

● Is the resistance less than 5 ohms?

→ Yes
GO to A13.

→ No
REPAIR circuit 8-AL16. REPEAT the self-test. CLEAR the DTCs.

A13 CHECK CIRCUIT 8-AL16 (WH/BK) FOR AN OPEN

1



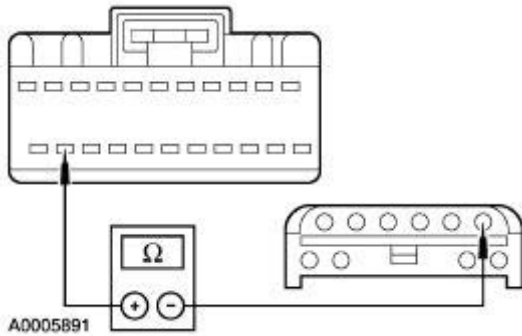
Steering Column Potentiometer Assembly C222

2



Instrument Cluster Module C220c

3



3

Measure the resistance between the retractor box C218-6, circuit 8-AL16 (WH/BK), harness side and the instrument cluster C220c-21, circuit 8-AL16 (WH/BK), harness side.

● Is the resistance less than 5 ohms?

→ Yes

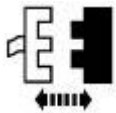
INSTALL a new steering column potentiometer assembly. REPEAT the self-test. CLEAR the DTCs.

→ No

REPAIR circuit 8-AL16. REPEAT the self-test. CLEAR the DTCs.

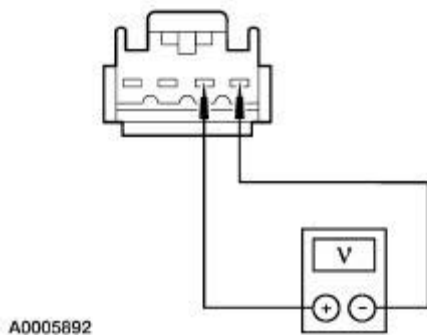
A14 ISOLATE THE MOTOR

1



Steering Column Motor Connector C227

2



3



Instrument Cluster Module Active Command STEERING COLUMN CONTROL

2

Connect a voltmeter between the steering column motor C227-3, circuit 35-AL7 (VT/BK), harness side, and the steering column motor C227-4, circuit 34-AL7 (BU/BK), harness side.

4



Trigger TELES CP IN On, Then TELES CPOUT On

5

Measure the voltage during the activate commands.

• **Is voltage present for one second after each command is sent?**

→ **Yes**

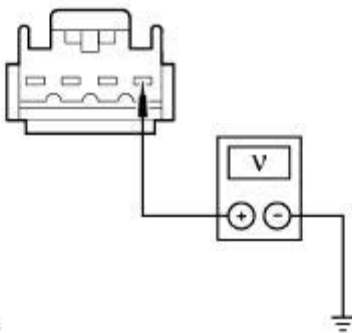
INSTALL a new telescope motor.
REPEAT the self-test. CLEAR the DTCs.

→ **No**

GO to A15.

A15 CHECK CIRCUIT 34-AL7 (BU/BK) FOR VOLTAGE

1



A0005893

2



Instrument Cluster Module Active Command STEERING COLUMN CONTROL

3



Trigger TELES CPOUT On

1

Connect a voltmeter between steering column motor C227-4, circuit 34-AL7 (BU/BK), harness side and ground.

4

Measure the voltage during the activate command.

• **Is voltage present for one second after command is sent?**

→ **Yes**

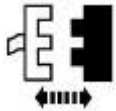
GO to A17.

→ **No**

GO to A16.

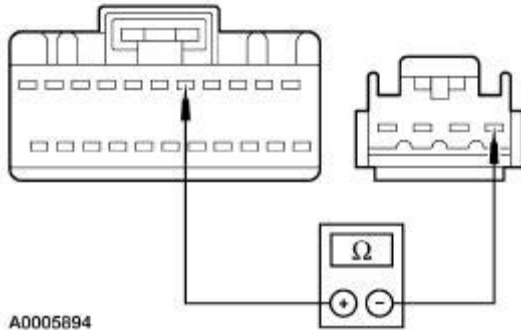
A16 CHECK CIRCUIT 34-AL7 (BU/BK) FOR AN OPEN

1



Instrument Cluster Module C220a

2



2

Measure the resistance between steering column motor C227-4, circuit 34-AL7 (BU/BK), harness side and the instrument cluster module C220a-5, circuit 34-AL7 (BU/BK), harness side.

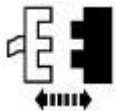
● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new instrument cluster module. REFER to [Section 413-01](#). REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR circuit 34-AL7. REPEAT the self-test. CLEAR the DTCs.

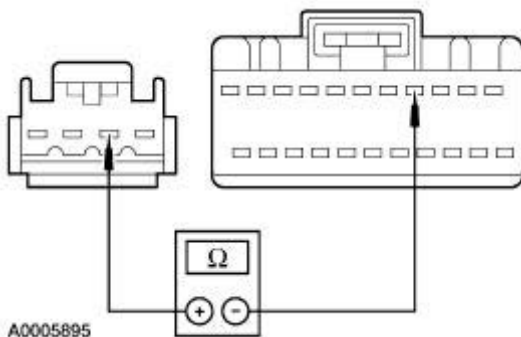
A17 CHECK CIRCUIT 35-AL7 (VT/BK) FOR AN OPEN

1



Instrument Cluster Module C220a

2



2




Measure the resistance between steering column motor C227-3, circuit 35-AL7 (VT/BK), harness side and the instrument cluster module C220a-4, circuit 35-AL7 (VT/BK), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new instrument cluster module. REFER to [Section 413-01](#). REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR circuit 35-AL7. REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST B: DTC B2332: STEERING COLUMN TILT FEEDBACK POTENTIOMETER CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CONTINUOUS DTCs	
<p>1</p>  <p>Instrument Cluster Module (ICM) Continuous DTCs</p>	<p>● Is DTC B2332 present?</p> <p>→ Yes GO to <u>B2</u>.</p> <p>→ No GO to <u>B11</u>.</p>
B2 CHECK FOR MOTION FAULTS	
<p>2</p>  <p>Instrument Cluster Module CLEAR DTCs</p> <p>5</p>  <p>Instrument Cluster Module SELF-TEST</p>	<p>1 Disconnect and reconnect the battery.</p> <p>3 Actuate the steering column to the full in position.</p> <p>4 Actuate the steering column to the full out position.</p> <p>● Is DTC B2328 present?</p> <p>→ Yes GO to <u>B3</u>.</p> <p>→ No System was deactivated due to ICM registering an excessive number of motion faults. NOTIFY owner that</p>

concern has been corrected. REPEAT the self-test. CLEAR the DTCs.

B3 CHECK STEERING COLUMN BEARINGS

- 1 Remove the steering column shrouds.
- 2 Check the steering column bearings to make sure that they are fully seated back against the stops.

- **Are the steering column bearings correctly seated back against the stops?**

→ **Yes**
GO to B4.

→ **No**
SEAT the steering column bearings back against the stops. REPEAT the self-test. CLEAR the DTCs.

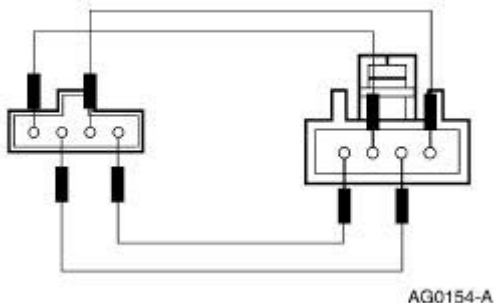
B4 ISOLATE THE POTENTIOMETERS

1



Steering Column Potentiometer Assembly C222

2



- 2 Connect a jumper wire between the steering column potentiometer assembly C222-1, circuit 9-AL17 (PK/OG), harness side and the steering column potentiometer assembly terminal 1.

- 3 Connect a jumper wire between the steering column potentiometer assembly C222-4, circuit 7-AL17 (DG/WH), harness side and the steering column potentiometer assembly terminal 4.

- 4 Connect a jumper wire between the steering column potentiometer assembly C222-2, circuit 8-AL17 (DB/YE) and the steering column potentiometer assembly terminal 3.

- 5 Connect a jumper wire between the steering column potentiometer assembly C222-3, circuit 8-AL16 (PK/LB) and the steering column potentiometer assembly terminal 2.

6



Instrument Cluster Module Self-Test

● Is DTC B2328 retrieved?

→ **Yes**
INSTALL a new steering column potentiometer assembly. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to B5.

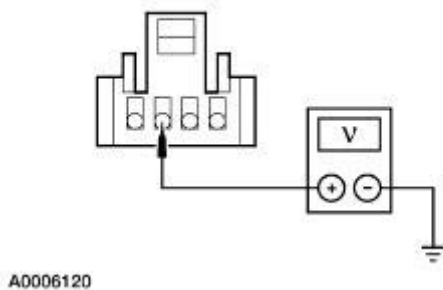
B5 CHECK CIRCUIT 8-AL17 (DB/YE) FOR A SHORT TO B+

1



Retractor Box C218

2



2

Measure the voltage at the steering column potentiometer assembly C222-2, circuit 8-AL17 (DB/YE), harness side.

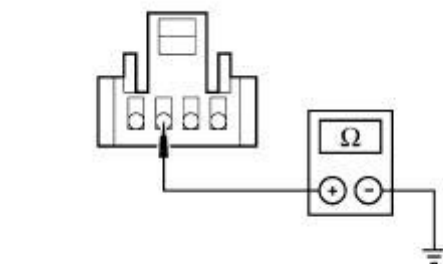
● Is voltage present?

→ **Yes**
REPAIR circuit 8-AL17. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to B6.

B6 CHECK CIRCUIT 8-AL17 (DB/YE) FOR A SHORT TO GROUND

1



1

Measure the resistance between the steering column potentiometer assembly C222-2, circuit 8-AL17 (DB/YE), harness side and ground.

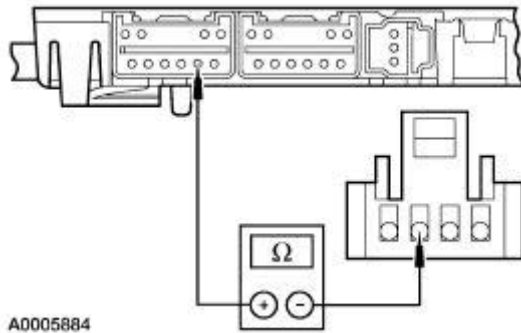
- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to B7.

→ **No**
REPAIR circuit 8-AL17. REPEAT the self-test. CLEAR the DTCs.

B7 CHECK CIRCUIT 8-AL17 (DB/YE) FOR AN OPEN

1



1

Measure the resistance between the steering column potentiometer assembly C222-2, circuit 8-AL17 (DB/YE), harness side and the retractor box C218-5, circuit 8-AL17 (DB/YE).

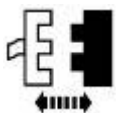
- Is the resistance less than 5 ohms?

→ **Yes**
GO to B8.

→ **No**
REPAIR circuit 8-AL17. REPEAT the self-test. CLEAR the DTCs.

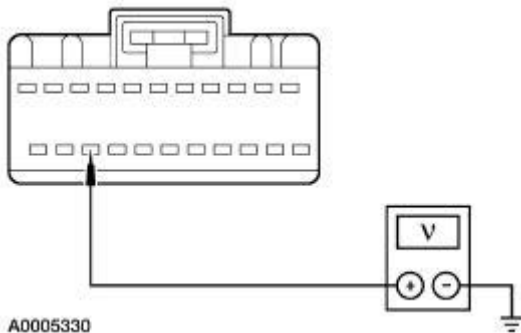
B8 CHECK CIRCUIT 8-AL17 (WH/VT) FOR A SHORT TO B+

1



Instrument Cluster Module C220c

2



2

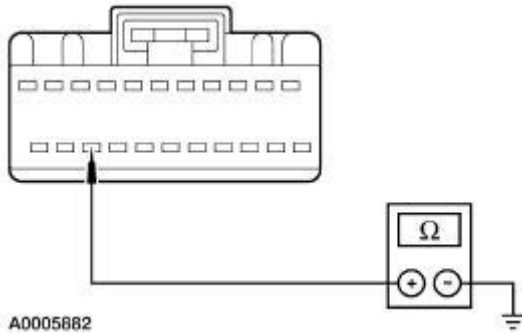
Measure the voltage at instrument cluster module C220c-20, circuit 8-AL17 (WH/VT), harness side.

- Is voltage present?

- **Yes**
REPAIR circuit 8-AL17. REPEAT the self-test. CLEAR the DTCs.
- **No**
GO to B9.

B9 CHECK CIRCUIT 8-AL17 (WH/VT) FOR A SHORT TO GROUND

1



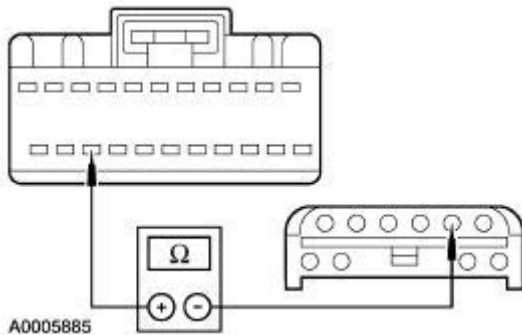
1 Measure the resistance between the instrument cluster module C220c-20, circuit 8-AL17 (WH/VT), harness side and ground.

- **Is the resistance greater than 10,000 ohms?**

- **Yes**
GO to B10.
- **No**
REPAIR circuit 8-AL17. REPEAT the self-test. CLEAR the DTCs.

B10 CHECK CIRCUIT 8-AL17 (WH/VT) FOR AN OPEN

1



1 Measure the resistance between the retractor box C218-6, circuit 8-AL17 (WH/VT), harness side and the instrument cluster C220c-20, circuit 8-AL17 (WH/VT), harness side.

- **Is the resistance less than 5 ohms?**

- **Yes**
INSTALL a new instrument cluster module. REFER to Section 413-01. REPEAT the self-test. CLEAR the DTCs.
- **No**
REPAIR circuit 8-AL17. REPEAT the self-test. CLEAR the DTCs.

B11 CHECK FOR STEERING COLUMN MOVEMENT

NOTE: This active command will only power motors for one second.

1



Instrument Cluster Module Active Command STEERING COLUMN CONTROL

2



Trigger TELES CP IN On, Then TELSCPOUT On

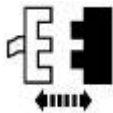
• Does the steering column telescope in and out?

→ **Yes**
GO to B12.

→ **No**
GO to B14.

B12 CHECK CIRCUIT 8-AL17 (DB/YE) FOR AN OPEN

1



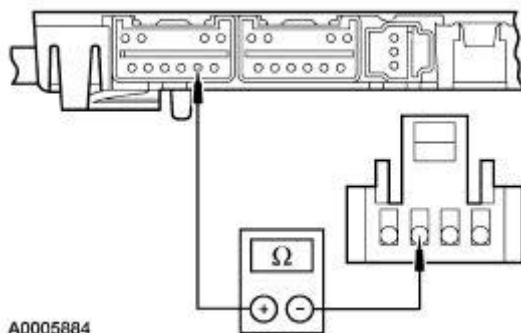
Steering Column Potentiometer Assembly C222

2



Retractor Box C218

3



3 Measure the resistance between the steering column potentiometer assembly C222-2, circuit 8-AL17 (DB/YE), harness side and the retractor box C218-5, circuit 8-AL17 (DB/YE).

• Is the resistance less than 5 ohms?

→ **Yes**
GO to B13.

→ **No**

REPAIR circuit 8-AL17. REPEAT the self-test. CLEAR the DTCs.

B13 CHECK CIRCUIT 8-AL17 (WH/VT) FOR AN OPEN

1



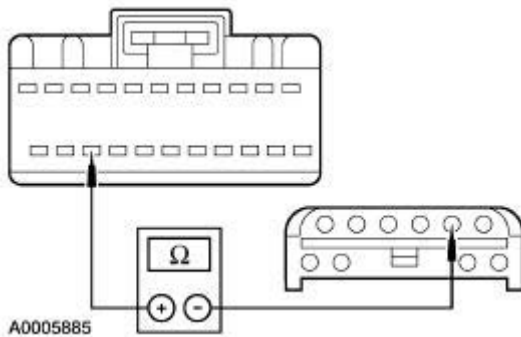
Steering Column Potentiometer Assembly C222

2



Instrument Cluster Module C220c

3



3

Measure the resistance between the retractor box C218-6, circuit 8-AL17 (WH/VT), harness side and the instrument cluster C220c-20, circuit 8-AL17 (WH/VT), harness side.

● Is the resistance less than 5 ohms?

→ Yes

INSTALL a new steering column potentiometer assembly. REPEAT the self-test. CLEAR the DTCs.

→ No

REPAIR circuit 8-AL17. REPEAT the self-test. CLEAR the DTCs.

B14 ISOLATE THE MOTOR

1

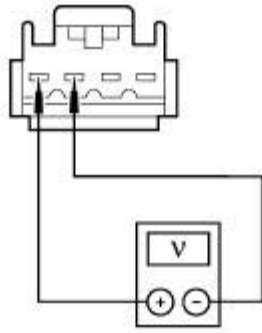


Steering Column Motor Connector C227

2

2

Connect a voltmeter between the steering column motor C227-2, circuit 32-AL6 (WH/BU), harness side, and the steering column motor C227-1, circuit 33-AL6 (YE/BU), harness side.



A0005886

3



Instrument Cluster Module Active Command STEERING COLUMN CONTROL

4



Trigger TELES CP IN On, Then TELES CPOUT On

5 Measure the voltage during the activate commands.

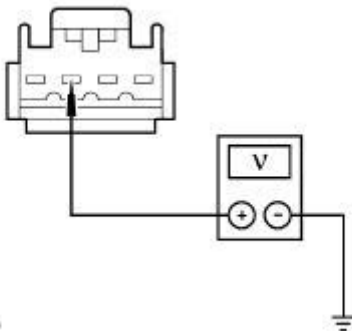
- Is voltage present for one second after each command is sent?

→ **Yes**
INSTALL a new telescope motor.
REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to B15.

B15 CHECK CIRCUIT 32-AL6 (WH/BU) FOR VOLTAGE

1



A0003860

2



Instrument Cluster Module Active Command STEERING COLUMN CONTROL

3

1 Connect a voltmeter between steering column motor C227-2, circuit 32-AL6 (WH/BU), harness side and ground.



Trigger TILTDOWN On

4 Measure the voltage during the activate command.

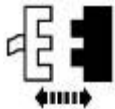
● Is voltage present for one second after command is sent?

→ Yes
GO to B17.

→ No
GO to B16.

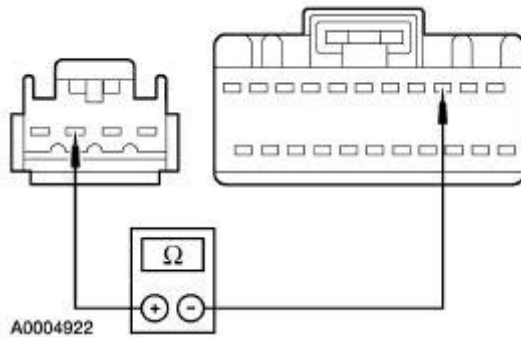
B16 CHECK CIRCUIT 32-AL6 (WH/BU) FOR AN OPEN

1



Instrument Cluster Module C220a

2



2 Measure the resistance between steering column motor C227-2, circuit 32-AL6 (WH/BU), harness side and the instrument cluster module C220a-3, circuit 32-AL6 (WH/BU), harness side.

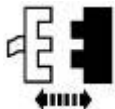
● Is the resistance less than 5 ohms?

→ Yes
INSTALL a new instrument cluster module. REFER to Section 413-01.
REPEAT the self-test. CLEAR the DTCs.

→ No
REPAIR circuit 32-AL6. REPEAT the self-test. CLEAR the DTCs.

B17 CHECK CIRCUIT 33-AL6 (YE/BU) FOR AN OPEN

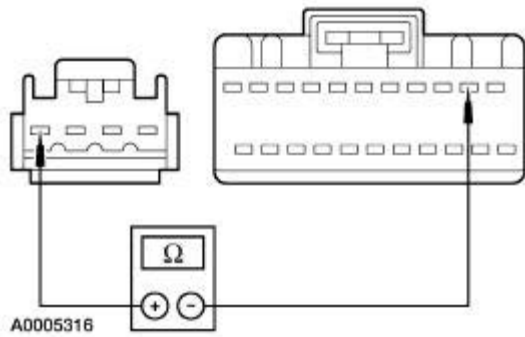
1



Instrument Cluster Module C220a

2

2 Measure the resistance between




steering column motor C227-1, circuit 33-AL6 (YE/BU), harness side and the instrument cluster module C220a-2, circuit 33-AL6 (YE/BU), harness side.

- **Is the resistance less than 5 ohms?**

→ **Yes**
 INSTALL a new instrument cluster module. REFER to Section 413-01.
 REPEAT the self-test. CLEAR the DTCs.

→ **No**
 REPAIR circuit 33-AL6. REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST C: DTC B2351: STEERING COLUMN SWITCH SIGNAL CIRCUIT FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE PIDs	
<p>1</p>  <p>Instrument Cluster Module PID TILT and PID TELESCP</p>	<p>2</p> <p>Actuate the steering column adjust switch to the tilt up, tilt down, telescope in, telescope out and neutral positions.</p> <ul style="list-style-type: none"> ● Does the PID TILT and the PID TELESCP read OFF in the neutral position and UP, DOWN, IN and OUT in the corresponding switch position? <p>→ Yes GO to <u>C2</u>.</p> <p>→ No GO to <u>C4</u>.</p>
C2 CHECK THE PID TILT	
<p>1</p>	



Instrument Cluster Module PID TILT

2 Actuate the steering column adjust switch to the tilt up and tilt down positions while monitoring the PID TILT.

- Does the PID TILT read UP with the switch in the up position and DOWN with the switch in the down position and OFF with the switch in the neutral position?

→ Yes
GO to C3.

→ No
INSTALL a new multi-function switch. REFER to Section 211-05. REPEAT the self-test. CLEAR the DTCs.

C3 CHECK THE PID TELES CP

1



Instrument Cluster Module PID TELES CP

2 Actuate the steering column adjust switch to the telescope out and the telescope in positions while monitoring the PID TELES CP.

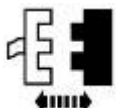
- Does the PID TELES CP read IN with the switch in the in position and OUT with the switch in the out position and OFF with the switch in the neutral position?

→ Yes
REPEAT the self-test. If DTC B2351 is retrieved, INSTALL a new instrument cluster module. REFER to Section 413-01. REPEAT the self-test. CLEAR the DTCs.

→ No
INSTALL a new multi-function switch. REFER to Section 211-05. REPEAT the self-test. CLEAR the DTCs.

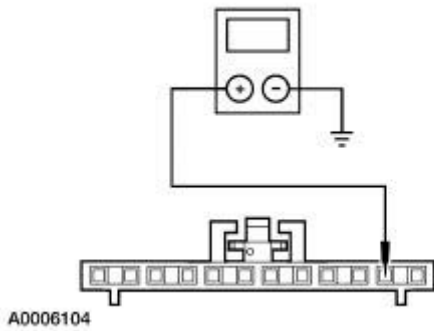
C4 CHECK CIRCUIT 9-AL10 (YE/RD) FOR A SHORT TO BATTERY/GROUND

1



Multi-Function Switch C202

2



2 Connect the multimeter positive lead to the multi-function switch C202-11, circuit 9-AL10 (YE/RD) and the negative lead to ground.

3 Measure the voltage and resistance.

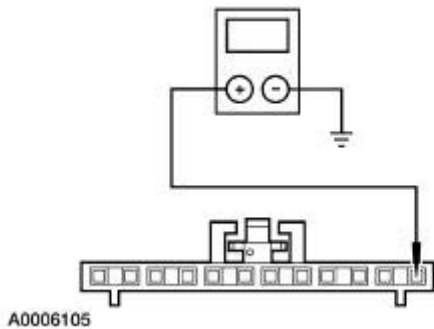
- Is the voltage greater than 11.5 volts or the resistance 5 ohms or less?

→ **Yes**
REPAIR circuit 9-AL10 (YE/RD).
REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to C5.

C5 CHECK CIRCUIT 8-AL10 (BN) FOR A SHORT TO BATTERY/GROUND

1



1 Connect the multimeter positive lead to the multi-function switch C202-12, circuit 8-AL10 (BN) and the negative lead to ground.

2 Measure the voltage and resistance.

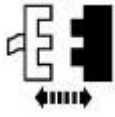
- Is the voltage greater than 11.5 volts or the resistance 5 ohms or less?

→ **Yes**
REPAIR circuit 8-AL10 (BN). REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to C6.

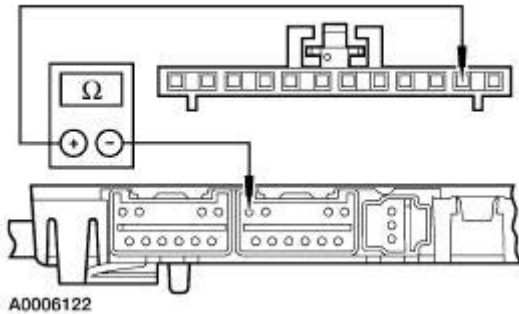
C6 CHECK CIRCUIT 9-AL10 (YE/RD) FOR AN OPEN

1



Retractor Box C217

2



2

Measure the resistance between the multi-function switch C202-11, circuit 9-AL10 (YE/RD), harness side and the retractor box C217-7, circuit 9-AL10 (YE/RD).

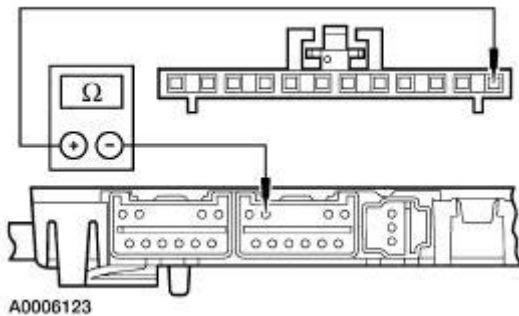
● Is the resistance less than 5 ohms?

→ Yes
GO to C7.

→ No
REPAIR circuit 9-AL10 (YE/RD).
REPEAT the self-test. CLEAR the DTCs.

C7 CHECK CIRCUIT 8-AL10 (BN) FOR AN OPEN

1



1

Measure the resistance between the multi-function switch C202-12, circuit 8-AL10 (BN), harness side and the retractor box C217-7, circuit 8-AL10 (BN).

● Is the resistance less than 5 ohms?

→ Yes
GO to C8.

→ No
REPAIR circuit 8-AL10 (BN). REPEAT the self-test. CLEAR the DTCs.

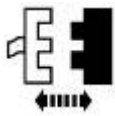
C8 CHECK CIRCUIT 9-AL10 (BN) FOR AN OPEN

1



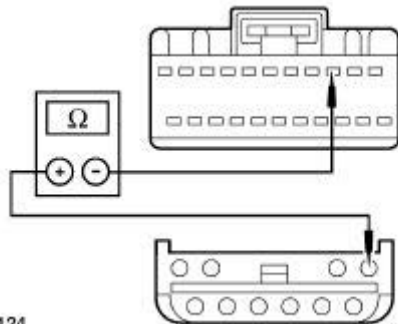
Multi-Function Switch C202

2



Instrument Cluster Module C220c

3



3

Measure the resistance between the retractor box C217-7, circuit 9-AL10 (BN), harness side and the instrument cluster module C220c-3, circuit 9-AL10 (BN), harness side.

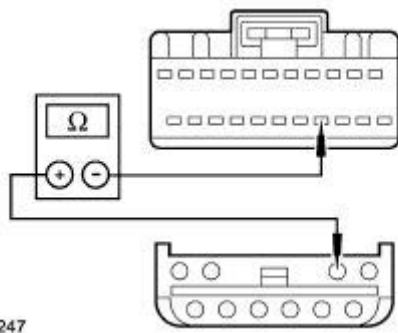
● Is the resistance less than 5 ohms?

→ **Yes**
GO to C9.

→ **No**
REPAIR circuit 9-AL10. REPEAT the self-test. CLEAR the DTCs.

C9 CHECK CIRCUIT 8-AL10 (WH) FOR AN OPEN

1



1


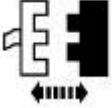

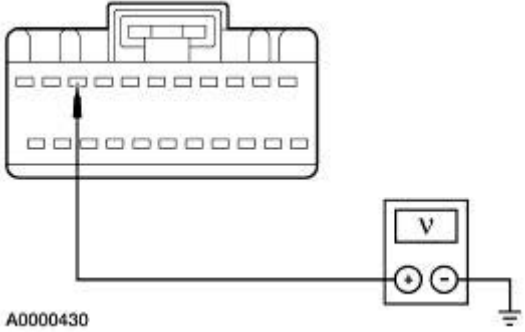
Measure the resistance between the retractor box C217-8, circuit 8-AL10 (WH), harness side and the instrument cluster module C220c-15, circuit 8-AL10 (WH), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new instrument cluster module. REFER to Section 413-01. REPEAT the self-test. CLEAR the DTCs.

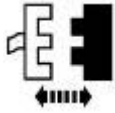
→ **No**
REPAIR circuit 8-AL10. REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST D: THE TILT AND TELESCOPE ADJUSTMENT ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK CONTINUOUS DTCs	
<p>1</p>  <p>Instrument Cluster Module (ICM) Continuous DTCs</p>	<ul style="list-style-type: none"> ● Are DTCs B2328 and B2332 present? <p>→ Yes Go To Pinpoint Test A or Go To Pinpoint Test B.</p> <p>→ No GO to <u>D2</u>.</p>
D2 CHECK CIRCUIT 9-AL17 (BN/WH) FOR A SHORT TO B+	
<p>1</p>  <p>Instrument Cluster Module Connector C220c</p> <p>2</p>  <p>3</p>  <p>A0000430</p>	<p>3</p> <p>Measure the voltage at the instrument cluster module C220c-9, circuit 9-AL17 (BN/WH), harness side.</p> <ul style="list-style-type: none"> ● Is voltage reading B+? <p>→ Yes GO to <u>D3</u>.</p> <p>→ No GO to <u>D4</u>.</p>
D3 CHECK CIRCUIT 7-AL17 (YE/VT) FOR A SHORT TO B+	
<p>1</p>	



2

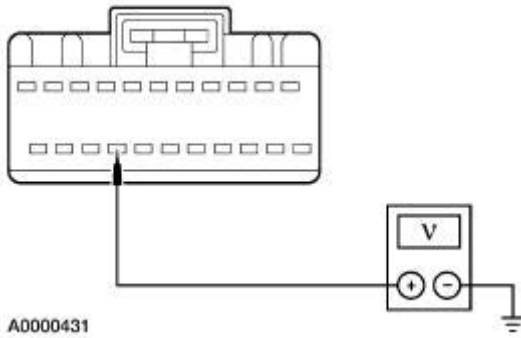


Steering Column Potentiometer Assembly C222

3



4



4 Measure the voltage at the instrument cluster module C220c-19, circuit 7-AL17 (YE/VT), harness side.

• Is the voltage reading B+?

→ **Yes**
REPAIR circuit 7-AL17. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR circuit 9-AL17. REPEAT the self-test. CLEAR the DTCs.

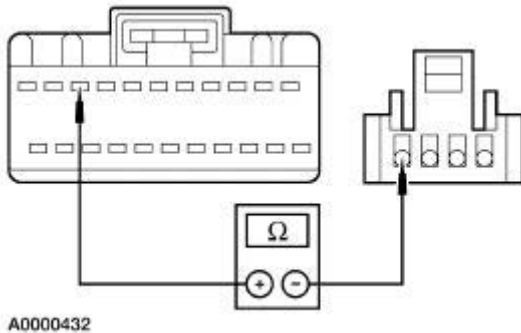
D4 CHECK CIRCUIT 9-AL17 (BN/WH) FOR AN OPEN

1



Steering Column Potentiometer Assembly C222

2



2 Measure the resistance between the instrument cluster module C220c-9, circuit 9-AL17 (BN/WH), harness side and the steering column potentiometer assembly C222-1, circuit 9-AL17 (BN/WH), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to D5.

→ **No**
REPAIR circuit 9-AL17. REPEAT the self-test. CLEAR the DTCs.

D5 CHECK FOR MOTOR MOTION SENSED

1



Instrument Cluster Module Active Command STEERING COLUMN CONTROL

2



Select PIDs TELEPOS and TILTPOS

3 **NOTE:** This active command will only power the motors for one second.

Trigger TILT UP, TILT DOWN, TELSCP IN and TELSCPOUT on, one at a time while monitoring the PID TELEPOS and TILTPOS.

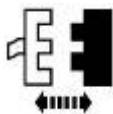
● Do the PIDs TELEPOS and TILTPOS read **SENSED** when the corresponding motors are triggered on?

→ **Yes**
INSPECT the steering column potentiometer assembly connection and the steering column/ignition/lighting control module connectors for loose or intermittent connections. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to D6.

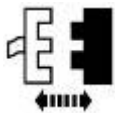
D6 CHECK CIRCUIT 9-AL17 (PK/OG) FOR AN OPEN

1



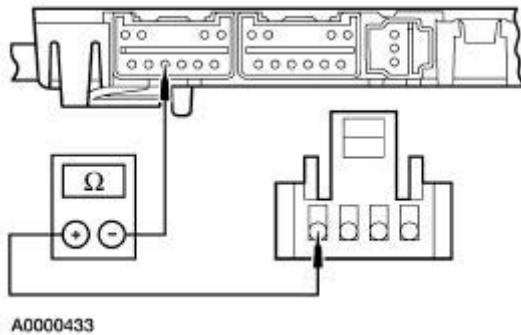
Steering Column Potentiometer Assembly C222

2



Retractor Box C218

3



3

Measure the resistance between the steering column potentiometer assembly C222-1, circuit 9-AL17 (PK/OG), harness side and retractor box C218-3, circuit 9-AL17 (PK/OG).

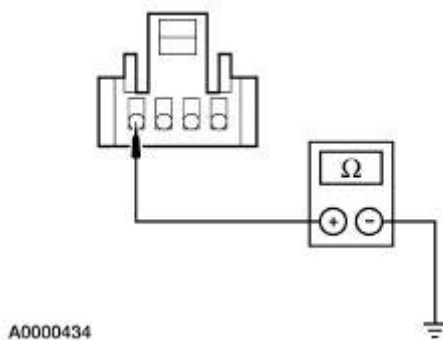
- Is the resistance less than 5 ohms?

→ **Yes**
GO to D7.

→ **No**
REPAIR circuit 9-AL17. REPEAT the self-test. CLEAR the DTCs.

D7 CHECK CIRCUIT 9-AL17 (PK/OG) FOR A SHORT TO GROUND

1



1

Measure the resistance between the steering column potentiometer assembly C222-1, circuit 9-AL17 (PK/OG), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to D8.

→ **No**
REPAIR circuit 9-AL17. REPEAT the self-test. CLEAR the DTCs.

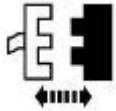
D8 CHECK CIRCUIT 9-AL17 (BN/WH) FOR AN OPEN

1



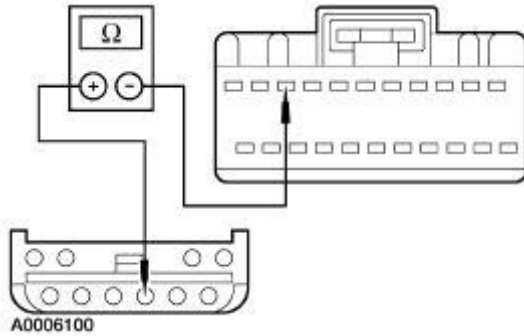
Steering Column Potentiometer Assembly C222

2



Instrument Cluster Module C220c

3



3

Measure the resistance between the retractor box C218a-3, circuit 9-AL17 (BN/WH), harness side and the instrument cluster module C220c-9, circuit 9-AL17 (BN/WH), harness side.

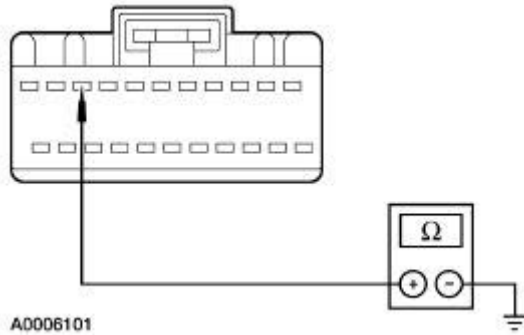
● Is the resistance less than 5 ohms?

→ **Yes**
GO to D9.

→ **No**
REPAIR circuit 9-AL17. REPEAT the self-test. CLEAR the DTCs.

D9 CHECK CIRCUIT 9-AL17 (BN/WH) FOR A SHORT TO GROUND

1



1

Measure the resistance between the instrument cluster module C220c-9, circuit 9-AL17 (BN/WH), harness side and ground.

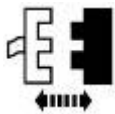
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to D10.

→ **No**
REPAIR circuit 9-AL17. REPEAT the self-test. CLEAR the DTCs.

D10 ISOLATE THE POTENTIOMETERS

1



Steering Column Potentiometer Assembly C222

2



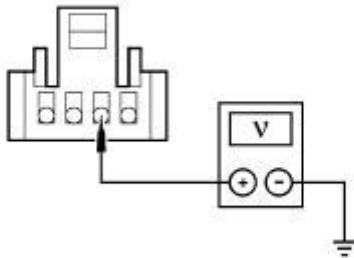
Instrument Cluster Module Active Command STEERING COLUMN CONTROL

3



Trigger TELESOP IN On

4



A0006113

- 4 Measure the voltage at steering column potentiometer assembly C222-4, circuit 7-AL17 (DG/WH), harness side during the active command.

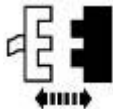
- Is the voltage greater than 10 volts?

→ **Yes**
INSTALL a new steering column potentiometer assembly. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to D11.

D11 CHECK CIRCUIT 7-AL17 (DG/WH) FOR A SHORT TO GROUND

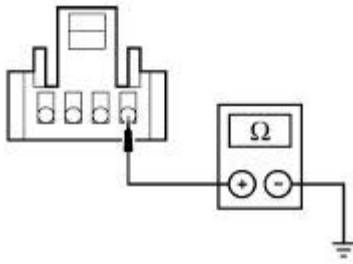
1



Retractor Box C218

2

- 2 Measure the resistance between steering column potentiometer assembly C222-4, circuit 7-AL17 (DG/WH), harness side and ground.



A0006119

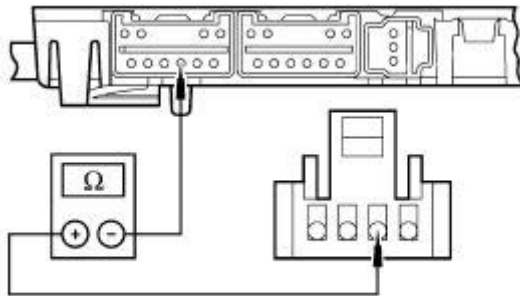
- Is the resistance greater than 10,000 ohms?

→ **Yes**
REPAIR circuit 7-AL17. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to D12.

D12 CHECK CIRCUIT 7-AL17 (DG/WH) FOR AN OPEN

1



A0006115

1

Measure the resistance between steering column potentiometer assembly C222-4, circuit 7-AL17 (DG/WH), harness side and retractor box C218 pin 4, circuit 7-AL17 (DG/WH).

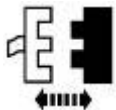
- Is the resistance less than 5 ohms?

→ **Yes**
GO to D13.

→ **No**
REPAIR circuit 7-AL17. REPEAT the self-test. CLEAR the DTCs.

D13 CHECK CIRCUIT 7-AL17 (YE/VT) FOR A SHORT TO GROUND

1

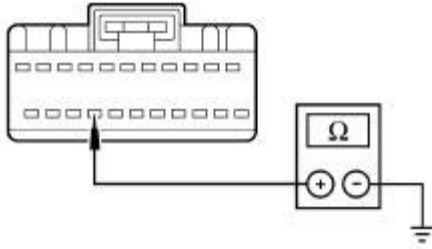


Retractor Box C218

2

2

Measure the resistance between instrument cluster module C220c-19, circuit 7-AL17 (YE/VT), harness side and ground.



A0006116

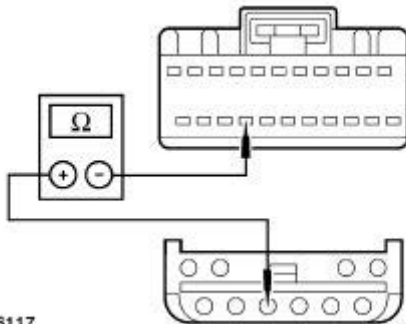
- Is the resistance greater than 10,000 ohms?

→ **Yes**
REPAIR circuit 7-AL17. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to D14.

D14 CHECK CIRCUIT 7-AL17 (YE/VT) FOR AN OPEN

1



A0006117

1

Measure the resistance between instrument cluster module C220c-19, circuit 7-AL17 (YE/VT), harness side and retractor box C218-4, circuit 7-AL17 (YE/VT), harness side.


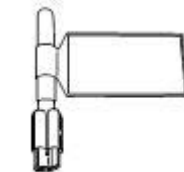
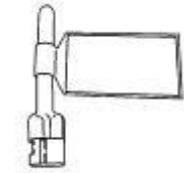
- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new instrument cluster module. REPEAT the self-test. CLEAR the DTCs.


→ **No**
REPAIR circuit 7-AL17. REPEAT the self-test. CLEAR the DTCs.


Supplemental Restraint System (SRS) Deactivation and Reactivation

Special Tool(s)


 ST2502-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Deactivation


 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

 **WARNING:** The safety belt buckle pretensioner and safety belt retractor pretensioner are pyrotechnic devices. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.



WARNING: Vehicle sensor orientation is critical for proper system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Replace and properly position the sensor or any other damaged supplemental restraint system (SRS) components whether or not the air bag is deployed.



WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

NOTE: If a seat equipped with a seat mounted side air bag and/or a safety belt pretensioner (if equipped) system is being serviced, **the air bag system must be deactivated.**

NOTE: Restraint system diagnostic tools **MUST** be installed under the seats in the seat side air bag (if equipped) and safety belt pretensioner (if equipped) to floor connectors.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.



- WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

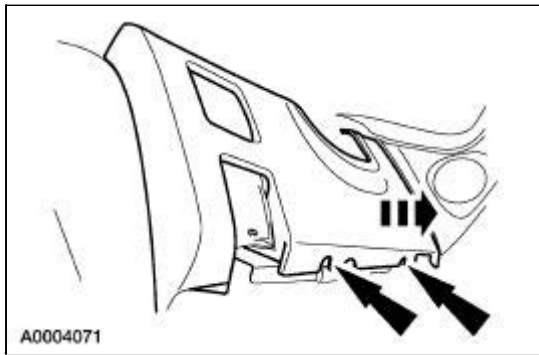
Please refer to the appropriate vehicle workshop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

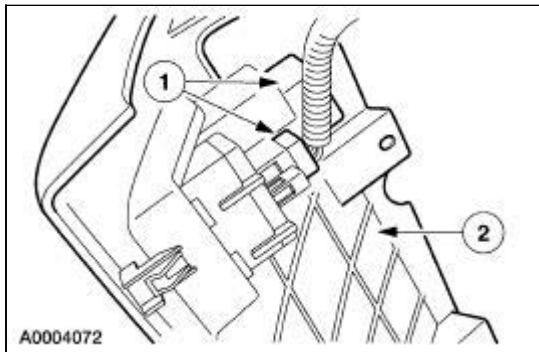
To deplete the backup power supply energy, Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. For additional information, refer to [Section 414-01](#).

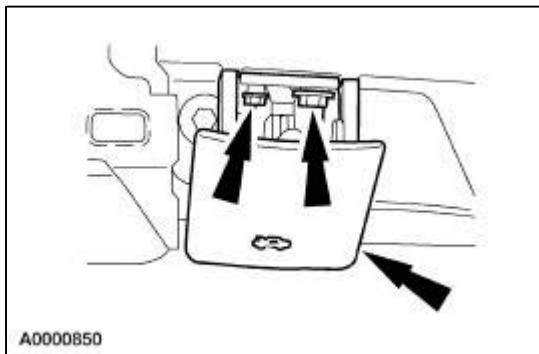
- Remove the two screws and pull out on the lower steering column opening finish panel enough to access the electrical connectors.



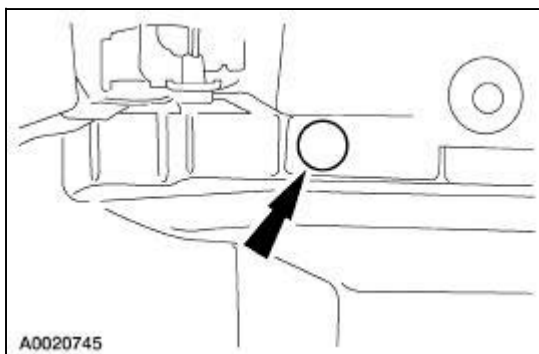
3. Remove the lower steering column opening finish panel.
 1. Disconnect the electrical connectors.
 2. Remove the lower steering column opening finish panel.



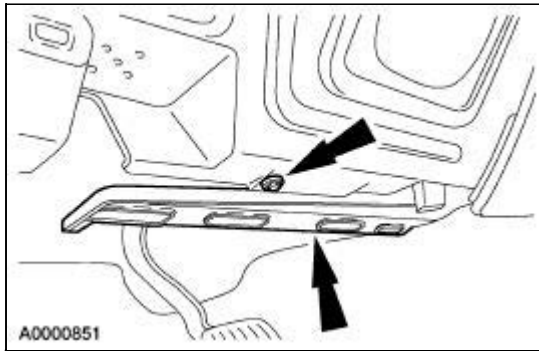
4. Remove the screws. Separate the hood latch release cable and handle assembly from the steering column opening reinforcement.



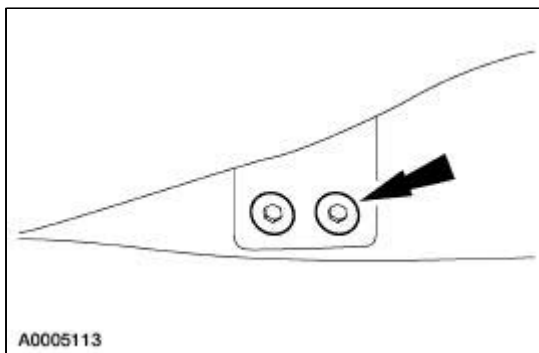
5. Remove the two pin-type retainers and the RH instrument panel insulator.
 - Disconnect the courtesy lamp.



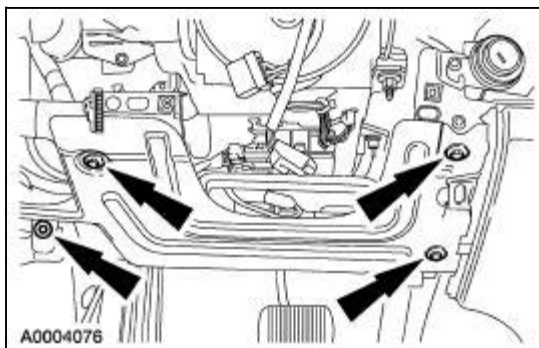
6. Remove the screw and the heater duct.



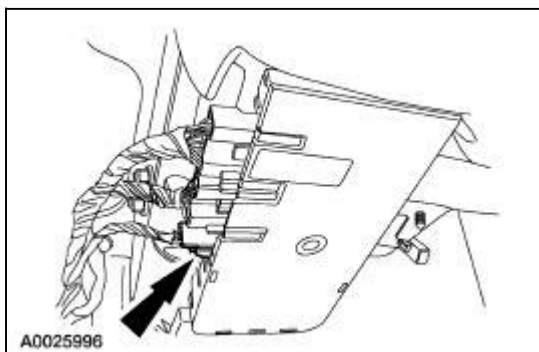
7. Loosen the two driver-side instrument panel tunnel brace bolts.
- Position the carpet aside to gain access to the bolts.



8. Remove the screws and the steering column opening reinforcement.

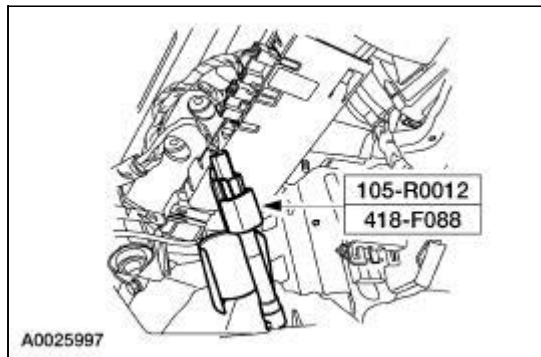


9. Disconnect the clockspring electrical connector at the base of the steering column.

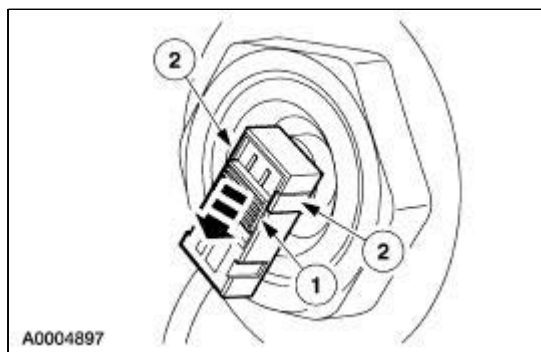


10. Attach the restraint system diagnostic tool to the vehicle harness side of the clockspring

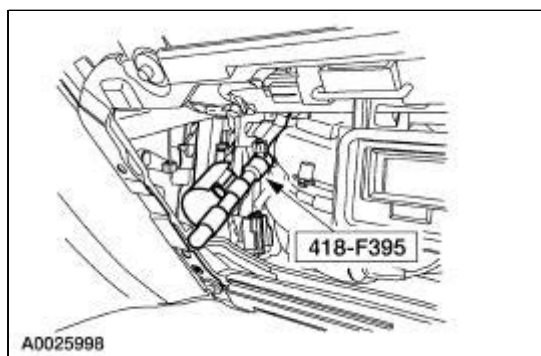
electrical connector.




11. Remove the glove compartment. For additional information, refer to [Section 501-12](#).
12. Disconnect the passenger air bag module electrical connector.
 1. Reaching into the glove box opening toward the center of the instrument panel, under the cross-car beam, slide and disengage the passenger air bag module electrical connector locking clip.
 2. Push in on the two release tabs and disconnect the passenger air bag module electrical connector.



13. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag electrical connector.



14. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
15. Move and tilt the front seats to their highest and most forward position.
16.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors,

instrument panel, console, door latches, strikers, seats and hood latches.

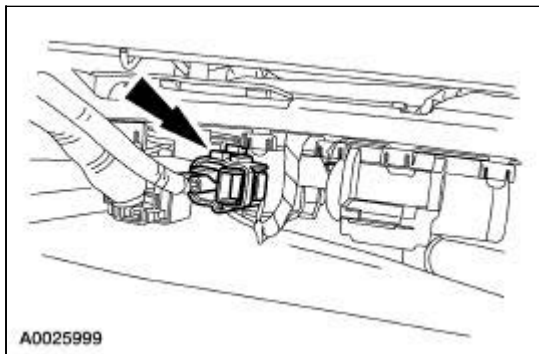
Please refer to the appropriate vehicle workshop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

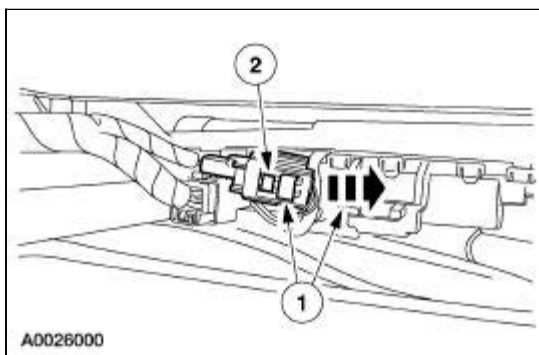
To deplete the backup power supply energy, Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. For additional information, refer to [Section 414-01](#).

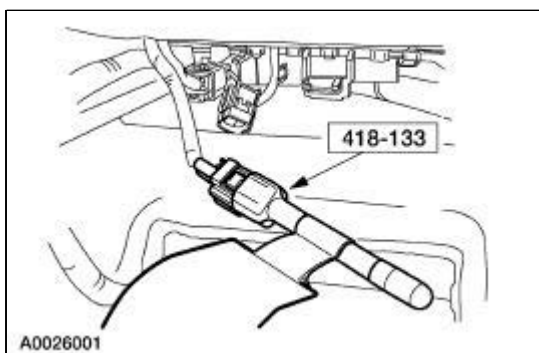
17. From under the passenger seat, release the tab on the connector bracket and remove the passenger seat side air bag electrical connector.



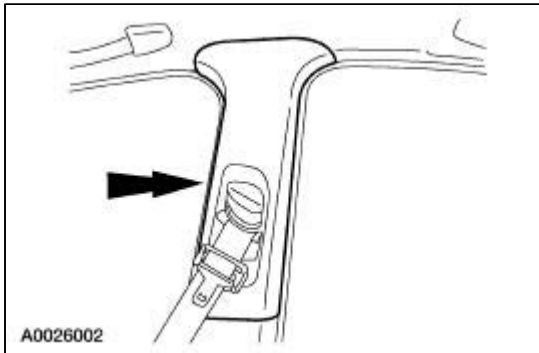
18. Disconnect the passenger seat side air bag electrical connector.
 1. Slide and disengage the passenger seat side air bag electrical connector locking clip.
 2. Push in to release the tab and disconnect the passenger seat side air bag electrical connector.



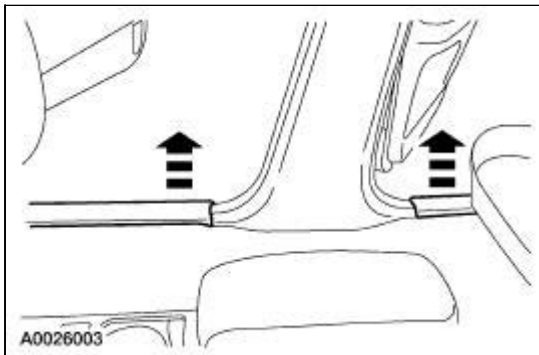
19. Attach the restraint system diagnostic tool to the passenger seat side air bag floor electrical connector.



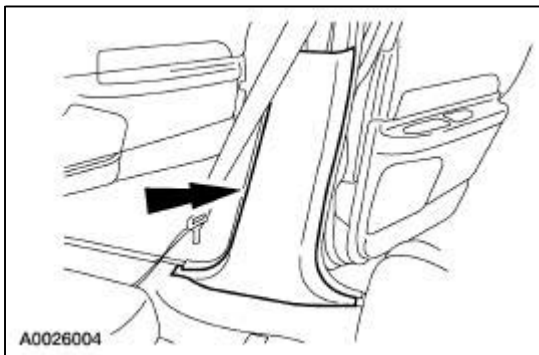
20. Remove the passenger side B-pillar weatherstripping.
21. Position the safety belt D-ring to its highest point.
22. Remove the passenger side B-pillar upper trim panel.



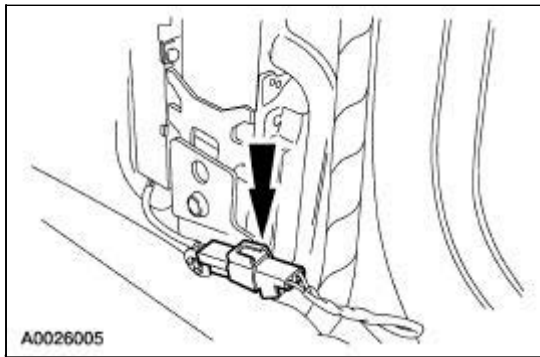
23. Remove the passenger side front and rear door scuff plates.



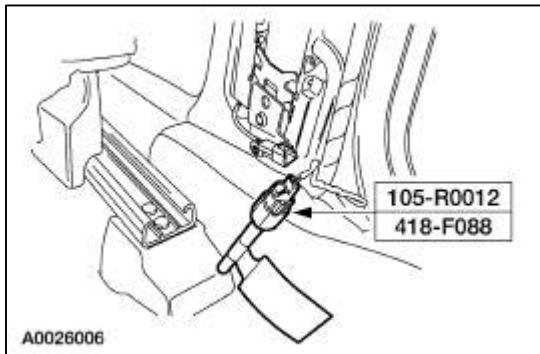
24. Remove the passenger side B-pillar lower trim panel.



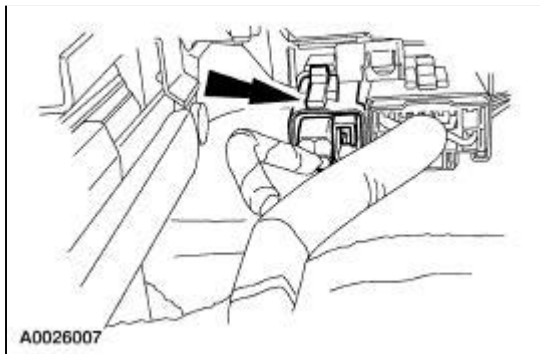
25. Disconnect the passenger side safety belt retractor pretensioner floor electrical connector.



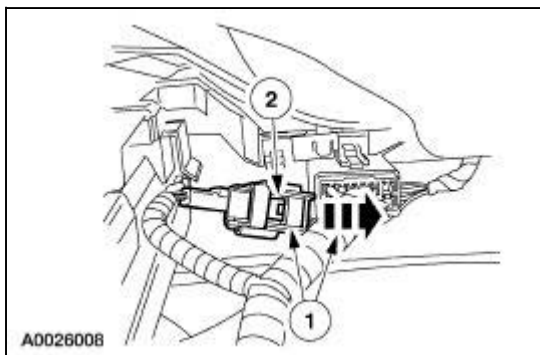
26. Attach the restraint system diagnostic tool to the passenger side safety belt retractor pretensioner floor electrical connector.



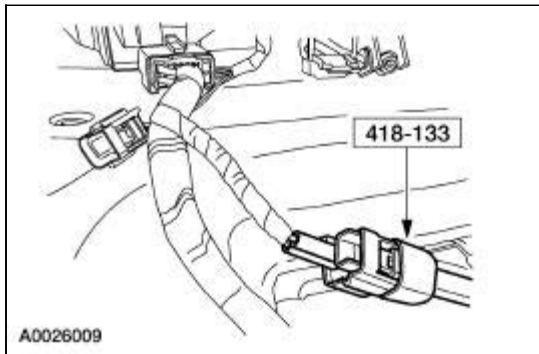
27. From under the driver seat, release the tab on the connector bracket and remove the driver seat side air bag electrical connector.



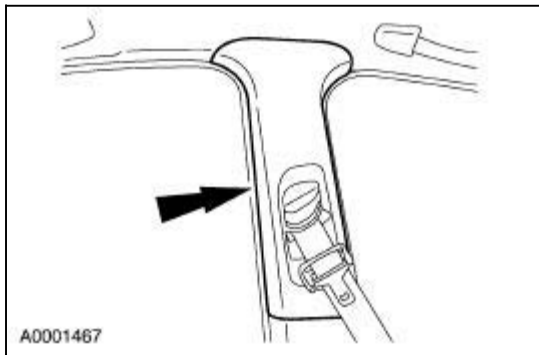
28. Disconnect the driver seat side air bag electrical connector.
1. Slide and disengage the driver seat side air bag electrical connector locking clip.
 2. Push down to release the tab and disconnect the driver seat side air bag electrical connector.



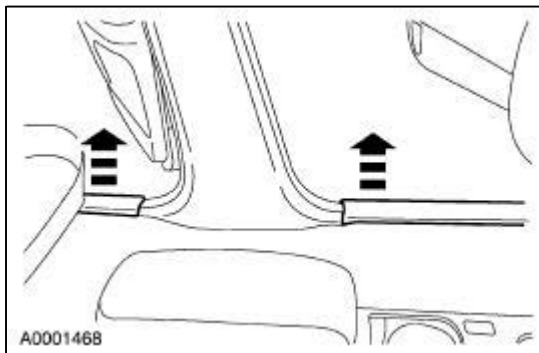
29. Attach the restraint system diagnostic tool to the driver seat side air bag floor electrical connector.



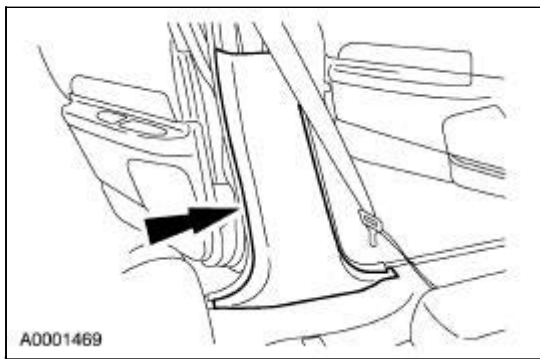
30. Remove the driver side B-pillar weatherstripping.
31. Position the safety belt D-ring to its highest point.
32. Remove the driver side B-pillar upper trim panel.



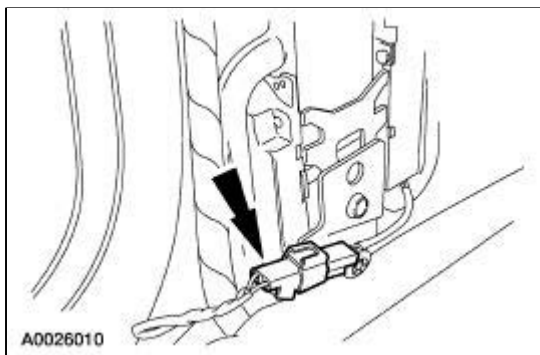
33. Remove the driver side front and rear door scuff plates.



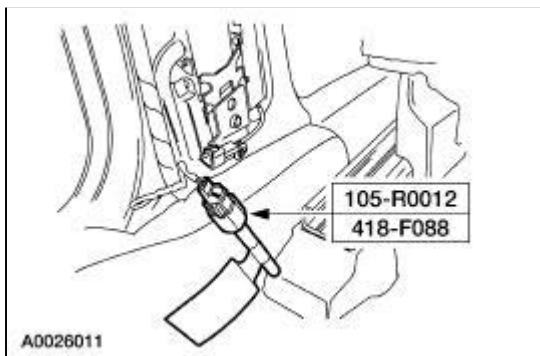
34. Remove the driver side B-pillar lower trim panel.



35. Disconnect the driver side safety belt retractor pretensioner electrical connector.



36. Attach the restraint system diagnostic tool to the driver side safety belt retractor pretensioner floor electrical connector.

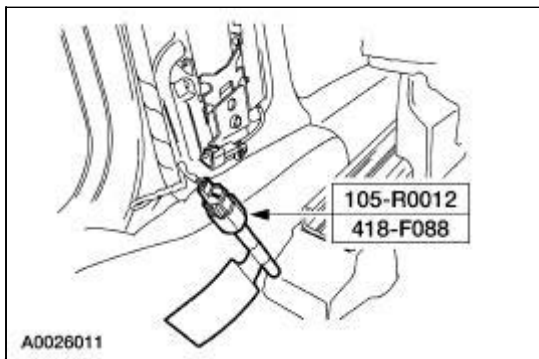


37. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
38. With the restraint system diagnostic tools installed at all deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).
39. Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. For additional information, refer to [Section 414-01](#).

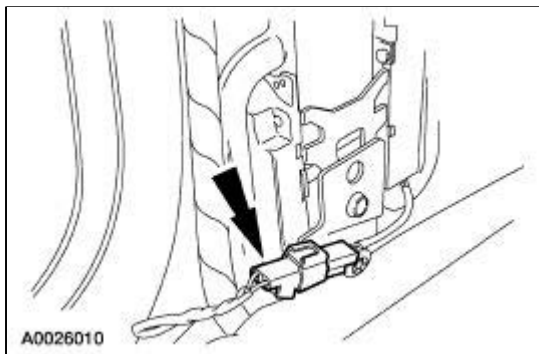
Reactivation

⚠️ WARNING: To reduce the risk of serious personal injury, read and follow all warnings and notes at the beginning of the deactivation procedure.

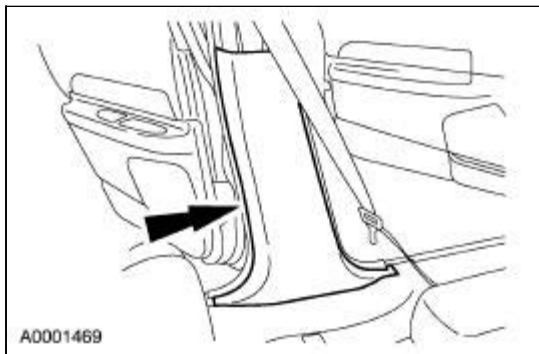
1. Remove the restraint system diagnostic tool from the driver side safety belt retractor pretensioner floor electrical connector.



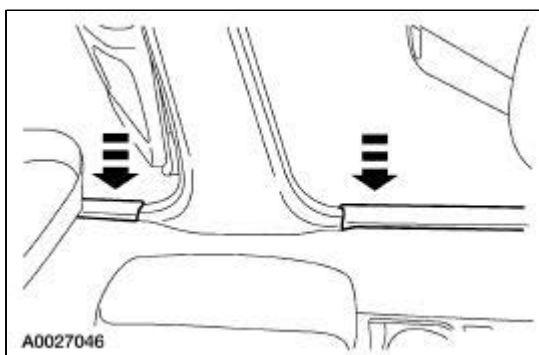
2. Connect the driver side safety belt retractor pretensioner electrical connector.



3. Install the driver side B-pillar lower trim panel.

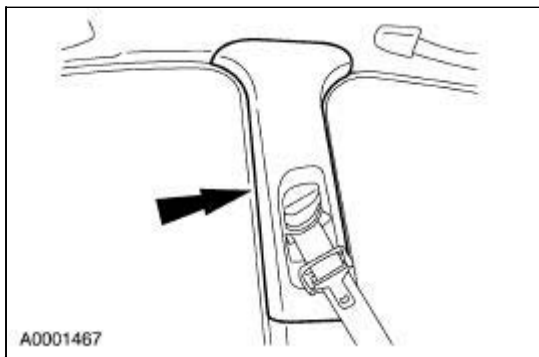


4. Install the driver side front and rear door scuff plates.

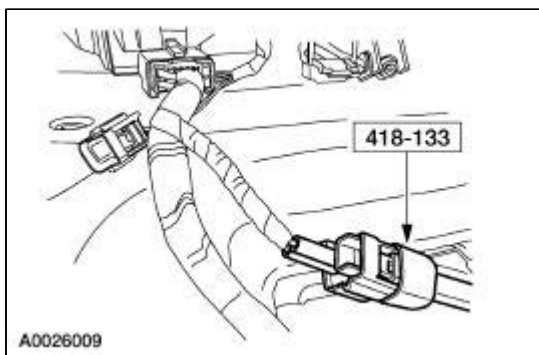


5. **NOTE:** Position the safety belt D-ring to its highest point.

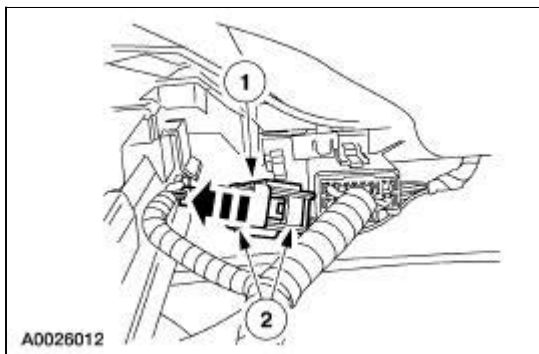
Install the driver side B-pillar upper trim panel.



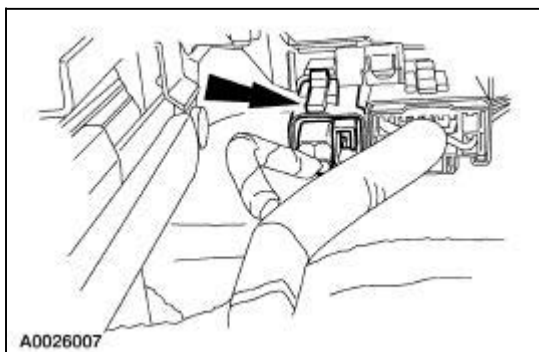
6. Install the driver side B-pillar weatherstripping.
7. Remove the restraint system diagnostic tool from the driver seat side air bag floor electrical connector.



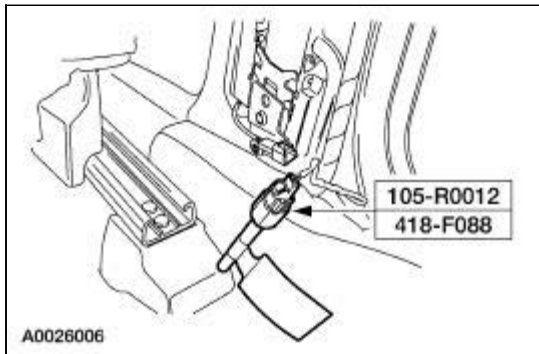
8. Connect the driver seat side air bag electrical connector.
 1. Connect the driver seat side air bag electrical connector.
 2. Slide and engage the driver seat side air bag electrical connector locking clip.



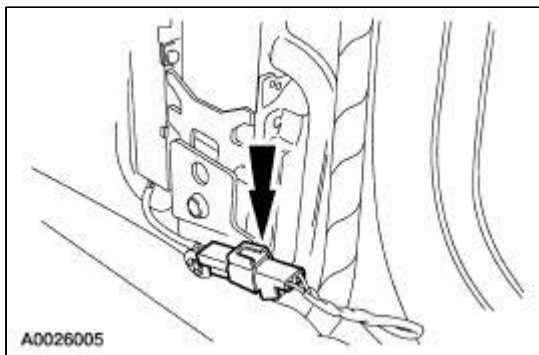
9. Install the driver seat side air bag electrical connector onto the connector bracket under the driver seat.



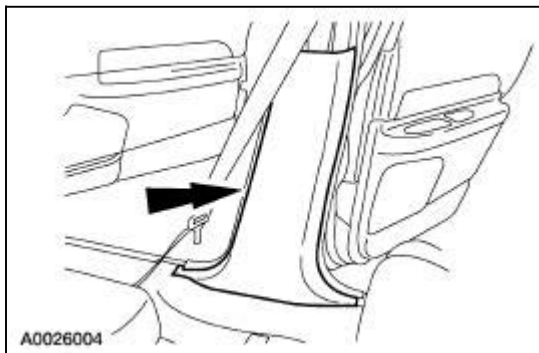
10. Remove the restraint system diagnostic tool from the passenger side safety belt retractor pretensioner electrical connector.



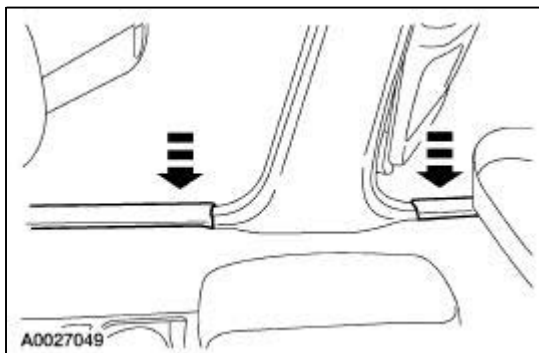
11. Connect the passenger side safety belt retractor pretensioner electrical connector.



12. Install the passenger side B-pillar lower trim panel.

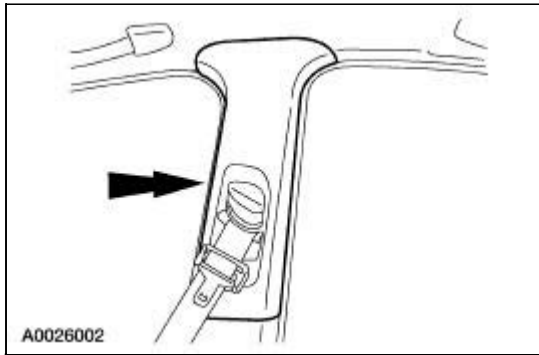


13. Install the passenger side front and rear door scuff plates.



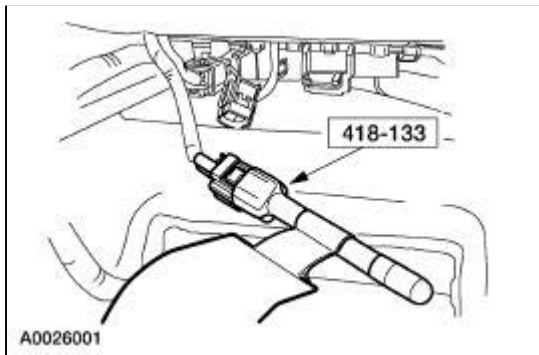
14. **NOTE:** Position the safety belt D-ring to its highest point.

Install the passenger side B-pillar upper trim panel.



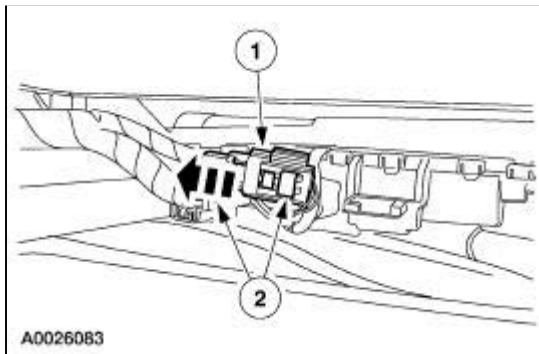
15. Install the passenger side B-pillar weatherstripping.

16. Remove the restraint system diagnostic tool from the passenger seat side air bag floor electrical connector.

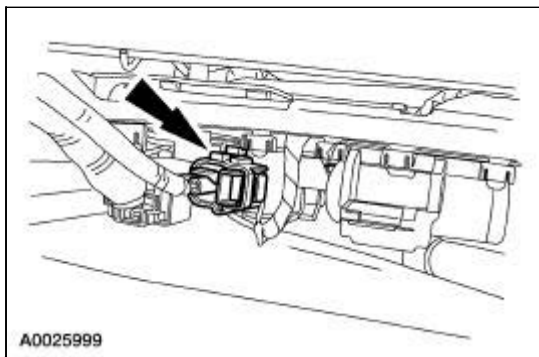


17. Connect the passenger seat side air bag electrical connector.


1. Connect the passenger seat side air bag electrical connector.
2. Slide and engage the passenger seat side air bag electrical connector locking clip.



18. Install the passenger seat side air bag electrical connector onto the connector bracket under the passenger seat.



19. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
20. Position the front seats rearward.

21.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

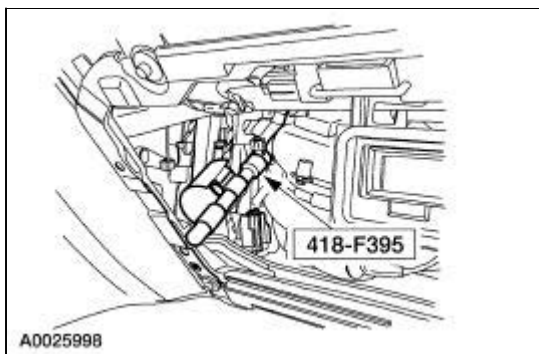
Please refer to the appropriate vehicle workshop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

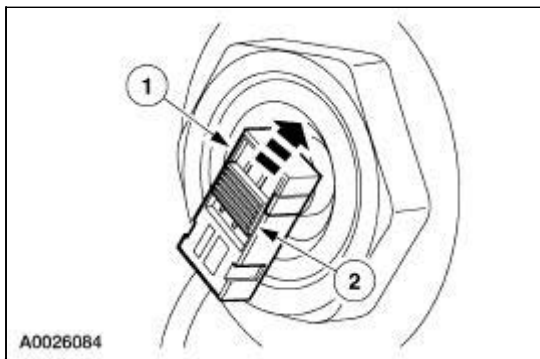
To deplete the backup power supply energy, Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. For additional information, refer to [Section 414-01](#).

22. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag electrical connector.

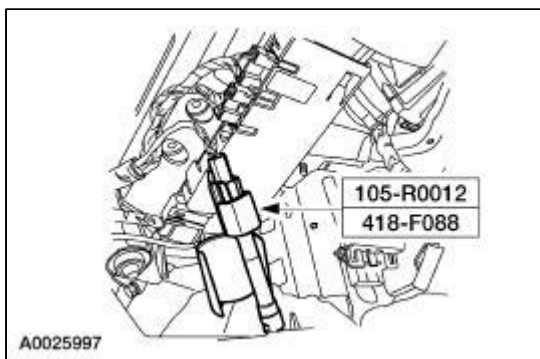


23. Connect the passenger air bag module electrical connector.
 1. Reach into the glove box opening toward the center of the instrument panel, under the cross-car beam and connect the passenger air bag module electrical connector.
 2. Slide and engage the passenger air bag module electrical connector locking clip.

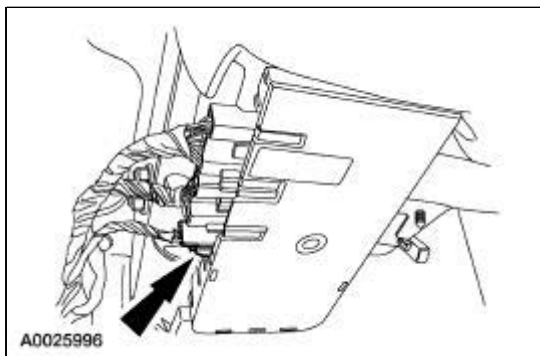


24. Install the glove compartment. For additional information, refer to [Section 501-12](#).

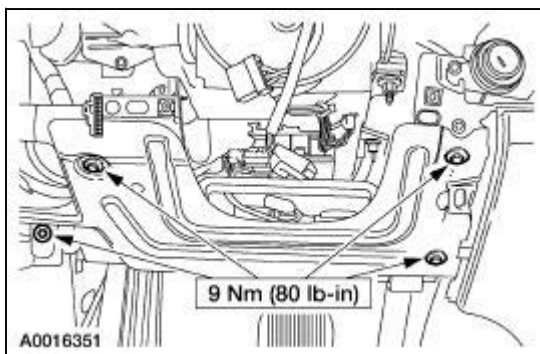
25. Remove the restraint system diagnostic tool from the vehicle harness side of the clockspring electrical connector.



26. Connect the clockspring electrical connector at the base of the steering column.

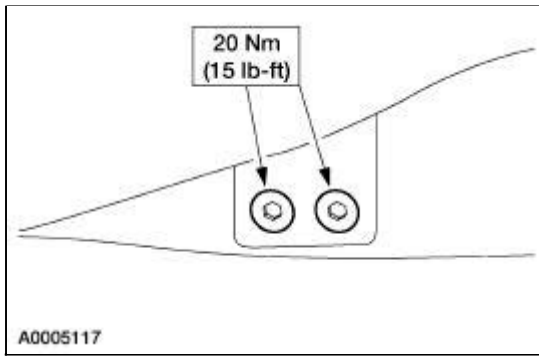


27. Position the steering column opening reinforcement and install the screws.

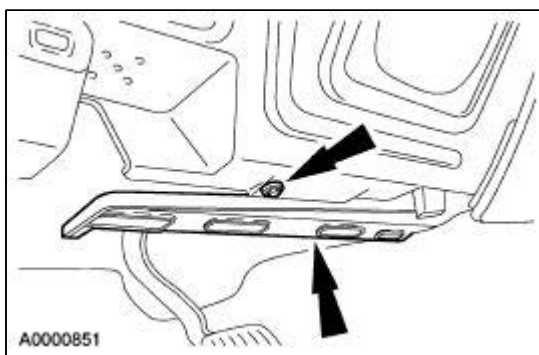


28. Tighten the two driver-side instrument panel tunnel brace bolts.

- Reposition the carpet.

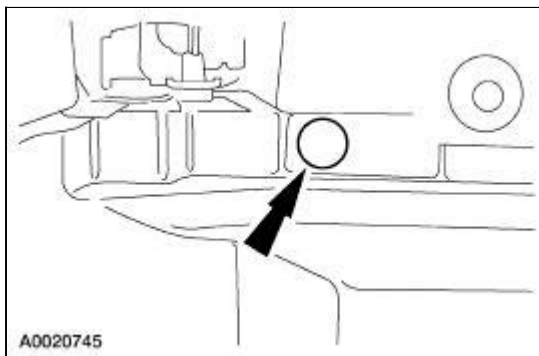


29. Position the heater duct and install the screw.

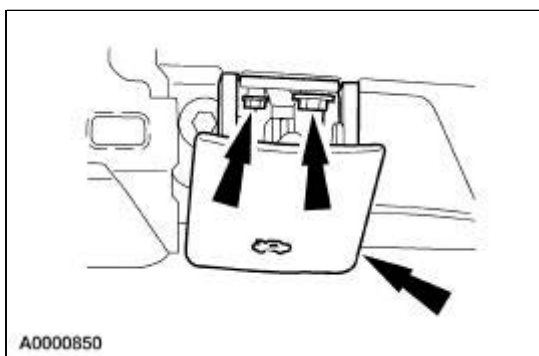


30. Install the RH instrument panel insulator and the two pin-type retainers.

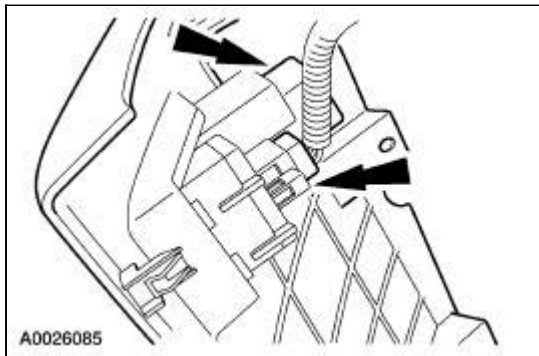
- Connect the courtesy lamp.



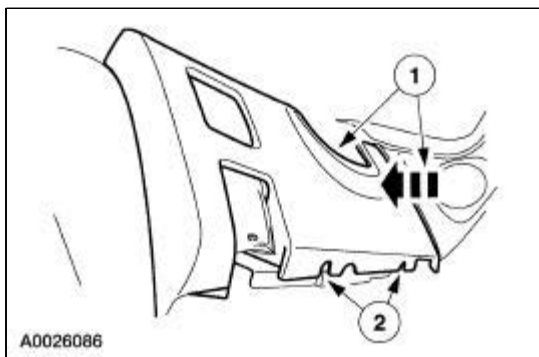
31. Position the hood latch release cable and handle assembly to the steering column opening reinforcement and install the screws.




32. Connect the electrical connectors to the switches in the lower steering column opening finish panel.



33. Install the lower steering column opening finish panel to the instrument panel.
1. Position the lower steering column opening finish panel to the instrument panel and push in, seating the retaining clips.
 2. Install the screws.



34. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).

35.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

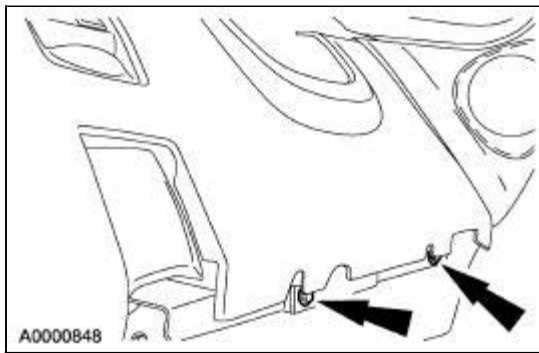
With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

36. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).
-

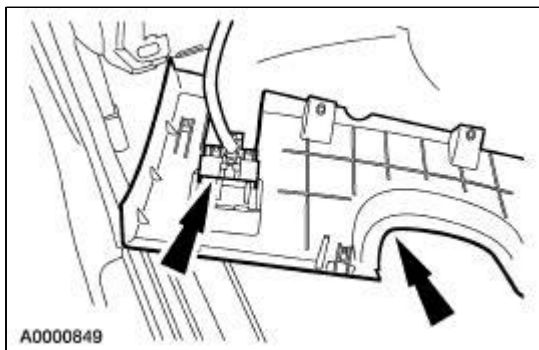
Ignition Switch Lock Cylinder

Removal and Installation

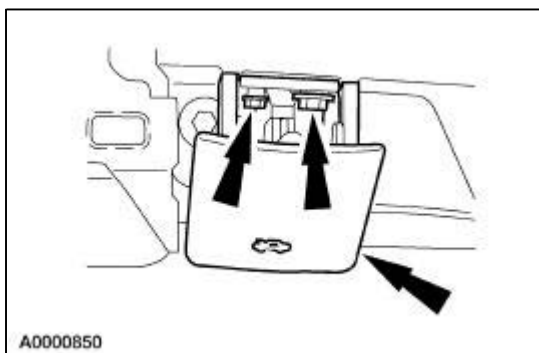
1. Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. For additional information, refer to [Section 414-01](#).
2. Remove the bolts. Detach the steering column opening cover.



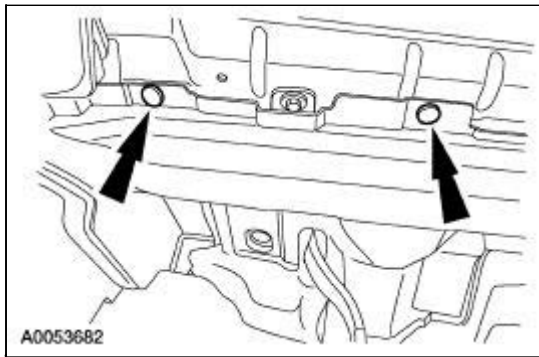
3. Disconnect the electrical connector. Remove the steering column opening cover.



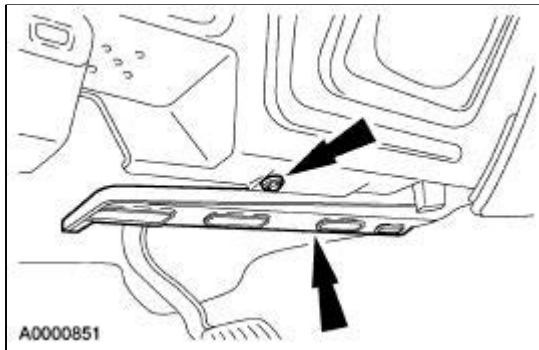
4. Remove the bolts and the hood release handle assembly.



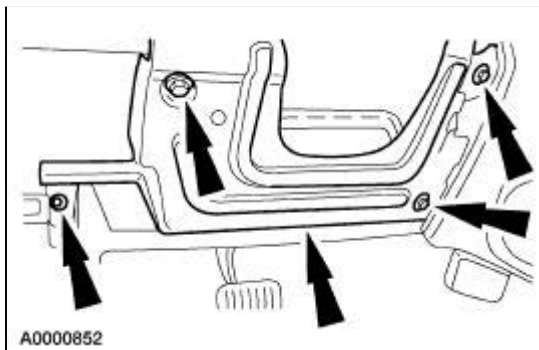
5. Remove the pushpins and the insulator panel.



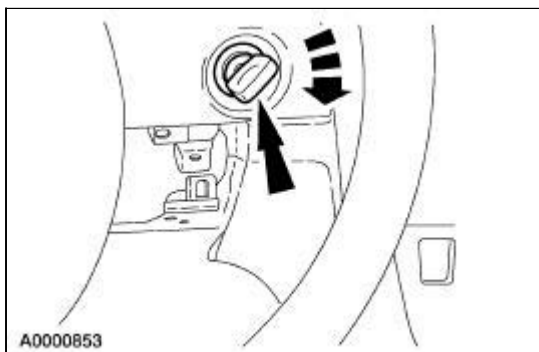
6. Remove the bolt and the heater duct.



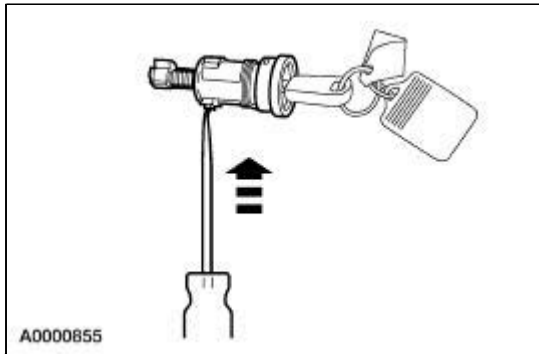
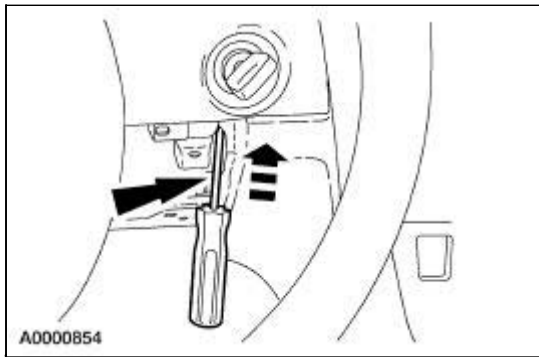
7. Remove the bolts and the steering column opening cover reinforcement.



8. Turn the ignition switch to the RUN position.



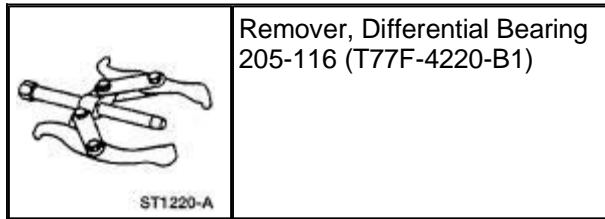
9. Using a small flat-blade screwdriver, depress the ignition switch lock cylinder tab. Remove the ignition switch lock cylinder.



10. To install, reverse the removal procedure.
- Verify correct operation of the ignition switch lock cylinder.
-


Steering Wheel

Special Tool(s)



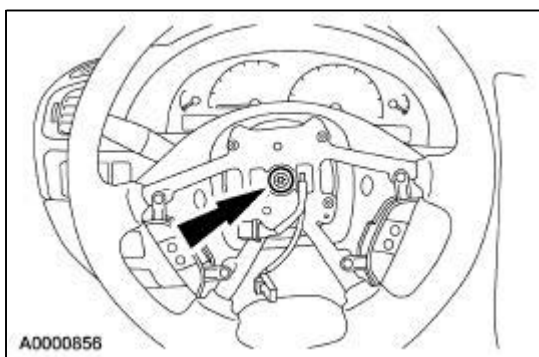
Removal

1. Center the steering wheel to the straight-ahead position.
2. Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. For additional information, refer to [Section 414-01](#).

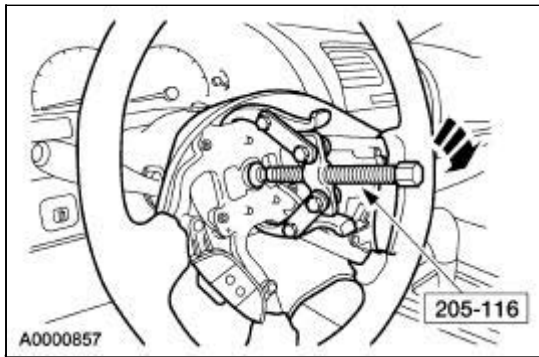
3.  **WARNING: To avoid the risk of serious personal injury, read and follow all warnings, cautions, notes and instructions in the supplemental restraint system (SRS) deactivation procedure.**

Deactivate the supplemental restraint system. For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

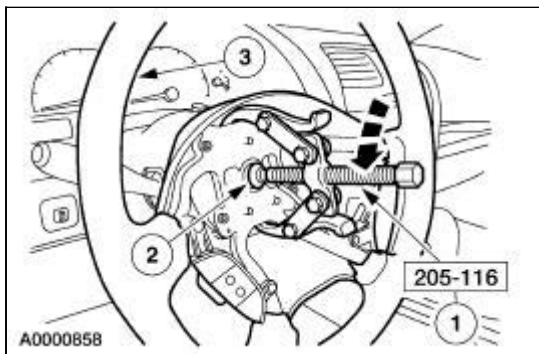
4. Remove the horn blow switch. For additional information, refer to [Section 413-06](#).
5. Loosen the steering wheel retaining bolt.



6. Using the special tool, loosen the steering wheel.

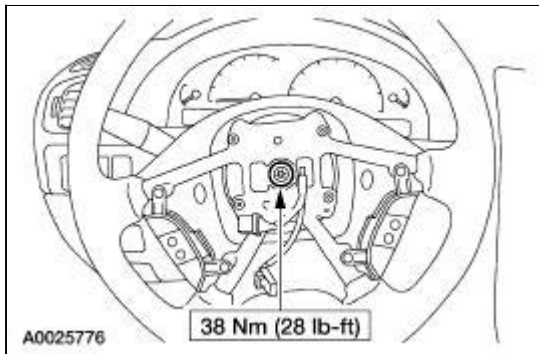



7. Remove the steering wheel.
 1. Remove the special tool.
 2. Remove and discard the steering wheel retaining bolt.
 3. Remove the steering wheel.



Installation

1. Install the steering wheel and a new steering wheel retaining bolt.



2. Install the horn blow switch. For additional information, refer to [Section 413-06](#).
3.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes and instructions in the supplemental restraint system (SRS) deactivation procedure.

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

Clockspring


Removal and Installation

For additional information, refer to [Section 501-20B](#).

Steering Column

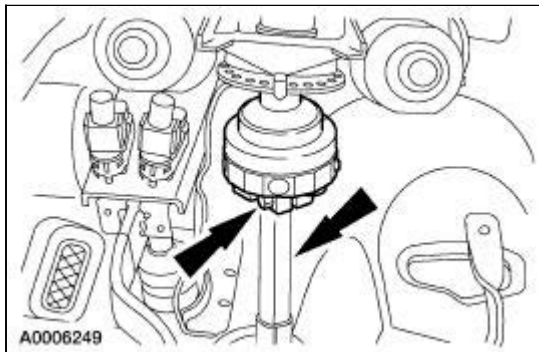
Removal

All vehicles

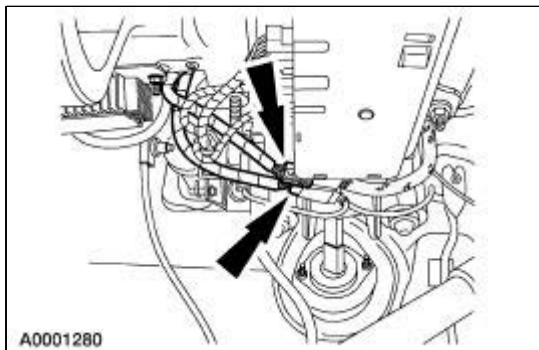
1. Prepare the vehicle for steering column removal.
 1. Disconnect the battery ground cable for at least one minute to allow for the depletion of the restraint system backup power supply. For additional information, refer to [Section 414-01](#).
 2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes and instructions in the supplemental restraint system (SRS) deactivation procedure.**

Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3. Remove the clockspring. For additional information, refer to [Section 501-20B](#).
2. Remove and discard the steering column shaft pinch bolt. Detach the intermediate shaft from the steering column yoke.

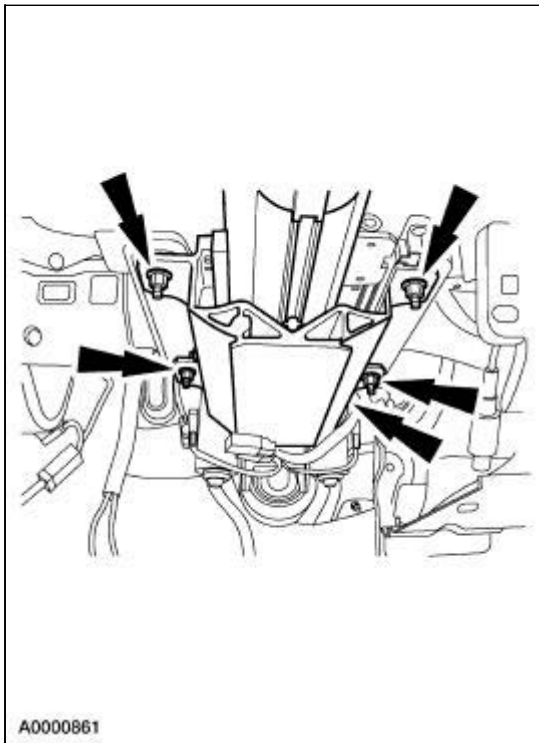


3. Disconnect the electronic steering sensor and steering column release motor harness electrical connectors.



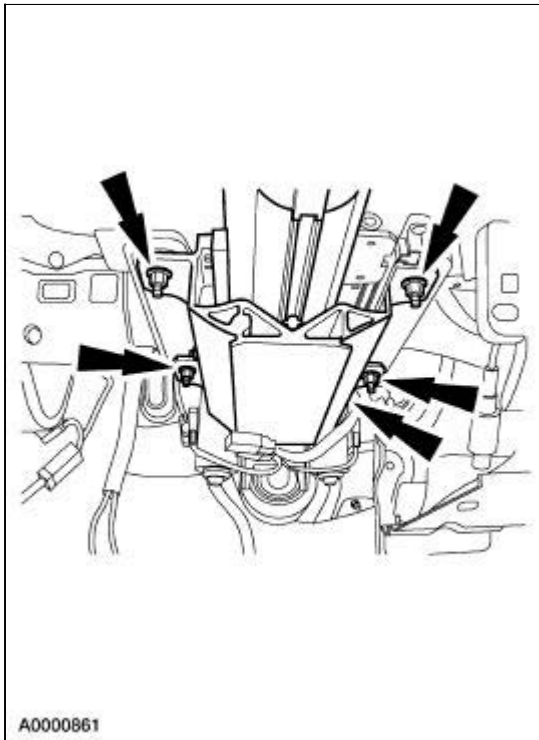
Vehicles with automatic transmission

4. While supporting the steering column, remove and discard the lock nuts. Remove the steering column.

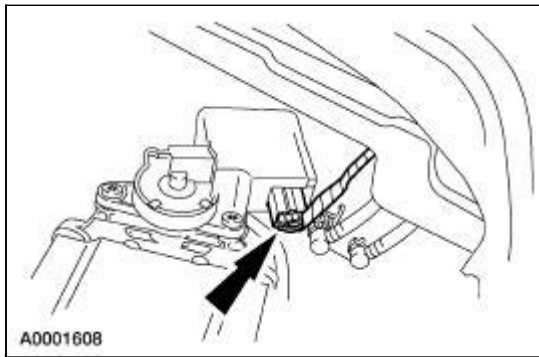


Vehicles with manual transmission

5. While supporting the steering column, remove and discard the lock nuts. Lower the steering column.



6. Disconnect the steering wheel lock actuator electrical connector.

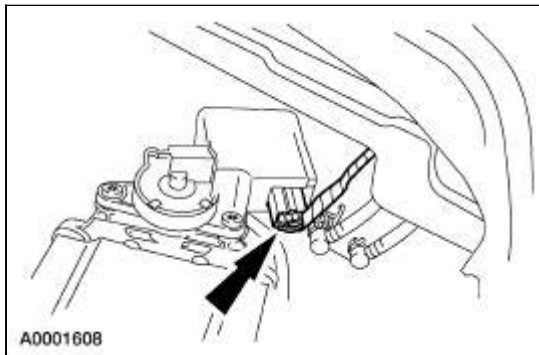


7. Remove the steering column.

Installation

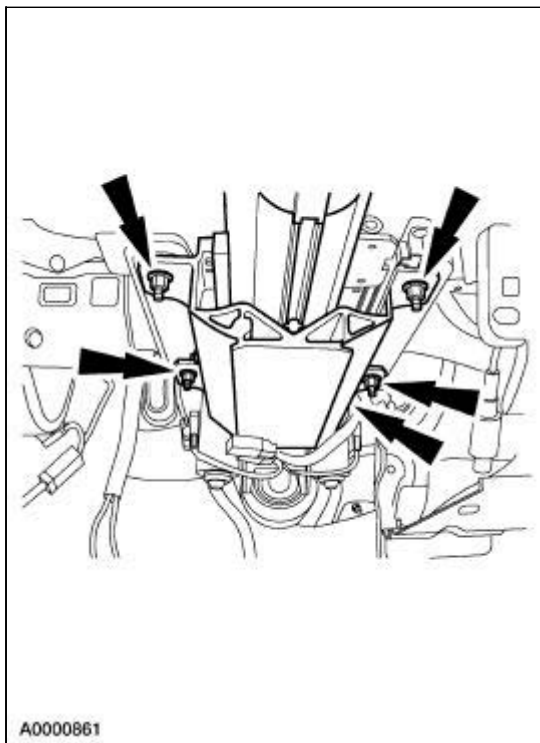
Vehicles with manual transmission

1. Connect the steering wheel lock actuator electrical connector.

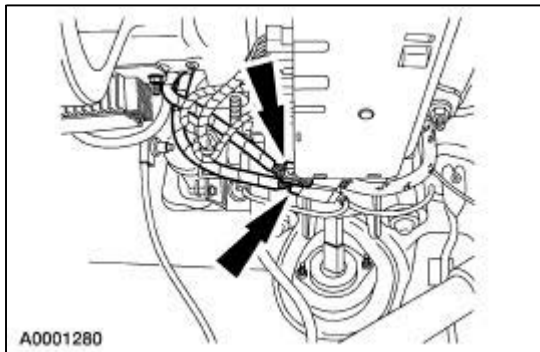


All vehicles

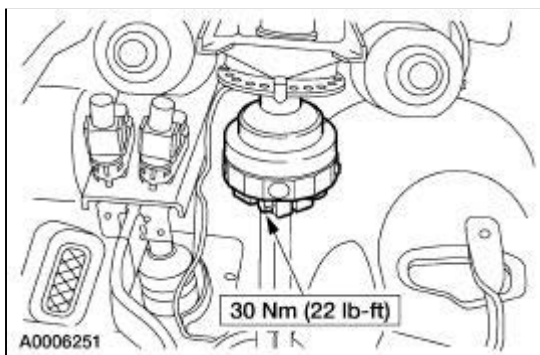
2. Position the steering column and loosely install the bolts.




3. Connect the electronic steering sensor and the steering column release motor electrical connectors.



4. Attach the intermediate shaft to the steering column yoke and install the pinch bolt.



5. Restore the vehicle to operating condition.
 1. Install the clockspring. For additional information, refer to [Section 501-20B](#).
 2.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes and instructions in the supplemental restraint system (SRS) deactivation procedure.

Reactivate the supplemental restraint system (SRS). For additional information, refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

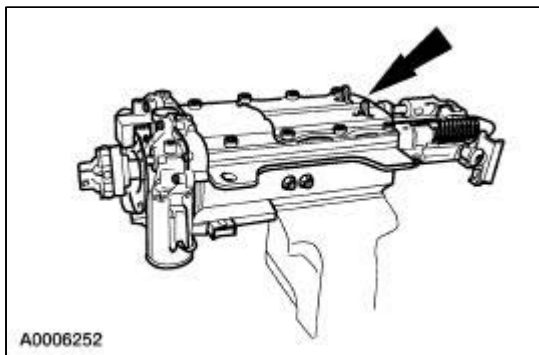
Tilt/Telescopic Motors

Removal and Installation

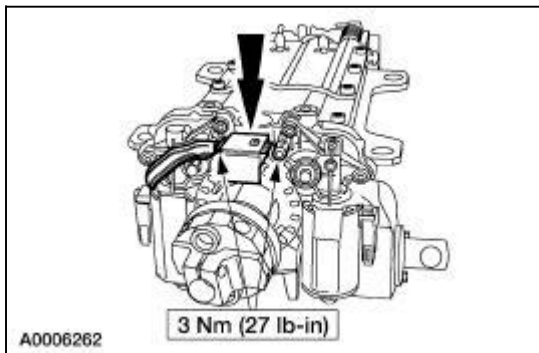
1.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes and instructions in the steering column removal and installation procedure.

Remove the steering column. For additional information, refer to [Steering Column](#) in this section.

2. Place the steering column in a vise.

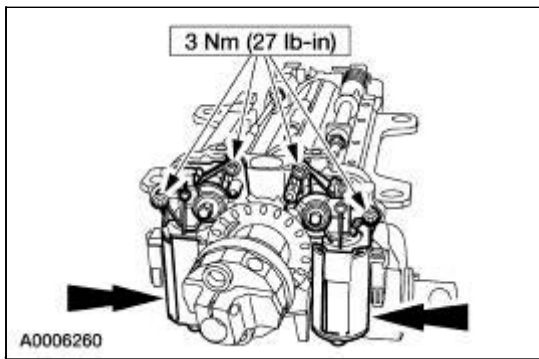


3. Remove the screws and the electronic steering sensor (18B015).



4. **NOTE:** Do not disconnect the steering column release motor harness electrical connectors from the steering column release motor assemblies (3D538).

Remove the screws and the steering column release motor assemblies.



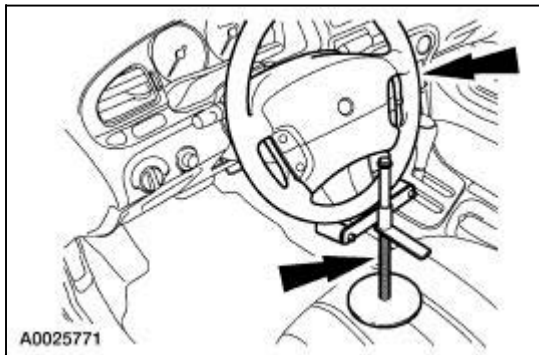
5.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes and instructions in the steering column procedure.

To install, reverse the removal procedure.

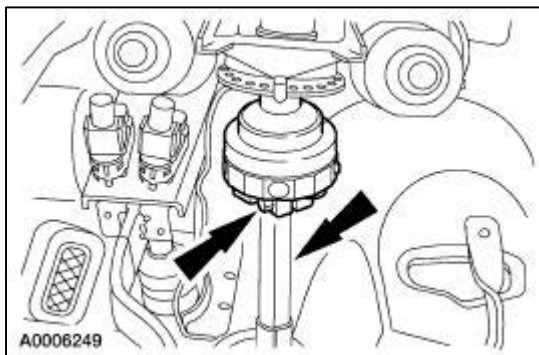
Steering Column Shaft —Intermediate


Removal and Installation

1. Hold the steering wheel in the straight forward position using a suitable holding device.



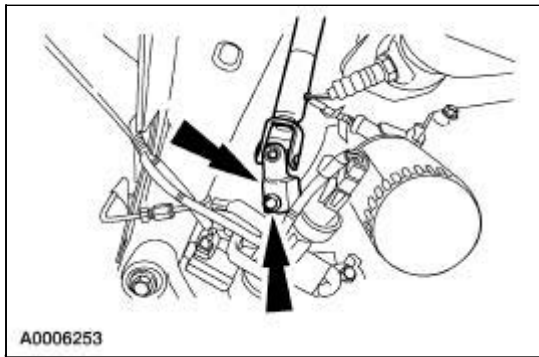
2. Remove the pinch bolt and detach the intermediate shaft from the steering column yoke.
 - Discard the bolt.



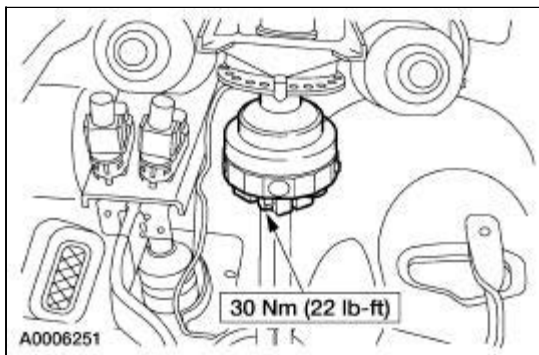
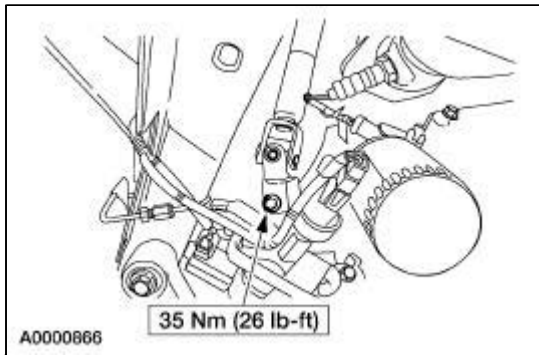
3. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
4.  **CAUTION: Do not allow the steering wheel to rotate while the steering column intermediate shaft is disconnect or damaged to the clockspring can result. If there is evidence that the wheel has rotated, the clockspring must be removed and recentered. For additional information, refer to [Section 501-20B](#).**

Remove the pinch bolt and detach the coupler.

- Discard the bolt.

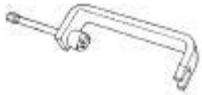


5. Remove the intermediate shaft.
6. To install, reverse the removal procedure.



Steering Column —Power Tilt/Telescopic

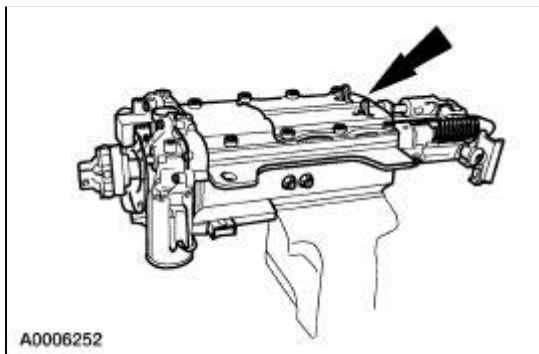
Special Tool(s)

 ST1692-A	Tilt Column Spring Compressor 211-201 (T97P-3D655-A)
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Disassembly

All vehicles

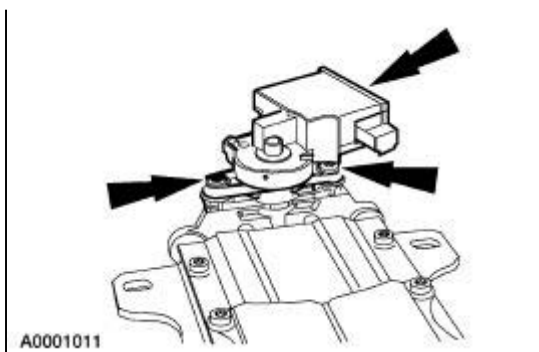
1. Place the steering column in a vise.



Vehicles with manual transmission

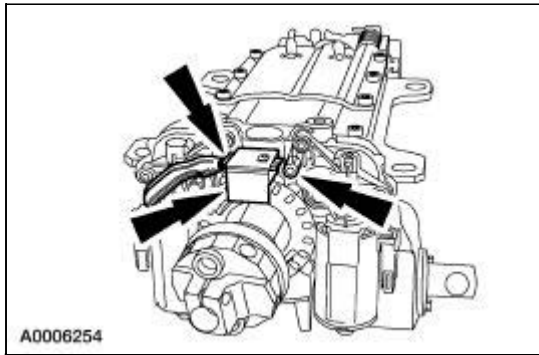
2.  **CAUTION:** Use care not damage the steering wheel lock actuator (3K772) when removing the heads from the shear bolts.


Using a suitable drill and 3/8-in drill bit, remove heads of the shear bolts. Remove the steering wheel lock actuator. Using locking pliers, remove the shear bolts from the steering column upper shaft assembly.




All vehicles

3. Remove the screws and the electronic steering sensor (18B015).

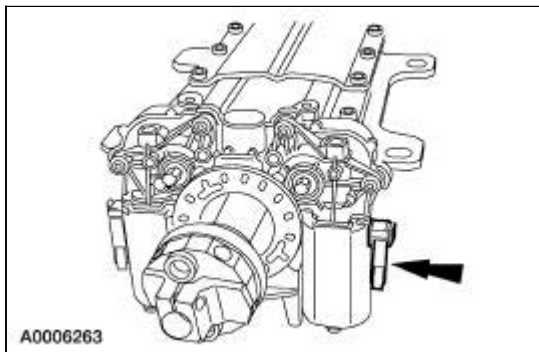


4.  **CAUTION:** Do not telescope the steering column manually or by any means other than those described below. Failure to do so can result in damage to the steering column potentiometer (14A605) and the steering column actuator assembly (3F797).

 **CAUTION:** Pay close attention to the travel of power steering potentiometer while operating the steering column with the battery charger. Overtravel of the steering column can damage the steering column potentiometer and cause other electrical failures.

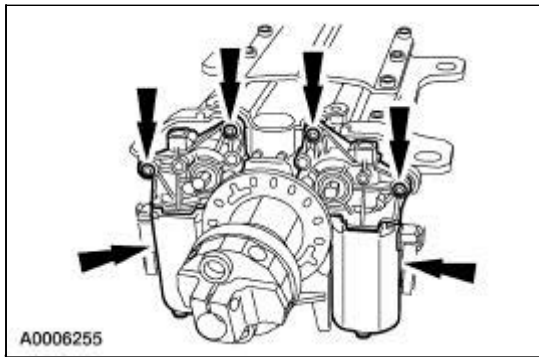
Disconnect the steering column release motor (telescopic) electrical connector. Using a suitable 1 amp 12 volt battery charger connected to the steering column release motor (telescopic) electrical terminals, telescope the steering column out until it reaches the stop (fully extended). Connect the steering column release motor (telescopic) electrical connector.

- If the steering column release motor (telescopic) is damaged or inoperable, a new steering column release motor (telescopic) must be installed before telescoping the steering column.



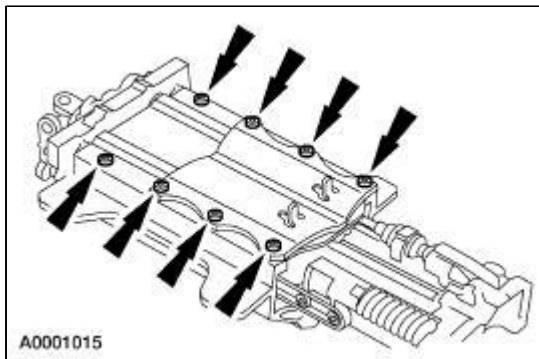
5. **NOTE:** Do not disconnect the steering column release motor harness electrical connectors from the steering column release motor assemblies (3D538).

Remove the screws and the steering column release motor assemblies.

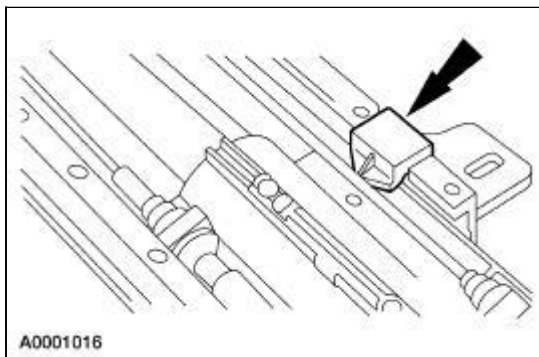


6. **NOTE:** The upper steering column track (3B628) will fall free when the steering column outer housing (3F789) is removed.

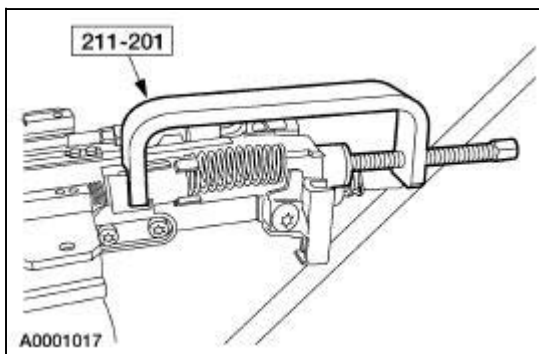
Remove the bolts, steering column outer housing cover plate (3F790), steering column outer housing and steering column track.



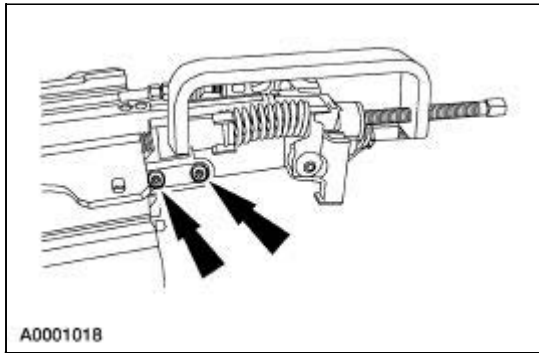
7. Remove the steering column connector link (3A517).



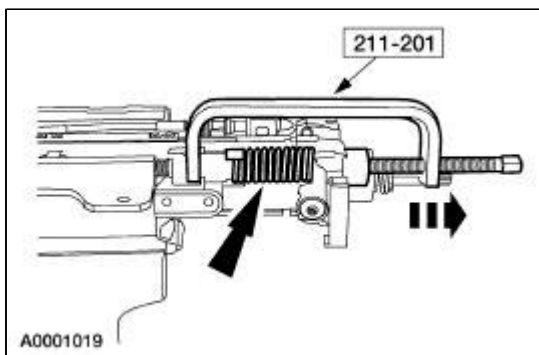
8. Install the special tool hand tight on the steering column position spring (3D655).



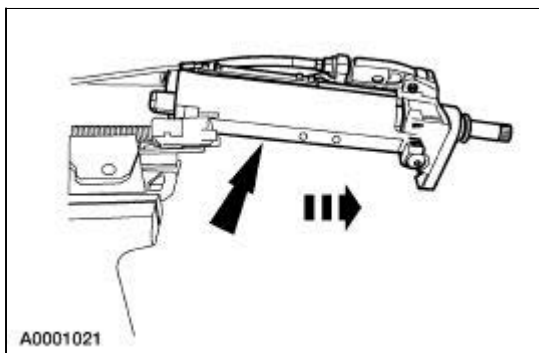
9. Remove the bolts.



10. Using the special tool, release the spring tension. Remove the special tool and the steering column position spring.

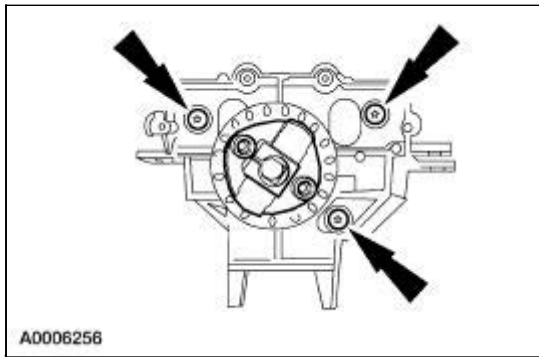


11. Separate the front and rear halves of the steering column upper shaft assembly and the steering column inner housing (3F791).



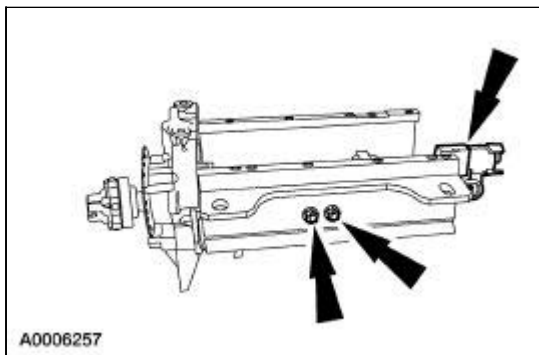
12. **NOTE:** The steering column upper shaft assembly, sensor ring and coupler are serviced as an assembly.

Remove the bolts. Remove the rear half of the steering column upper shaft assembly from the steering column support assembly (3B718).

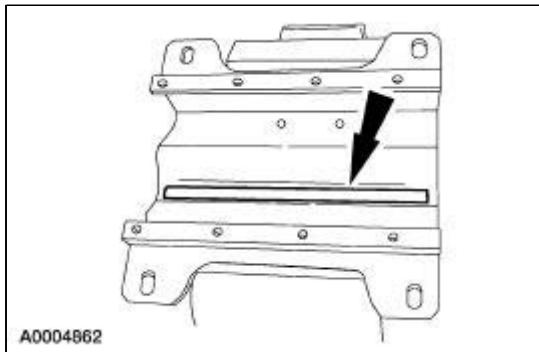


13.  **CAUTION: The curl strap on the steering column actuator assembly (telescopic) (3F797) must not be bent or altered under any circumstances.**

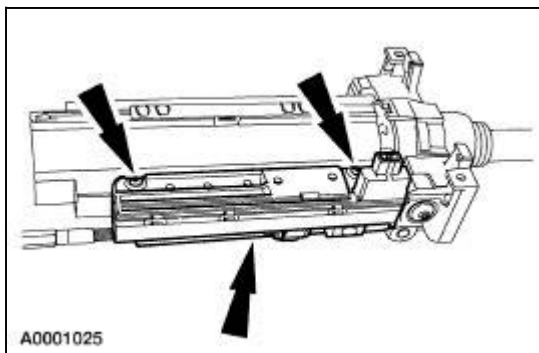
Remove the nuts and the steering column actuator assembly (telescopic). If the curl strap is damaged, a new steering column actuator assembly (telescopic) must be installed.



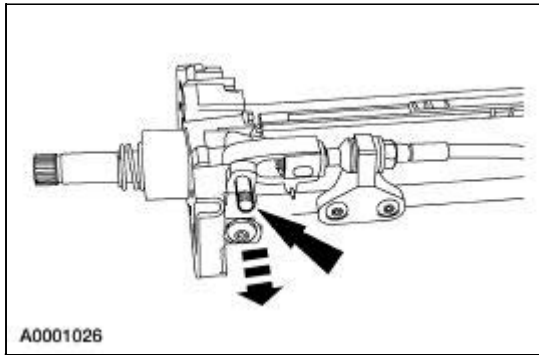
14. Remove the steering column track from the steering column support assembly.



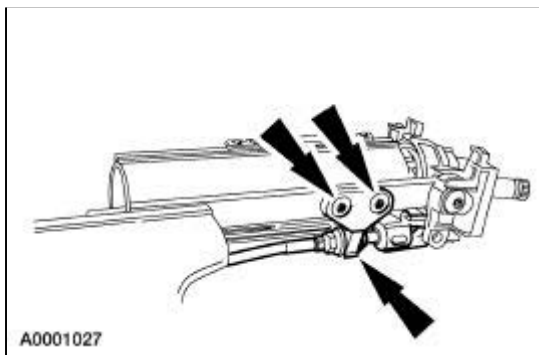
15. Remove the screws and the steering column potentiometer assembly (14A605).



16. Remove the steering column release pin (3D545).

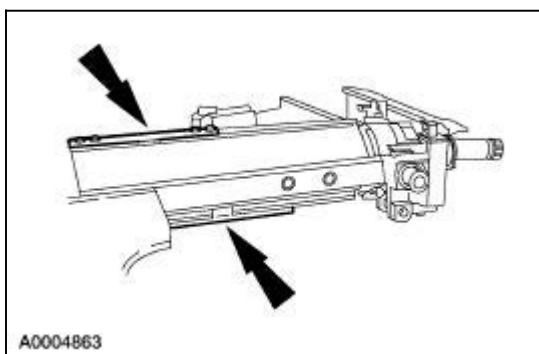


17. Place the steering column inner housing assembly (3F791) in a vise.
18. Remove the bolts and the steering column actuator assembly (tilt) (3F797).

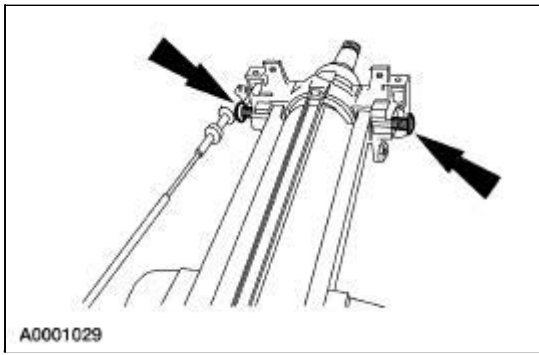


19. **NOTE:** The steering column inner track bearing retainer assemblies (3F795) snap into place and will hold the steering column tracks to the steering column inner housing.

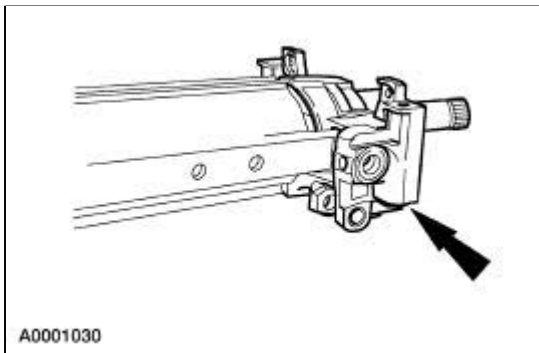
Remove the steering column inner track bearing retainer assemblies and steering column tracks.



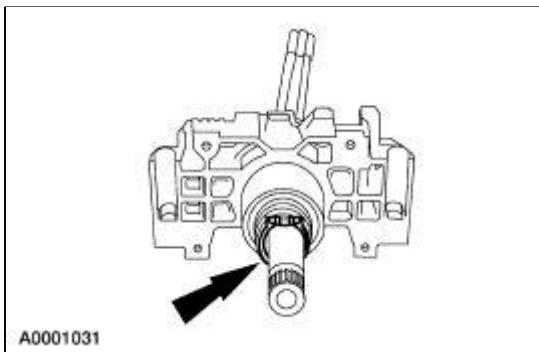
20. Remove the bolts.



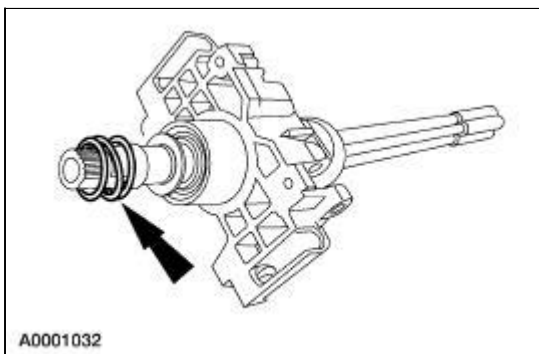
21. Remove the steering column tube flange (3511).



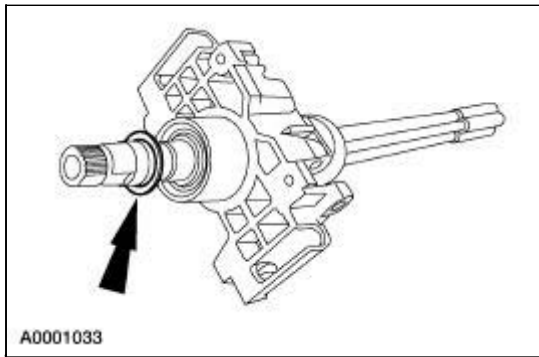
22. Remove the steering column upper bearing retainer (97663).



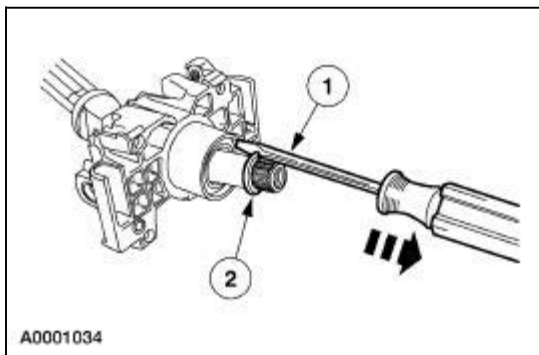
23. Remove the steering column upper bearing spring (3520).



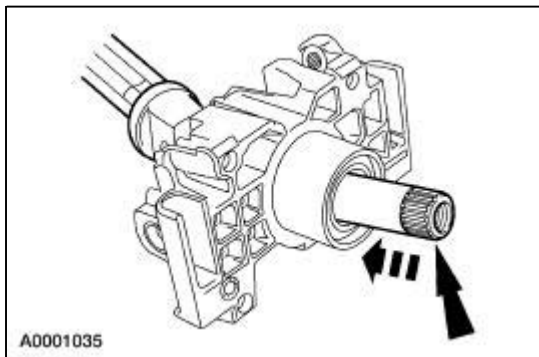
24. Remove the steering column bearing sleeve (3518).



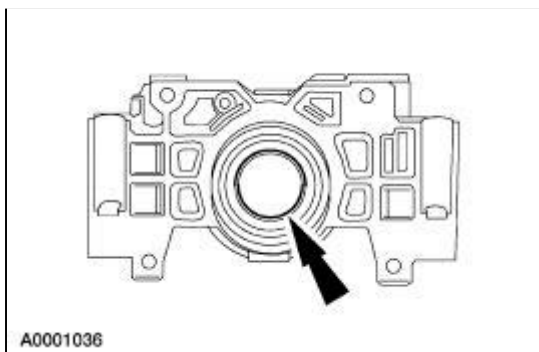
25. Remove the steering column upper bearing tolerance ring (3L539).
1. Using a flat-blade screwdriver, spread out the steering column upper bearing tolerance ring.
 2. Slide the steering column upper bearing tolerance ring from the steering column upper shaft assembly.



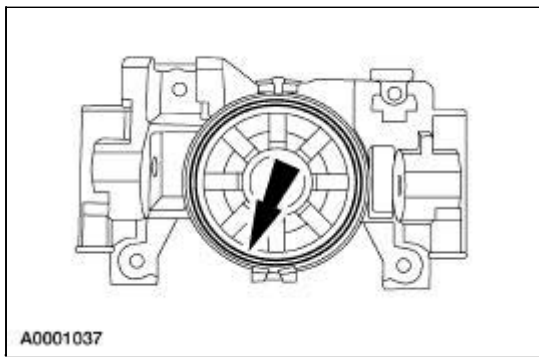
26. Remove the front half of the steering column upper shaft assembly.



27. Using a suitable brass drift, drive out the small steering column tube bearing assembly (3517).



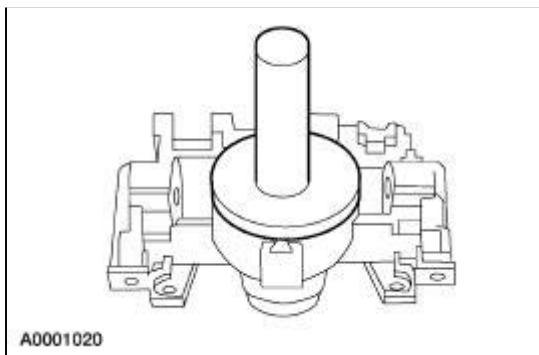
28. Using a suitable brass drift, drive out the large steering column tube bearing assembly (3517).



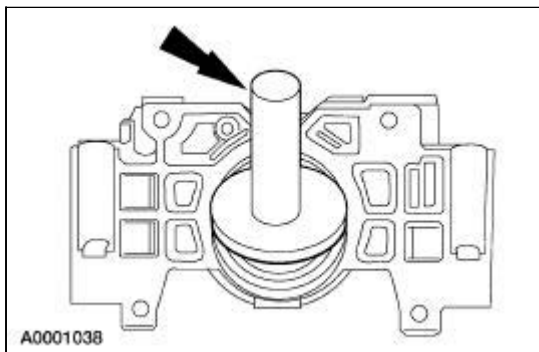
Assembly

All vehicles

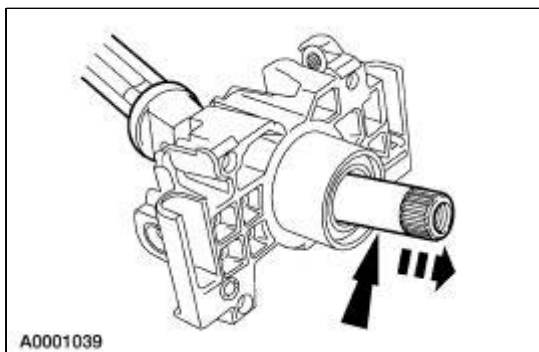
1. Using a suitable bearing installer tool, install the large steering column tube bearing assembly.



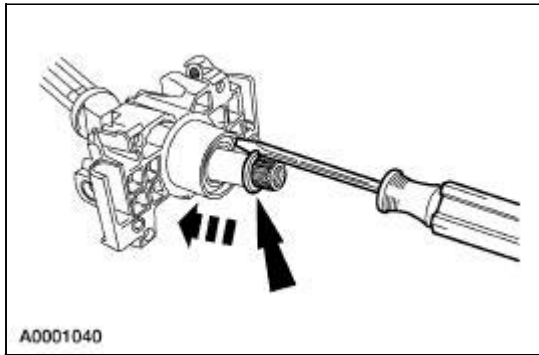
2. Using a suitable bearing installer tool, install the small steering column tube bearing assembly.



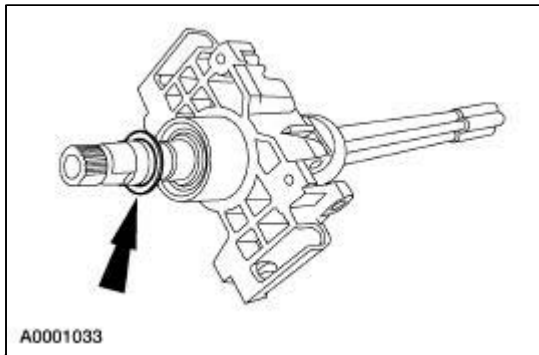
3. Slide the steering shaft into the tilt housing.



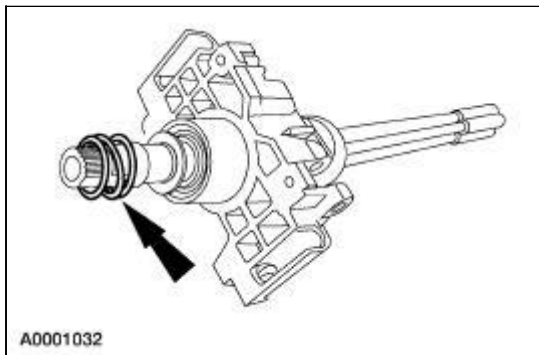
4. Install the steering column upper bearing tolerance ring.



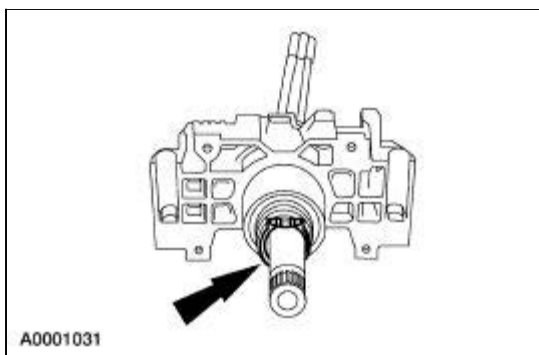
5. Install the steering column bearing sleeve.



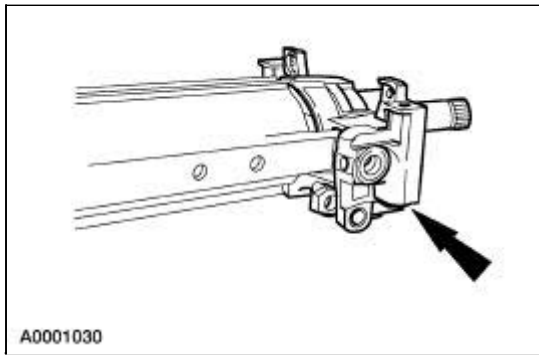
6. Install the steering column upper bearing spring.



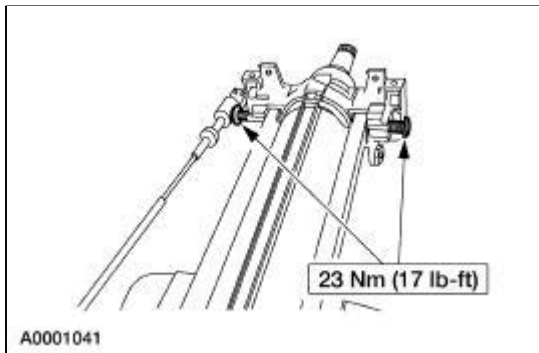
7. Install the steering column upper bearing retainer.



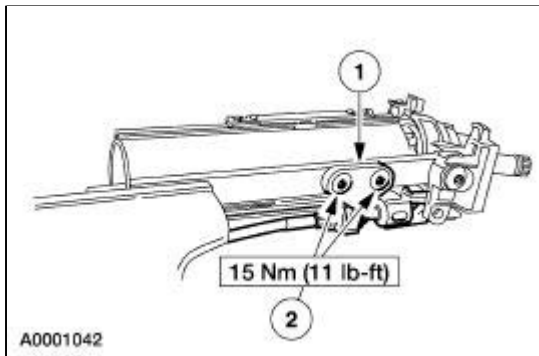
8. Install the steering column tube flange.



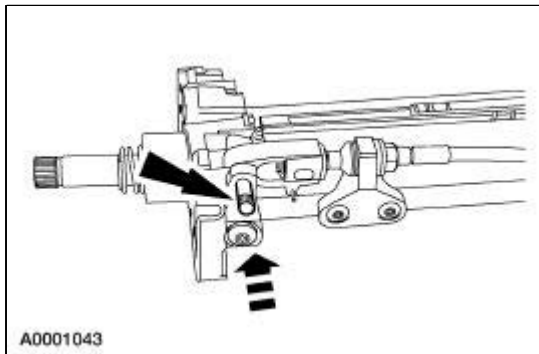
9. Install the bolts.



10. Install the steering column actuator assembly (tilt).
1. Position the steering column actuator assembly (tilt).
2. Install the bolts.

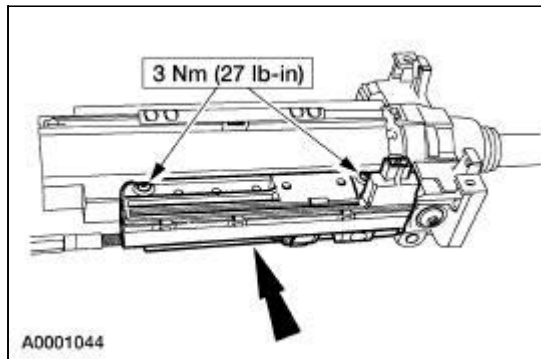


11. Install the steering column release pin.

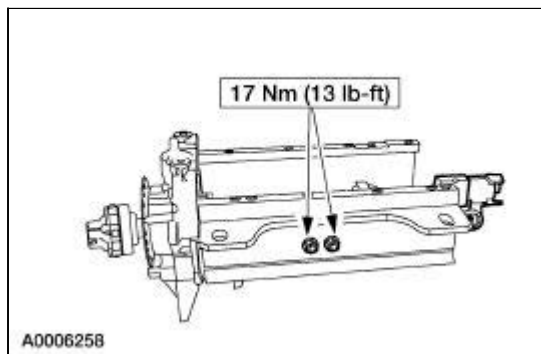


12. Install the steering column potentiometer assembly and screws.
● Line up the pin on the steering column actuator assembly (tilt) with the slot on the

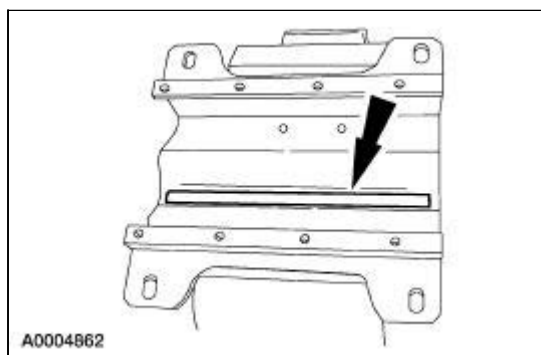
steering column potentiometer assembly.



13. Install the steering column actuator assembly (telescopic) and nuts. If the curl strap is damaged, a new steering column actuator assembly (telescopic) must be installed.



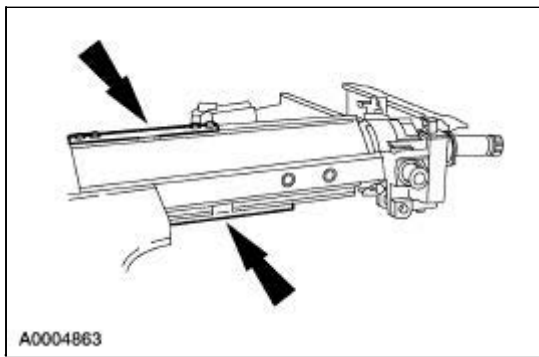
14. Install the steering column track on the steering column support assembly.
 - Apply Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B to the bearing surface of the steering column track.



15. **⚠ CAUTION: The staging of the steering column inner track bearing assemblies is very critical. The steering column inner track bearing assemblies must be installed against the rear steering column inner housing track bearing assembly retaining end. The steering column inner housing must be installed in the fully extended (out) position. Failure to correctly stage the steering column inner track bearing assemblies will result in damage to the steering column.**

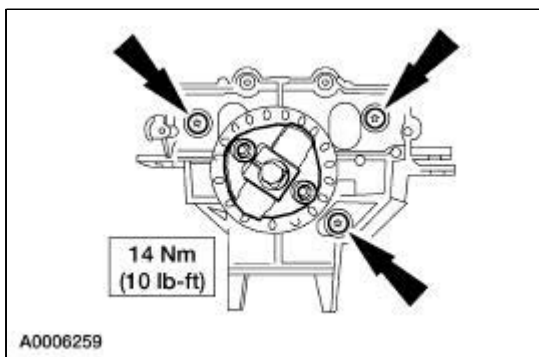
Attach the steering column tracks and steering column inner track bearing assemblies on the steering column inner housing.

- Apply Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B to the steering column track bearing assemblies and the bearing surface of the steering column tracks.

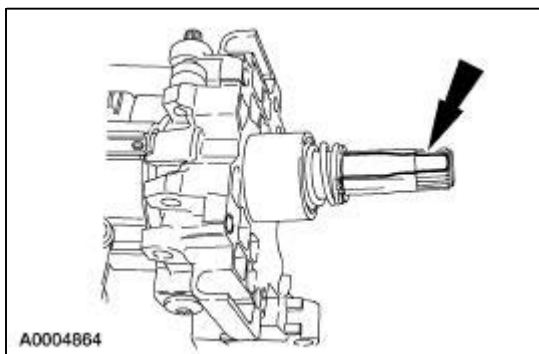


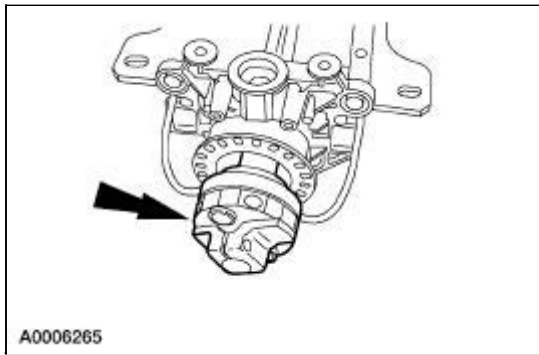
16. **NOTE:** The steering column upper shaft assembly, sensor ring and coupler are serviced as an assembly.

Install the rear half of the steering column upper shaft assembly into the steering column support assembly. Install the bolts.

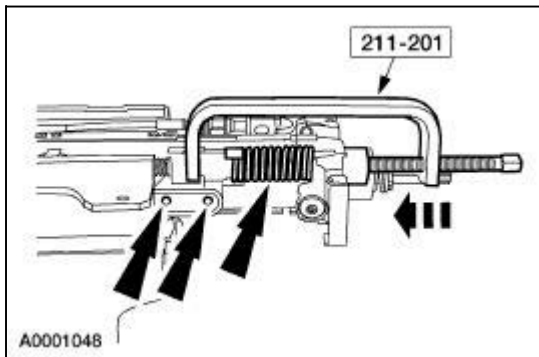


17. Join the front and rear halves of the steering column upper shaft assembly and the steering column inner housing in the steering column support housing.
- Position the front half of the upper steering column upper shaft assembly with flat portion up before installing.
 - Position the rear half of the upper steering column upper shaft assembly with smooth face of the coupling up (machined side down) before installing.

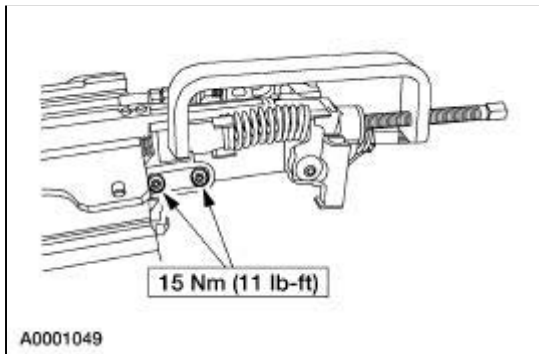




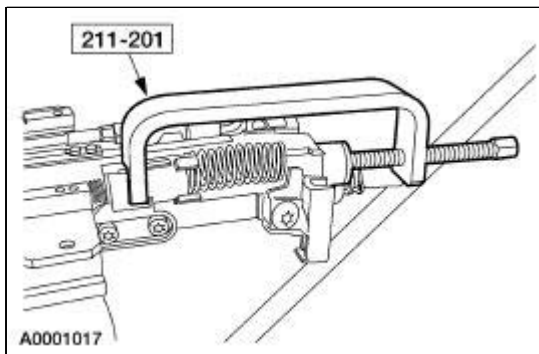
18. Position the steering column spring. Using the special tool, compress the steering column position spring until the steering column actuator assembly (telescopic) bolt holes align.



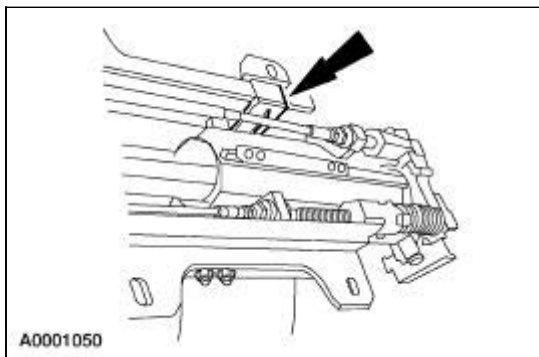
19. Install the bolts.




20. Remove the special tool.



21. Install the steering column connector link.



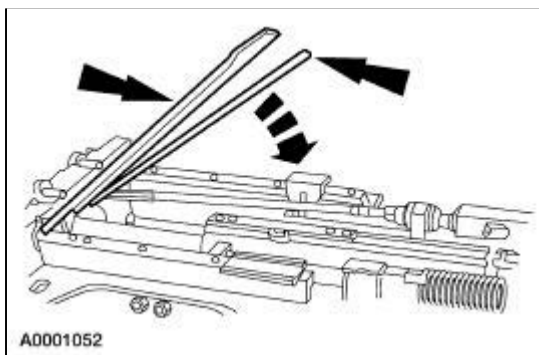
22. Install the steering column track on the steering column outer housing.
- Apply Premium Long-Life Grease XG-1-C or equivalent meeting Ford specification ESA-M1C75-B to the bearing surface of the steering column track.

23.  **CAUTION: The staging of the steering column inner track bearing assemblies is very critical. The steering column inner track bearing assemblies must be installed against the rear steering column inner housing track bearing assembly retaining end. The steering column inner housing must be installed in the fully extended (out) position. Failure to correctly stage the steering column inner track bearing assemblies will result in damage to the steering column.**

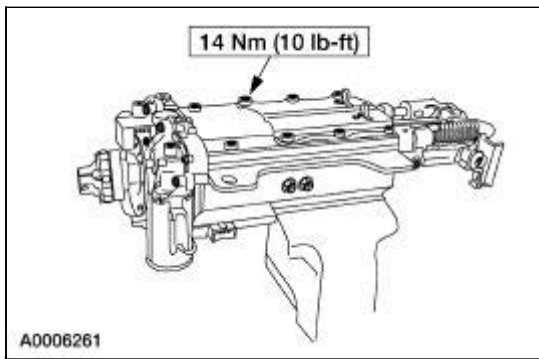
NOTE: Make sure that the steering column inner track bearing retainer assemblies are correctly staged before the steering column outer housing and steering column outer housing cover plate are installed.

Install the steering column outer housing, steering column outer housing cover plate and bolts. Loosely hand tighten the bolts. Check that the steering column inner track bearings are correctly staged, correct as necessary.

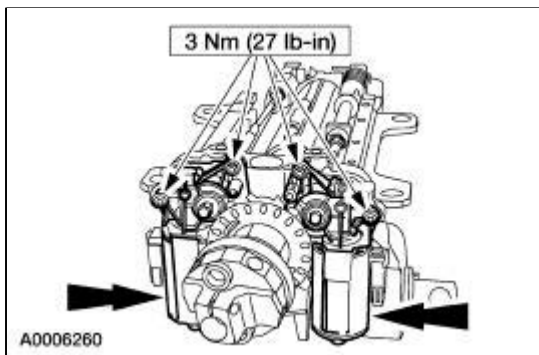
- Apply Threadlock 262, E2FZ-19554-B or equivalent meeting Ford specification WSK-M2G351-A6 to the bolt threads.





24. Tighten the bolts.



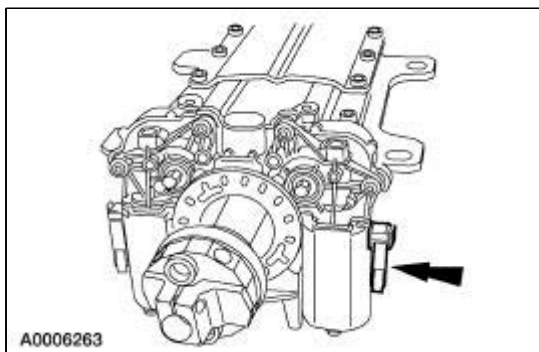
25. Install the steering column release motor assemblies and screws.




26.  **CAUTION:** Do not telescope the steering column manually or by any means other than those described below. Failure to do so can result in damage to the steering column potentiometer and the steering column actuator assembly.

 **CAUTION:** Pay close attention to the travel of power steering potentiometer while operating the steering column with the battery charger. Overtravel of the steering column can damage the steering column potentiometer and cause other electrical failures.

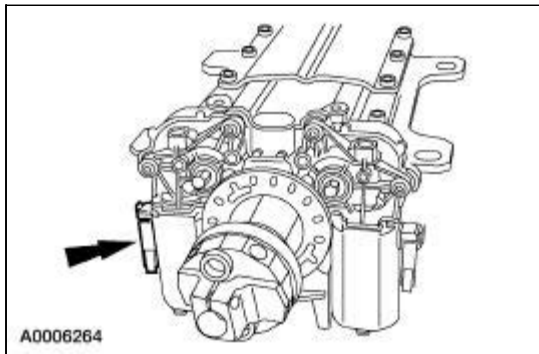
Disconnect the steering column release motor (telescopic) electrical connector. Using a suitable 1 amp 12 volt battery charger connected to the steering column release motor (telescopic) electrical terminals, test the steering column for normal operation. Connect the steering column release motor (telescopic) electrical connector.



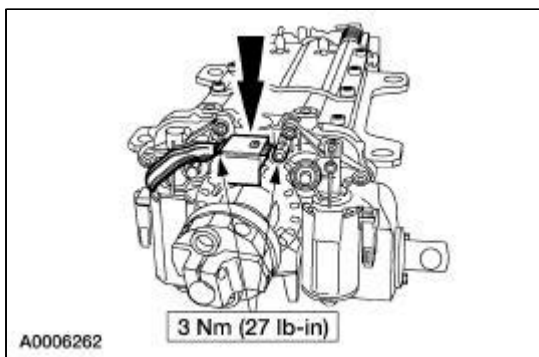
27.  **CAUTION:** Pay close attention to the travel of power steering potentiometer while operating the steering column with the battery charger. Overtravel of the steering column can damage the steering column potentiometer and cause other electrical failures.

Disconnect the steering column release motor (tilt) electrical connector. Using a suitable 1 amp 12 volt battery charger connected to the steering column release motor (tilt) electrical terminals,

test the steering column for normal operation. Connect the steering column release motor (tilt) electrical connector.

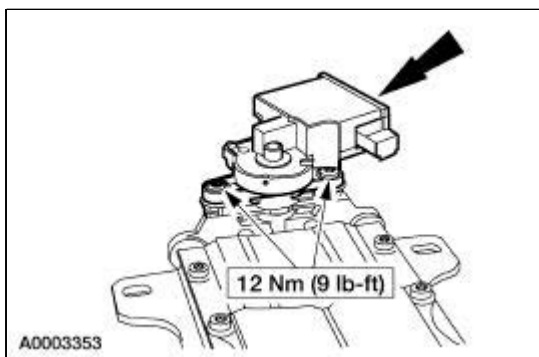


28. Install the electronic steering sensor and screws.



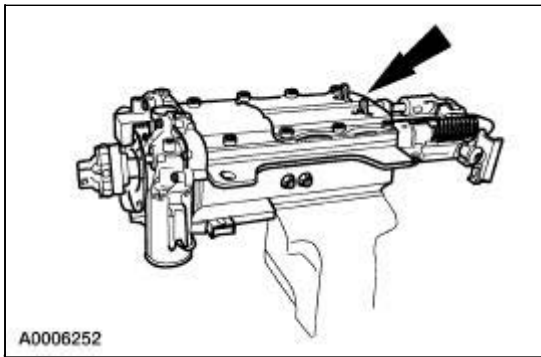
Vehicles with manual transmission

29. Install the steering wheel lock actuator and new shear bolts.



All vehicles

30. Remove the steering column from the vise.



A0006252

Torque Specifications

Description	Nm	lb-ft	lb-in
Battery ground cable bolt	10	—	89
Steering column lock actuator screw	14	10	—

Steering Column Switches

The steering column switches system consists of the following components:

- ignition switch (11572)
- multifunction switch (13K359)
- steering column lock actuator (manual transmission only)

The ignition switch is mounted in the instrument panel to the RH side of the steering column and is activated by rotating the ignition key in the ignition switch lock cylinder.



The integrated multifunction switch is mounted to the steering column and controls the turn signals, hazard flasher, windshield wiper/washer control, and headlamp dimmer/flash-to-pass.

The steering column lock actuator will unlock when a valid ignition key is inserted into the ignition switch lock cylinder. The steering column lock actuator will only lock when the ignition key is removed, and both the vehicle messages for vehicle speed and engine rpm are not present on the standard corporate protocol (SCP) link. Power must not be enabled to the steering column lock actuator while the engine is running. While the steering column lock actuator is in the locked position, the vehicle will be inhibited from cranking.

The steering column lock actuator receives power from the REM, ground from the FEM, and exchanges security-related communication messages with the instrument cluster (IC) module over the SCP link.

Steering Column Switches

Special Tool(s)

 <p>ST1137-A</p>	<p>73 III Automotive Meter or equivalent 105-R0057</p>
 <p>ST2332-A</p>	<p>Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool</p>

Refer to the Wiring Diagrams Section 700-02-00 for schematic and connector information.

Refer to the Wiring Diagrams Section 417-01-00 for schematic and connector information.

Refer to the Wiring Diagrams Section 211-00-00 for schematic and connector information.

Inspection and Verification

1. Verify the customer's concern by operating the ignition switch, the multifunction switch, and the steering column lock actuator (if equipped) (manual transmission only) on the steering column.
2. Visually inspect for obvious signs of mechanical and electrical damage; refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Multifunction switch ● Ignition key ● Ignition switch ● Steering column ● Wiper/washer switch ● Steering column lock (SCL) actuator (if equipped) 	<ul style="list-style-type: none"> ● Circuit ● Central junction box (CJB) Fuse: <ul style="list-style-type: none"> ■ 201 (5A) ■ 202 (5A) ■ 203 (5A) ■ 204 (5A) ■ 205 (5A) ■ 213 (5A) ■ 214 (10A) ■ 216 (5A) ■ 217 (5A) ■ 226 (3A)

- 227 (10A)
- 229 (5A)
- Underhood auxiliary junction box (AJB) Fuse:
 - 102 (10A)
 - 120 (30A)
- Battery junction box (BJB) Fuse:
 - 402 (10A)
 - 406 (10A)
 - 422 (20A)
- Relay

3. If an obvious cause for an observed or reported concern is found, correct the cause before proceeding to the next step.
4. If the diagnostic tool does not power up, refer to the diagnostic tool manual.
5. **NOTE:** The SCL actuator will only allow communication with a tester after the SCL actuator has been activated. To activate the SCL actuator, open the driver door and **do not** put the key in the ignition (or alternatively, you can press one of the buttons on the key fob while there is no key in the ignition). The SCL actuator will stay activated for 30 minutes after the driver door is opened (or a key fob button is pressed).

If equipped with SCL actuator (manual transmission vehicles only), and the concern remains after inspection, connect the diagnostic tool. The diagnostic tool will receive power through the diagnostic connector. If the diagnostic tool does not communicate, refer to the diagnostic tool manual.

6. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70-ALL ECUS NO RESP/NOT EQUIP, refer to Section 418-00.
 - NO RESP/NOT EQUIP for front electronic module (FEM), go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for rear electronic module (REM), go to Pinpoint Test B.
 - NO RESP/NOT EQUIP for instrument cluster (IC), go to Pinpoint Test D.
 - NO RESP/NOT EQUIP for steering column lock module (SCLM), ignore this message and proceed to specific data link diagnostic test for the steering column lock module as follows:

NOTE: Ignition key must be kept out of the ignition switch even though the diagnostic tool may request ignition to the RUN position.

NOTE: Ignore NO RESP/NOT EQUIP messages for all modules except the steering column lock module for this test.

Turn key to OFF, remove key from ignition switch, close the driver door, open the driver door. Carry out the DATA LINK DIAGNOSTIC TEST FOR THE SCL ACTUATOR. If the diagnostic tool responds with:

- NO RESP/NOT EQUIP for steering column lock module (SCLM), go to Pinpoint Test C.
- Otherwise, retrieve and record the continuous diagnostic trouble codes (DTCs) for the SCLM, , erase the continuous DTCs, insert the key into the ignition switch, turn the ignition switch to RUN, Turn the ignition switch to OFF, remove the key from the ignition switch, close the driver door, open the driver door, record new continuous DTCs for the SCLM.

7. If the DTCs retrieved are related to the concern, go to the SCL actuator Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1342	ECU Is Defective	FEM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1438	Wiper Mode Select Switch Circuit Failure	FEM	REFER to Section 501-16 .
B1446	Wiper Park Sense Circuit Failure	FEM	REFER to Section 501-16 .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to Section 413-01 .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1567	Lamp Headlamp High-Beam Circuit Failure	FEM	REFER to Section 417-01 .
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B1794	Lamp Headlamp Low-Beam Circuit Failure	FEM	REFER to Section 417-01 .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	REFER to Section 501-11 .
B2215	Window Passenger Front Down Switch Short to Battery	FEM	REFER to Section 501-11 .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2443	Powertrain Performance Mode Switch Circuit Failure	FEM	Not Used
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
C1284	Oil Pressure Switch Failure	FEM	REFER to Section 413-01 .

C1446	Brake Switch Circuit Failure	FEM	REFER to <u>Section 413-01</u> .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to <u>Section 211-00</u> .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to <u>Section 211-00</u> .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	CARRY OUT the PCM self-test.
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test.
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	CARRY OUT the ICM self-test.
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	ICM	CARRY OUT the ICM self-test.

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
AL_EVT1	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT2	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT3	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT4	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT5	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT6	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT7	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT8	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR

FLUID_1	Brake Fluid Level Switch #1	OFF, ON
HOOD_SW	Hood Ajar Switch	CLOSED, AJAR
IGN_R	Ignition Switch -RUN Position	NO, YES
L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position Sensor (Left/Right)	#####
PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%
R_HIGH	Right High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RADIO_SW	Security Input Switch Status	OFF, ON
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-
STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	Volts
WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKSW	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%

BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON
FRONT WINDOW CONTROL	PR DOWN	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
POWER MIRROR CONTROL	PR DOWN	OFF, ON
POWER MIRROR CONTROL	PR LEFT	OFF, ON
POWER MIRROR CONTROL	PR RIGHT	OFF, ON
POWER MIRROR CONTROL	PR UP	OFF, ON
STEERING COLUMN CONTROL COMMAND	LOCK_GND	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON
VAPS II OUTPUT PULSE CONTROL	VAPSIIOUT	%

REM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	REM	REFER to Section 413-01 .
B1300	Power Door Lock Circuit Failure	REM	REFER to Section 501-14B .
B1310	Power Door Unlock Circuit Failure	REM	REFER to Section 501-14B .
B1331	Decklid Ajar Rear Door Circuit Failure	REM	REFER to Section 417-02 .
B1335	Door Ajar RR Circuit Failure	REM	REFER to Section 417-02 .
B1342	ECU Is Defective	REM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1483	Brake Pedal Input Circuit Failure	REM	REFER to Section 417-01 .
B1499	Lamp Turn Signal Left Circuit Failure	REM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	REM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	REM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	REM	REFER to Section 417-01 .
B1551	Decklid Release Circuit Failure	REM	REFER to Section 501-14B .
B1571	Door Ajar LR Circuit Failure	REM	REFER to Section 417-02 .

B1676	Battery Pack Voltage Out of Range	REM	REFER to <u>Section 414-00</u> .
B2172	Inertia Switch Input Circuit Open	REM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	REFER to <u>Section 501-11</u> .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	REFER to <u>Section 501-11</u> .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	REFER to <u>Section 501-11</u> .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	REFER to <u>Section 501-11</u> .
B2477	Module Configuration Failure	REM	REFER to <u>Section 418-01</u> .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test

REM Parameter Identification (PID) Index

PID	Description	Expected Value
BOO	Brake Switch Input	OFF, ON
DECKLID	Decklid Ajar Switch	CLOSED, AJAR
DL_DSRM	Decklid Disarm	NO, YES
DLIDOUT	Decklid Driver	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
DLIDRLS	Deck Lid Release	OFF, ON
L_TAIL	Left & Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LMRKOUT	Left Marker Lamp Driver Output State	OFF, ON
LMRKSTB	Left Marker Lamp Driver Short To Battery	NO, YES
LR_TURN	Left & Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LRDN_SW	Left Rear Window Down Switch	OFF, UP
LRDR_SW	Left Rear Door Ajar Switch	CLOSED, AJAR
LRUP_SW	Left Rear Window Up Switch	OFF, DOWN

PD_LOCK	Passenger Door Lock	NO, YES
PD_UNLK	Passenger Door Unlock	NOTLOC, LOCK
R_TAIL	Left & Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RR_TURN	Left & Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RRDN_SW	Right Rear Window Down Switch	OFF, UP
RRDR_SW	Right Rear Door Ajar Switch	CLOSED, AJAR
RRUP_SW	Right Rear Window Up Switch	OFF, DOWN

REM Active Command Index

Active Command	Display	Action
EXTERIOR LAMP CONTROL	BACKUPLMP	OFF, ON
EXTERIOR LAMP CONTROL	H MNT STP	OFF, ON
EXTERIOR LAMP CONTROL	L STOP	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
EXTERIOR LAMP CONTROL	R DEF RLY	OFF, ON
EXTERIOR LAMP CONTROL	R FOG LMP	OFF, ON
EXTERIOR LAMP CONTROL	R STOP	OFF, ON
POWER WINDOW ENABLE COMMAND	PSGR RLY	OFF, ON
REAR DOOR LOCK CONTROL	LR LOCK	OFF, ON
REAR DOOR LOCK CONTROL	LR UNLOCK	OFF, ON
REAR DOOR LOCK CONTROL	RELEASE	OFF, ON
REAR WINDOW CONTROL	LR DOWN	OFF, ON
REAR WINDOW CONTROL	LR UP	OFF, ON
REAR WINDOW CONTROL	RR DOWN	OFF, ON
REAR WINDOW CONTROL	RR UP	OFF, ON
STEERING COLUMN CONTROL	LOCK_PWR	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

SCL Actuator Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU Is Defective	SCL Actuator	CLEAR the DTCs. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new SCL actuator. REFER to <u>Steering Column Lock Actuator</u> .

B2162	Data Mismatch #2 (received data does not match what was expected)	SCL Actuator	CARRY OUT the steering column lock module parameter reset. Refer to Steering Column Lock Module Parameter Reset .
B2168	Unable to Confirm Unlock Condition	SCL Actuator	GO to Pinpoint Test I .
B2169	Unable to Confirm Lock Condition	SCL Actuator	GO to Pinpoint Test I .
B2170	Steering Column Lock Switch Circuit Failure	SCL Actuator	INSTALL a new SCL actuator. REFER to Steering Column Lock Actuator .

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	ICM	REFER to Section 413-01 .
B1205	EIC Switch-1 Assembly Circuit Failure	ICM	INSTALL a new instrument cluster; REFER to Section 413-01 . TEST the system for normal operation.
B1209	EIC Switch-2 Assembly Circuit Failure	ICM	INSTALL a new instrument cluster; REFER to Section 413-01 . TEST the system for normal operation.
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	ICM	REFER to Section 419-01B .
B1246	Dim Panel Potentiometer Switch Circuit Failure	ICM	REFER to Section 413-00 .
B1342	ECU Is Defective	ICM	REFER to Section 413-01 .
B1352	Ignition Key-In Circuit Failure	ICM	REFER to Section 413-09 .
B1470	Lamp Headlamp Input Circuit Failure	ICM	REFER to Section 417-01 .
B1567	Lamp Headlamp High Beam Circuit Failure	ICM	REFER to Section 417-01 .
B1600	PATS Ignition Key Transponder Signal Is Not Received	ICM	REFER to Section 419-01B .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	ICM	REFER to Section 419-01B .
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	ICM	REFER to Section 419-01B .
B1676	Battery Pack Voltage Out of Range	ICM	REFER to Section 413-01 .
B1681	PATS Transceiver Module Signal Is Not Received	ICM	REFER to Section 419-01B .
B1689	Autolamp Delay Circuit Failure	ICM	REFER to Section 417-01 .
B1875	Turn Signal / Hazard Switch Signal Circuit Failure	ICM	REFER to Section 417-01 .
B2103	Antenna Not Connected	ICM	REFER to Section 419-01B .
B2139	Security Data Mismatch (Receive Data Does Not Match What Was Expected)	ICM	REFER to Section 419-01A .
B2141	NVM Configuration Failure	ICM	REFER to Section 419-01B .
B2143	NVM Memory Failure	ICM	REFER to Section 419-01B .

B2162	Security Data Mismatch #2 (Receive Data Does Not Match What Was Expected)	ICM	REFER to Section 419-01B .
B2328	Column Reach Feedback Potentiometer Circuit Failure	ICM	REFER to Section 211-04 .
B2332	Column Tilt Feedback Potentiometer Circuit Failure	ICM	REFER to Section 211-04 .
B2351	Steering Column Switch Circuit Failure	ICM	REFER to Section 211-04 .
B2431	Transponder Programming Failed	ICM	REFER to Section 419-01A .
B2472	Fog Lamp Switch Failure	ICM	REFER to Section 417-01 .
B2477	Module Configuration Failure	ICM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS/TC/IVD	CARRY OUT the ABS/TC/IVD self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test.
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant Fluid Temperature	PCM	CARRY OUT the PCM self-test.
U1123	SCP (J1850) Invalid or Missing Data for Odometer Rolling Count	ABS/TC/IVD	CARRY OUT the ABS/TC/IVD self-test.
U1131	SCP (J1850) Invalid or Missing Data for Fuel System	ICM	REFER to Section 413-01 .
U1147	SCP (J1850) Invalid or Missing Data for Vehicle Security System	PCM	CARRY OUT the PCM self-test.

Instrument Cluster Parameter Identification (PID) Index

PID	Description	Expected Value
ABCHIME	Air Bag Chime	OFF, ON
ANTISCN	Anti-Scan Function	DISABL, ENABLE
ASWSTAT	Autolamp Switch Input Status	OFF, DELAY7, DELAY6, DELAY5, DELAY4, DELAY3, DELAY2, DELAY1, INVLD
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_SBELT	Driver Seat Belt	OUT, IN
DSWSTAT	Dimmer Switch Input Status	ON, LVL1, LVL2, LVL3, LVL4, LVL5, LVL6, LVL7, LVL8, LVL9, LVL10, LVL11, LVL12, LVL13, LVL14, LVL15, LVL16, LVL17, LVL18, LVL19, LVL20, LVL21, Invalid
ENABL_S	Vehicle Enable Status	DISABL, ENABLE
FOG_SW, HZ_SW	Fog Lamp Switch, Hazard Switch	OFF, ON, OFF, ON
HEAD_L	Headlamp Switch Input Status	OFF, PARK, HEADLP, R_FOG, INVLD, (OPEN/SHORT)
HIBEAM	High Beam Switch Input Status	OFF, HIGH, PASS, INVLD, (SHORT)
HORN_SW	Horn Input Switch	OFF, ON

IGN_A	Ignition Switch - ACCY Position	NO, YES
IGN_KEY	Ignition Key In / Out	OUT, IN
IGN_O/U	Ignition Switch - OFF/Unlock Position	NO, YES
IGN_R	Ignition Switch - RUN Position	NO, YES
IGN_S	Ignition Switch - START Position	NO, YES
LIGHTSN	Night (True) / Day (False)	NO, YES
LTURN	Left Turn Switch	OFF, ON
MIN#KEY	Minimum Number Of Keys Required	0-67
M_KEY	Master Key Present	notPRE, PRESNT
NUMKEYS	Number Of Keys Stored In Module	one count per bit
PCM_ID	PCM ID Status	notSTR, STORED
PCM_VFY	PCM Verify OK	NO, YES
RESETSW	Reset Switch	OFF, ON
RTURN	Right Turn Switch	OFF, ON
SELECT	Select/Mode Switch	OFF, ON
SERVMOD	Service Module	NO, YES
SPAREKY	Spare key programming: 0 = Enabled, 1 = Disabled	0-14
TILT	Steering Column Tilt Switch	SHORT, UP, DOWN, OFF
TELEPOS	Telescope Position Sensor	notSEN, SENSED
TELESCP	Steering Column Telescope Switch	SHORT, IN, OUT, OFF
TILTPOS	Tilt Position Sensor	notSEN, SENSED
TR_PARK	Transmission Select Lever In Park Pos	NO, YES

Instrument Cluster Active Command Index

Active Command	Display	Action
ANTI-THEFT INDICATOR LAMP	THEFT LAMP	OFF, ON
DISPLAY DIMMING CONTROL	ILLUMINAT	OFF, ON
DISPLAY SEGMENT CONTROL II	SEGMENTS	OFF, ON
ENGINE COOLANT GAUGE CONTROL	ENGCOOLNT	0%-100%
FUEL GAUGE CONTROL	FUELLEVEL	0%-100%
MEMORY SELECT CONTROL	MEMORY 1	OFF, ON

MEMORY SELECT CONTROL	MEMORY 2	OFF, ON
PRNDL DISPLAY CONTROL COMMAND	SEGMENTS	OFF, ON
RF SIGNAL	RF	OFF, ON
SPEEDOMETER CONTROL	SPDOMETER	0%-100%
TACHOMETER CONTROL	TCHOMETER	0%-100%
WARNING LAMPS AND CHIME	ALL LAMPS	OFF, ON
WARNING LAMPS AND CHIME	CHIME	OFF, ON

Symptom Chart


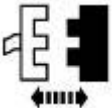
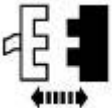

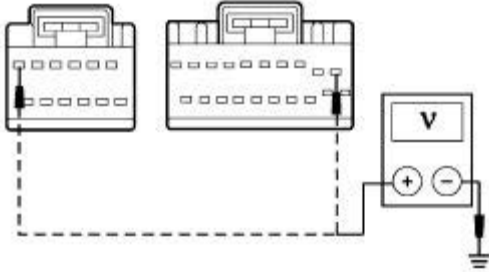
Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the front electronic module 	<ul style="list-style-type: none"> BJB Fuse 425 (40A). BJB Fuse 422 (20A). FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> No communication with the rear electronic module 	<ul style="list-style-type: none"> Circuit. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
<ul style="list-style-type: none"> No communication with the steering column lock actuator 	<ul style="list-style-type: none"> SCL actuator not activated SCL actuator. Circuit. 	<ul style="list-style-type: none"> REMOVE the ignition key from the ignition switch, open the driver door, and restart diagnosis. GO to Pinpoint Test C.
<ul style="list-style-type: none"> No communication with the instrument cluster module 	<ul style="list-style-type: none"> CJB Fuse 220 (10A). BJB Fuse 425 (40A). Circuitry. J1850 Communication Network (SCP). IC. 	<ul style="list-style-type: none"> GO to Pinpoint Test D.
<ul style="list-style-type: none"> The ignition switch is inoperative 	<ul style="list-style-type: none"> BJB Fuse 422 (20A). Ignition switch. Circuit. 	<ul style="list-style-type: none"> GO to Pinpoint Test E.
<ul style="list-style-type: none"> No power in ACC 	<ul style="list-style-type: none"> Ignition switch. Circuit. 	<ul style="list-style-type: none"> Go to Pinpoint Test F.
<ul style="list-style-type: none"> No power in RUN 	<ul style="list-style-type: none"> Ignition switch. Circuit. 	<ul style="list-style-type: none"> GO to Pinpoint Test F.
<ul style="list-style-type: none"> No power in START 	<ul style="list-style-type: none"> Ignition switch. Circuit. 	<ul style="list-style-type: none"> GO to Pinpoint Test G.
<ul style="list-style-type: none"> The multifunction switch/hazard switch does not operate correctly 	<ul style="list-style-type: none"> Underhood auxiliary junction box (AJB) Fuse 102 (10A), Fuse 120 (30A). Battery junction box (BJB) Fuse 402 (10A), Fuse 406 (10A). Relay. 	<ul style="list-style-type: none"> CARRY OUT the Multifunction Switch Component Test. REFER to Wiring Diagrams, Section 700-09 Component Testing. If the test is OK, GO to Pinpoint Test H.

	<ul style="list-style-type: none"> ● Circuit. ● Multifunction switch. 	
<ul style="list-style-type: none"> ● The steering column lock actuator does not operate correctly 	<ul style="list-style-type: none"> ● Circuit(s). ● SCL actuator. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test I</u>.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>A1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK22 (OG/YE) FOR VOLTAGE</p>	
<p>NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.</p>	
<p>1</p>  <p>2</p>  <p>FEM C201c</p> <p>3</p>  <p>FEM C201f</p> <p>4</p>  <p>5</p>  <p>A0006297</p>	<p>5</p> <p>Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22 (OG/YE) harness side and ground.</p> <p>● Are the voltages greater than 10 volts?</p>

→ **Yes**
GO to A2.

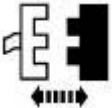
→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

A2 CHECK CIRCUITS 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS

1

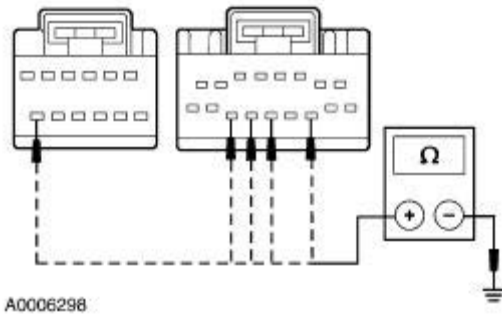


2



FEM C201a

3



3 Using the following table, measure the resistance between FEM connectors, harness side and ground:

FEM	Pin	Circuit
C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)
C201a	15	31-DK20D (BK/RD)

● **Is the resistance less than 5 ohms?**

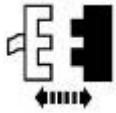
→ **Yes**
REFER to Section 418-00 .

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST B: NO COMMUNICATION WITH THE REAR ELECTRONIC MODULE

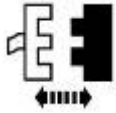
CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CIRCUIT 29-DK31 (OG/BK) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
1	

2



REM C420d

3

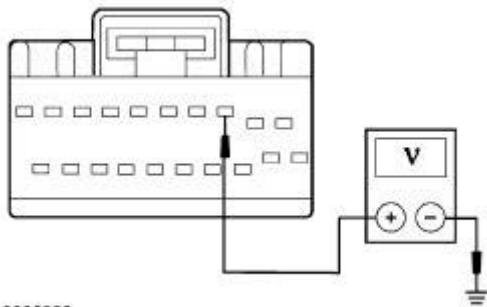


REM C420c

4



5



A0006299

5 Measure the voltage between REM C420d pin 3, circuit 29-DK31 (OG/BK), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to B2 .

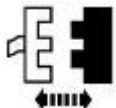
→ No
REPAIR the circuit. TEST the system for normal operation.

B2 CHECK CIRCUITS 29S-DK31 (OG/BK), 31-DK30D (BK), 31-DK30E (BK), 31-DK30F (BK), 31-DK30G (BK) AND 31-DK30H (BK/OG), FOR OPENS

1



2

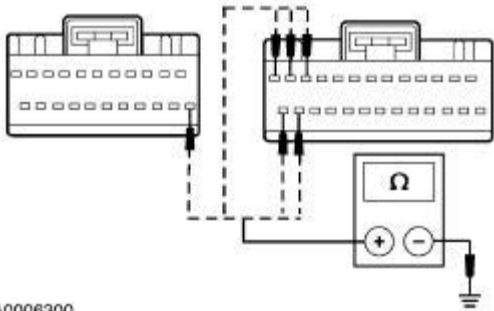


REM C420b

3

3 Using the following table, measure the resistance between REM connectors, harness side and ground:

REM	Pin	Circuit



C420c	13	29S-DK31 (OG/BK)
C420c	12	31-DK30E (BK)
C420c	11	31-DK30D (BK)
C420c	26	31-DK30G (BK)
C420c	25	31-DK30F (BK)
C420b	12	31-DK30H (BK/OG)

● Is the resistance less than 5 ohms?

→ **Yes**

REFER to [Section 418-00](#).

→ **No**

REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST C: NO COMMUNICATION WITH THE STEERING COLUMN LOCK ACTUATOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The SCL actuator will only allow communication with a tester after the SCL actuator has been activated. To activate the SCL actuator, open the driver door and do not put the key in the ignition (or alternatively, you can press one of the buttons on the key fob while there is no key in the ignition). The SCL actuator will stay activated for 30 minutes after the driver door is opened (or a key fob button is pressed).</p>	
<p>C1 CHECK STEERING COLUMN LOCK ACTUATOR OPERATION</p>	
	<p>1 NOTE: The ignition key must be out of the ignition before proceeding with this test.</p> <p>Insert the ignition key into the ignition switch.</p> <p>2 Remove the ignition key from the ignition switch.</p> <p>● Does the steering column lock actuator unlock and lock?</p> <p>→ Yes REFER to Section 418-00.</p> <p>→ No GO to Pinpoint Test I.</p>

PINPOINT TEST D: NO COMMUNICATION WITH THE INSTRUMENT CLUSTER MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>D1 CHECK HOT AT ALL TIMES POWER SUPPLY CIRCUIT</p>	

1

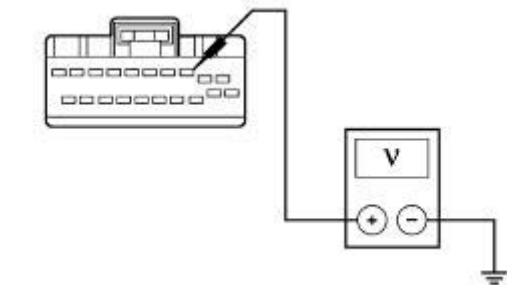


2



Instrument Cluster C220b

3



A0002792

3

Measure the voltage between instrument cluster C220b pin 3, circuit 29-GG11 (OG/BU), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to D2.

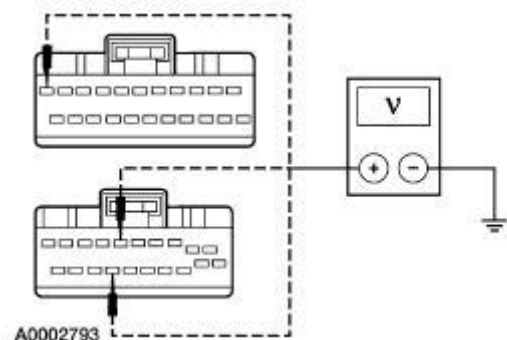
→ No
REPAIR the circuit. TEST the system for normal operation.

D2 CHECK HOT IN RUN POWER SUPPLY CIRCUITS

1



2



A0002793

2

Measure the voltage between the instrument cluster and ground as follows:

Connector Pin	Circuit
C220a pin 11	15-JA14 (GN/BK)
C220b pin 6	15-GG14 (GN/RD)
C220b pin 17	75-GG15 (YE/GN)

• Are the voltages greater than 10 volts?

→ Yes
GO to D3.

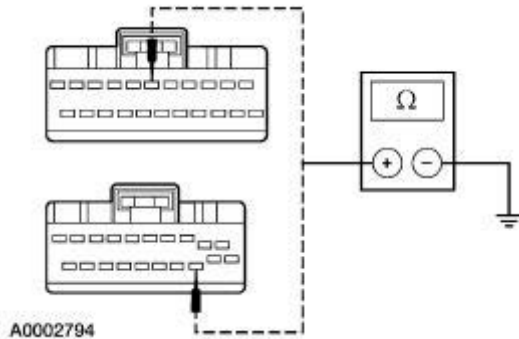
→ **No**
REPAIR the circuit(s). TEST the system for normal operation.

D3 CHECK GROUND CIRCUITS

1



2



2 Measure the resistance between the instrument cluster and ground as follows:

Connector Pin	Circuit
C220a pin 6	31-AL11 (BK)
C220b pin 13	91-GG11 (BN/RD)

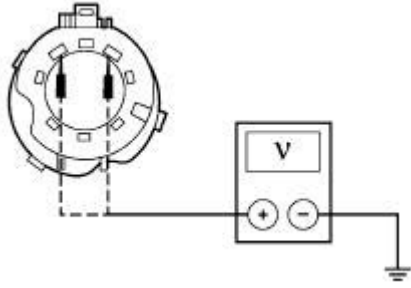
- Are the resistances less than 5 ohms?

→ **Yes**
REFER to [Section 418-00](#).

→ **No**
REPAIR the circuit(s). TEST the system for normal operation.

PINPOINT TEST E: THE IGNITION SWITCH IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK CIRCUIT 30-BB20 (RD) AND CIRCUIT 30-BB9 (RD)	
<p>1</p> <p>2</p> <p>Ignition Switch C250</p> <p>3</p>	<p>3 Measure the voltage between ignition switch C250, pin 7 circuit 30-BB20 (RD), harness side, and ground; and between ignition switch C250, pin 1 circuit 30-BB9 (RD), harness side, and ground.</p>





A0000315

● Is the voltage greater than 10 volts?

→ **Yes**
 INSTALL a new ignition switch; REFER to Ignition Switch .

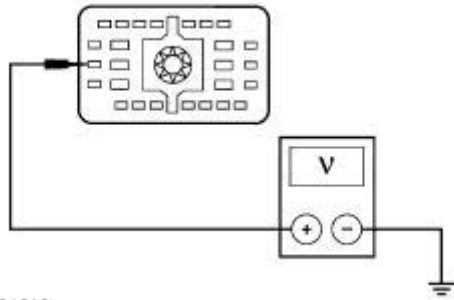
→ **No**
 REPAIR circuit 30-BB20 (RD), Circuit 30-BB9 (RD) or Circuit 30-DA5 (RD) as necessary. TEST the system for normal operation.

PINPOINT TEST F: NO POWER IN ACC

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK IGNITION SWITCH	
	<p>1 Carry out the Ignition Switch Component Test; refer to Wiring Diagrams, Section 700-09, Component Testing.</p> <p>● Is the ignition switch OK?</p> <p>→ Yes GO to <u>F2</u> .</p> <p>→ No INSTALL a new ignition switch; REFER to <u>Ignition Switch</u> .</p>
F2 CHECK CIRCUIT 75-DD1 (YE)	
<p>1</p>  <p>2</p>  <p>CJB C270a</p> <p>3</p>	



4



A0001613

4

Measure the voltage between the CJB C270a, pin 15 circuit 75-DD1 (YE), and ground.

● Is the voltage greater than 10 volts?

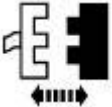
→ Yes

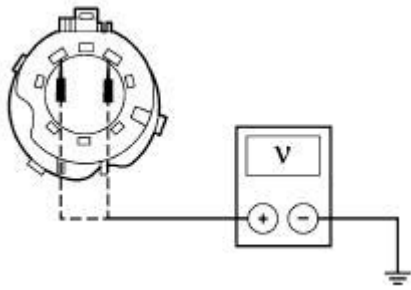
REFER to the appropriate Section. REPAIR the circuit in question. TEST the system for normal operation.

→ No

REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST G: NO POWER IN START

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK IGNITION SWITCH	
	<p>1 Carry out the Ignition Switch Component Test. Refer to Wiring Diagrams Section 700-09, Component Testing.</p> <p>● Is the ignition switch OK?</p> <p>→ Yes GO to <u>G2</u>.</p> <p>→ No INSTALL a new ignition switch; REFER to <u>Ignition Switch</u>. TEST the system for normal operation.</p>
G2 CHECK CIRCUIT 30-BB20 (RD) AND CIRCUIT 30-BB9 (RD)	
<p>1</p>  <p>Ignition Switch C250</p> <p>2</p>	<p>2 Measure the voltage between ignition switch C250, pin 7 circuit 30-BB20 (RD),</p>



A0000315

harness side, and ground; and between ignition switch C250, pin 1 circuit 30-BB9 (RD), harness side, and ground.

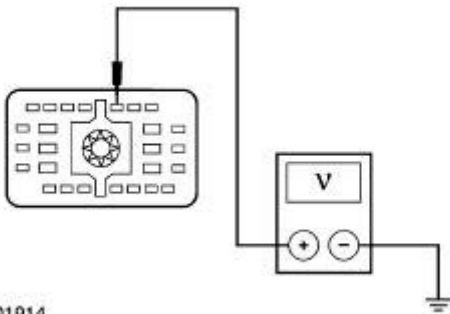
● Is the voltage greater than 10 volts?

→ **Yes**
GO to G3.

→ **No**
REPAIR circuit 30-BB20 (RD), circuit 30-BB9 (RD) or circuit 30-DA5 (RD) as necessary. TEST the system for normal operation.

G3 CHECK CIRCUIT 50-DD5 (GN/BK)

1



A0001914

1

Measure the voltage between the CJB C270a pin 3, circuit 50-DD5 (GN/BK), and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
REFER to Section 303-06.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST H: THE MULTIFUNCTION SWITCH/HAZARD SWITCH DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK TURN SIGNAL LEVER POSITIONS	
NOTE: Prior to testing, make sure the hazard knob is pushed in fully to the OFF position.	
1	



- 2 Check the turn signal lever in the RH and LH turn positions with the steering wheel locked in the straight-ahead position. Lock the lever in position for each.
- 3 Check the lever by slightly holding it in the RH and LH turn positions. When releasing, observe that the lever springs back to normal position.
- 4 Road test the vehicle and observe the turn signals for the RH and LH turn positions while manually turning the steering wheel for each position. Verify the lever cancels when the steering returns from the desired turn position.

● **Does the turn signal lever operate correctly?**

→ **Yes**
GO to H2.

→ **No**
If the lever will not cancel, CHECK the turn indicator cancel cam for damage. If the lever is worn or damaged, INSTALL a new multifunction switch. REFER to Multifunction Switch. TEST the system for normal operation.

H2 CHECK HAZARD SWITCH

- 1 Fully press the hazard switch and release to turn ON the hazard lamps. Verify the switch operation.
- 2 Fully press the hazard switch and release to turn OFF the hazard lamps. Verify the switch operation.

● **Does the hazard switch operate correctly?**

→ **Yes**
GO to H3.

→ **No**
If the hazard switch is worn or damaged, INSTALL a new multifunction switch. REFER to Multifunction Switch. TEST the system for normal operation.


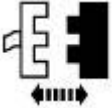

H3 CHECK HIGH BEAM AND FLASH-TO-PASS

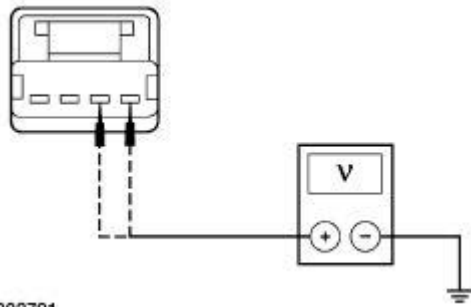
- 1 Turn the headlamps ON.
- 2 Press the turn signal lever towards the instrument panel to the STOP position. Release the lever. Verify the high beams.
- 3 Move the lever back toward the seat. Release the lever. Verify the low beams.
- 4 Pull the lever toward the driver seat gently to the flash-to-pass position. Hold the position, and verify both the high and low beams illuminate.
- 5 Release the lever. Verify the low beams.
- 6 Turn the headlamps OFF.
- 7 Pull the lever to the flash-to-pass again and hold. Verify the high beams illuminate. Release the lever. Verify no high beams.

● **Does the high beam, low beam and flash-to-pass operate?**

	<p>→ Yes GO to <u>H4</u>.</p> <p>→ No If the lever is worn or damaged, INSTALL a new multifunction switch. REFER to <u>Multifunction Switch</u>. TEST the system for normal operation.</p>
<p>H4 CHECK WINDSHIELD WIPER AND WASH</p>	
	<p>1 Rotate the windshield wiper switch to LOW, HIGH and intermittent positions. Verify the rotation of the switch and wiper operation.</p> <p>2 Turn the switch to the OFF position. Verify the switch rotates to OFF and the wipers stop operating.</p> <p>3 Push the end of the switch in toward the center of the steering column to the WASH position. Release the wash position. Verify the wipers operate for a few cycles and return to OFF.</p> <p>4 Operate WASH in all speeds of the wiper switch. Verify the wipers return to selected speed after releasing from the WASH position.</p> <p>● Does the windshield wiper switch and WASH operate correctly?</p> <p>→ Yes Multifunction switch is OK.</p> <p>→ No If the switch or lever is worn or damaged, INSTALL a new switch; REFER to <u>Section 501-16</u>.</p>

PINPOINT TEST I: THE STEERING COLUMN LOCK DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: This test assumes that the instrument cluster (IC) module is sending the correct engine rpm, and vehicle speed to the FEM and REM over the standard corporate protocol (SCP) communication network. Refer to <u>Section 418-00</u>.</p>	
<p>I1 CHECK CIRCUIT 31-GL58 (BK) AND 75-GL58 (YE/GN) FOR SHORT TO POWER</p>	
<p>1 </p> <p>2  SCL Actuator C267</p> <p>3 </p> <p>4</p>	<p>4 Measure the voltage between the SCL</p>



A0002791

actuator C267 pin 1, circuit 31-GL58 (BK), harness side, and ground; and between SCL actuator C267 pin 2, circuit 75-GL58 (YE/GN), harness side, and ground.

● Is the voltage greater than 10 volts?

→ **Yes**

If circuit 31-GL58 (BK) is greater than 10 volts, GO to 12. If circuit 75-GL58 (YE/GN) is greater than 10 volts, GO to 13.

→ **No**

GO to 14.

12 CHECK FEM FOR INTERNAL SHORT TO POWER

1



2

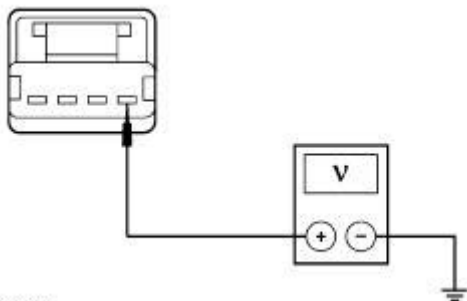


FEM C201a

3



4



A0002808

4 Measure the voltage between the SCL actuator C267 pin 1, circuit 31-GL58 (BK) and ground.

● Is the voltage greater than 10 volts?

→ **Yes**

REPAIR the circuit in question. TEST the system for normal operation.

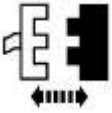
→ **No**
INSTALL a new FEM; REFER to [Section 419-10](#). TEST the system for normal operation.

I3 CHECK REM FOR INTERNAL SHORT TO POWER

1



2

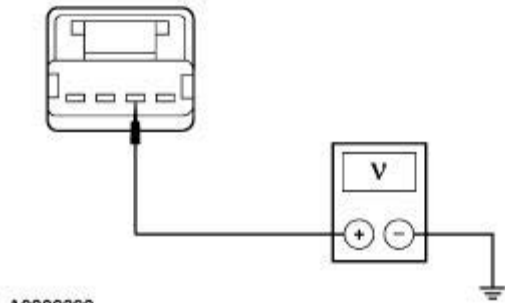


REM C420

3



4



4 Measure the voltage between SCL actuator C267 pin 2, circuit 75-GL58 (YE/GN), harness side, and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
REPAIR the circuit in question. TEST the system for normal operation.

→ **No**
INSTALL a new REM; REFER to [Section 419-10](#). TEST the system for normal operation.

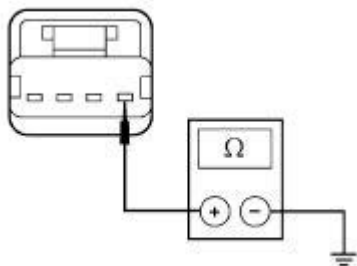
I4 CHECK FEM FOR CORRECT OPERATION

1



2

2 Measure the resistance between SCL actuator C267 pin 1, circuit 31-GL58 (BK), harness side, and ground, while triggering the FEM active command LOCK_GND ON.



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- Does the resistance change to less than 50 ohms when commanded?

→ **Yes**
GO to 15.

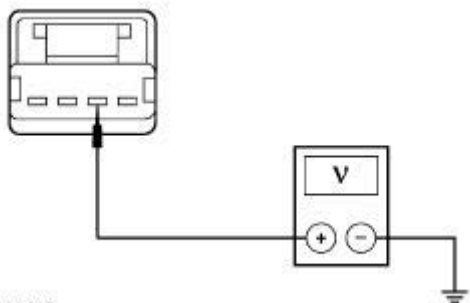
→ **No**
GO to 16.

15 CHECK REM FOR CORRECT OPERATION

1



2



A0002809

- 3 Measure the voltage between SCL actuator C267 pin 2, circuit 75-GL58 (YE/GN), harness side, and ground while triggering the REM active command LOCK_PWR ON.

- Is the voltage greater than 10 volts when commanded?

→ **Yes**
INSTALL a new SCL actuator; REFER to Steering Column Lock Actuator . Test the system for normal operation.

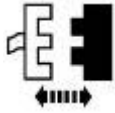
→ **No**
GO to 17.

16 CHECK CIRCUIT 31-GL58 (BK) FOR OPEN

1

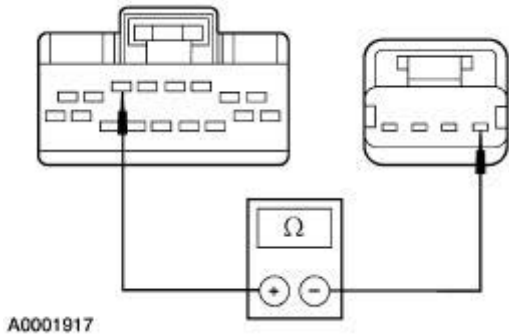


2



FEM C201a

3



3

Measure the resistance between SCL actuator C267 pin 1, circuit 31-GL58 (BK), harness side, and the FEM C201a pin 6, circuit 31-GL58 (BK), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**

INSTALL a new FEM; REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**

REPAIR the circuit in question. TEST the system for normal operation.

I7 CHECK CIRCUIT 75-GL58 (YE/GN) FOR OPEN

1

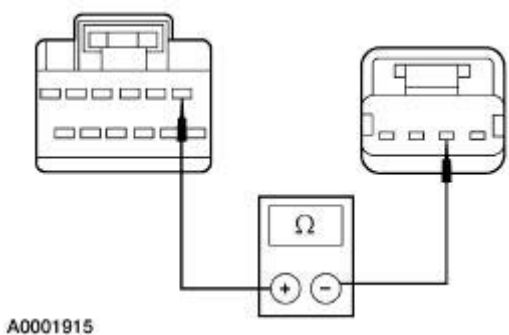


2



REM C420a

3



3

Measure the resistance between SCL actuator C267 pin 2, circuit 75-GL58 (YE/GN), harness side, and the REM C420a pin 1, circuit 75-GL58 (YE/GN) harness side.

● **Is the resistance less than 5 ohms?**

→ **Yes**


INSTALL a new REM; REFER to Section 419-10. TEST the system for normal operation.

→ **No**

REPAIR the circuit in question. TEST the system for normal operation.

Steering Column Lock Module Parameter Reset

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool
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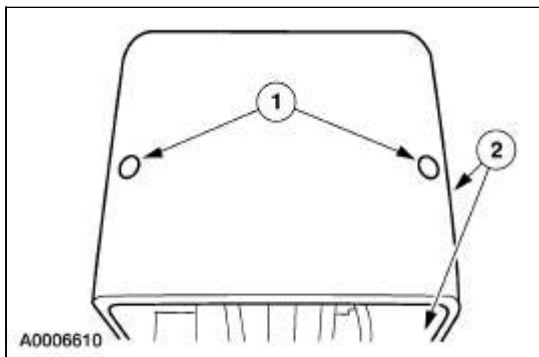
NOTE: The SCL actuator will only allow communication with a tester after the SCL actuator has been activated. To activate the SCL actuator, open the driver door and **do not** put the key in the ignition (or alternatively, you can press one of the buttons on the key fob while there is no key in the ignition). The SCL actuator will stay activated for 30 minutes after the driver door is opened (or a key fob button has been pressed).

1. Remove the ignition key from the ignition switch.
2. Close and open the driver door (must complete steps 3-6 within 30 minutes of completing step 2).
3. Connect the diagnostic tool (use service function card).
4. Select SCLM.
5. Select ENTER SECURITY ACCESS. Wait eight minutes for security access to be granted.
6. Select PARAMETER RESET.
7. Insert key into ignition switch and place in the RUN position.
8. Select ICM.
9. Select ENTER SECURITY ACCESS. Wait 10 minutes for security access to be granted.
10. Select RESET SCLM PARAMETER.
11. Disconnect the diagnostic tool.
12. Place ignition key in the OFF position.
13. Remove ignition key from ignition switch.
14. Insert ignition key into ignition switch.
15. Place ignition key in the RUN position.
16. Remove the ignition key.

Multifunction Switch

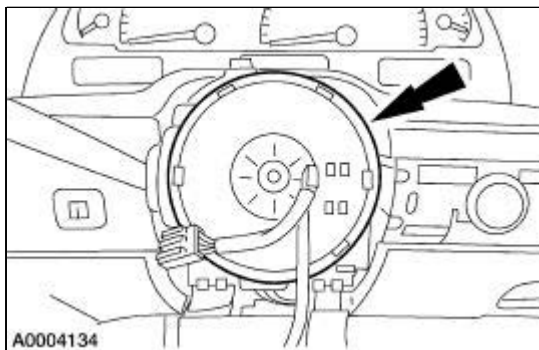
Removal and Installation

1. Remove the steering wheel. For additional information, refer to [Section 211-04](#).
2. Remove the instrument panel cluster finish panel. For additional information, refer to [Section 501-12](#).
3. Remove the upper and lower steering column shrouds.
 1. Remove the screws.
 2. Remove the upper and lower steering column shrouds.

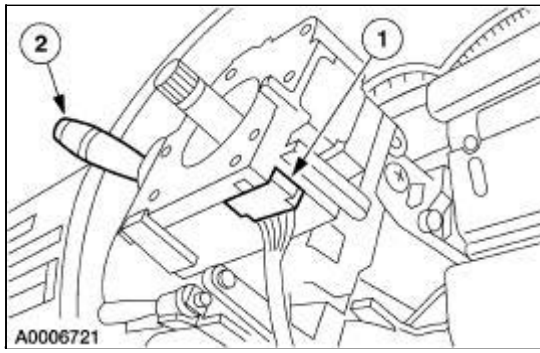


4.  **CAUTION:** Apply two strips of masking tape across the air bag sliding contact to prevent rotation.

Depress the three clips and position the air bag sliding contact aside.



5. Remove the multifunction switch.
 1. Disconnect the electrical connector.
 2. Remove the multifunction switch.

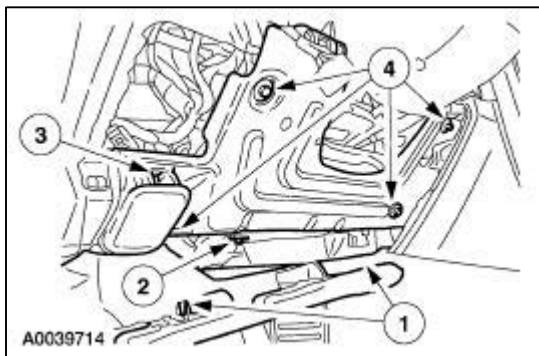


6. To install, reverse the removal procedure.

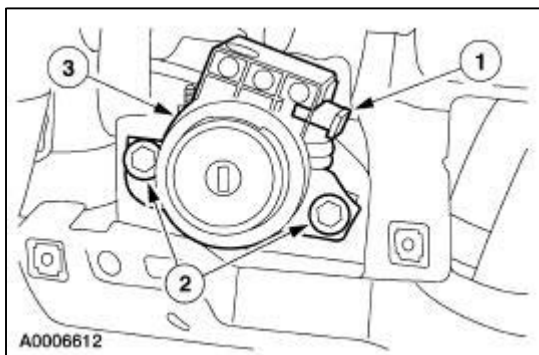
Ignition Switch

Removal and Installation

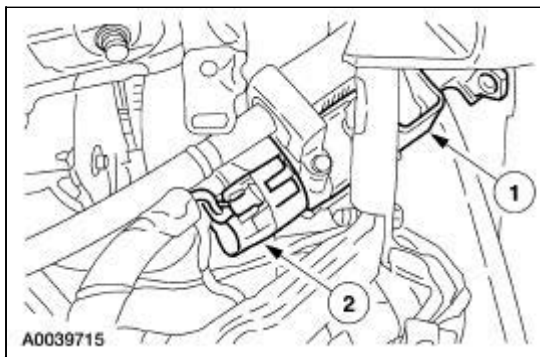
1. Remove the instrument panel cluster finish panel. For additional information, refer to [Section 501-12](#).
2. Remove the steering column reinforcement.
 1. Remove the two screws and position the lower instrument panel insulator aside.
 2. Remove the bolt and position the air duct aside.
 3. Remove the hood release handle from the reinforcement and position it aside.
 4. Remove the five bolts and the reinforcement.



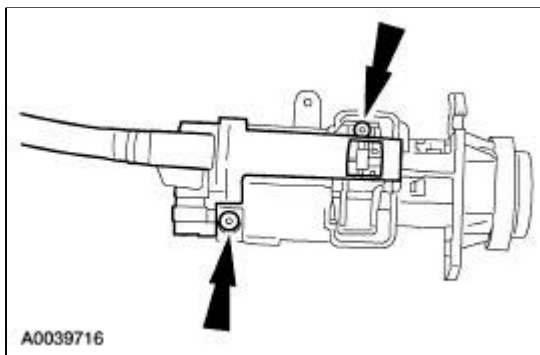
3. Disconnect the ignition lock cylinder.
 1. Disconnect the electrical connector.
 2. Remove the two front screws.
 3. Remove the rear screw.



4. Remove the ignition lock cylinder.
 1. Remove the lock cylinder from the housing.
 2. Disconnect the electrical connector.



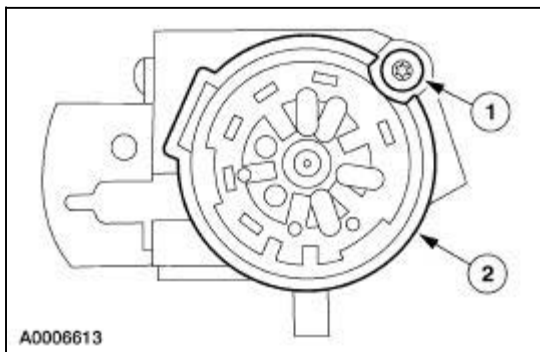
5. Remove the screws and position the shift lock cable aside.



6. **NOTE:** The ignition key should be in the OFF position.

Remove the ignition switch.

1. Remove the screw.
2. Remove the ignition switch.

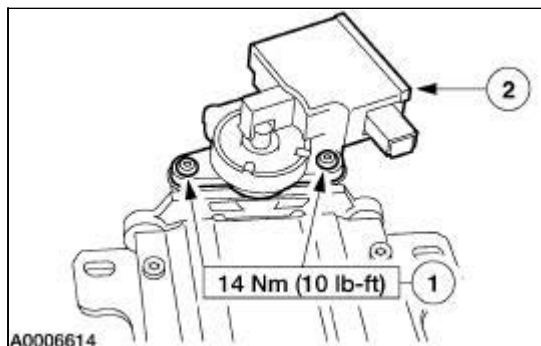


7. To install, reverse the removal procedure.
-

Steering Column Lock Actuator

Removal

1. Remove the steering column. For additional information, refer to [Section 211-04](#).
2. Remove the steering column lock actuator.
 1. Remove the screws.
 2. Remove the steering column lock actuator.



Installation

1. To install, reverse the removal procedure.
 - After the installation is complete, carry out the steering column lock module parameter reset. Refer to [Steering Column Lock Module Parameter Reset](#).
-

General Specifications

Item	Specification
Lubricants and Sealants	
Epoxy Sealer	M3D35-A (E)
Threadlock® 262 E2FZ-19554-B	WSK-M2G351-A6
SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP or equivalent	WSS-M2C153-G
Gasoline Engine Oil Dye 164-R3705	ESE-M99C103-B1
Engine Shampoo and Degreaser F4AZ-19A536-A or equivalent	ESR-M14P3-A

Engine

NOTE: This section contains information, steps and procedures that may not be specific to your engine.

This section covers general procedures and diagnosis and testing of the engine system, except for exhaust emission control devices, which are covered in the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

The engines incorporate the following features:

- a closed positive crankcase ventilation (PCV) system. For additional information, refer to [Section 303-08](#).
- an exhaust emission control system. For additional information, refer to [Section 303-08](#).
- an evaporative emission control system. For additional information, refer to [Section 303-13](#).


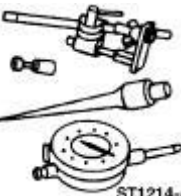
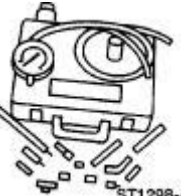



The engine, fuel system, ignition system, emissions system and exhaust system all affect exhaust emission levels and must be maintained according to the maintenance schedule. For additional information, refer to the Scheduled Maintenance Guide.

Correct engine identification is necessary to order parts. Refer to the appropriate section in Group [303](#) for the procedure.

For complete vehicle and engine identification codes, refer to [Section 100-01](#).

Engine

Special Tool(s)

 <p>ST1298-A</p>	<p>Quick Disconnect Compression Tester 134-R0212 or equivalent</p>
 <p>ST1214-A</p>	<p>Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent</p>
 <p>ST1298-A</p>	<p>Engine Cylinder Leak Detection/Air Pressurization Kit 014-00708 or equivalent</p>
 <p>ST1296-A</p>	<p>Oil Pressure Gauge 303-088 (T73L-6600-A)</p>
 <p>ST1300-A</p>	<p>12 Volt Master UV Diagnostic Inspection Kit 164-R0756 or equivalent (Leak Detector)</p>
 <p>ST1297-A</p>	<p>Vacuum/Pressure Tester 164-R0253 or equivalent</p>

Inspection and Verification

1. Verify the customer concern by operating the engine to duplicate the condition.
2. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

Visual Inspection Chart



Mechanical
<ul style="list-style-type: none"> ● Engine coolant leaks ● Engine oil leaks ● Fuel leaks ● Damaged or severely worn parts ● Loose mounting bolts, studs and nuts

3. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.
4. If the concerns remain after the inspection, determine the symptoms. GO to Symptom Chart.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Difficult starting 	<ul style="list-style-type: none"> ● Inoperative or damaged ignition system. ● Inoperative or damaged fuel system. ● Inoperative or damaged starting system. ● Damaged charging system/battery. ● Burnt valve. ● Worn piston. ● Worn piston rings. ● Worn cylinder. ● Damaged head gasket. ● Inoperative or damaged cooling system (failsafe cooling invoked). 	<ul style="list-style-type: none"> ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. ● REFER to <u>Section 414-00</u>. ● INSTALL a new cylinder head. ● For 3.0L, INSTALL a new piston. For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new piston ring. For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new cylinder block. For 3.9L, INSTALL a new short block. ● INSTALL a new cylinder head gasket. ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
<ul style="list-style-type: none"> ● Poor idling 	<ul style="list-style-type: none"> ● Vacuum leaks. 	<ul style="list-style-type: none"> ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis

	<ul style="list-style-type: none"> ● Inoperative or damaged ignition system. ● Inoperative or damaged cooling system (failsafe cooling invoked). ● Inoperative or damaged fuel system. ● Misadjusted valve lash. ● Incorrect valve-to-valve seat contact. ● Damaged head gasket. 	<p>(PC/ED) manual.</p> <ul style="list-style-type: none"> ● Refer to the appropriate section in Group <u>303</u> for the procedure. ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. ● ADJUST valve lash. Refer to the appropriate section in Group <u>303</u> for the procedure. ● INSTALL a new cylinder head. ● INSTALL a new cylinder head gasket.
<ul style="list-style-type: none"> ● Abnormal combustion 	<ul style="list-style-type: none"> ● Inoperative or damaged fuel system. ● Inoperative or damaged cooling system (failsafe cooling invoked). ● Inoperative or damaged ignition system. ● Burnt or sticking valve. ● Weak or broken valve spring. ● Carbon accumulation in combustion chamber. 	<ul style="list-style-type: none"> ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. ● INSTALL a new cylinder head. ● INSTALL a new valve spring. ● ELIMINATE carbon buildup.
<ul style="list-style-type: none"> ● Excessive oil consumption 	<ul style="list-style-type: none"> ● Leaking oil. ● Inoperative PCV system. ● Worn valve stem seal. ● Worn valve stem or valve guide. ● Sticking piston rings. ● Worn piston ring 	<ul style="list-style-type: none"> ● REPAIR oil leakage. ● REPAIR or INSTALL new components as necessary. ● INSTALL a new valve stem seal. ● INSTALL a new cylinder head. ● For 3.0L, REPAIR or INSTALL new piston rings. For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new

	<p>groove.</p> <ul style="list-style-type: none"> ● Worn piston or cylinder. 	<p>piston and piston pin. For 3.9L, INSTALL a new short block.</p> <ul style="list-style-type: none"> ● For 3.0L, REPAIR or INSTALL a new piston or cylinder block. For 3.9L, INSTALL a new short block.
<ul style="list-style-type: none"> ● Engine noise 	<ul style="list-style-type: none"> ● Leaking exhaust system. ● Incorrect drive belt tension. ● Worn generator bearing. ● Worn or damaged water pump bearing. ● Inoperative or damaged cooling system. ● Inoperative or damaged fuel system. ● Loose timing chain (6268). ● Damaged timing chain tensioner (6L266). ● Excessive main bearing clearance. ● Seized or heat damaged crankshaft main bearing. ● Excessive crankshaft end play. ● Excessive connecting rod bearing clearance. ● Heat damaged connecting rod bearing (6211). ● Damaged connecting rod bushing (6207). ● Worn cylinder. ● Worn piston (6108) 	<ul style="list-style-type: none"> ● REPAIR exhaust leakage. ● REFER to <u>Section 303-05</u>. ● Refer to the appropriate section in Group 414 for the procedure. ● REFER to <u>Section 303-03</u>. ● REFER to <u>Section 303-03</u>. ● Refer to the appropriate section in Group 303 for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. ● ADJUST or INSTALL a new timing chain. ● INSTALL a new timing chain tensioner. ● For 3.0L, INSTALL a new crankshaft main bearing (6333). For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new crankshaft main bearing. For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new thrust bearing or crankshaft (6303). For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new connecting rod bearing or connecting rod (6200). For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new connecting rod bearing. For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new connecting rod bushing. For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new cylinder block (6010). For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new

	<p>or piston pin (6135).</p> <ul style="list-style-type: none"> ● Damaged piston rings. ● Bent connecting rod. ● Worn or damaged valve tappet. ● Excessive valve tappet or lash adjuster clearance. ● Broken valve spring (6513). ● Excessive valve guide clearance. 	<p>piston or piston pin. For 3.9L, INSTALL a new short block.</p> <ul style="list-style-type: none"> ● For 3.0L, INSTALL new piston rings. For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new connecting rod. For 3.9L, INSTALL a new short block. ● INSTALL a new valve tappet. ● ADJUST clearance or INSTALL a new valve tappet. ● INSTALL a new valve spring. ● INSTALL a new cylinder head.
<ul style="list-style-type: none"> ● Insufficient power 	<ul style="list-style-type: none"> ● Inoperative or damaged ignition system. ● Inoperative or damaged fuel system. ● Inoperative or damaged cooling system (failsafe cooling invoked). ● Damaged or plugged exhaust system. ● Incorrect tire size. ● Dragging brakes. ● Slipping transmission. ● Misadjusted valve lash. ● Worn or damaged valve tappet. ● Damaged valve tappet guide. ● Compression leakage at valve seat. ● Seized valve stem. ● Weak or broken valve spring. ● Worn or damaged cam. ● Damaged head gasket (6051). 	<ul style="list-style-type: none"> ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. ● Refer to the appropriate section in Group <u>303</u> for the procedure. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. ● INSPECT exhaust system. ● REFER to <u>Section 204-04</u>. ● REFER to <u>Section 206-00</u>. ● Refer to the appropriate section in Group <u>307</u> for the procedure. ● ADJUST valve lash. Refer to the appropriate section in Group <u>303</u> for the procedure. ● INSTALL a new valve tappet. ● INSTALL a new cylinder head. ● INSTALL a new cylinder head. ● INSTALL a new cylinder head. ● INSTALL a new valve spring. ● INSTALL a new camshaft. ● INSTALL a new head gasket.

	<ul style="list-style-type: none"> ● Cracked or distorted cylinder head. ● Damaged, worn or sticking piston ring (s). ● Worn or damaged piston. 	<ul style="list-style-type: none"> ● INSTALL a new cylinder head. ● For 3.0L, REPAIR or INSTALL new piston ring(s). For 3.9L, INSTALL a new short block. ● For 3.0L, INSTALL a new piston and piston pin. For 3.9L, INSTALL a new short block.
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Component Tests

Engine Oil Leaks

NOTE: When diagnosing engine oil leaks, the source and location of the leak must be positively identified prior to repair.

Prior to carrying out this procedure, clean the cylinder block, cylinder heads, valve covers, oil pan and flywheel with a suitable solvent to remove all traces of oil.

Engine Oil Leaks—Fluorescent Oil Additive Method

Use the 12 Volt Master UV Diagnostic Inspection Kit to carry out the following procedure for oil leak diagnosis.

1. Clean the engine with a suitable solvent to remove all traces of oil.
2. Add Gasoline Engine Oil Dye 164-R3705 meeting Ford specification ESE-M99C103-B1 or equivalent to the engine oil. Use a minimum 14.8 ml (0.5 ounce) to a maximum 29.6 ml (1 ounce) of fluorescent additive to all engines.
3. Run the engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using the 12 Volt Master UV Diagnostic Inspection Kit. A clear bright yellow or orange area will identify the leak. For extremely small leaks, several hours may be necessary for the leak to appear.

Leakage Points—Underhood

Examine the following areas for oil leakage:

- valve cover gaskets
- cylinder head gaskets
- oil cooler, if equipped
- oil filter adapter
- engine front cover
- oil filter adapter and filter body
- oil level indicator tube connection
- oil pressure sensor

Leakage Points—Under Engine—With Vehicle on Hoist

- oil pan gaskets (6710)
- oil pan sealer

924 kPa (134 psi)	696 kPa (101 psi)	1131 kPa (164 psi)	848 kPa (123 psi)	1338 kPa (194 psi)	1000 kPa (146 psi)	1544 kPa (224 psi)	1158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1145 kPa (166 psi)	855 kPa (124 psi)	1351 kPa (196 psi)	1014 kPa (147 psi)	1558 kPa (226 psi)	1165 kPa (169 psi)
952 kPa (138 psi)	717 kPa (104 psi)	1158 kPa (168 psi)	869 kPa (126 psi)	1365 kPa (198 psi)	1020 kPa (148 psi)	1572 kPa (228 psi)	1179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1172 kPa (170 psi)	876 kPa (127 psi)	1379 kPa (200 psi)	1034 kPa (150 psi)	1586 kPa (230 psi)	1186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1186 kPa (172 psi)	889 kPa (129 psi)	1303 kPa (202 psi)	1041 kPa (151 psi)	1600 kPa (232 psi)	1200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1200 kPa (174 psi)	903 kPa (131 psi)	1407 kPa (204 psi)	1055 kPa (153 psi)	1055 kPa (153 psi)	1207 kPa (175 psi)
1007 kPa (146 psi)	758 kPa (110 psi)	1214 kPa (176 psi)	910 kPa (132 psi)	1420 kPa (206 psi)	1062 kPa (154 psi)	1627 kPa (154 psi)	1220 kPa (177 psi)
1020 kPa (148 psi)	765 kPa (111 psi)	1227 kPa (178 psi)	917 kPa (133 psi)	1434 kPa (208 psi)	1075 kPa (156 psi)	1641 kPa (238 psi)	1227 kPa (178 psi)
1034 kPa (150 psi)	779 kPa (113 psi)	1241 kPa (180 psi)	931 kPa (135 psi)	1448 kPa (210 psi)	1083 kPa (157 psi)	1655 kPa (240 psi)	1241 kPa (180 psi)
1048 kPa (152 psi)	786 kPa (114 psi)	1255 kPa (182 psi)	936 kPa (136 psi)	1462 kPa (212 psi)	1089 kPa (158 psi)	1669 kPa (242 psi)	1248 kPa (181 psi)
1062 kPa (154 psi)	793 kPa (115 psi)	1269 kPa (184 psi)	952 kPa (138 psi)	1476 kPa (214 psi)	1103 kPa (160 psi)	1682 kPa (244 psi)	1262 kPa (183 psi)
1076 kPa (156 psi)	807 kPa (117 psi)	1282 kPa (186 psi)	965 kPa (140 psi)	1489 kPa (216 psi)	1117 kPa (162 psi)	1696 kPa (246 psi)	1269 kPa (184 psi)
1089 kPa (158 psi)	814 kPa (118 psi)	1296 kPa (188 psi)	972 kPa (141 psi)	1503 kPa (218 psi)	1124 kPa (163 psi)	1710 kPa (248 psi)	1202 kPa (186 psi)
1103 kPa (160 psi)	827 kPa (120 psi)	1310 kPa (190 psi)	979 kPa (142 psi)	1517 kPa (220 psi)	1138 kPa (165 psi)	1724 kPa (250 psi)	1289 kPa (187 psi)
1110 kPa (161 psi)	834 kPa (121 psi)	1324 kPa (192 psi)	993 kPa (144 psi)	1631 kPa (222 psi)	1145 kPa (166 psi)	—	—

If one or more cylinders reads low, squirt approximately one tablespoon of engine oil meeting Ford specification on top of the pistons in the low-reading cylinders. Repeat the compression pressure check on these cylinders.

Compression Test—Interpreting Compression Readings

1. If compression improves considerably, piston rings are worn or damaged.
2. If compression does not improve, valves are sticking or not seating correctly.
3. If two adjacent cylinders indicate low compression pressures and squirting oil on each piston does not increase compression, the head gasket may be leaking between cylinders. Engine oil or coolant in cylinders could result from this condition.
Use the Compression Pressure Limit Chart when checking cylinder compression so that the lowest reading is within 75 percent of the highest reading.

Cylinder Leakage Detection

When a cylinder produces a low reading, use of the Engine Cylinder Leak Detection/Air Pressurization Kit will be helpful in pinpointing the exact cause.

The leakage detector is inserted in the spark plug hole, the piston is brought up to dead center on the compression stroke, and compressed air is admitted.

Once the combustion chamber is pressurized, a special gauge included in the kit will read the percentage of leakage. Leakage exceeding 20 percent is excessive.

While the air pressure is retained in the cylinder, listen for the hiss of escaping air. A leak at the intake valve (6507) will be heard in the throttle body (9E926). A leak at the exhaust valve (6505) can be heard at the tailpipe. Leakage past the piston rings will be audible at the positive crankcase ventilation (PCV) connection. If air is passing through a blown head gasket to an adjacent cylinder, the noise will be evident at the spark plug hole of the cylinder into which the air is leaking. Cracks in the cylinder block or gasket leakage into the cooling system may be detected by a stream of bubbles in the radiator (8005).

Oil Consumption Test

The following diagnostic procedure is used to determine the source of excessive internal oil consumption.

1. **NOTE:** Oil use is normally greater during the first 16,100 km (10,000 miles) of usage. As mileage increases, oil use generally decreases. Vehicles in normal usage should get at least 1,450 km per liter (900 miles per quart) after 16,100 km (10,000 miles) of service. High speed driving, towing, high ambient temperature and other factors may result in greater oil use.

Define excessive oil consumption, such as the number of miles driven per liter (quart) of oil used. Also determine customer's driving habits, such as sustained high speed operation, towing, extended idle and other considerations.

2. Verify that the engine has no external oil leak as described under Engine Oil Leaks in the Diagnosis and Testing portion of this section.
3. Verify that the engine has the correct oil level dipstick (6750).
4. Verify that the engine is not being run in an overfilled condition. Check the oil level at least five minutes after a hot shutdown with the vehicle parked on a level surface. In no case should the level be above MAX or the letter F in FULL. If significantly overfilled, carry out Steps 6a through 6d.
5. Verify the spark plugs are not oil saturated. If the spark plugs are oil saturated and compression is good it can be assumed the valve seals or valve guides are at fault.
6. Carry out an oil consumption test:
 - a. Drain the engine oil, remove the oil filter (6714) and refill with one liter (quart) less than the recommended amount.
 - b. Run the engine for three minutes (10 minutes if cold), and allow the oil to drain back for at least five minutes with the vehicle on a level surface.
 - c. Remove oil level dipstick and wipe clean. (Do not wipe with anything contaminated with silicone compounds.) Reinstall the oil level dipstick, being sure to seat it firmly in the oil level indicator tube (6754). Remove the oil level dipstick and draw a mark on the back (unmarked) surface at the indicated oil level. This level should be about the same as the MIN or ADD mark on the face of the oil level dipstick.
 - d. Add one liter (quart) of oil. Restart the engine and allow to idle for at least two minutes. Shut off the engine and allow the oil to drain back for at least five minutes. Mark the oil level dipstick, using the procedure above.
 - e. Record the vehicle mileage.
 - f. Instruct the customer to drive the vehicle as usual and carry out the following:
 - Check the oil level regularly at intervals of 160 to 240 km (100-150 miles).

- Return to the repair point when the oil level drops below the lower (MIN or ADD) mark on the oil level dipstick.
 - Add only full liters (quarts) of the same oil in an emergency. Note the mileage at which the oil is added.
- g. Check the oil level under the same conditions and at the same location as in Steps 5c and 5d.
- Measure the distance from the oil level to the UPPER mark on the oil level dipstick and record.
 - Measure the distance between the two scribe marks and record.
 - Divide the first measurement by the second.
 - Divide the distance driven during the oil test by the result. This quantity is the approximate oil consumption rate in kilometers per liter or in miles per quart.
- h. If the oil consumption rate is unacceptable, go to Step 7.
7. Check the positive crankcase ventilation (PCV) system. Make sure the system is not plugged.
8. Check for plugged oil drain-back holes in the cylinder heads and cylinder block.
9. If the condition still exists after carrying out the above steps, go to Step 10.
10. Carry out a cylinder compression test or cylinder leak detection test with Engine Cylinder Leak Detection/Air Pressurization Kit. This can help determine the source of oil consumption such as valves, piston rings or other areas.
11. **NOTE:** After determining if new parts should be installed, make sure correct new parts are used.
- Check valve guides for excessive guide clearance. Install new valve stem seals (6571) after verifying valve guide clearance.
12. Worn or damaged internal engine components can cause excessive oil consumption. Small deposits of oil on the tips of spark plugs can be a clue to internal oil consumption. If internal oil consumption still persists, proceed as follows:
- a. Remove the engine from the vehicle and place it on an engine work stand. Remove the intake manifolds (9424), cylinder heads, oil pan (6675) and oil pump (6600).
 - b. Check piston ring clearance, ring gap and ring orientation. Repair as necessary.
 - c. Check for excessive bearing clearance. Repair as necessary.
13. Repeat the oil consumption test (Step 6) to confirm the oil consumption concern has been resolved.

Intake Manifold Vacuum Test

Bring the engine to normal operating temperature. Connect the Vacuum/Pressure Tester to the intake manifold. Run the engine at the specified idle speed.

The vacuum gauge should read between 51-74 kPa (15-22 in-Hg) depending upon the engine condition and the altitude at which the test is conducted. Subtract 4.0193 kPa (1 in-Hg) from the specified reading for every 304.8 m (1,000 feet) of elevation above sea level.

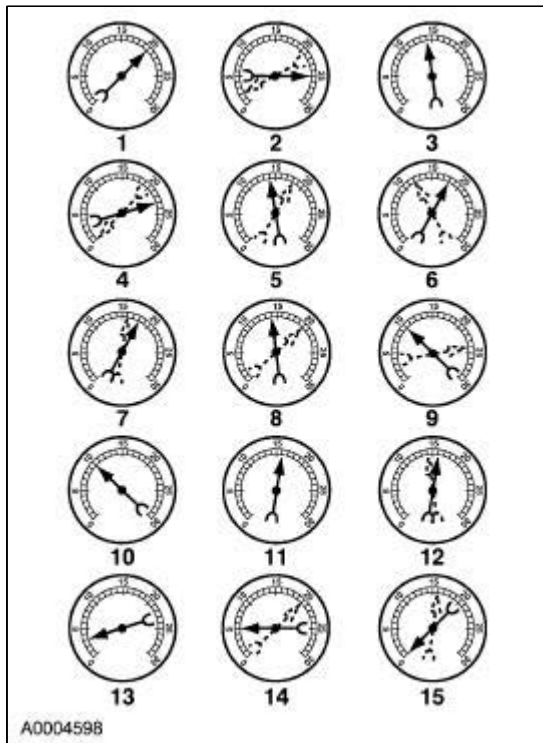
The reading should be steady. If necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust the damper until the needle moves easily without excessive flutter.

Intake Manifold Vacuum Test—Interpreting Vacuum Gauge Readings

A careful study of the vacuum gauge reading while the engine is idling will help pinpoint trouble areas. Always conduct other appropriate tests before arriving at a final diagnostic decision. Vacuum gauge readings, although helpful, must be interpreted carefully.

Most vacuum gauges have a normal band indicated on the gauge face.

The following are potential gauge readings. Some are normal; others should be investigated further.



1. **NORMAL READING:** Needle between 51-74 kPa (15-22 in-Hg) and holding steady.
2. **NORMAL READING DURING RAPID ACCELERATION AND DECELERATION:** When the engine is rapidly accelerated (dotted needle), the needle will drop to a low reading (not to zero). When the throttle is suddenly released, the needle will snap back up to a higher than normal figure.
3. **NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP:** The needle will register as low as 51 kPa (15 in-Hg) but will be relatively steady. Some oscillation is normal.
4. **WORN RINGS OR DILUTED OIL:** When the engine is accelerated (dotted needle), the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).
5. **STICKING VALVES:** When the needle (dotted) remains steady at a normal vacuum but occasionally flicks (sharp, fast movement) down and back about 13 kPa (4 in-Hg), one or more valves may be sticking.
6. **BURNED OR WARPED VALVES:** A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or warped valves. Insufficient valve clearance will also cause this reaction.
7. **POOR VALVE SEATING:** A small but regular downscale flicking can mean one or more valves are not seating.
8. **WORN VALVE GUIDES:** When the needle oscillates over about a 13 kPa (4 in-Hg) range at idle speed, the valve guides could be worn. As engine speed increases, the needle will become steady if guides are responsible.

9. **WEAK VALVE SPRINGS:** When the needle oscillation becomes more violent as engine rpm is increased, weak valve springs are indicated. The reading at idle could be relatively steady.
10. **LATE VALVE TIMING:** A steady but low reading could be caused by late valve timing.
11. **IGNITION TIMING RETARDING:** Retarded ignition timing will produce a steady but somewhat low reading.
12. **INSUFFICIENT SPARK PLUG GAP:** When spark plugs are gapped too close, a regular, small pulsation of the needle can occur.
13. **INTAKE LEAK:** A low, steady reading can be caused by an intake manifold or throttle body gasket leak.
14. **BLOWN HEAD GASKET:** A regular drop of fair magnitude can be caused by a blown head gasket or warped cylinder head-to-cylinder block surface.
15. **RESTRICTED EXHAUST SYSTEM:** When the engine is first started and is idled, the reading may be normal, but as the engine rpm is increased, the back pressure caused by a clogged muffler (5230), kinked tailpipe or other concerns will cause the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust clogging will cause the needle to drop to a low point even if the engine is only idling.
16. When vacuum leaks are indicated, search out and correct the cause. Excess air leaking into the system will upset the fuel mixture and cause concerns such as rough idle, missing on acceleration or burned valves. If the leak exists in an accessory unit such as the power brake booster (2005), the unit will not function correctly. Always fix vacuum leaks.

Excessive Engine Oil Consumption

The amount of oil an engine uses will vary with the way the vehicle is driven in addition to normal engine-to-engine variation. This is especially true during the first 16,100 km (10,000 miles) when a new engine is being broken in or until certain internal engine components become conditioned. Vehicles used in heavy-duty operation may use more oil. The following are examples of heavy-duty operation:

- trailer towing applications
- severe loading applications
- sustained high speed operation

Engines need oil to lubricate the following internal components:

- cylinder block cylinder walls
- pistons and piston, pin and rings (6102)
- intake and exhaust valve stems
- intake and exhaust valve guides
- all internal engine components

When the pistons move downward, a thin film of oil is left on the cylinder walls. As the vehicle is operated, some oil is also drawn into the combustion chambers past the intake and exhaust valve stem seals and burned.

The following is a partial list of conditions that can affect oil consumption rates:

- engine duty cycle
- operator driving habits
- ambient temperature
- quality and viscosity of the oil
- oil filler cap not seated
- oil level indicator not seated

Operation under varying conditions can frequently be misleading. A vehicle that has been run for several thousand miles on short trips or in below-freezing ambient temperatures may have consumed a "normal" amount of oil. However, when checking the engine oil level, it may measure up to the FULL or MAX on the oil level dipstick due to dilution (condensation and fuel) in the engine crankcase. The vehicle might then be driven at high speeds on the highway where the condensation and fuel boil off. The next time the engine oil is checked, it may appear that a liter (quart) of oil was used in about 160 km (100 miles). This perceived 160 km (100 miles) per liter (quart) oil consumption rate causes customer concern even though the actual overall oil consumption rate is about 2400 km (1500 miles) per liter (quart).

Make sure the selected engine oil meets the current recommended API performance category with SAE viscosity grade as shown in the vehicle Owner Literature. It is also important that the engine oil is changed at the intervals specified. For additional information, refer to the Vehicle Owner Literature.

Oil Pressure Test

1. Disconnect and remove the oil pressure sensor (9278) from the engine.
2. Connect the Engine Oil Pressure Gauge to the oil pressure sender oil galley port.
3. Run the engine until normal operating temperature is reached.
4. Run the engine at the specified rpm and record the gauge reading.
5. The oil pressure should be within specifications; For additional information, refer to the specification chart in the appropriate engine section.
6. If the pressure is not within specification, check the following possible sources:
 - insufficient oil
 - oil leakage
 - worn or damaged oil pump
 - oil pump screen cover and tube (6622)
 - excessive main bearing clearance
 - excessive connecting rod bearing clearance

Valve Train Analysis—Engine Off—Valve Cover Removed

Check for damaged or severely worn parts and correct assembly. Make sure correct parts are used with the static engine analysis as follows.

Valve Train Analysis—Engine Off

- Check for loose mounting bolts on camshaft caps.

- Check valve shim to camshaft gap.

Valve Train Analysis—Engine Off, Camshaft—Engines

- Check for broken or damaged parts.

Valve Train Analysis—Valve Springs

- Check for broken or damaged parts.

Valve Train Analysis—Engine Off, Valve Spring Retainer and Valve Spring Retainer Keys

- Check for correct seating of the valve spring retainer key (6518) on the valve stem and in valve spring retainer (6514).
- Check for correct seating on the valve stem.

Valve Train Analysis—Engine Off, Valves and Cylinder Head

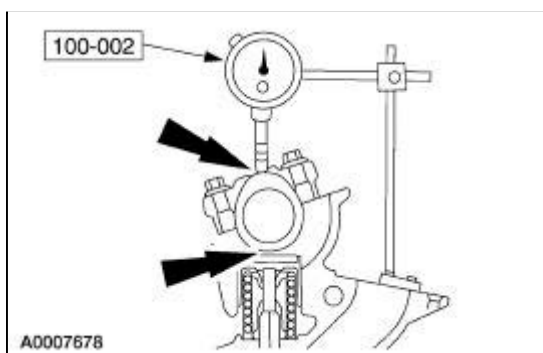
- Check for plugged oil drain back holes.
- Check for worn or damaged valve tips.
- Check for missing or damaged valve stem seals or guide-mounted valve stem seal.
- Check valve tappet shim gap.
- Check for missing or worn valve spring seats.
- Check for plugged oil metering orifice in cylinder head oil reservoir (if equipped).

Static checks (engine off) are to be made on the engine prior to the dynamic procedure.

Valve Train Analysis—Engine Off, Camshaft Lobe Lift—OHC Engines

Check the lift of each camshaft lobe in consecutive order and make a note of the readings.

1. Remove the valve covers.
2. Remove the spark plugs.
3. Install the special tool so the rounded tip of indicator is on top of the camshaft lobe and on the same plane as the valve tappet.
4. Rotate the crankshaft using a breaker bar and socket attached to the crankshaft pulley retainer bolt. Rotate the crankshaft until the base circle of the camshaft lobe is reached.



5. Zero the dial indicator. Continue to rotate the crankshaft until the high-lift point of the camshaft lobe is in the fully-raised position (highest indicator reading).
6. To check the accuracy of the original indicator reading, continue to rotate crankshaft until the base circle is reached. The indicator reading should be zero. If zero reading is not obtained, repeat Steps 1 through 6.
7. Install the spark plugs.
8. Install the valve covers.

Valve Train Analysis—Engine Off, Valve Tappet


Valve tappet noise can be caused by any of the following:

- excessive valve tappet shim gap
- excessive valve guide wear

Excessive collapsed valve tappet shim gap can be caused by loose rocker arm seat bolts/nuts, incorrect initial adjustment or wear of valve tappet shim face.

For additional information, refer to the valve train shim and gap inspection procedure in the appropriate engine section.

Sprockets

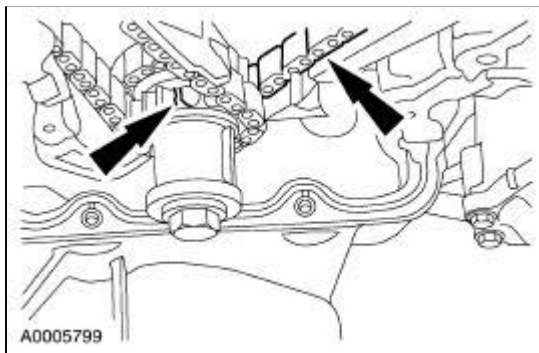
1.  **WARNING:** To avoid the possibility of personal injury or damage to the vehicle, do not operate the engine with the hood open until the fan blade has been examined for possible cracks and separation. Failure to follow these instructions may result in personal injury.

NOTE: Specifications show the expected minimum or maximum condition.

NOTE: If a component fails to meet the specifications, it is necessary to install a new component or refinish the component. If the component can be refinished, wear limits are provided as an aid to making a decision. If a component fails to meet specifications and cannot be refinished, a new component must be installed.

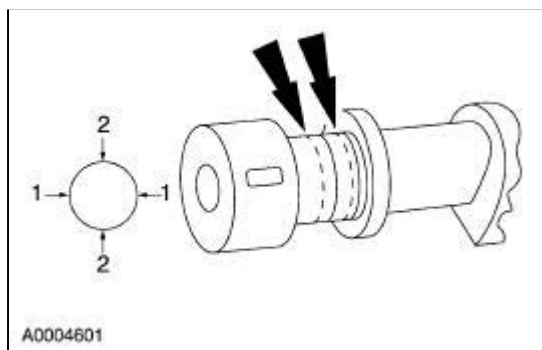
Inspect the timing chain/belt and the sprockets.

- Install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



Camshaft Journal — Diameter

1. Measure each camshaft journal diameter in two directions.
 - If it is out of specification, install a new camshaft. Refer to the appropriate section in Group 303 for the procedure.



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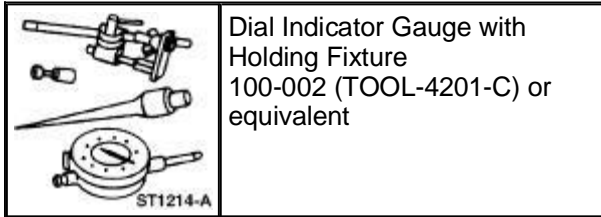
Camshaft Journal

NOTE: The camshaft journals must meet specifications before checking camshaft journal clearance.

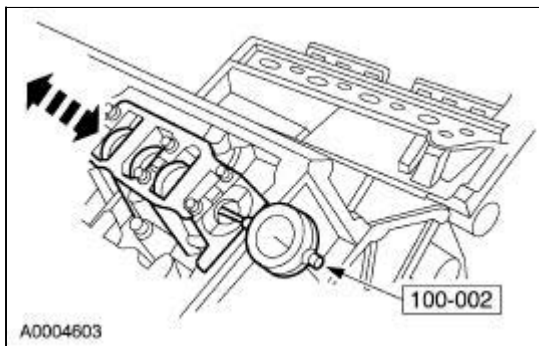
Refer to the appropriate section in Group [303](#) for the procedure.

Camshaft —End Play, OHC Engines

Special Tool(s)

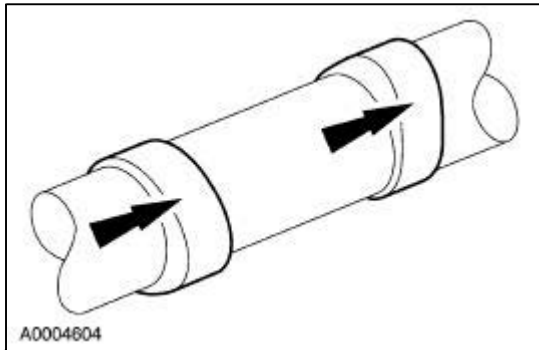


1. Use the special tool to measure camshaft end play.
2. Position the camshaft to the rear of the cylinder head.
3. Zero the indicator.
4. Move the camshaft to the front of the cylinder head. Note and record the camshaft end play. Refer to the appropriate section in Group 303 for the procedure.
 - If camshaft end play exceeds specifications, install new camshaft thrust bearing washers.



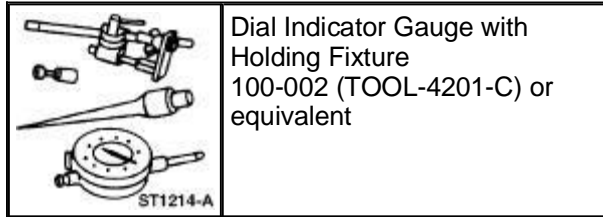
Camshaft —Lobe Surface

1. Inspect camshaft lobes for pitting or damage in the active area. Minor pitting is acceptable outside the active area.
 - If excessive pitting or damage is present, install a new camshaft. Refer to the appropriate section in Group [303](#) for the procedure.

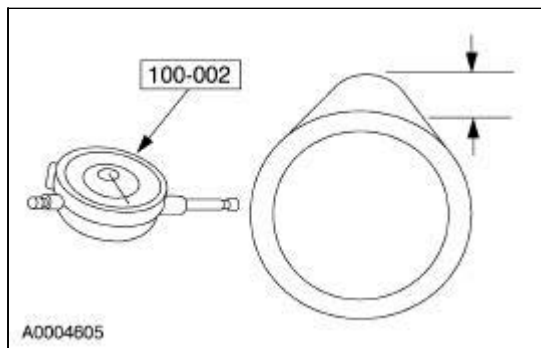


Camshaft —Lobe Lift

Special Tool(s)

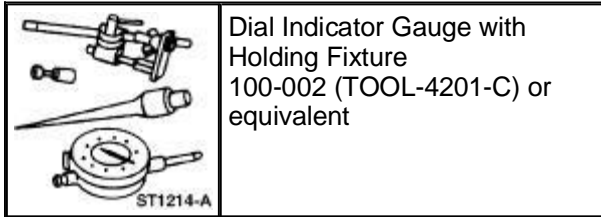


1. Use the special tool to measure camshaft intake/exhaust lobe lift.
 - Rotate the camshaft and subtract the lowest indicator reading from the highest indicator reading to figure the camshaft lobe lift.
 - For additional information, refer to base engine section for specification.



Camshaft —Runout

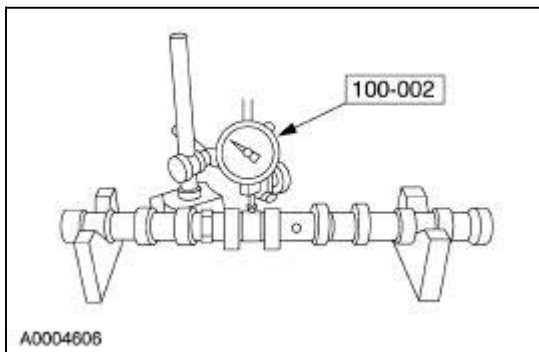
Special Tool(s)



1. **NOTE:** Camshaft journals must be within specifications before checking runout.

Use the special tool to measure the camshaft runout.

- Rotate the camshaft and subtract the lowest indicator reading from the highest indicator reading.
- For additional information, refer to the Specifications chart in the appropriate engine section.
- If it is out of specification, install a new camshaft. Refer to the appropriate section in Group 303 for the procedure.

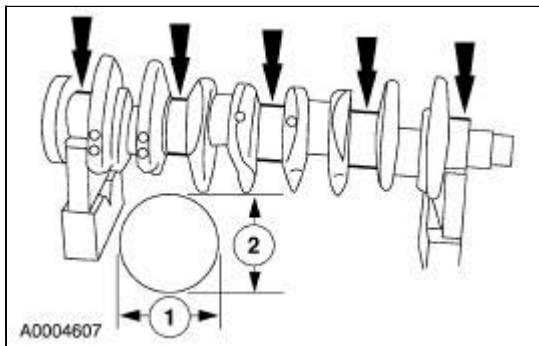


Crankshaft Main Bearing Journal —Diameter

1. **NOTE:** Check part availability before engine disassembly.

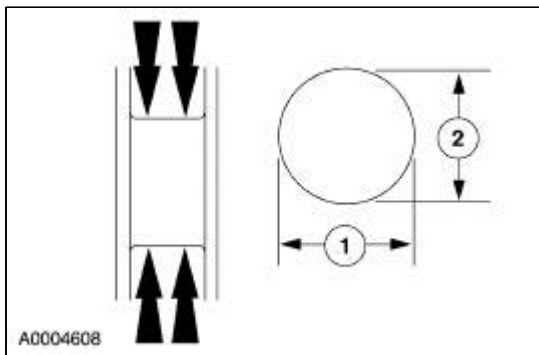
Measure each of the crankshaft main bearing journal diameters in at least two directions.

- For additional information, refer to the Specifications chart in the appropriate engine section.
- If it is out of specification, install new components as necessary. Refer to the appropriate section in Group 303 for the procedure.



Crankshaft Main Bearing Journal —Taper

1. Measure each of the crankshaft main bearing journal diameters in at least two directions at each end of the main bearing journal.
 - For additional information, refer to the Specifications chart in the appropriate engine section.
 - If it is out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



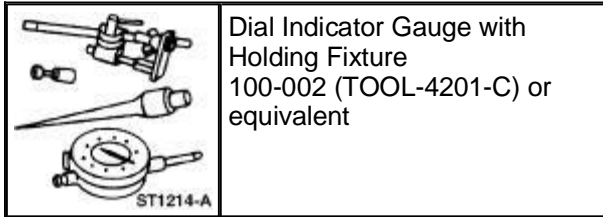
Crankshaft Main Bearing Journal — Clearance

NOTE: Crankshaft main bearing journals must be within specifications before checking journal clearance.

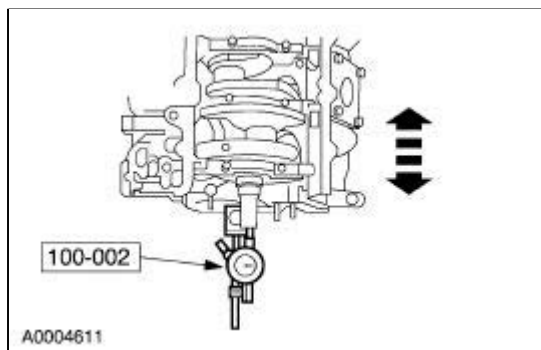
Refer to the appropriate section in Group [303](#) for the procedure.

Crankshaft —End Play

Special Tool(s)

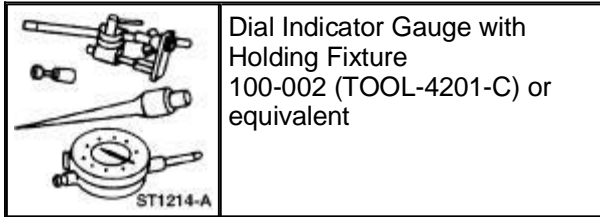


1. Measure the crankshaft end play.
 - Use the special tool to measure crankshaft end play.
2. Position the crankshaft to the rear of the cylinder block.
3. Zero the indicator.
4. Move the crankshaft to the front of the cylinder block. Using the special tool, note and record the crankshaft end play.
 - If crankshaft end play exceeds specifications, install a new crankshaft thrust washer (6334) or crankshaft thrust main bearing (6337). Refer to the appropriate section in Group [303](#) for the procedure.



Crankshaft —Runout

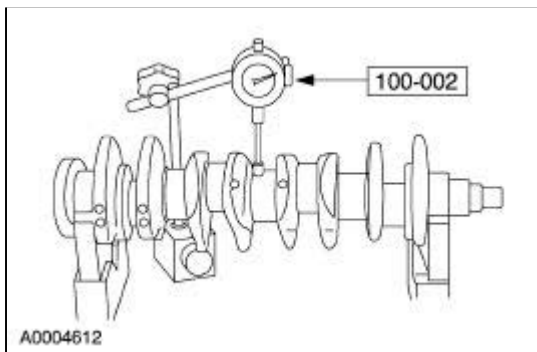
Special Tool(s)



1. **NOTE:** Crankshaft main bearing journals must be within specifications before checking runout.

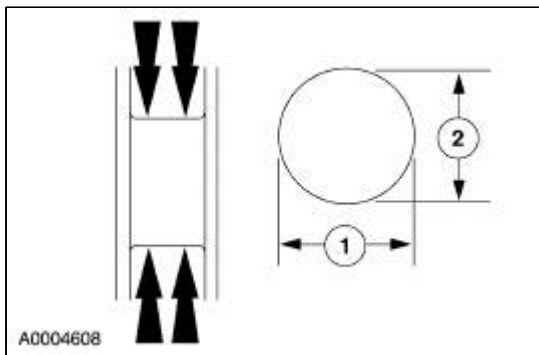
Use the special tool to measure the crankshaft runout.

- For additional information, refer to the Specifications chart in the appropriate engine section. Rotate the crankshaft and subtract the lowest dial indicator reading from the highest dial indicator reading to figure the crankshaft runout. If it is out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



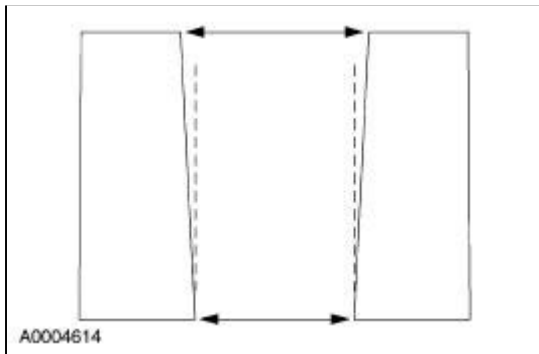
Crankshaft —Connecting Rod Journal Taper, Out of Round

1. Measure the crankshaft connecting rod journal diameters in two directions perpendicular to one another at each end of the connecting rod journal. The difference in the measurements from one end to the other is the taper. Verify measurement is within the wear limit.
 - For additional information, refer to the appropriate engine section Specifications chart.
 - If it is out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



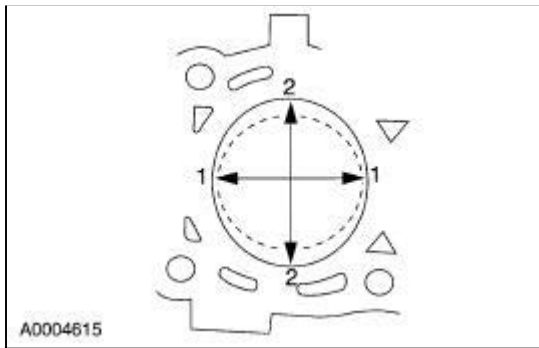
Cylinder Bore —Taper

1. Measure the cylinder bore at the top and bottom. Verify the cylinder bore is within the wear limit. The difference indicates the cylinder bore taper. Bore the cylinder to the next oversize.
 - For additional information, refer to the appropriate engine section Specifications chart.



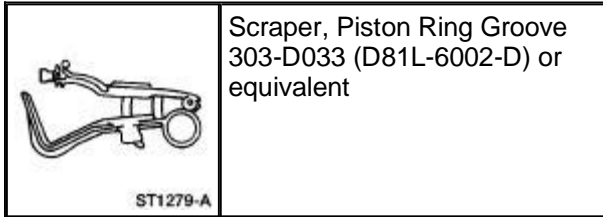
Cylinder Bore —Out-of-Round


1. Measure the cylinder bore in two directions. The difference is the out-of-round. Verify the out-of-round is within the wear limit and bore the cylinder to the next oversize limit.
 - For additional information, refer to the appropriate engine section Specifications Chart.



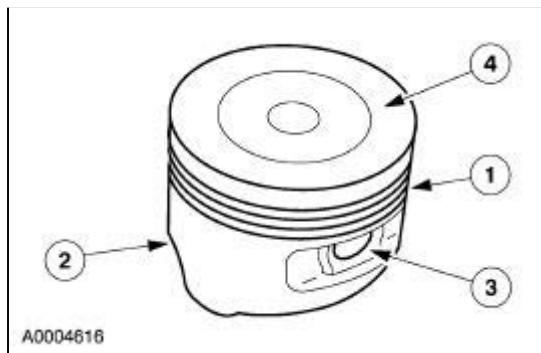
Piston — Inspection

Special Tool(s)

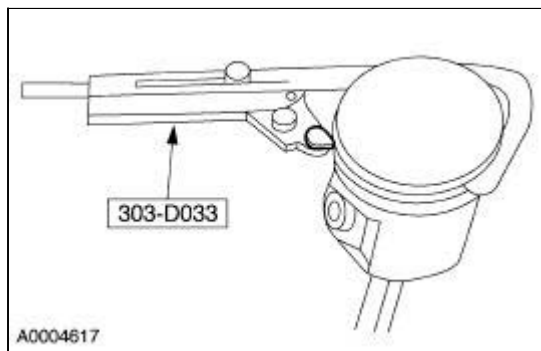


 **CAUTION:** Do not use a caustic cleaning solution or a wire brush to clean the pistons or damage can occur.


1. Clean and inspect the (1) ring lands, (2) skirts, (3) pin bosses, and the (4) tops of the pistons. If wear marks, scores or glazing is found on the piston skirt, check for a bent or twisted connecting rod.



2. Use the special tool to clean the piston ring grooves.
 - Make sure the oil ring holes are clean.



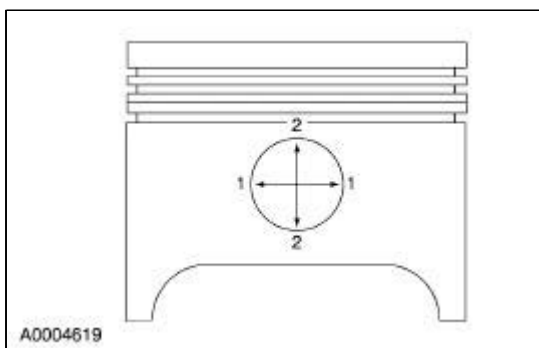
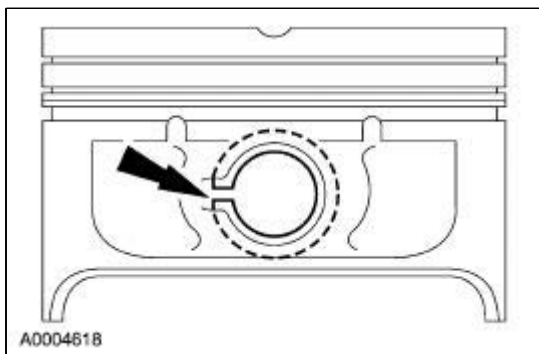
Piston — Pin to Bore Diameter

1.  **WARNING:** Cover the end of the pin bore with a hand or shop rag when removing the retainer ring, since it has a tendency to spring out. Wear eye protection. Failure to follow these instructions may result in personal injury.

NOTE: Piston and piston pins are a matched set and should not be interchanged.

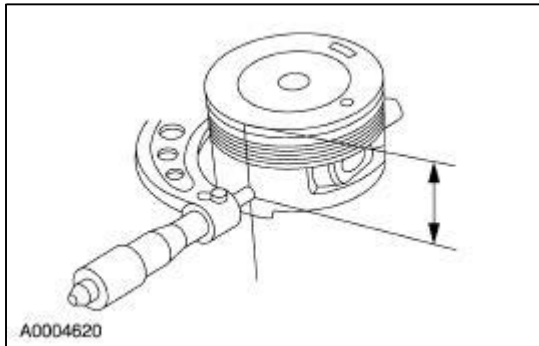
Measure the piston pin bore diameter in two directions on each side. Verify the diameter is within specification.

- If it is out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



Piston — Diameter

1. Measure the piston dome and skirt diameter 90 degrees from the piston pin at the points indicated. For additional information, refer to the Specifications Chart in the appropriate engine section.
 - If it is out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



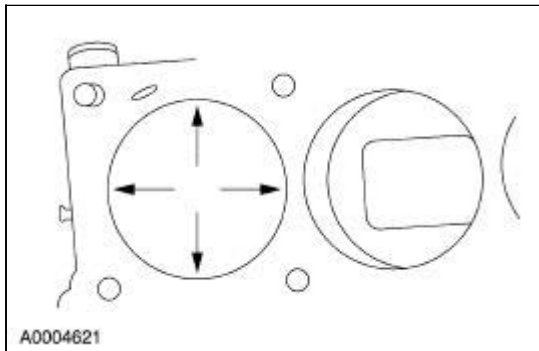
Piston —to Cylinder Bore Clearance

1. Subtract the piston diameter from the cylinder bore diameter to find the piston-to-cylinder bore clearance.
-

Piston — Selection

NOTE: The cylinder bore must be within the specifications for taper and out-of-round before fitting a piston.

1. Select a piston size based on the cylinder bore.



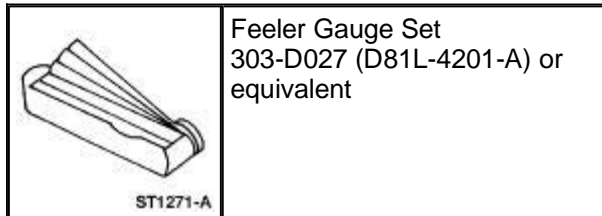
2. **NOTE:** For precision fit, new pistons are divided into three categories within each size range based on their relative position within the range. A number on the new pistons indicates the position within the size range.

Choose the piston with the correct grade size.


- Refer to the appropriate section in Group [303](#) for the procedure.
-

Piston — Ring End Gap

Special Tool(s)

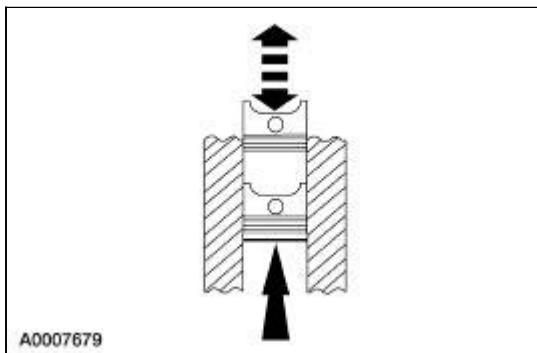


 **CAUTION:** Use care when fitting piston rings to avoid possible damage to the piston ring or the cylinder bore.

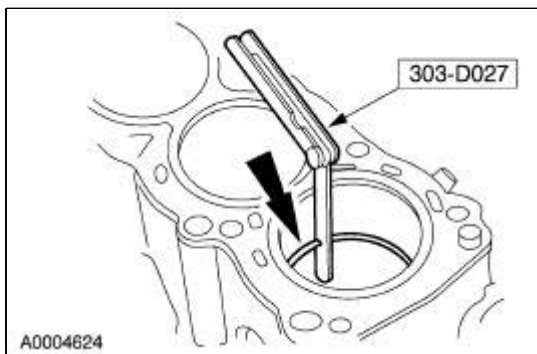
 **CAUTION:** Piston rings should not be transferred from one piston to another.

NOTE: Cylinder bore must be within specification for taper and out-of-round.

1. Use a piston without rings to push a piston ring in a cylinder to the bottom of ring travel.

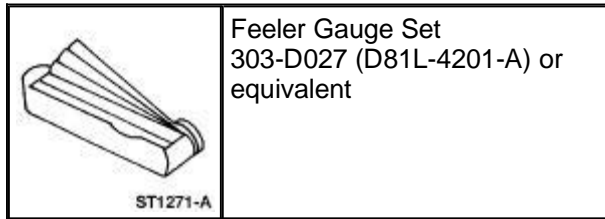


2. Use the special tool to measure the top piston ring end gap and the second piston ring end gap.
 - For additional information, refer to the appropriate engine section Specifications chart.

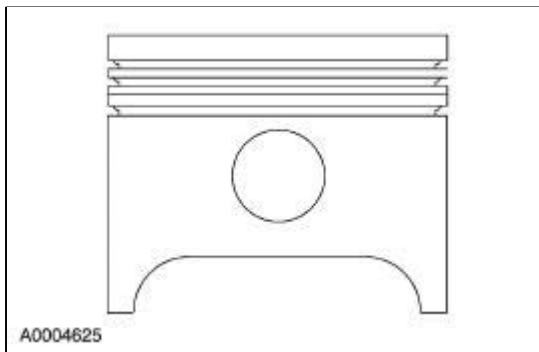


Piston — Ring-to-Groove Clearance

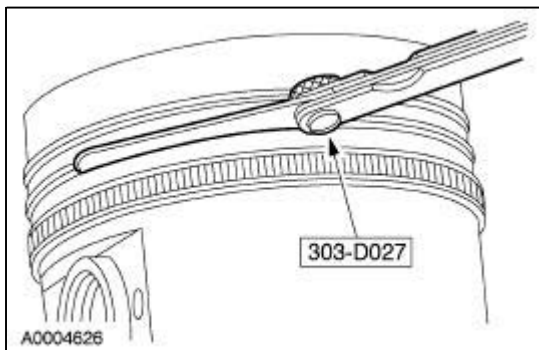
Special Tool(s)



1. Inspect for a step in the grooves.

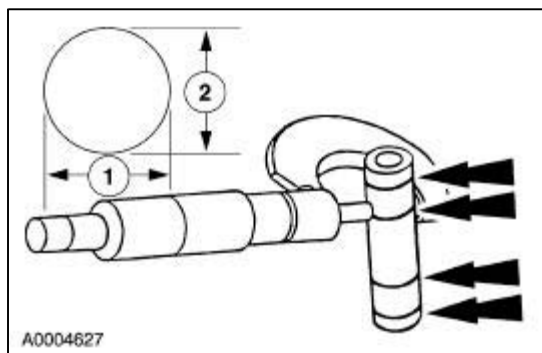


2. Measure the piston ring-to-groove clearance.
 - For additional information, refer to the appropriate engine section Specifications chart.
 - If out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



Piston —Pin Diameter

1. Measure the piston pin diameter in two directions at the points shown. Verify the diameter is within specification.
 - For additional information, refer to the appropriate engine section Specifications chart.
 - If out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



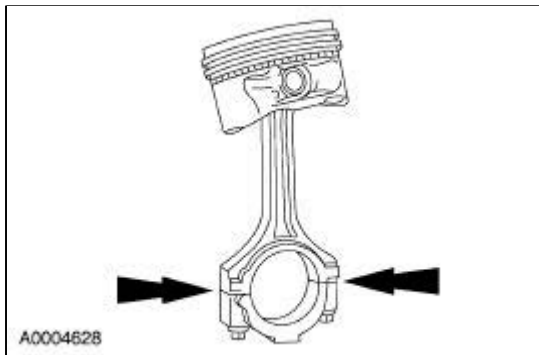
Connecting Rod —Cleaning



CAUTION: Do not use a caustic cleaning solution or damage to connecting rods can occur.

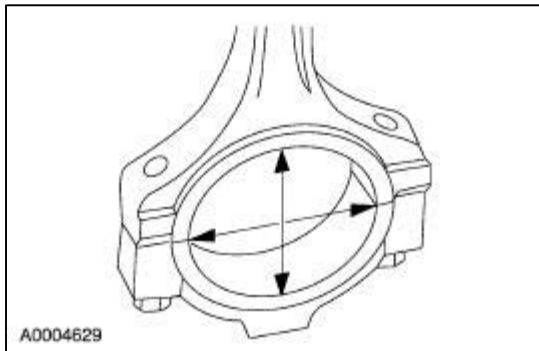
1. **NOTE:** If the connecting rod large end is mechanically split or cracked to produce a unique parting face, a locking joint is produced. Parts are not interchangeable.

Mark and separate the parts and clean with solvent. Clean the oil passages.



Connecting Rod —Large End Bore

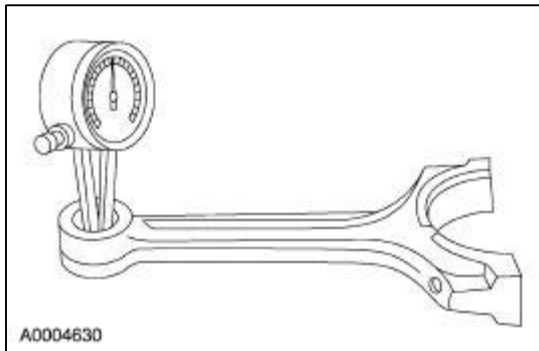
1. Measure the bore in two directions. The difference is the connecting rod bore out-of-round. Verify the out-of-round is within specification.
 - For additional information, refer to the appropriate engine section Specifications chart.
 - If out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



A0004629

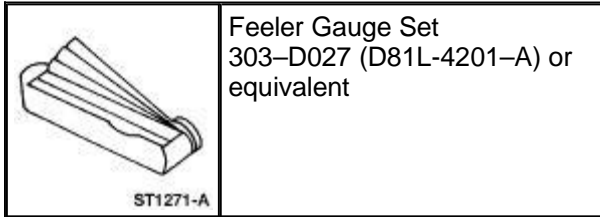
Connecting Rod — Bushing Diameter

1. Measure the inner diameter of the connecting rod bushing, if equipped. Verify the diameter is within specification.
 - For additional information, refer to the appropriate engine section Specifications chart.
 - If out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.

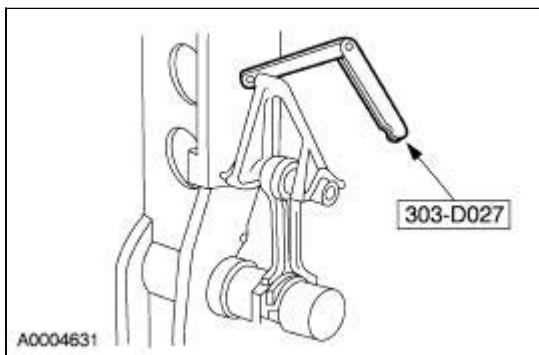


Connecting Rod — Bend

Special Tool(s)

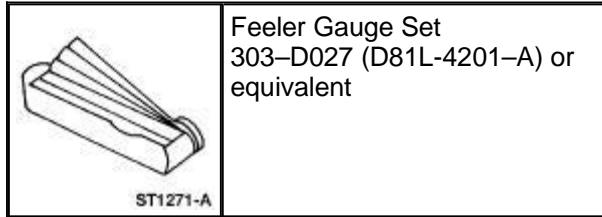


1. Measure the connecting rod bend on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. Verify the bend measurement is within specification.
 - For additional information, refer to the appropriate engine section Specifications chart.
 - If out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.

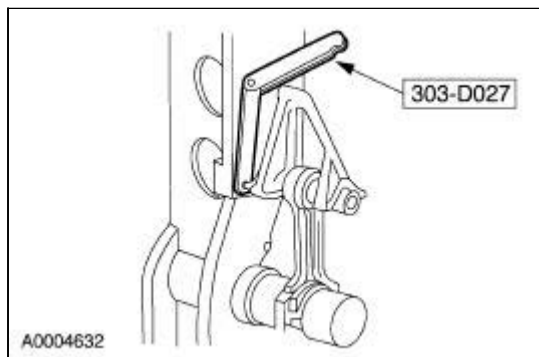


Connecting Rod —Twist

Special Tool(s)

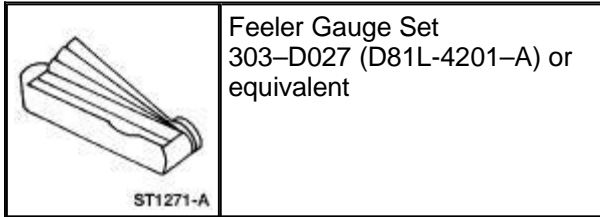


1. Measure the connecting rod twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. Verify the measurement is within specification.
 - For additional information, refer to the appropriate engine section Specifications chart.
 - If out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.

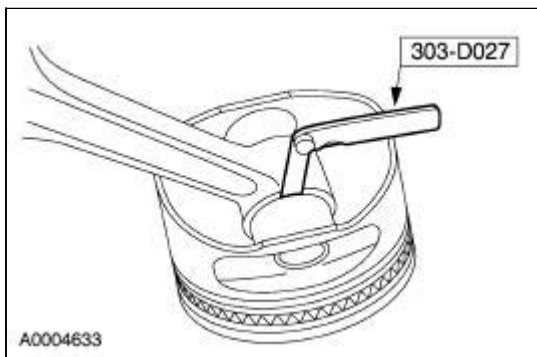


Connecting Rod —Piston Pin Side Clearance

Special Tool(s)



1. Measure the clearance between the connecting rod and the piston. Verify the measurement is within specification.
 - For additional information, refer to the appropriate engine section Specifications chart.
 - If out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.

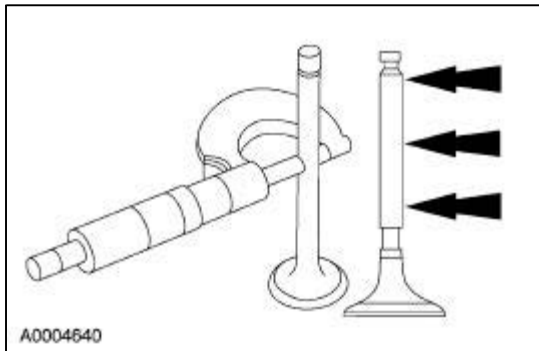


Connecting Rod —Bearing Journal Clearance

Refer to the appropriate section in Group 303 for the procedure.

Valve — Stem Diameter


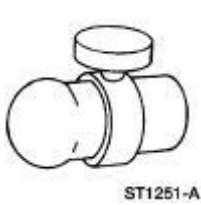
1. Measure the diameter of each intake and exhaust valve stem at the points shown. Verify the diameter is within specification.
 - Refer to the appropriate engine section Specifications chart.
 - If out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



A0004640

Valve — Stem to Valve Guide Clearance

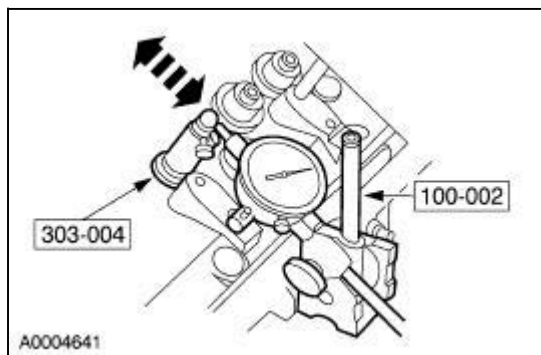
Special Tool(s)

	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
	Clearance Gauge, Valve Guide 303-004 (TOOL-6505-E) or equivalent

NOTE: Valve stem diameter must be within specifications before checking valve stem to valve guide clearance.

1. **NOTE:** If necessary, use a magnetic base.

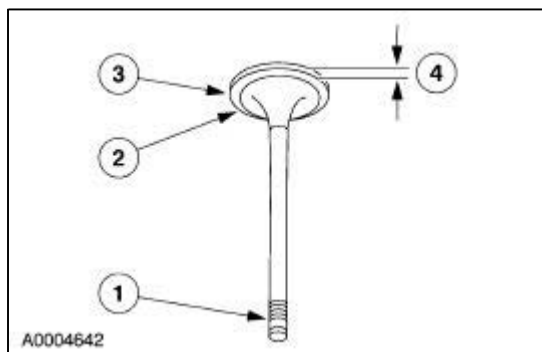
Using special tool Valve Stem Checking Tool and Dial Indicator with Bracketry, lower the valve until the Valve Stem Checking Tool contacts the upper surface of the valve guide.



2. Move the Valve Stem Checking Tool toward the indicator and zero the indicator. Move the Valve Stem Checking Tool away from the indicator and note the reading. The reading will be **DOUBLE** the valve stem-to-valve guide clearance.

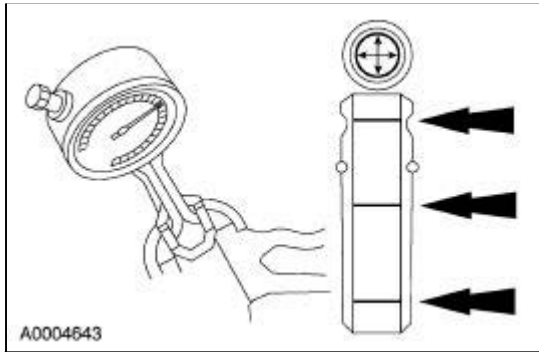
Valve — Inspection

1. Inspect the following valve areas:
 1. the end of the stem for grooves or scoring
 2. the valve face and the edge for pits, grooves or scores
 3. the valve head for signs of burning, erosion, warpage and cracking
 4. the valve margin for wear



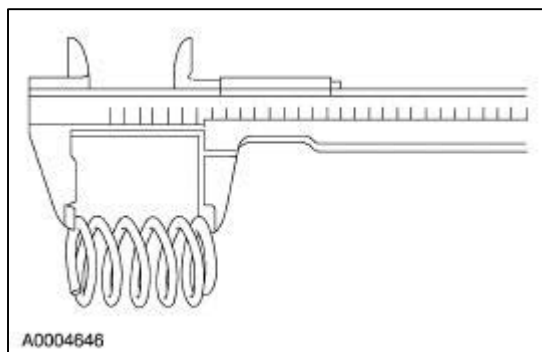
Valve —Guide Inner Diameter

1. Measure the inner diameter of the valve guides in two directions where indicated.
 - Refer to the appropriate engine section Specifications chart.



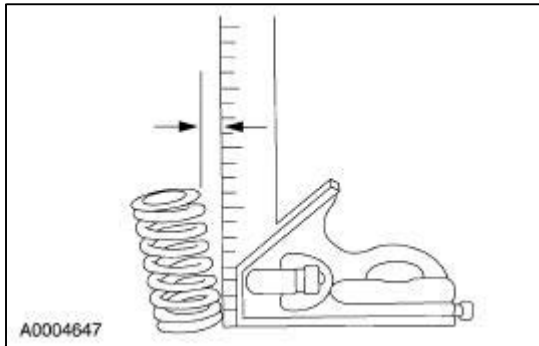
Valve — Spring Free Length

1. Measure the free length of each valve spring.
 - Refer to the Specifications chart in the appropriate engine section.
 - If out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



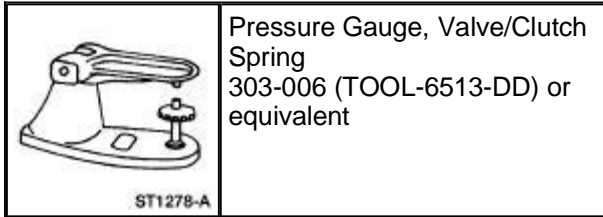
Valve —Spring Squareness

1. Measure the out-of-square on each valve spring.
 - Turn the valve spring and observe the space between the top of the valve spring and the square. Install a new valve spring if out of square. Refer to the appropriate section in Group 303 for the procedure.

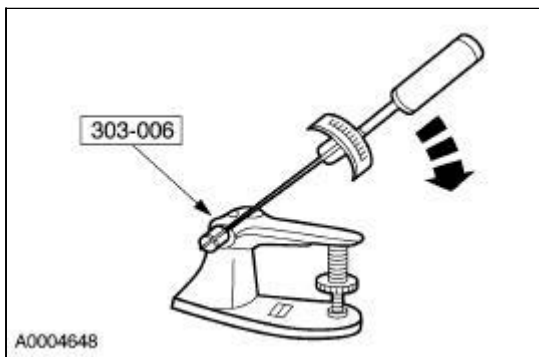


Valve — Spring Strength

Special Tool(s)



1. Use the special tool to check the valve spring for correct strength at the specified valve spring length.
 - Refer to the appropriate engine section Specifications chart.
 - If out of specification, install new components as necessary. Refer to the appropriate section in Group [303](#) for the procedure.



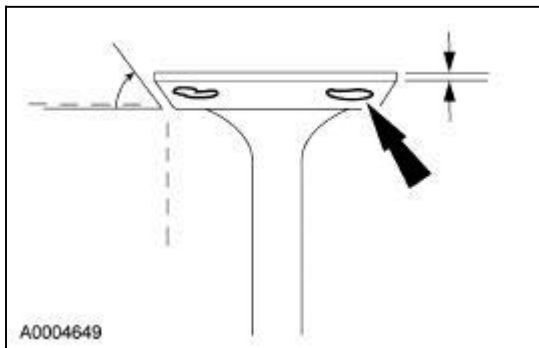
Valve — Seat Inspection

Valve and Seat Refacing Measurements



CAUTION: After grinding valves or valve seats, check valve clearance.

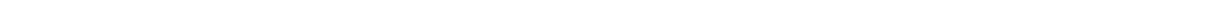
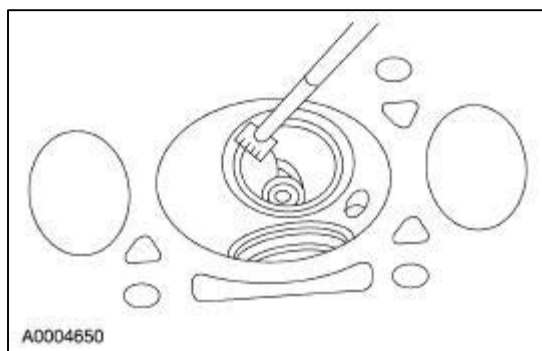
1. Check the valve head and seat.
 - Check valve angles.
 - Check margin width.
 - Refer to the Specifications chart in the appropriate engine section.
 - Be sure margin width is within specification.



2. Inspect for abnormalities on the valve face and seat.
-

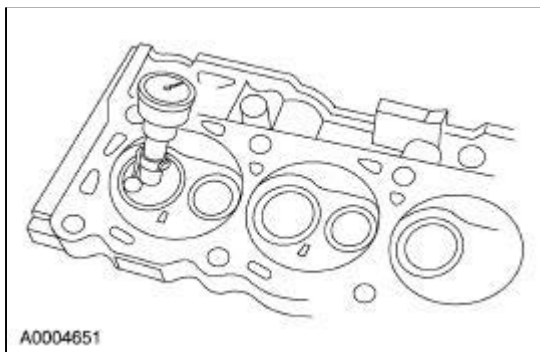
Valve — Seat Width

1. Measure the valve seat width. Install a new cylinder head if measurements are not within specification. Refer to the appropriate section in Group [303](#) for the procedure.
 - Measure the intake valve seat width.
 - Measure the exhaust valve seat width.
 - Refer to the Specifications chart in the appropriate engine section.



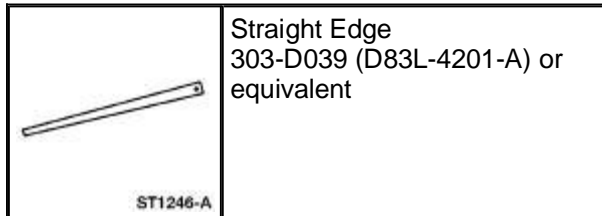
Valve —Seat Runout

1. Check valve seat runout.
 - Verify that the runout is within specification.

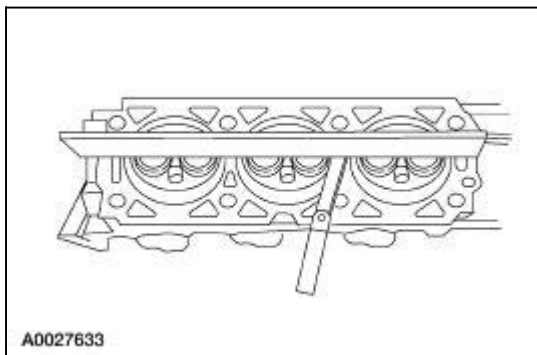


Cylinder Head —Distortion

Special Tool(s)



1. Use a straight edge and a feeler gauge to inspect the cylinder head for flatness. If the cylinder head is distorted, install a new cylinder head.



Cylinder Bore —Cleaning

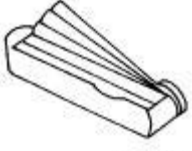

1.  **CAUTION:** If these procedures are not followed, rusting of the cylinder bores may occur.

Clean the cylinder bores with soap or detergent and water.

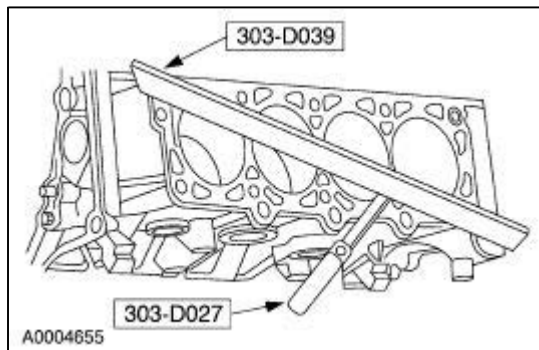
2. Thoroughly rinse with clean water and wipe dry with a clean, lint-free cloth.
 3. Use a clean, lint-free cloth and lubricate the cylinder bores.
 - Use engine oil meeting Ford specification.
-

Cylinder Block —Distortion

Special Tool(s)

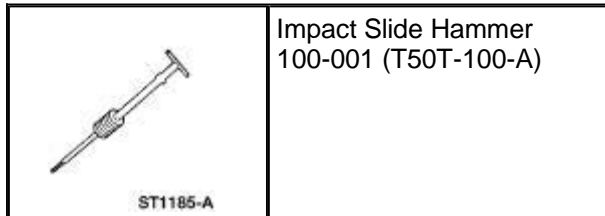
 <p>ST1271-A</p>	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent
 <p>ST1246-A</p>	Straight Edge 303-D039 (D83L-4201-A) or equivalent

1. Use the special tools to inspect the cylinder block for flatness. If the cylinder block is distorted, install a new cylinder block. Refer to the appropriate section in Group [303](#) for the procedure.

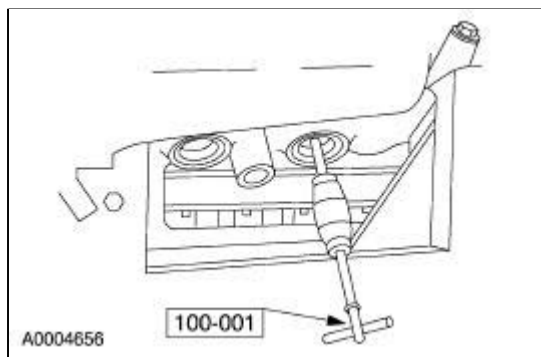


Cylinder Block —Core Plug Replacement

Special Tool(s)



1. Use the special tool to remove the cylinder block core plug.



2. Inspect the cylinder block plug bore for any damage that would interfere with the correct sealing of the plug. If the cylinder block plug bore is damaged, bore for the next oversize plug.
3. **NOTE:** Oversize plugs are identified by the OS stamped in the flat located on the cup side of the plug.

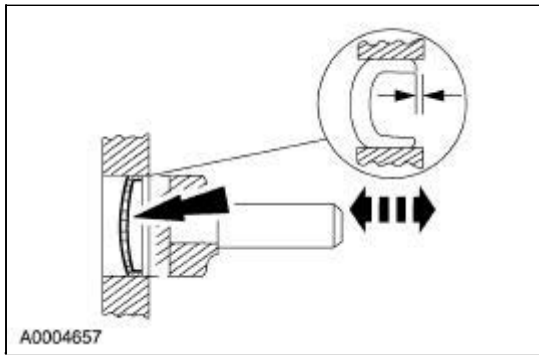
Coat the cylinder block core plug and bore lightly with Threadlock® 262 E2FZ-19554-B or equivalent meeting Ford specification WSK-M2G351-A6 and install the cylinder block core plug.

Cup-Type

4.  **CAUTION:** Use care during this procedure so as not to disturb or distort the cup sealing surface.

 **CAUTION:** When installed, the flanged edge must be below the chamfered edge of the bore to effectively seal the bore.

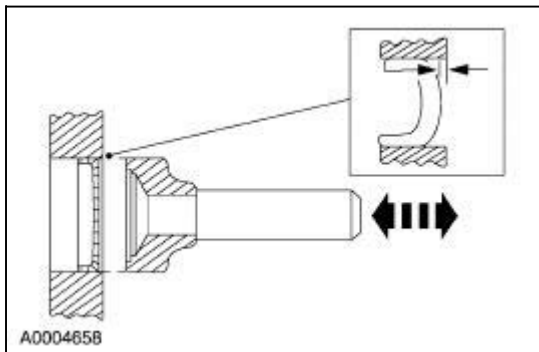
Use a tooling suitable to seat the cup type cylinder block core plug.



Expansion-Type


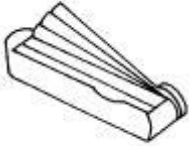
1.  **CAUTION:** Do not contact the crown when installing an expansion type cylinder block core plug. This could expand the plug before seating and result in leakage.

Use tooling suitable to seat the expansion type cylinder block core plug.

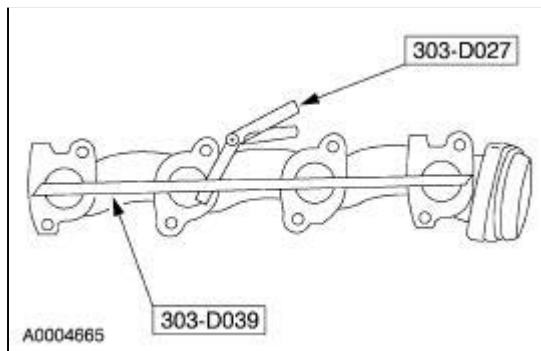


Exhaust Manifold — Inspection

Special Tool(s)

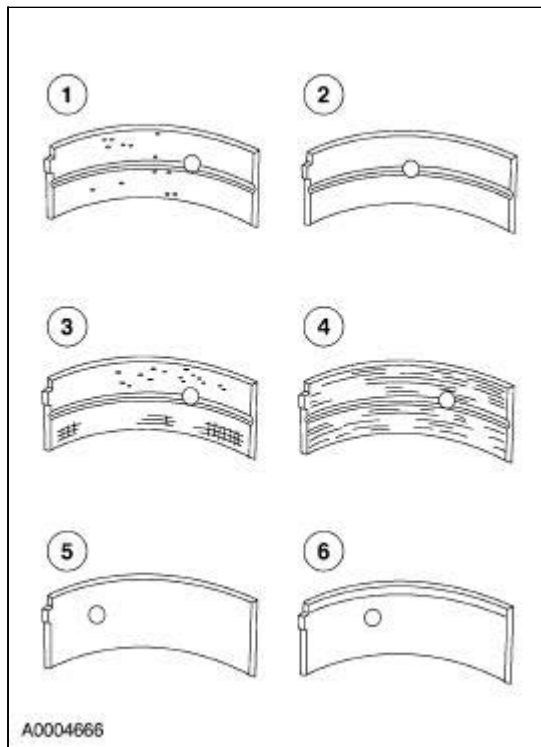
 ST1246-A	Straight Edge 303-D039 (D83L-4201-A) or equivalent
 ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent

1. Use the special tools to check for warping.



Bearing — Inspection

1. Inspect bearings for the following defects. Possible causes are shown:
 1. cratering—fatigue failure
 2. spot glazing—incorrect seating
 3. scratching—dirty
 4. base exposed—poor lubrication
 5. both edges worn—journal damaged
 6. one edge worn—journal tapered or bearing not seated



General Specifications

Item	Specification
Metal Surface Cleaner F4AZ-19A536-RA	WSE-M5B392-A
Silicone Gasket and Sealant F7AZ-19554-EA	WSE-M4G323-A4
Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP	WSS-M2C153-H
Engine oil capacity (with filter change)	6.5 Liters (6.9 Quarts)

General Specifications

Item	Specification
Intake valve clearance	0.175 mm - 0.225 mm (0.0069 in - 0.0089 in)
Exhaust valve clearance	0.325 mm - 0.375 mm (0.0128 in - 0.0148 in)

Item	Specification
General Specifications	
Displacement	3.0L (4V) (182 CID)
Number of cylinders	6
Bore and stroke	89.0 x 79.5 (3.5 x 3.13 in)
Firing order	1-4-2-5-3-6
Oil pressure (hot 1,500 rpm)	138-310 kPa (20-45 psi)
Spark plug	(AG5F-32FS) gap = 1.30-1.40 mm (0.052-0.056 in)
Cylinder head and valve train	
Combustion chamber volume	45.7 ± 1.5 cc
Valve seats	
· Width—intake	1.1-1.4 mm (0.043-0.055 in)
· Width—exhaust	1.4-1.7 mm (0.055-0.066 in)
· Angle	89-90 degrees
· Runout (T.I.R.)	0.04 mm (0.001 in)
Valve stem guide clearance	
· Intake	0.022-0.067 mm (0.0008-0.0026 in)
· Exhaust	0.035-0.080 mm (0.001-0.003 in)
Valve head diameter	
· Intake	35 mm (1.38 in)

- Exhaust	30 mm (1.18 in)
- Gauge diameter	33.5 and 28.0 mm (1.318 and 1.102 in)
Valve face runout limit	0.02 mm (0.007 in)
Valve guide runout at bottom of guide with respect to valve seat and top of guide	0.029 mm (0.0011 in)
Valve face angle	45.5 degrees
Valve stem diameter (standard)	
- Intake	5.492-5.477 mm (0.216-0.215 in)
- Exhaust	5.479-5.464 mm (0.215 in)
Valve spring compression pressure (N @ spec. length)	
- Intake	400 ± 22 at 24.5 mm (89.92 ± 4.94 at 0.964 in)
- Exhaust	400 ± 22 at 24.5 mm (89.92 ± 4.94 at 0.964 in)
Valve spring free length (approximate)	
- Intake	44.2 mm (1.740 in)
- Exhaust	44.2 mm (1.740 in)
Valve spring installed pressure (N @ spec. length)	
- Intake	175 ± 10 at 33.41 mm (39.34 ± 2.24 at 1.315 in)
- Exhaust	175 ± 10 at 33.41 mm (39.34 ± 2.24 at 1.315 in)
Camshaft	
Lobe lift	
- Intake (primary)	8.466 mm (0.333 in)
- Intake (secondary)	8.466 mm (0.333 in)
- Exhaust	9.461 mm (0.372 in)
Camshaft end play	
- Standard	0.07-0.15 mm (0.002-0.005 in)
- Service limit	0.277 mm (0.010 in)
Journal to bearing clearance	
- Standard	0.025-0.076 mm (0.001-0.0029 in)
- Service limit	0.151 mm (0.005 in)
Journal diameter	
- All	26.929-26.936 mm (1.060 in)
Bearing diameter (all) in head	
- All	26.987-27.012 mm (1.062-1.063 in)
Cylinder block	
Head gasket surface finish — cylinder block	0.12 mm (0.004 in)
Head gasket surface finish — cylinder head	0.12 mm (0.004 in)
Main bearing bore diameter	67.998-68.022 mm (2.677-2.6780 in)
Cylinder bore	

- Diameter	Grade 1: 89.000-89.010 mm (3.503-3.504 in) Grade 2: 89.010-89.020 mm (3.504 in) Grade 3: 89.020-89.030 mm (3.504-3.505 in)
- Surface finish (RMS)	0.2-0.6 microns
- Out-of-round limit	0.015 mm (0.0005 in)
- Out-of-round service limit	0.020 mm (0.0007 in)
- Taper service limit	0.020 mm (0.007 in)
Crankshaft	
Main bearing journal diameter	62.968-62.992 mm (2.467-2.479 in)
Connecting rod journal diameter	49.970-49.990 mm (1.967-1.968 in)
Crankshaft free end play	0.110-0.232 mm (0.004-0.009 in)
Crankshaft runout to rear face of cylinder block	0.053 mm max. (0.019 in)
Connecting rod bearings	
- Clearance to crankshaft	0.028-0.045 mm (0.0011-0.0017 in)
- Bearing wall thickness (std)	1.503 mm (0.059 in)
Main bearings	
Clearance to crankshaft	
- Desired	0.025-0.045 mm (0.0009-0.0001 in)
- Allowable	0.025-0.050 mm (0.0009-0.0019 in)
Bearing wall thickness	
- Grade 1	2.479 mm (0.0975 in)
- Grade 2	2.501 mm (0.0985 in)
- Grade 3	2.505 mm (0.0986 in)
Connecting rod	
- Piston pin bore diameter	21.017-21.031 mm (0.827-0.828 in)
- Length (center-to-center)	138.06-138.14 mm (5.435-5.38 in)
Alignment (bore-to-bore max. diff.)	
- Twist	0.050 mm per 25.0 (0.0019 per 0.984 in)
- Bend	0.038 mm per 25.0 (0.0014 per 0.984 in)
Side clearance (assembled to crank)	
- Standard	0.100-0.30 mm (0.0039-0.0118 in)
- Service limit	0.35 mm max. (0.0137 in)
Piston	
Piston diameter	
- Coded grade 1	88.990-89.010 mm (3.5035-3.5043 in)
- Coded grade 2	88.998-89.022 mm (3.5039-3.5048 in)
- Coded grade 3	89.010-89.030 mm (3.5043-3.5051 in)
Piston-to-bore clearance	0.012 to 0.022 mm (0.0005-0.0009 in)

Piston bore diameter (piston)	21.008-21.021 mm (0.8270-0.8275 in)
Ring groove width	
- Compression (top)	1.230-1.245 mm (0.0484-0.0490 in)
- Compression (bottom)	1.530-1.545 mm (0.0602-0.0608 in)
- Oil ring	3.030-3.055 mm (0.1192-0.0120 in)
Piston pin	
- Length	60.51-60.08 mm (2.382-2.365 in)
- Diameter	21.011-21.013 mm (0.8272 in)
Pin to piston clearance	-0.005 to +0.001 mm (0.0001-0.00003 in)
Pin to rod clearance	
- Standard	0.004-0.020 mm (0.0001-0.0007 in)
- Service limit	0.035 mm (0.0013 in)
Side clearance	
- Compression (top)	0.040-0.075 mm (0.0015-0.0029 in)
- Compression (bottom)	0.040-0.085 mm (0.0015-0.0033 in)
- Oil ring	Snug fit
- Service limit	0.10 mm (0.0039 in)
Piston ring gap	
- Compression (top) — gauge diameter	0.100-0.250 mm (0.0039-0.0098 in)
- Compression (bottom) — gauge diameter	0.27-0.42 mm (0.0106-0.0165 in)
- Oil ring (steel rail) — gauge diameter	0.15-0.65 mm (0.0059-0.0255 in)
- Compression (top) — service limit	0.50 mm max. (0.0196 in)
- Compression (bottom) — service limit	0.65 mm max. (0.0255 in)
- Oil ring (steel rail) — service limit	0.90 mm max. (0.0354 in)
Lubrication system	
Oil capacity	6.5 Liter 6.9 Quarts
Drive belt tension	
Note: Drive belts have differing tension specifications depending on whether they are newly installed	
Drive belt type	
- 6 rib front end accessory drive	Automatic tensioner

Torque Specifications

Description	Nm	lb-ft	lb-in
Ignition coil bolts	6	—	53
Valve cover studs and bolts	10	—	89
Upper intake manifold bolts	10	—	89
Front intake manifold support nut	10	—	89

Lower intake manifold bolts	10	—	89
Differential pressure feedback EGR nuts	6	—	53
Coolant outlet tube bolts	25	18	—
Coolant inlet tube bolts	25	18	—
Crankshaft position sensor bolts	10	—	89
Camshaft journal cap bolts	a	a	—
Camshaft position sensor bolt	10	—	89
Exhaust manifold nuts	20	15	—
Oil level indicator tube stud bolt	10	—	89
Oil pan bolts	25	18	—
Oil pressure switch	14	10	—
Oil pump bolts	10	—	89
Oil separator bolts	10	—	89
Oil pump screen tube bolts	10	—	89
Oil filter adapter bolts	25	18	—
Oil filter adapter bolt (large single)	a	a	—
EGR to exhaust manifold tube	40	30	—
Upper intake support bolt	10	—	89
Upper intake support bracket nuts	6	—	53
Oil cooler bolt	57	42	—
Spark plugs	15	11	—
Upper intake support bracket nut	10	—	89
LH and RH engine mount nuts	63	46	—
Power steering pump bolts	25	18	—
Cable bracket nut	10	—	89
A/C manifold bolt	21	15	—
A/C line bracket	10	—	89
Secondary air tube connector	38	28	—
Cylinder head bolts	a	a	—
Lower cylinder block bolts	a	a	—
Generator mounting bolts	48	35	—
A/C compressor mounting bracket bolts	25	18	—
Engine mount bolts	63	46	—
Engine mount nuts	63	46	—
Engine mount bracket bolts	25	18	—
Flywheel bolts	80	59	—
Connecting rod cap nuts	a	a	—
Front cover bolts and studs	25	18	—
Crankshaft damper bolts	a	a	—
Belt tensioner bolt	48	35	—
Belt idler pulley bolt	25	18	—

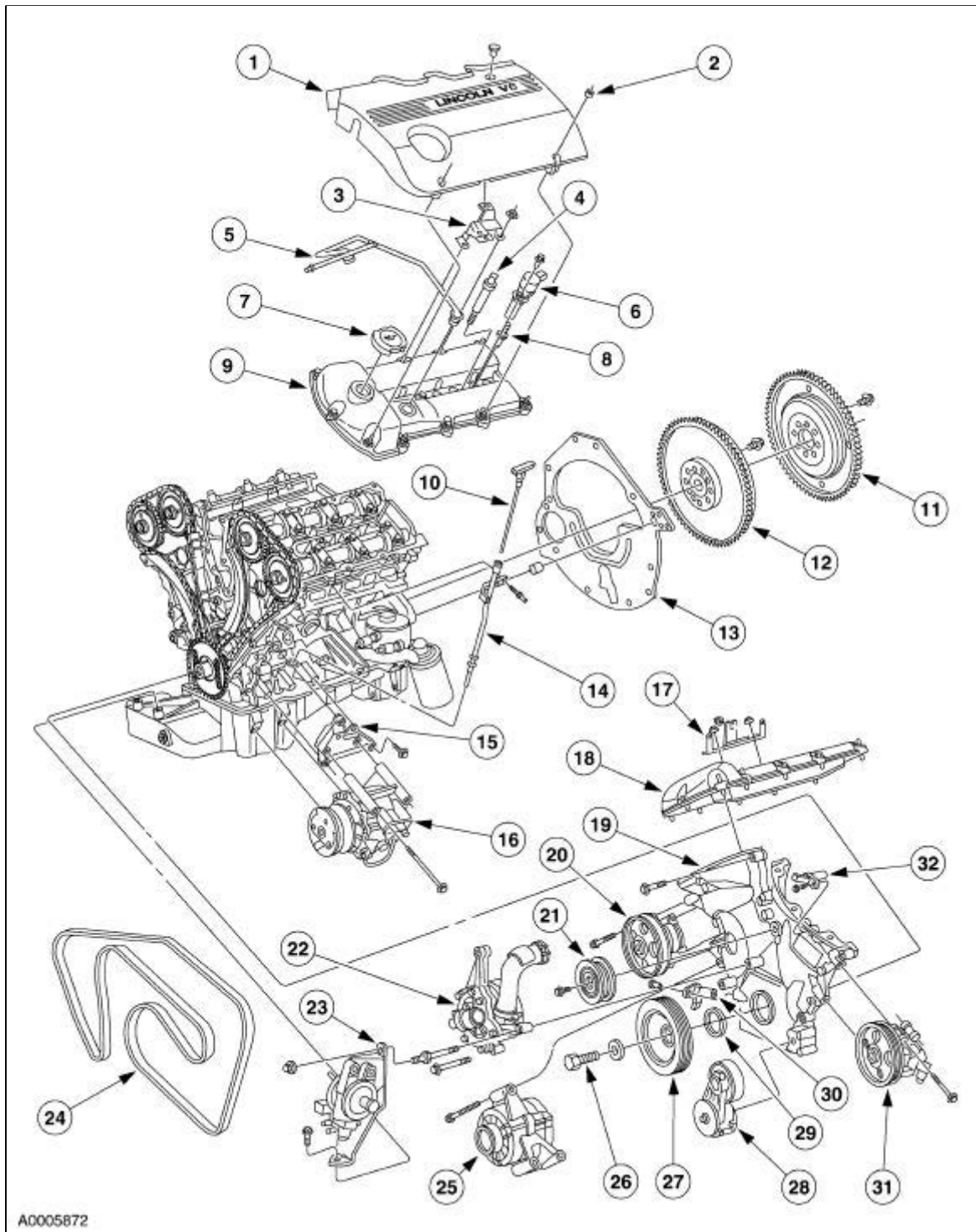
Transmission cooler line bracket bolt	11	—	8
Torque converter nuts	31-39	23-28	—
Cylinder head temperature sensor	15	11	—
Timing chain guide bolts	25	18	—
Timing chain tensioner bolts	25	18	—
Exhaust manifold heat shield bolts	10	—	89
Power steering reservoir bolts	12	9	—
Power steering pump bolts	25	18	—
Power steering line bracket bolt	10	—	89
Hydraulic cooling fan pump bolts	25	18	—
Hydraulic cooling fan reservoir bolts	12	9	—
Water pump bolts and studs	25	18	—
Cross vehicle support bolts	20	15	—
Ground strap to body bolt	10	—	89
Ground strap to engine stud bolt and nut	10	—	89
Steering shaft clamp bolt	25	18	—
Starter studs and bolt	25	18	—
Transmission oil cooler lines	20	15	—
Engine to transmission bolts	45	35	—
Radio ignition interference capacitor bolts	10	—	89
Knock sensor bolts	25	18	—
Front crossmember bolts	103	76	—
Center crossmember bolts	103	76	—
Lower strut mount bolts	175	129	—
Upper ball joint nuts	90	66	—
Lower stabilizer link nut	55	41	—
Front brake caliper bolts	103	76	—
Throttle cable bracket bolts	10	—	89
Upper radiator support bracket bolts	10	—	89
Fuel pressure sensor shield bolts	10	—	89
Fuel pressure sensor shield nut	6	—	53
Wiring harness to valve cover bracket nuts	6	—	53
Fuel line bracket bolt	10	—	89
Appearance cover bracket nuts	6	—	53
Transmission to oil pan bolts	45	35	—
Transmission cooler line bracket nut	10	—	89
A/C compressor bolts	25	18	—
Subframe bolts	104	77	—
Lower control arm through bolt	175	129	—
Steering gear nuts	103	76	—
Engine mount nuts (upper)	40	30	—
Main engine wiring harness connector bolt			

	10	—	89
Cable bracket nut	10	—	89

^a Refer to the procedure in this section.

Engine

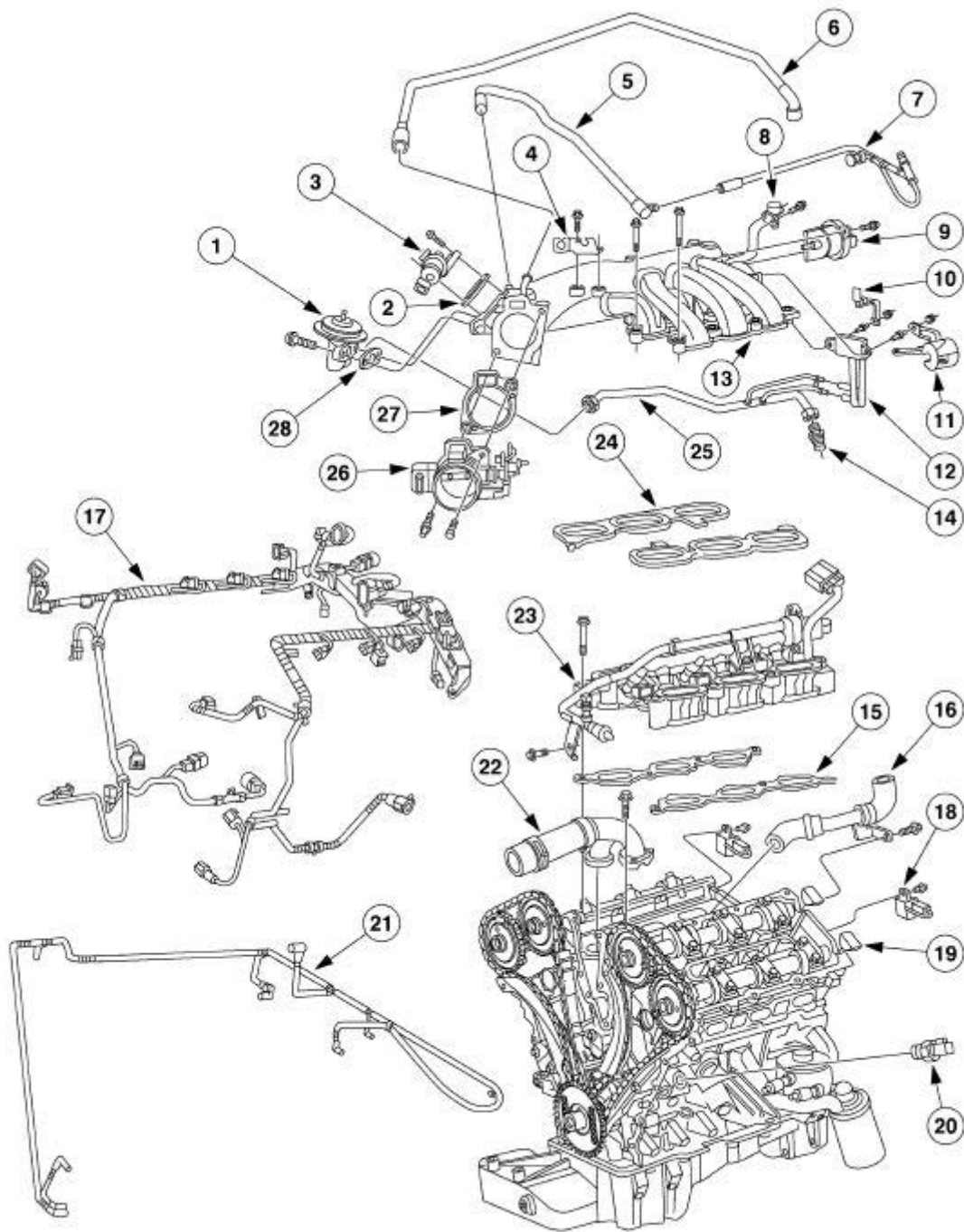
Engine Disassembled View



Item	Part Number	Description
1	6P068	Engine cover
2	6N030	Engine cover grommet

3	9J444	Appearance cover support bracket
4	6G004	Cylinder head temperature (CHT) sensor
5	6758	Crankcase vent tube
6	12A663	Ignition coil assembly
7	6766	Engine oil filler cap
8	12405	Spark plug
9	6A505	Valve cover — LH
10	6750	Engine oil level indicator
11	6375	Flexplate assy.
12	6477	Dual mass flywheel assy.
13	6A373	Engine rear plate
14	6754	Engine oil level indicator tube
15	19N586	A/C compressor mounting bracket
16	19D269	A/C compressor
17	9J444	Intake support bracket
18	6582	Valve cover — RH
19	6C086	Engine front cover assy.
20	8C648	Radiator cooling fan pump assy.
21	9C348	Accessory drive belt idler pulley
22	8501	Water pump assy.
23	9G442	Electronic thermactor air (ETA) valve and bracket
24	8620	Accessory drive belt
25	10300	Generator
26	W701512	Crankshaft pulley bolt
27	6316	Crankshaft pulley/damper
28	6B209	Accessory drivebelt tensioner
29	6700	Crankshaft front oil seal
30	6C315	Crankshaft position (CKP) sensor
31	3A696	Power steering pump
32	6B288	Camshaft position (CMP) sensor

Engine Disassembled View

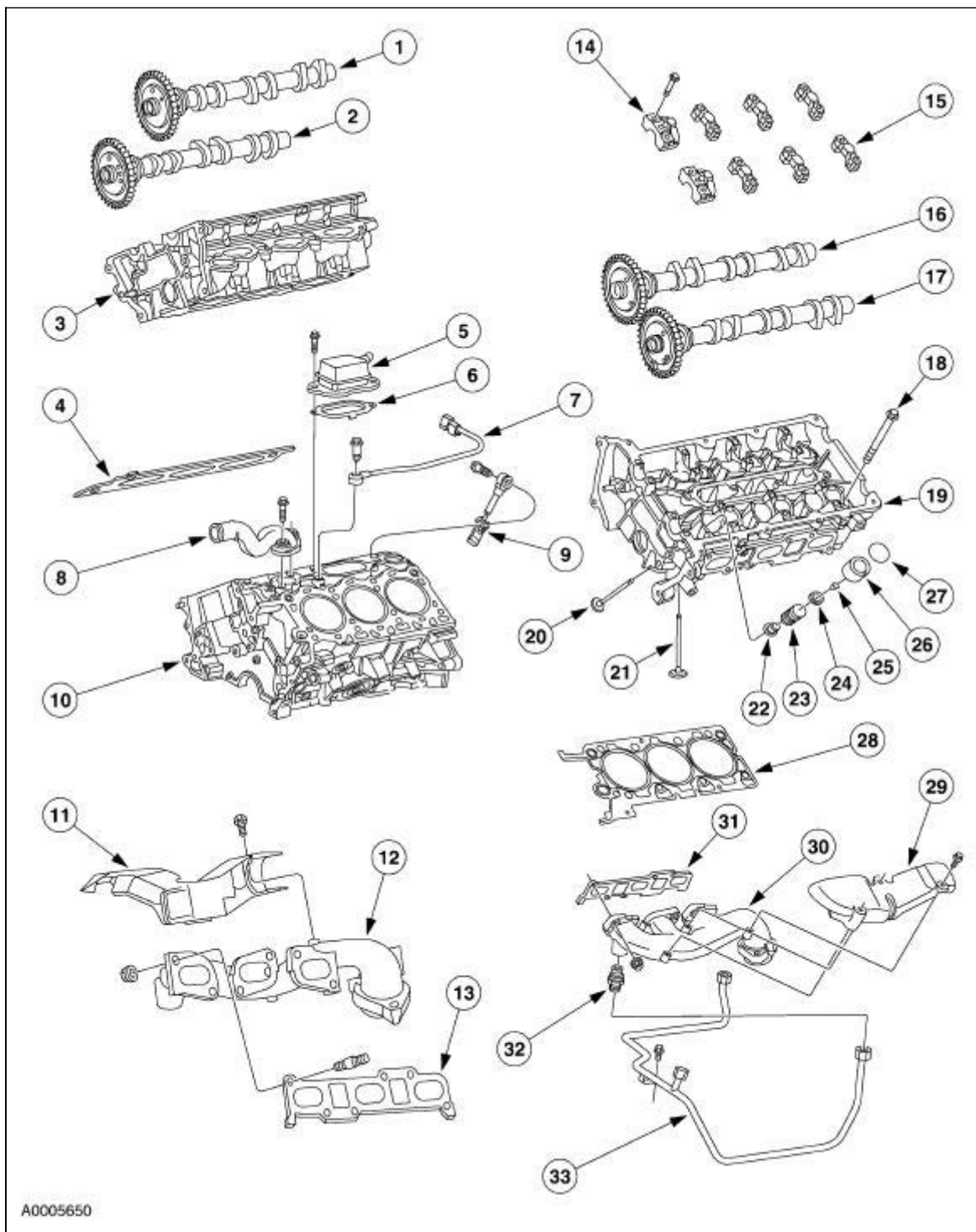


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Item	Part Number	Description
1	9D960	Exhaust gas recirculation (EGR) valve
2	9F560	Air bypass valve gasket
3	9F716	Air bypass valve
4	9728	Accelerator cable bracket
5	9D289	Fuel vapor tube assy.
6	6C324	Positive crankcase ventilation (PCV) tube and valve assy.
7	9D289	Fuel vapor tube assy.

8	9J459	Electronic vacuum regulator (EVR) solenoid
9	9L490	Intake air control valve
10	9D736	Accelerator cable support bracket
11	9G609	Fuel pressure sensor shield
12	9J433	Differential pressure feedback EGR transducer
13	9424	Upper intake manifold
14	9F485	EGR tube to exhaust manifold connector
15	9439	Lower intake manifold gasket
16	6C661	Crankcase vent tube and hose assy.
17	12B637	Wire harness assy.
18	18801	Radio ignition interference capacitor
19	6G017	Cap
20	9278	Oil pressure switch
21	9E498	Emission vacuum control harness
22	8548	Water bypass tube assy.
23	95447	Lower intake manifold assy.
24	9H486	Upper intake manifold gasket
25	9D477	EGR tube
26	9E926	Throttle body assy.
27	9E936	Throttle body gasket
28	9D476	EGR valve gasket

Engine Disassembled View



A0005650

Item	Part Number	Description
1	6A268	Intake camshaft
2	6A266	Exhaust camshaft
3	6049	Cylinder head
4	6051	Cylinder head gasket
5	6B673	Crankcase vent oil separator assy.
6	6B752	Oil separator to cylinder block gasket
7	12A699	Knock sensor
8	6A560	Water inlet tube assembly

9	12A699	Knock sensor
10	6010	Cylinder block
11	9A462	Exhaust manifold heat shield
12	9430	RH exhaust manifold
13	9448	Exhaust manifold gasket
14	6B280	Camshaft bearing cap
15	6B280	Camshaft bearing cap
16	6A267	Intake camshaft
17	6A269	Exhaust camshaft
18	6065	Cylinder head bolt
19	6050	Cylinder head
20	6507	Intake valve
21	6505	Exhaust valve
22	6A517	Seal and seat assy.
23	6513	Valve spring
24	6514	Retainer
25	6518	Key
26	6500	Tappet
27	6K514	Shim
28	6083	Cylinder head gasket
29	9Y427	Exhaust manifold heat shield
30	9431	LH exhaust manifold
31	9448	Exhaust manifold gasket
32	9D439	ETA tube adapter
33	9B480	ETA tube

The 3.0L (4V) (182 CID) is a 60 degree V-6 engine with dual overhead camshafts (DOHC), four valves per cylinder and sequential multiport fuel injection (SFI). The engine has:

- an aluminum upper intake manifold.
- a lower intake manifold.
- aluminum cylinder heads.
- a cast aluminum upper cylinder block.

The ignition system is electronic (distributorless) with a single ignition coil located above each spark plug. This high energy ignition system is required for fast-burn combustion.

A unique intake air system utilizes two separate plenums, one for each side of the engine. The plenums can be connected through the operation of a special intake manifold tuning valve (IMTV) to improve upper rpm power.

Identification

For quick identification refer to the safety certification decal:

- The decal is located on the LH front door lock face panel.
- An engine identification label is also attached to the engine.
- The symbol code on the identification tag identifies each engine for determining parts usage; for instance, engine displacement in liters or cubic inch displacement and model year.

Engine Code Information

The engine code information label is located on the front fender. The label contains, among other information:

- the engine calibration number
- the engine build date
- the engine plant code
- the engine code

Emission Calibration Label

NOTE: The engine codes and the calibration numbers must be used when making inquiries or ordering parts.

The emission calibration number label is located on the LH side door or LH door post pillar. It identifies:

- the engine calibration number
- the engine code number
- the revision level

These numbers are used to determine if parts are unique to specific engines.

Exhaust Emission Control System

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Induction System

The fuel needed for burning in the cylinders is provided by a returnless, sequential multiport fuel injection (SFI).

- Fuel is supplied from the vehicle fuel tank by a high-pressure electric fuel pump mounted in the fuel tank.
- The fuel is filtered and sent to the fuel injection supply manifold.
- Fuel pressure is regulated by modulating pump output based upon readings from the fuel pressure sensor, located on the fuel rail.
- Fuel is metered into the intake air stream in accordance with engine by six solenoid operated fuel injectors mounted in the lower intake manifolds.
- The six fuel injectors are mounted above the intake valves and connected in series with the fuel pressure regulator.
- These fuel induction systems are mounted on a phenolic resin intake manifold.

Crankshaft

The crankshaft is supported on the bottom of the cylinder block by four steel-backed, over-plated, aluminum crankshaft main bearings.

To provide smooth engine operation, the piston crankpins are positioned to provide a power impulse every 120 degrees of crankshaft rotation. The spacing provides smooth and quiet operation.

Two sprockets and timing chains connect the crankshaft with the camshafts and provide a 2:1 drive ratio.

Camshaft

The camshafts:

- are supported on four bearing inserts.
- thrust loads and end play are limited by a camshaft thrust plate.

Cylinder Head

The spark plug is installed in the center of the fuel/air roof-shaped combustion chamber to ignite the mixture in the combustion chamber. The central location of the spark plug causes the flame front to be evenly spread across the chamber, which also reduces spark knock.

Valve Train

Both camshafts are driven by a shared timing chain, and operate four valves per cylinder by means of an selective shim setting on the top of a tappet. One spring on each valve is used to close the valve. The adjusting shims in the valve tappets can be changed to correct the valve clearance. These are available in 44 different thicknesses. The shim thickness is ink printed on the back of the shim. Using a special procedure, the camshafts can be lifted without timing chain disassembly to change the shims. A high degree of accuracy is required during adjusting to avoid repeated changing of the shims. The camshaft cams run concentrically on the valve tappets. At engine speeds of about 3,000 rpm this causes the tappets to rotate, and they in turn transfer the rotation to the valves. This valve rotation is required because it produces an even valve seating and prevents the valves from wearing in a certain position which could cause them to leak.

Positive Crankcase Ventilation System

The engine is equipped with a positive, closed-type crankcase ventilation system which recycles the crankcase vapors to the throttle body.

Engine Lubrication System

The engine lubrication system is of the force-feed type in which oil is supplied under full pressure to the crankshaft, connecting rod bearings and timing chain tensioners. The flow of oil to the valve tappets and valve train is controlled by a restricting orifice located in the head gaskets.

Oil Pump

The lubrication system is designed to provide optimum oil flow to critical components of the engine through its entire operating range.

The heart of the system is a positive displacement internal gear oil pump. Generically this design is known as a G-rotor pump.

- The oil pump is mounted on the front face of the cylinder block.
- The inner rotor is piloted on the crankshaft post and is driven through the crankshaft.

System pressure is limited by an integral, internally vented relief valve which directs the bypassed oil back to the inlet side of the oil pump.

- Oil pump displacement has been selected to provide adequate volume so there is correct oil pressure both at hot idle and maximum speed.
- Relief valve calibration protects the system from excessive pressure during high viscosity conditions, yet is designed to provide adequate connecting rod bearing lubrication under high temperature and high speed conditions.

Engine Cooling System

The engine is liquid-cooled:

- by a centrifugal water pump driven through the front engine accessory drive by the crankshaft.

A water thermostat is used to restrict coolant flow until the engine reaches normal operating temperature.

Oil Pan

The oil pan is cast aluminum and is attached to the cylinder block and transmission.

- The oil pan acts as a reservoir holding lubricating oil that is pumped through the engine by the oil pump after start up.

Drive Belt System

Accessories mounted on the front of the engine are belt-driven by the crankshaft and an automatically tensioned serpentine drive belt is routed over the following components:

- water pump
 - A/C compressor
 - generator
 - drive belt tensioner
 - drive belt idler pulley
 - crankshaft pulley
 - power steering pump pulley
 - cooling fan pump pulley
-

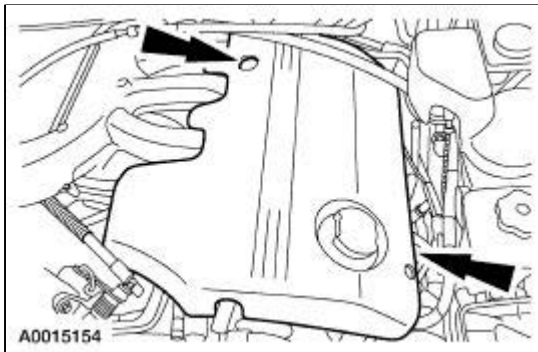
Engine

Refer to Section 303-00 .

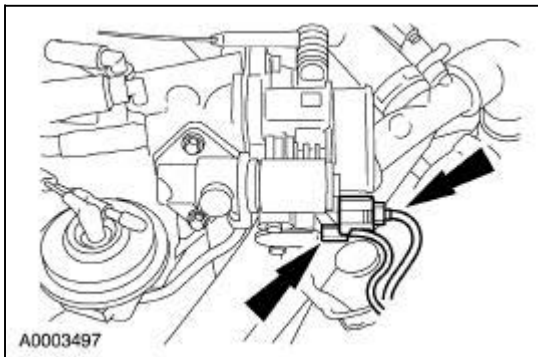
Intake Manifold —Upper

Removal

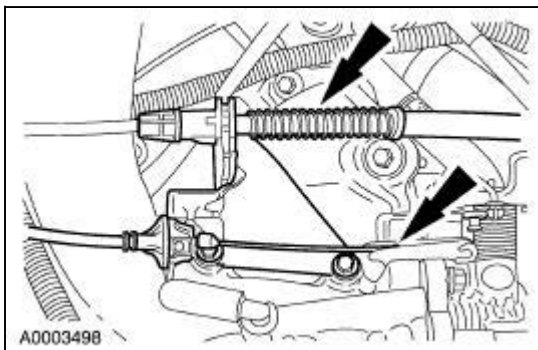
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01.
2. Drain the engine cooling system. For additional information, refer to [Section 303-03](#).
3. Remove the engine appearance cover.



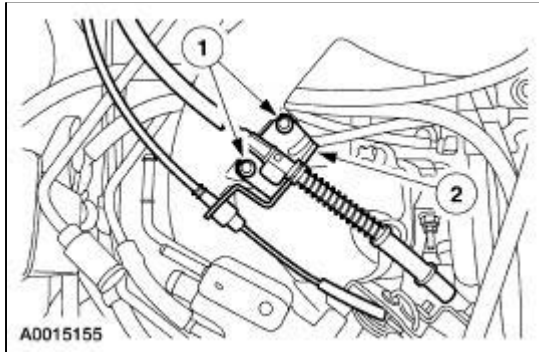
4. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
5. Disconnect the throttle position (TP) sensor and the idle air control (IAC) solenoid electrical connectors.



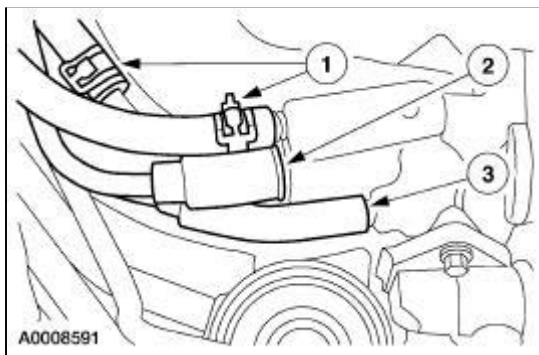
6. Disconnect the accelerator and speed control cables.



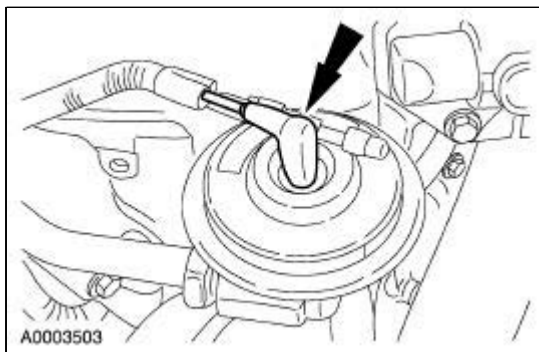
7. Remove the cable bracket.
 1. Remove the bolts.
 2. Remove the bracket.



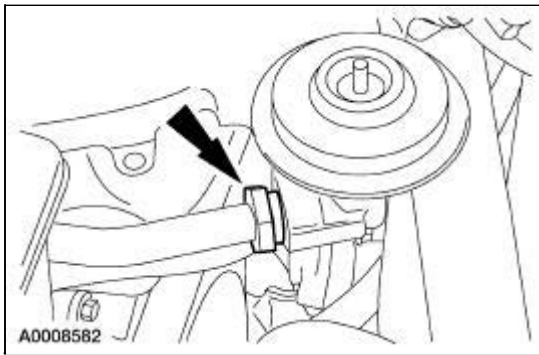
8. Disconnect the throttle body hoses.
 1. Disconnect the coolant hoses.
 2. Disconnect the positive crankcase ventilation (PCV) hose.
 3. Disconnect the vapor purge hose.



9. Disconnect the vacuum hose.

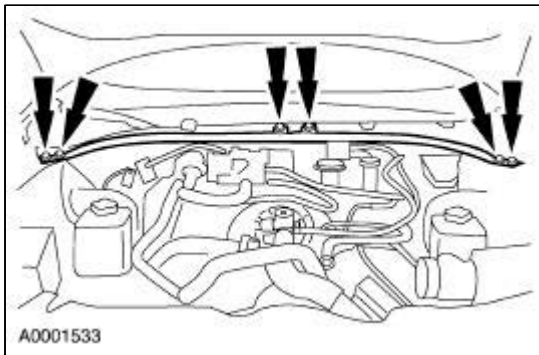


10. Disconnect the EGR to exhaust manifold tube nut.

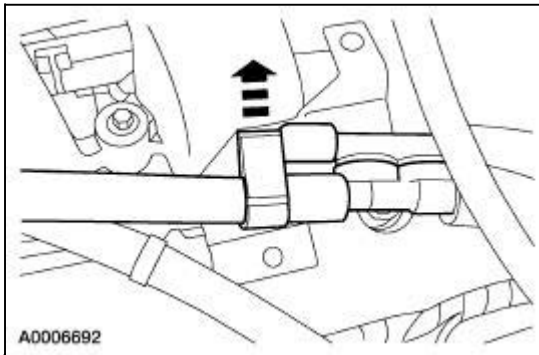


11. Remove the cowl vent screen. For additional information, refer to [Section 501-02](#).

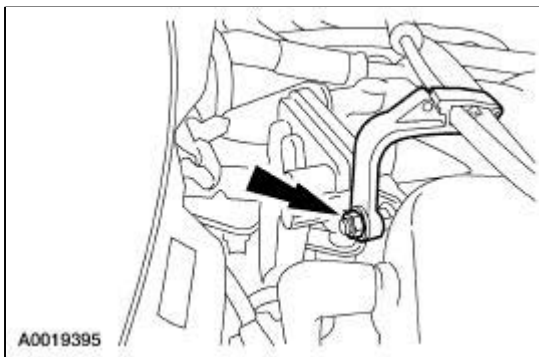
12. Remove the brace.



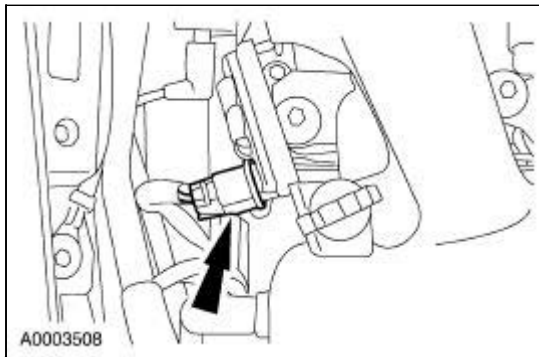
13. Remove the vacuum hoses from the mounting bracket.



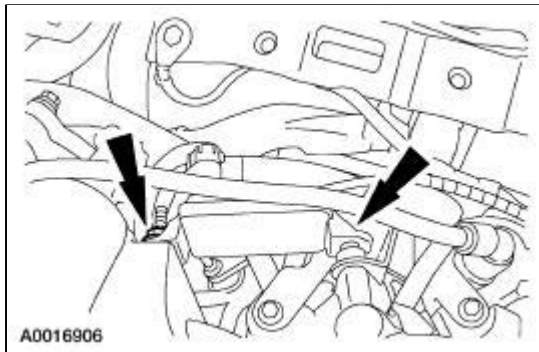
14. Remove the bracket and position the accelerator and cruise control cables aside.



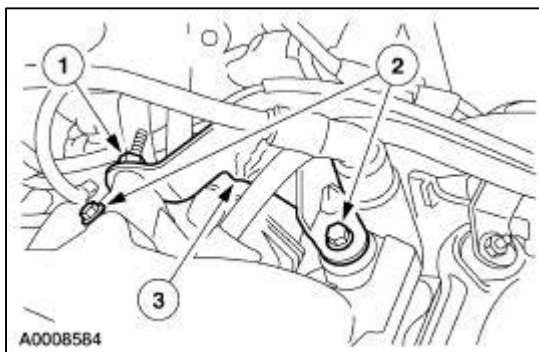
15. Disconnect the differential pressure feedback EGR electrical connector.



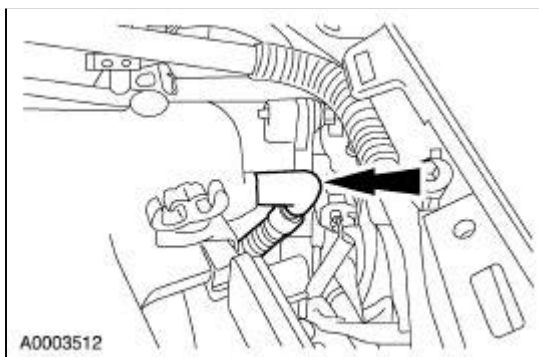
16. Remove the stud and nut and position the differential pressure feedback EGR transducer aside.



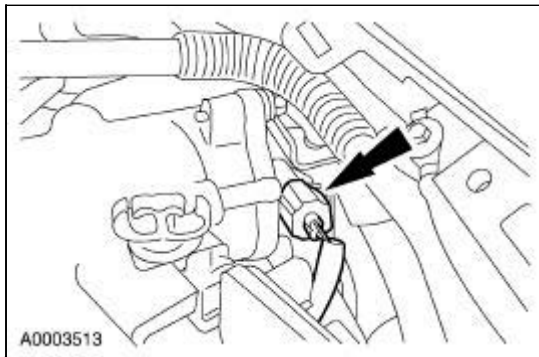
17. Remove the fuel pressure sensor shield.
 1. Remove the nut.
 2. Remove the bolts.
 3. Remove the shield.



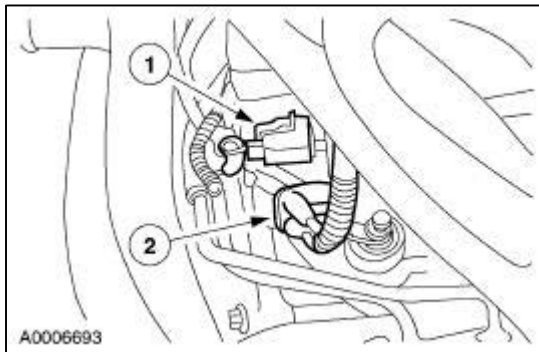
18. Disconnect the vacuum hose from the rear of the upper intake manifold.



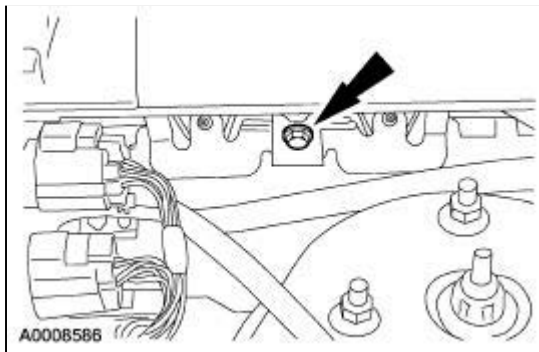
19. Disconnect the intake manifold tuning valve (IMTV) electrical connector.



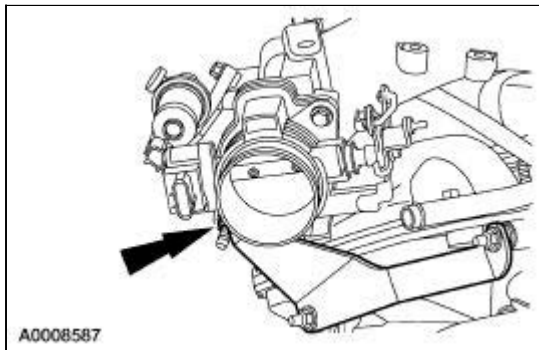
20. Disconnect the exhaust vacuum regulator (EVR).
 1. Disconnect the electrical connector.
 2. Disconnect the vacuum line.



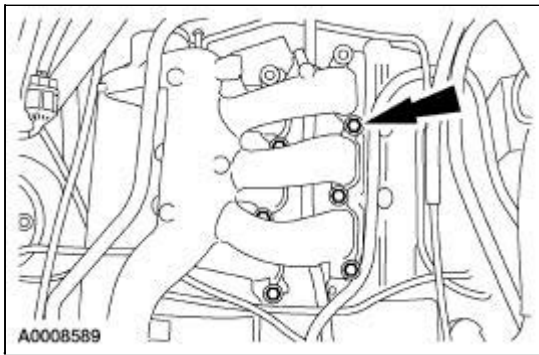
21. Remove the upper intake support bolt.



22. Remove the front intake manifold support bolt.

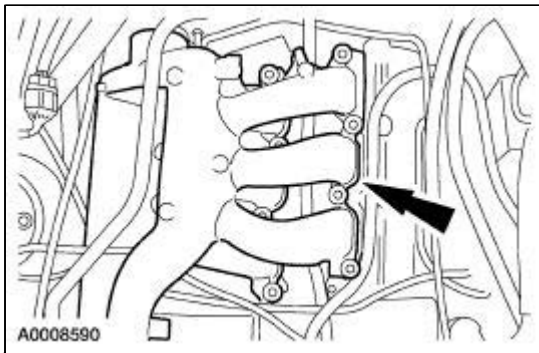


23. Remove the bolts and the upper intake manifold.
 - Inspect the gaskets and discard as necessary.

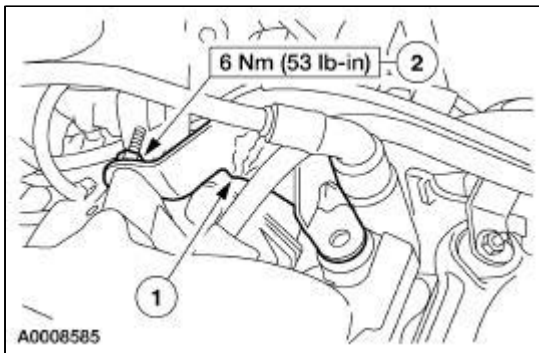


Installation

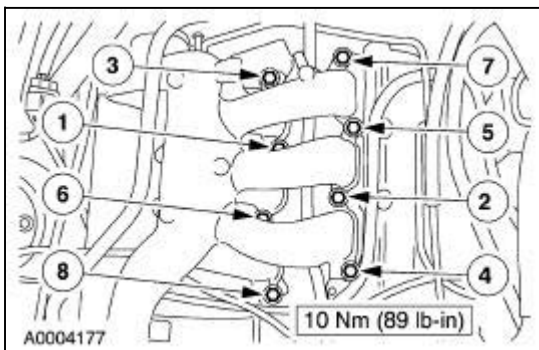
1. Position the upper intake manifold and gaskets.



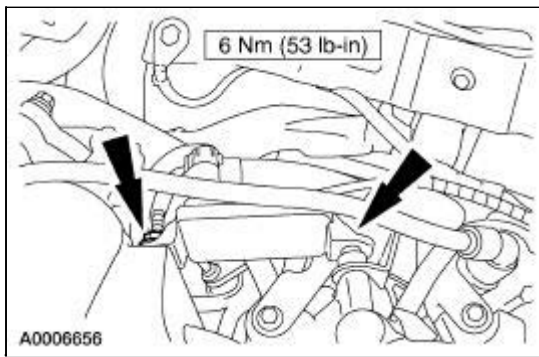
2. Install the fuel pressure sensor shield.
 1. Position the shield.
 2. Install the nut.



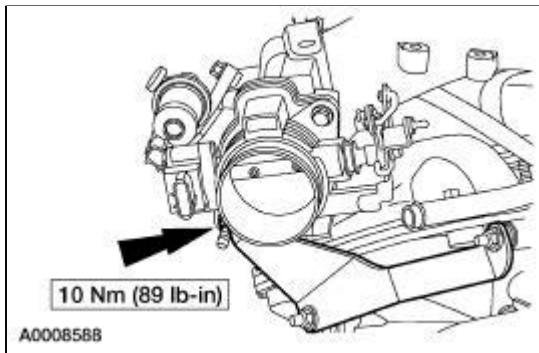
3. Install the upper intake manifold bolts and tighten in the sequence shown.



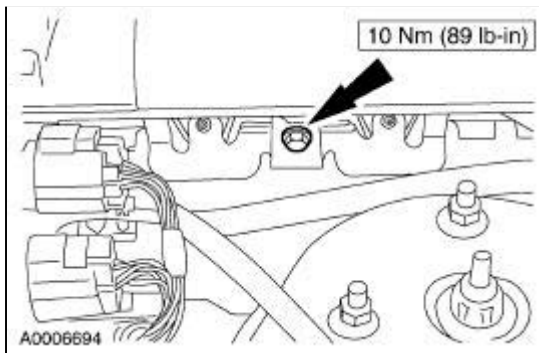
4. Position the differential pressure feedback EGR and install the nut and stud.



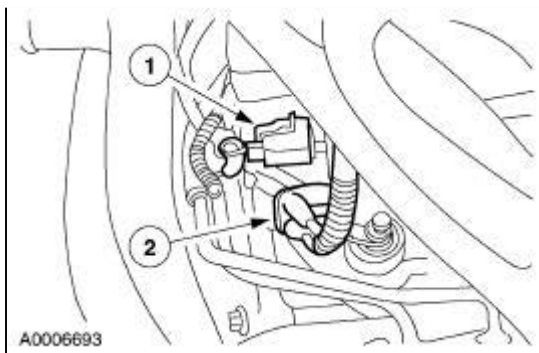
5. Install the upper intake manifold support bolt.



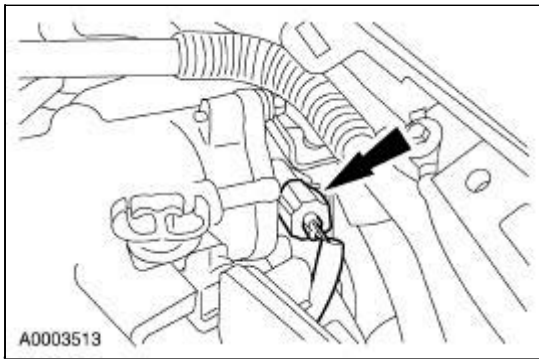
6. Install the upper intake support bolt.



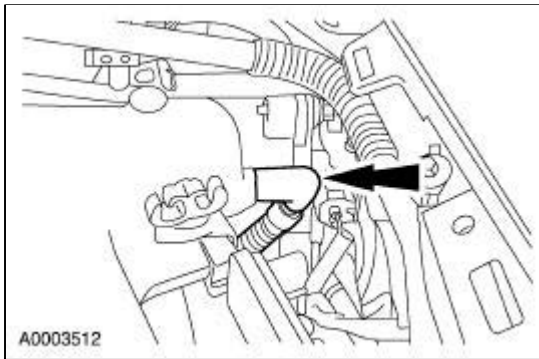
7. Connect the exhaust vacuum regulator (EVR).
 1. Connect the electrical connector.
 2. Connect the vacuum line.



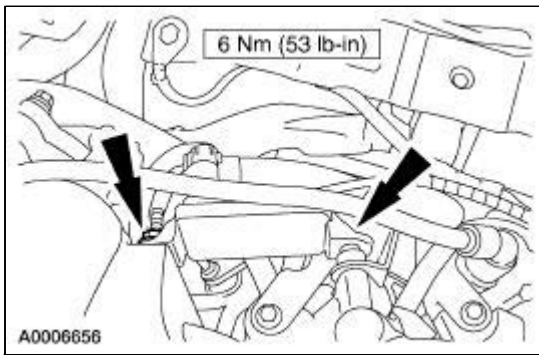
8. Connect the intake manifold tuning valve (IMTV) electrical connector.



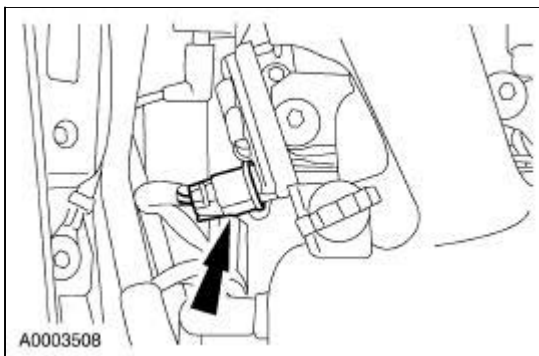
9. Connect the vacuum hose to the rear of the upper intake manifold.



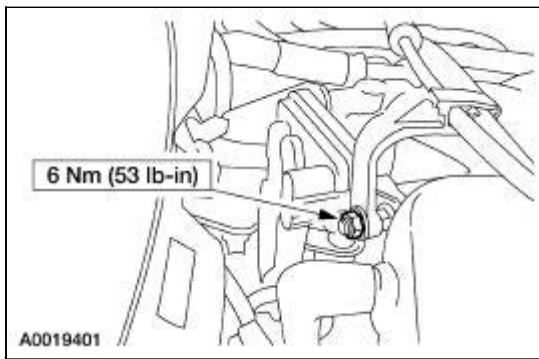
10. Position the differential pressure feedback EGR electrical connector.



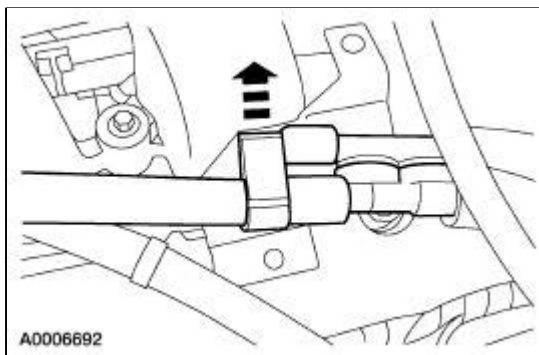
11. Connect the differential pressure feedback EGR electrical connector.



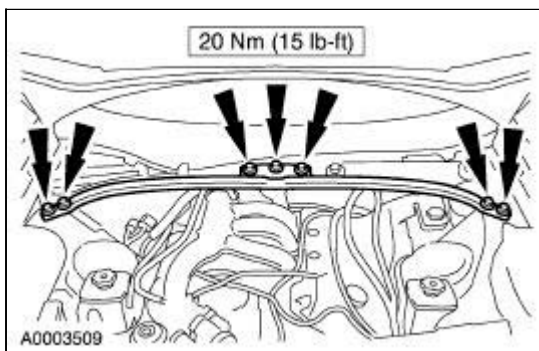
12. Position the accelerator and cruise control cables and install the bracket.



13. Clip the vacuum hoses into the mounting bracket.

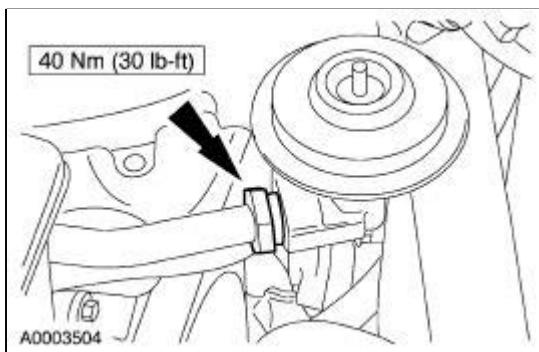


14. Install the brace.

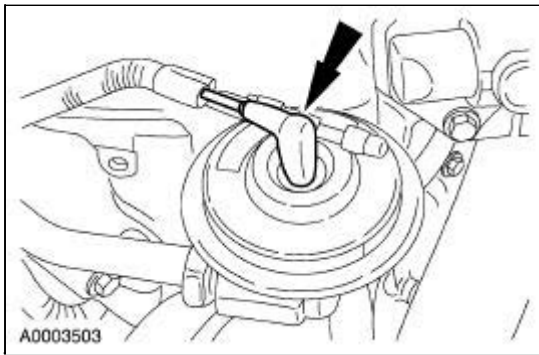


15. Install the cowl vent screen. Refer to [Section 501-02](#).

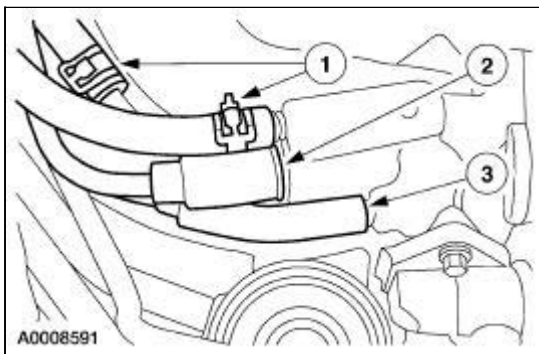
16. Connect the EGR to exhaust manifold tube nut.



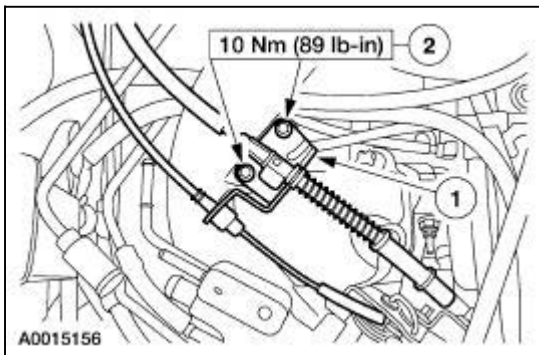
17. Connect the vacuum hose.



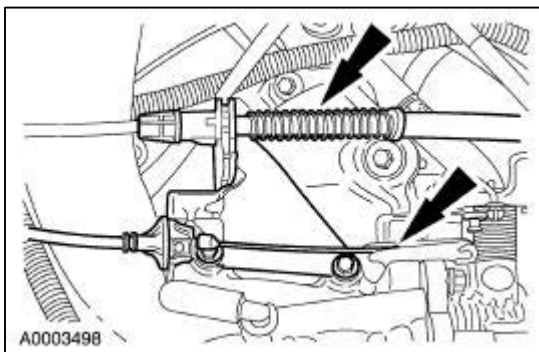
18. Connect the throttle body hoses.
1. Connect the coolant hoses.
 2. Connect the PCV hose.
 3. Connect the vapor purge hose.



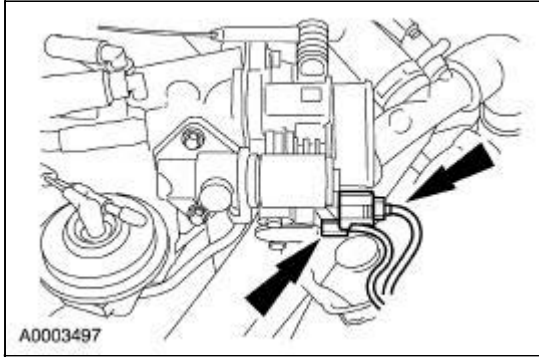
19. Install the cable bracket.
1. Position the bracket.
 2. Install the bolts.



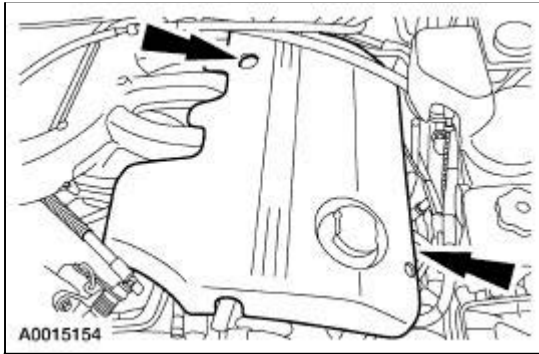
20. Connect the accelerator and speed control cables.



21. Connect the TP sensor and the IAC solenoid electrical connectors.



22. Install the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
23. Install the engine appearance cover.

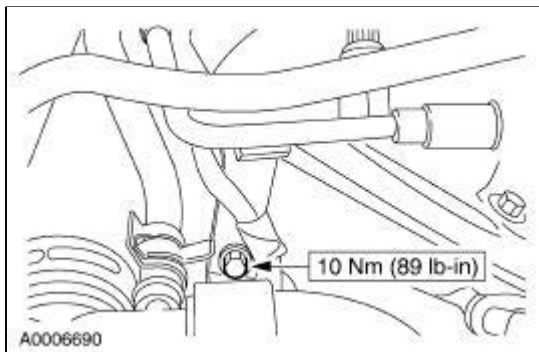


24. Fill the engine cooling system. For additional information, refer to [Section 303-03](#).
 25. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
-

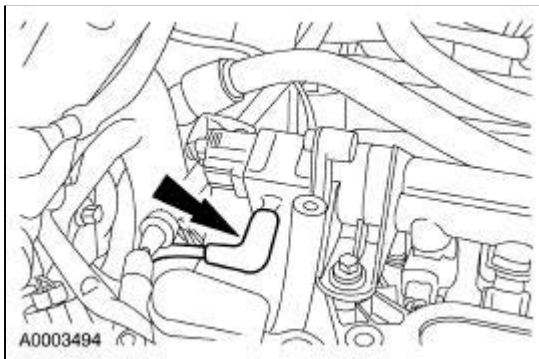
Intake Manifold —Lower

Removal

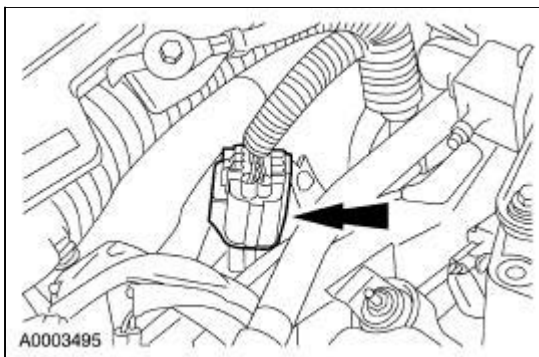
1. Remove the upper intake manifold. Refer to [Intake Manifold—Upper](#).
2. Disconnect the fuel line. For additional information, refer to [Section 310-00](#).
3. Remove the fuel line bracket bolt.



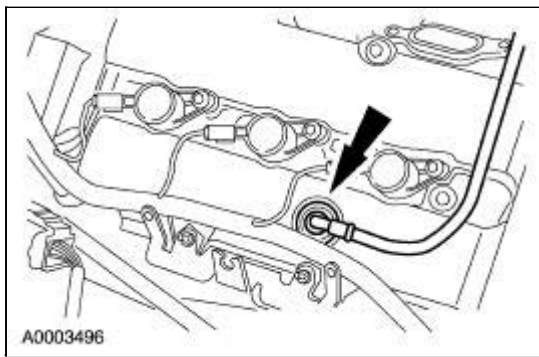
4. Disconnect the fuel pressure sensor vacuum line.



5. Disconnect the fuel charging wiring harness connector.

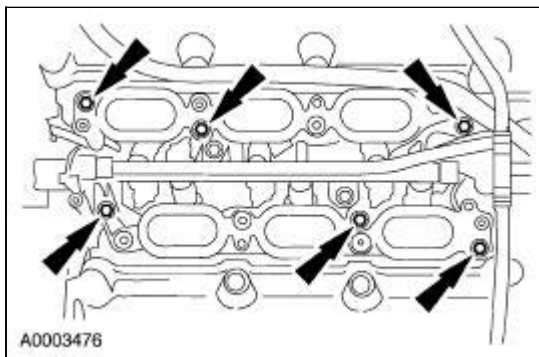


6. Disconnect the crankcase ventilation tube and position out of the way.

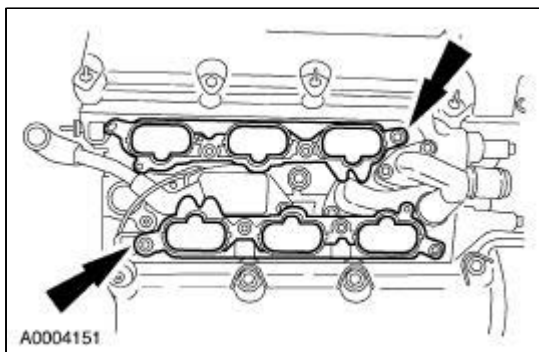


7.  **CAUTION:** Lower intake manifold and fuel injection supply manifold must be removed as an assembly.

Remove the bolts and the lower intake manifold.

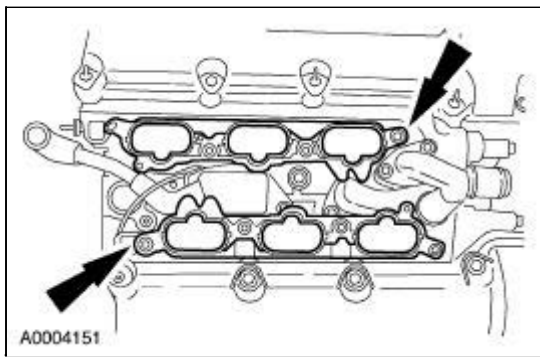


8. Remove the lower intake manifold gaskets.
- Inspect the gaskets and install new gaskets if necessary.

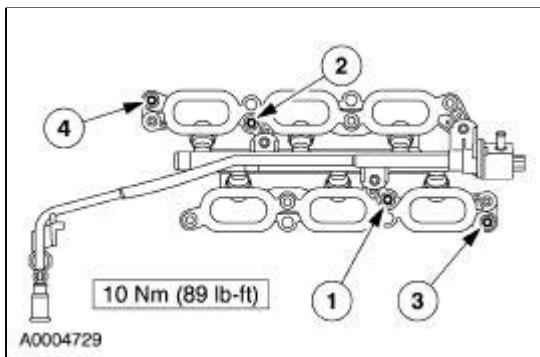


Installation

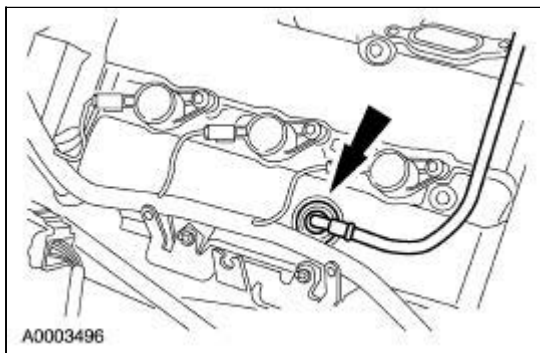
1. Position the lower intake manifold gaskets.



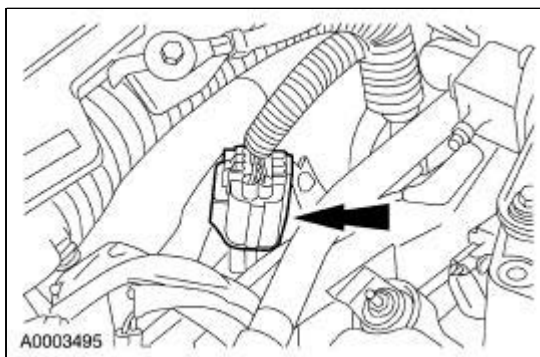
2. Position the lower intake manifold and install the bolts in the sequence shown.



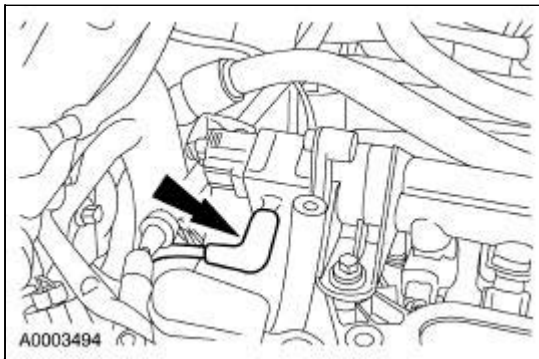
3. Connect the crankcase ventilation tube.



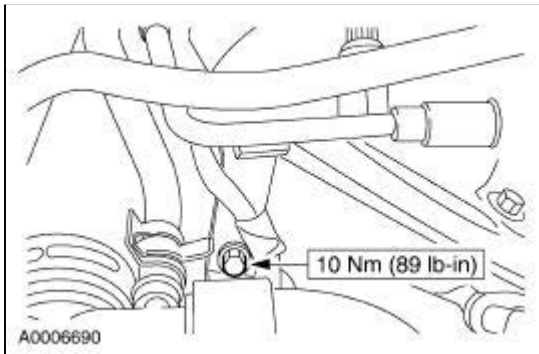
4. Connect the fuel charging wiring harness connector.



5. Connect the fuel pressure sensor vacuum line.



6. Install the fuel line bracket bolt.

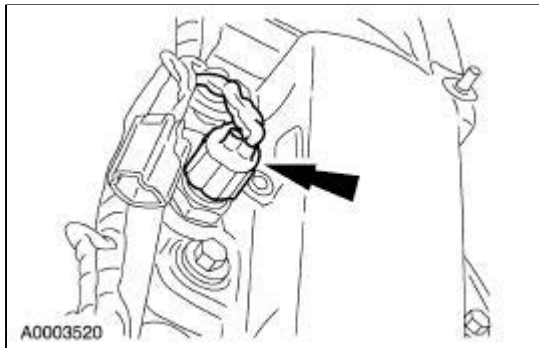


7. Connect the fuel line. For additional information, refer to [Section 310-00](#).
 8. Install the upper intake manifold. For additional information, refer to [Intake Manifold—Upper](#).
-

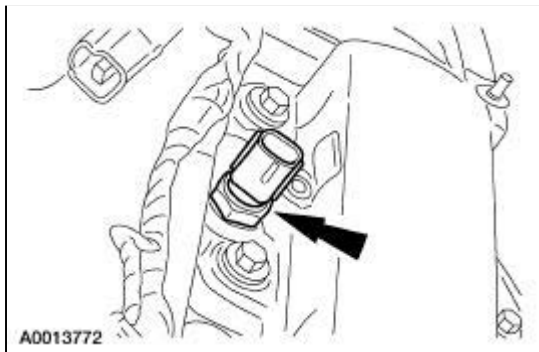
Valve Cover —LH

Removal

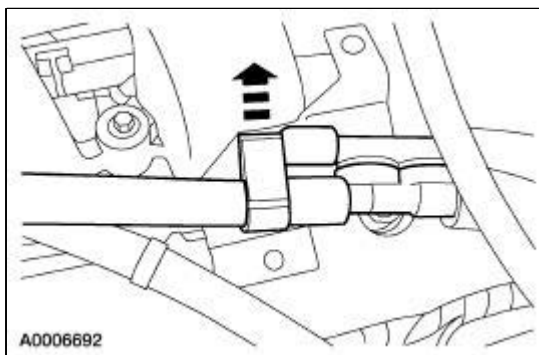
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the LH ignition coils. For additional information, refer to [Section 303-07A](#).
3. Disconnect the cylinder head temperature (CHT) electrical connector.



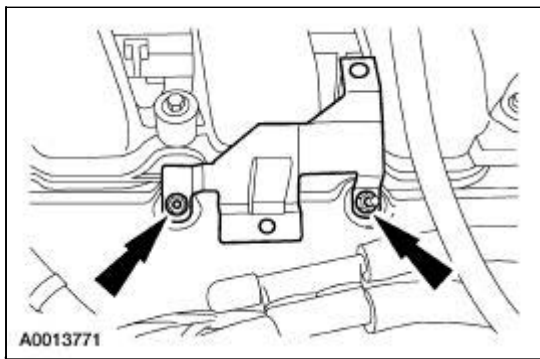
4. Remove the CHT sensor.



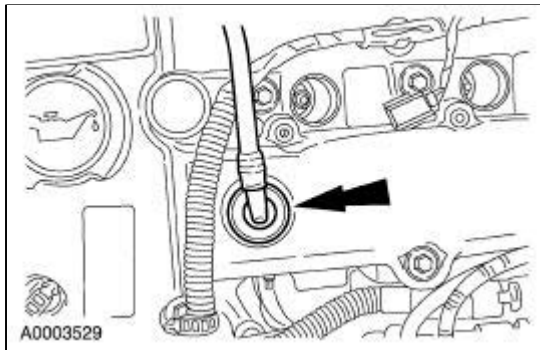
5. Remove the vacuum hoses from the appearance cover support bracket.



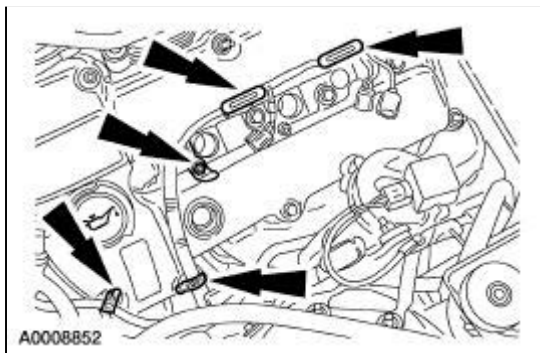
6. Remove the nuts and the appearance cover support bracket.



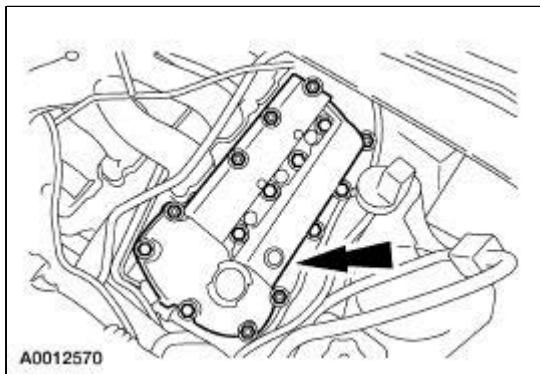
7. Disconnect the positive crankcase ventilation (PCV) tube and position aside.



8. Remove the ignition coil wiring harness from the retainers.



9. Remove the studs, bolts, and the valve cover.
 - Discard the gasket.

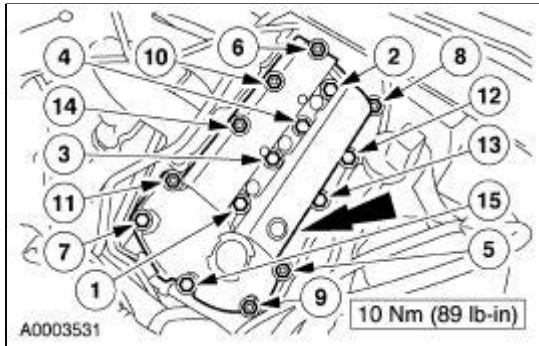


Installation

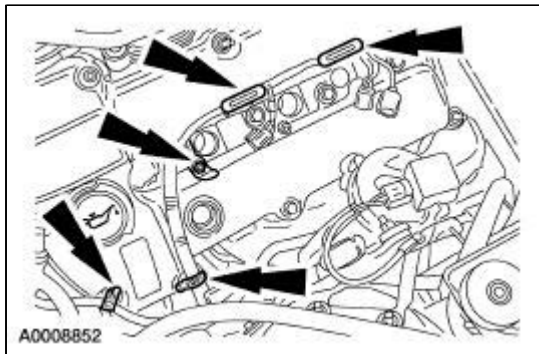
1. **NOTE:** Apply a 5 mm (0.2 in) bead of Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323 to the front cover joints.

Install a new gasket.

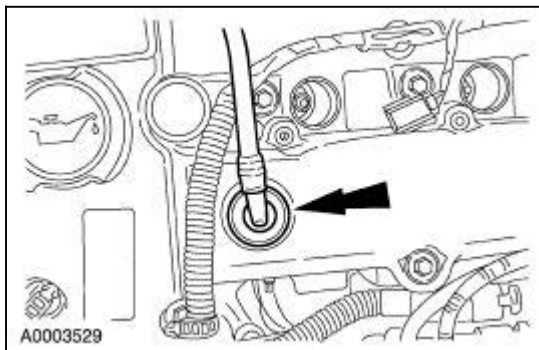
2. Position the valve cover and install the bolts and studs in the sequence shown.



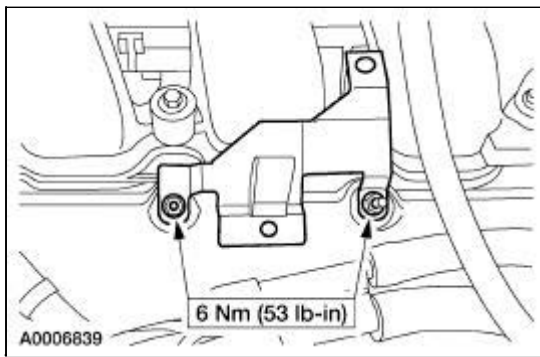
3. Install the ignition coil wiring harness onto the retainers.



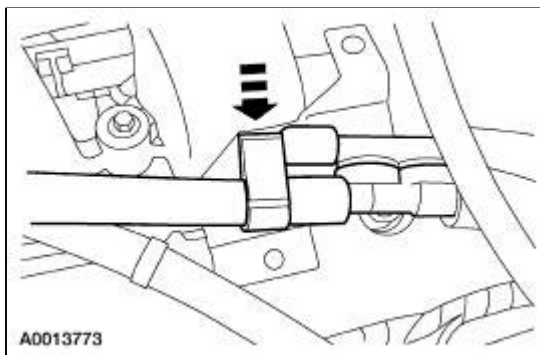
4. Connect the PCV tube.



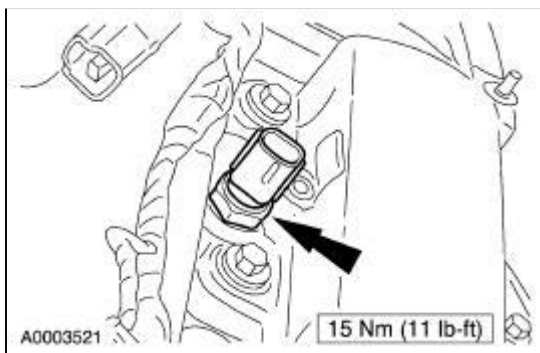
5. Install the appearance cover support bracket.



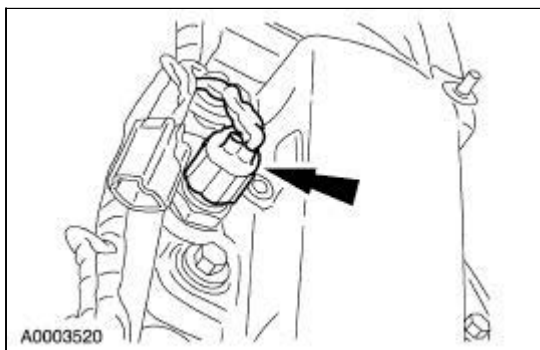
6. Install the vacuum hoses to the appearance cover support bracket.



7. Install the CHT sensor.



8. Connect the CHT electrical connector.

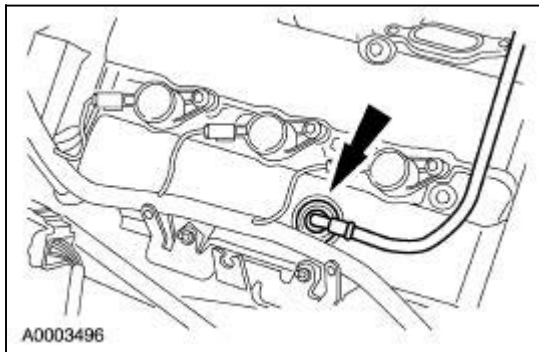


9. Install the LH ignition coils. For additional information, refer to [Section 303-07A](#).
-

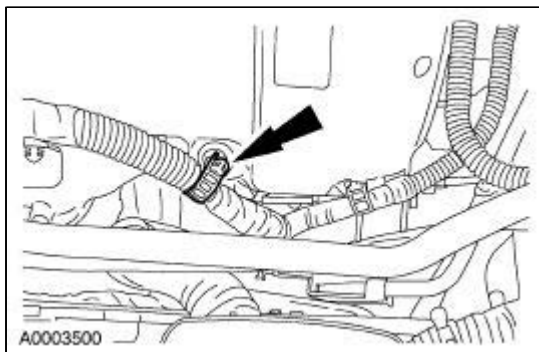
Valve Cover —RH

Removal

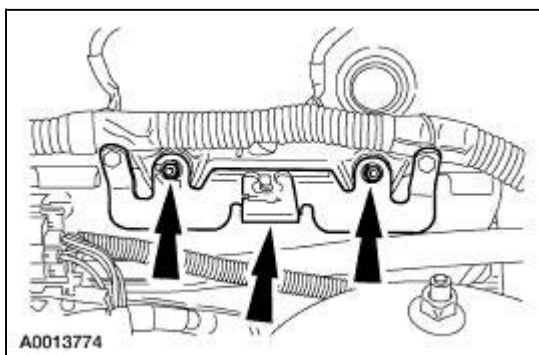
1. Disconnect the positive crankcase ventilation (PCV) tube and position aside.



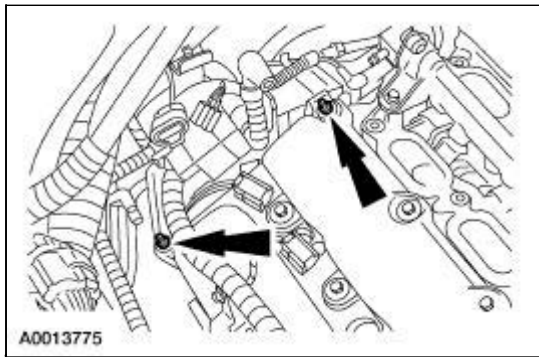
2. Remove the RH ignition coils. For additional information, refer to [Section 303-07A](#).
3. Remove the wiring harness retainer from the stud.



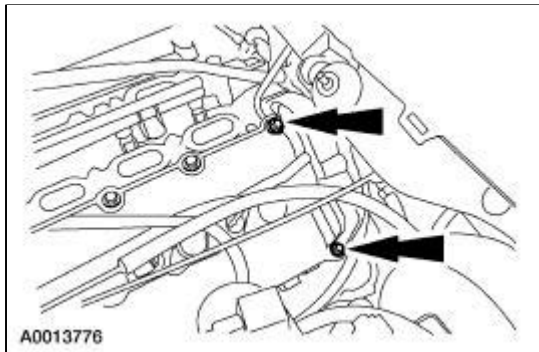
4. Remove the nuts and position the upper intake manifold support bracket aside.



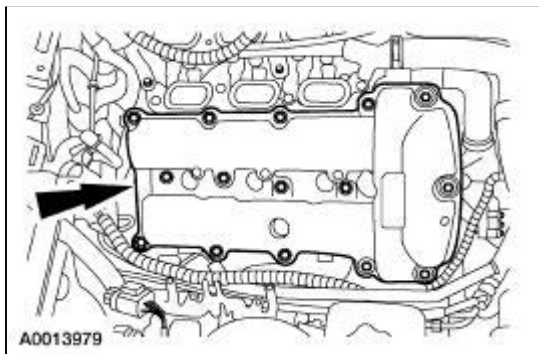
5. Remove the wiring harness bracket nuts.



6. Remove the wiring harness bracket nuts and position the wiring harness aside.



7. Remove the studs, bolts, and the valve cover.
 - Discard the gasket.

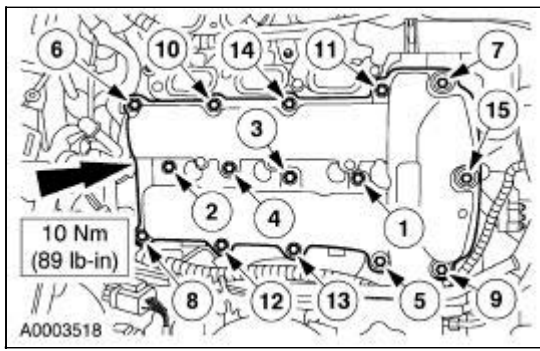


Installation

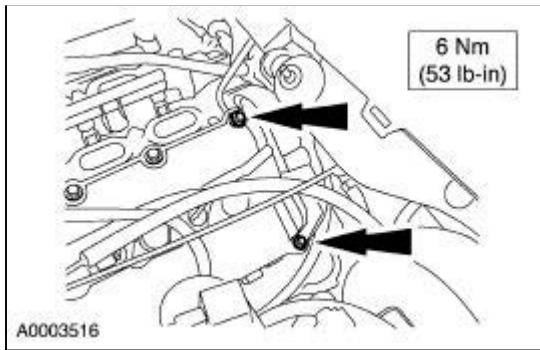
1. **NOTE:** Apply a 5 mm (0.2 in) bead of Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4 to the front cover joints.

Install a new gasket.

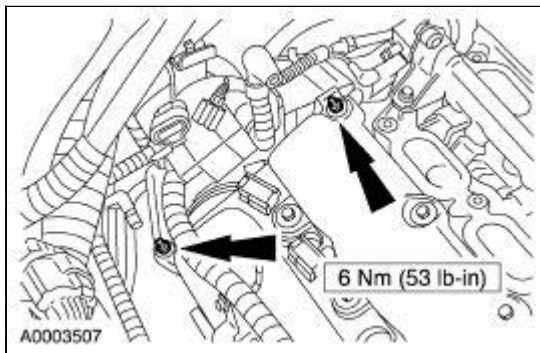
2. Position the valve cover and install the bolts and studs in the sequence shown.



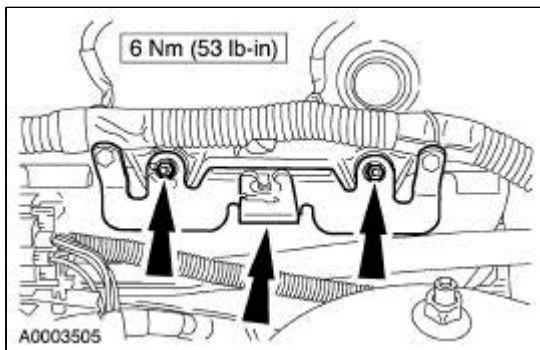
3. Install the wiring harness bracket and nuts.



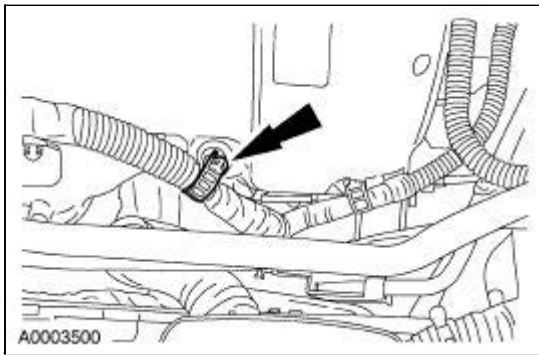
4. Install the wiring harness bracket nuts.



5. Install the upper intake manifold support bracket.

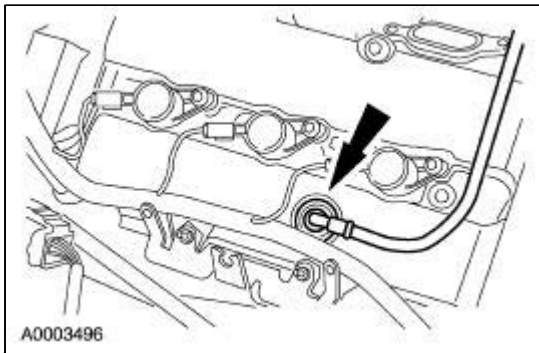


6. Install the wiring harness retainer onto the stud.



7. Install the RH ignition coils. For additional information, refer to [Section 303-07A](#).

8. Connect the PCV tube.



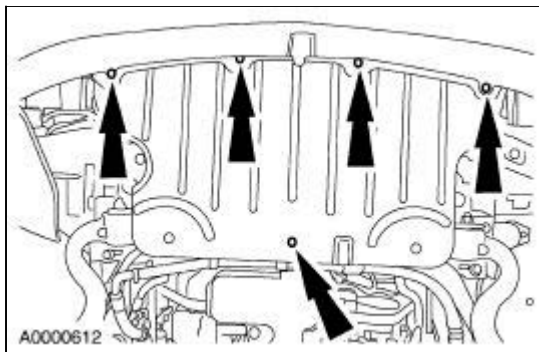
Crankshaft Pulley

Special Tool(s)

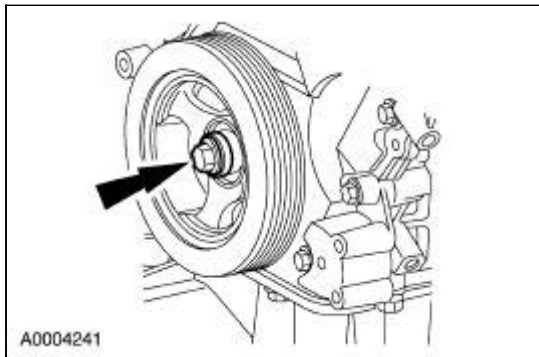
 ST1287-A	Crankshaft Damper Replacer 303-102 (T74P-6316-B)
 ST1184-A	Crankshaft Damper Remover 303-D121
 ST1438-A	Strap Wrench 303-D055 (D85L-6000-A)


Removal

1. Remove the accessory drive belt. For additional information, refer to [Section 303-05](#).
2. If equipped, remove the secondary air valve, bracket and tube. For additional information, refer to [Section 303-08](#).
3. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
4. Remove the front center splash panel.

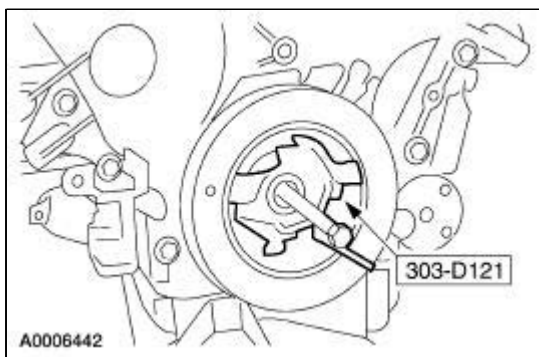


5. Remove the crankshaft pulley bolt and washer.
 - Discard the bolt.



6.  **CAUTION:** The special tool must grab the inside of the damper, or damage to the damper may occur.

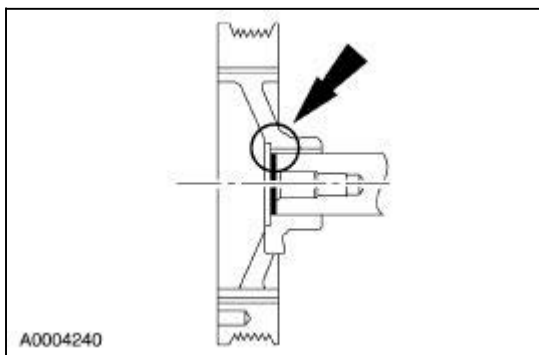
Using the special tool, remove the crankshaft damper.



Installation

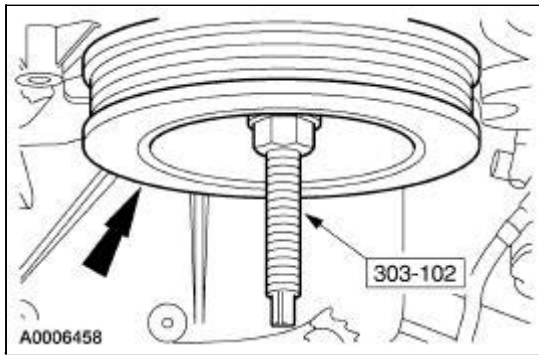
1. **NOTE:** Seal surface must be free of dirt and oil.

Apply Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSK-M2G343-A4, to the end of the keyway slot.



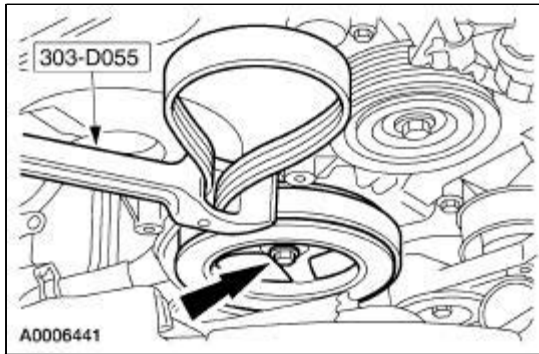
2. **NOTE:** Lubricate the outside diameter sealing surface of the crankshaft pulley with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H.

Using the special tool, install the crankshaft pulley assembly.

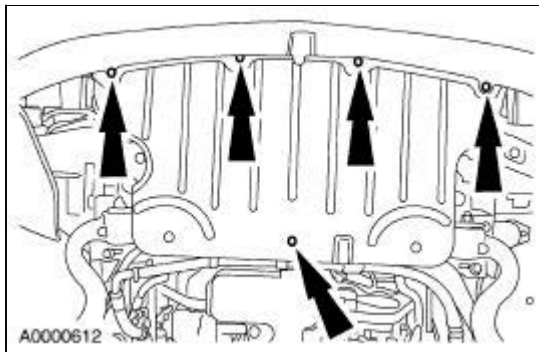


3. Using the special tool, install a new bolt and the washer.

- Tighten the bolt in four stages.
- Stage 1: Tighten to 120 Nm (89 lb-ft).
- Stage 2: Loosen one full turn (360 degrees).
- Stage 3: Tighten to 50 Nm (37 lb-ft).
- Stage 4: Tighten an additional 90 degrees.



4. Install the front center splash panel.



5. Lower the vehicle.

6. If equipped, install the secondary air valve, bracket and tube. For additional information, refer to [Section 303-08](#).

7. Install the accessory drive belt. For additional information, refer to [Section 303-05](#).

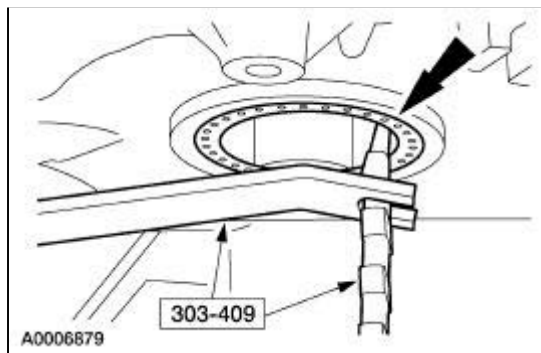
Crankshaft Front Oil Seal

Special Tool(s)

 <p>ST1385-A</p>	Seal Remover 303-409 (T92C-6700-CH)
 <p>ST1328-A</p>	Front Crankshaft Seal Installer 303-335

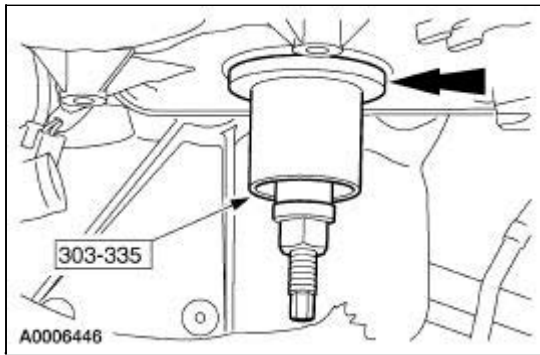
Removal

1. Remove the crankshaft pulley. For additional information, refer to [Crankshaft Pulley](#) in this section.
2. Using the special tool, remove the crankshaft front oil seal.



Installation

1. Lubricate the inside diameter of the seal with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H.
2. Using the special tool, install the crankshaft front oil seal.

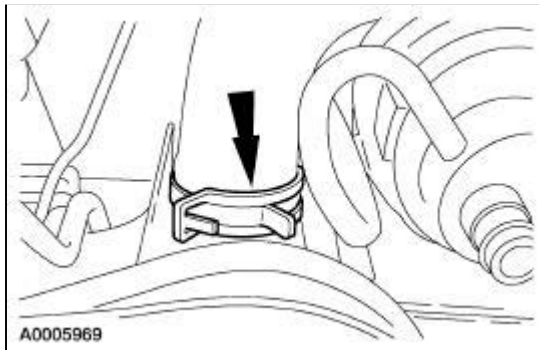


3. Install the crankshaft pulley. For additional information, refer to [Crankshaft Pulley](#) in this section.
-

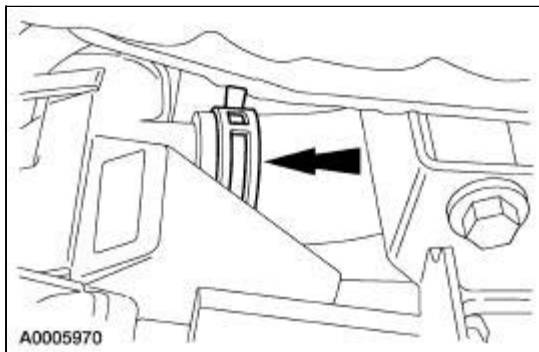
Engine Front Cover

Removal

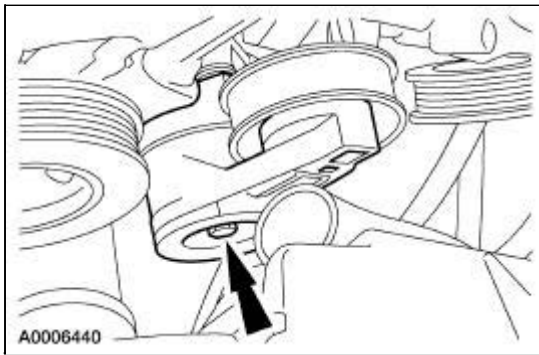
1. Remove the RH valve cover. For additional information, refer to [Valve Cover—RH](#) in this section.
2. Remove the LH valve cover. For additional information, refer to [Valve Cover—LH](#) in this section.
3. Remove the belt idler pulley. For additional information, refer to [Section 303-05](#).
4. Remove the water pump. For additional information, refer to [Section 303-03](#).
5. Disconnect the upper hose from the radiator.



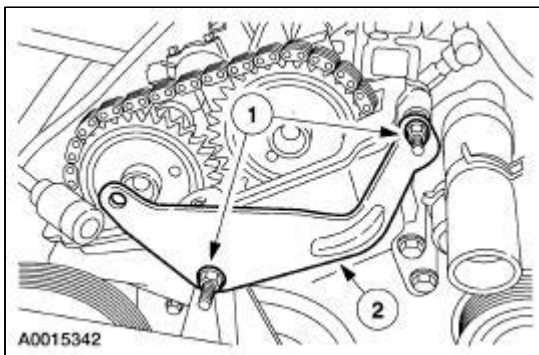
6. Disconnect the lower hose from the radiator.



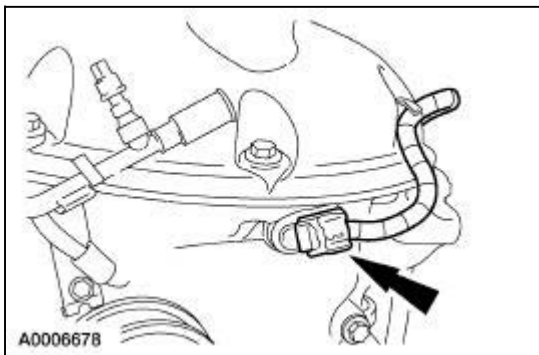
7. Remove the oil pan. For additional information, refer to [Oil Pan](#) in this section.
8. Remove the power steering pump. For additional information, refer to [Section 211-02](#).
9. Remove the hydraulic cooling fan pump. For additional information, refer to [Section 303-03](#).
10. Remove the bolt and the belt tensioner.



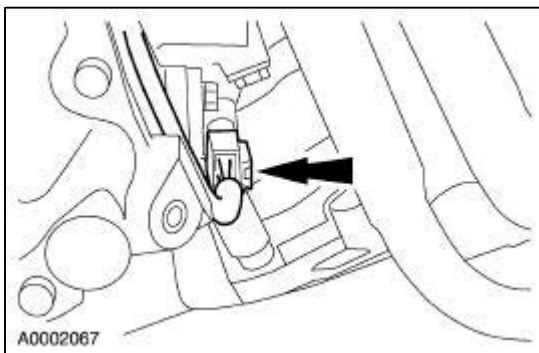
11. Remove the crankshaft front oil seal. For additional information, refer to [Crankshaft Front Oil Seal](#) in this section.
12. Remove the bracket.



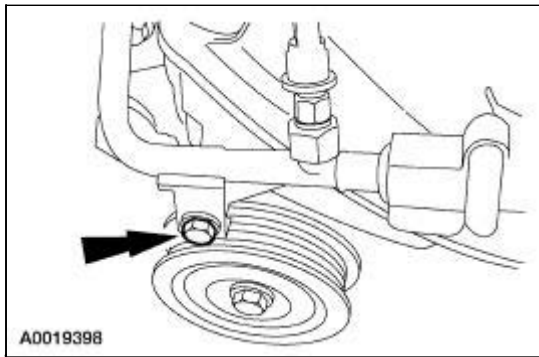
13. Disconnect the camshaft position (CMP) sensor electrical connector.



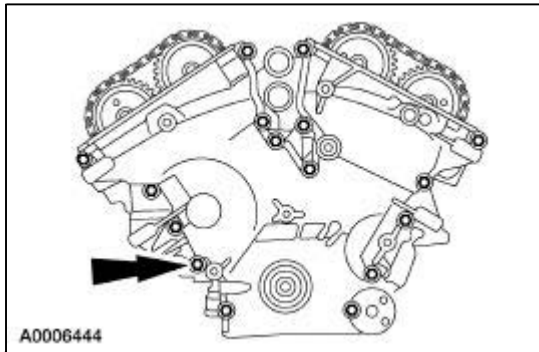
14. Disconnect the crankshaft position (CKP) sensor electrical connector.



15. Remove the fuel supply manifold bolt.



16. Remove the bolts and the engine front cover.
 - Discard the gasket.

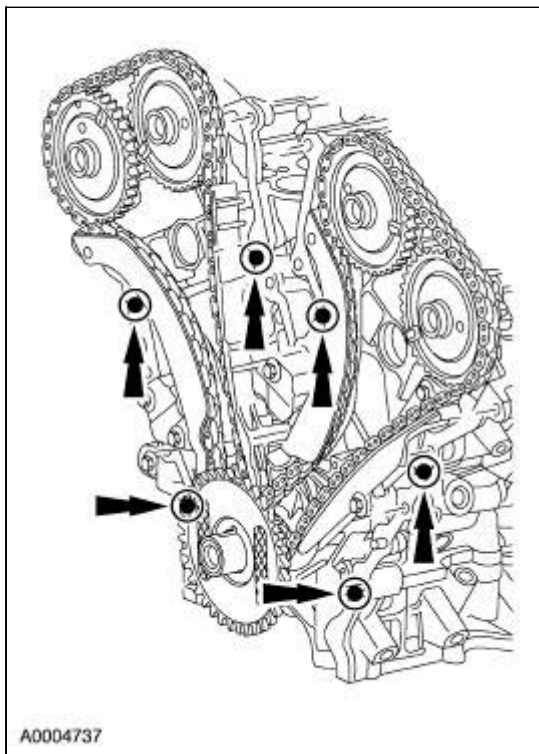


Installation

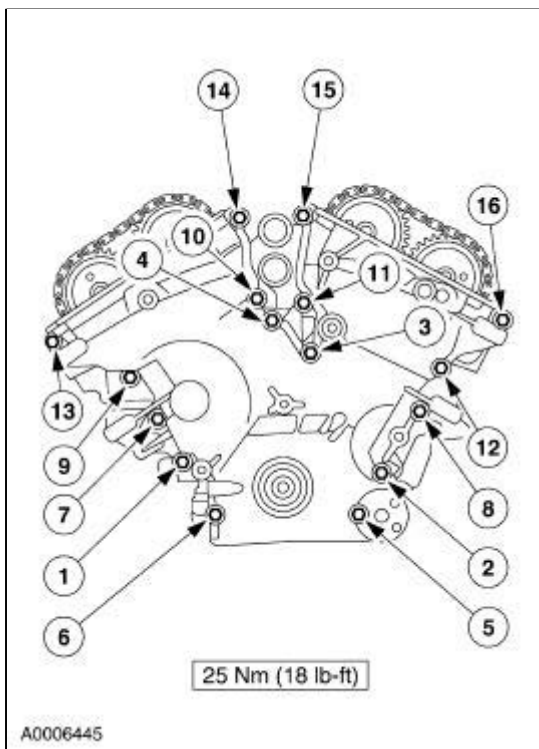
1. Clean the sealing surfaces on the engine and the front cover.
2. **NOTE:** Install the engine front cover within six minutes of sealer application.

Apply a 6 mm (0.24 in) diameter dot of Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4 to the areas indicated.

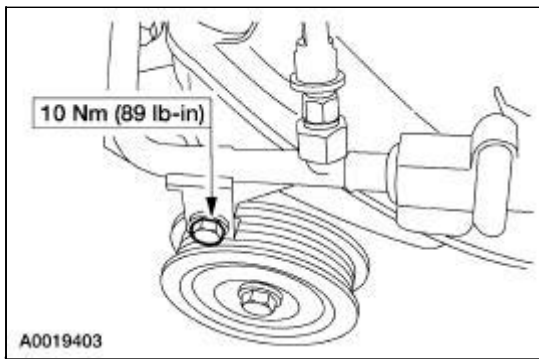
- Install a new gasket.



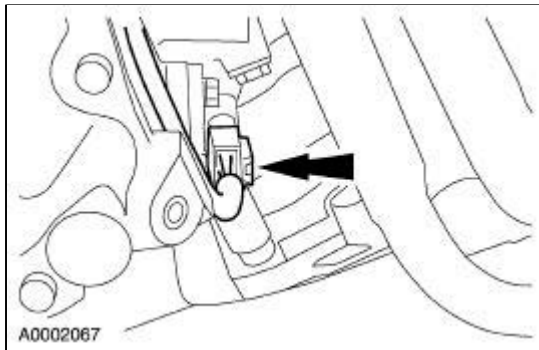
3. Position the front cover and tighten the bolts in the sequence shown.



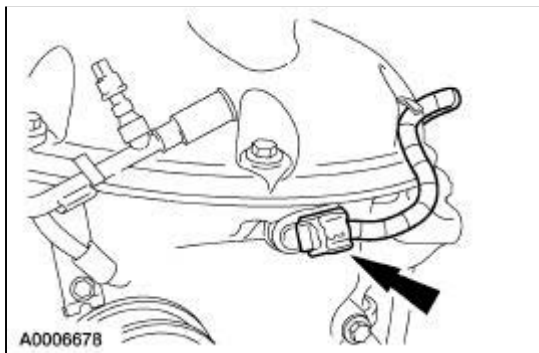
4. Install the fuel supply manifold bolt.



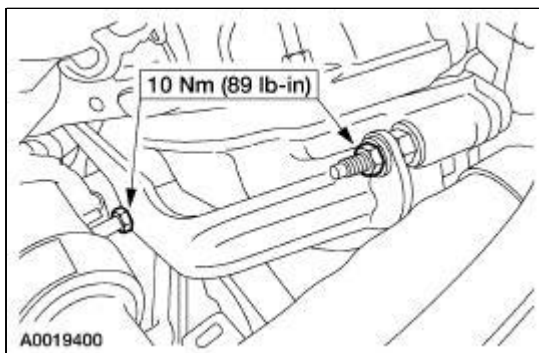
5. Connect the CKP sensor electrical connector.



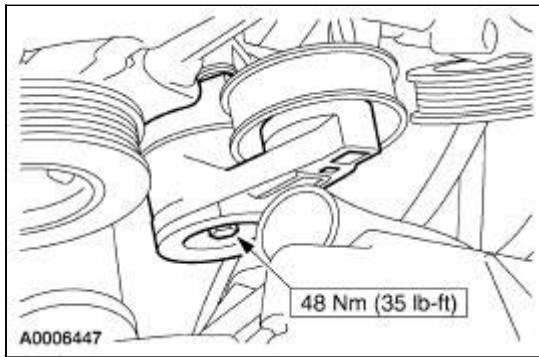
6. Connect the CMP sensor electrical connector.



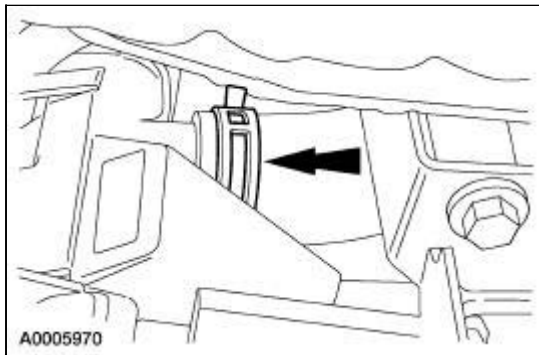
7. Install the bracket.



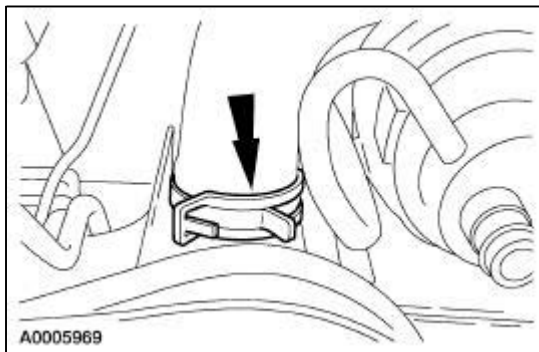
8. Install the crankshaft front oil seal. For additional information, refer to [Crankshaft Front Oil Seal](#) in this section.
9. Position the belt tensioner and install the bolt.



10. Install the hydraulic cooling fan pump. For additional information, refer to [Section 303-03](#).
11. Install the power steering pump. For additional information, refer to [Section 211-02](#).
12. Install the oil pan. For additional information, refer to [Oil Pan](#) in this section.
13. Connect the lower hose to the radiator.



14. Connect the upper hose to the radiator.

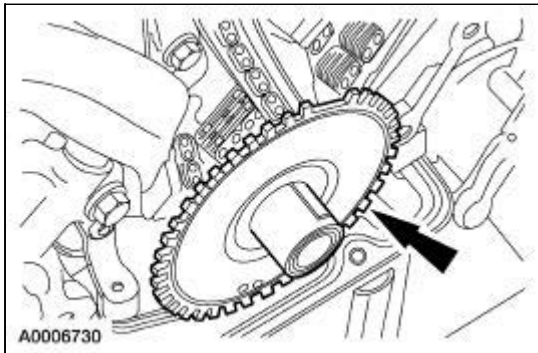


15. Install the water pump. For additional information, refer to [Section 303-03](#).
16. Install the belt idler pulley. For additional information, refer to [Section 303-05](#).
17. Install the LH valve cover. For additional information, refer to [Valve Cover—LH](#) in this section.
18. Install the RH valve cover. For additional information, refer to [Valve Cover—RH](#) in this section.
19. Fill the cooling system. For additional information, refer to [Section 303-03](#).

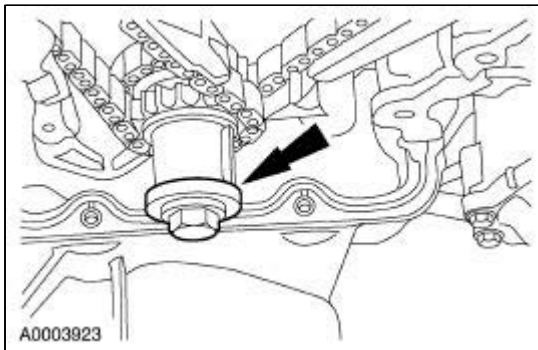
Timing Drive Components


Removal

1. Remove the engine front cover. For additional information, refer to [Engine Front Cover](#) in this section.
2. Remove the ignition pulse ring.

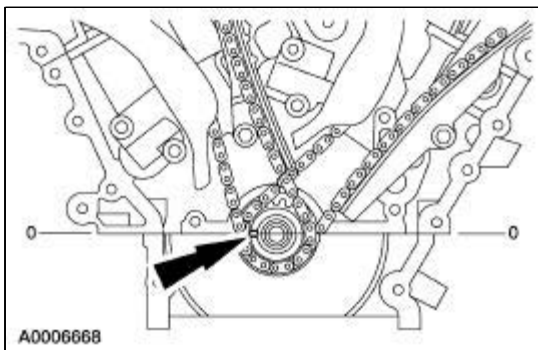



3. Reinstall the crankshaft damper bolt and washer.



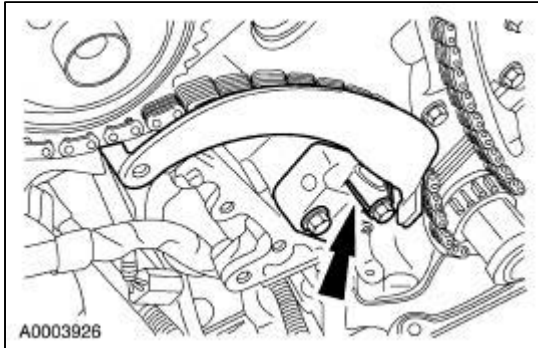
4.  **CAUTION:** Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

Rotate the crankshaft clockwise to position the crankshaft keyway to the nine o'clock position.

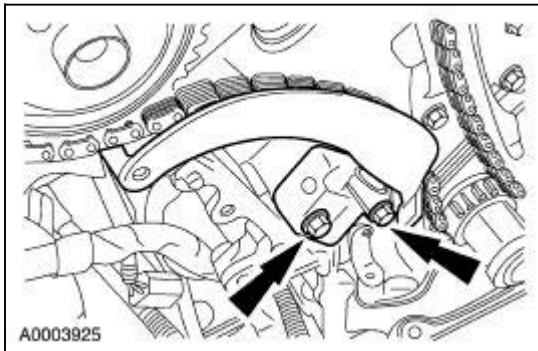


5.  **CAUTION:** If the RH timing chain tensioner arm and RH chain guide are to be reused, mark the position of each piece to make sure that they are installed on the correct side when reassembled.

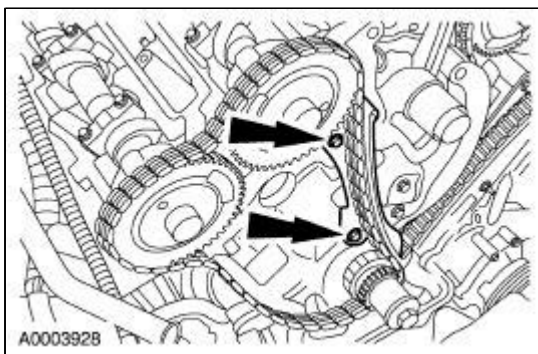
Install a stiff wire or paper clip into the RH timing chain tensioner before removing the bolts.



6. Remove the bolts, the timing chain tensioner and the tensioner arm.

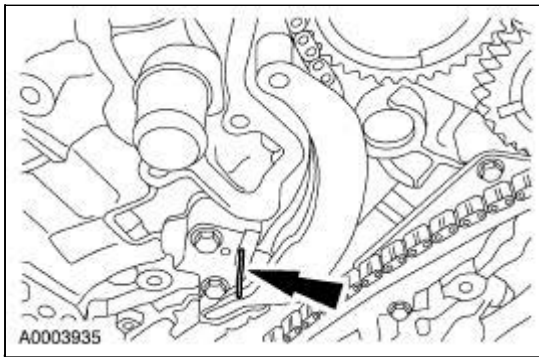


7. Remove the RH timing chain.
8. Remove the bolts and the RH timing chain guide.

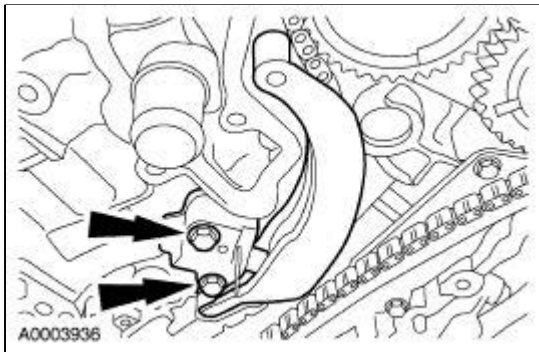


9.  **CAUTION:** If the LH timing chain tensioner arm and the LH chain guide are to be reused, mark the position of each piece to make sure that they are installed on the correct side when reassembled.

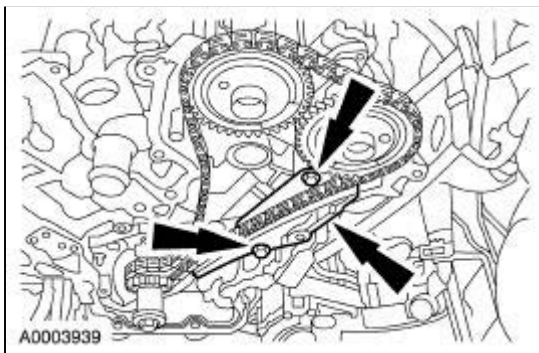
Install a stiff wire or paper clip into the LH timing chain tensioner.



10. Remove the bolts, the timing chain tensioner and the tensioner arm.




11. Remove the bolts and LH chain guide.

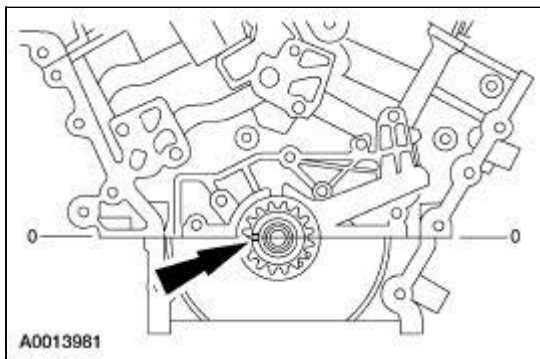



12. Remove the LH timing chain.

Installation

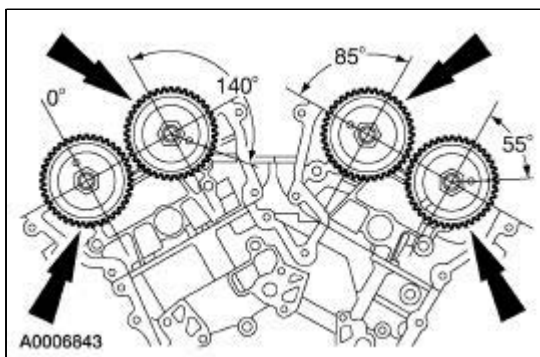
1.  **CAUTION:** Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

Verify that the crankshaft keyway is in the nine o'clock position.

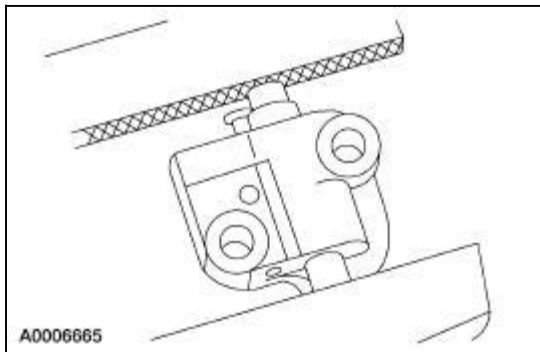


2.  **CAUTION:** The crankshaft keyway must remain in the nine o'clock position until the cams are located, or damage to the valves may occur.

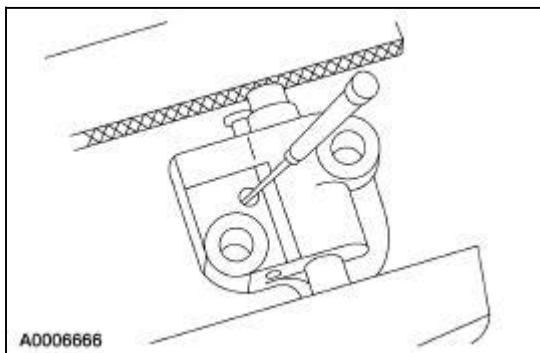
Rotate the LH and RH intake and exhaust camshafts to locate them in their neutral positions.



3. Position the LH chain tensioner in a soft-jawed vise.



4. Hold the chain LH tensioner ratchet lock mechanism away from the ratchet stem with a small pick.

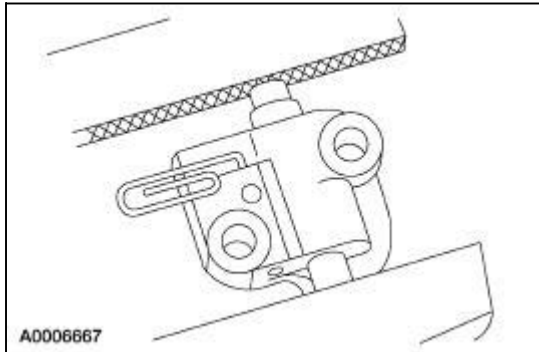


5.  **CAUTION:** During tensioner compression, do not release the ratchet stem until the tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

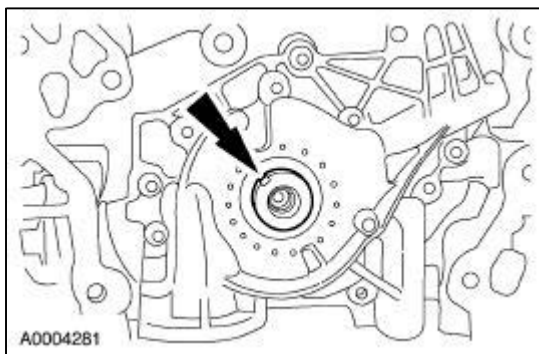
Slowly compress the LH timing chain tensioner.

6. **NOTE:** The wire must remain in the timing chain tensioner until the tensioner is installed.

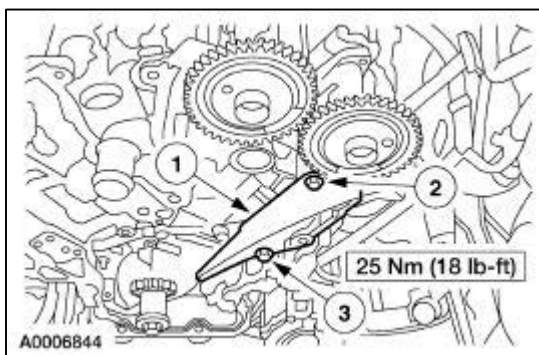
Retain the LH tensioner piston with a 1.5 mm (0.06 in) wire or paper clip.



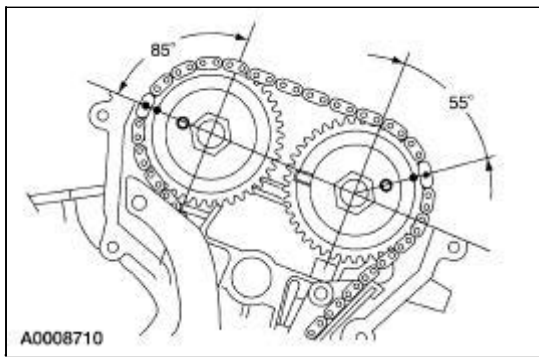
7. Rotate the crankshaft clockwise to position the keyway to the 11 o'clock position and remove the crankshaft damper bolt and washer.



8. Install the LH timing chain guide.
1. Position the guide to the engine.
 2. Install the shorter (gold color) bolt into the upper hole.
 3. Install the longer bolt (black color) into the lower hole.

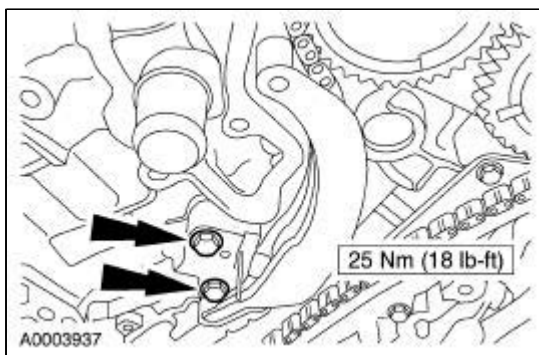


9. Install the LH timing chain, aligning the timing index link (gold color) with the marks on the camshaft and crankshaft sprockets.

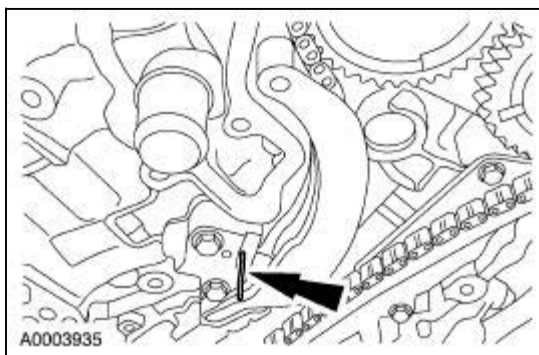


10. **NOTE:** Be sure to position the tensioner so that the tensioner piston is fully engaged in the tensioner arm.

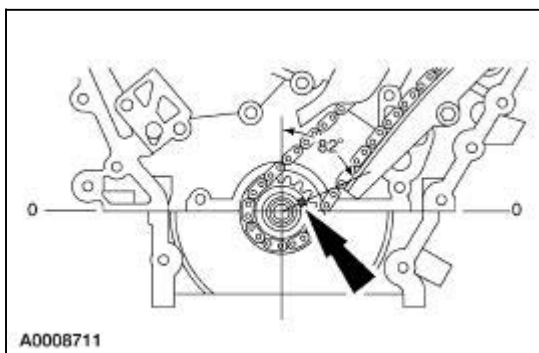
Install the LH tensioner arm, tensioner and bolts.



11. Remove the wire or paper clip from the tensioner.

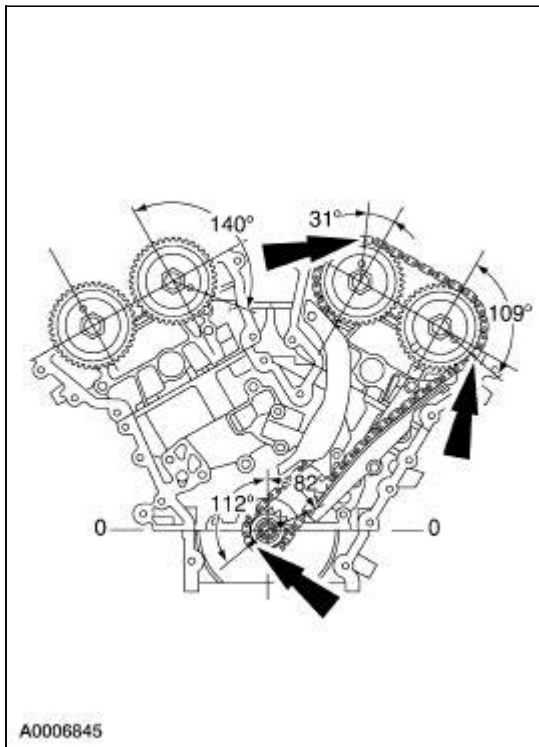


12. Rotate the crankshaft clockwise and position the keyway between the two o'clock and three o'clock positions for RH timing chain installation.

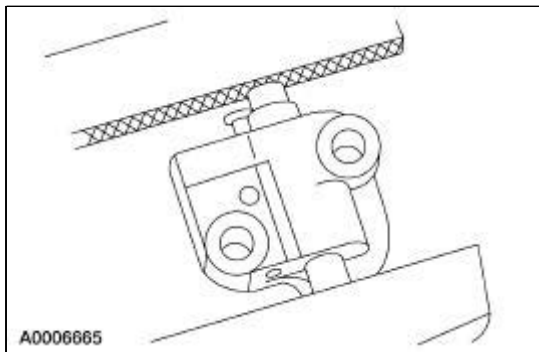


13. Verify that the timing index links (gold color) on the LH timing chain are in alignment with the

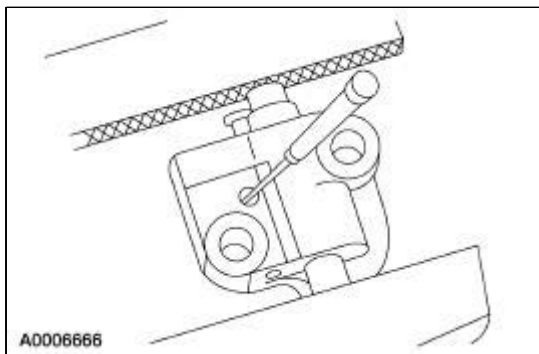
timing index marks on the camshaft and crankshaft sprockets.



14. Position the RH chain tensioner in a soft-jawed vise.



15. Hold the RH chain tensioner ratchet lock mechanism away from the ratchet stem with a small pick.

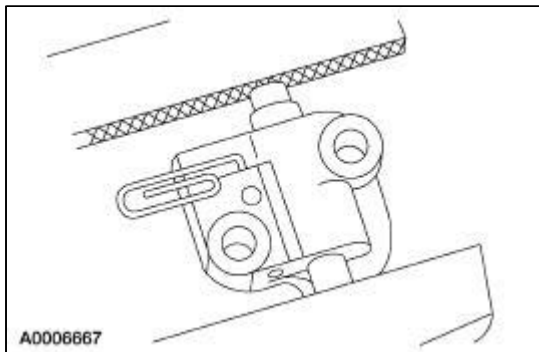


16.  **CAUTION:** During tensioner compression, do not release the ratchet stem until the tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

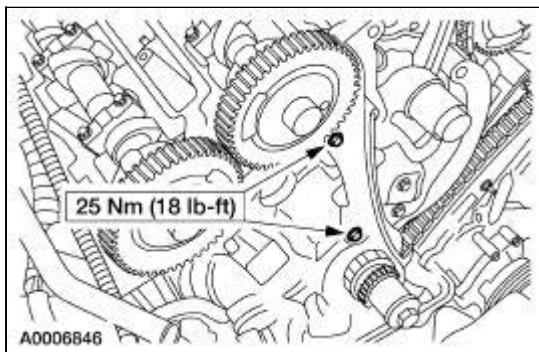
Slowly compress the RH timing chain tensioner.

17. **NOTE:** The wire must remain in the timing chain tensioner until the tensioner is installed.

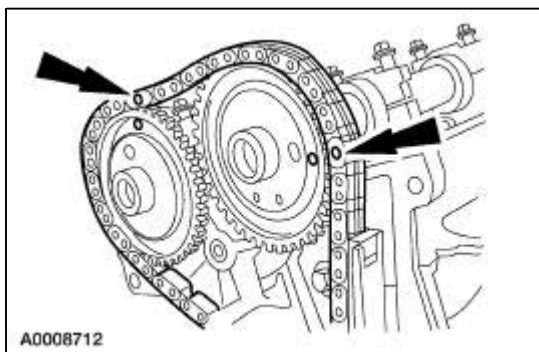
Retain the RH tensioner piston with a 1.5 mm (0.06 in) wire or paper clip.



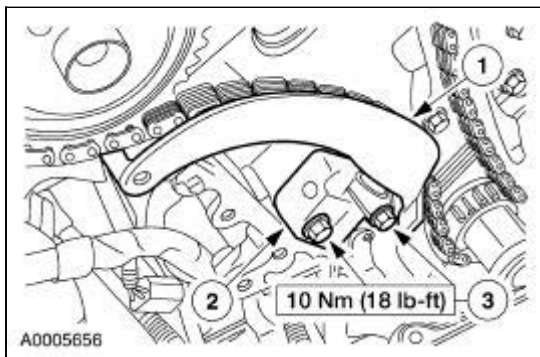
18. Install the RH chain guide and bolts.



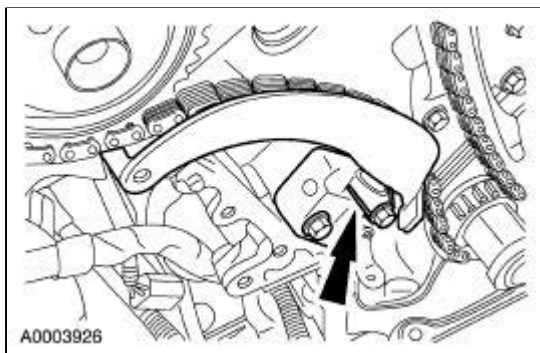
19. Install the RH timing chain, aligning the timing index links (gold color) with the marks on the camshaft and crankshaft sprockets.



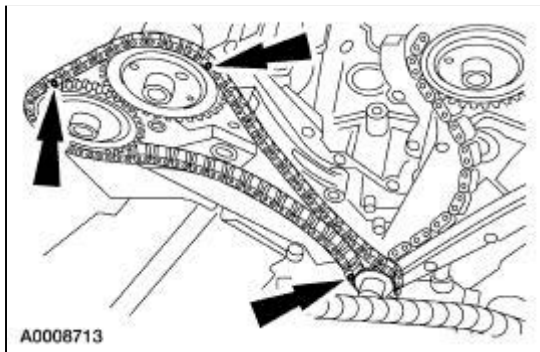
20. Install the RH tensioner.
1. Position the tensioner arm.
 2. Position the tensioner.
 3. Install the bolts.



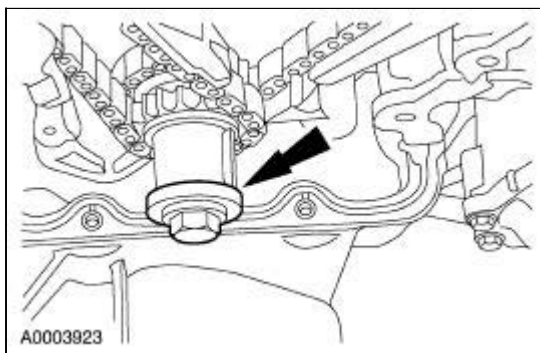
21. Remove the wire or paper clip from the RH tensioner.



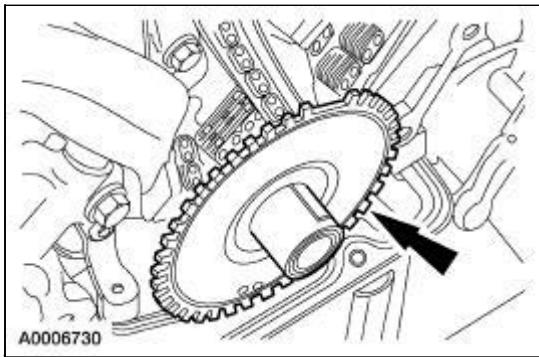
22. Verify that the timing index links (gold color) on the RH timing chain are in alignment with the timing index marks on the camshaft and crankshaft sprockets.



23. Remove the bolt and washer.



24. Install the ignition pulse ring.




25. Install the engine front cover. For additional information, refer to [Engine Front Cover](#) in this section.
-

Camshaft —LH

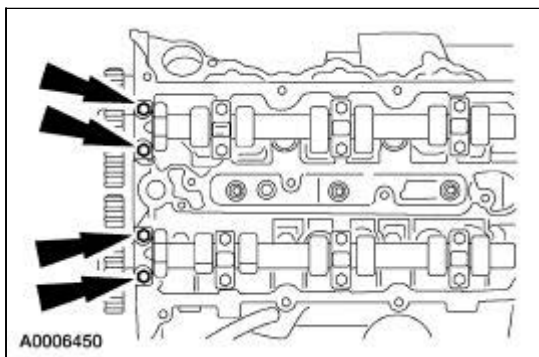
Removal

1. Remove the timing chains. For additional information, refer to [Timing Drive Components](#) in this section.

2.  **CAUTION:** Remove the camshaft journal thrust caps prior to loosening other camshaft journal cap bolts. Damage to the camshaft journal thrust cap may occur if not removed first.

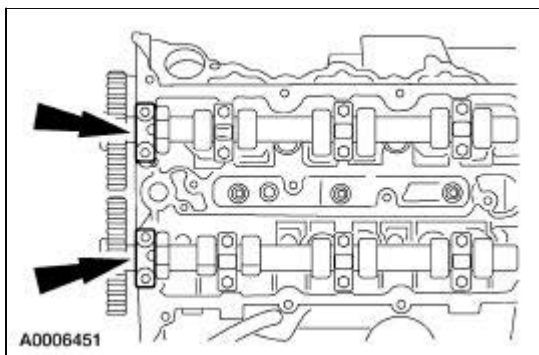
 **CAUTION:** Cylinder head camshaft journal caps and cylinder heads are numbered to be sure they are assembled in their original positions. Keep camshaft journal caps with the cylinder head from which they were removed. Do not mix with camshaft journal caps from another cylinder head.

Remove the bolts.

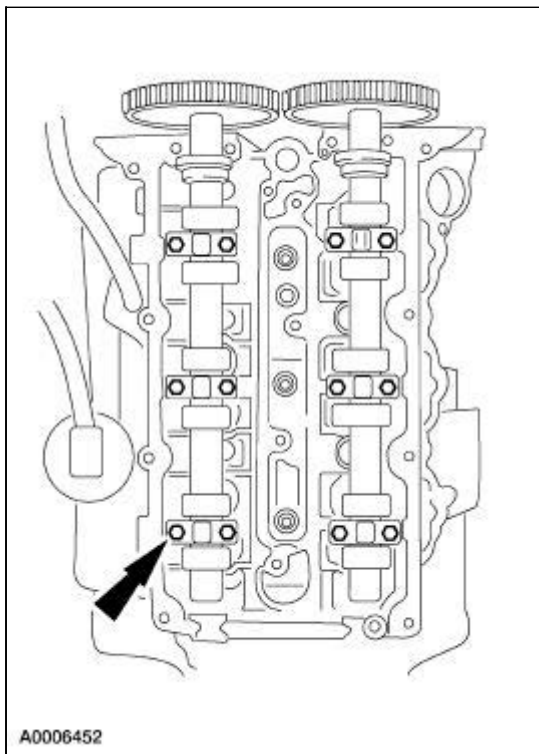


3. **NOTE:** The camshaft journal thrust caps have alignment dowels.

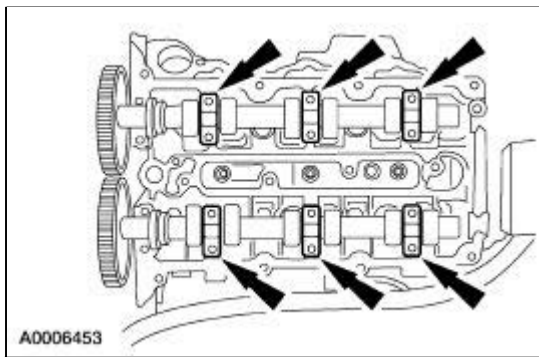
Using a soft-faced mallet, gently loosen and remove the camshaft journal thrust caps.



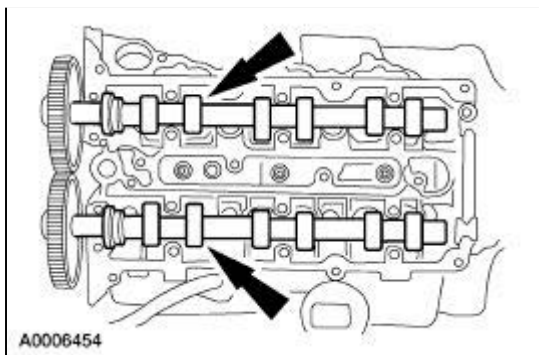
4. Remove the remaining camshaft journal bolts.



5. Using a soft-faced mallet, gently loosen and remove the remaining camshaft journal caps.



6. Carefully lift out the camshafts.

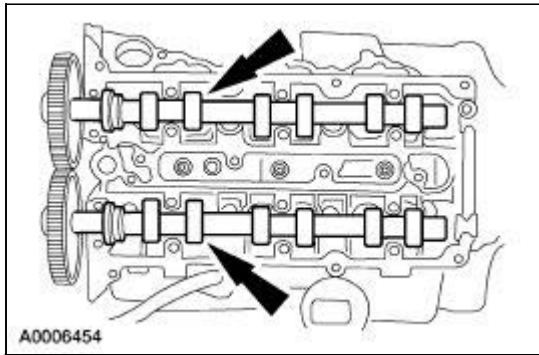


Installation

1. **NOTE:** Be sure camshaft bearing caps are installed in original positions.

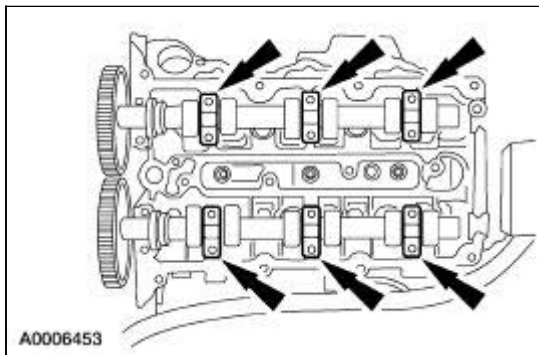
Lubricate camshafts with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H and carefully position the camshafts into the

cylinder head.

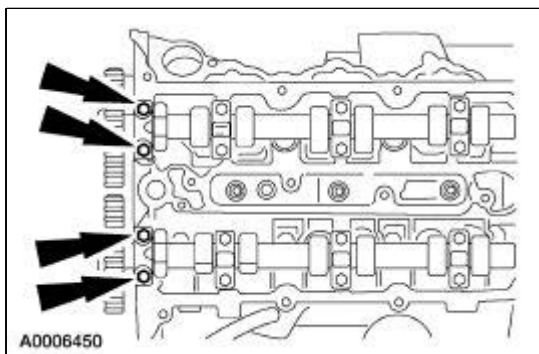


2.  **CAUTION:** Do not install the camshaft journal thrust caps until all of the camshaft bearing caps have been installed, or damage to the thrust caps may occur.

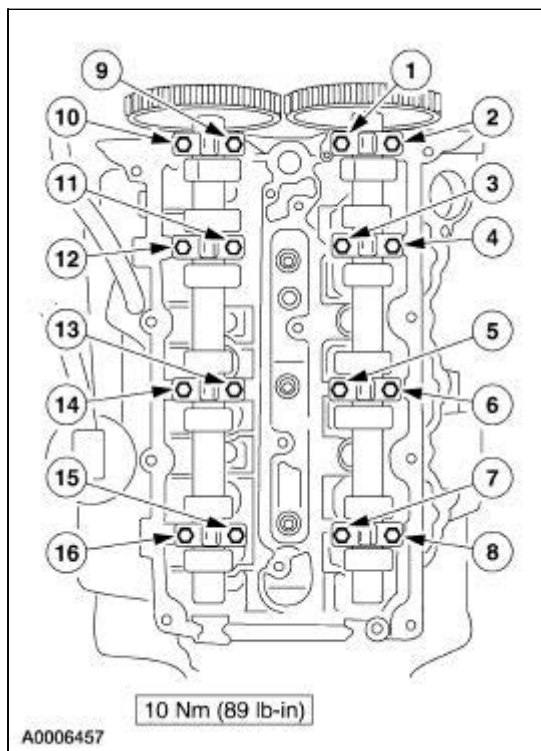
Lubricate the bearing surfaces of the camshaft bearing caps with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H, and install the bearing caps and loosely install the bolts.



3. Lubricate the bearing surfaces of the camshaft caps with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H, and loosely install the caps and bolts.




4. Tighten the bolts in sequence shown.



5. **NOTE:** If new camshafts were installed, refer to [Valve Spring—Lash Adjustment](#) in this section.

Lubricate the tappet shims and camshaft lobes with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H.

6.  **CAUTION:** Verify that the crankshaft is in the nine o'clock position before rotating the camshafts, or damage to the valve train may result.


Rotate the camshafts to be sure they are not binding. If binding occurs, check to make sure that all bearing caps are in their original positions. Loosen all bearing cap bolts in reverse order and retighten.


7. Install the timing chains. For additional information, refer to [Timing Drive Components](#) in this section.
-

Camshaft —RH

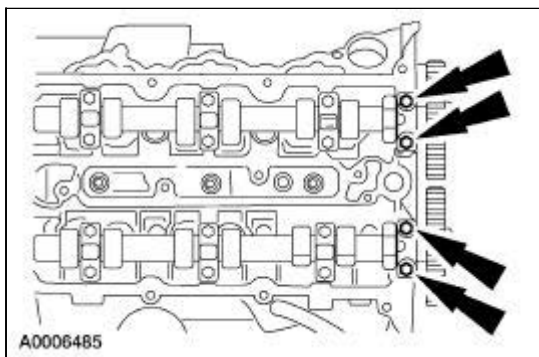
Removal

1. Remove the timing chains. For additional information, refer to [Timing Drive Components](#) in this section.

2.  **CAUTION:** Remove the camshaft journal thrust caps prior to loosening other camshaft journal cap bolts. Damage to the camshaft journal thrust cap may occur if not removed first.

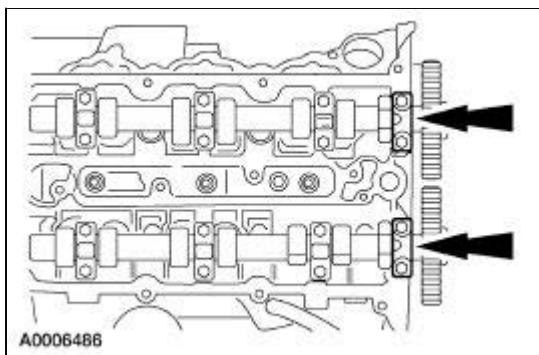
 **CAUTION:** Cylinder head camshaft journal caps and cylinder heads are numbered for assembly in their original positions. Keep camshaft journal caps with the cylinder head from which they were removed. Do not mix with camshaft journal caps from another cylinder head.

Remove the bolts.

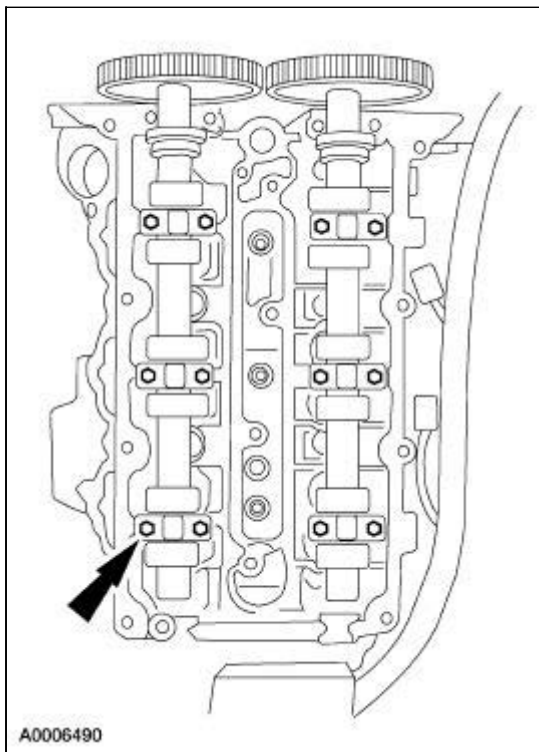


3. **NOTE:** The camshaft journal thrust caps have alignment dowels.

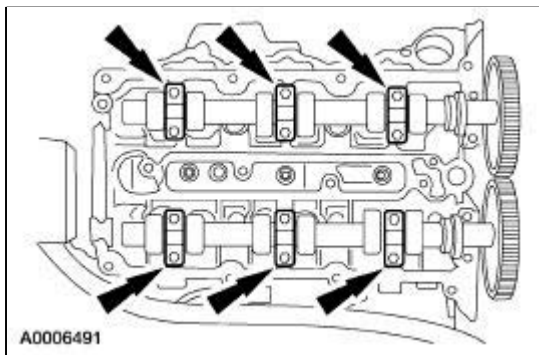
Using a soft-faced mallet, gently loosen and remove the camshaft journal thrust caps.



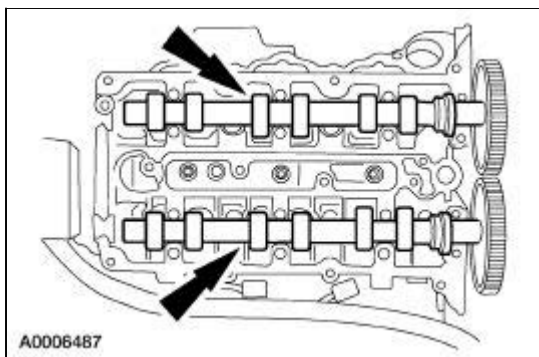
4. Remove the remaining camshaft journal cap bolts.



5. Using a soft-faced mallet, gently loosen and remove the remaining camshaft journal caps.



6. Carefully lift out the camshafts.

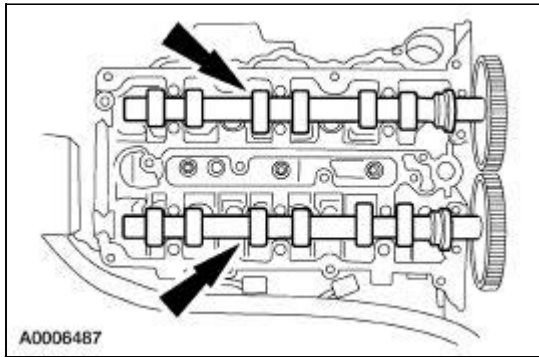


Installation

1. **NOTE:** Be sure camshaft bearing caps are installed in original positions.

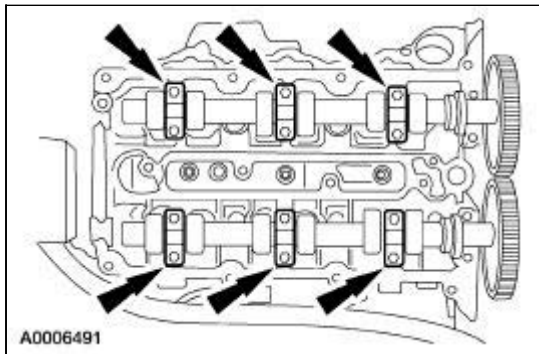
Lubricate camshafts with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H and carefully position the camshafts into the

cylinder head.

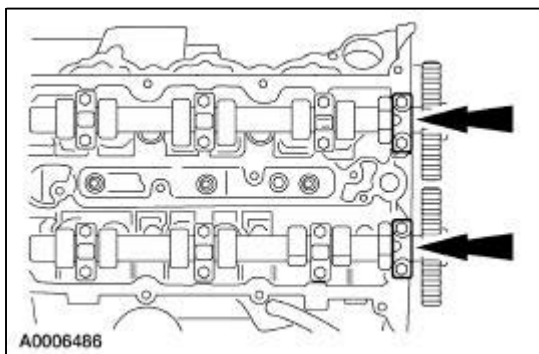


2.  **CAUTION:** Do not install the camshaft journal thrust caps until all of the camshaft bearing caps have been installed, or damage to the thrust caps may occur.

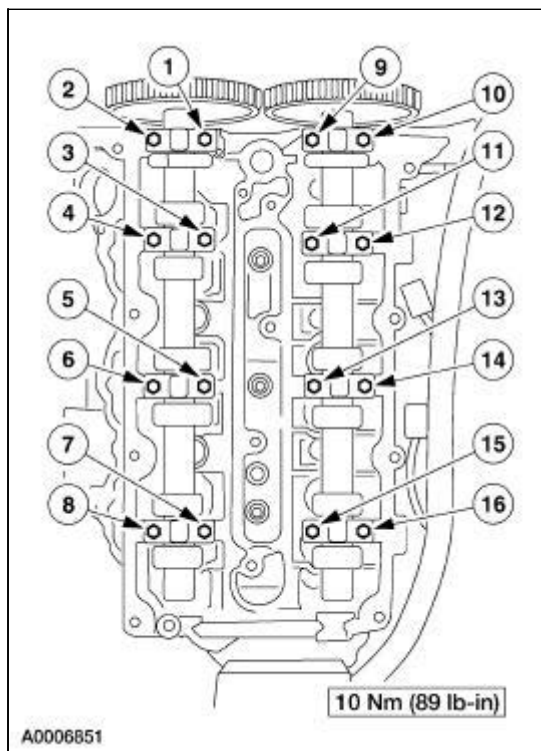
Lubricate the bearing surfaces of the camshaft bearing caps with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H, and install the bearing caps and loosely install the bolts.



3. Lubricate the bearing surfaces of the camshaft bearing thrust caps with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H, and install the caps and loosely install the bolts.




4. Tighten the bolts in sequence shown.



5. **NOTE:** If either of the camshafts were replaced, refer to [Valve Spring—Lash Adjustment](#) in this section.

Lubricate the tappet shims and camshaft lobes with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H.

6.  **CAUTION:** Verify that the crankshaft is in the nine o'clock position before rotating the camshafts, or damage to the valve train may result.

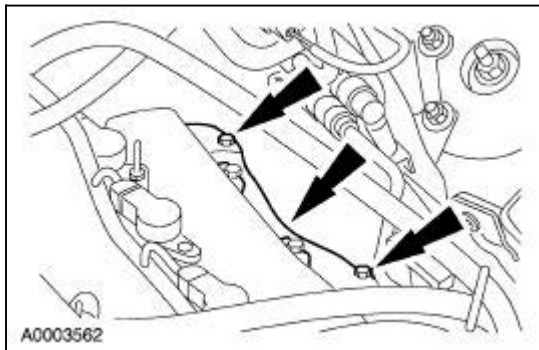
Rotate the camshafts to be make sure they are not binding. If binding occurs, check to sure that all bearing caps are in their original positions. Loosen all bearing cap bolts in reverse order and retighten.

7. Install the timing chains. For additional information, refer to [Timing Drive Components](#) in this section.
-

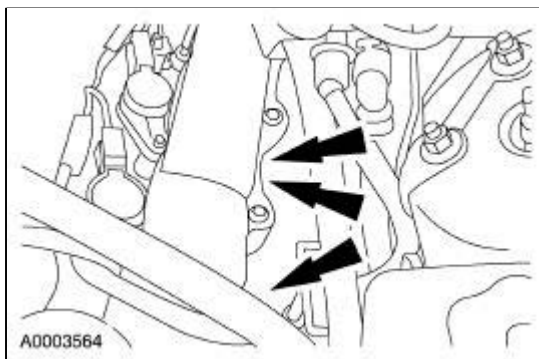
Exhaust Manifold — LH

Removal

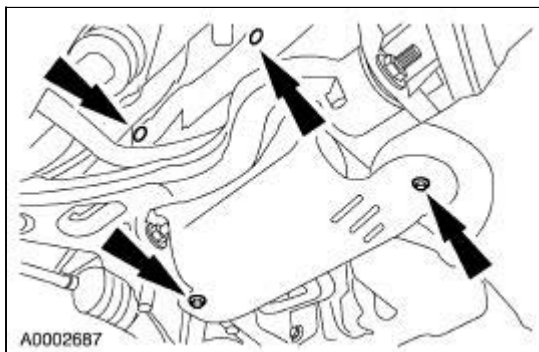
1. If equipped, remove the heat shield.



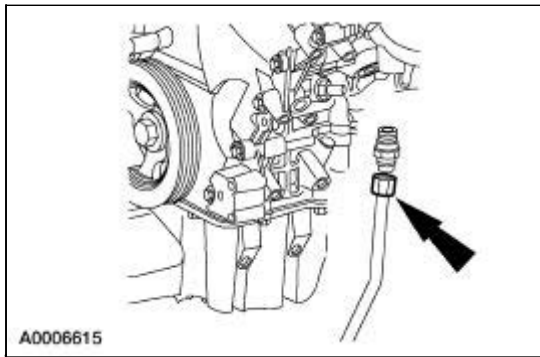
2. Remove the three upper nuts on the LH exhaust manifold.



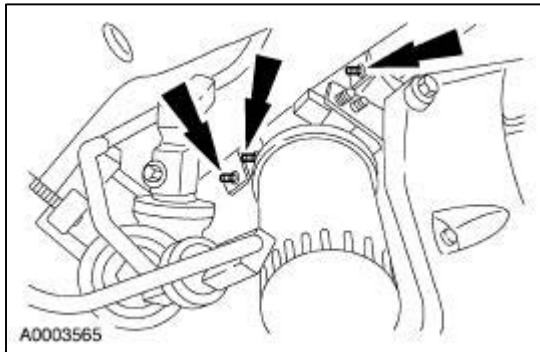
3. Remove the three-way catalytic converter (TWC). For additional information, refer to [Section 309-00](#).
4. Remove the lower splash shield.
 - Remove the bolts.
 - Remove the pin-type retainers and the shield.



5. If equipped, remove the secondary air tube from the exhaust manifold.



6. Remove the three lower nuts and the exhaust manifold.
 - Discard the gasket.

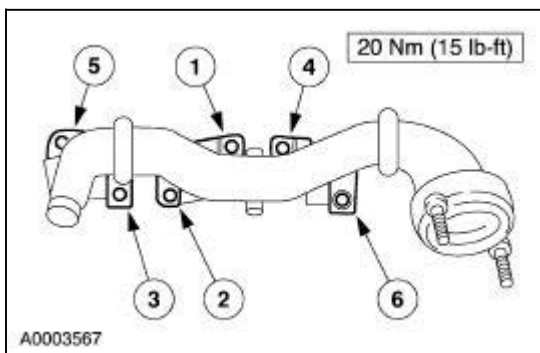


Installation

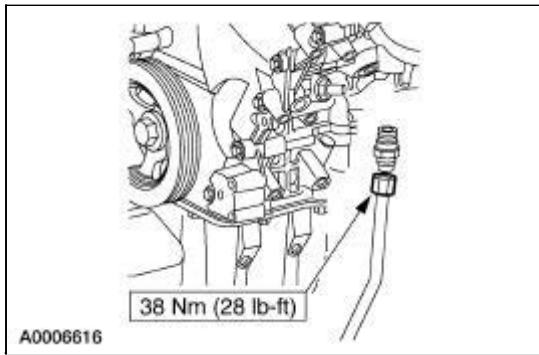
1. **NOTE:** To make sure of a seal, the manifold bolts must be tightened to the same specification two times.

Using a new gasket, install the exhaust manifold. Tighten the nuts in two stages.

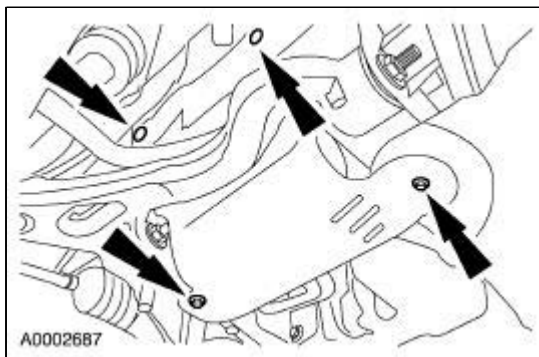
- Stage 1: Tighten to 20 Nm (15 lb-ft).
- Stage 2: Tighten to 20 Nm (15 lb-ft).



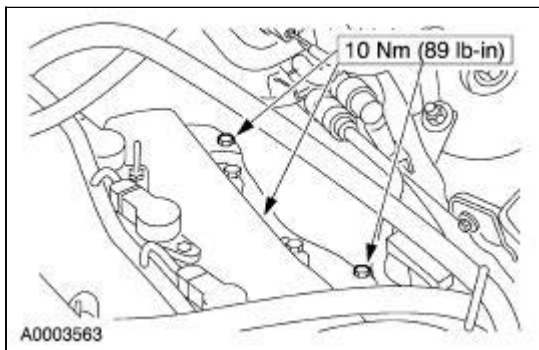
2. If equipped, install the secondary air tube to the exhaust manifold.



3. Install the lower splash shield.
 - Install the shield and the pin-type retainers.
 - Install the bolts.



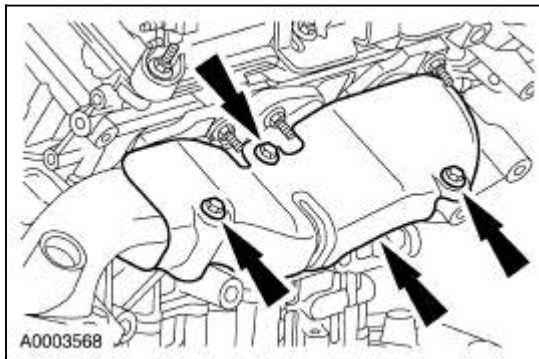
4. Install the TWC. For additional information, refer to [Section 309-00](#).
5. If equipped, install the heat shield.



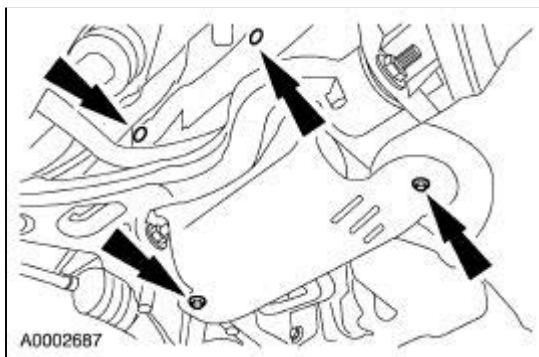
Exhaust Manifold —RH

Removal

1. If equipped, remove the heat shield.

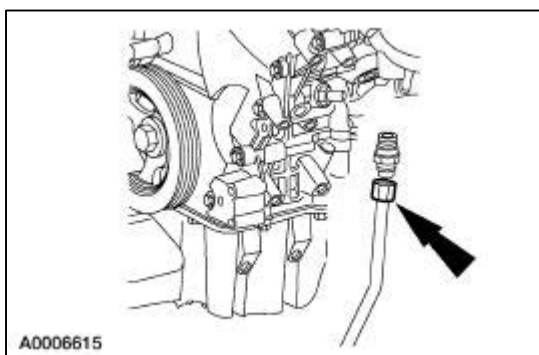


2. Remove the three-way catalytic converter (TWC). For additional information, refer to [Section 309-00](#).
3. Remove the lower splash shield.
 - Remove the bolts.
 - Remove the pin-type retainers and the shield.

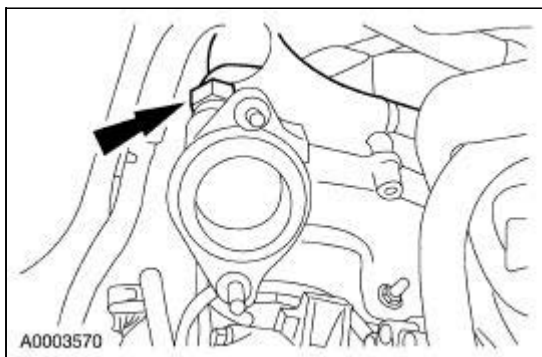


4. **NOTE:** Left side shown; right side similar.

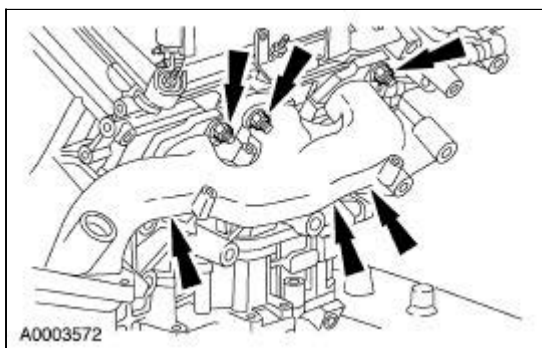
If equipped, remove the secondary air tube from the exhaust manifold.



5. Disconnect the EGR valve to exhaust manifold tube.



6. Remove the six nuts and the exhaust manifold.
 - Discard the gasket.

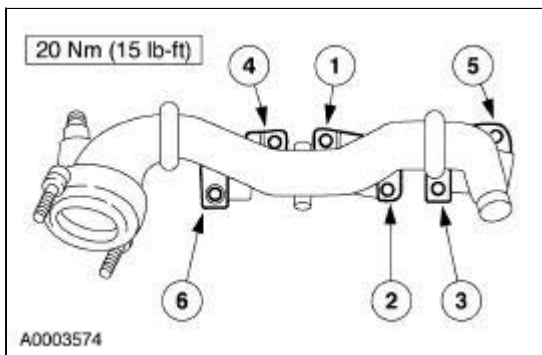


Installation

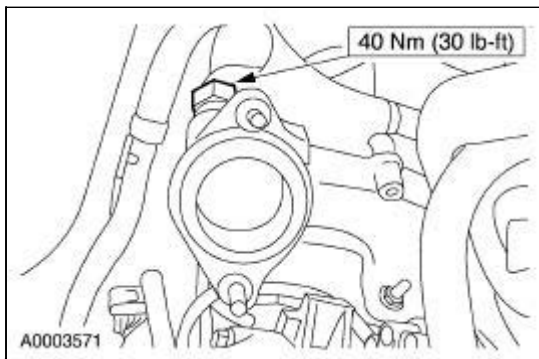
1. **NOTE:** To verify the seal, the manifold bolts must be tightened to the same specification two times.

Using a new gasket, install the exhaust manifold. Tighten the nuts in two stages:

- Stage 1: Tighten to 20 Nm (15 lb-ft).
- Stage 2: Tighten to 20 Nm (15 lb-ft).

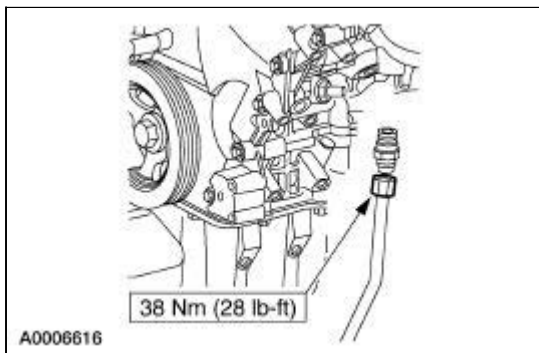


2. Install the EGR valve-to-exhaust manifold tube.

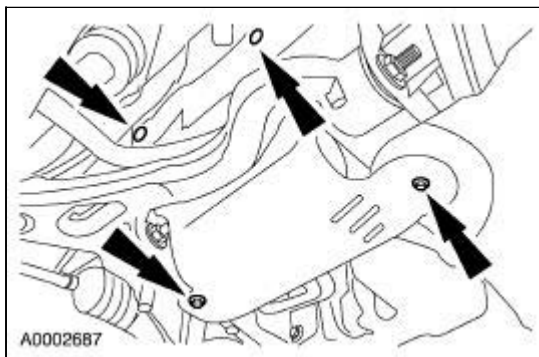


3. **NOTE:** Left side shown; right side similar.

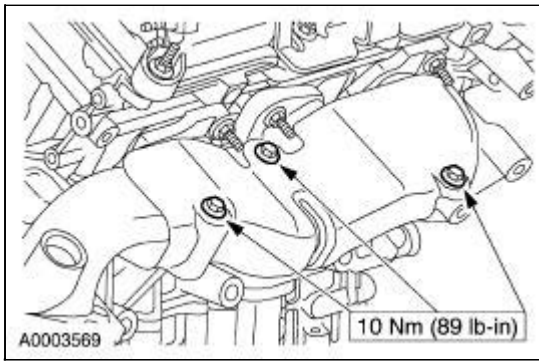
If equipped, install the secondary air tube to the exhaust manifold.



4. Install the lower splash shield.
- Install the shield and the pin-type retainers.
 - Install the bolts.



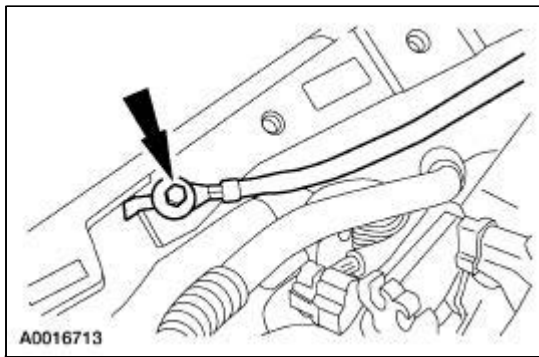
5. Install the TWC. For additional information, refer to [Section 309-00](#).
6. If equipped, install the heat shield.



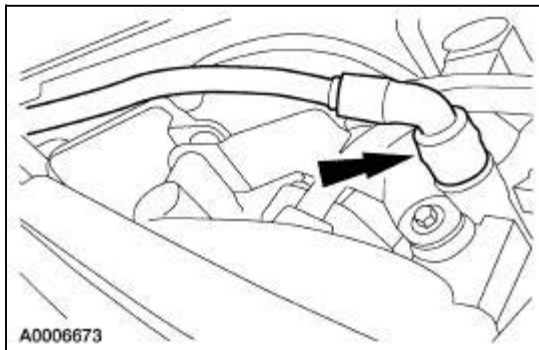
Cylinder Head —LH

Removal

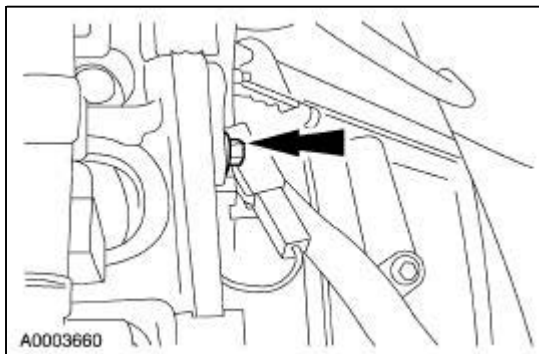
1. Remove the LH camshafts. For additional information, refer to [Camshaft—LH](#) in this section.
2. Remove the LH exhaust manifold. For additional information, refer to [Exhaust Manifold—LH](#) in this section.
3. Remove the lower intake manifold. Refer to [Intake Manifold—Lower](#).
4. Remove the ground strap.



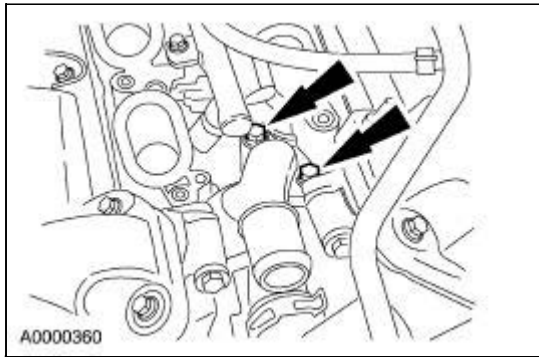
5. Disconnect the PCV tube.



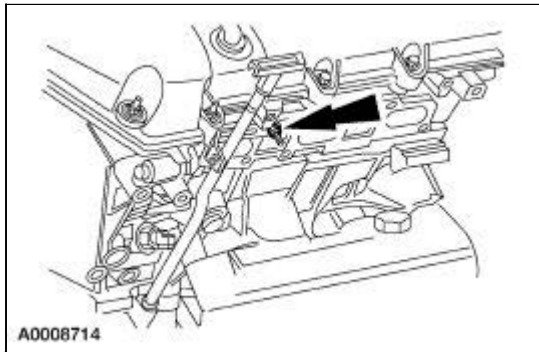
6. Remove the noise suppressor bolt.



7. Remove the bolts and the coolant outlet tube.

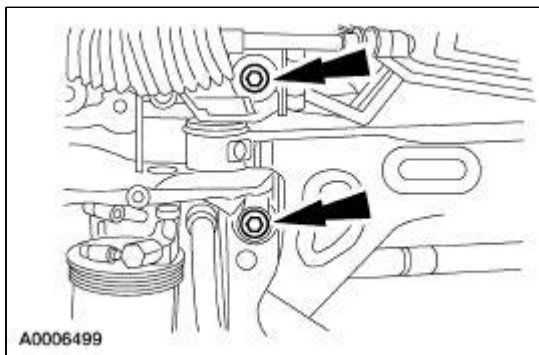


8. Remove the oil level indicator tube stud bolt.



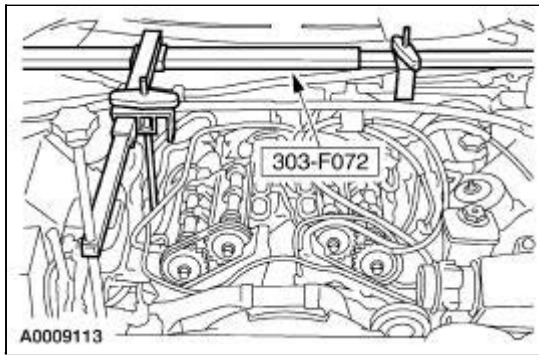
9. Raise the vehicle.

10. Install the four crossmember bolts.

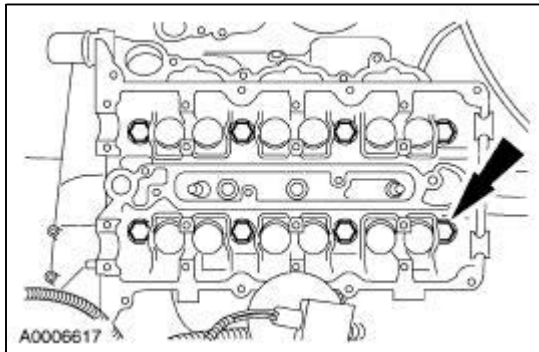


11. Lower the vehicle.


12. Remove the special tool.



13. Remove the bolts and the LH cylinder head.
 - Discard the gasket.



Installation

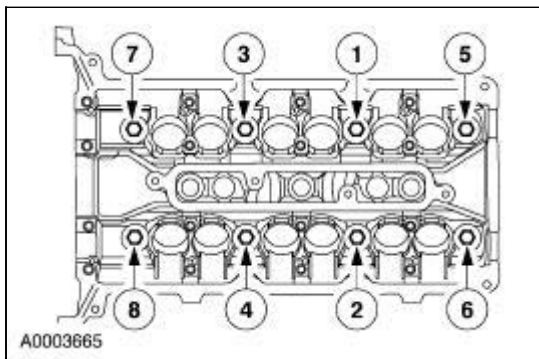
1.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tool cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

 **CAUTION:** The cylinder head bolts must be replaced with new bolts. They are tighten-to-yield designed and cannot be reused.

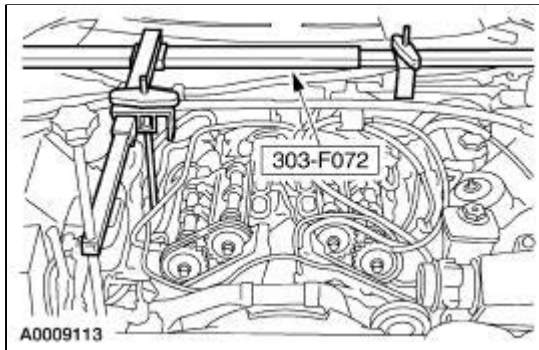
NOTE: LH and RH cylinder head gaskets are not interchangeable.

Using a new cylinder head gasket and bolts, install the LH cylinder head and loosely install the bolts.

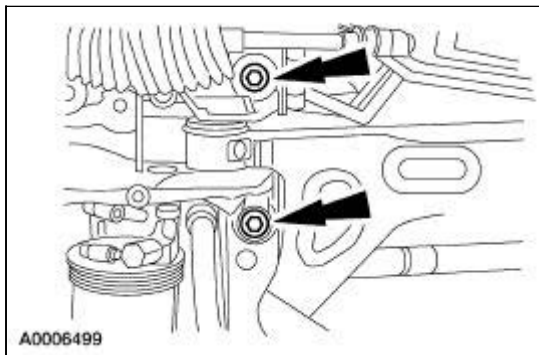
2. Tighten the bolts in six stages in the sequence shown.
 - Stage 1: Tighten to 30 Nm (22 lb-ft).
 - Stage 2: Rotate 90 degrees.
 - Stage 3: Back out a minimum of one full turn (360 degrees).
 - Stage 4: Tighten to 30 Nm (22 lb-ft).
 - Stage 5: Rotate 90 degrees.
 - Stage 6: Rotate all bolts an additional 90 degrees.



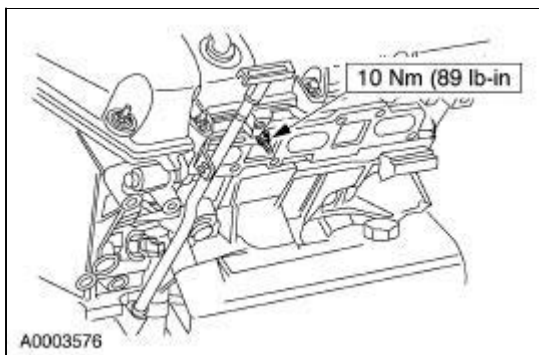
3. Install the special tool.



4. Raise the vehicle.
5. Remove the four crossmember bolts.

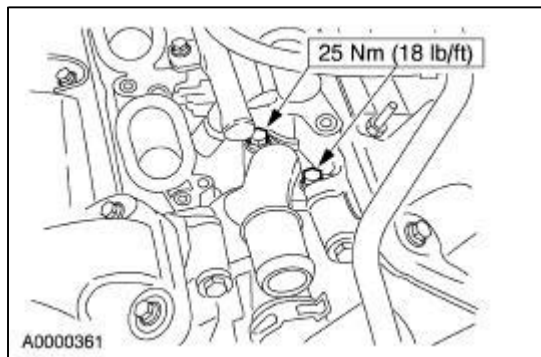


6. Lower the vehicle.
7. Install the oil level indicator tube stud bolt.

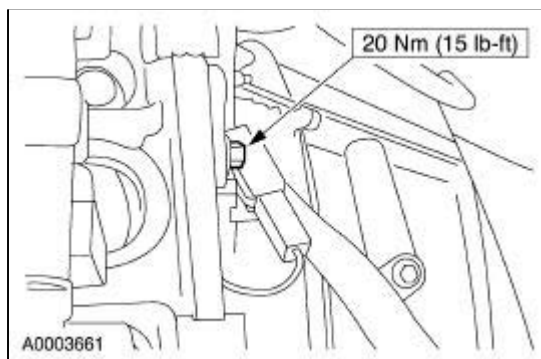


8. **NOTE:** Clean the sealing surfaces and inspect the O-ring seals thoroughly.

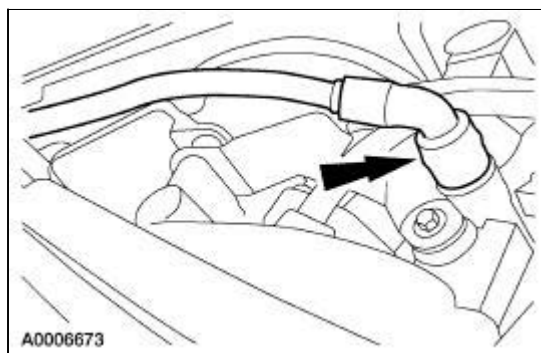
Install the coolant outlet tube and the retaining bolts.



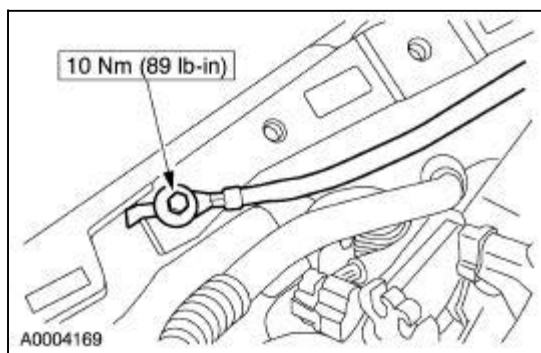
9. Position the noise suppressor and install the bolt.



10. Connect the PCV tube.



11. Install the ground strap.

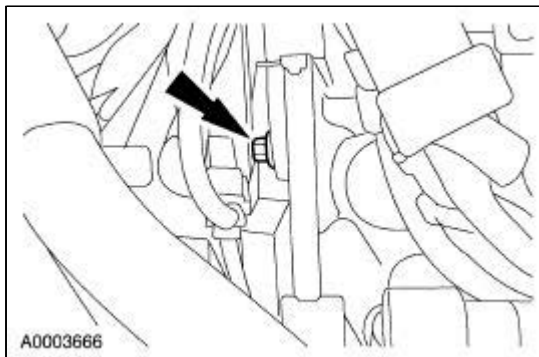


12. Install the lower intake manifold. For additional information, refer to [Intake Manifold—Lower](#) in this section.
 13. Install the LH exhaust manifold. For additional information, refer to [Exhaust Manifold—LH](#) in this section.
 14. Install the LH camshafts. For additional information, refer to [Camshaft—LH](#) in this section.
-

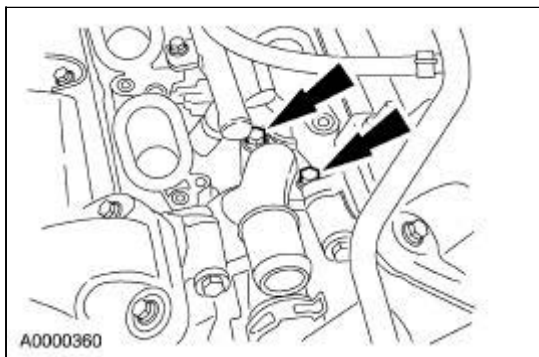
Cylinder Head —RH

Removal

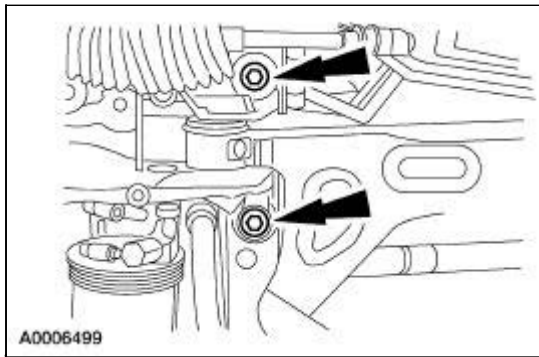
1. Remove the RH camshafts. For additional information, refer to [Camshaft—RH](#) in this section.
2. Remove the RH exhaust manifold. For additional information, refer to [Exhaust Manifold—RH](#) in this section.
3. Remove the lower intake manifold. For additional information, refer to [Intake Manifold—Lower](#) in this section.
4. Remove the noise suppressor bolt.



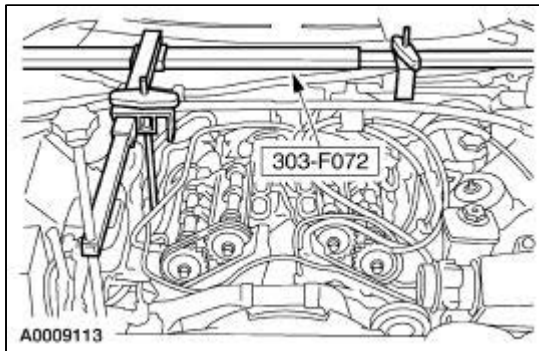
5. Remove the bolts and the coolant outlet tube.



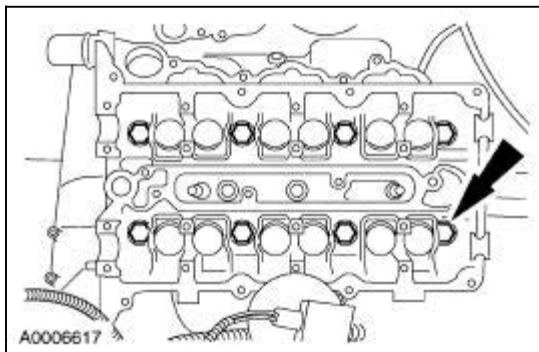
6. Raise the vehicle.
7. Install the four crossmember bolts.




8. Lower the vehicle.
9. Remove the special tool.



10. Remove the bolts and the RH cylinder head.
 - Discard the gasket.



Installation

1.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tool cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

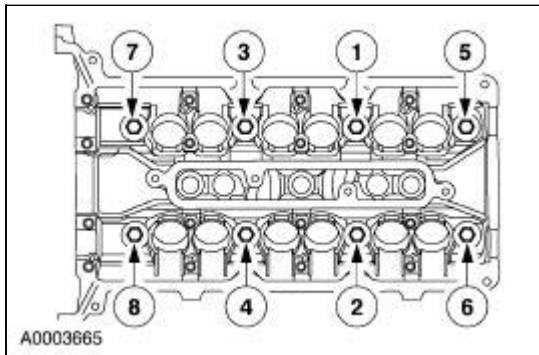
 **CAUTION:** The cylinder head bolts must be replaced with new bolts. They are tighten-to-yield designed and cannot be reused.

NOTE: LH and RH cylinder head gaskets are not interchangeable.

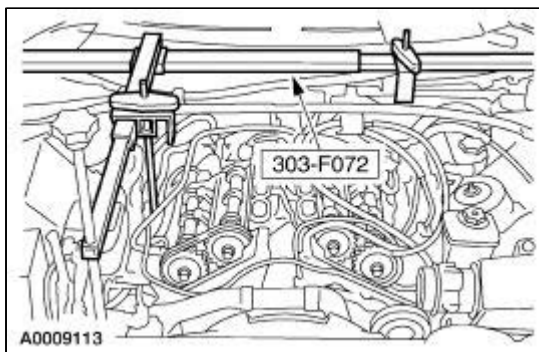
Using a new cylinder head gasket and bolts, install the RH cylinder head and loosely install the bolts.

2. Tighten the bolts in six stages in the sequence shown.

- Stage 1: Tighten to 30 Nm (22 lb-ft).
- Stage 2: Rotate 90 degrees.
- Stage 3: Back out a minimum of one full turn (360 degrees).
- Stage 4: Tighten to 30 Nm (22 lb-ft).
- Stage 5: Rotate 90 degrees.
- Stage 6: Rotate all bolts an additional 90 degrees.

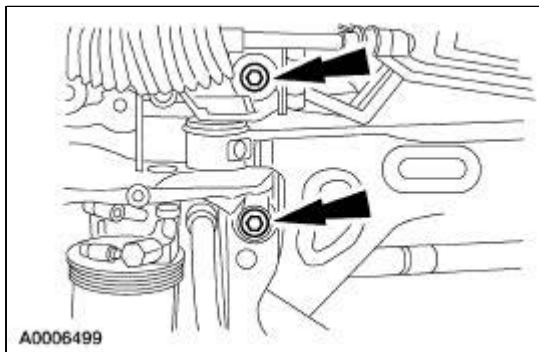


3. Install the special tool.



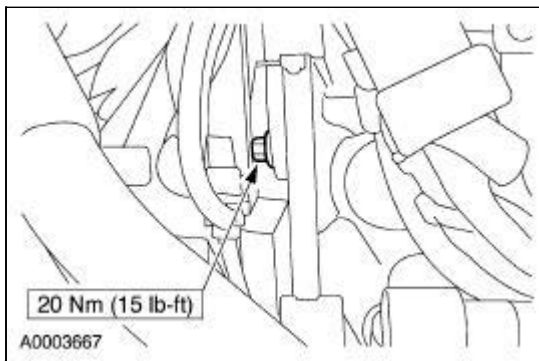
4. Raise the vehicle.

5. Remove the four crossmember bolts.



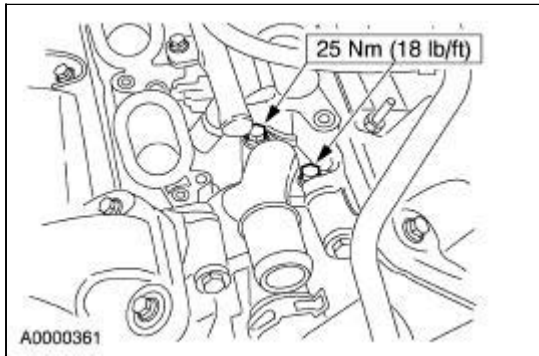
6. Lower the vehicle.

7. Position the noise suppressor and install the bolt.



8. **NOTE:** Clean the sealing surfaces and inspect the O-ring seals thoroughly.

Position the coolant outlet tube and install the bolts.



9. Install the lower intake manifold. For additional information, refer to [Intake Manifold—Lower](#) in this section.
 10. Install the RH exhaust manifold. For additional information, refer to [Exhaust Manifold—RH](#) in this section.
 11. Install the RH camshafts. For additional information, refer to [Camshaft—RH](#) in this section.
-

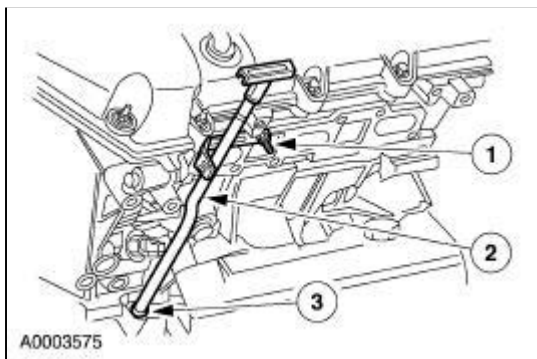
Oil Level Indicator and Tube

Removal

1. **NOTE:** The exhaust manifold is removed for clarity.

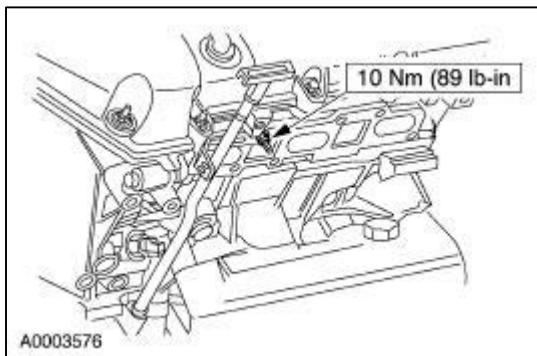
Remove the oil level indicator and tube.

1. Remove the stud bolt.
2. Remove the oil level indicator tube.
3. Inspect the O-ring seal at the end of the oil level indicator tube and install a new O-ring seal if necessary.



Installation

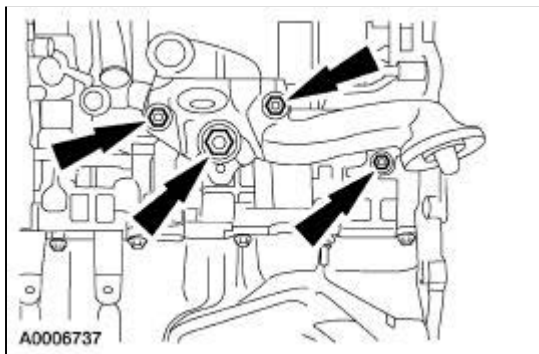
1. To install, reverse the removal procedure.



Oil Filter Adapter

Removal

1. Remove the LH engine mount. For additional information, refer to [Engine Mount—LH](#) in this section.
2. Drain the engine oil.
3. Remove the oil filter.
4. If equipped, remove the oil cooler. For additional information, refer to [Oil Cooler](#) in this section.
5. Remove the bolts and the oil filter adapter.



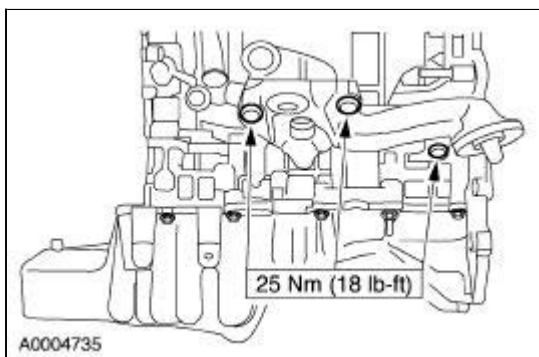
Installation

1. **NOTE:** The oil filter adapter bolts must be tightened in two steps.

NOTE: Inspect the O-ring seal and the surfaces for contamination prior to installation.

NOTE: Non-oil cooler equipped engine shown. Engines equipped with oil cooler are similar.

Position the oil filter adapter and a new O-ring seal and install the bolts.

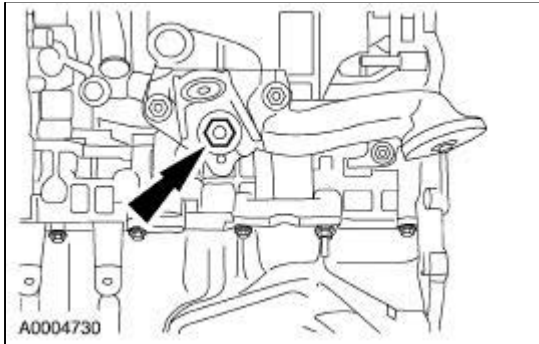


2. **NOTE:** Non-oil cooler equipped engine shown. Engines equipped with oil cooler are similar.

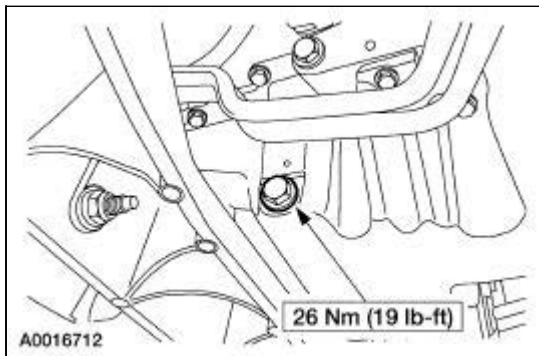
Using a new O-ring seal, lubricate with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H and install the bolt.

Tighten the oil filter adapter bolts in two stages:

- Stage 1: Tighten to 30 Nm (22 lb-ft).
- Stage 2: Tighten to 155 Nm (114 lb-ft).



3. Tighten the oil pan drain plug.

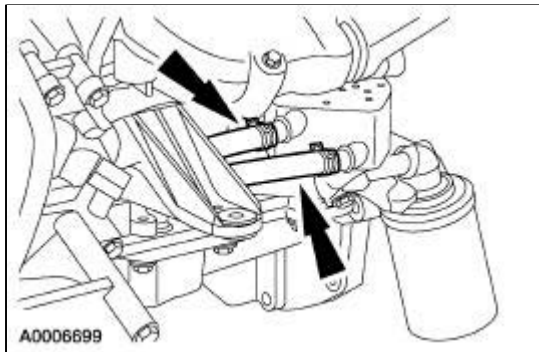


4. Install the oil filter.
 5. If equipped, install the oil cooler. For additional information, refer to [Oil Cooler](#) in this section.
 6. Fill the engine with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP meeting Ford specification WSS-M2C153-H or equivalent.
 7. Install the LH engine mount. For additional information, refer to [Engine Mount—LH](#) in this section.
 8. If drained, fill the engine cooling system. For additional information, refer to [Section 303-03](#).
-

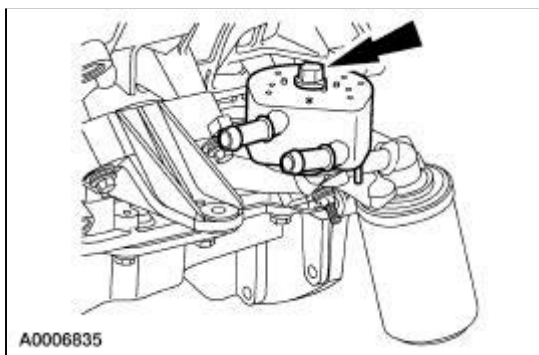
Oil Cooler

Removal

1. Drain the engine cooling system. For additional information refer to [Section 303-03](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Remove the oil cooler hoses.



4. Remove the bolt and the oil cooler.
 - Inspect the gasket. Discard if damaged.

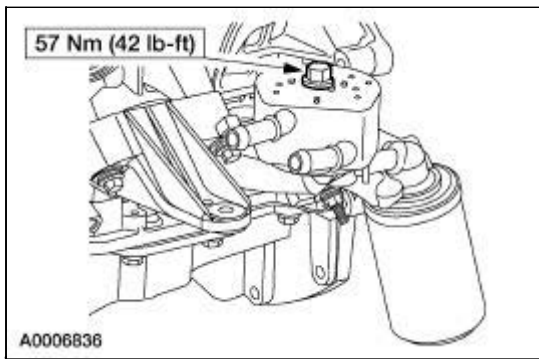


Installation

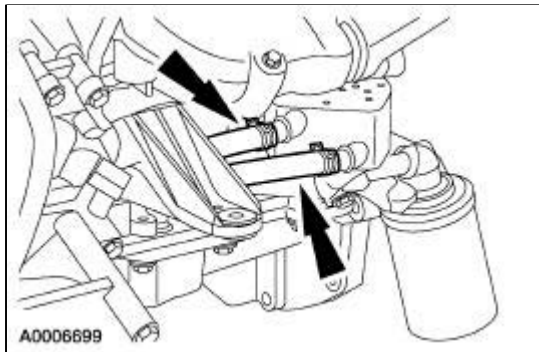
1. **NOTE:** Inspect gasket and surfaces for contamination prior to installation.

Position the oil cooler and gasket and install the bolt.

- Rotate the cooler clockwise until the locating pin hits the stop.



2. Install the oil cooler hoses.

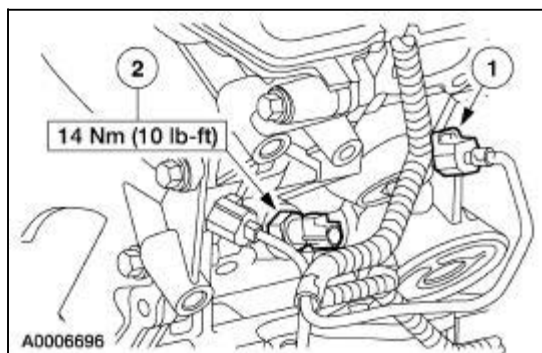


3. Lower the vehicle.
 4. Fill the engine cooling system. For additional information, refer to [Section 303-03](#).
-

Oil Pressure Switch —Oil Cooler

Removal and Installation

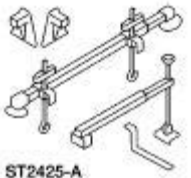

1. Remove the oil pressure switch.
 1. Disconnect the electrical connector.
 2. Remove the switch.



2. To install, reverse the removal procedure.
-

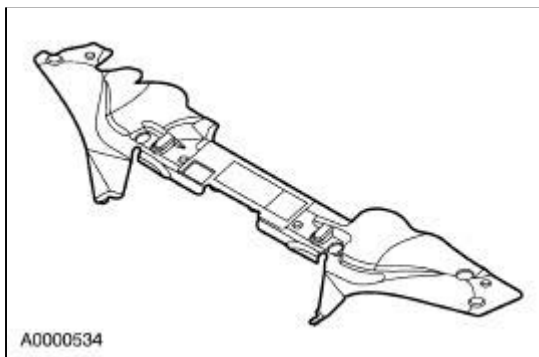
Oil Pan

Special Tool(s)

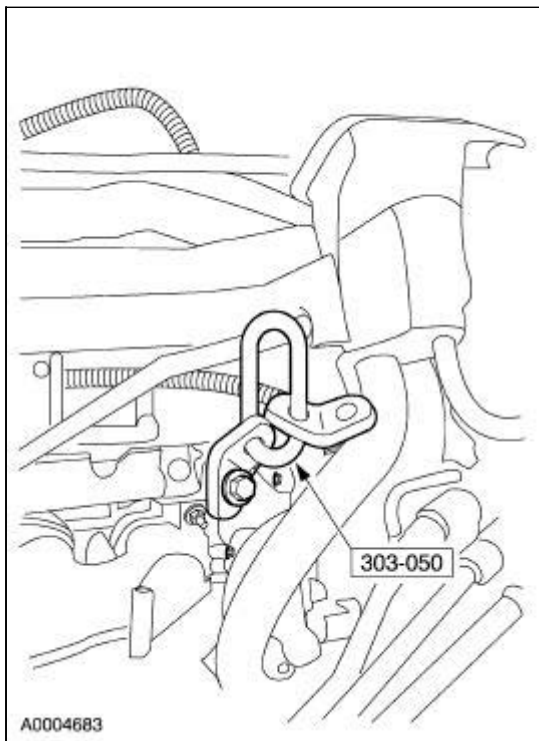
 <p>ST2425-A</p>	Three Bar Engine Support Kit 303-F072
 <p>ST1595-A</p>	Engine Lifting Brackets 303-050

Removal

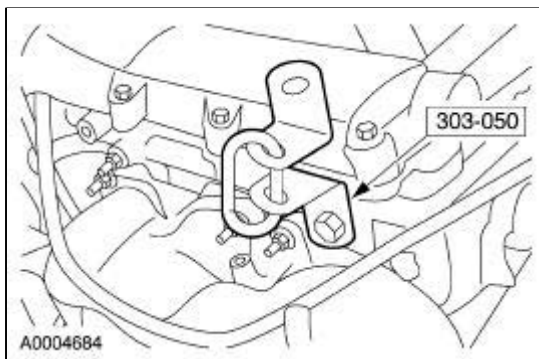
1. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
2. Remove the upper radiator sight shield.



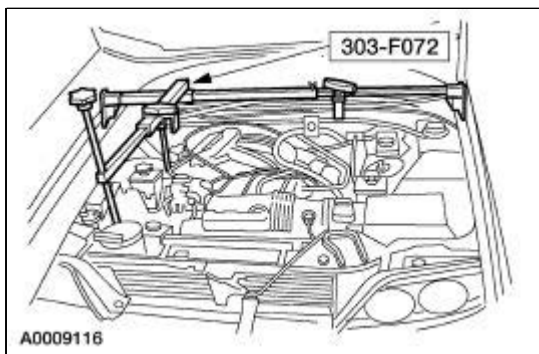
3. Install the special tool.



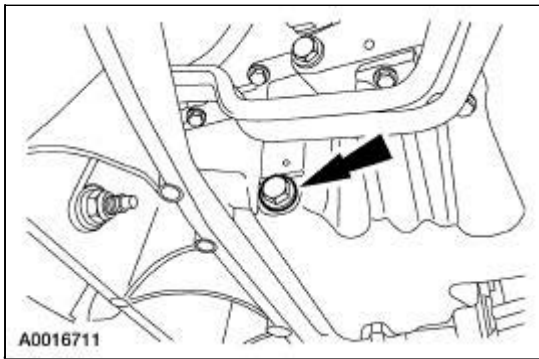
4. Install the special tool.



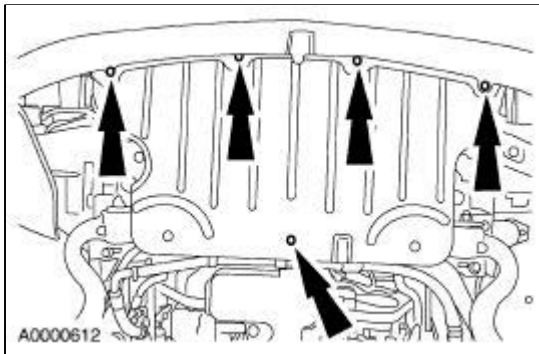
5. Using the special tool, support the engine.



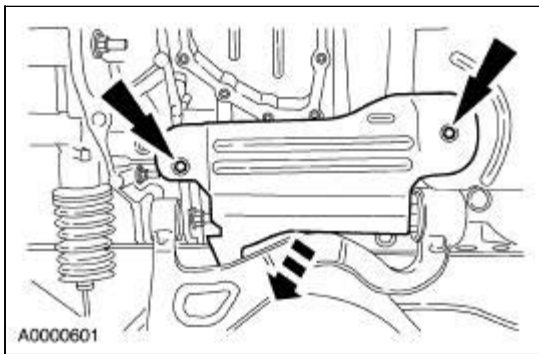
6. Remove the generator. For additional information, refer to [Section 414-02](#).
7. Drain the engine oil.



8. Remove the front center splash shield.

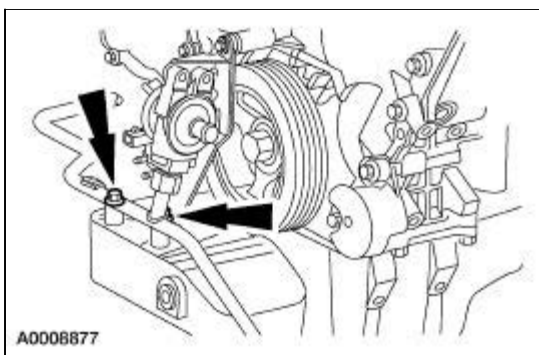


9. Remove the RH front splash shield.



10. Remove the A/C compressor. For additional information, refer to [Section 412-03](#).

11. If equipped, remove the electronic thermactor air (ETA) bracket bolts.

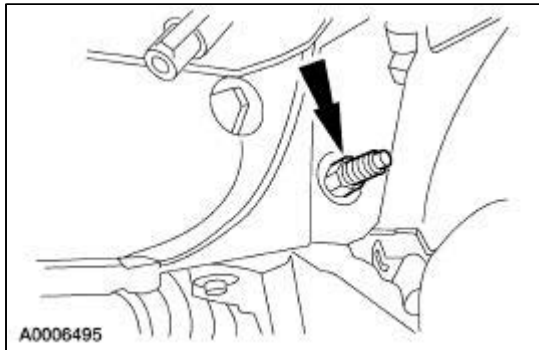


12. **NOTE:** On RH drive vehicles, the power steering line attaches to the oil pan stud.

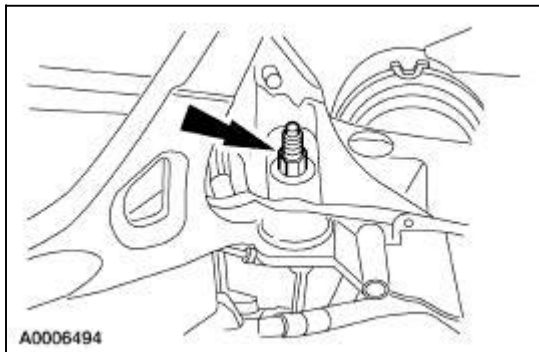
NOTE: On RH drive vehicles, the wiring harness attaches to the RH side of the oil pan.

Remove the steering gear. For additional information, refer to [Section 211-02](#).

13. Remove the LH lower control arm through bolt.

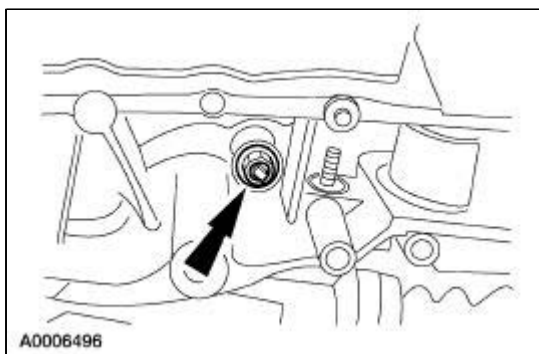


14. Remove the RH lower control arm through bolt.

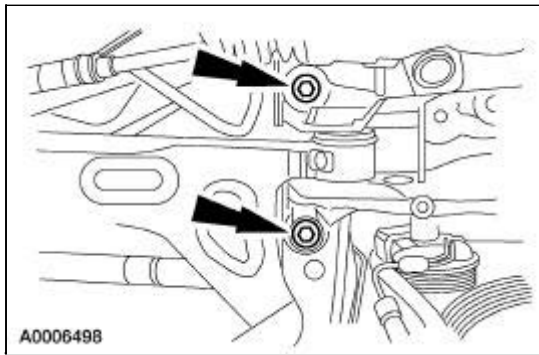


15. **NOTE:** LH shown; RH similar.

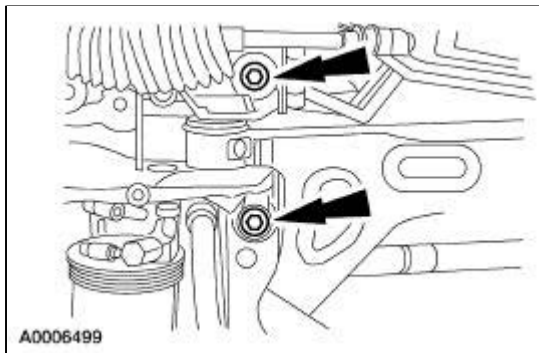
Remove the LH and the RH engine mount nuts.



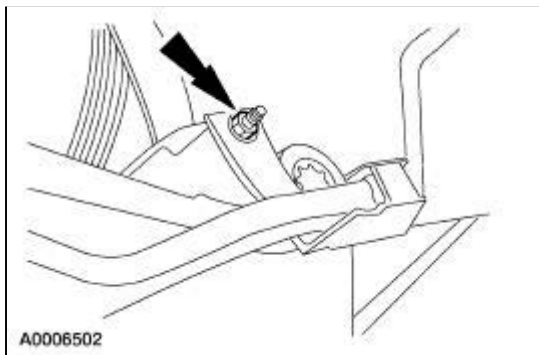
16. Remove the LH subframe bolts.



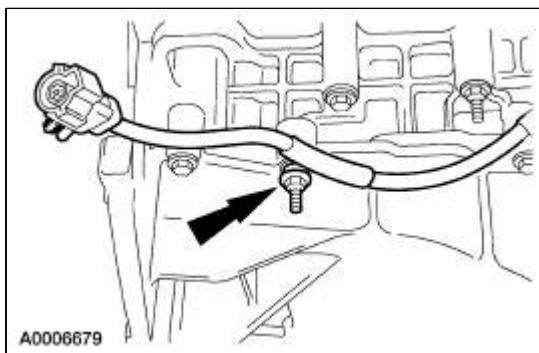
17. Remove the RH subframe bolts.



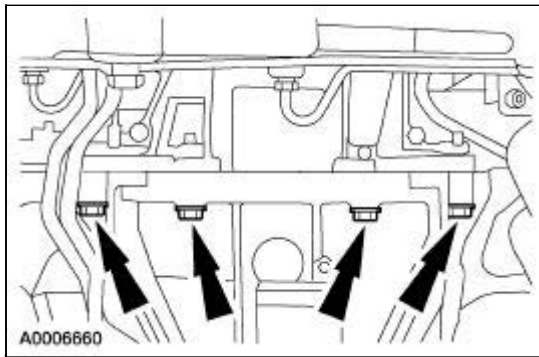
18. Remove the transmission cooler line bracket nut.



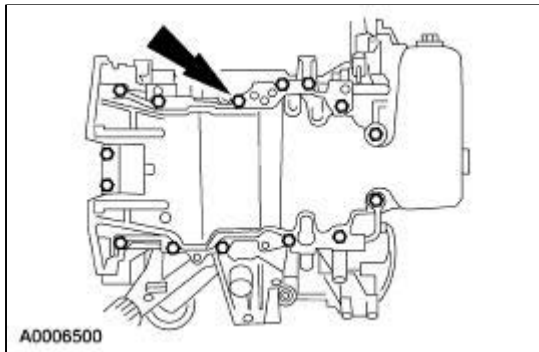
19. Remove the nut and the wiring harness from the stud.



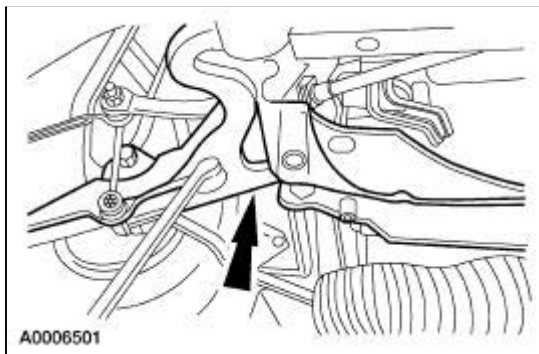
20. Remove the transmission to oil pan bolts.




21. Remove the oil pan bolts.



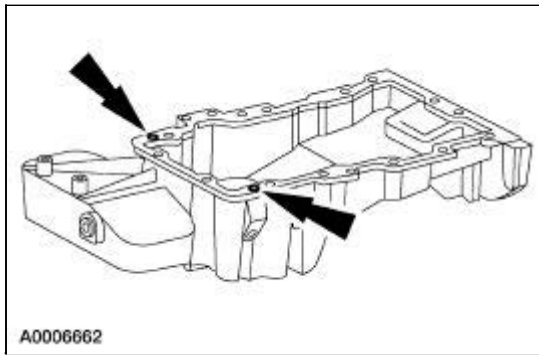
22. Gently pry the subframe down and remove the oil pan.
 - Discard the gasket.



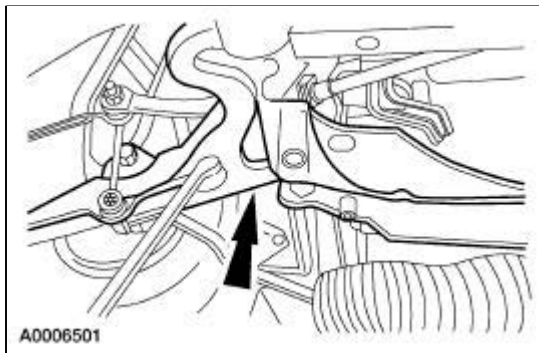
Installation

1. Clean all of the sealing surfaces.
2. Position a new gasket on the pan.
3.  **CAUTION: The oil pan must be installed and the bolts tightened within six minutes of the sealant application.**

Apply a 10 mm (0.40 in) dot of Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4 to the oil pan gasket in the indicated position.



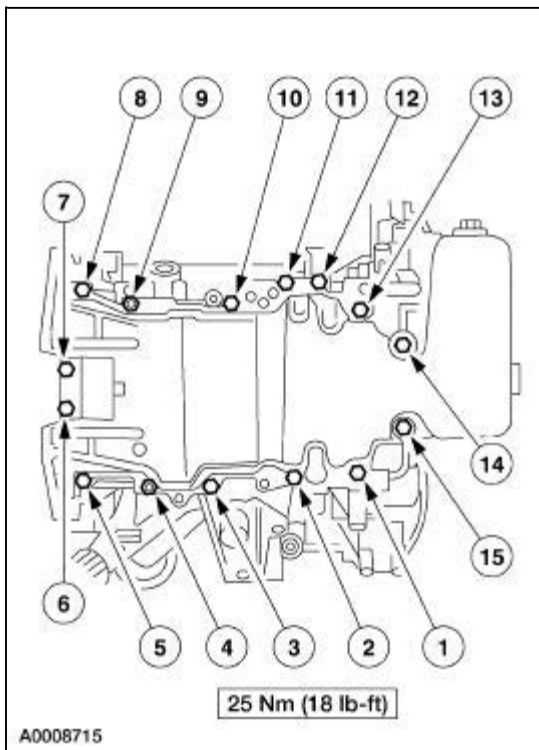
4. Gently pry the subframe down and install the oil pan.



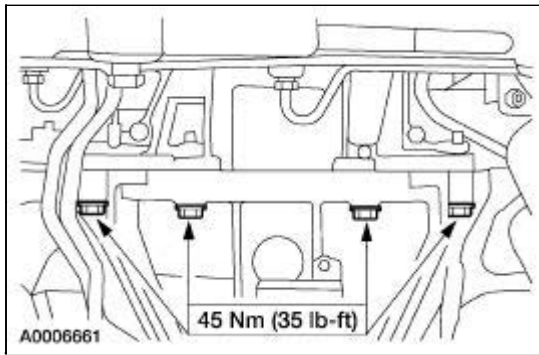
5. **NOTE:** Fasteners No. 4 and No. 9 are studs.

Position the oil pan and install the studs and bolts.

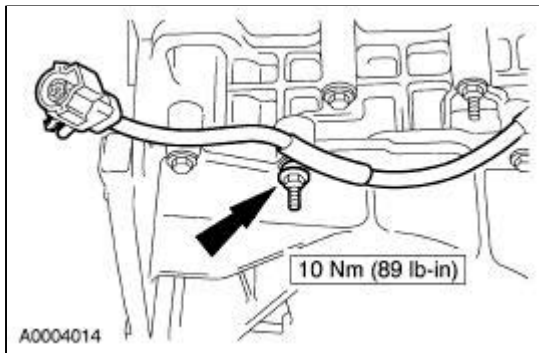
- Tighten the bolts in the sequence shown.



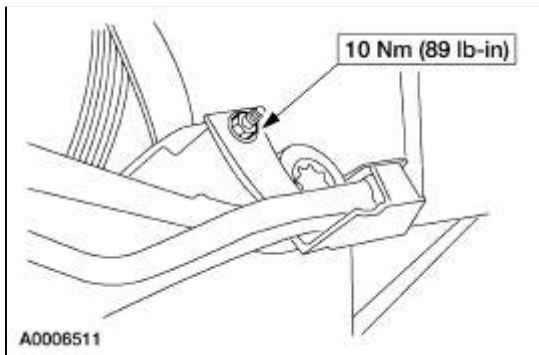
6. Install the transmission to oil pan bolts.



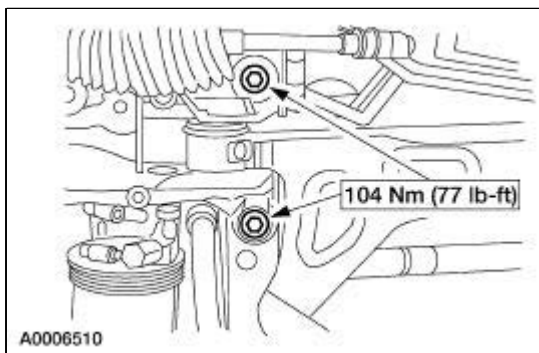
7. Position the wiring harness on the stud and install the nut.



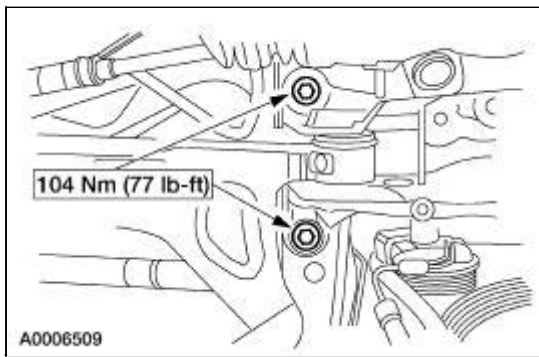
8. Install the transmission cooler line bracket nut.



9. Install the RH subframe bolts.

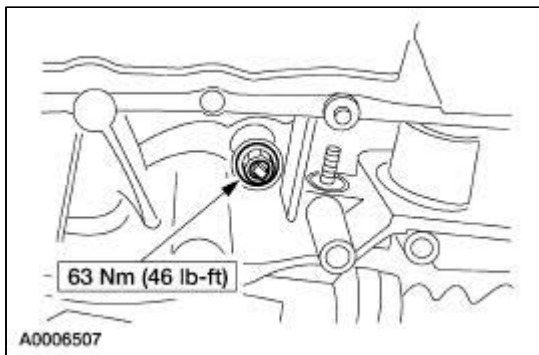


10. Install the LH subframe bolts.

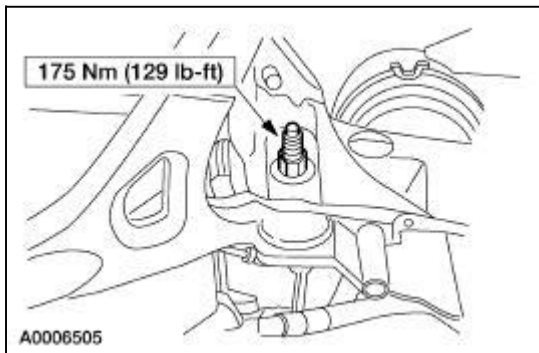


11. **NOTE:** LH shown; RH similar.

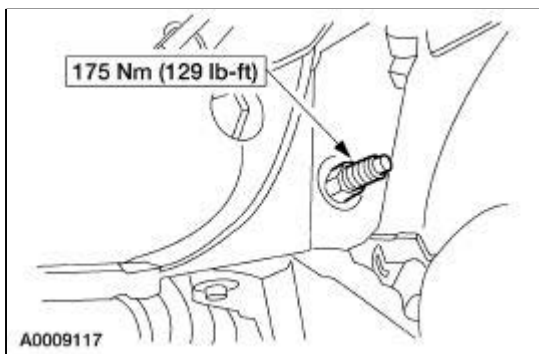
Install the LH and the RH engine mount nuts.



12. Install the RH lower control arm through bolt.

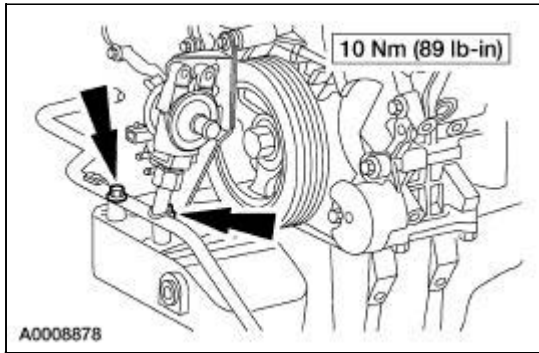


13. Install the LH lower control arm through bolt.



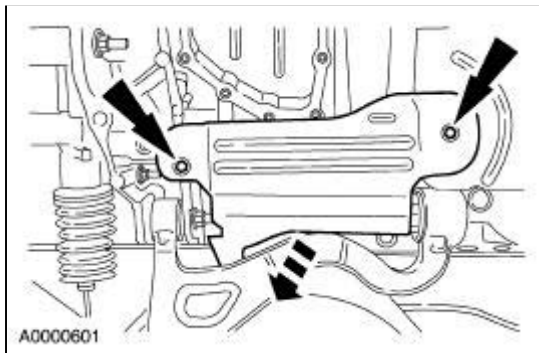
14. Install the steering gear. For additional information, refer to [Section 211-02](#).

15. If equipped, install the electronic thermactor air (ETA) bracket bolts.

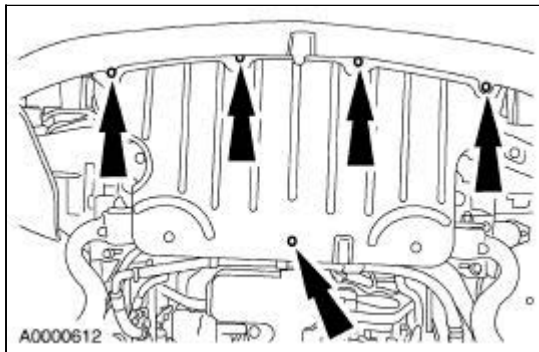


16. Install the A/C compressor. For additional information, refer to [Section 412-03](#).

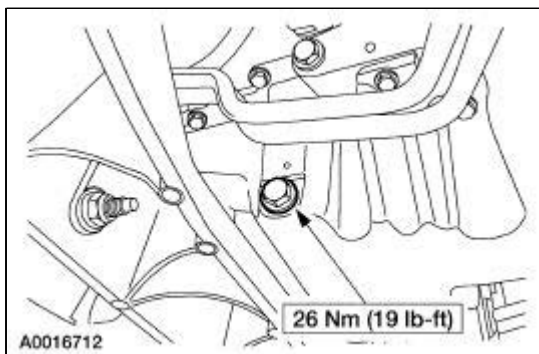
17. Install the RH front splash shield.



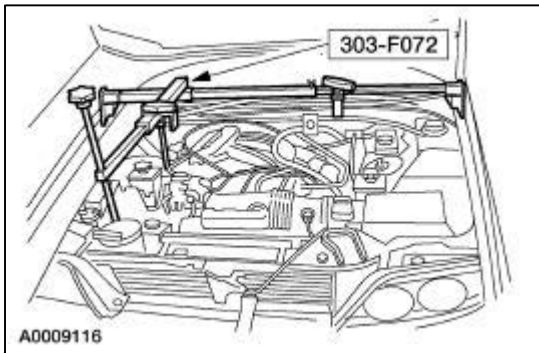
18. Install the front center splash shield.



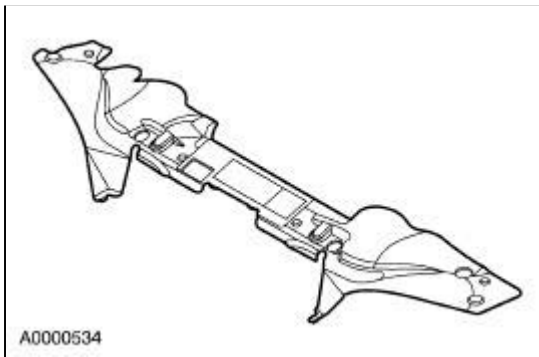
19. Tighten the oil pan drain plug.



20. Install the generator. For additional information, refer to [Section 414-02](#).
21. Remove all of the special tools.



22. Install the upper radiator sight shield.

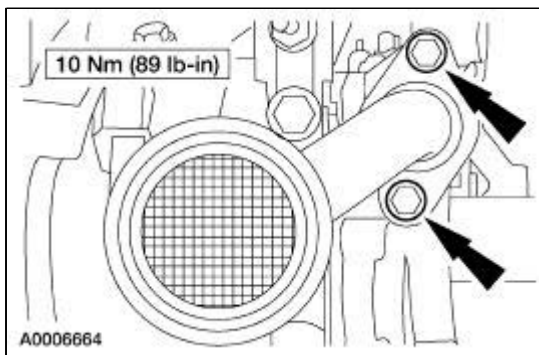


23. Install the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
 24. Fill the engine crankcase with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H.
 25. Check the vehicle alignment. For additional information, refer to [Section 204-00](#).
-

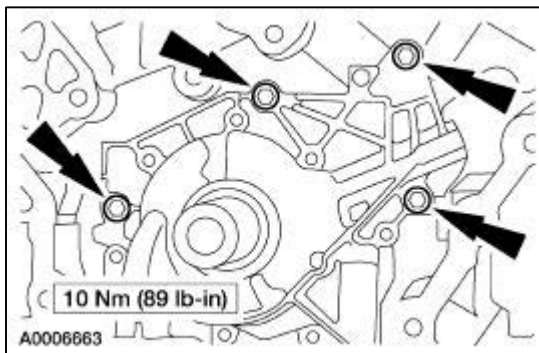
Oil Pump

Removal and Installation

1. Remove the timing chains. For additional information, refer to [Timing Drive Components](#) in this section.
2. Remove the crankshaft sprocket.
3. Remove the bolts and the oil pump screen tube.
 - Inspect the O-ring seal. Install a new seal if necessary.



4. Remove the bolts and the oil pump.

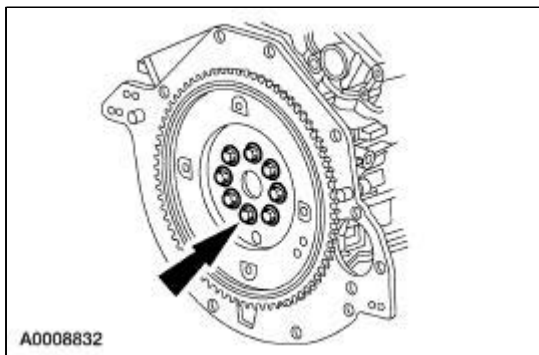


5. To install, reverse the removal procedure.

Flexplate

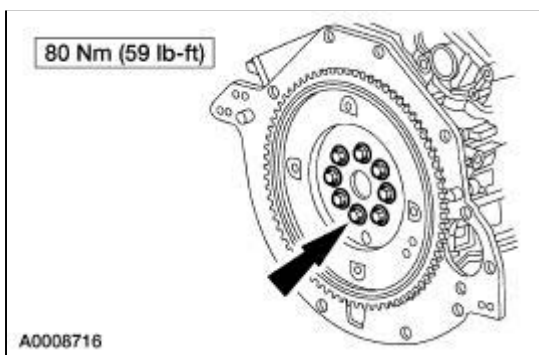
Removal

1. Remove the transmission. For additional information, refer to [Section 307-01](#).
2. Remove the bolts and the flexplate.
 - Inspect the flexplate for cracks or other damage. Install a new flexplate if necessary.



Installation

1. Position the flexplate and install the bolts.

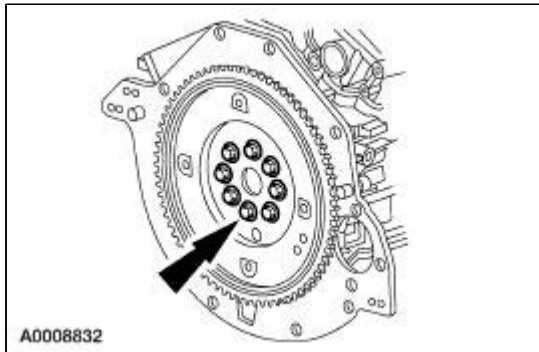


2. Install the transmission. For additional information, refer to [Section 307-01](#).
-

Flywheel

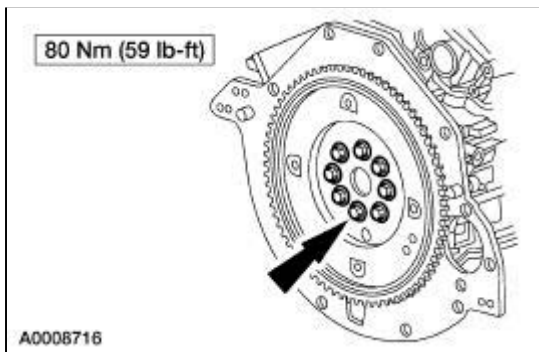
Removal

1. Remove the clutch. For additional information, refer to [Section 308-02](#).
2. Remove the bolts and the flywheel.



Installation



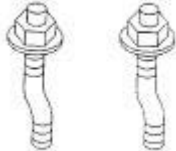

1. Position the flywheel and install the bolts.



2. Install the clutch. For additional information, refer to [Section 308-02](#).
-

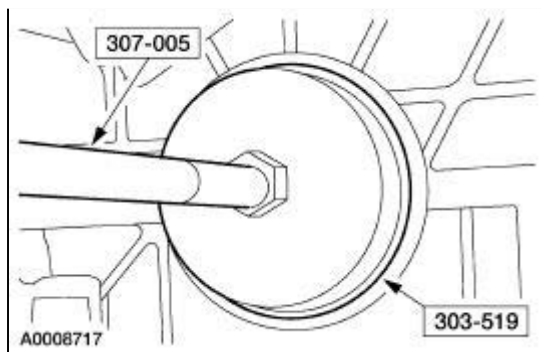
Crankshaft Rear Oil Seal

Special Tool(s)

 ST1187-A	Impact Slide Hammer 307-005
 ST1382-A	Rear Crankshaft Seal Remover 303-519 (T95P-6701-EH)
 ST1333-A	Rear Crankshaft Adapter Bolts 303-384 (T91P-6701-A)
 ST1327-A	Crankshaft Seal Replacer 303-178 (T82L-6701-A)

Removal

1. Remove the flywheel. For additional information, refer to [Flywheel](#) in this section.
2. Using the special tools, remove the crankshaft rear oil seal.

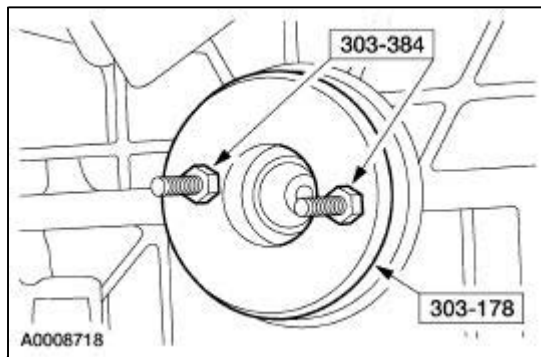


Installation

1. Lubricate the outer lips and the inner seal on the crankshaft rear oil seal with Super Premium

5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H.

2. Using the special tools, install the crankshaft rear oil seal.

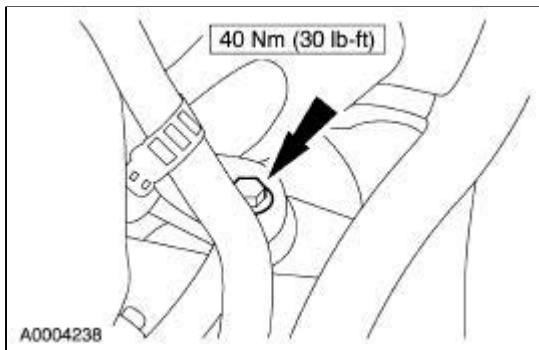


3. Install the flywheel. For additional information, refer to [Flywheel](#) in this section.
-

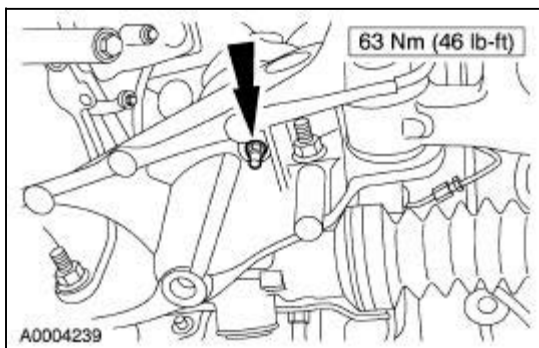
Engine Mount —LH


Removal and Installation

1. Remove the intake manifold tuning valve. For additional information, refer to [Section 303-14](#).
2. Remove the fresh air intake housing. For additional information, refer to [Section 412-01](#).
3. Remove the LH engine mount upper nut.

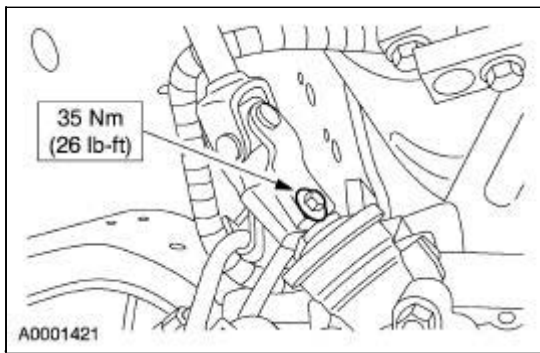


4. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
5. Remove the LH engine mount lower nut.

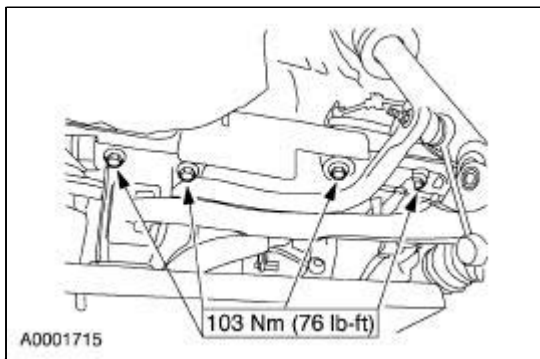


6.  **CAUTION:** The steering wheel must be in the locked position, or the lower end of the column wired in such a way that the steering column does not rotate, resulting in damage to air bag sliding contact.

Disconnect the steering coupling.



7. Raise the engine.
8. Loosen the four bolts and lower the sub-frame to remove the mount.

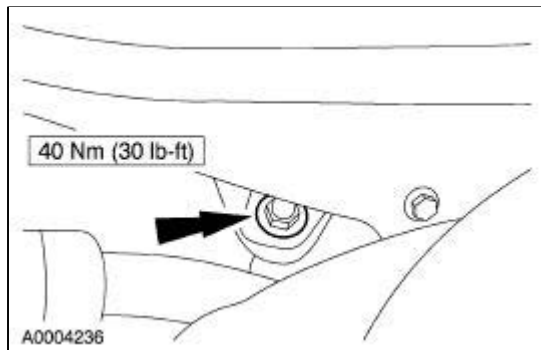


9. To install, reverse the removal procedure.
-

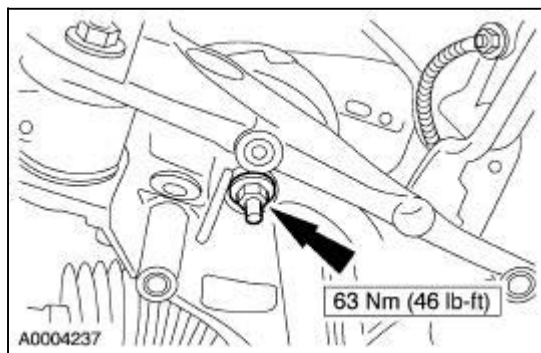
Engine Mount —RH

Removal and Installation

1. Remove the intake manifold tuning valve. For additional information, refer to [Section 303-14](#).
2. Remove the fresh air intake housing. For additional information, refer to [Section 412-01](#).
3. Remove the RH engine mount upper nut.





4. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
5. Remove the RH engine mount lower nut.




6. Raise the engine and remove the engine mount.
7. To install, reverse the removal procedure.


Valve Spring —Lash Adjustment

Special Tool(s)

 <p>ST2429-A</p>	Camshaft Lift Tools 303-659
 <p>ST1271-A</p>	Feeler Gauge Set 303-D027 (D81L-4201A)

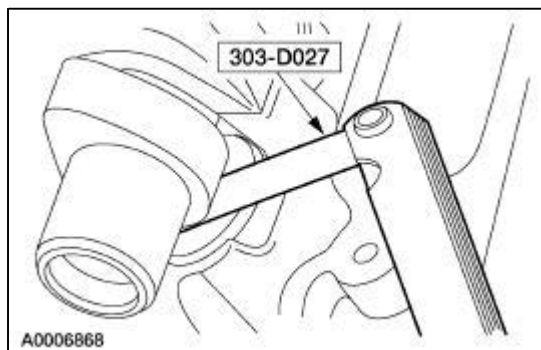
Removal

1. Remove the RH valve cover. For additional information, refer to [Valve Cover—RH](#) in this section.
2. Remove the LH valve cover. For additional information, refer to [Valve Cover—LH](#) in this section.
3.  **CAUTION: Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.**

 **CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve lash measurements will be incorrect.**

Rotate the engine clockwise to position the camshaft lobe away from the shim surface.

4. Using the special tool, measure the clearance between the camshaft and the shim surface. Record the information.

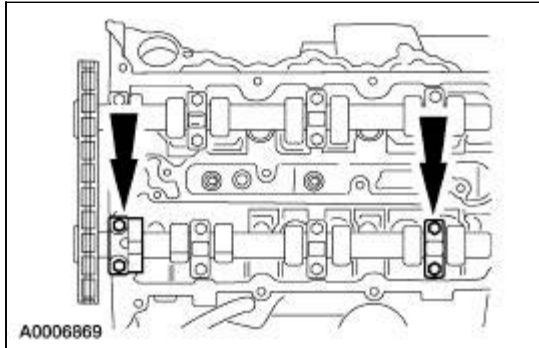


5. Use a bright colored marker to mark the position of the timing chain in relation to the camshaft sprockets to make sure that the timing remains correct.

6.  **CAUTION: The camshaft caps must be installed in their original positions.**

Mark the camshaft cap locations.

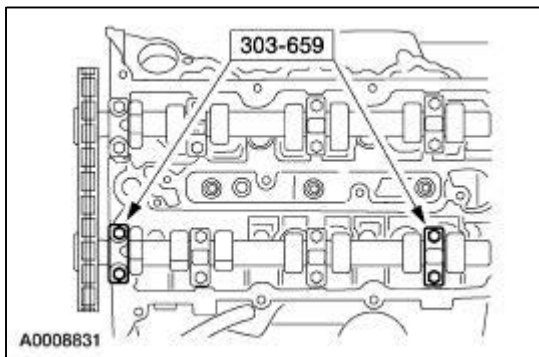
7. Remove the camshaft thrust cap and rear camshaft cap from the camshaft that requires shim adjustment.



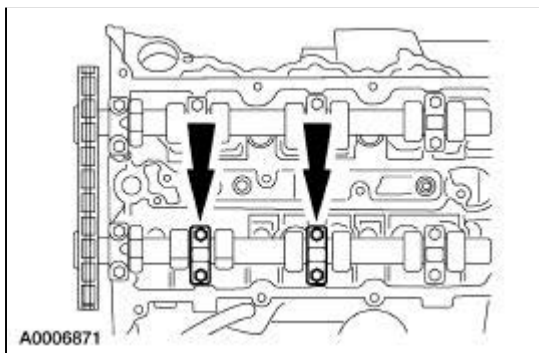
8. **NOTE:** The taller special tool is installed in place of the rear camshaft cap to allow the camshaft to be lifted to remove the shims.

Install the special tools.

- Hand-tighten the bolts.



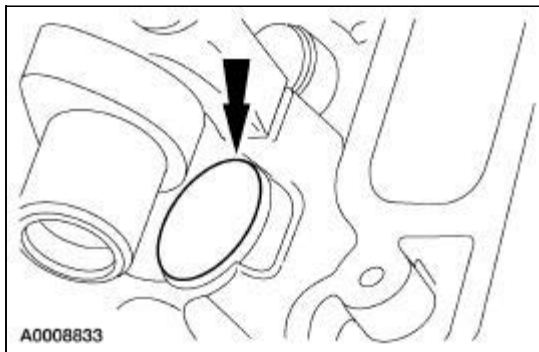
9. Remove the bolts and the center camshaft caps.



10.  **CAUTION: Do not use any means of marking the shims other than a permanent type marker. Any scratches or paint on the shims may result in incorrect lash adjustments and severe engine damage.**

Use a permanent marker to mark the location of each shim.

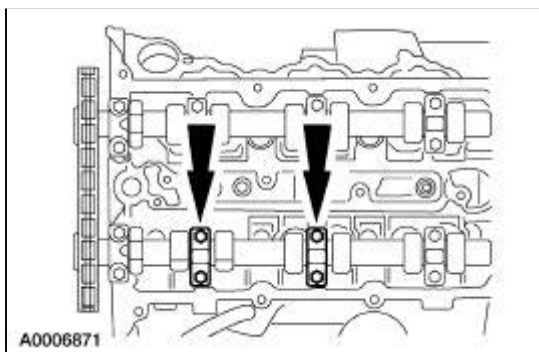
11. Use a rubber-tipped air gun and compressed air to remove the shims that require adjustment.
 - Blow compressed air between the shim edge and bucket rail to dislodge the shim.



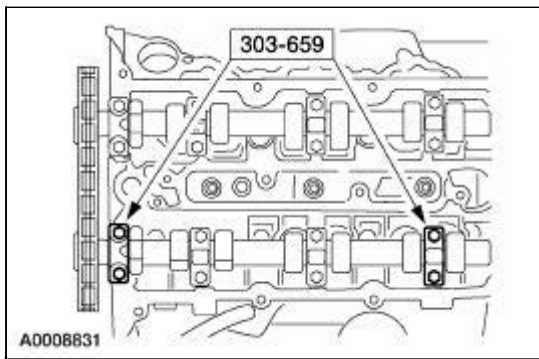
12. Measure and record the thickness of each shim to correspond with valve clearance.
13. Use the following formula to calculate the required shim thickness.
 - Valve clearance specification:
 - Intake: 0.175 mm — 0.225 mm (0.0069 in — 0.0089 in)
 - Exhaust: 0.325 mm — 0.375 mm (0.0128 in — 0.0148 in)
 - Original shim thickness + measured clearance - desired clearance = required shim thickness.

Installation

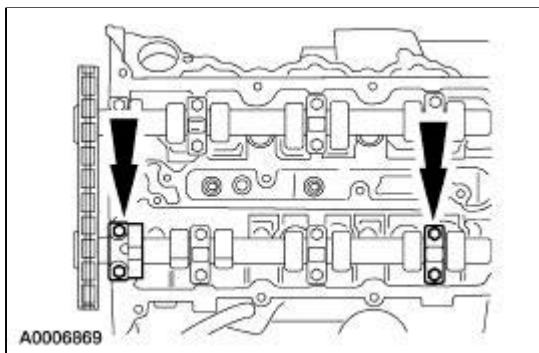
1. Apply a light coat of Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H to the replacement shim(s) and install the shim(s).
2. Apply Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H to the camshaft journals and bearing caps.
3. Position the center camshaft journal caps and loosely install the bolts.



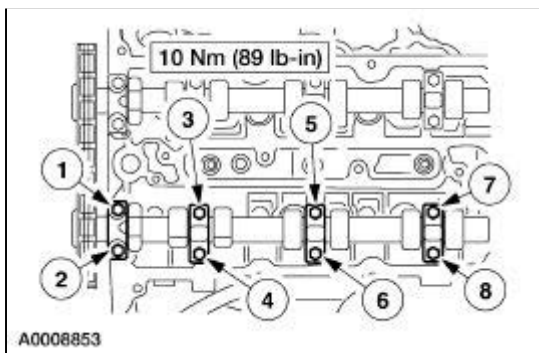
4. Remove the bolts and the special tools.



5. Position the camshaft journal rear and front thrust caps and loosely install the bolts.



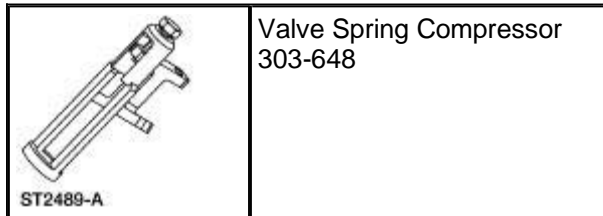
6. Tighten the bolts in the indicated sequence.



7. Rotate the crankshaft clockwise to rotate the camshafts two full revolutions and recheck the valve clearance.
 8. Install the LH valve cover. For additional information, refer to [Valve Cover—LH](#) in this section.
 9. Install the RH valve cover. For additional information, refer to [Valve Cover—RH](#) in this section.
-

Valve Spring —Springs, Retainers, and Stem Seals


Special Tool(s)



Removal

1. Remove the appropriate camshafts. For additional information, refer to [Camshaft—LH](#) or [Camshaft—RH](#) in this section.
2. Position the piston to the top of its stroke on the appropriate cylinder.
3. Remove the appropriate spark plug. For additional information, refer to [Section 303-07A](#).
4. Pressurize the cylinder with compressed air to hold both valves closed.

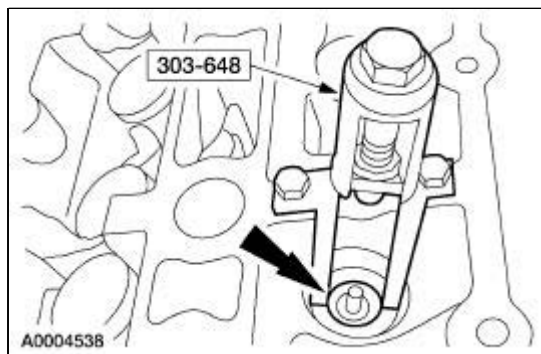
5.  **CAUTION: Do not use any means of marking the shims other than a permanent type marker. Any scratches or paint on the shims may result in incorrect lash adjustments and severe engine damage.**

 **CAUTION: The tappets and shims must be installed in their original positions to make sure of correct valve lash settings.**

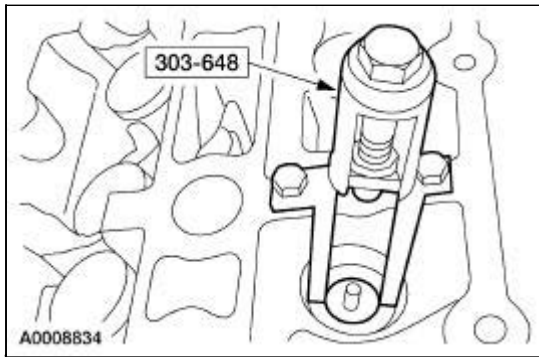
Remove the tappet and shim from the valve.

- If more than one tappet and shim are removed, mark them using a permanent type marker.

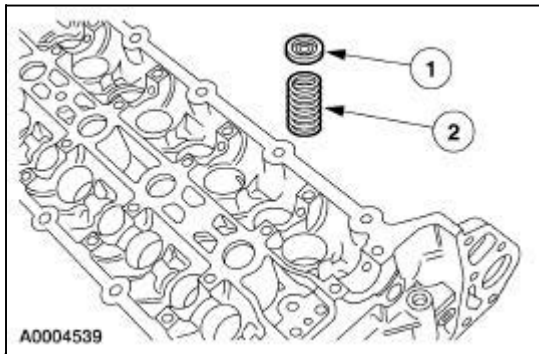
6. Using the special tool, compress the valve spring and remove the retainer locks.



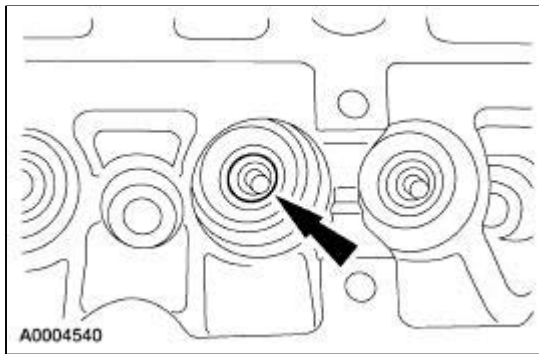
7. Remove the special tool.



8. Remove the valve spring.
 1. Remove the retainer.
 2. Remove the valve spring.



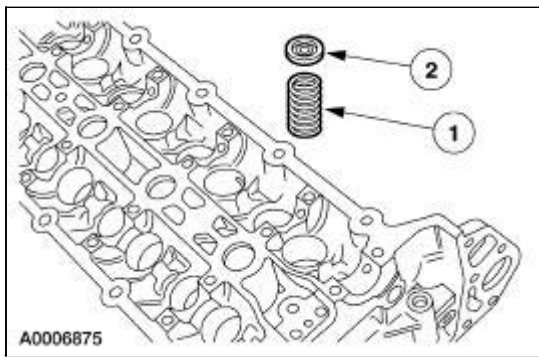
9. Remove the valve stem seal.



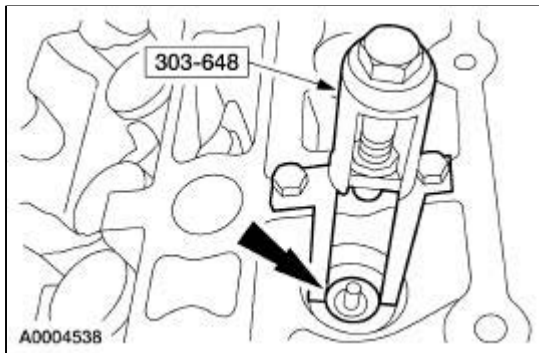
10. Repeat the procedure until all the valve stem seals have been removed.

Installation


1. Install the valve stem seal.
2. Install the valve spring.
 1. Install the spring.
 2. Install the retainer.



3. Using the special tool, compress the valve spring and install the retainer locks.



4. Release the compressed air used to hold the valves closed.
5. Install the spark plug. For additional information, refer to [Section 303-07A](#).
6. Repeat the procedure until all of the valve stem seals have been installed.

7.  **CAUTION: The tappets and shims must be installed in their original positions to make sure of correct valve lash settings.**

Install the tappet and shim from the valve.


8. Install the camshafts. For additional information, refer to [Camshaft—LH](#) or [Camshaft—RH](#) in this section.
-

Valve Tappet

Removal and Installation

1. Remove the appropriate camshafts. For additional information, refer to Camshaft—LH or Camshaft—RH in this section.

2.  **CAUTION: Do not use any means of marking the shims other than a permanent type marker. Any scratches or paint on the shims may result in incorrect lash adjustments and severe engine damage.**

 **CAUTION: The tappets and shims must be installed in their original positions to make sure of correct valve lash settings.**

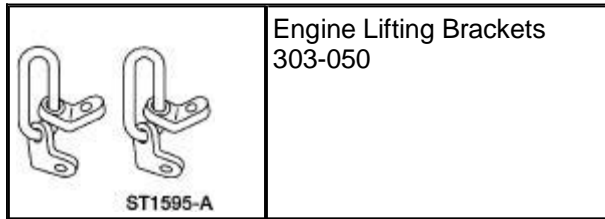
NOTE: The shim sits on top of the valve tappet.

Remove the tappet and shim.

3. To install, reverse the removal procedure.
-

Engine

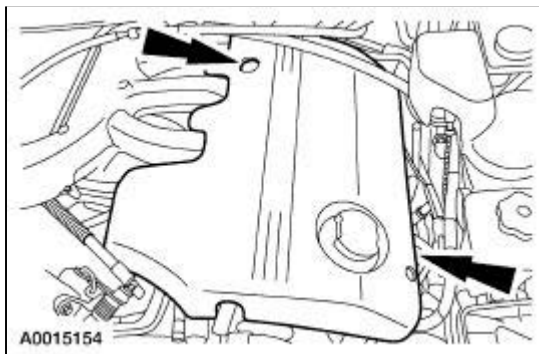
Special Tool(s)



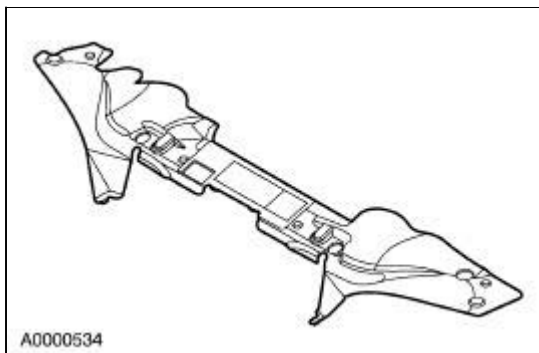
Removal

All vehicles

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the air cleaner outlet tube and the air cleaner. For additional information, refer to [Section 303-12](#).
3. Remove the engine appearance cover.

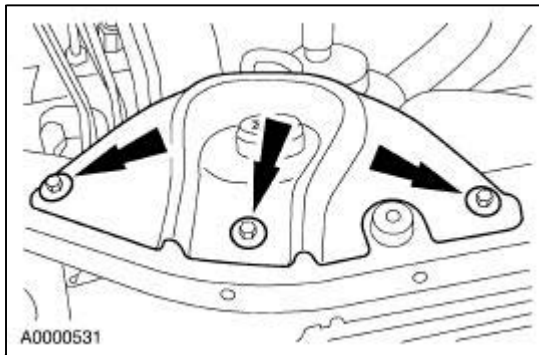


4. Drain the cooling system. For additional information, refer to [Section 303-03](#).
5. Evacuate the A/C system. For additional information, refer to [Section 412-00](#).
6. Remove the upper radiator sight shield.

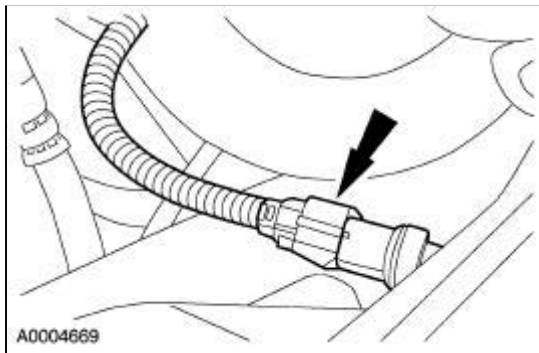


7. **NOTE:** RH shown; LH similar.

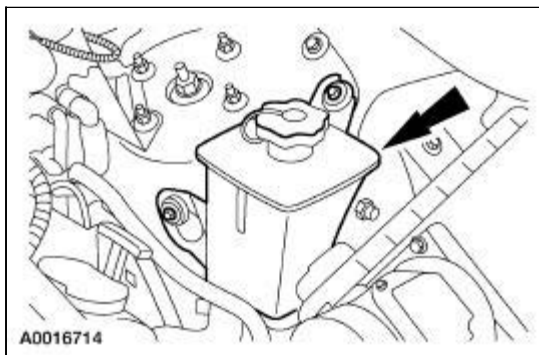
Remove the upper radiator support brackets.



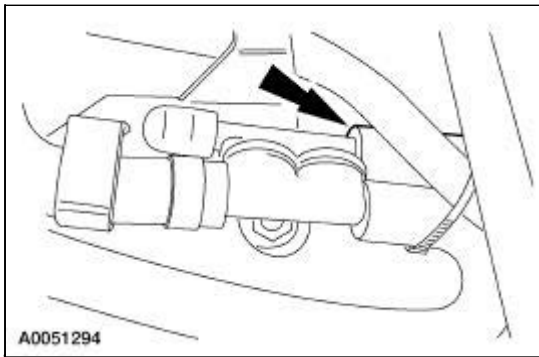
8. Disconnect the A/C pressure switch electrical connector.



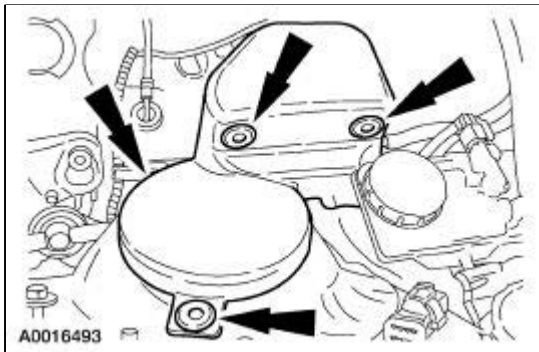
9. Remove the power steering reservoir bolts and secure the power steering reservoir to the engine.



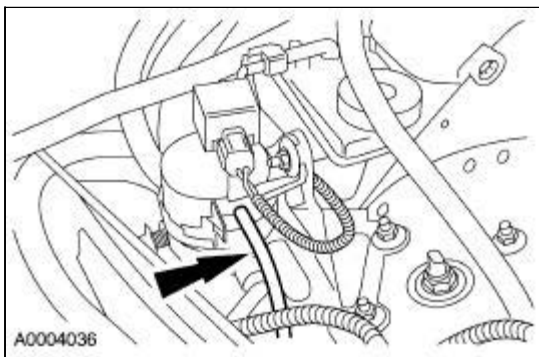
10. Disconnect the fuel tube. For additional information, refer to [Section 310-00](#).
11. Disconnect the brake booster vacuum hose.



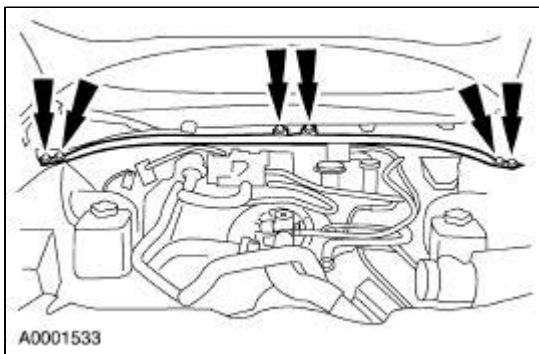
12. Remove the vapor management valve (VMV) cover.



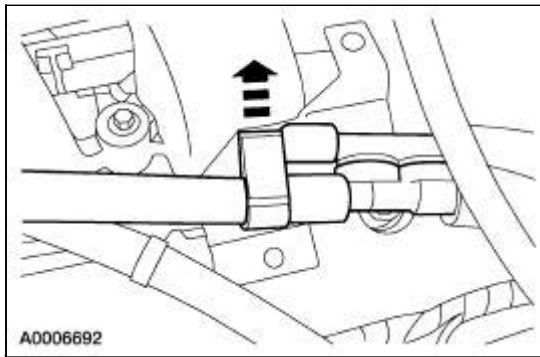
13. Disconnect the vacuum hose.



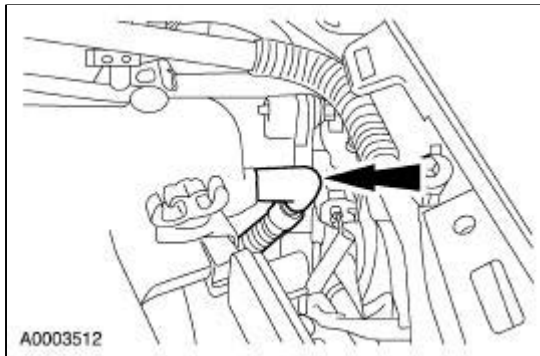
14. Remove the fresh air inlet duct. For additional information, refer to [Section 412-01](#).



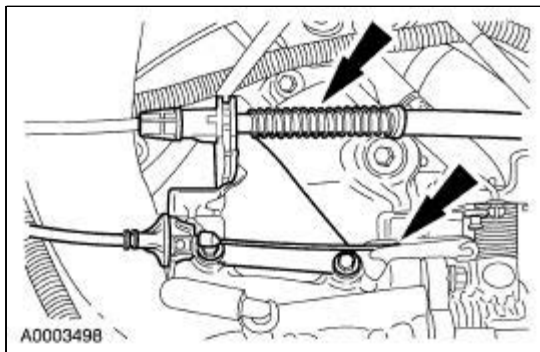
15. Unclip the chassis vacuum tubes from the support bracket and disconnect the tubes.



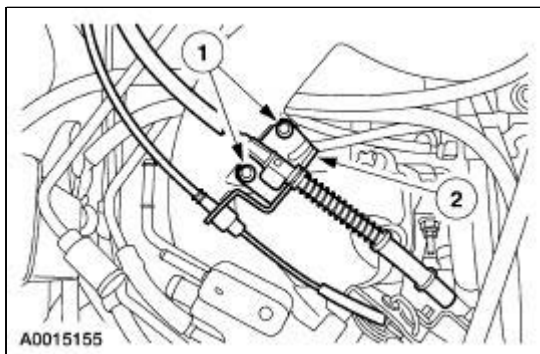
16. Disconnect the main vacuum hose from the rear of the intake manifold.



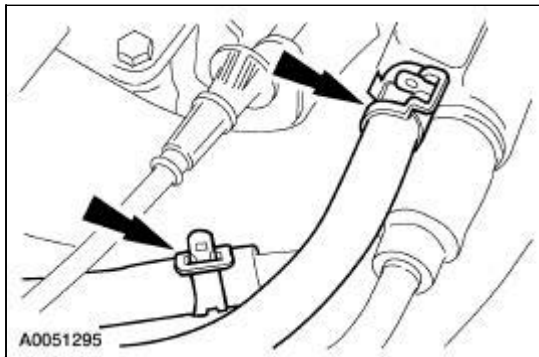
17. Disconnect the accelerator and speed control cables.



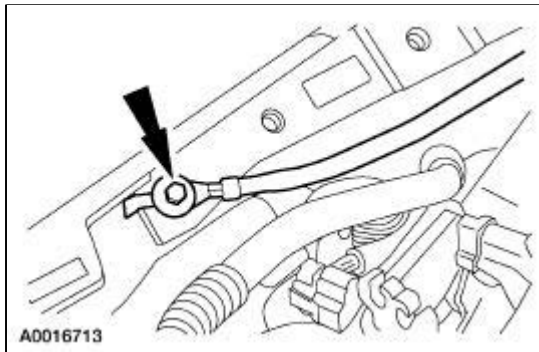
18. Remove the cable brackets.
1. Remove the bolts.
2. Remove the bracket.



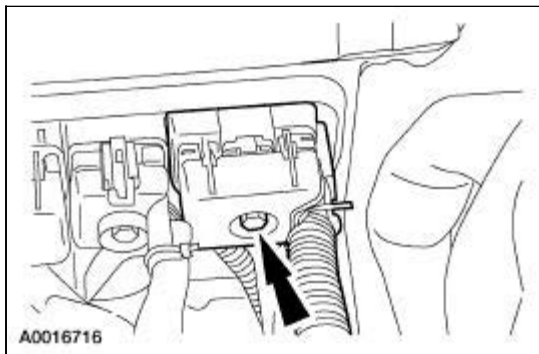
19. Disconnect the throttle body coolant hoses.



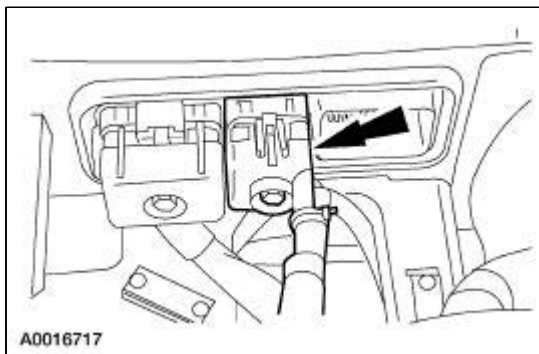
20. Remove the ground strap bolt.



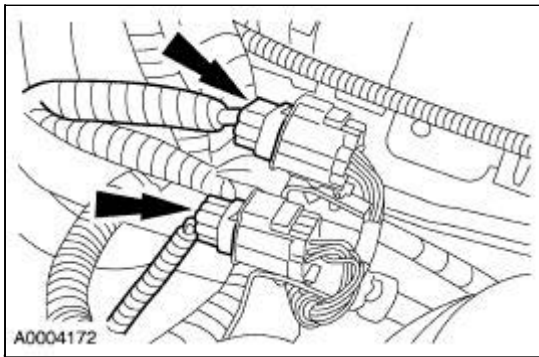
21. Loosen the bolt and disconnect the main engine wiring harness connector.



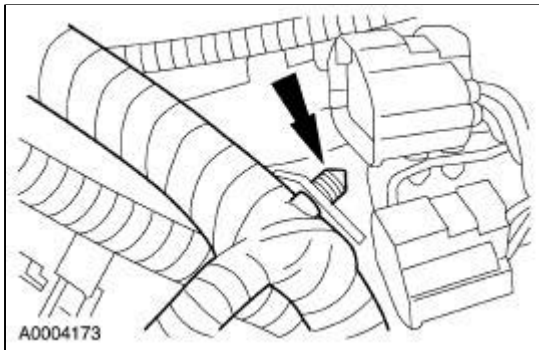
22. Loosen the bolt and disconnect the main transmission wiring harness connector.



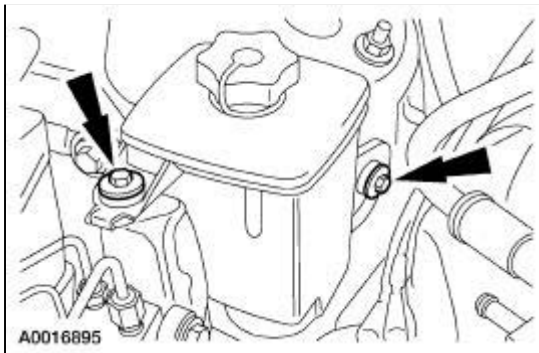
23. Disconnect the two fuel charging wiring harness connectors.



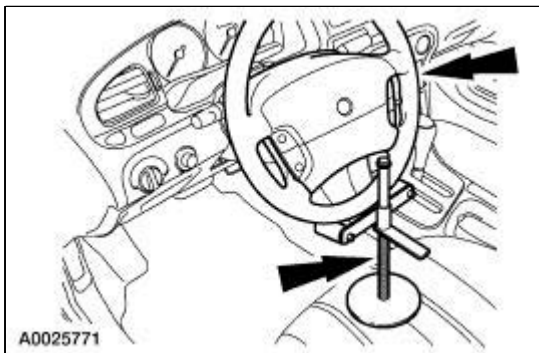
24. Disconnect the wiring harness retainer from the bracket.



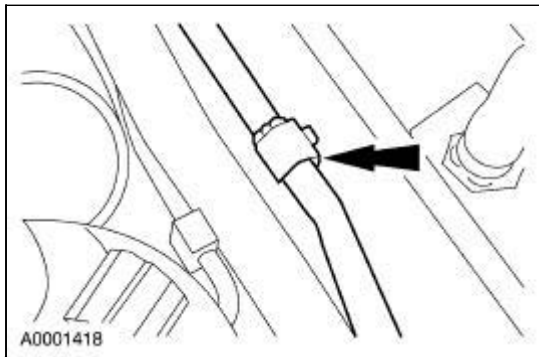
25. Remove the bolts and secure the hydraulic cooling fan reservoir to the engine.



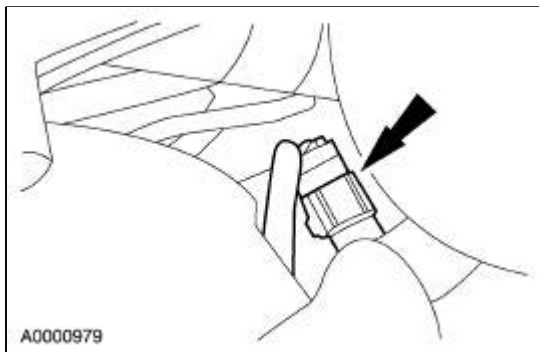
26. Hold the steering wheel in the straight forward position using a suitable holding device.



27. Unclip the tube from the frame.



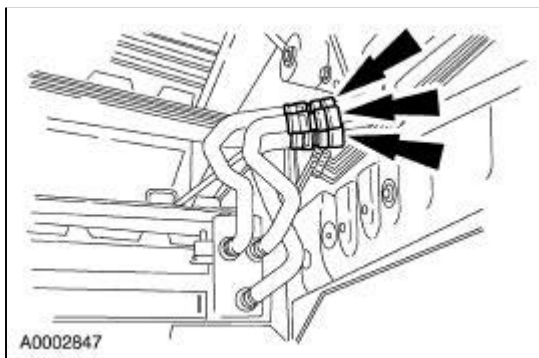
28. Disconnect the connector located at the end of the coolant valve harness pigtail.



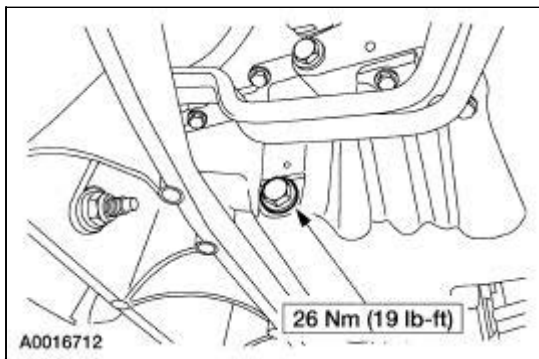
29. **NOTE:** The top heater hose has a green identifying mark to match the hose on the dual coolant flow valve. If the mark is not visible, identify the hoses for location. This will aid in the correct installation of the hose assemblies.

NOTE: Hose assemblies shown with components removed for clarity.

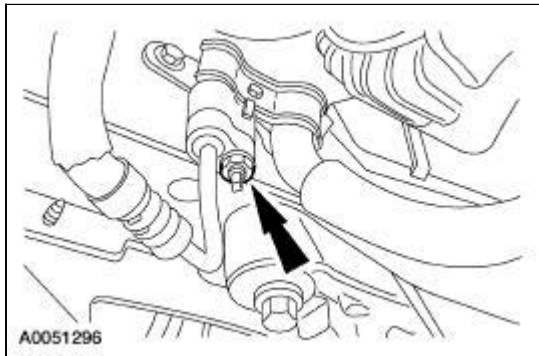
Disconnect the three quick-disconnect couplings from the coolant control valve hoses. For additional information, refer to [Section 412-00](#).



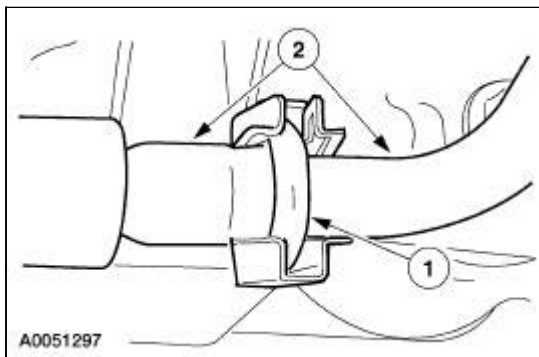
30. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
31. Drain the engine oil.



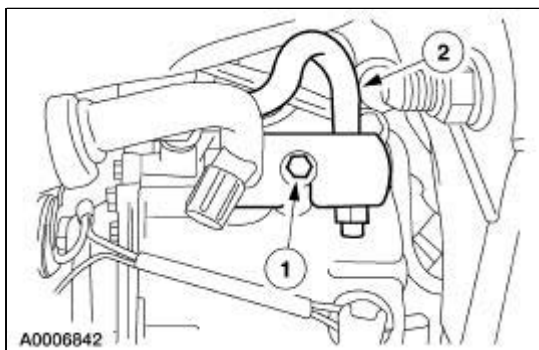
32. Remove the center, LH and RH splash shields.
33. Disconnect the A/C high pressure tube at the right frame rail.



34. Disconnect the A/C suction tube.
 1. Remove the safety clip.
 2. Disconnect the A/C tube.



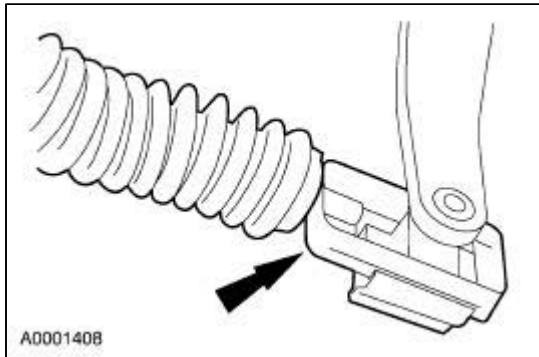
35. Reposition the A/C manifold and tube assembly.
 1. Remove the bolt.
 2. Reposition the A/C manifold and tube assembly.



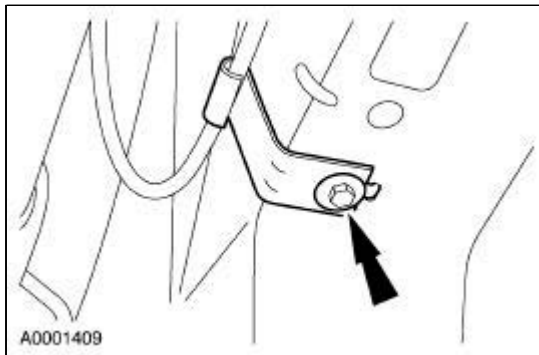
36. Remove the driveshaft. For additional information, refer to [Section 205-01](#).

Vehicles with automatic transmission

37. Disconnect the shift cable from the transmission.

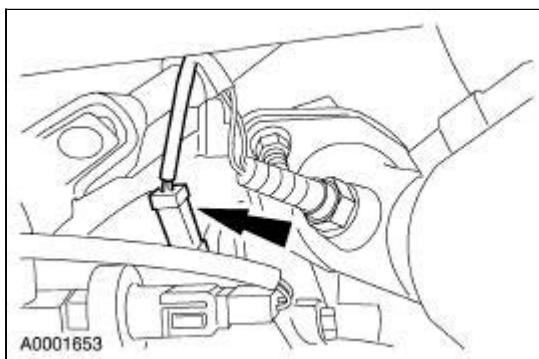


38. Remove the bolt securing the cable bracket to the floor.

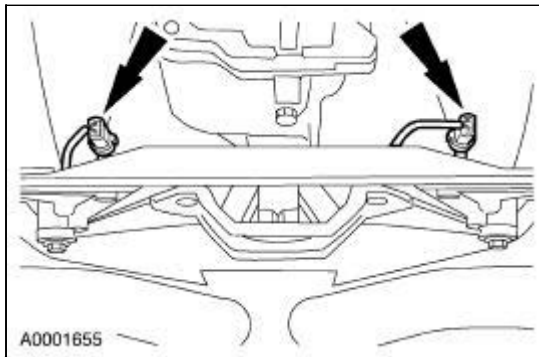


All vehicles

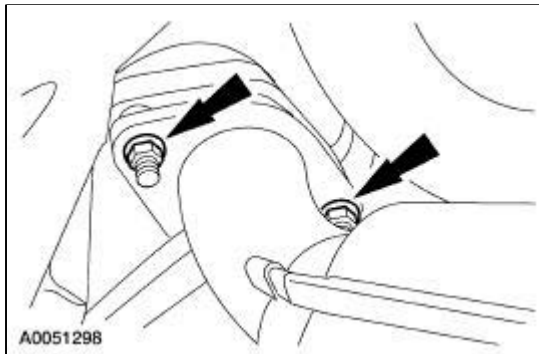
39. Disconnect the two heated oxygen sensors (HO2S) electrical connectors.



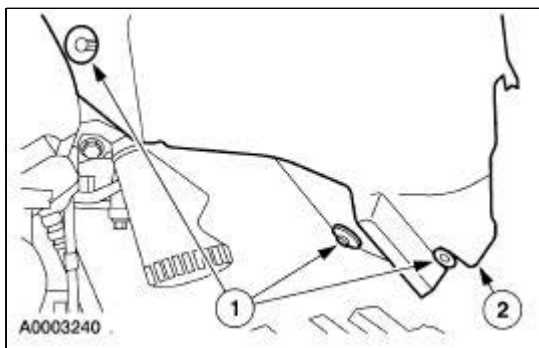
40. Disconnect the two catalyst monitor connectors.



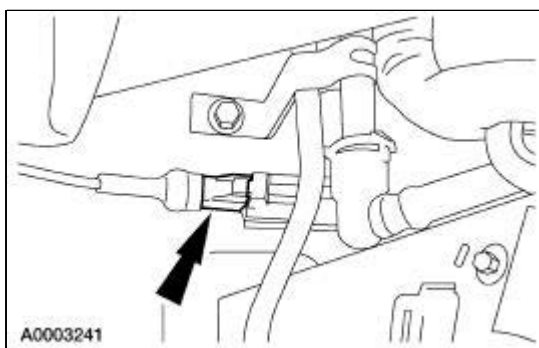
41. Remove the four nuts and the three-way catalytic converter.



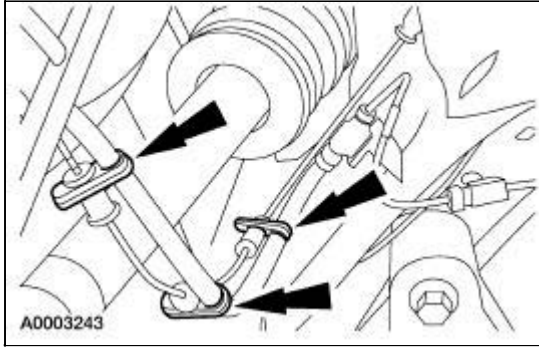
42. Lower the vehicle.
43. Remove the front wheels and tires. For additional information, refer to [Section 204-04](#).
44. Position the inner splash shield aside.
 1. Remove the pin-type retainers.
 2. Position the inner splash shield aside.



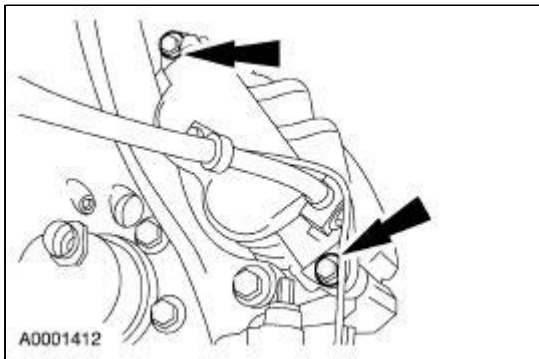
45. Disconnect the anti-lock brake sensor electrical connector.



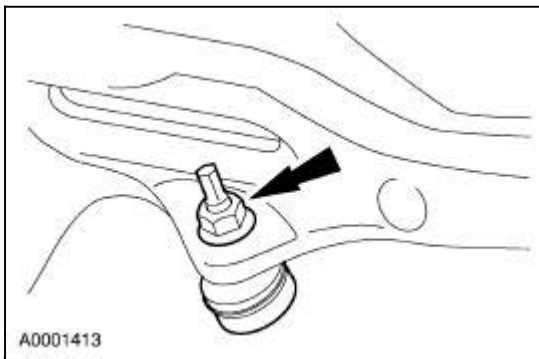
46. Remove the anti-lock brake sensor harness from the brake hose clips.



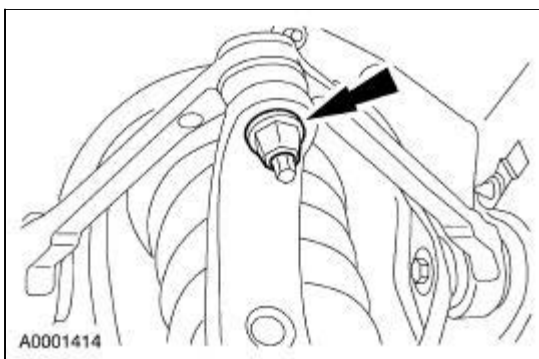
47. Remove the bolts and the front brake calipers. Support the calipers out of the way.



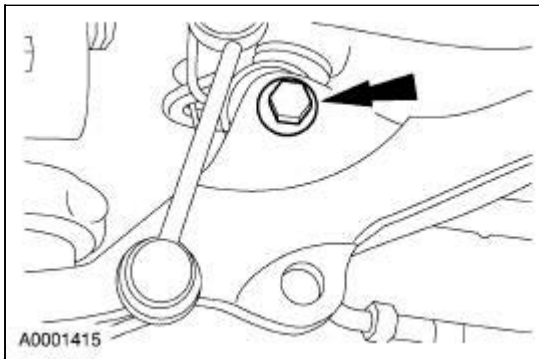
48. Remove the nuts and disconnect the stabilizer links lower mounts.



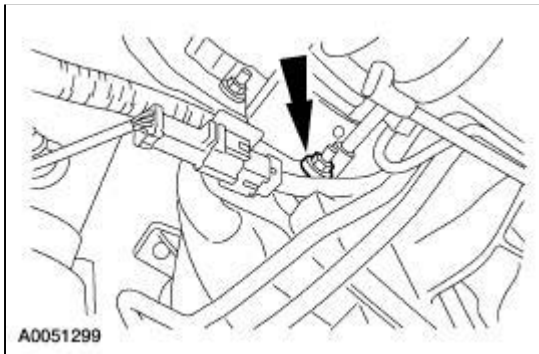
49. Remove the nuts and disconnect the upper ball joints.



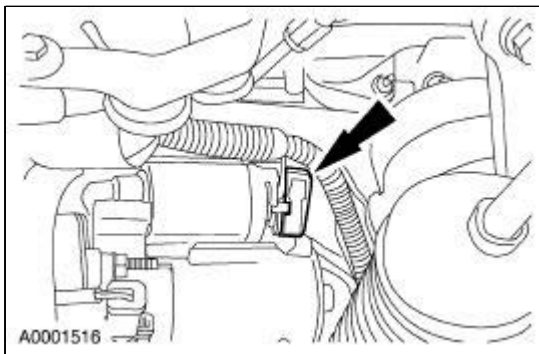
50. Remove the lower strut mount bolts.



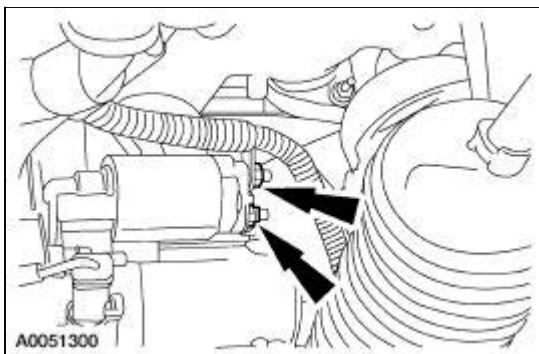
51. Disconnect the ground strap.



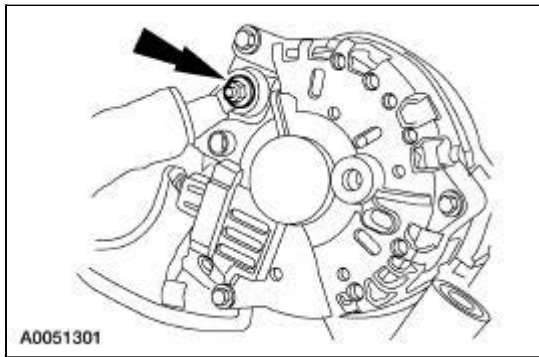
52. Remove the cover.



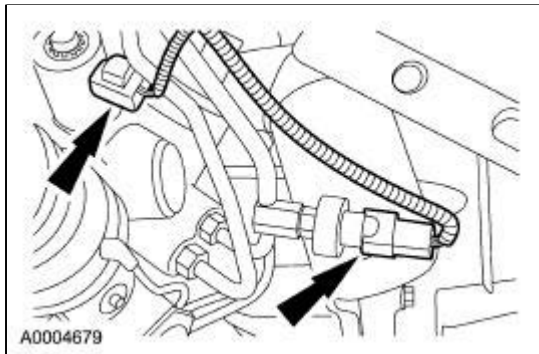
53. Remove the nuts and position the cables aside.



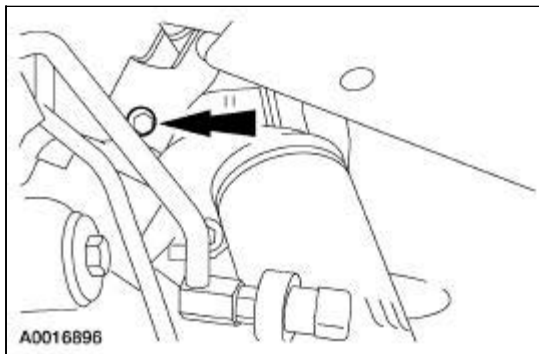
54. Disconnect the B+ terminal from the generator.



55. Disconnect the power steering pressure sensor electrical connectors.

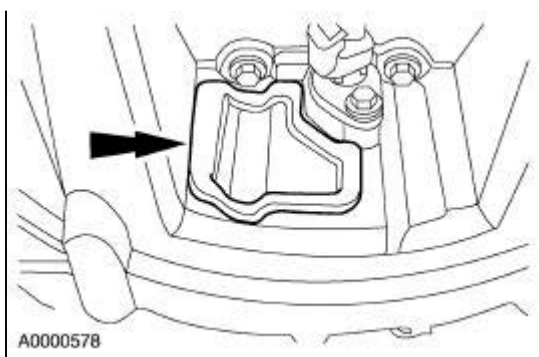


56. Remove the steering shaft clamp bolt.



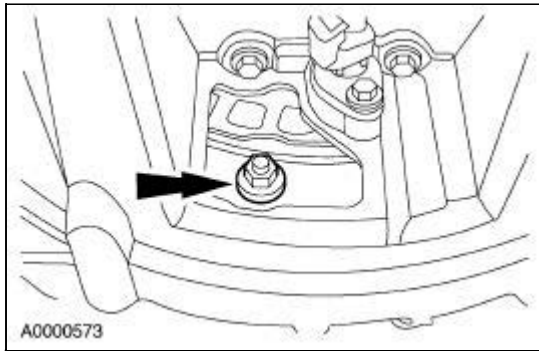
Vehicles with automatic transmission

57. Remove the access cover.



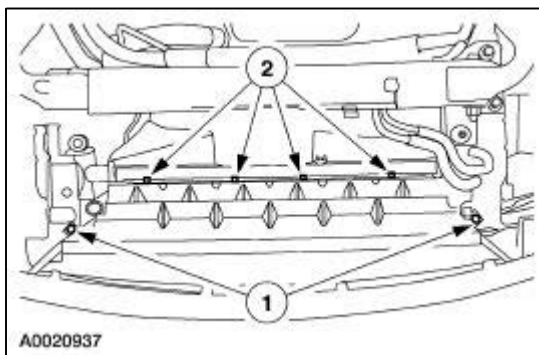
58. **NOTE:** Mark one stud and the flexplate for assembly reference.

Remove the nuts.

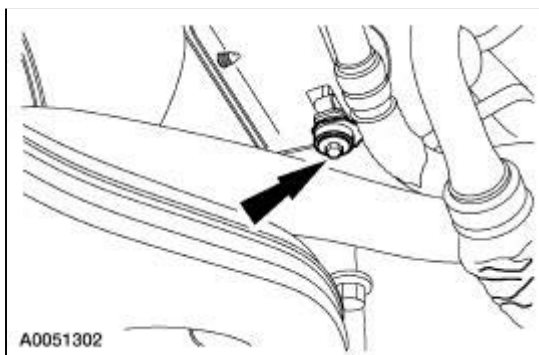


All vehicles

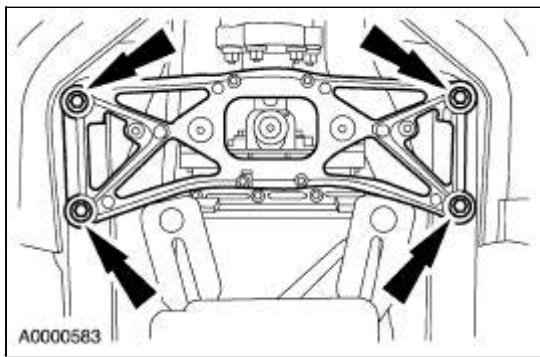
59. Remove the air deflector.
 1. Remove the pin-type retainers.
 2. Remove the side-clip retainers.



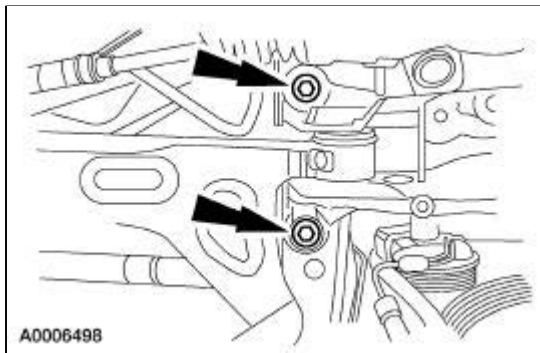
60. Remove the power steering hose bracket bolt.



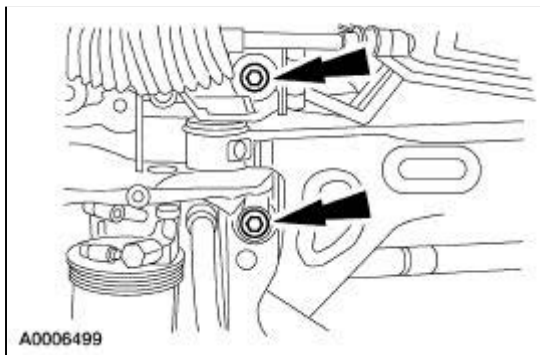
61. Support the rear of the vehicle with suitable safety stands.
62. Support the engine, transmission, front and center crossmembers and the cooling system with a powertrain lift and a transmission support bracket.
63. Remove the four transmission crossmember bolts.



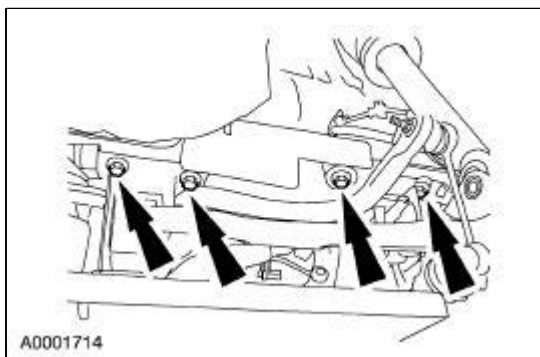
64. Remove the LH subframe bolts.



65. Remove the RH subframe bolts.



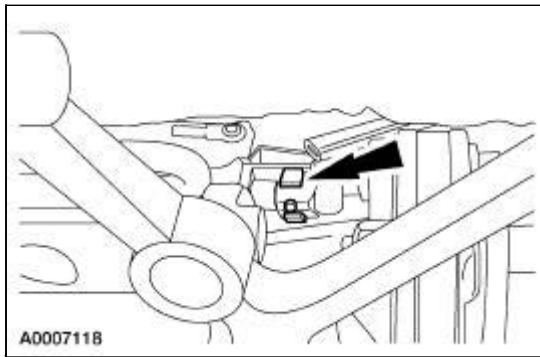
66. Remove the four crossmember bolts.



Vehicles with manual transmission

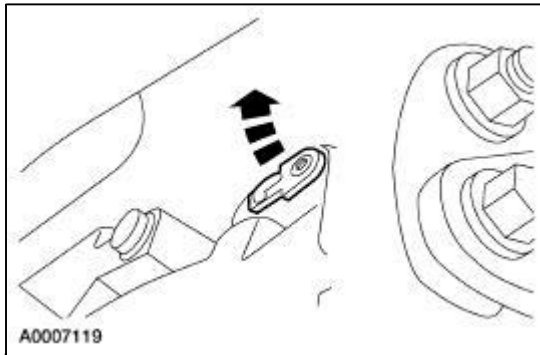
67. Disconnect the selector rod.

- Remove the selector rod locating pin.



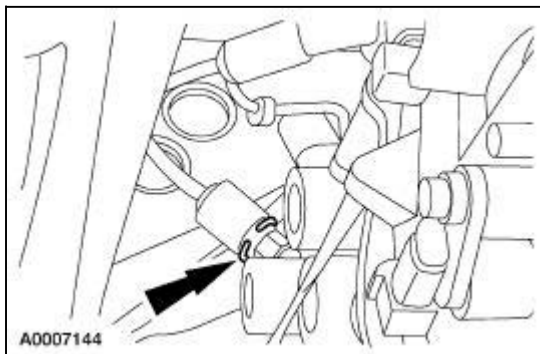
68. Disconnect the stabilizer rod.

- Remove the stabilizer rod locating pin.



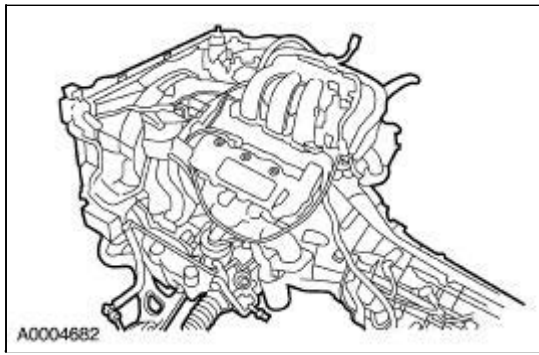
69. Disconnect the slave cylinder supply tube.

- Remove the slave cylinder supply tube retaining clip.
- Plug the hose to prevent loss of fluid.

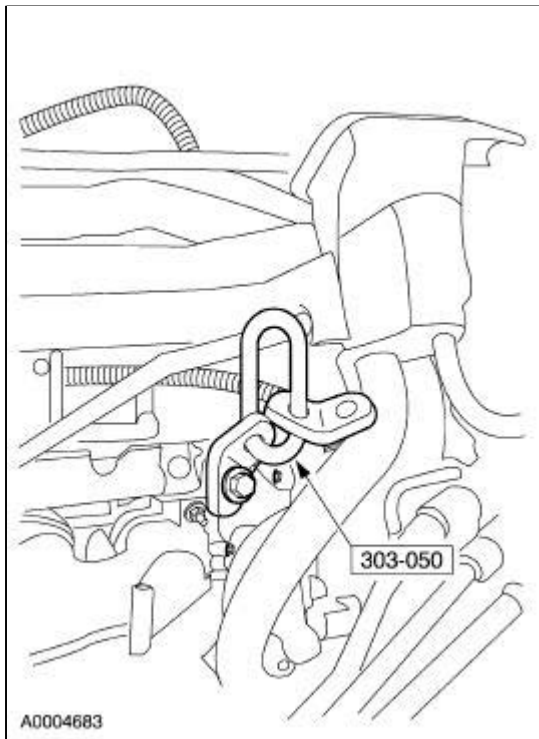


All vehicles

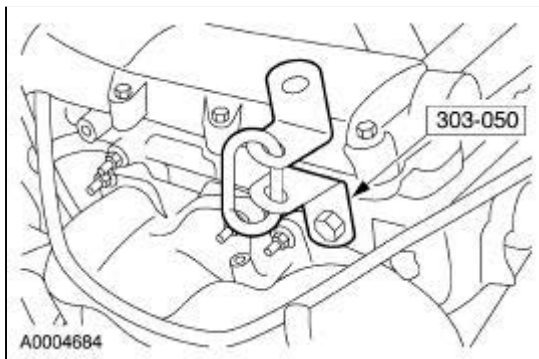
70. Carefully lower the entire assembly from the vehicle.



71. Install the special tool to the engine.

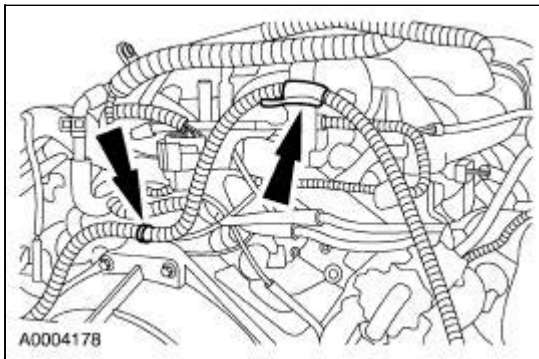


72. Install the special tool to the engine.

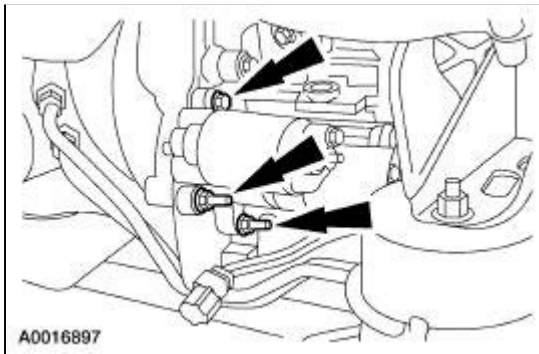


73. Using an engine crane and spreader bar, support the engine and transmission in the front subframe.

74. Disconnect the two wire harness retainers and position the harness out of the way.

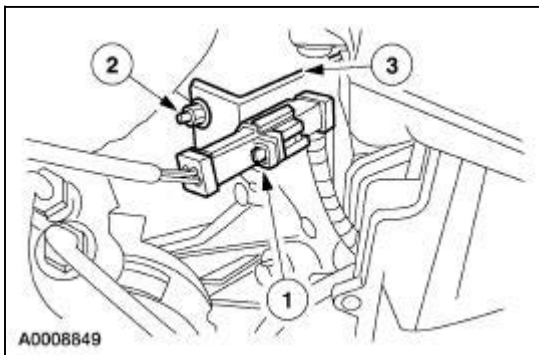


75. Remove the starter assembly.

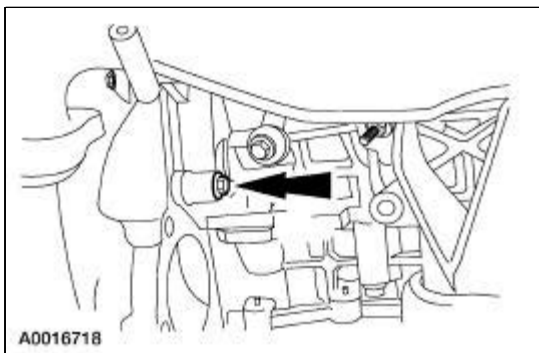


76. Remove the heated oxygen sensor (HO2S) bracket.

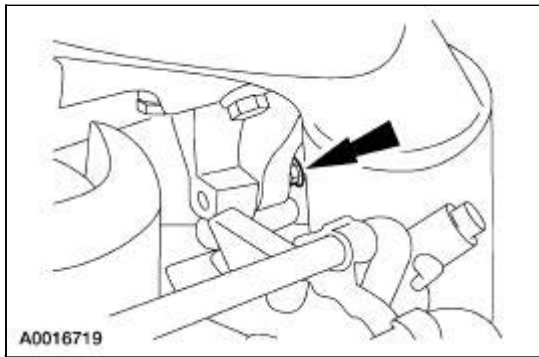
1. Unclip the connector.
2. Remove the nut.
3. Remove the bracket.



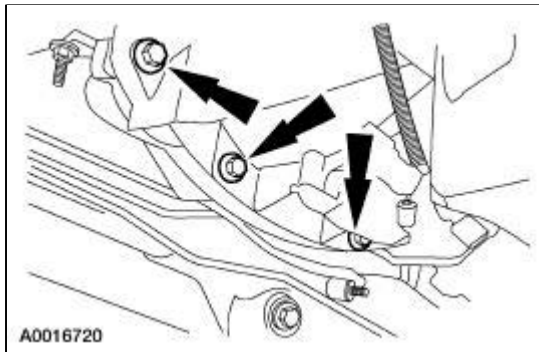
77. Remove the engine to transmission bolt.



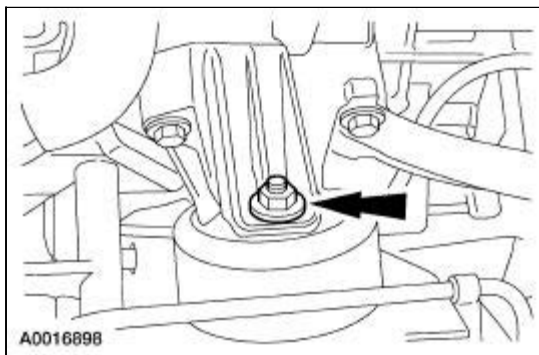
78. Remove the engine to transmission bolt.



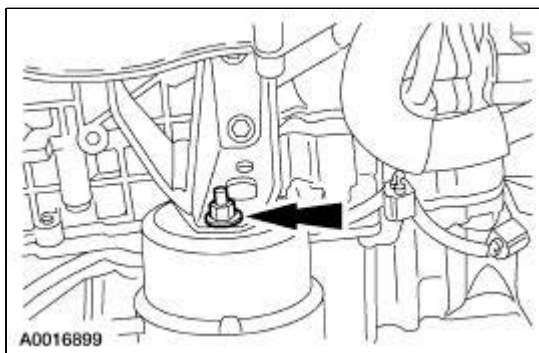
79. Remove the four lower engine to transmission bolts.



80. Remove the LH engine mount nut.

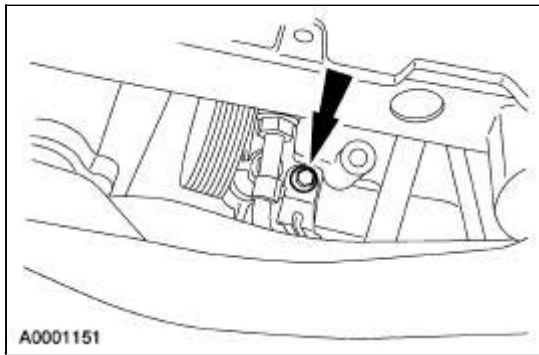


81. Remove the RH engine mount nut.

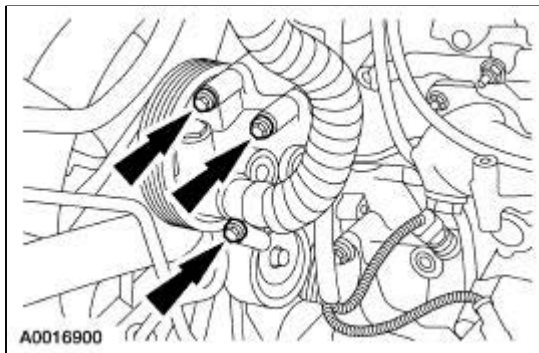


82. Remove the accessory drive belt. For additional information, refer to [Section 303-05](#).

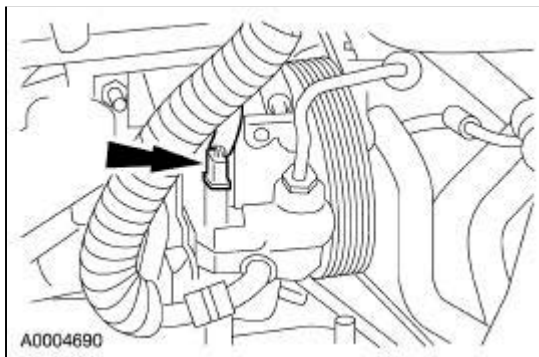
83. Remove the power steering bracket bolt and bracket.



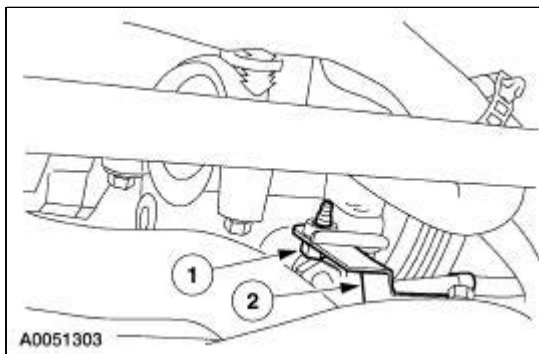
84. Remove the bolts and secure the power steering pump and reservoir aside.



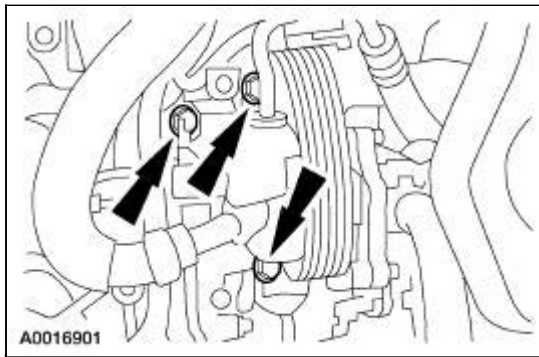
85. Disconnect the hydraulic cooling fan pump electrical connector.



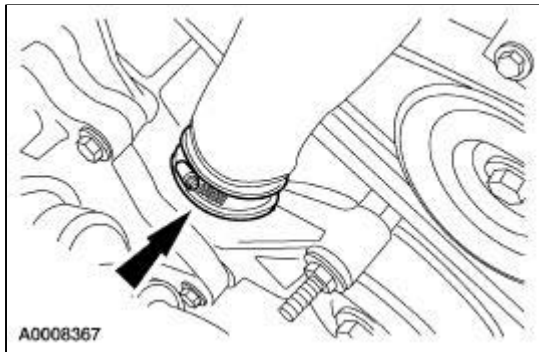
86. Remove the hydraulic cooling fan tube bracket.
1. Remove the bolt.
2. Remove the bracket.



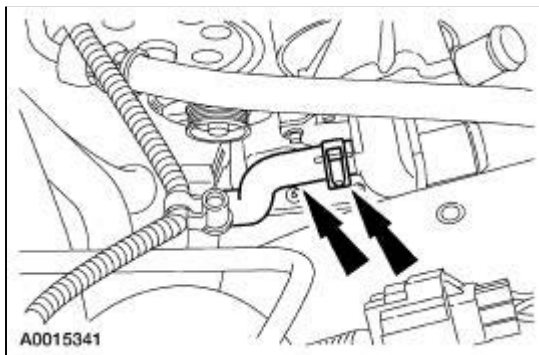
87. Remove the bolts and secure the hydraulic cooling fan pump aside.



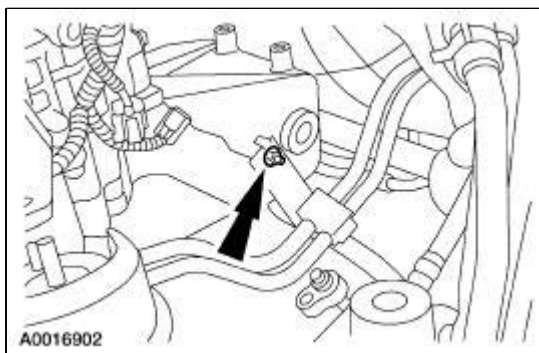
88. Disconnect the upper radiator hose.



89. Disconnect the heater water hose from the water pump.

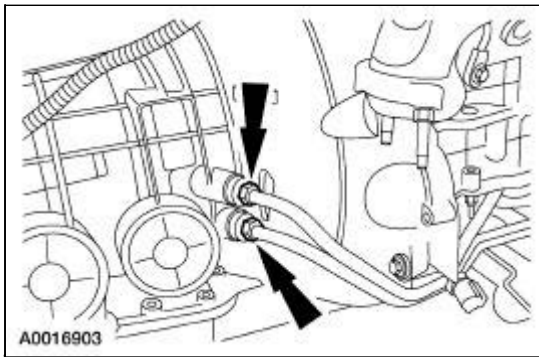


90. If equipped, remove the nut and transmission cooler tubes from the oil pan.

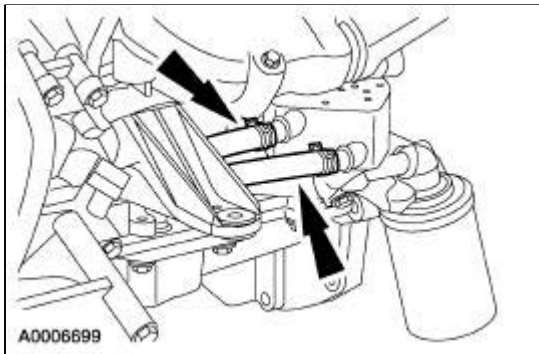


91. Remove the engine and transmission from the subframe. Rest on the floor or on a bench.

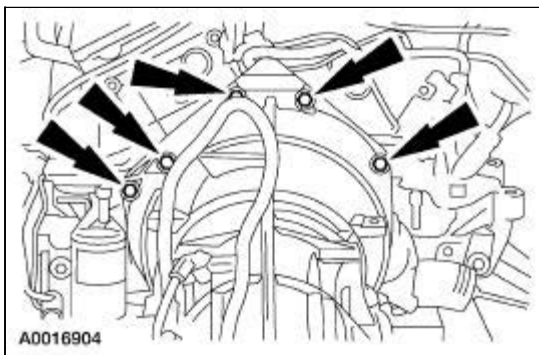
92. If equipped, remove the transmission oil cooler tubes and plug the openings.



93. If equipped, disconnect the oil cooler hoses.



94. Remove the bolts and separate the transmission from the engine.



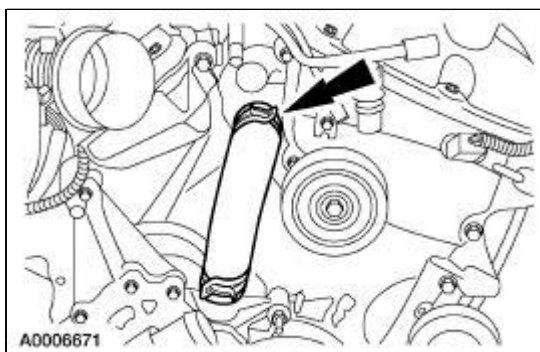
Engine

Special Tool(s)

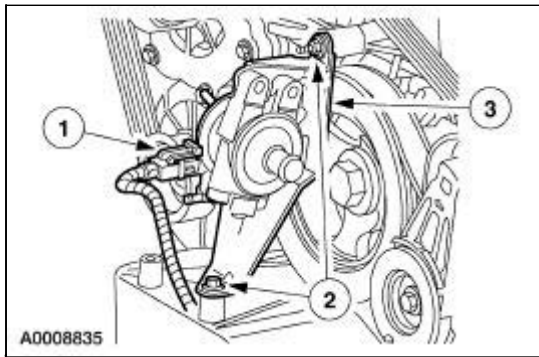
 ST2115-A	Connecting Rod Guide Set 303-462 (T94P-6136-AH)
 ST1184-A	Crankshaft Damper Remover 303-D121
 ST1276-A	Cylinder Ridge Reamer 303-016 (T64L-6011-EA)

Disassembly

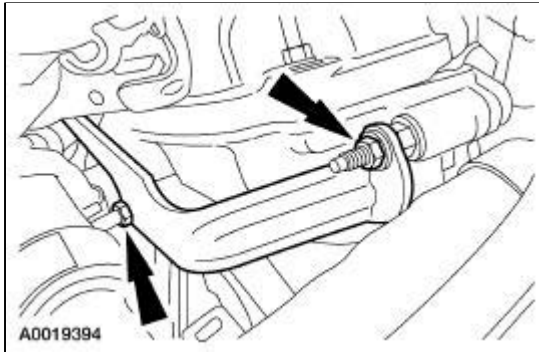
1. Disconnect the water pump hose from the inlet tube.



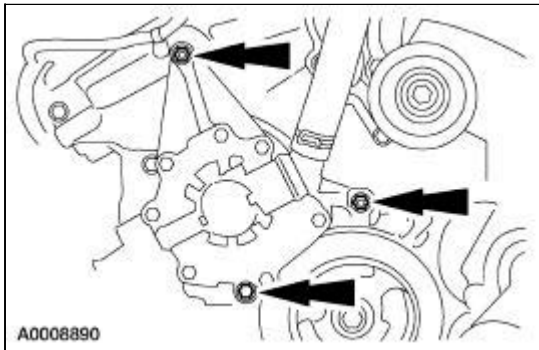
2. If equipped, remove the thermactor air control valve and bracket.
 1. Disconnect the electrical connector.
 2. Remove the bolt and nut.
 3. Remove the valve/bracket.



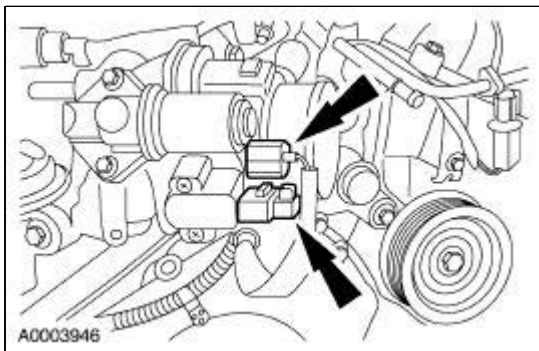
3. Remove the two nuts and the bracket.



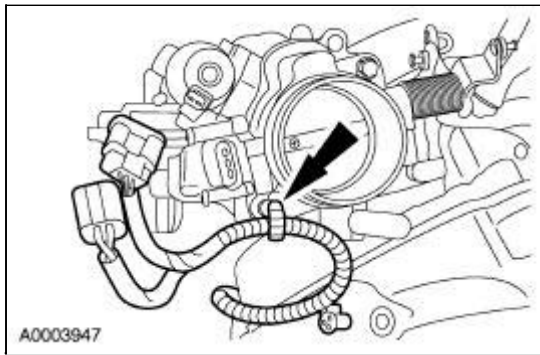
4. Remove the one bolt, two stud bolts, and the water pump.



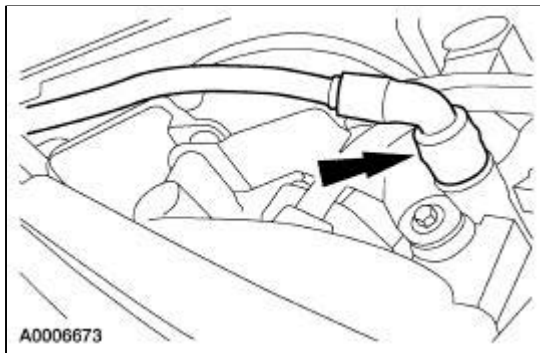
5. Disconnect the throttle position (TP) sensor and idle air control (IAC) electrical connectors.



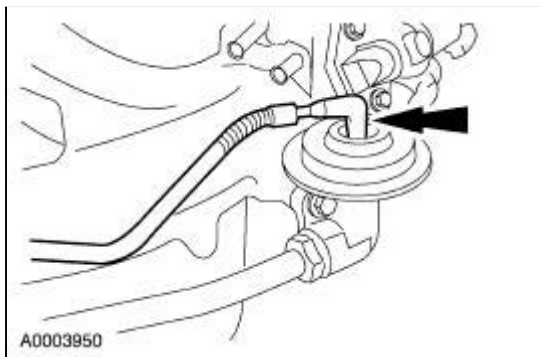
6. Unclip the wire harness retainer.



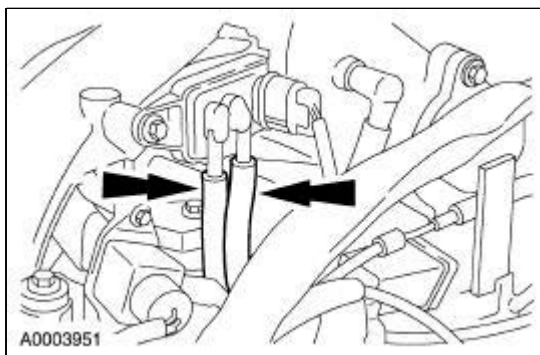
7. Disconnect the PCV tube at the rear of the upper intake manifold.



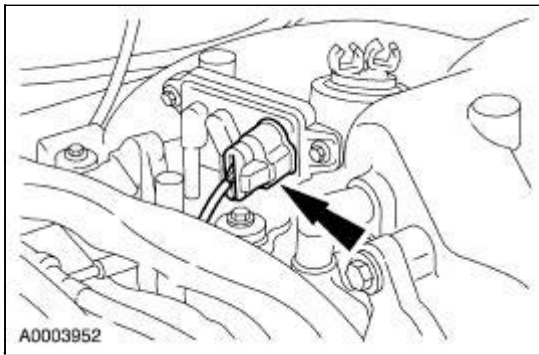
8. Disconnect the exhaust gas recirculation (EGR) vacuum line.



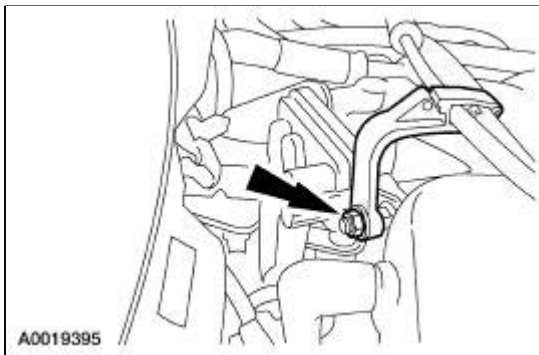
9. Disconnect the differential pressure feedback EGR hoses.



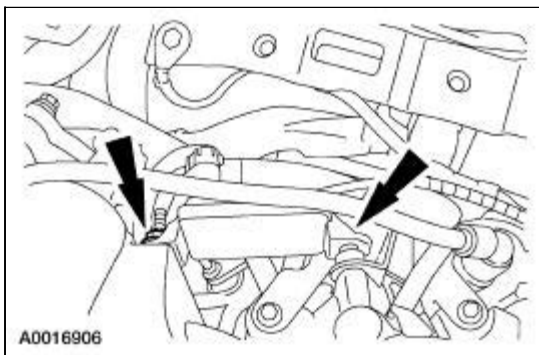
10. Disconnect the differential pressure feedback EGR electrical connector.



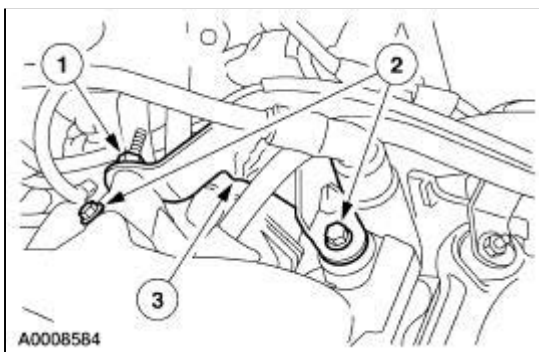
11. Remove the nut and the accelerator cable clip.



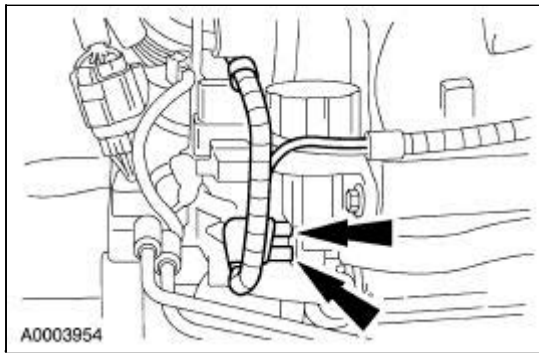
12. Remove the nut and stud and position the differential pressure feedback EGR transducer aside.



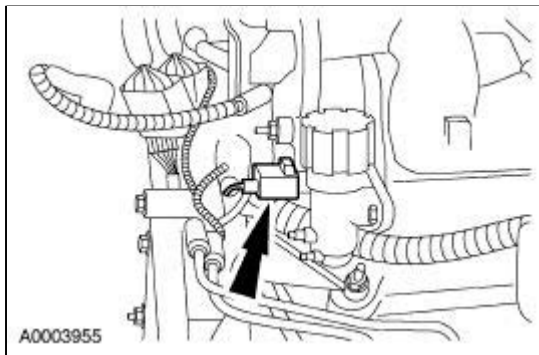
13. Remove the fuel pressure sensor shield.
 1. Remove the nut.
 2. Remove the bolts.
 3. Remove the shield.



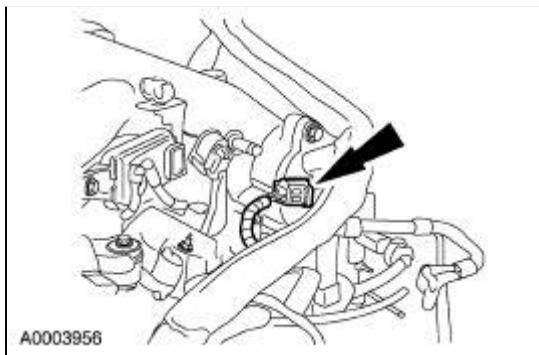
14. Disconnect the vacuum tubes from the EGR vacuum regulator control (EVR).



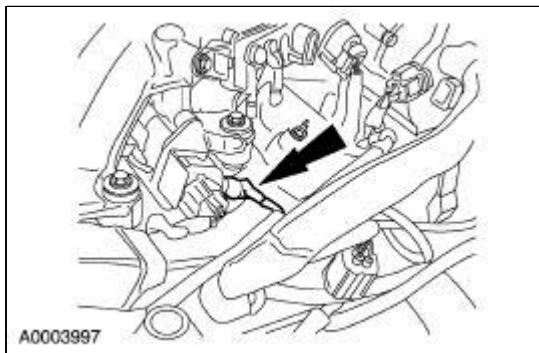
15. Disconnect the EVR electrical connector.



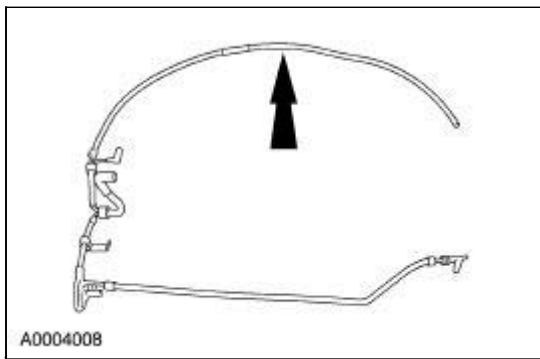
16. Disconnect the intake manifold tuning valve (IMTV) electrical connector.



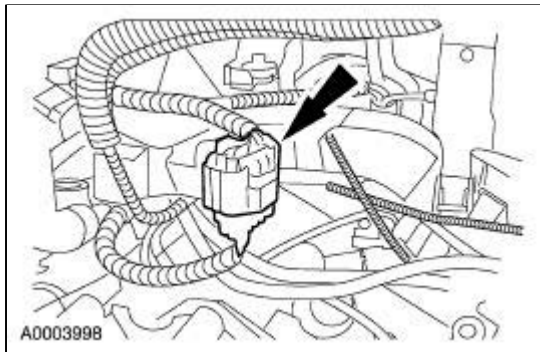
17. Disconnect the fuel pressure sensor jumper from the main vacuum harness.



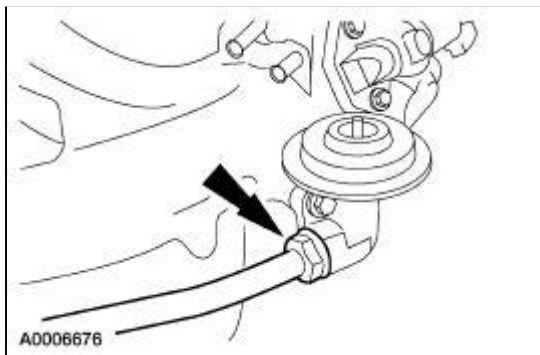
18. Remove the vacuum harness.



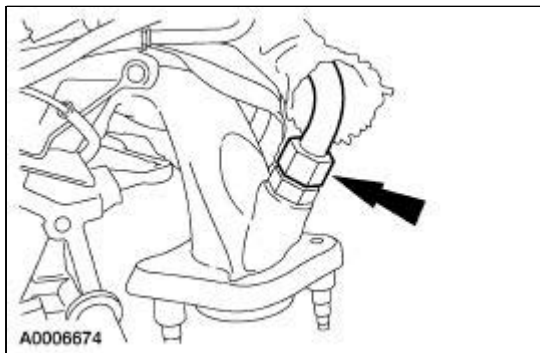
19. Disconnect the fuel injector wiring harness connector.



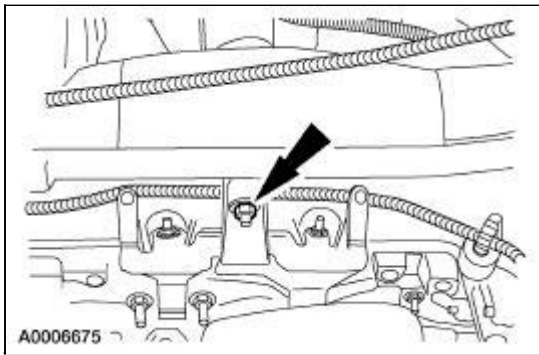
20. Disconnect the EGR tube at the EGR valve.



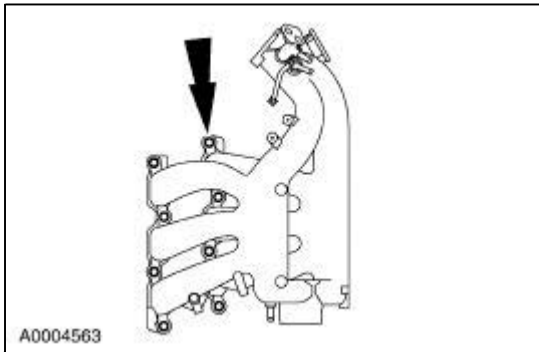
21. Disconnect the EGR tube at the exhaust manifold and remove the tube.



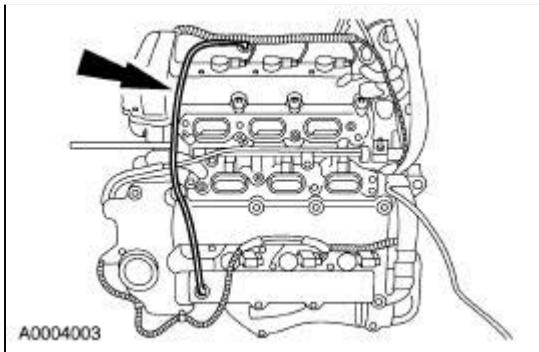
22. Remove the intake manifold bolt.



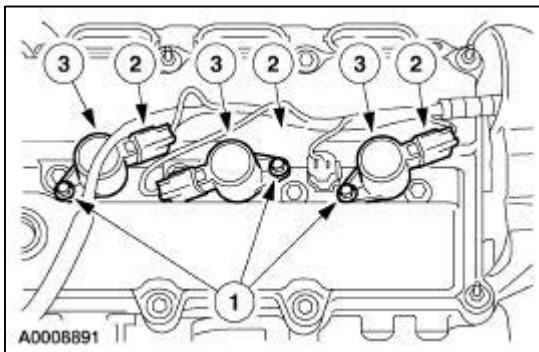
23. Remove the eight bolts and the upper intake manifold.
- Inspect the gaskets. Discard if damaged.



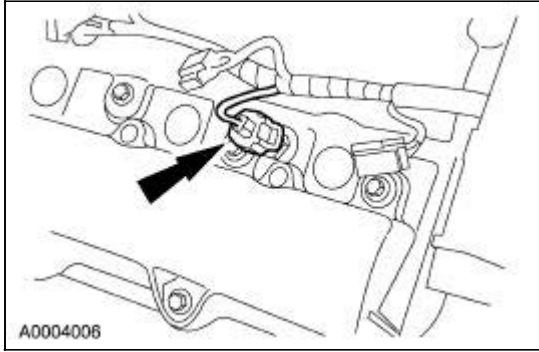
24. Remove the crankcase ventilation tube.



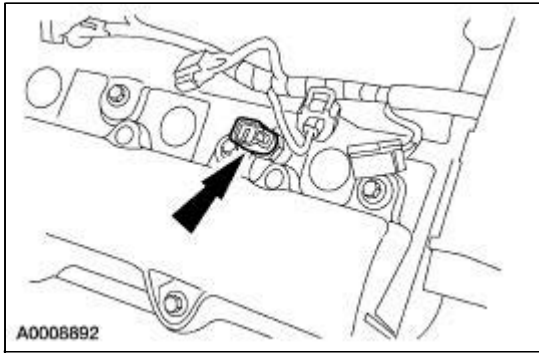
25. Remove the LH ignition coils.
1. Remove the bolts.
 2. Disconnect the electrical connectors.
 3. Remove the LH ignition coils.



26. Disconnect the cylinder head temperature (CHT) sensor connector.

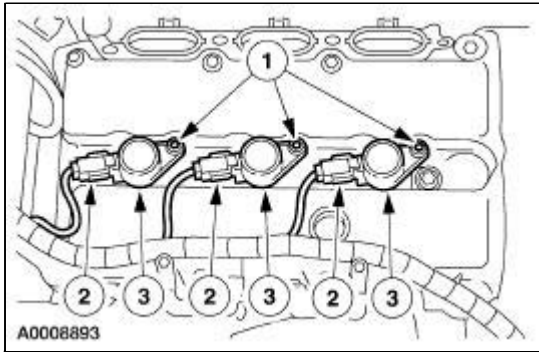


27. Remove the CHT sensor.

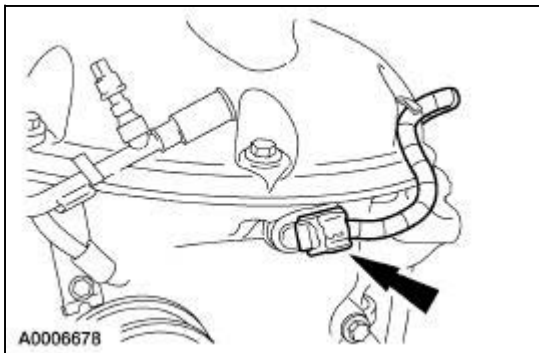


28. Remove the RH ignition coils.

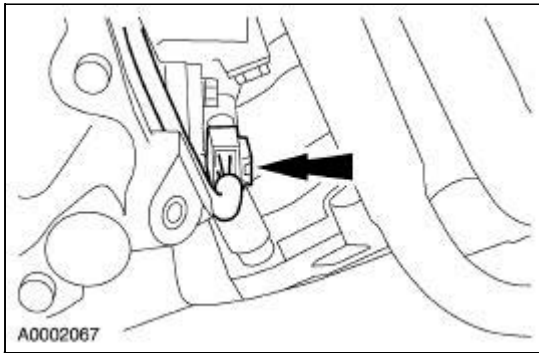
1. Remove the bolts.
2. Lift the coils and disconnect the electrical connectors.
3. Remove the RH ignition coils.



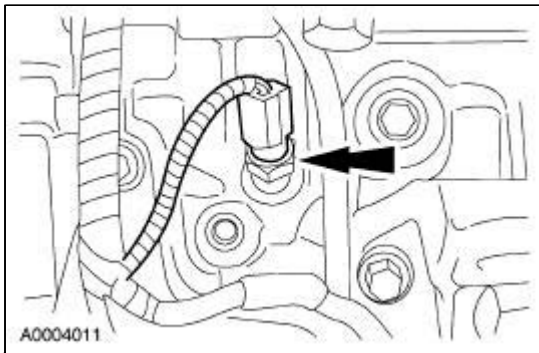
29. Disconnect the camshaft position (CMP) sensor electrical connector.



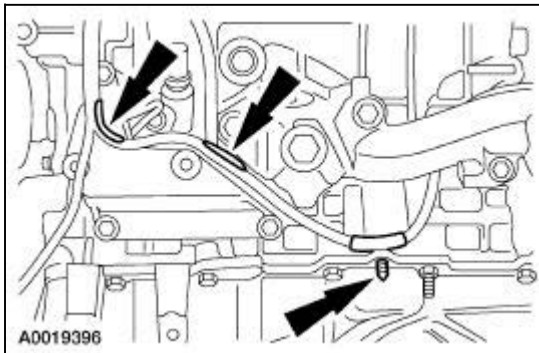
30. Disconnect the crankshaft position (CKP) sensor electrical connector.



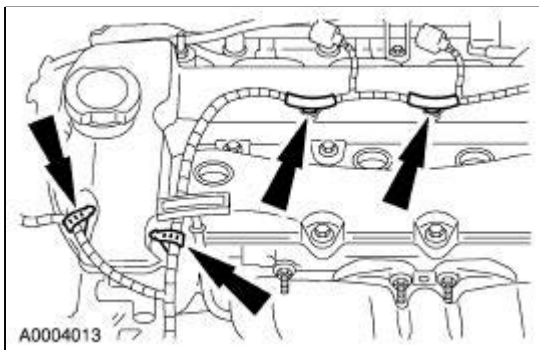
31. Disconnect the oil pressure sensor electrical connector.



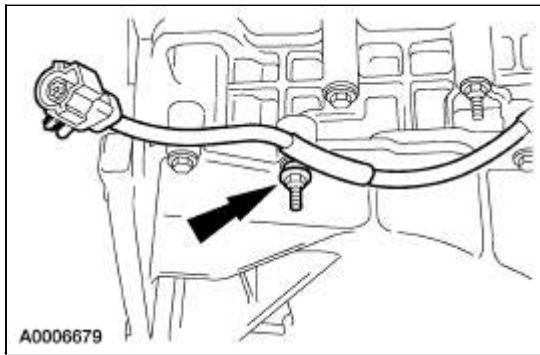
32. Detach the three wiring harness retainers from the block.



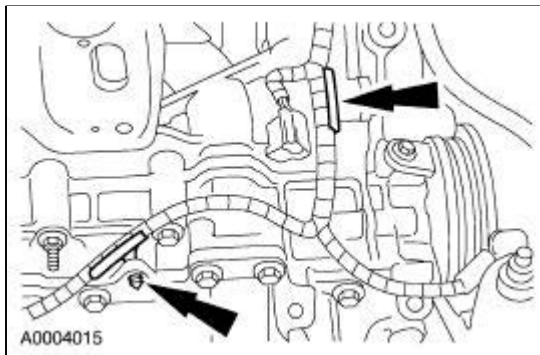
33. Detach the four wiring harness retainers.



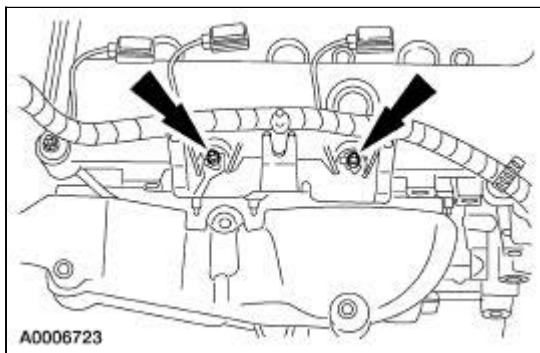
34. Remove the nut and wiring harness from the stud.



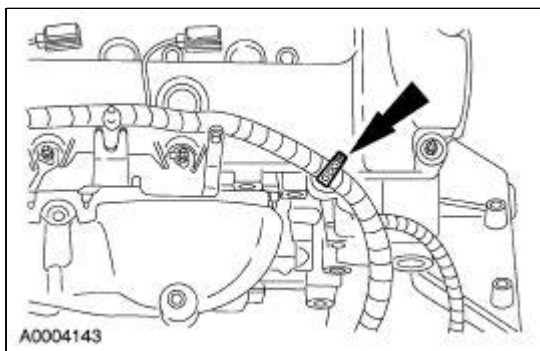
35. Detach the two wiring harness retainers from the block.



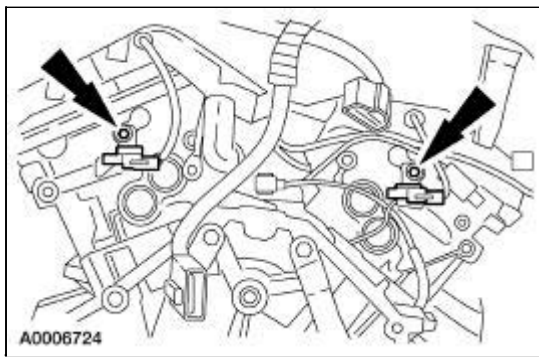
36. Remove the nuts.



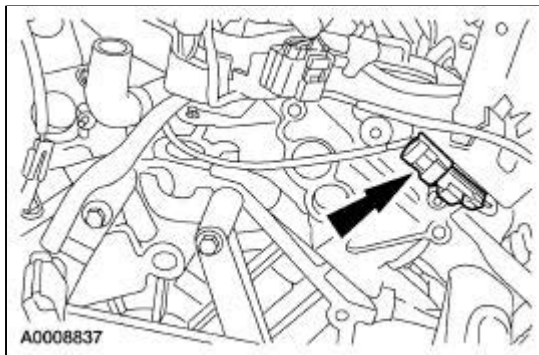
37. Unclip the wiring harness retainer.



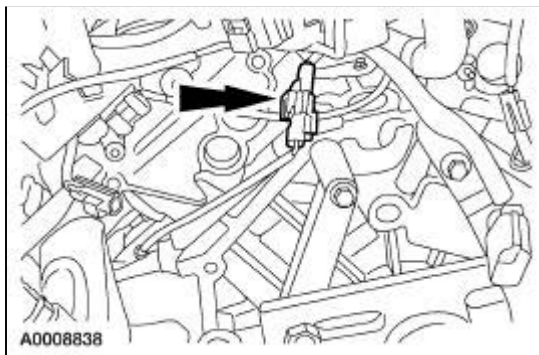
38. Remove the two bolts and the two radio ignition interference capacitors.



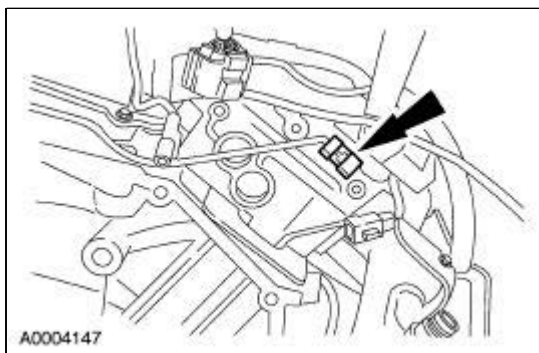
39. Disconnect the valley knock sensor electrical connector.



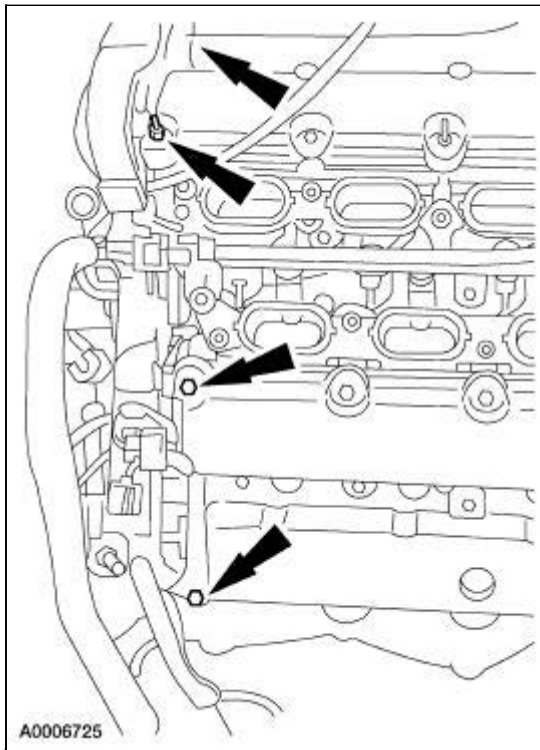
40. Disconnect the RH engine knock sensor (KS) electrical connector.



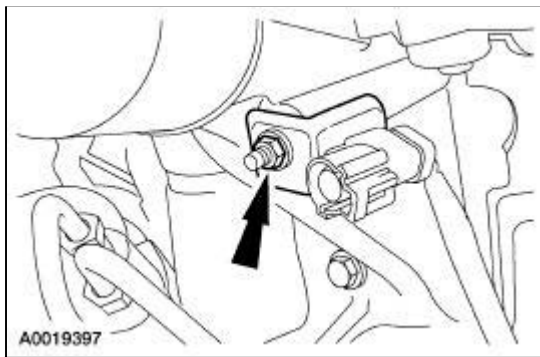
41. Unclip the KS connector from the wiring harness.



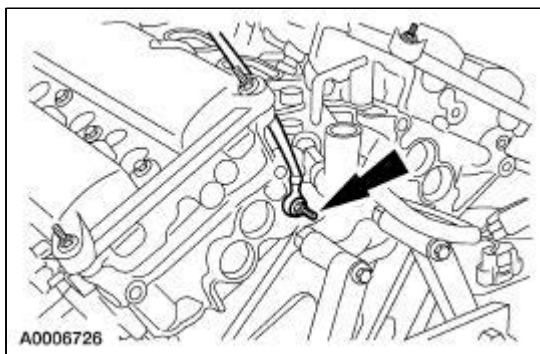
42. Remove the four nuts and the wiring harness.



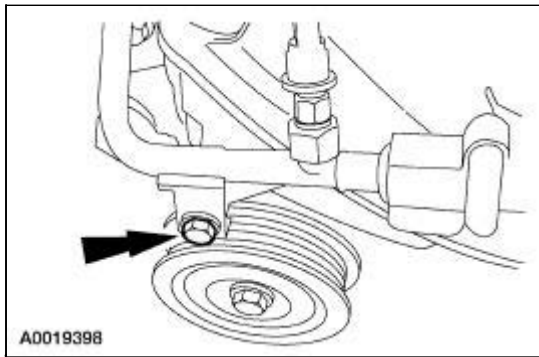
43. Remove the nut and the bracket.



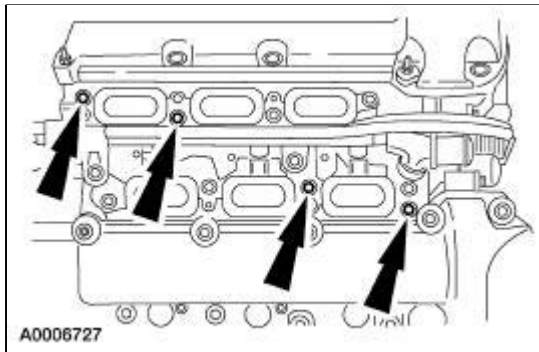
44. Remove the nut and the ground strap.



45. Remove the bolt.

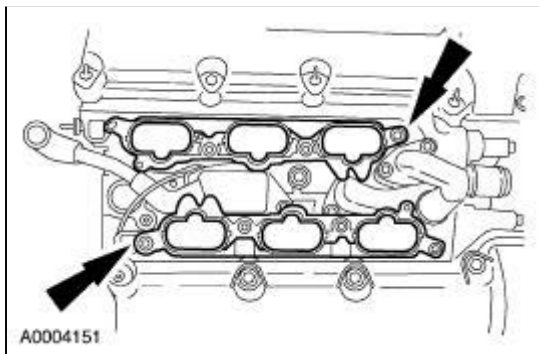


46. Remove the bolts and the lower intake manifold assembly.



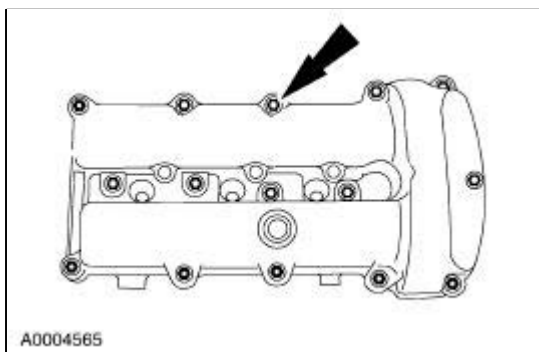
47. Remove the lower intake manifold gaskets.

- Inspect the gaskets for damage. Discard if damaged.

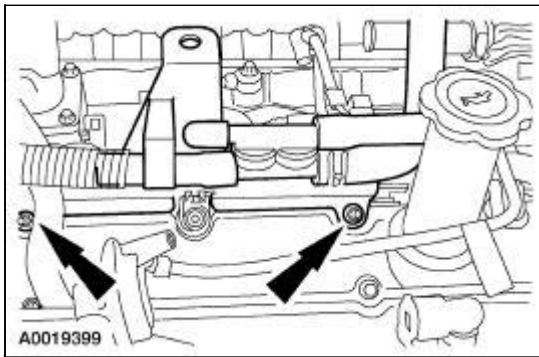


48. Remove the studs and bolts and remove the RH valve cover and gasket.

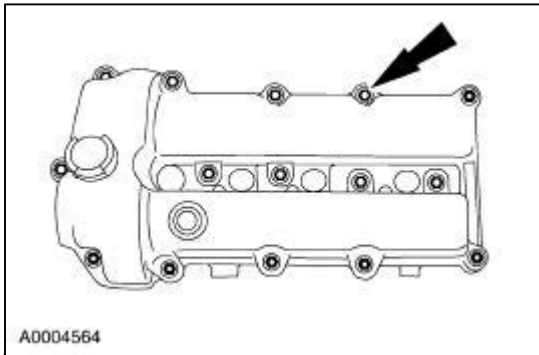
- Discard the gasket.



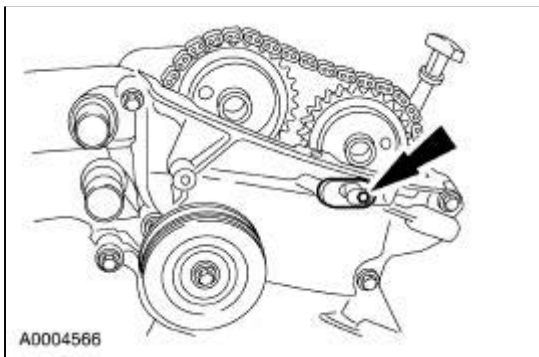
49. Remove the nuts and position the bracket aside.



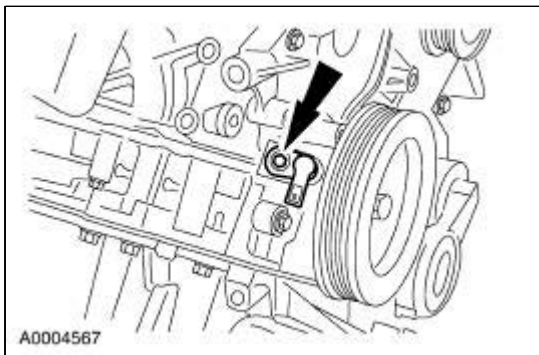
50. Remove the studs and bolts and remove the LH valve cover and gasket.
- Discard the gasket.



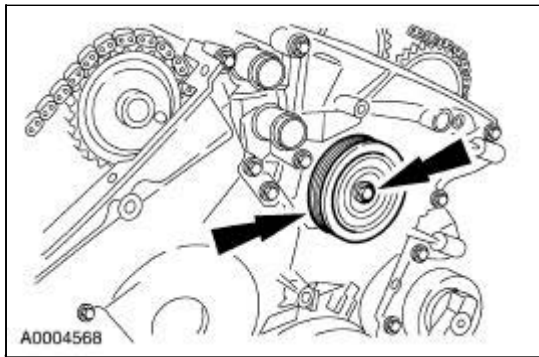
51. Remove the bolts and the CMP sensor.



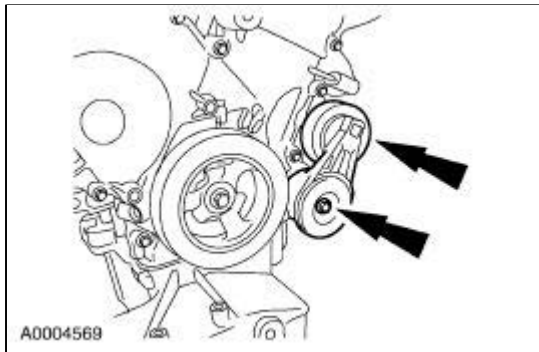
52. Remove the bolt and the CKP sensor.



53. Remove the bolt and the idler pulley.

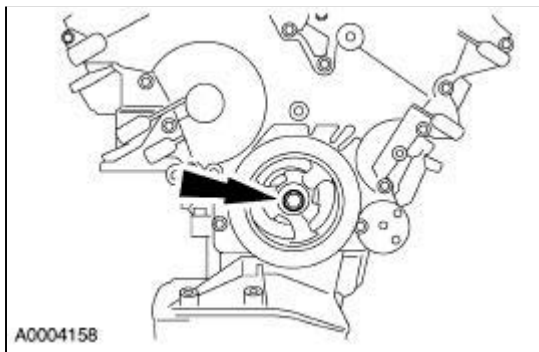


54. Remove the bolt and the drive belt tensioner.

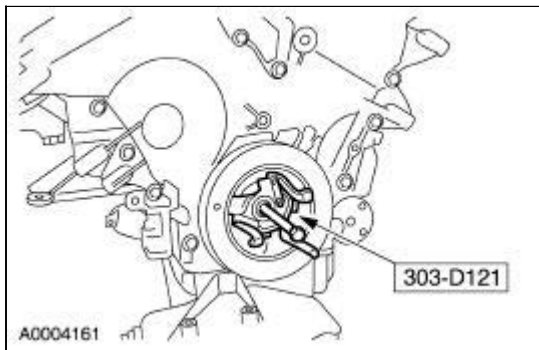


55. Remove the bolt.

- Discard the bolt.



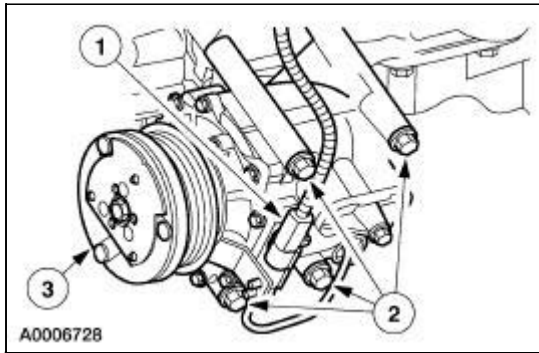
56. Using the special tool, remove the crankshaft pulley.



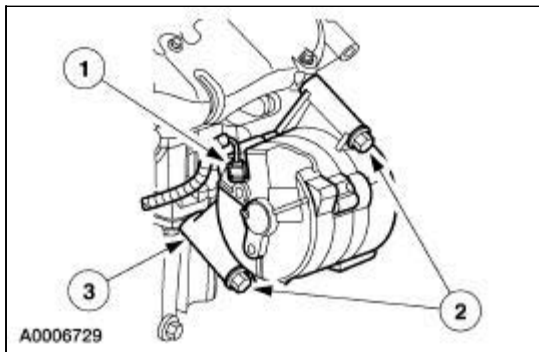
57. Remove the A/C compressor.

1. Disconnect the electrical connector.
2. Remove the bolts.

3. Remove the compressor.

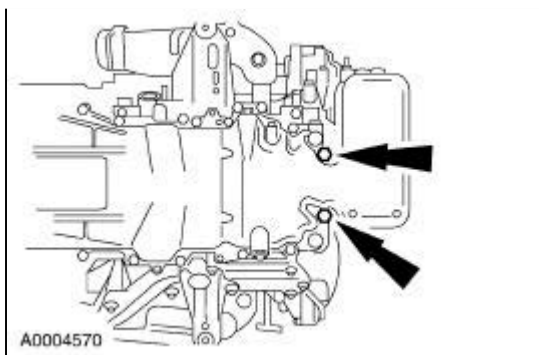


58. Remove the generator.
 1. Disconnect the electrical connector.
 2. Remove the bolts.
 3. Remove the generator.

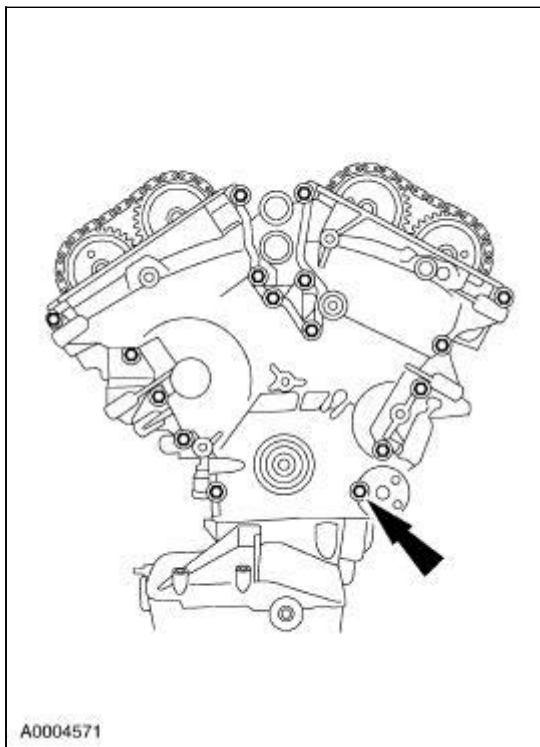


59. Remove the engine harness assembly.

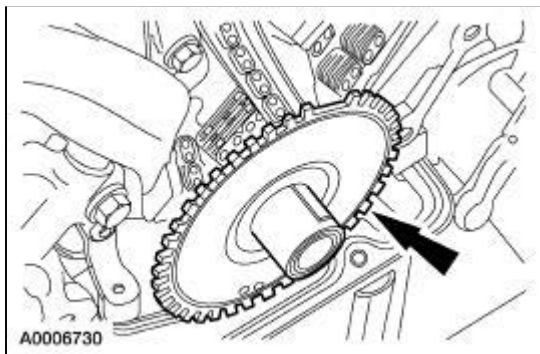
60. Remove the bolts.




61. Remove the bolts and the engine front cover and gasket.
 - Discard the gasket.



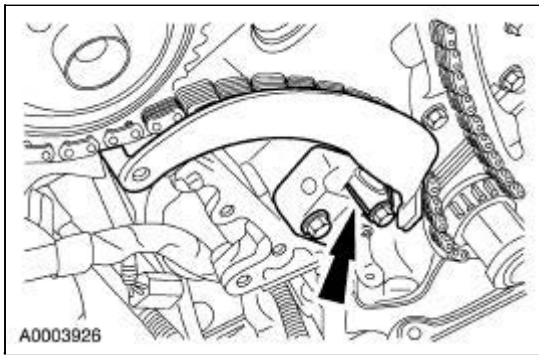
62. Remove the ignition pulse ring.



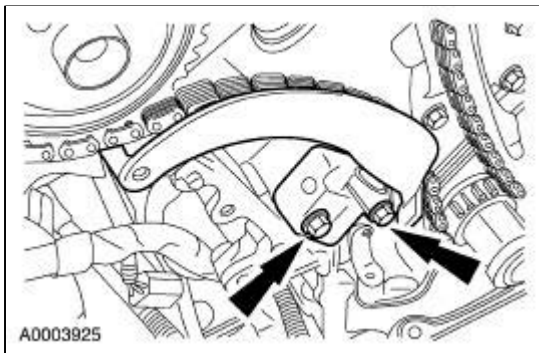
63.  **CAUTION:** Rotating the crankshaft in a counterclockwise direction may cause possible engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

 **CAUTION:** If the RH timing chain tensioner arm and RH timing chain guide are to be reused, mark position of each to make sure of original position when reassembled.

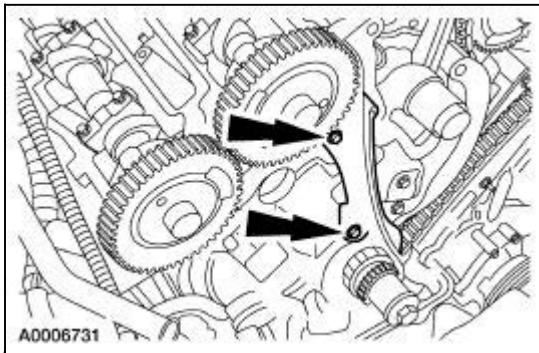
Install a stiff wire or paper clip into the timing chain tensioner before removing the bolts.




64. Remove the bolts, the timing chain tensioner and the tensioner arm.

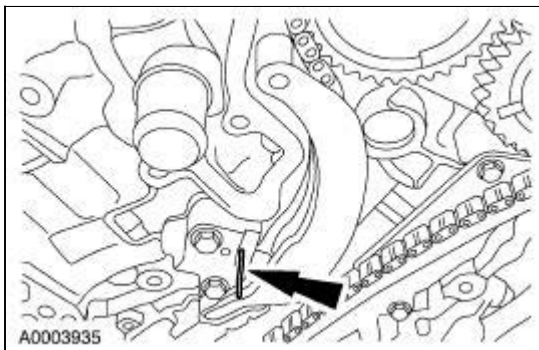


65. Remove the RH timing chain.
66. Remove the bolts and the RH timing chain guide.

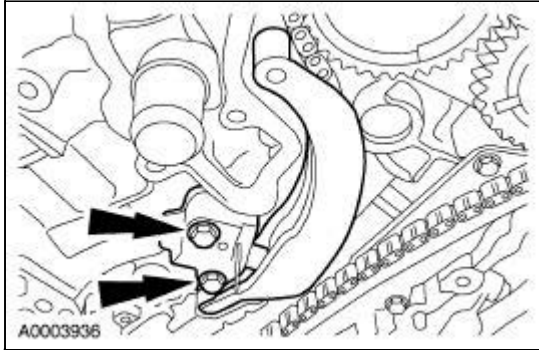


67.  **CAUTION:** If the LH timing chain tensioner arm and the LH timing chain guide are to be reused, mark position of each to make sure of original position when reassembled.

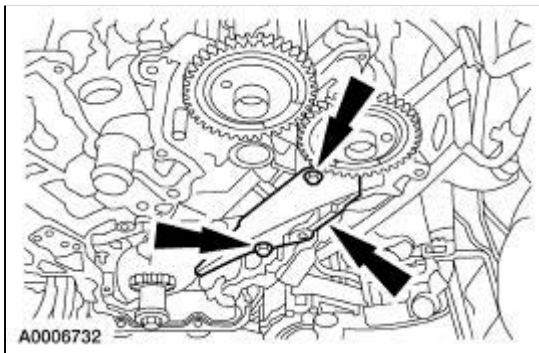
Install a stiff wire or paper clip into the timing chain tensioner before removing the bolts.



68. Remove the bolts, the timing chain tensioner and the tensioner arm.



69. Remove the LH timing chain.
70. Remove the bolts and the LH chain guide.



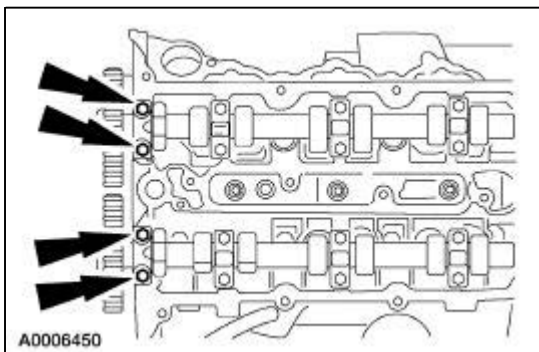
71. Remove the crankshaft sprocket.

72.  **CAUTION:** Remove the camshaft journal thrust caps prior to loosening other camshaft journal cap bolts. Damage to the camshaft journal thrust cap may occur if not removed first.

 **CAUTION:** Cylinder head camshaft journal caps and cylinder heads are numbered to be sure they are assembled in their original position. Keep camshaft journal caps with the cylinder head from which they were removed. Do not mix with camshaft journal caps from another cylinder head.

NOTE: LH side shown; RH side similar.

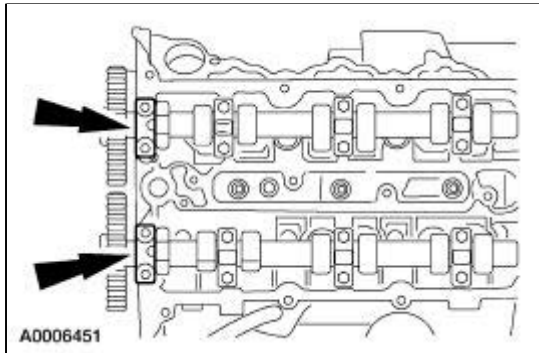
Remove the LH and RH camshaft thrust cap bolts.



73. **NOTE:** LH side shown; RH side similar.

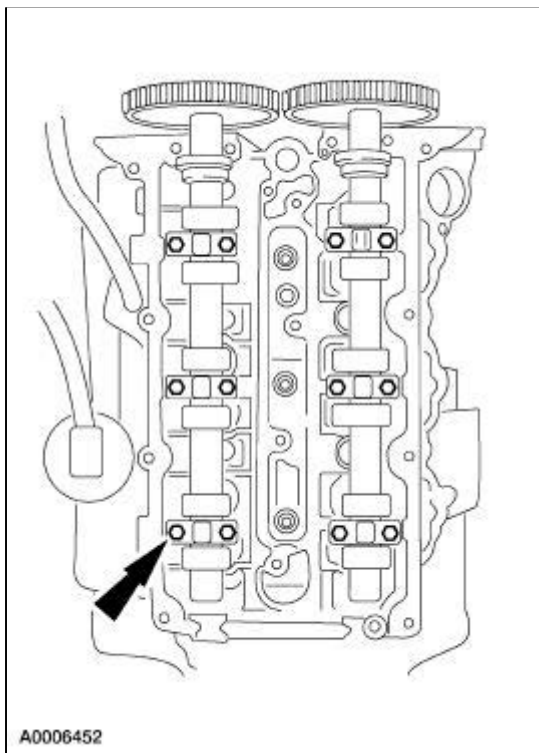
NOTE: The camshaft journal thrust caps have alignment dowels.

Using a soft-faced mallet, gently loosen and remove the LH and RH camshaft journal thrust caps.



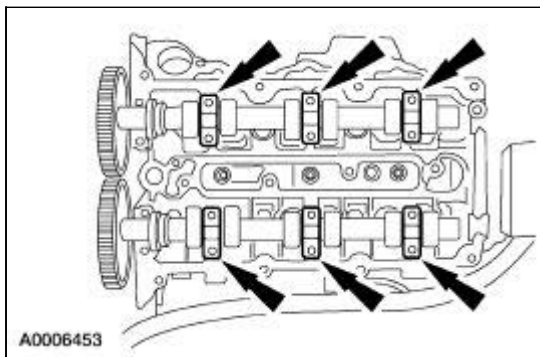
74. **NOTE:** LH side shown; RH side similar.


Remove the remaining bolts.



75. **NOTE:** LH side shown; RH side similar.

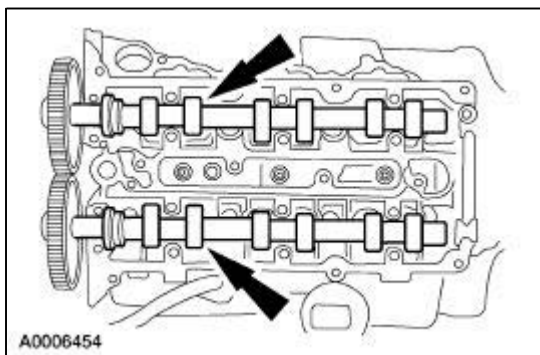
Using a soft-faced mallet, gently loosen and remove the remaining camshaft journal caps.



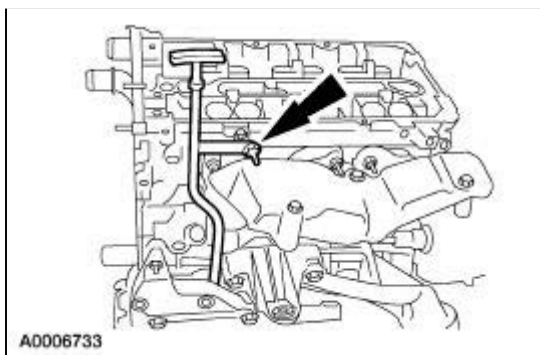
76.  **CAUTION:** If the bucket tappets are to be reused, mark the position of the bucket tappets to make sure they are assembled in their original positions.

NOTE: LH side shown; RH side similar.

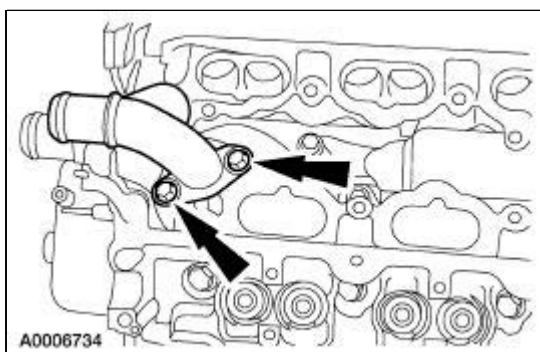
Carefully lift out the LH and RH intake and exhaust camshafts.



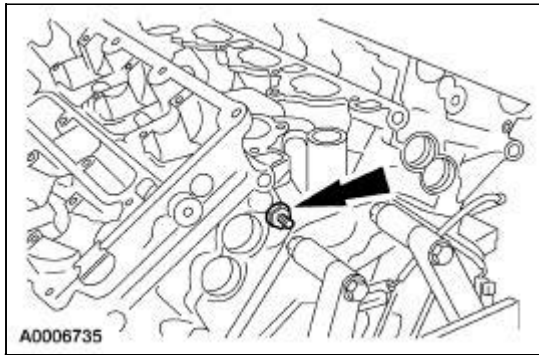
77. Remove the stud bolt and the oil level indicator tube.



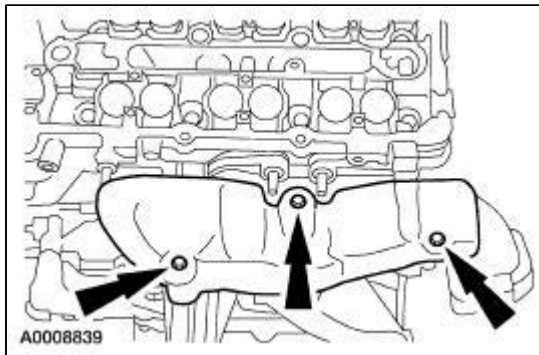
78. Remove the bolts and the coolant bypass tube.



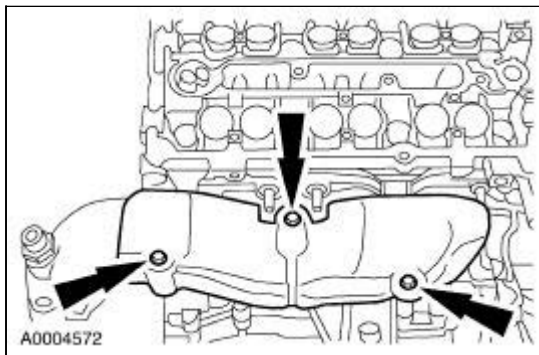
79. Remove the PCV tube stud.



80. If equipped, remove the bolts and the LH heat shield.



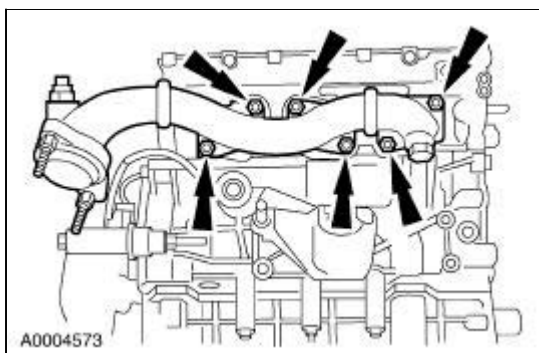
81. If equipped, remove the bolts and RH heat shield.



82. **NOTE:** RH side shown; LH side similar.

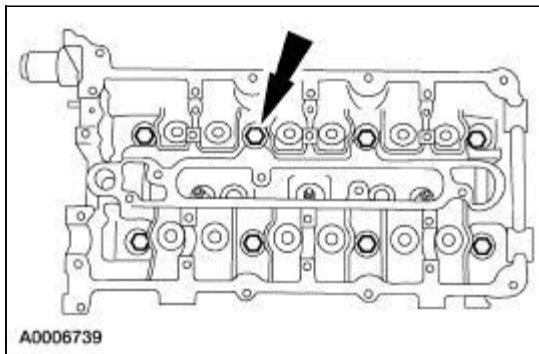
Remove the nuts and the RH and LH exhaust manifold and gasket.

- Discard the gasket.

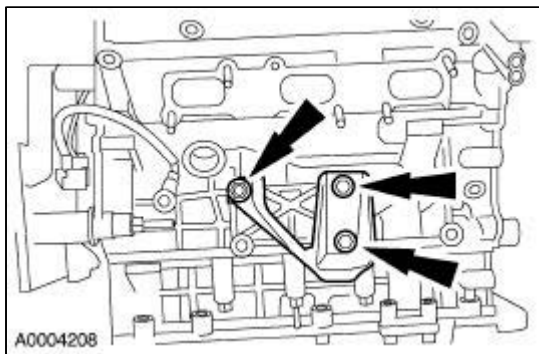


83. Remove the bolts and the RH and LH cylinder heads.

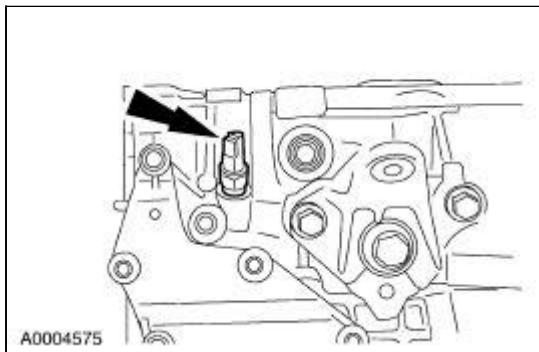
- Discard the gaskets.



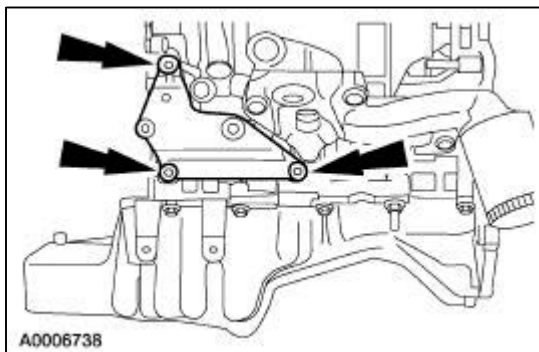
84. Remove the one stud, two bolts and the RH engine mount bracket.



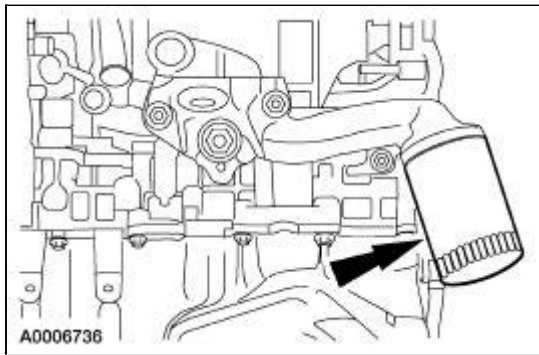
85. Remove the oil pressure switch.



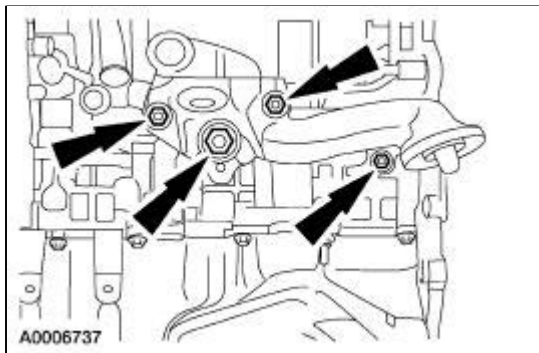
86. Remove the bolts and the A/C compressor mounting bracket.



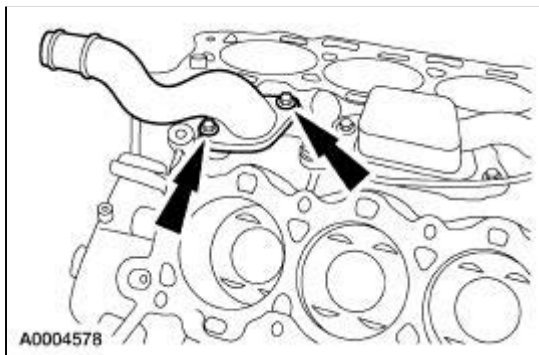
87. Remove the oil filter.



88. Remove the bolts and the oil filter adapter.

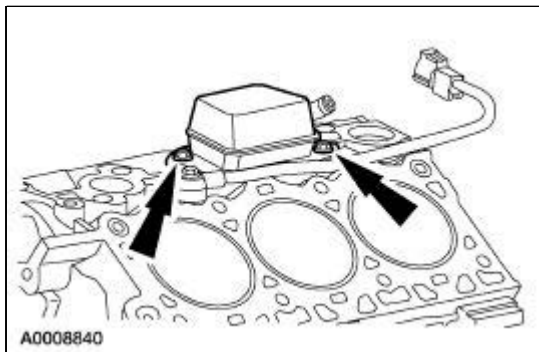


89. Remove the bolts and the inlet tube.

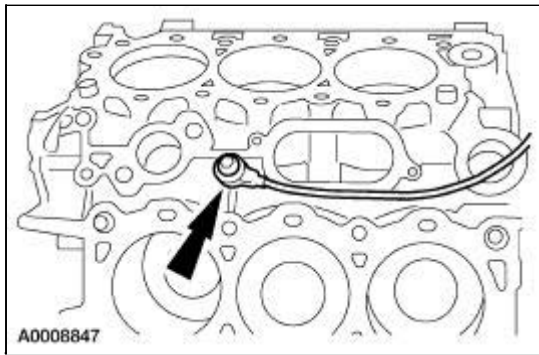


90. Remove the bolts and the oil separator.

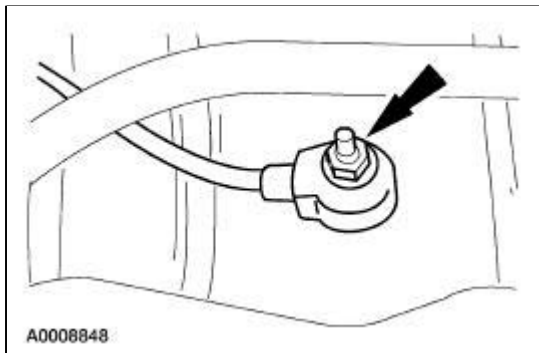
- Discard the gasket.



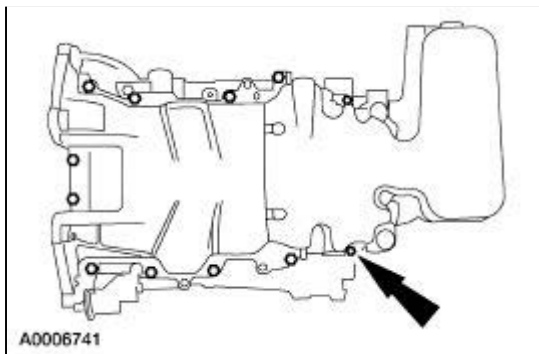
91. Remove the bolt and the top-mounted KS.



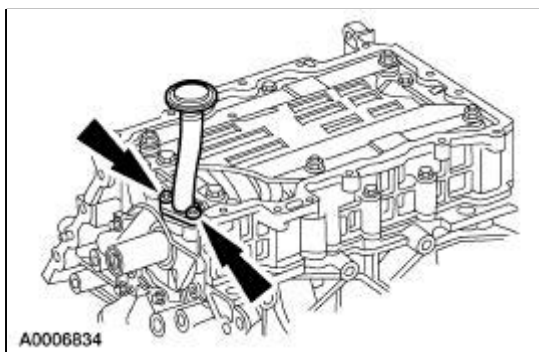
92. Remove the nut and the side-mounted KS.



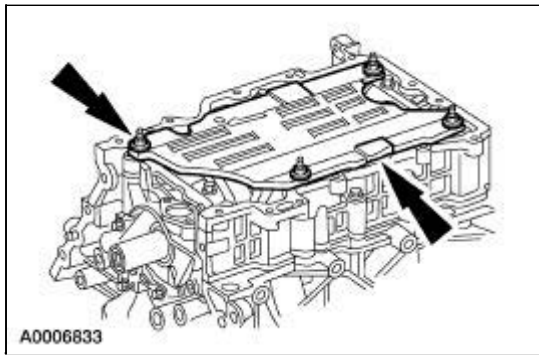
93. Remove the bolts and studs and the oil pan.
● Discard the gasket.



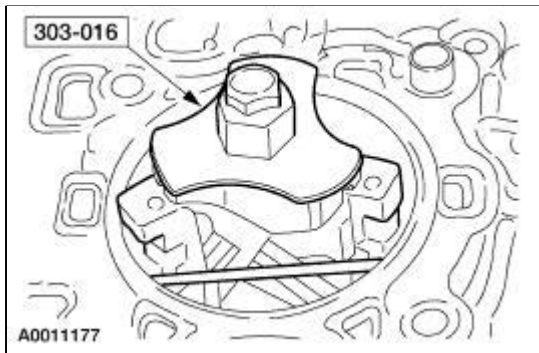
94. Remove the bolts and the oil pick up tube.
● Inspect the O-ring seal for damage.



95. Remove the nuts and the oil pan baffle.



96. Using the special tool, remove the cylinder ridge.



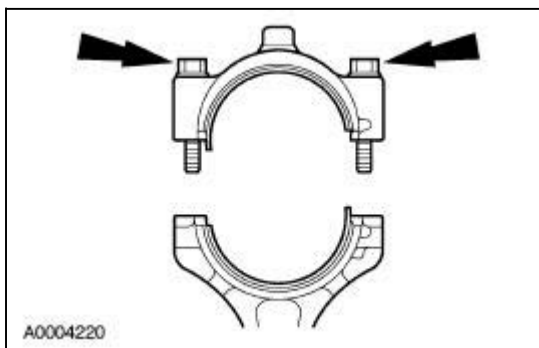
97.  **CAUTION: Pistons, connecting rods, connecting rod bearings and caps should be marked to be sure they are assembled in their original locations.**

NOTE: Before removing piston or connecting rod assemblies, inspect the top of the cylinder bores. If necessary, remove any ridge or carbon deposits from each cylinder using a suitable cylinder ridge reamer. For additional information, refer to [Section 303-00](#).

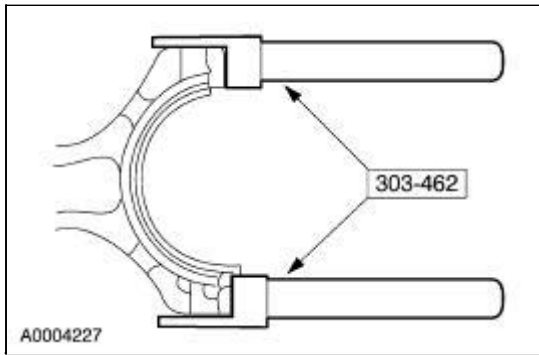
Turn crankshaft until the piston to be removed is at the high point of its travel near the cylinder head deck.

98. **NOTE:** Connecting rod bearing caps are cracked and split from the connecting rods during manufacture, thereby providing an exact fit to the connecting rod when assembled. Care should be taken to prevent dirt or grease from contaminating the cap and rod mating surfaces. Identification marks on the cap and rod must remain aligned as a matched set during assembly.

Remove the connecting rod cap retaining bolts, connecting rod cap, and lower connecting rod bearing. Keep the cap and bearing together.



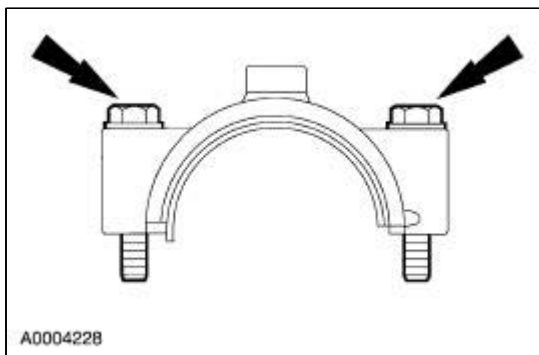
99. Using the special tool to protect the cylinder, push the piston, connecting rod and upper bearing assembly through the top of the cylinder bore.



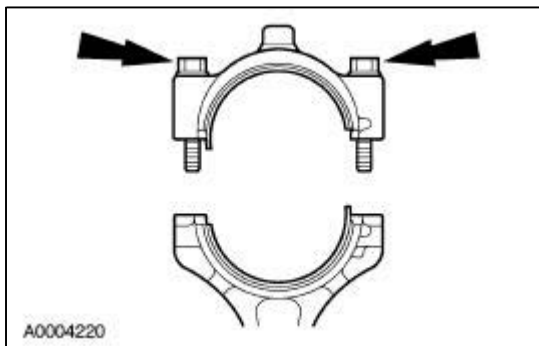
100.  **CAUTION:** Care should be taken not to damage the connecting rod and cap joint face surfaces or possible engine damage may occur.

 **CAUTION:** Connecting rod bolts must be replaced with new bolts. They are torque-to-yield and cannot be reused.

Connecting rod bolts are retained in the connecting rod caps with a slight press fit. Using a hammer and punch, drive the bolts from the caps.

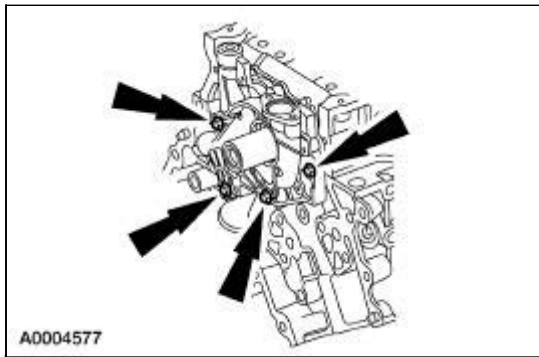


101. Using new connecting rod bolts, attach the connecting rod cap and lower bearing to the connecting rod and upper bearing to prevent mixing parts and damaging the connecting rod joint face surfaces.



102. If piston ring replacement, or piston and connecting rod disassembly is required, refer to Disassembly and Assembly of Subassemblies in this section.

103. Remove the bolts and the oil pump.

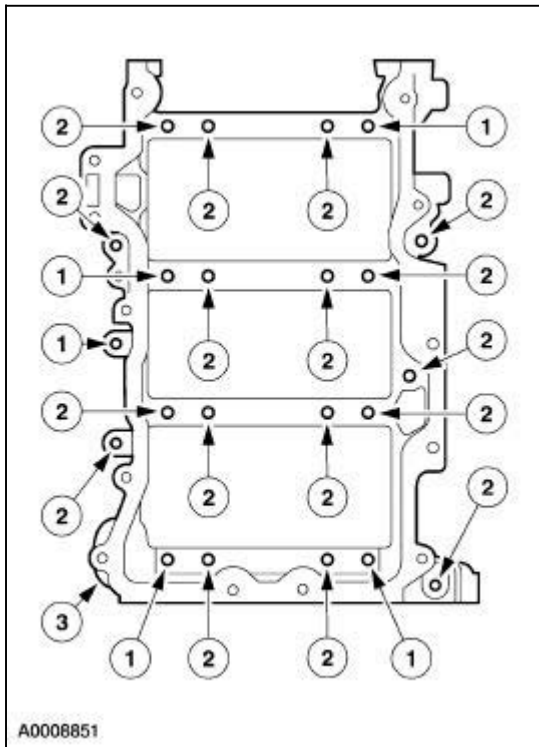


104.  **CAUTION: The bolts are torque-to-yield and cannot be reused. The bolts must be replaced.**

NOTE: Note the location of the stud bolts for assembly.

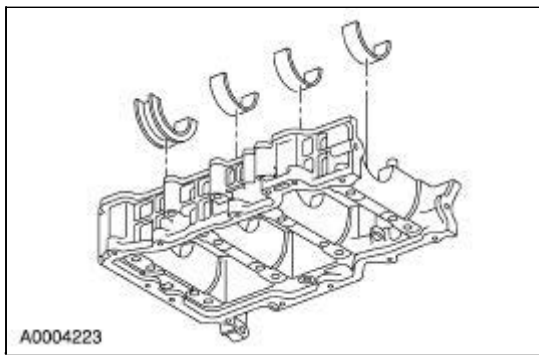
Remove the lower cylinder block.

1. Remove and discard the stud bolts.
2. Remove and discard the 17 bolts.
3. Remove the lower cylinder block.

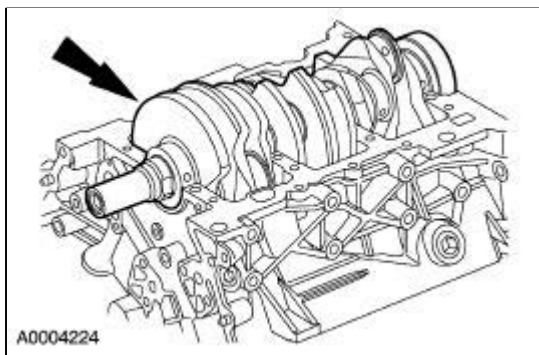


105. **NOTE:** If bearings are to be reused, mark the position of the upper and lower crankshaft main bearings and crankshaft thrust bearing.

Remove the lower crankshaft main bearings and crankshaft thrust bearing from the lower cylinder block.

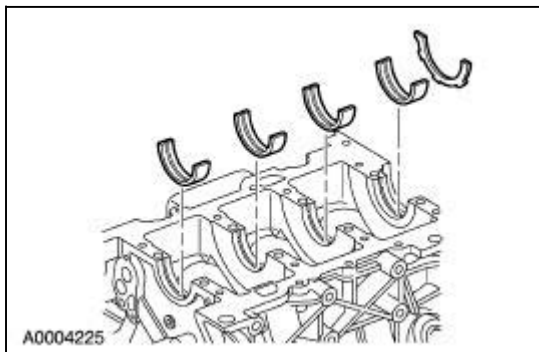


106. Carefully remove the crankshaft from the upper cylinder block.

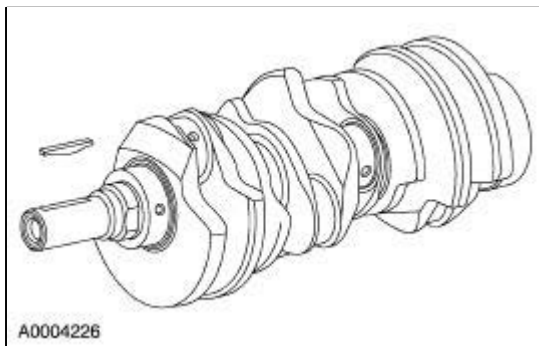


107. Remove and discard the crankshaft rear oil seal.

108. Remove the upper crankshaft bearings and thrust bearing from the upper cylinder block.



109. If necessary, remove the crankshaft key from the crankshaft keyway.

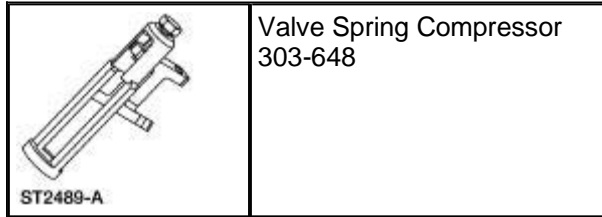


110. Remove the pipe plugs, engine block heater, and dowels from the cylinder block as necessary to clean foreign material from the oil and coolant passages.

111. Inspect the crankshaft, cylinder block and cylinder heads. For additional information, refer to Section 303-00.

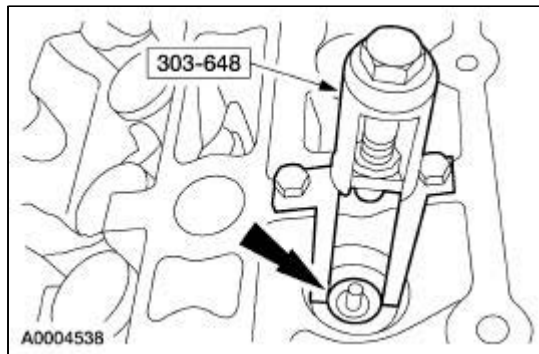
Cylinder Head

Special Tool(s)

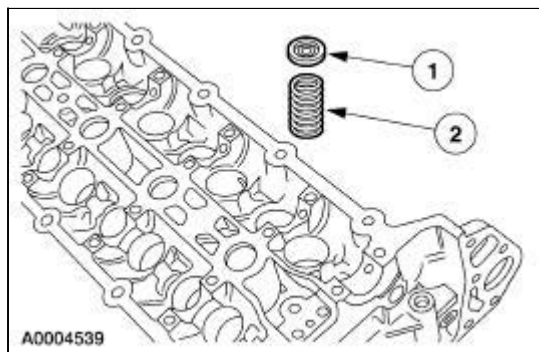


Disassembly

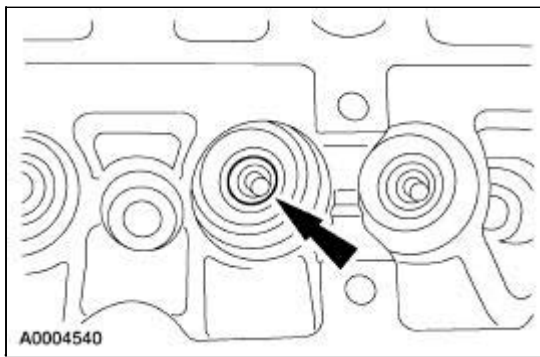
1. Using the special tool, remove the valve spring retainer key.



2. Remove the valve spring.
 - Remove the retainer.
 - Remove the spring.

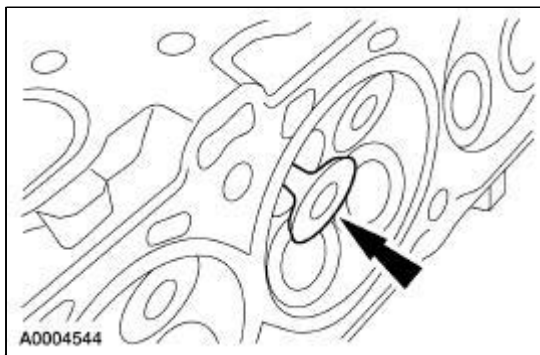


3. For component tests of the valve spring retainer, refer to [Section 303-00](#).
4. Remove the valve stem seal.



5. Remove the valve.

- For component tests of the valve, refer to [Section 303-00](#).
- For component tests of the cylinder head, refer to [Section 303-00](#).



6. Repeat the procedure until all of the valves are removed.

Assembly

1. To install, reverse the removal procedure.

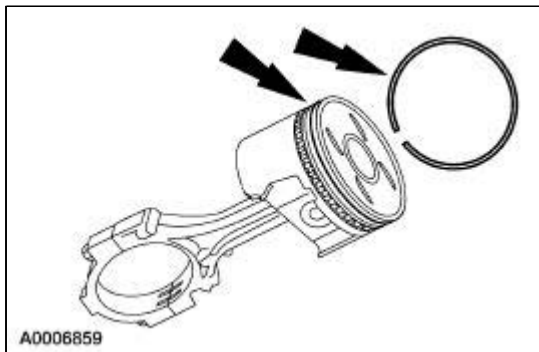
- Lubricate the valve stem and the valve stem seal with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H.
-

Piston

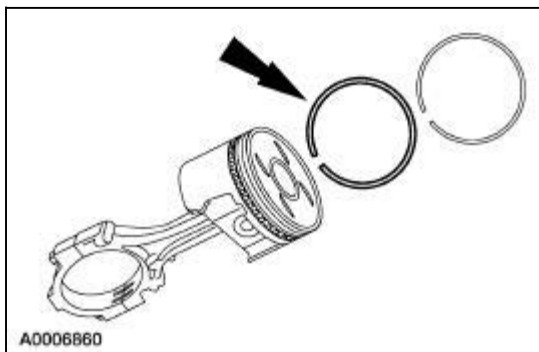
Disassembly

1. **NOTE:** Use a suitable ring expander to remove piston rings to prevent damage.

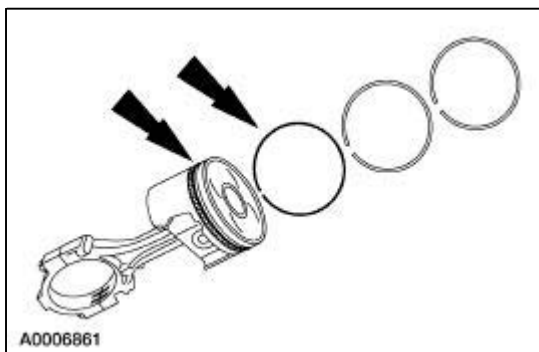
Remove the top compression ring.



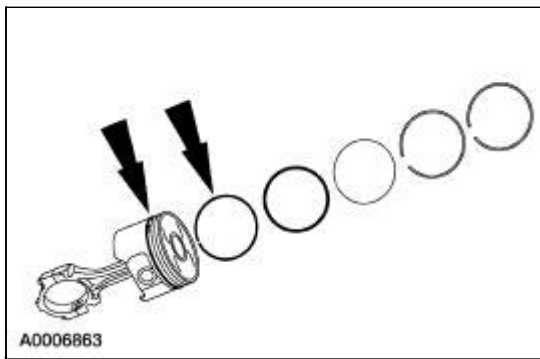
2. Remove the second compression ring.



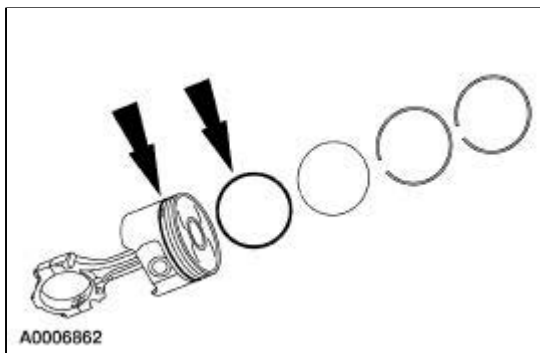
3. Remove the first oil control ring.



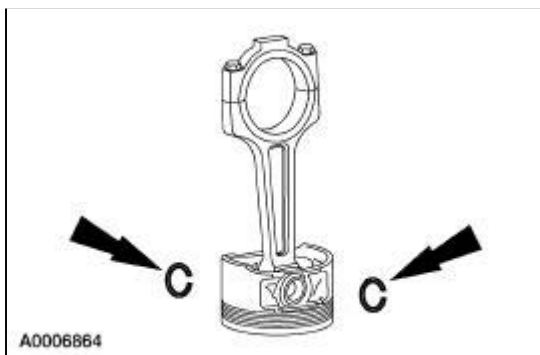
4. Remove the second oil control ring.



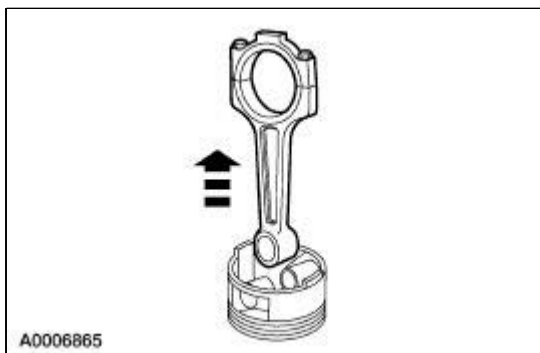
5. Remove the oil control spacer ring.



6. Remove the clips.



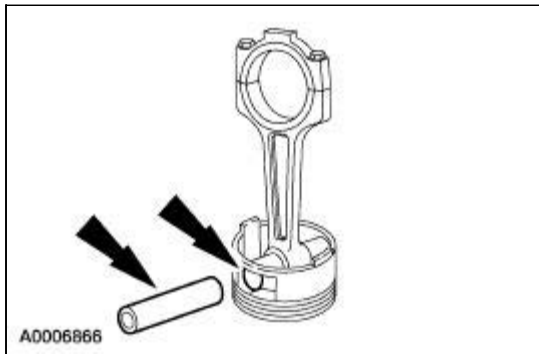
7. Remove the piston pin and the connecting rod from the piston.



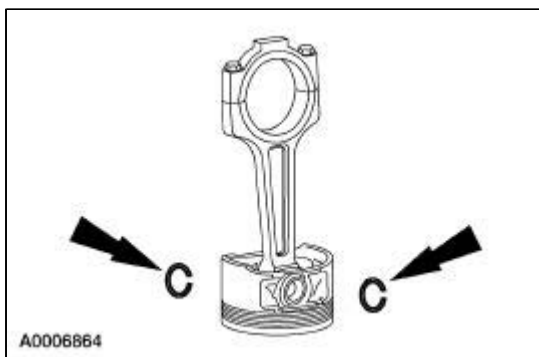
8. Clean and inspect the connecting rod and the piston; refer to [Section 303-00](#).

Assembly

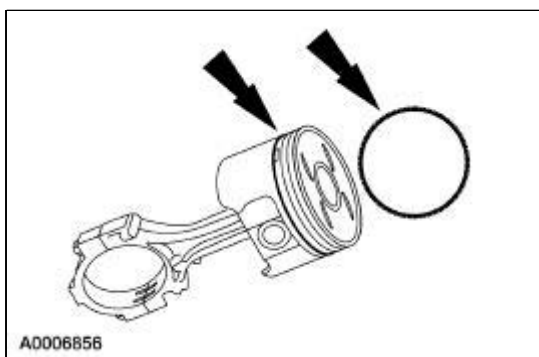
1. Lubricate the piston pin and piston pin bore with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H and install the piston pin.



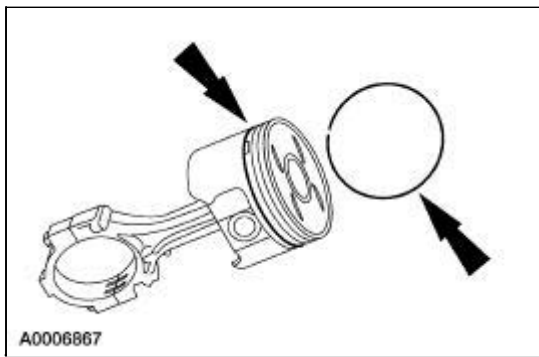
2. Install the clips.



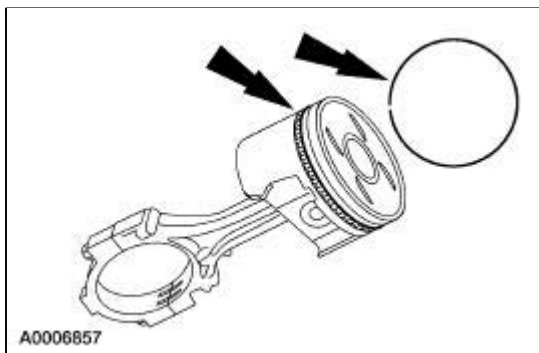
3. Check piston ring end gap. For additional information, refer to [Section 303-00](#).
4. Lubricate the piston and the piston rings with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H.
5. Install the oil control spacer ring.



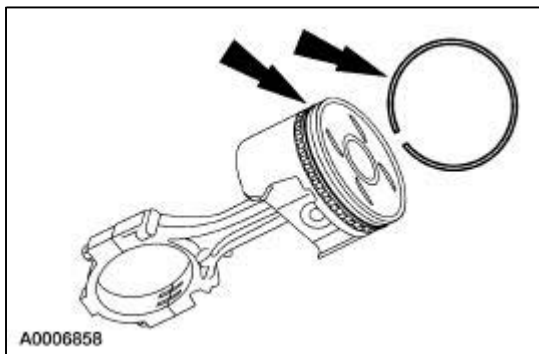
6. Install the second oil control ring.



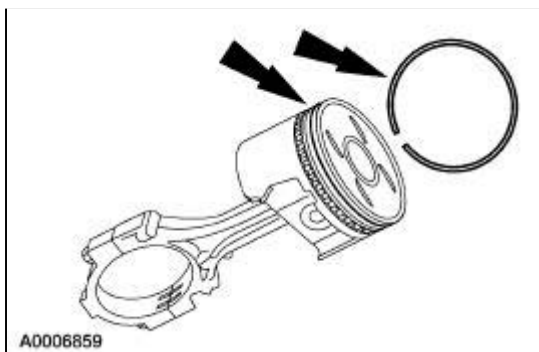
7. Install the first oil control ring.



8. Install the second compression ring.
 - The top of the second compression ring has a "0" on it. Position this side of the ring towards the top of the piston.

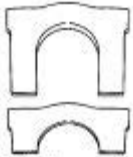



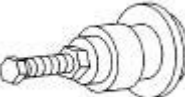
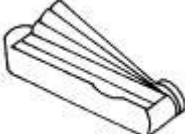



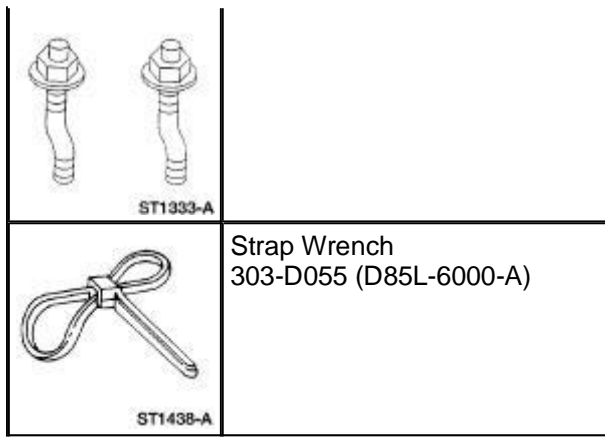
9. Install the top compression ring.
 - The top compression ring can be installed with either side up.




Engine

Special Tool(s)

 <p>ST2429-A</p>	<p>Camshaft Lift Tools 303-659</p>
 <p>ST2115-A</p>	<p>Connecting Rod Guide Set 303-462 (T94P-6136-AH)</p>
 <p>ST1327-A</p>	<p>Crankshaft Seal Replacer 303-178 (T82L-6701-A)</p>
 <p>ST1287-A</p>	<p>Crankshaft Damper Replacer 303-102 (T74P-6316-B)</p>
 <p>ST1328-A</p>	<p>Crankshaft Seal Installer/Aligner 303-335 (T88T-6701-A)</p>
 <p>ST1271-A</p>	<p>Feeler Gauge Set 303-D027 (D81L-4201-A)</p>
	<p>Piston Ring Compressor 303-D032 (D81L-6002-C)</p>
	<p>Rear Crankshaft Adapter Bolts 303-384 (T91P-6701-A)</p>

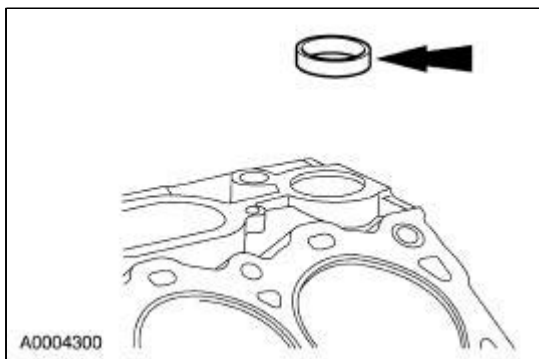


1.  **WARNING: Eye protection is required to be worn during the use of compressed air. Failure to follow these instructions may result in possible personal injury.**

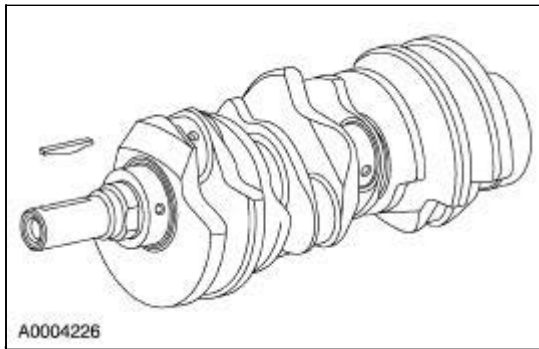
NOTE: If required, deglaze the cylinder walls using a suitable spring-type tool. Clean the cylinder walls with a detergent and water solution upside-down to prevent contamination of the lower portion of the cylinder block.

Clean gasket material, dirt and foreign material from the cylinder block. Wash the cylinder block with a suitable soap and water solution, and dry with compressed air.

2. Install the cup plugs, block dowels or pipe plugs that may have been removed during disassembly. Tighten the pipe plugs as follows:
 - 3/8-18 inch to 20 Nm (15 lb-ft) + 180 degrees
 - 1/2-14 inch to 40 Nm (30 lb-ft) + 180 degrees
 - 3/4-14 inch to 10 Nm (89 lb-in) + 720 degrees or 40 Nm (30 lb-ft), whichever comes first. Do not exceed 720 degrees or 40 Nm (30 lb-ft).
3. Measure the cylinder bore diameter and compare to specification. Cylinder bore measurements should be taken within 50 mm (2 in) from the top of the bore. Mark the outside of the block with the appropriate bore grade number for the replacement piston. Replacement pistons and domes are marked with grade numbers. For additional information, refer to [Section 303-00](#).
4. If removed, install cup plugs. Apply a 2 mm (0.08 in) bead of sealant meeting Ford specification WSK-M2G349-A7 to the cup plug prior to installation.



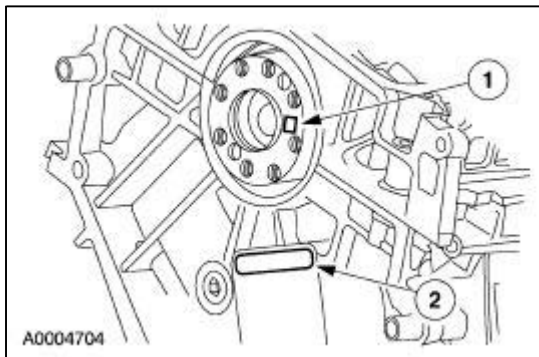
5. If removed, install the engine block heater. For additional information, refer to [Section 303-03](#).
6. If removed, install the crankshaft key into the keyway on the crankshaft.



7. **NOTE:** This procedure is for selecting bearings using a new crankshaft.

Select the crankshaft main bearings for each crankshaft journal.

1. Read the code on the crankshaft flange.
2. Read the code on the cylinder block rear face.
 - The first two numbers after the asterisk make up the code for main No. 1 and the next two numbers for main No. 2.
 - The first two numbers after the second asterisk make up the code for main No. 3 and the last two numbers for main No. 4.

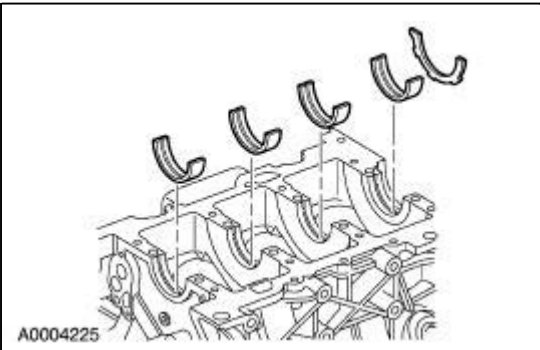


8. Look at the Select-Fit Chart and for each main, match the block and crankshaft code with its corresponding column or row, by reading across the crankshaft row and down the block column. Select the proper grade bearing for each main.
- For example: If the block code is *0609*0711* and the crankshaft code is *8480*8082*, main No. 1 should use grade 1 bearings, as determined by the intersection of the 06 block column and the 84 crankshaft row. Main Nos. 2, 3 and 4 should all be grade 2.

		BLOCK CODE																							
		98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21
CRANKSHAFT CODE	91	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
	90	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
	89	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
	88	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
	87	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
	86	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
	85	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2
	84	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3
	83	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3
	82	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
	81	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
	80	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
	79	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
	78	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
	77	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
	76	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
	75	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
	74	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
	73	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
	72	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
	71	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
	70	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
	69	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
	68	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3

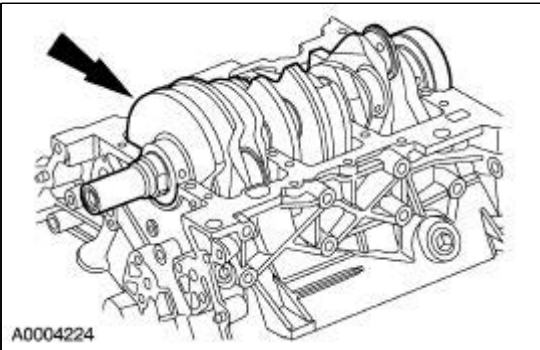
A0004705

- Install the upper main bearing and upper thrust bearing into the cylinder block in the correct locations.



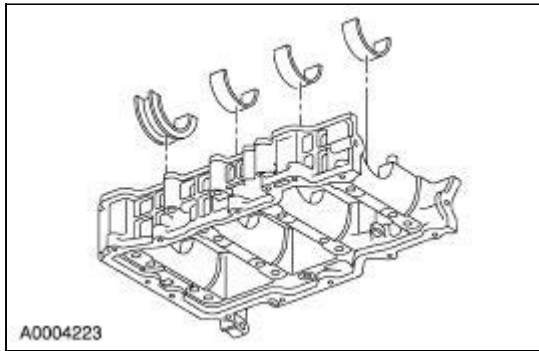
- NOTE:** Lubricate the crankshaft main bearings and the crankshaft journals with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H.


Carefully install the crankshaft into the cylinder block.



- Install the lower main bearings and lower thrust bearing into the lower cylinder block in the

correct locations.

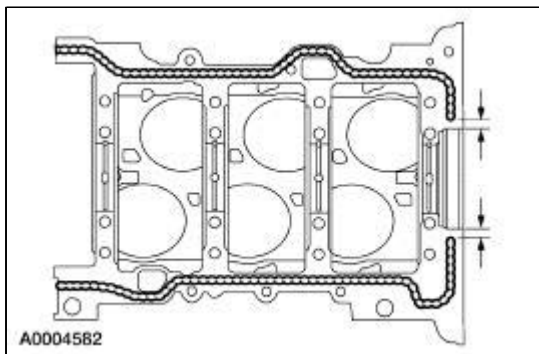


12.  **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs, or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which may make leak paths. Use a plastic scraper to remove all traces of old sealant.**

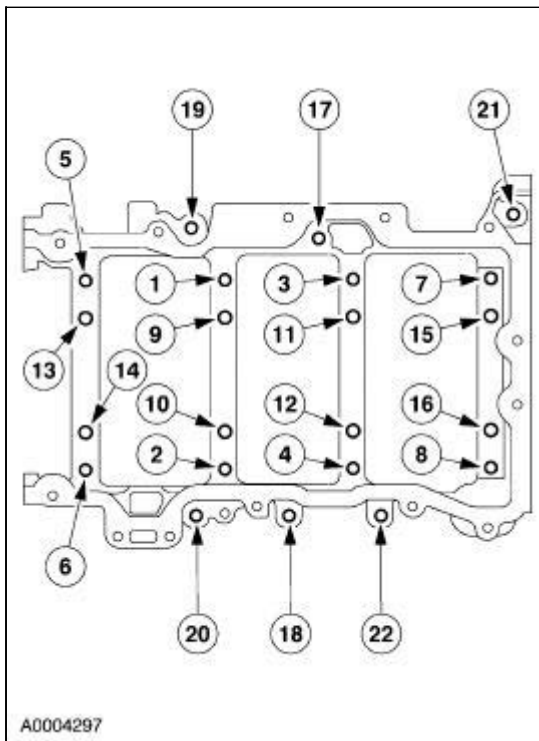
NOTE: Both sealing surfaces must be clean, dry and free of any dirt or other contamination prior to application of the sealant. Use Metal Surface Cleaner F4AZ-19A536-RA or equivalent meeting Ford specification WSE-M5B392-A. Allow to dry until there is no sign of wetness, or four minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.


NOTE: The lower cylinder block and bolts, with all bolts tightened, must be assembled within four minutes of applying sealer.

Apply a 3 mm (0.12 in) bead of Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4 to the lower cylinder block ending 6 mm (0.24 in) from the rear crankshaft seal bore on both sides.



13. Install the lower cylinder block and bolts.
- Tighten the bolts in the sequence shown in four stages.
 - Stage 1: Tighten numbers 1 through 8 to 25 Nm (18 lb-ft).
 - Stage 2: Tighten numbers 9 through 16 to 40 Nm (30 lb-ft).
 - Stage 3: Rotate numbers 1 through 16 an additional 90 degrees.
 - Stage 4: Tighten numbers 17 through 22 to 25 Nm (18 lb-ft).

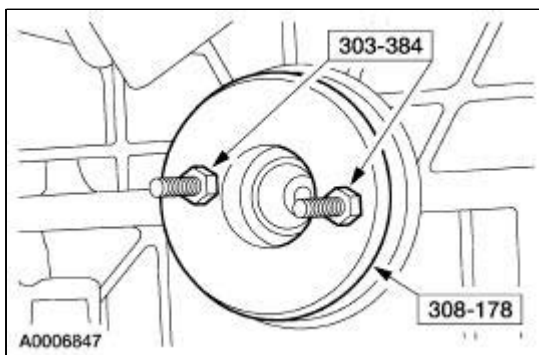


14. Remove the squeezed out sealer at the engine front cover surface and the rear seal bore inner diameter.
15. Check crankshaft end play. For additional information, refer to [Section 303-00](#).
16.  **CAUTION: Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.**

Rotate the crankshaft clockwise to verify free rotation.

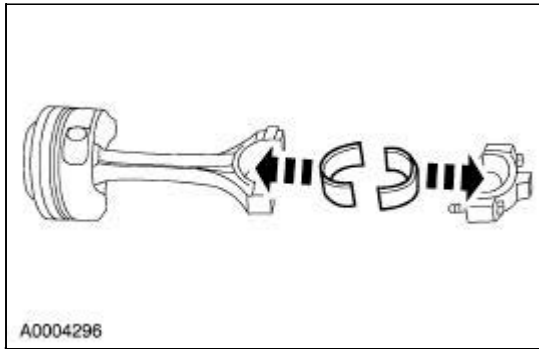
17. **NOTE:** Apply Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H to the crankshaft flange outer diameter and to the crankshaft seal bore inner diameter prior to seal installation.


Using the special tool, install the crankshaft rear oil seal.



18. Select the correct size connecting rod bearings. For additional information, refer to [Section 303-00](#).
19. **NOTE:** The connecting rod bearing tangs should align with the notch in the connecting rod and cap.

Install the connecting rod bearings into the connecting rods and connecting rod caps.



20.  **CAUTION:** Be sure not to scratch the cylinder wall or crankshaft journal with the connecting rod. Push the piston down until the connecting rod bearing seats on the crankshaft journal.

NOTE: Lubricate the pistons, piston rings, connecting rod bearings and entire cylinder bores with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H prior to installation.

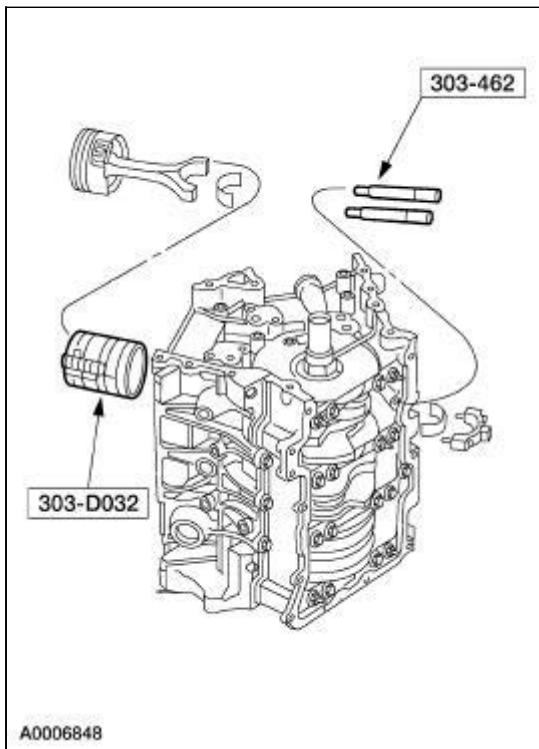
NOTE: Check piston rings for correct orientation prior to installing piston into cylinder bore. For additional information, refer to [Section 303-00](#).

NOTE: Install pistons with arrows on pistons to front of engine.

NOTE: After installation of each piston and connecting rod, rotate the crankshaft to verify smooth operation.

Turn the crankshaft until the crankshaft throw is at the bottom of the stroke. Using the special tools, install the piston, connecting rod, and connecting rod bearing assemblies Nos. 1 and 4. Tighten the bolts in three stages:

- Stage 1: Tighten to 23 Nm (17 lb-ft).
- Stage 2: Tighten to 43 Nm (32 lb-ft)
- Stage 3: Tighten an additional 90 degrees.

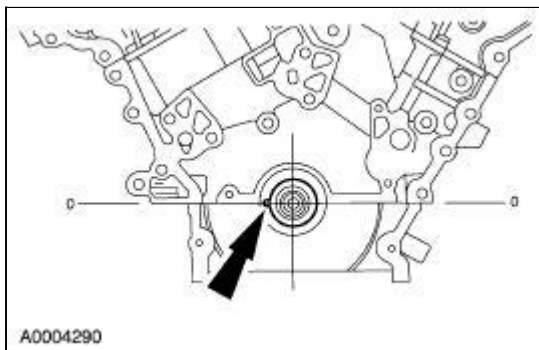


21. Install the piston, connecting rod and connecting rod bearing assemblies Nos. 2 and 5. Tighten the bolts in three stages:
 - Stage 1: Tighten to 23 Nm (17 lb-ft).
 - Stage 2: Tighten to 43 Nm (32 lb-ft).
 - Stage 3: Tighten an additional 90 degrees.

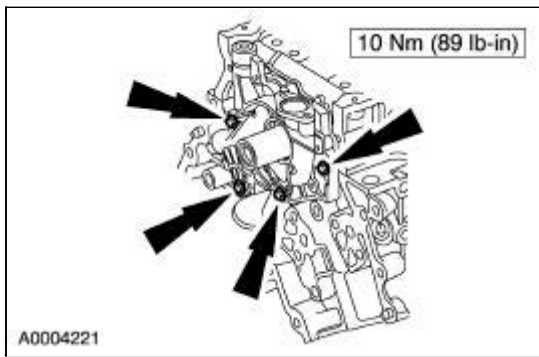
22. Install the piston, connecting rod and connecting rod bearing assemblies Nos. 3 and 6. Tighten the bolts in three stages:
 - Stage 1: Tighten to 23 Nm (17 lb-ft).
 - Stage 2: Tighten to 43 Nm (32 lb-ft).
 - Stage 3: Tighten an additional 90 degrees.

23. Check the connecting rod side clearance for all of the connecting rods. For additional information, refer to [Section 303-00](#).

24. Rotate the crankshaft to position the keyway at the nine o'clock position.

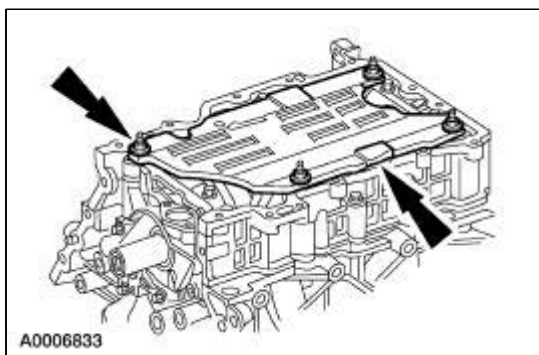


25. Position the oil pump and install the bolts.



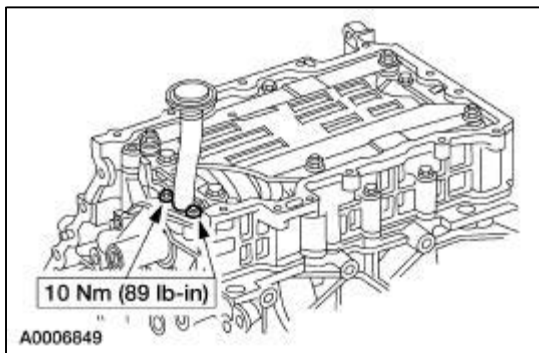
26. Position the oil pan baffle and install the nuts. Tighten in two stages:

- Stage 1: Tighten to 5 Nm (44 lb-in).
- Stage 2: Tighten an additional 45 degrees.

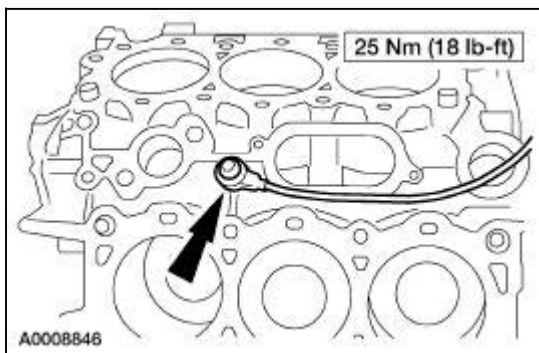


27. Position the oil pump screen cover and tube and install the bolts.

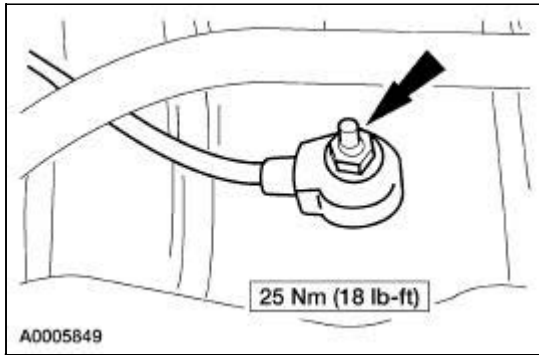
- Use a new O-ring seal if necessary.



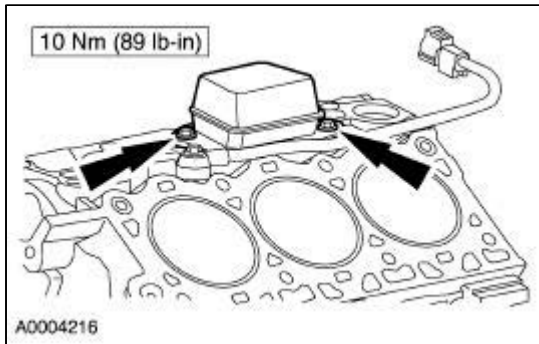
28. Position the top-mounted KS and install the bolt.



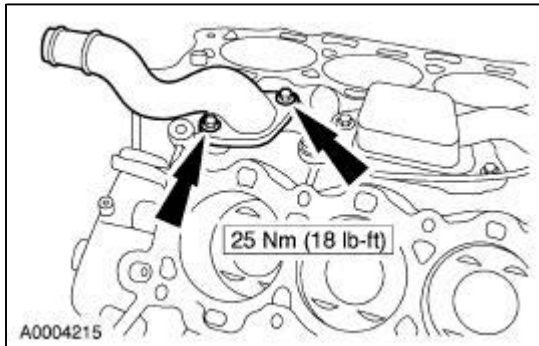
29. Position the side-mounted KS and install the nut.




30. Using a new gasket, position the oil separator and install the bolts.



31. Using a new O-ring seal, position the coolant inlet tube and install the bolts.



32.  **CAUTION:** The cylinder head gasket surfaces are ground to a precision finish. Do not rest cylinder heads on gasket surfaces. Do not use any abrasive during cleaning of the surfaces. Hairline scratches, small burrs, or dirt can provide a leak path for a cylinder head gasket to leak. If gasket material remains on the sealing surface, use only a plastic-tipped scraper to remove the material. Do not attempt to reuse the head gaskets.

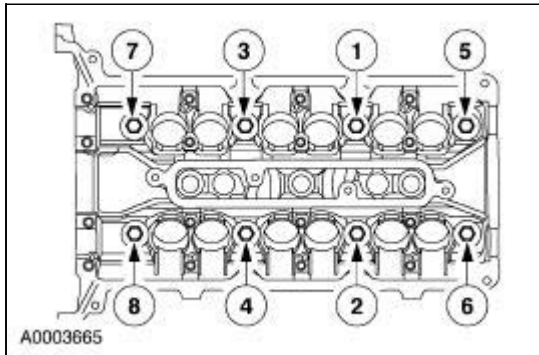
 **CAUTION:** Cylinder head bolts are torque-to-yield and cannot be reused.

NOTE: The LH and RH cylinder head gaskets are not interchangeable.

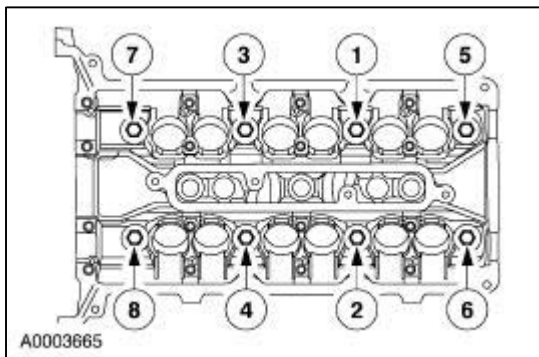
Using a new cylinder head gasket, position the RH cylinder head, and install the bolts.


- Tighten the bolts in six stages:
- Stage 1: Tighten to 30 Nm (22 lb-ft).
- Stage 2: Tighten an additional 90 degrees.


- Stage 3: Back out a minimum of one full turn (360 degrees).
- Stage 4: Tighten to 30 Nm (22 lb-ft).
- Stage 5: Tighten an additional 90 degrees.
- Stage 6: Tighten an additional 90 degrees.



33. Using a new cylinder head gasket, position the LH cylinder head, and install the bolts.
- Tighten the bolts in six stages:
 - Stage 1: Tighten to 30 Nm (22 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.
 - Stage 3: Back out a minimum of one full turn (360 degrees).
 - Stage 4: Tighten to 30 Nm (22 lb-ft).
 - Stage 5: Tighten an additional 90 degrees.
 - Stage 6: Tighten an additional 90 degrees.



34.  **CAUTION: The tappets and shims must be installed in their original positions.**

 **CAUTION: The bucket tappets and bores must be absolutely clean prior to bucket tappet installation. Failure to correctly clean these components may result in a sticking valve leading to severe engine damage or failure.**

NOTE: Only lightly lubricate the tappet shim prior to installation. Excess oil on the tappet shim may cause inaccurate valve clearance measurements.

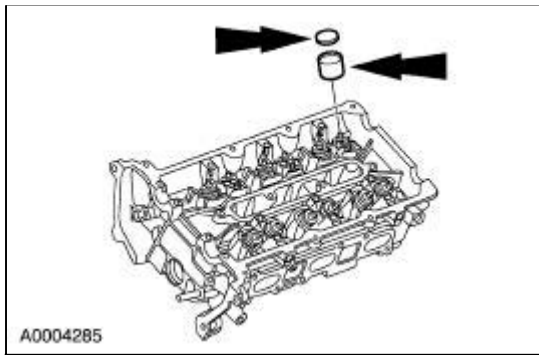
NOTE: LH side shown; RH side similar.

Lubricate all of the valve tappets, shims and bores and install them in their original positions.

- Lubricate the valve tappets and bores with Super Premium SAE 5W-20 Motor Oil XO-

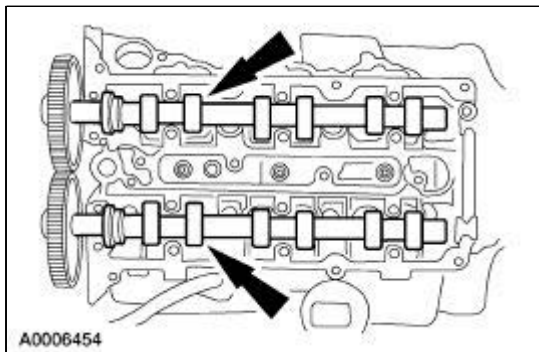
5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H.


- Lubricate the shims with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H.




35. **NOTE:** Be sure camshaft bearing caps are installed in their original positions.

Lubricate the LH camshafts with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H and carefully position the camshaft into the LH cylinder head.

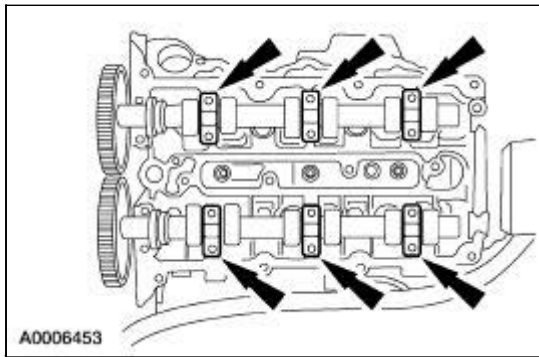


36.  **CAUTION:** This is not a free-spinning engine. The crankshaft keyway must be at the nine o'clock position prior to tightening the camshaft caps or rotating the camshafts. Failure to follow these directions may result in serious engine damage.

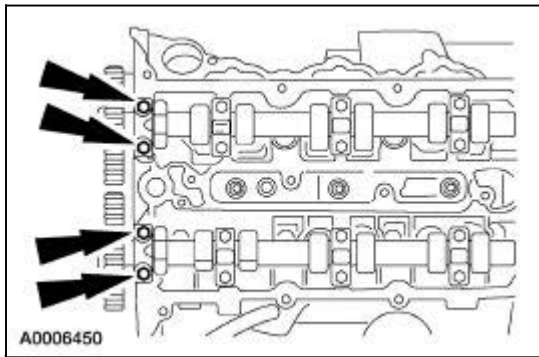
 **CAUTION:** Cylinder head camshaft journal caps are numbered. Keep camshaft journal caps with the cylinder head from which they were removed. Do not mix with camshaft journal caps from another cylinder head.

 **CAUTION:** Do not install the camshaft journal thrust caps until all of the camshaft bearing journal caps have been tightened, or damage to the thrust caps may occur.

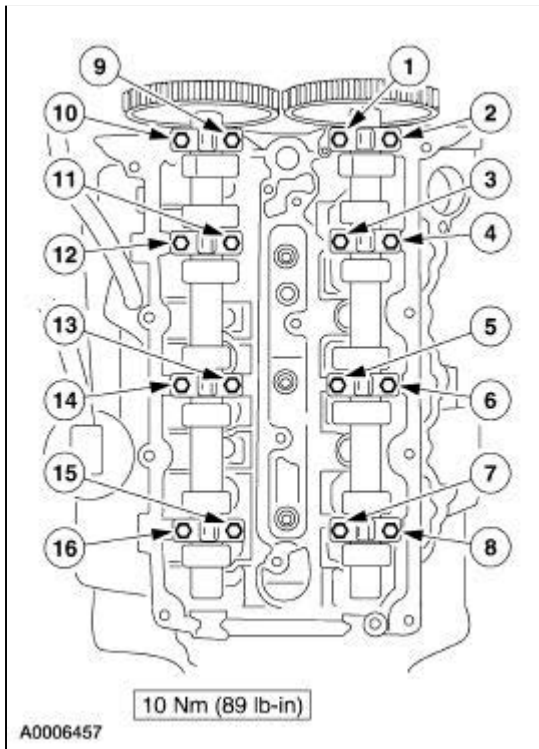
Lubricate the LH camshaft bearing journal caps with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H. Position the caps in their correct locations and loosely install the bolts.



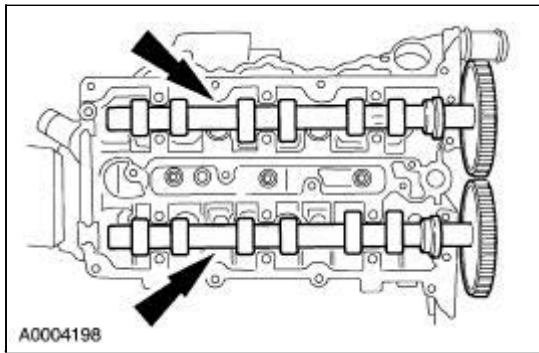
37. Lubricate the LH camshaft thrust caps with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H and position the caps and loosely install the bolts.




38. Tighten the bolts in sequence shown.



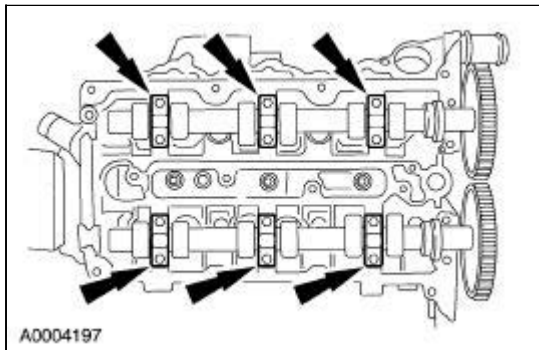
39. Lubricate the RH camshafts with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H and carefully position the camshaft into the RH cylinder head.



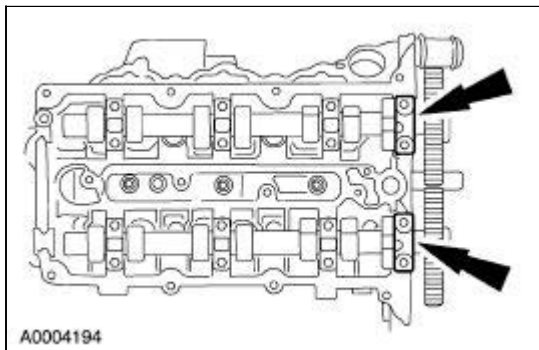
40.  **CAUTION:** Cylinder head camshaft journal caps and cylinder heads are numbered to make sure they are installed in their original position. Keep camshaft journal caps with the cylinder head from which they were removed. Do not mix with camshaft journal caps from another cylinder head.

 **CAUTION:** Do not install the camshaft journal thrust caps until all of the camshaft bearing journal caps have been tightened or damage to the thrust caps may occur.

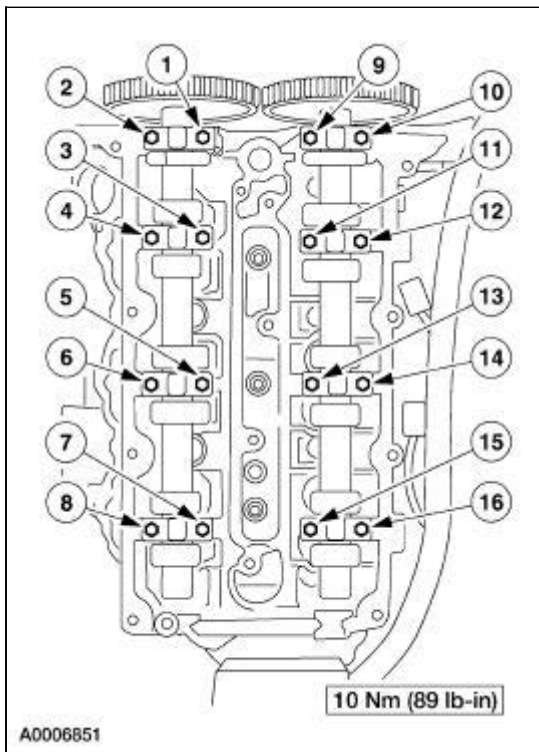
Lubricate the camshaft bearing journal caps with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H. Position the caps in their correct locations and loosely install the bolts.




41. Lubricate the RH camshaft thrust caps with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H and loosely install the caps and bolts.

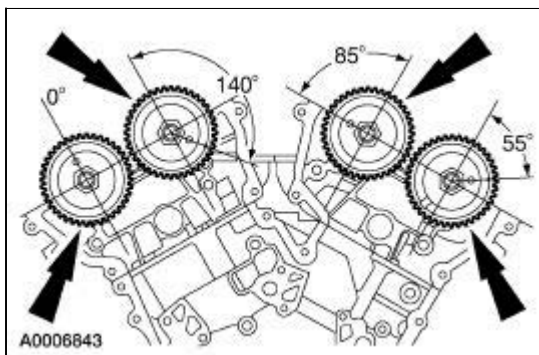


42. Tighten the camshaft journal cap bolts in the sequence shown.

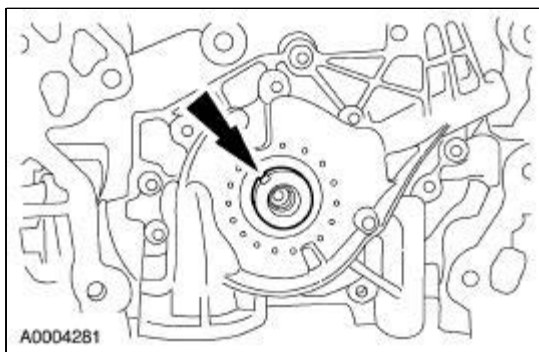


43.  **CAUTION:** The crankshaft keyway must remain in the nine o'clock position until the cams are located, or damage to the valves may occur.

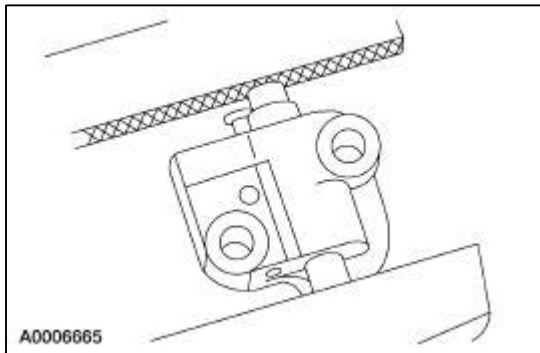
Rotate each camshaft to make sure there is smooth rotation and to position the cams in their neutral position.



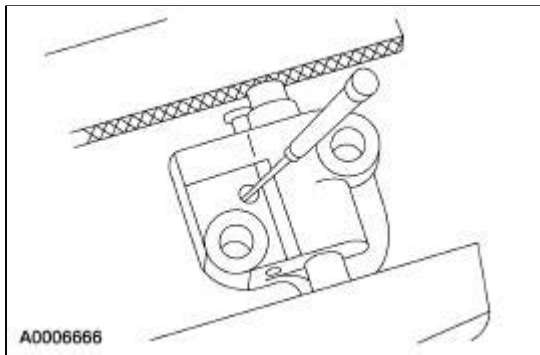
44. Install the crankshaft pulley and tighten the bolt.
45. Rotate the crankshaft clockwise to position the keyway to the 11 o'clock position.



46. Remove the bolt and the crankshaft pulley.
47. Position the LH chain tensioner in a soft-jawed vise.



48. Hold the chain LH tensioner ratchet lock mechanism away from the ratchet stem with a small pick.

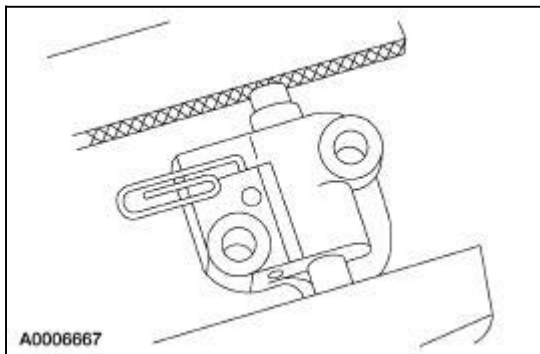


49.  **CAUTION:** During tensioner compression, do not release the ratchet stem until the tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

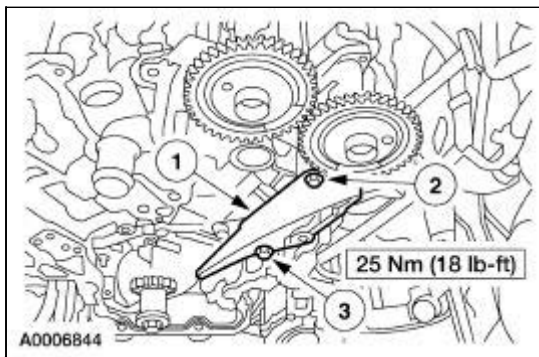
Slowly compress the LH timing chain tensioner.

50. **NOTE:** The wire must remain in the timing chain tensioner until the tensioner is installed.

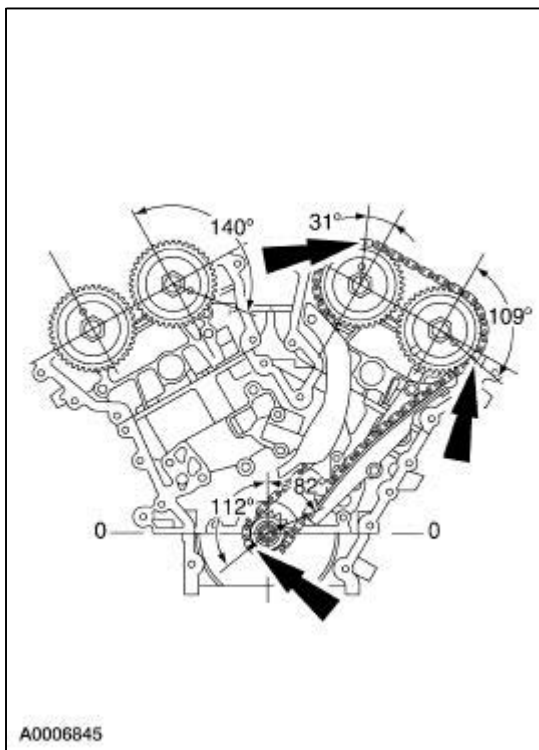
Retain the LH tensioner piston with a 1.5 mm (0.06 in) wire or paper clip.



51. Install the LH timing chain guide.
 1. Position the guide to the engine.
 2. Install the shorter (gold color) bolt into the upper hole.
 3. Install the longer bolt (black color) into the lower hole.

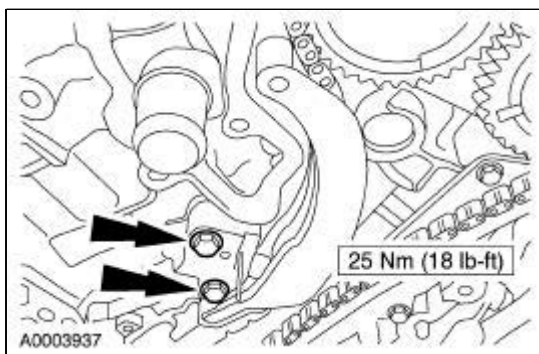


52. Install the LH timing chain, aligning the timing index link (gold color) with the marks on the camshaft and crankshaft sprockets.

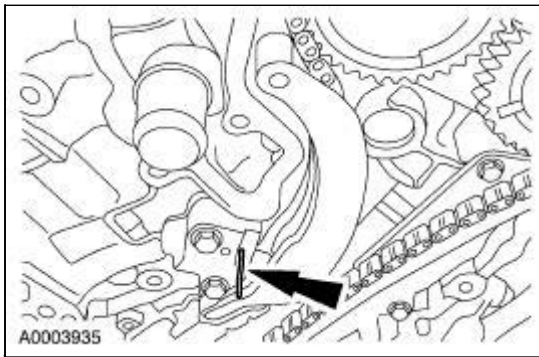


53. **NOTE:** Be sure to position the tensioner so that the tensioner piston is fully engaged in the tensioner arm.

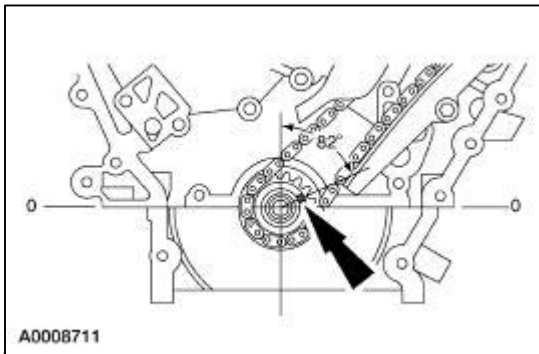
Install the LH tensioner arm, tensioner and tensioner bolts.



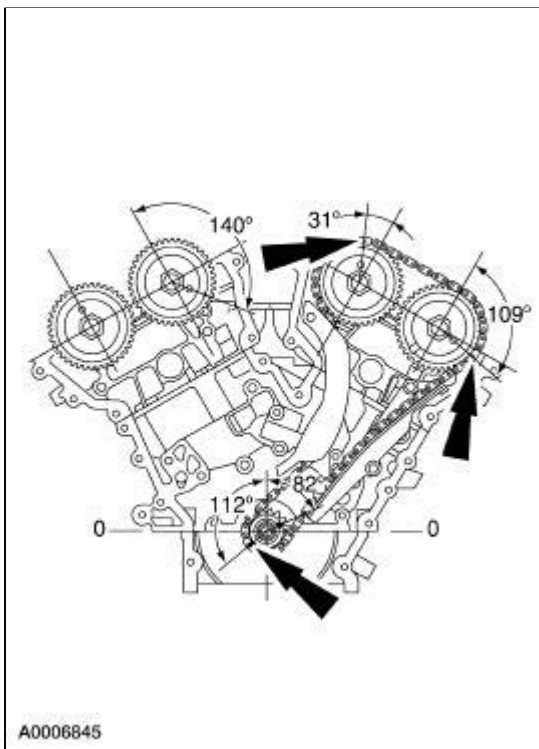
54. Remove the wire or paper clip from the tensioner.



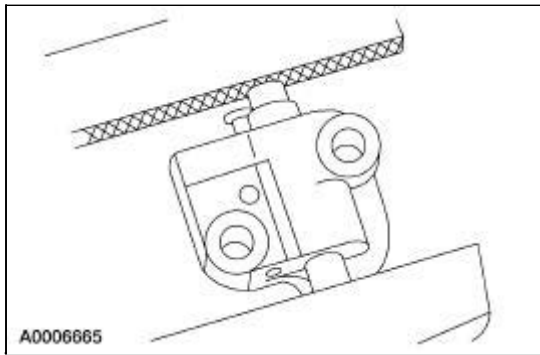
55. Rotate the crankshaft clockwise and position the keyway between the 2 o'clock and 3 o'clock positions for RH timing chain installation.



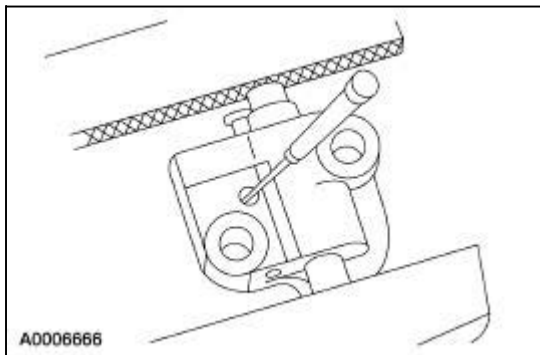
56. Verify that the timing index links (gold color) on the LH timing chain are in alignment with the timing index marks on the camshaft and crankshaft sprockets.



57. Position the RH chain tensioner in a soft-jawed vise.



58. Hold the RH chain tensioner ratchet lock mechanism away from the ratchet stem with a small pick.

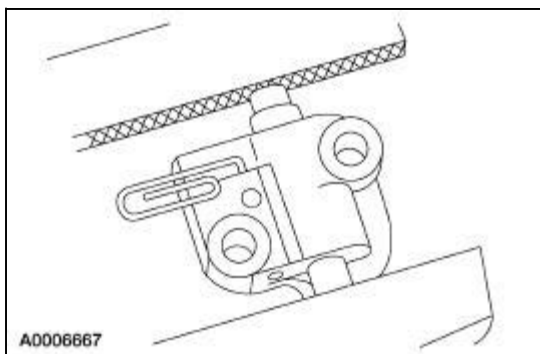


59.  **CAUTION:** During tensioner compression, do not release the ratchet stem until the tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

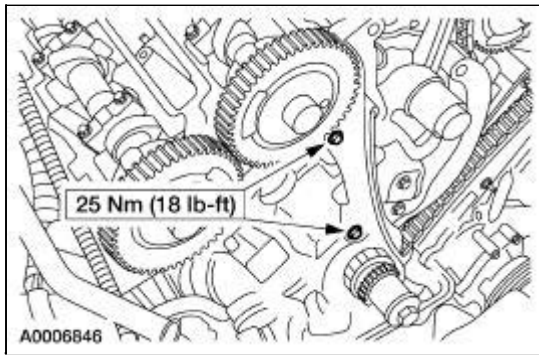
Slowly compress the RH timing chain tensioner.

60. **NOTE:** The wire must remain in the timing chain tensioner until the tensioner is installed.

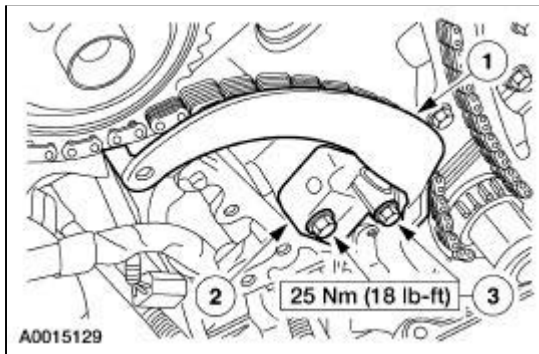
Retain the RH tensioner piston with a 1.5 mm (0.06 in) wire or paper clip.



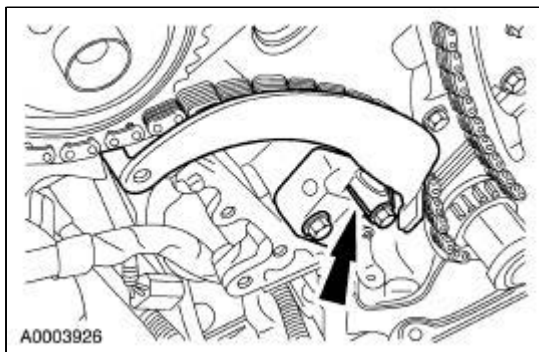
61. Install the RH chain guide and bolts.



62. Install the RH timing chain, aligning the timing index links (gold color) with the marks on the camshaft and crankshaft sprockets.
63. Install the RH tensioner.
 1. Position the tensioner arm.
 2. Position the tensioner.
 3. Install the bolts.



64. Remove the wire or paper clip from the RH tensioner.

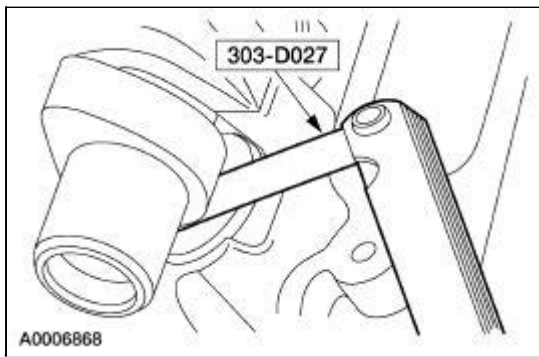


65. **⚠ CAUTION: Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.**


⚠ CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve lash measurements will be incorrect.

Rotate the engine clockwise to position the camshaft lobe away from the shim surface.

66. Using the special tool, measure the clearance between the camshaft lobe and the shim surface. Record the information.

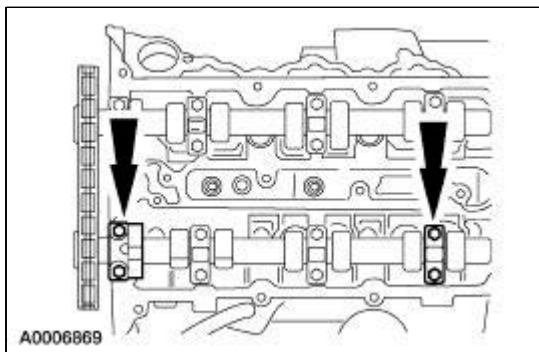


67. Use a bright colored marker to mark the position of the timing chain in relation to the camshaft sprockets to make sure that the timing remains correct.

68.  **CAUTION: The camshaft caps must be installed in their original positions.**

Mark the camshaft caps location.

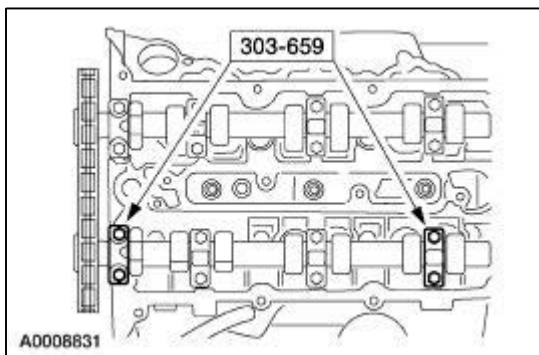
69. Remove the camshaft thrust cap and rear camshaft cap from the camshaft that requires shim adjustment.



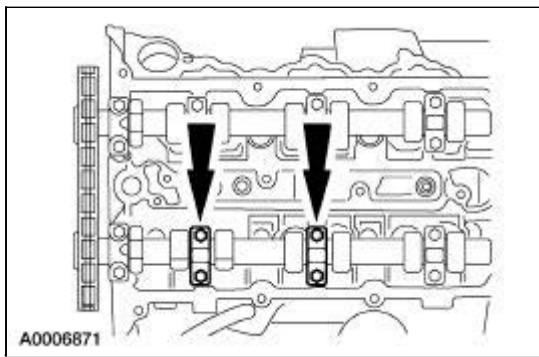
70. **NOTE:** The taller special tool is installed in place of the rear camshaft cap to allow the camshaft to be lifted to remove the shims.

Install the special tool.

- Hand-tighten the bolts.



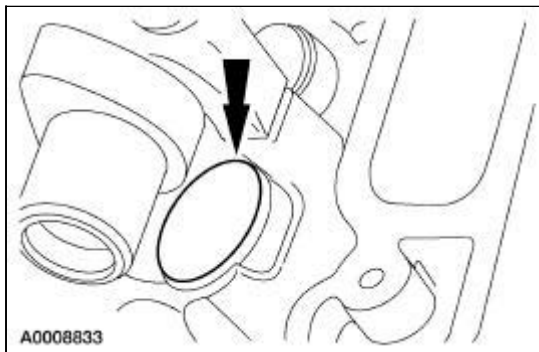
71. Remove the bolts and the center camshaft caps.



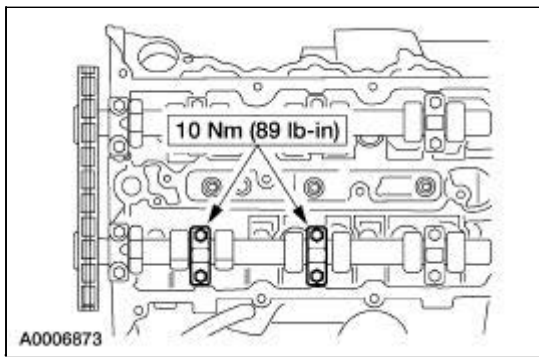
72.  **CAUTION: Do not use any means of marking the shims other than a permanent type marker. Any scratches or paint on the shims may result in incorrect lash adjustments and severe engine damage.**

Use a permanent marker to mark the location of each shim.

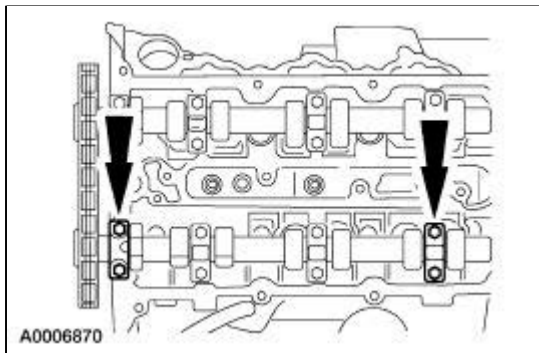
73. Use a rubber-tipped air gun and compressed air to remove the shims that require adjustment.
- Blow compressed air between the shim edge and bucket rail to dislodge the shim.



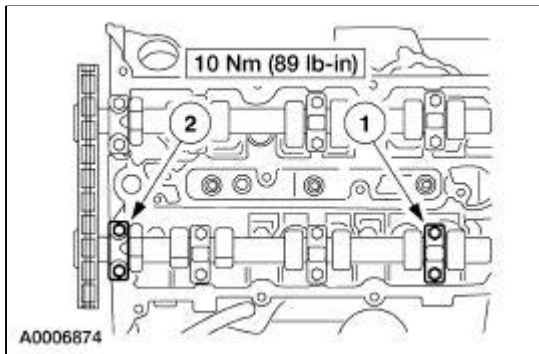
74. Measure and record the thickness of each shim to correspond with the valve clearance.
75. Use the following formula to calculate the required shim thickness.
- Valve clearance specification:
 - Intake: 0.175 mm — 0.225 mm (0.0069 in — 0.0089 in)
 - Exhaust: 0.325 mm — 0.375 mm (0.0128 in — 0.0148 in)
 - Original shim thickness + measured clearance - desired clearance = required shim thickness.
76. Apply a light coat of Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H to the replacement shim(s) and install the shim(s).
77. Apply Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H to the camshaft journals and bearing caps.
78. Position the center camshaft journal caps and install the bolts.



79. Remove the bolts and the special tools.

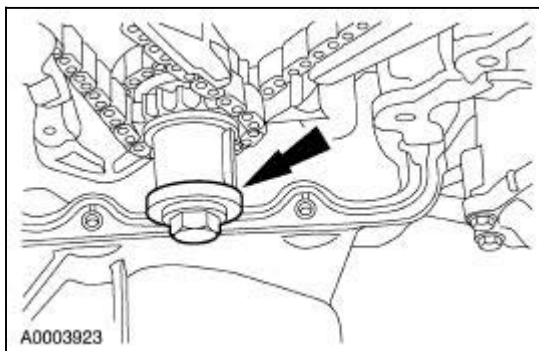


80. Install the camshaft caps.
1. Position the rear camshaft journal cap and install the bolts.
2. Position the camshaft journal thrust cap and install the bolts.

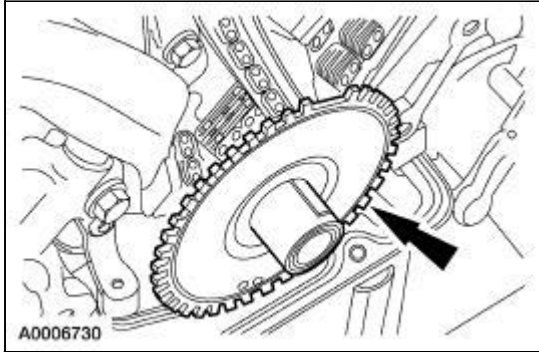


81. Rotate the engine clockwise to rotate the camshafts two full revolutions and recheck the valve clearance.

82. Remove the bolt and washer.

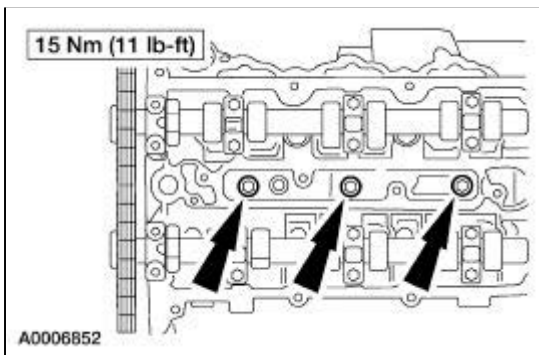


83. Install the ignition pulse ring.

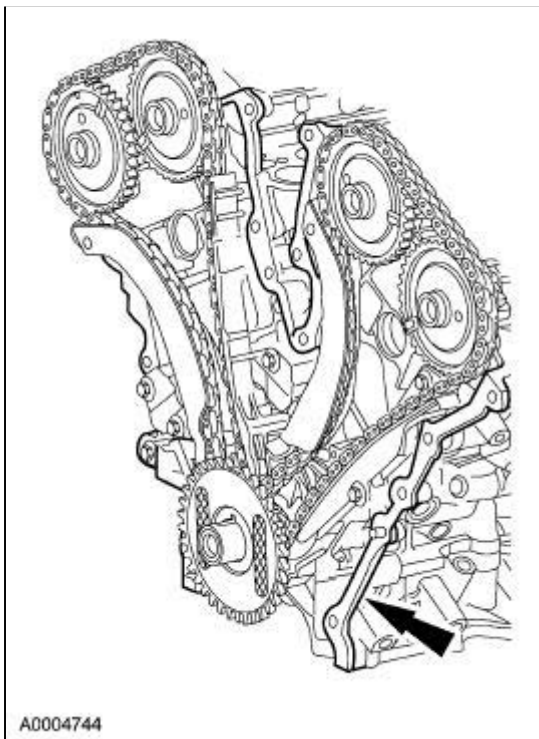


84. **NOTE:** LH shown; RH similar.

Install the LH and RH spark plugs.



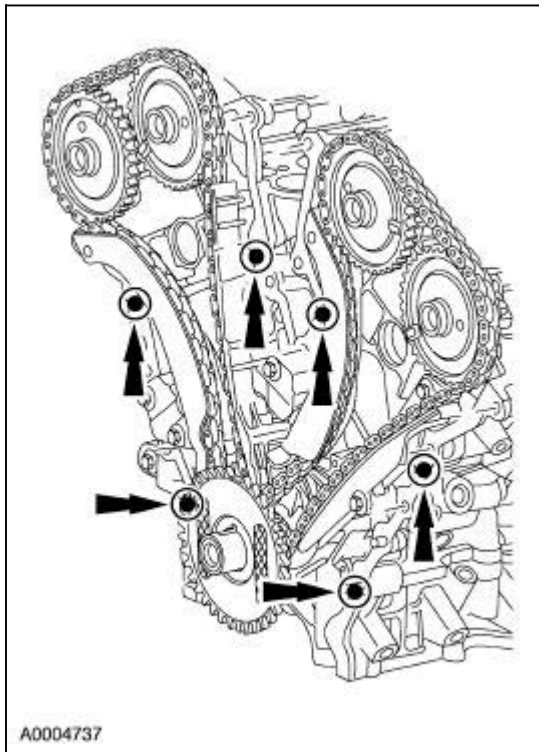
85. Clean the engine front cover to cylinder block and cylinder head sealing surfaces using a clean shop towel and Metal Surface Cleaner F4AZ-19A536-RA or equivalent meeting Ford specification WSE-M5B392-A to remove all residue.



86. Install new front cover seals into the front cover.

87. **NOTE:** Install the engine front cover and bolts no more than six minutes after applying sealer.

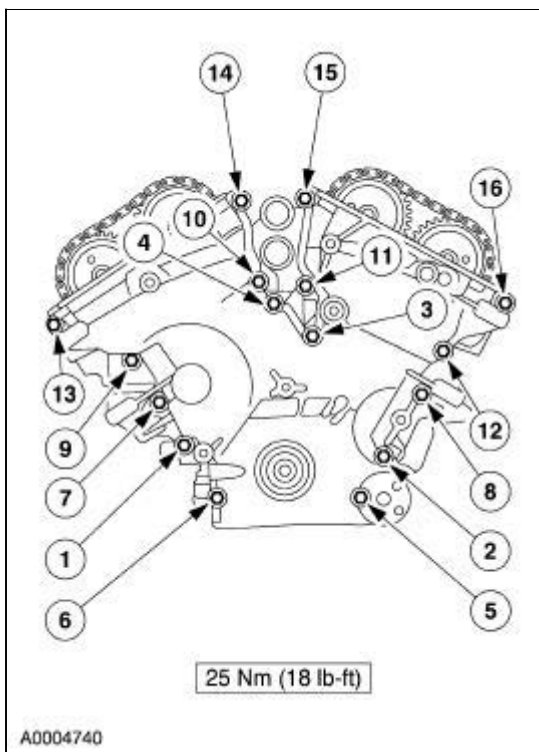
Apply a 6 mm (0.24 in) diameter dot of Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4.



88. **NOTE:** Fastener No. 14 is a stud bolt.

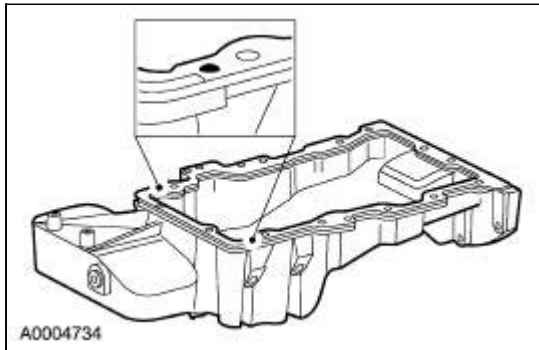
Install the engine front cover and the bolts.

- Tighten the bolts in the sequence shown.



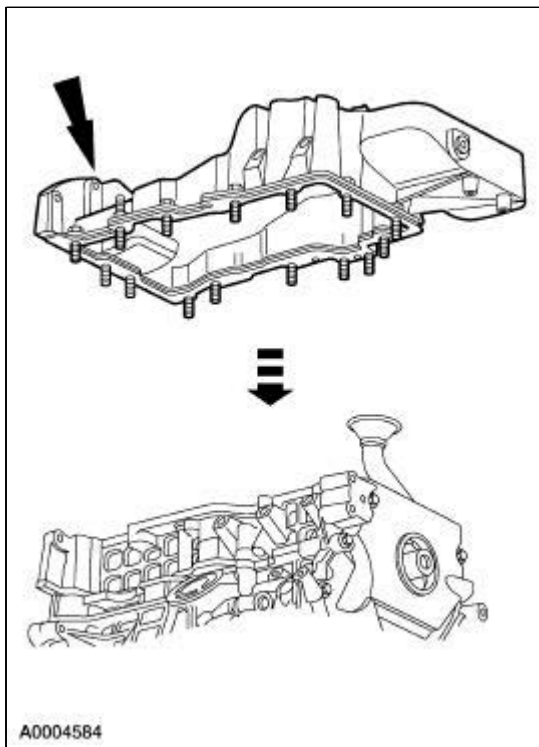
89. Rotate the engine upside down on the engine stand.
90. Clean the oil pan to cylinder block sealing surfaces on the oil pan and cylinder block with a clean shop towel and Metal Surface Cleaner F4AZ-19A536-RA or equivalent meeting Ford specification WSE-M5B392-A to remove all residues.
91. **NOTE:** Install the oil pan and bolts no more than six minutes after applying sealer.

Apply a 10 mm (0.4 in) dot of Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4 onto the top of the new oil pan gasket at the two locations shown.

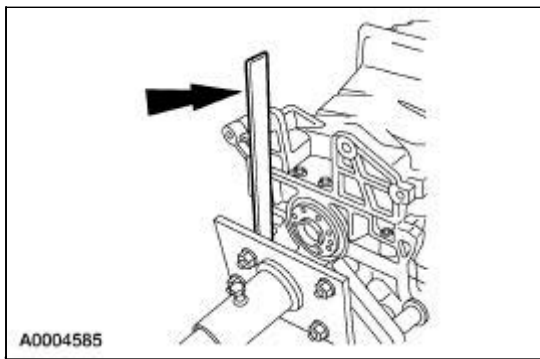


92. **NOTE:** The oil pan rear face must be installed flush to the cylinder block rear face to within +/- 0.10mm (0.0039 in). Failure to maintain this specification will require the oil pan to be removed and installed again.

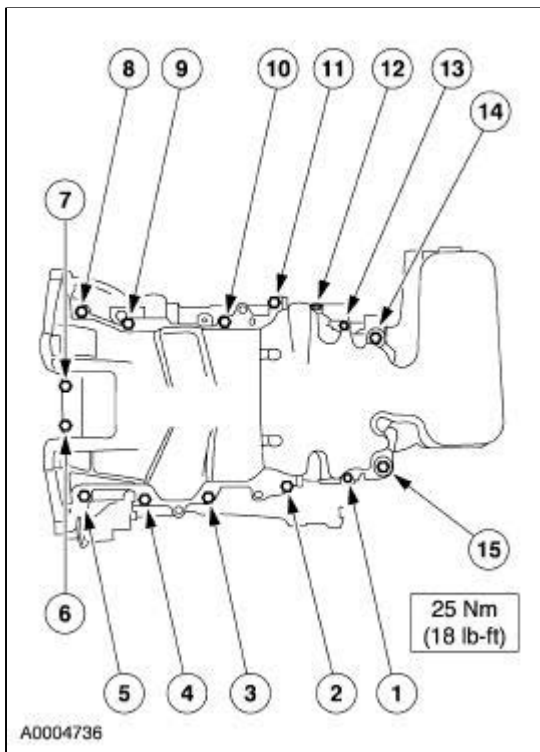
Position the oil pan and a new gasket and install the bolts finger-tight.



93. Using a straightedge, align the rear face of the oil pan flush with the rear face of the cylinder block.

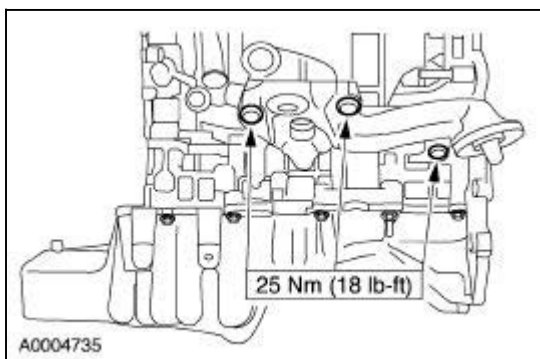


94. Tighten the oil pan bolts in the sequence shown.



95. **NOTE:** Non-oil cooler equipped engine shown. Engines equipped with oil cooler are similar.

Position the oil filter adapter and a new O-ring seal, and install the bolts.

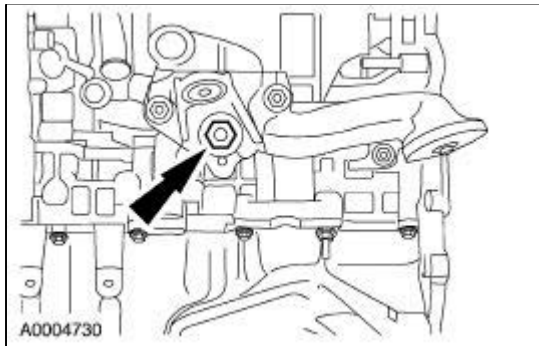


96. **NOTE:** Non-oil cooler equipped engine shown. Engines equipped with oil cooler are similar.

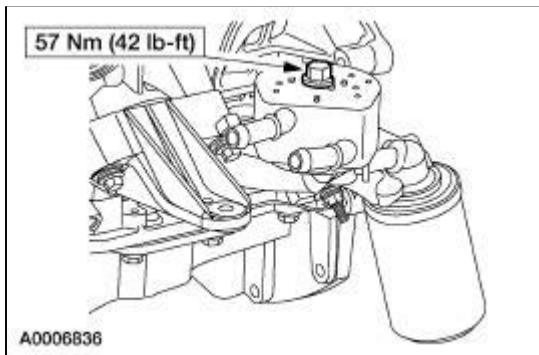
Using a new O-ring seal, lubricate with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H and install the bolt.

Tighten the bolt in two stages:

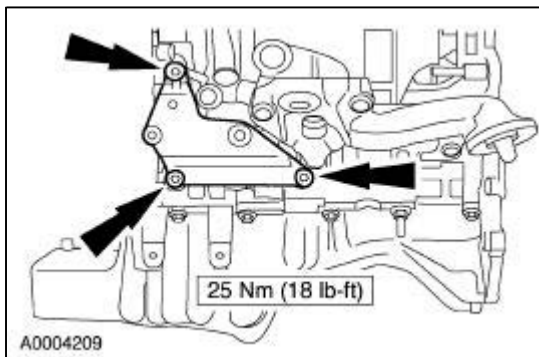
- Stage 1: Tighten to 30 Nm (22 lb-ft).
- Stage 2: Tighten to 155 Nm (114 lb-ft).



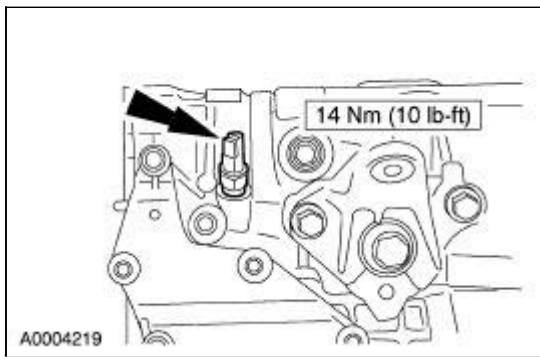
97. On vehicles equipped with an oil cooler, position the oil cooler and gasket and install the bolt.
- Rotate the cooler clockwise until the location pin hits the stop.



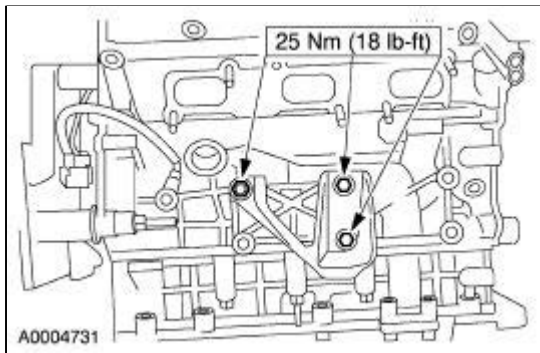
98. Lubricate the oil filter sealing ring with Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent meeting Ford specification WSS-M2C153-H and install the oil filter.
99. Position the A/C compressor mounting bracket and install the bolts.



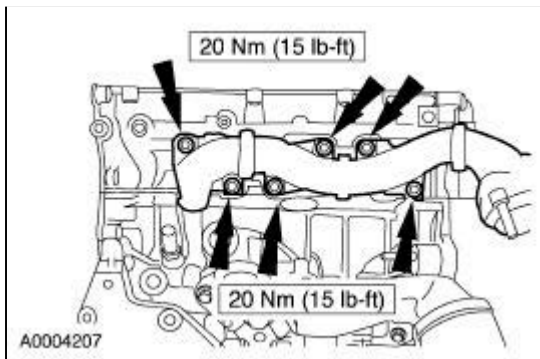
100. Install the oil pressure switch.



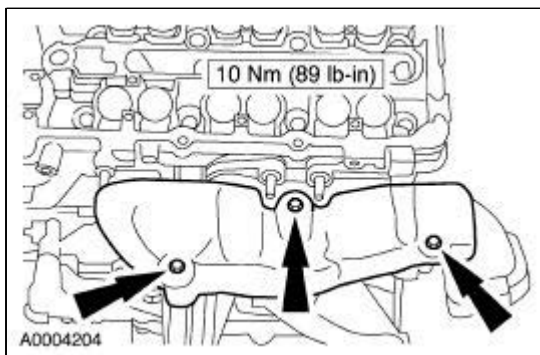
101. Position the RH engine mount bracket and install the bolts.



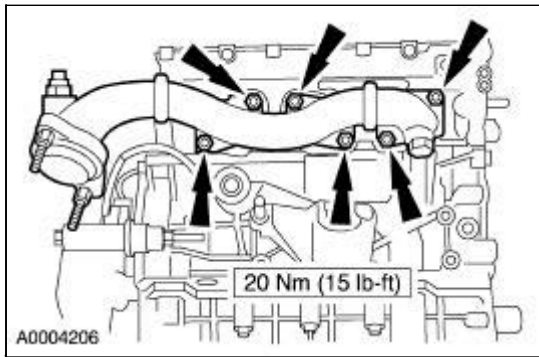
102. Using a new gasket, position the LH exhaust manifold and install the nuts.



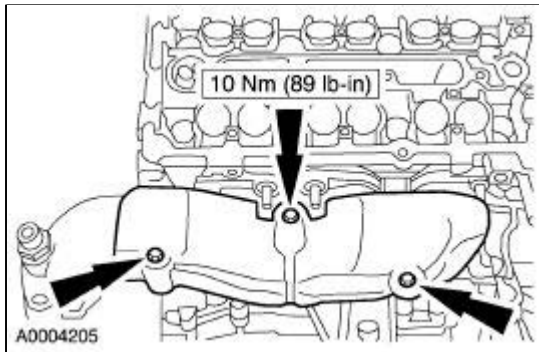
103. If equipped, position the LH heat shield and install the bolts.



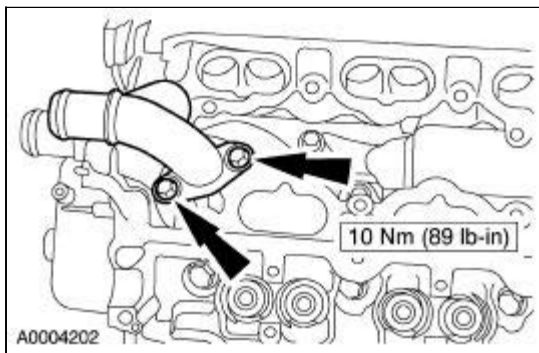
104. Using a new gasket, position the RH exhaust manifold and install the nuts.



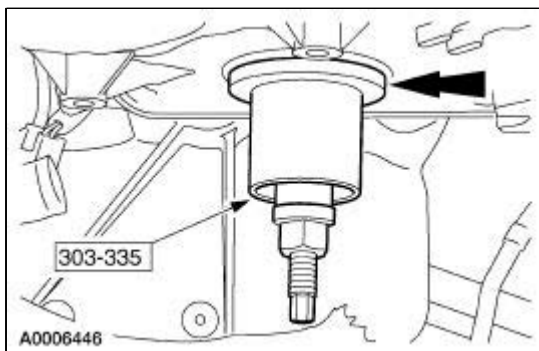
105. If equipped, position the RH heat shield and install the bolts.



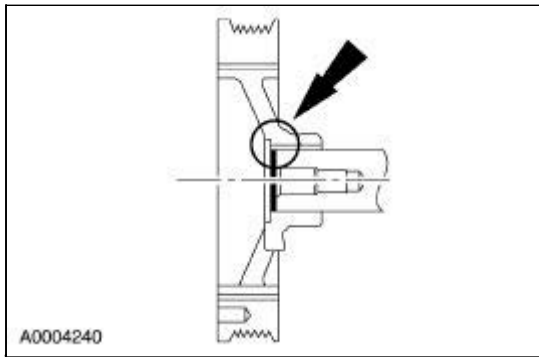
106. Using new O-ring seals, install the coolant bypass tube.



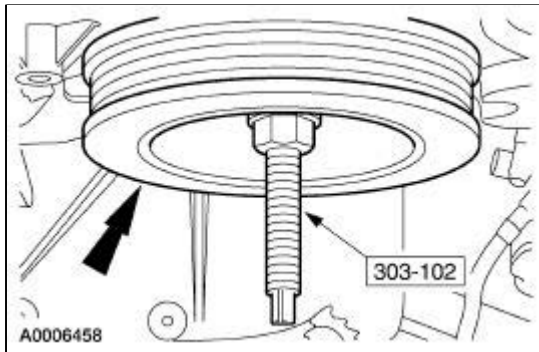
107. Using the special tool, install the crankshaft front oil seal.



108. Apply a dot of Silicone Gasket and Sealant F7AZ-19954-EA or equivalent meeting Ford specification WSE-M4G323-A4 to the crankshaft damper keyway slot.

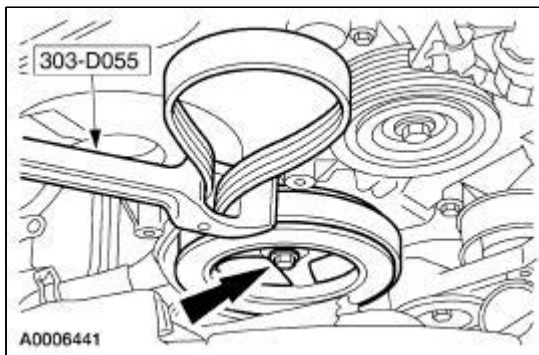


109. Using the special tool, install the crankshaft damper.

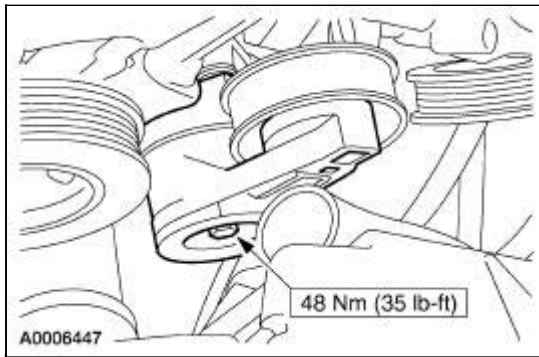


110. Using the special tool, install the washer and a new bolt. Tighten the bolt in four stages:

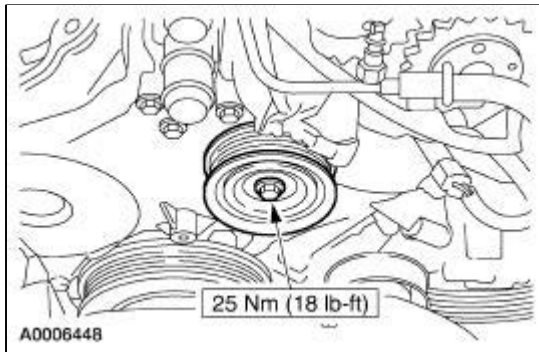
- Stage 1: Tighten to 120 Nm (89 lb-ft).
- Stage 2: Back out a minimum of one full turn (360 degrees).
- Stage 3: Tighten to 50 Nm (37 lb-ft).
- Stage 4: Tighten an additional 90 degrees.



111. Position the belt tensioner and install the bolt.

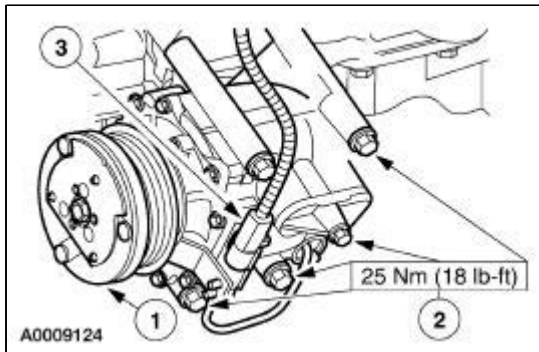


112. Position the idler pulley and install the bolt.

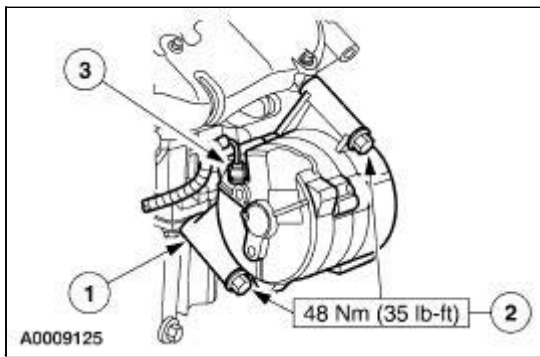


113. Install the engine harness assembly.

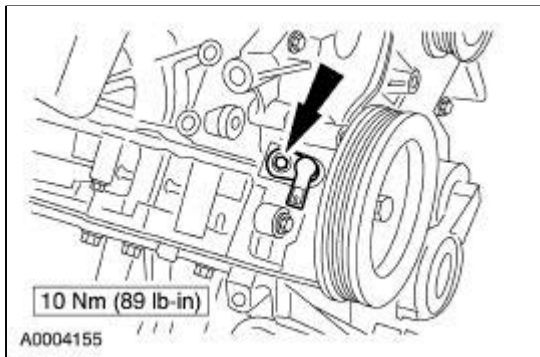
114. Install the A/C compressor.
1. Position the compressor.
 2. Install the bolts.
 3. Connect the electrical connector.



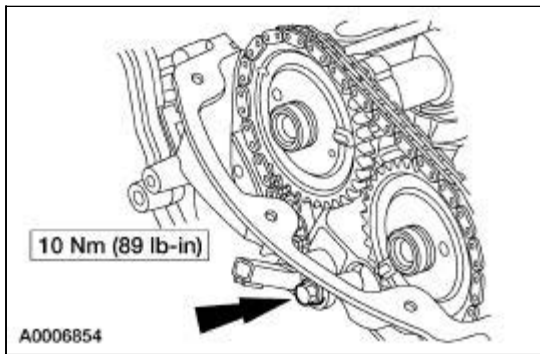
115. Install the generator.
1. Position the generator.
 2. Install the bolts.
 3. Connect the electrical connector.



116. Position the crankshaft position (CKP) sensor and install the bolt.

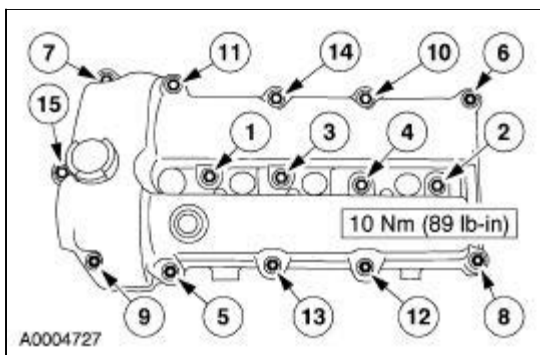


117. Position the camshaft position (CMP) sensor and install the bolt.

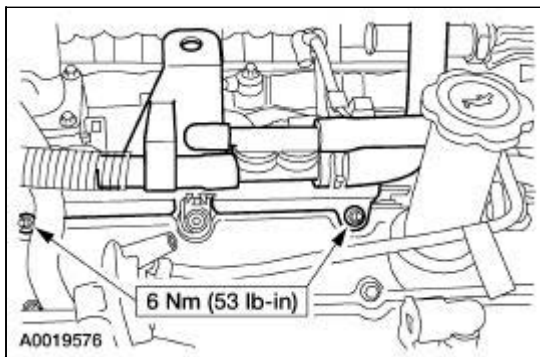


118. Install a new gasket in the LH valve cover.

119. Position the LH valve cover and install the bolts in the sequence shown.

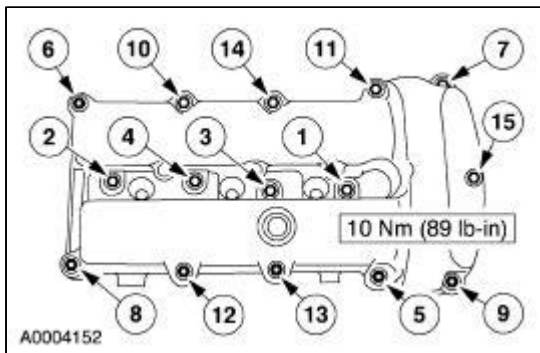


120. Install the bracket.

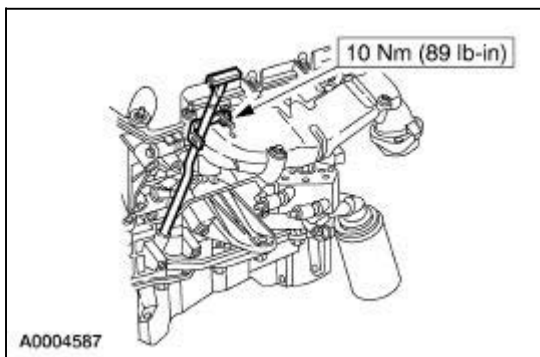


121. Install a new gasket in the RH valve cover.

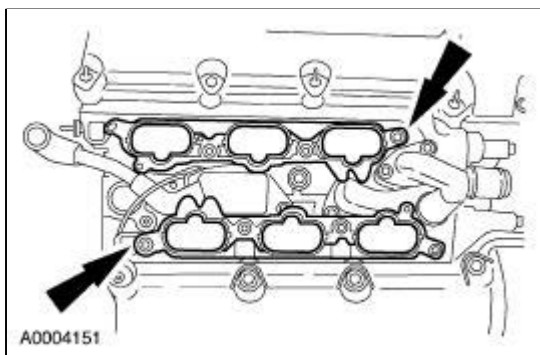
122. Position the RH valve cover and install the bolts in the sequence shown.



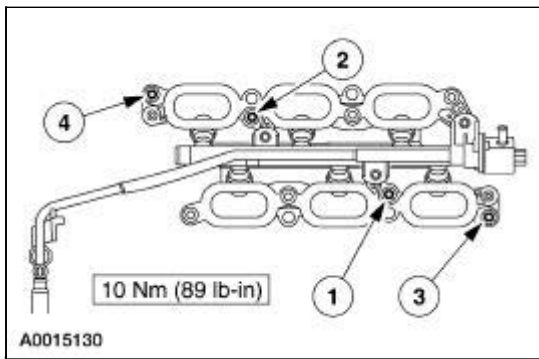
123. Install the oil level indicator and tube and install the stud bolt.



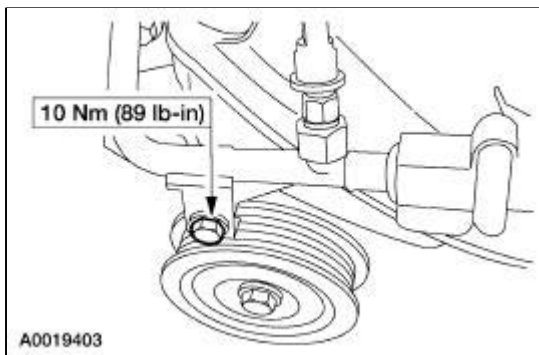
124. Position new lower intake manifold gaskets.



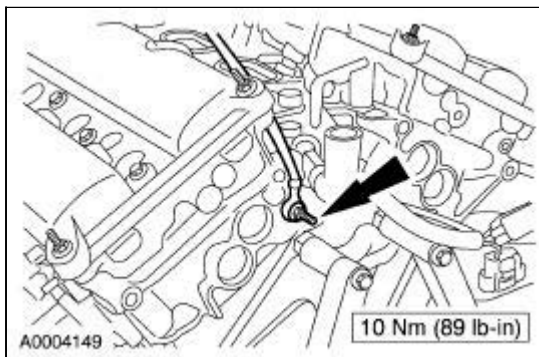
125. Position the lower intake manifold assembly and install the bolts in the sequence shown.



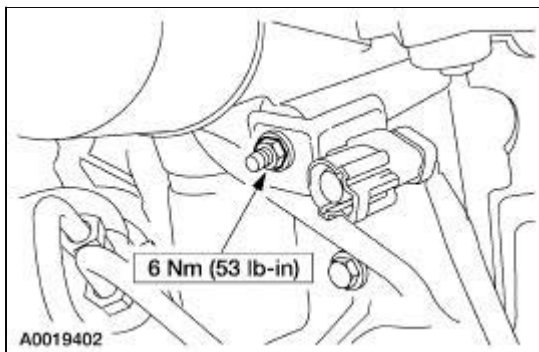
126. Install the bolt.



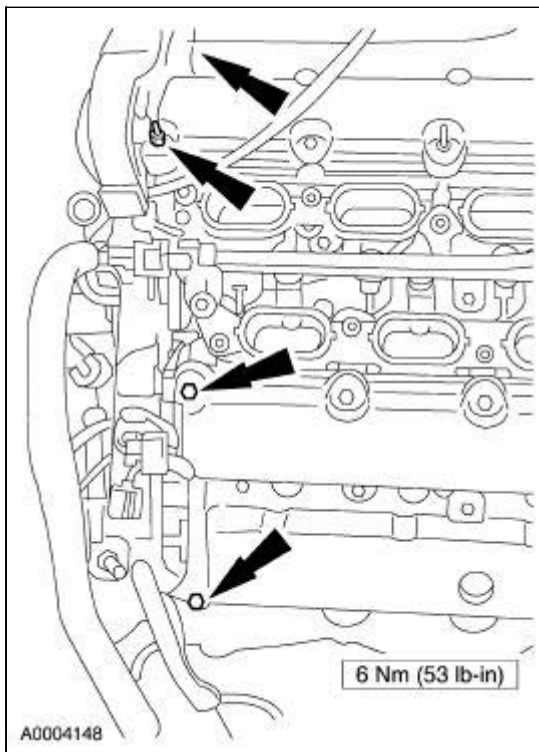
127. Position the ground strap and install the nut.



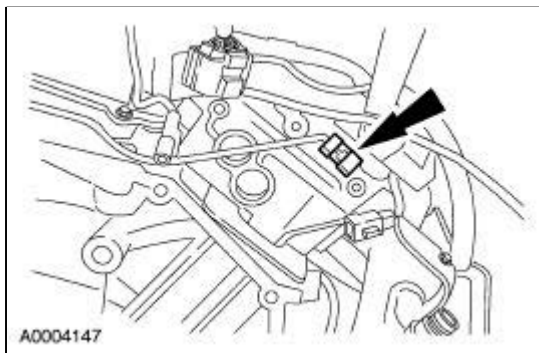
128. Install the bracket and the nut.



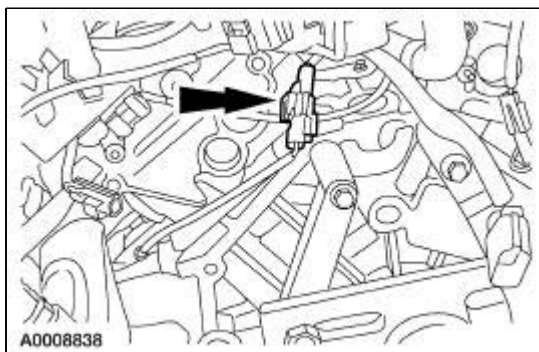
129. Position the wiring harness and install the four nuts.



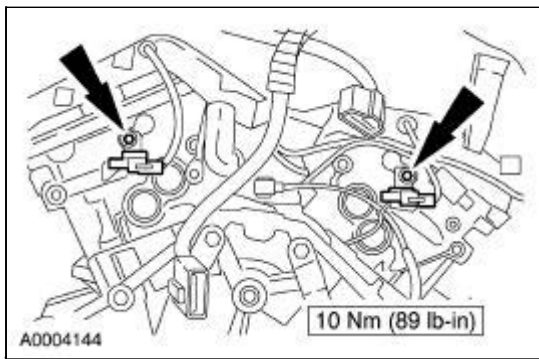
130. Clip the KS connector to the wiring harness.



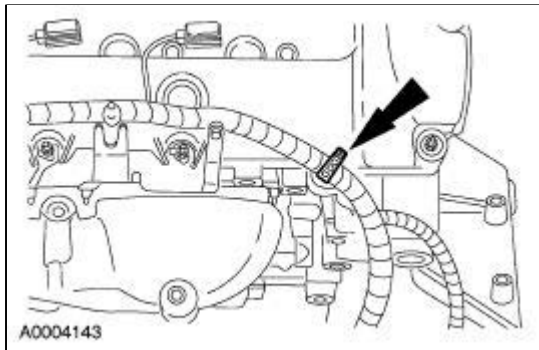
131. Connect the RH KS electrical connector.



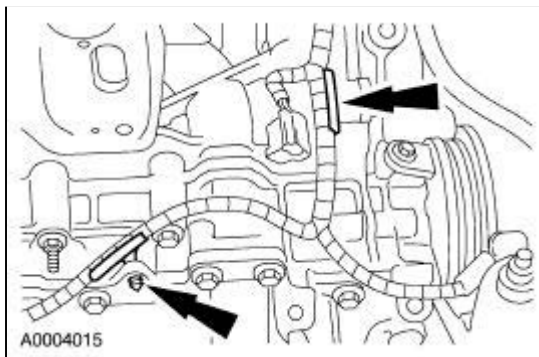
132. Position the two radio ignition interference capacitors and install the bolts.



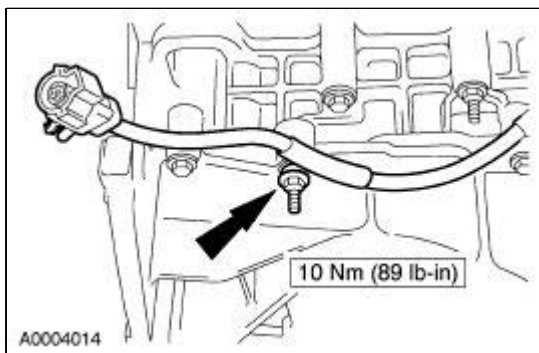
133. Attach the wiring harness retainer.



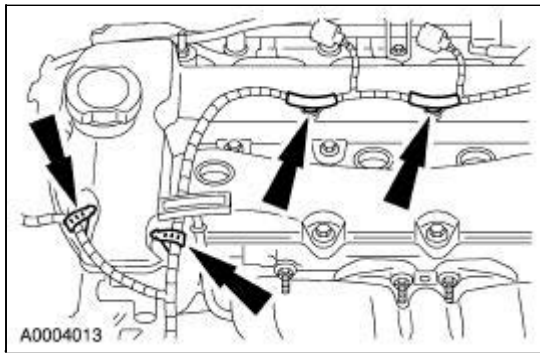
134. Clip the two wiring harness retainers into the brackets.



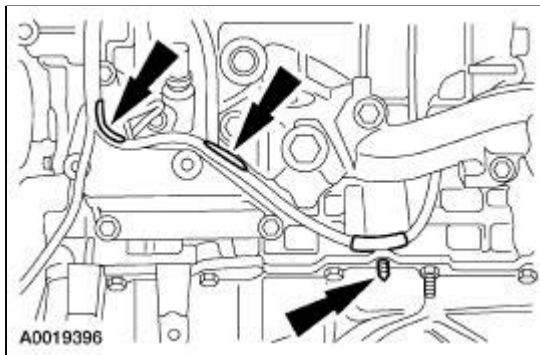
135. Position the wiring harness and install the nut.



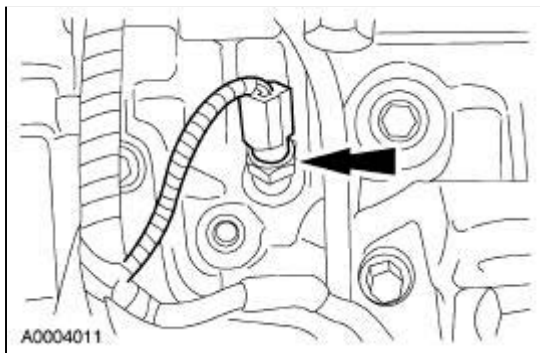
136. Attach the four wiring harness retainers.



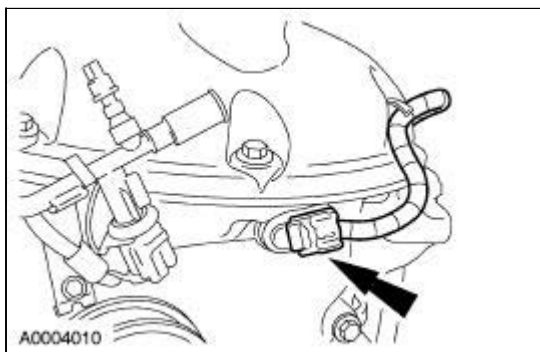
137. Attach the three wiring harness retainers.



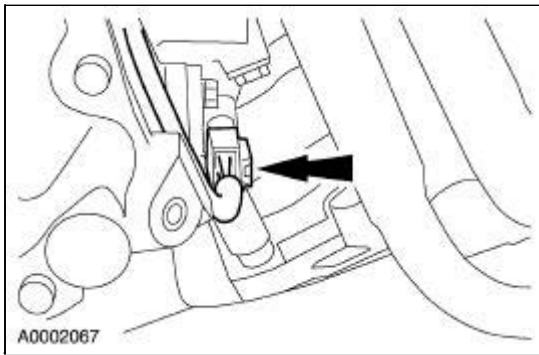
138. Connect the oil pressure sensor electrical connector.



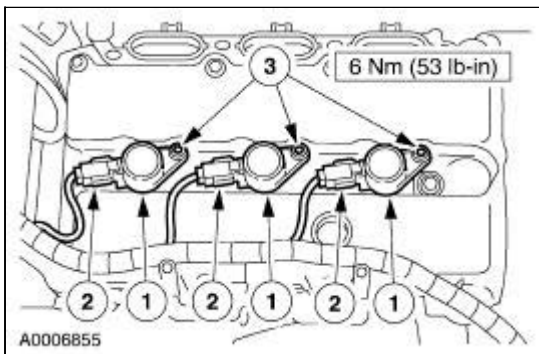
139. Connect the CMP sensor electrical connector.



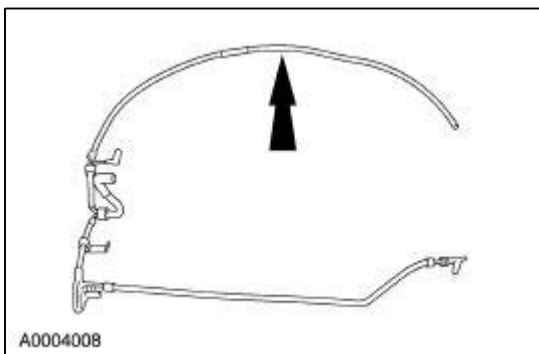
140. Connect the CKP sensor electrical connector.



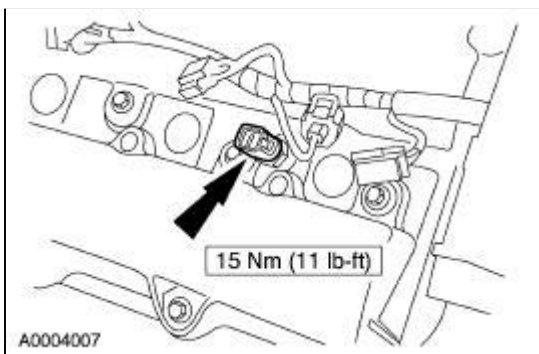
141. Install the RH ignition coils.
1. Install the RH ignition coils.
 2. Connect the electrical connectors.
 3. Install the bolts.



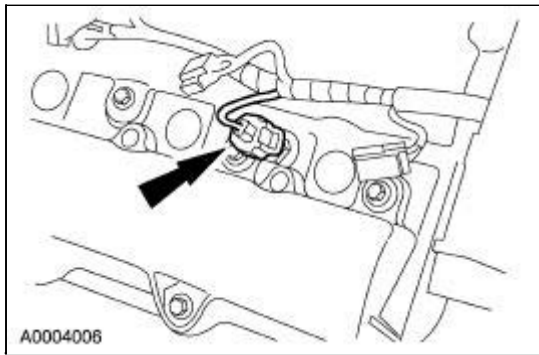
142. Install the vacuum harness.



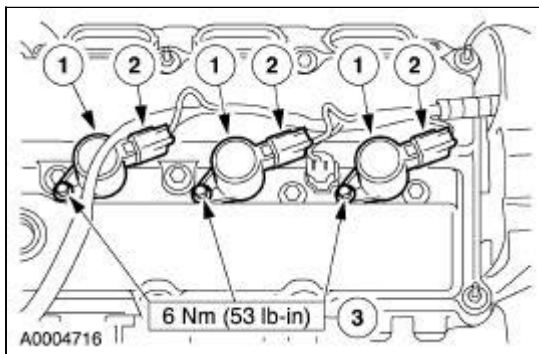
143. Install the cylinder head temperature (CHT) sensor.



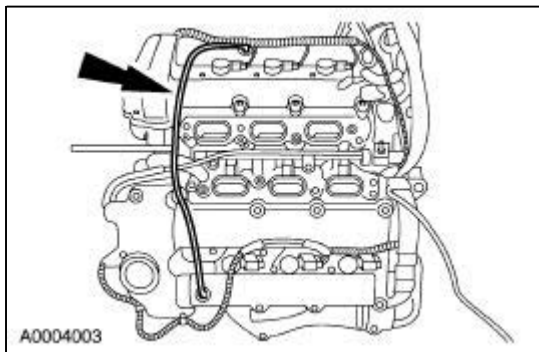
144. Connect the CHT sensor electrical connector.



145. Install the LH ignition coils.
1. Install the LH ignition coils.
 2. Connect the electrical connectors.
 3. Install the two studs and one bolt.

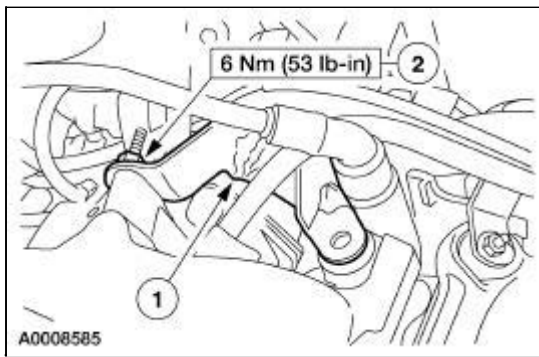


146. Install the crankcase ventilation tube.

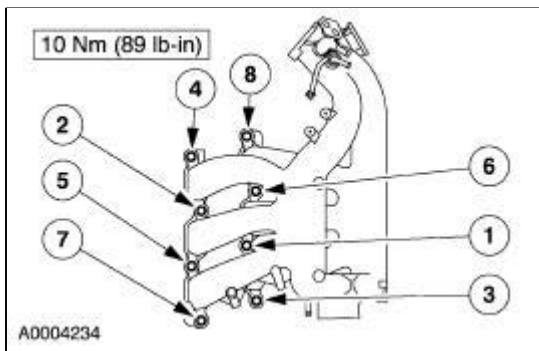


147. Position the upper intake manifold and gaskets.

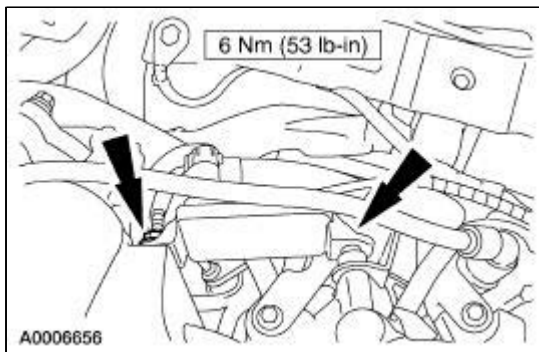
148. Install the fuel pressure sensor shield.
1. Position the shield.
 2. Install the nut.



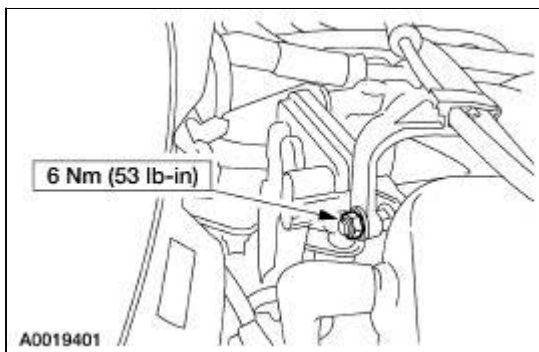
149. Install the upper intake bolts in the sequence shown.



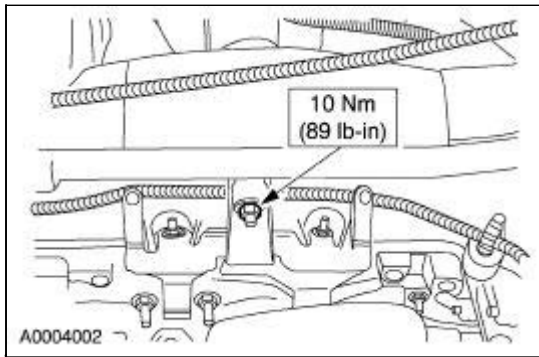
150. Position the differential pressure sensor EGR transducer and install the nut and stud.



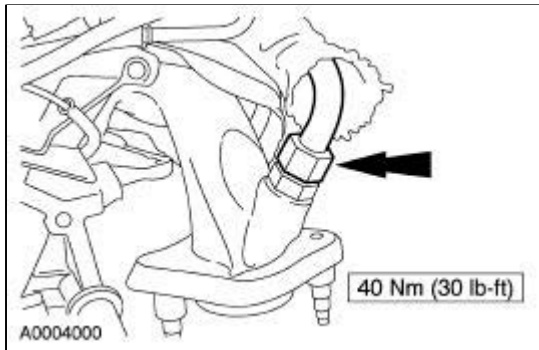
151. Install the accelerator cable clip and the nut.



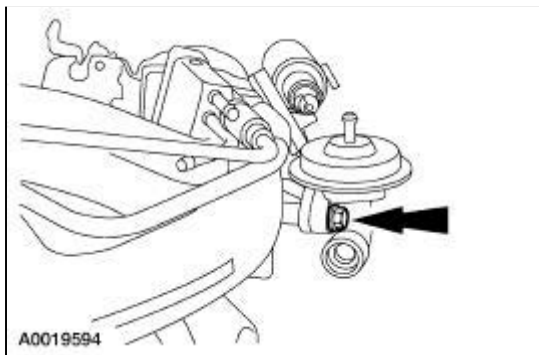
152. Install the upper intake support bracket bolt.



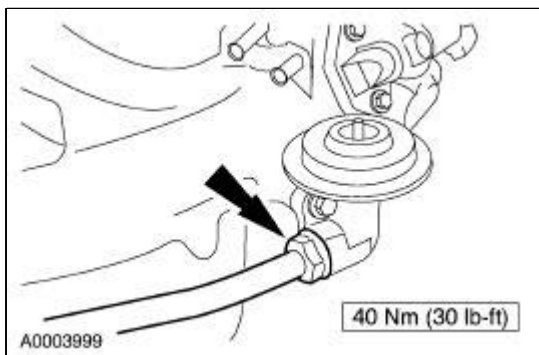
153. Connect the EGR tube at the exhaust manifold.



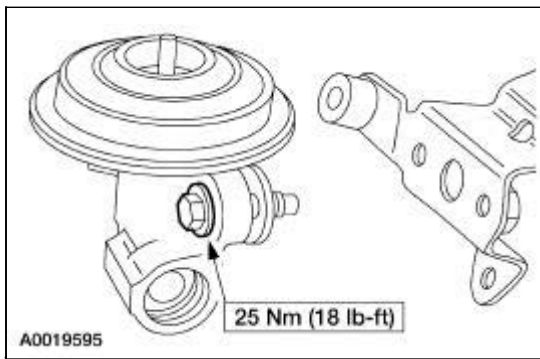
154. Loosen the EGR valve.



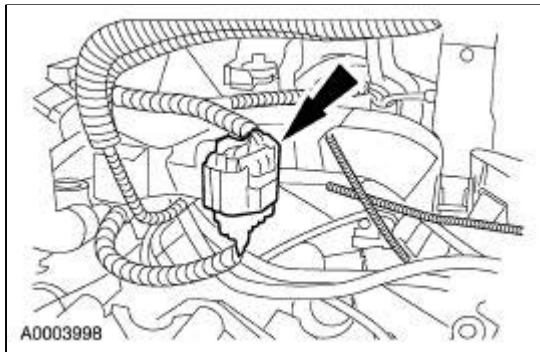
155. Connect the EGR tube to the EGR valve.



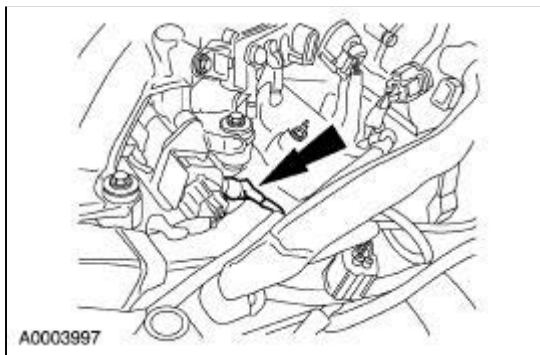
156. Tighten the EGR valve.



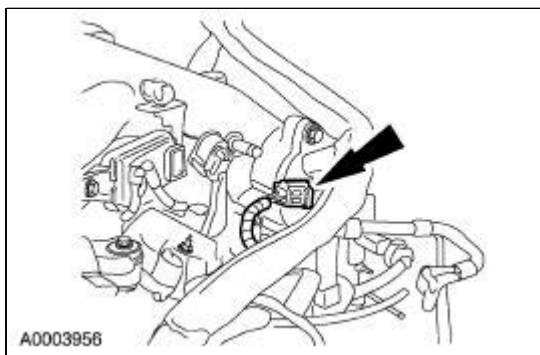
157. Connect the fuel injector wiring harness connector.



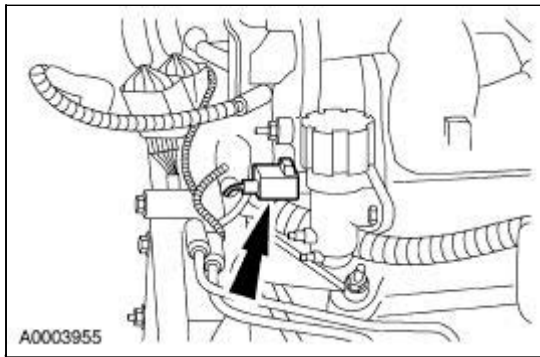
158. Connect the vacuum hose to the fuel pressure sensor.



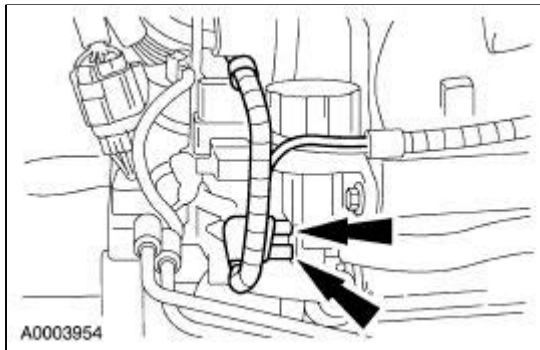
159. Connect the intake manifold tuning valve electrical connector.



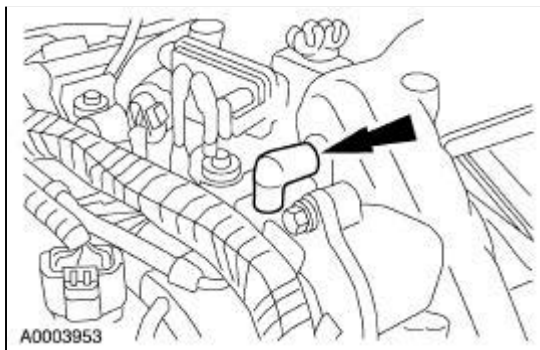
160. Connect the EGR vacuum regulator control electrical connector.



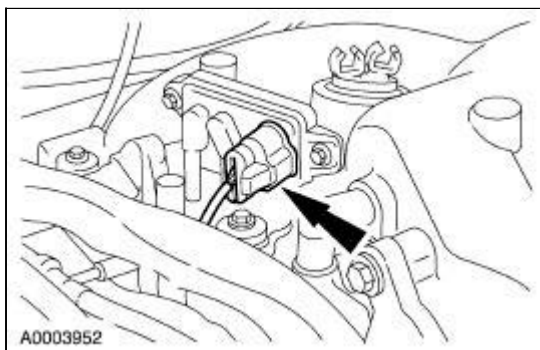
161. Connect the vacuum tubes at the EGR vacuum regulator control.



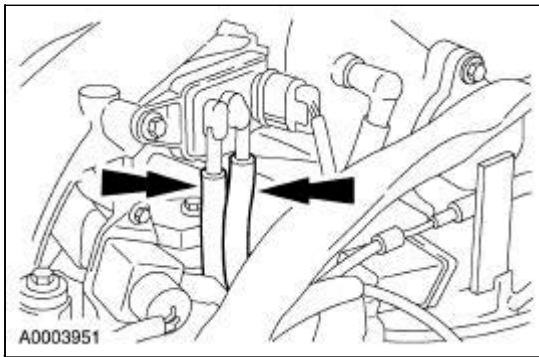
162. Connect the vacuum hose to the rear of the upper intake.



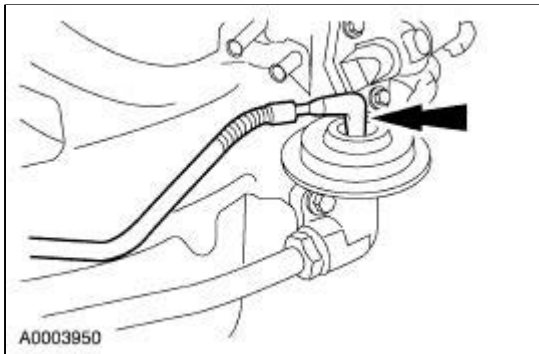
163. Connect the differential pressure feedback EGR electrical connector.



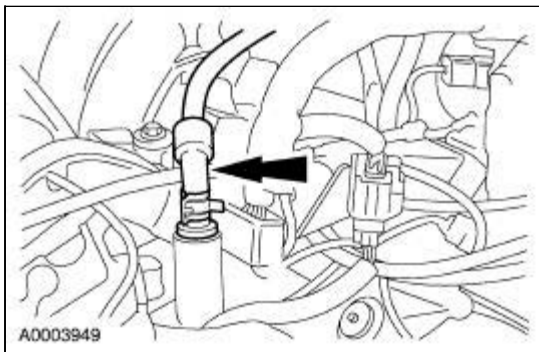
164. Connect the differential pressure feedback EGR vacuum hoses.



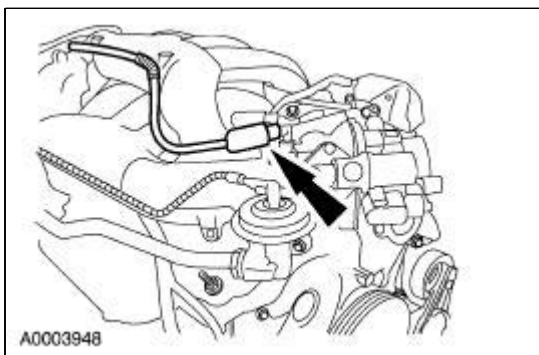
165. Connect the vacuum hose to the EGR valve.



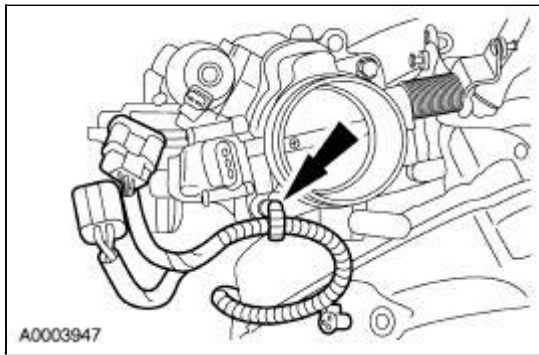
166. Install the PCV valve and tube.



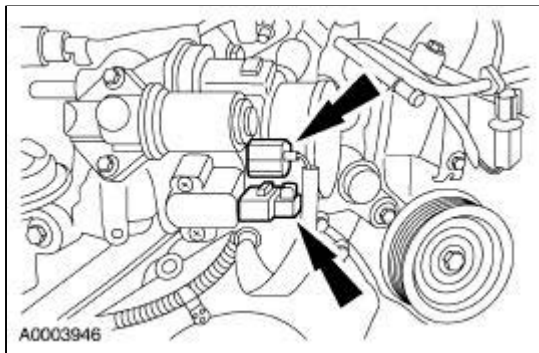
167. Connect the PCV tube to the throttle body.



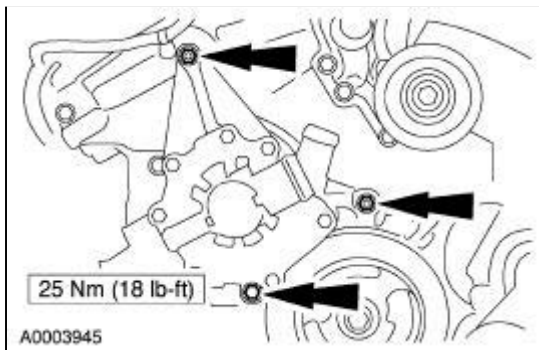
168. Attach the wiring harness retainer to the throttle body.



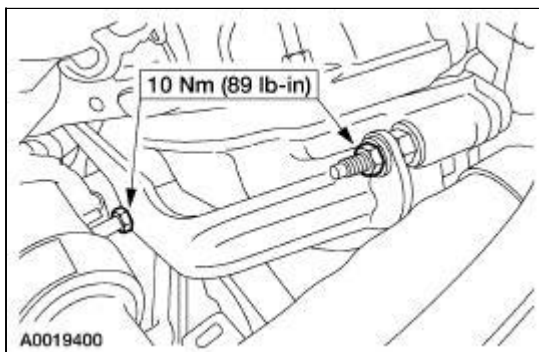
169. Connect the idle air control (IAC) valve and throttle position (TP) sensor electrical connectors.



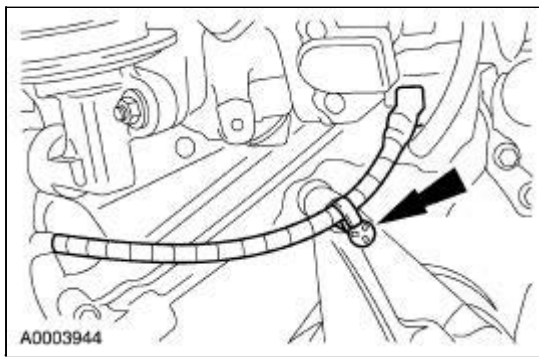
170. Position the water pump and install the one bolt and two studs.



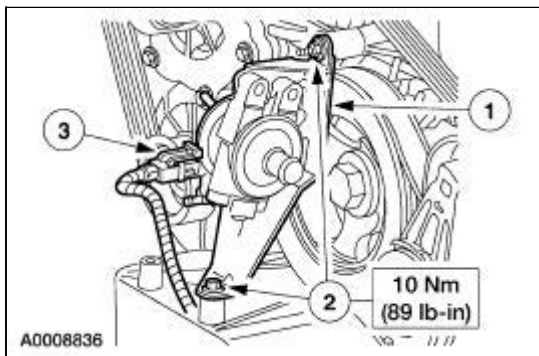
171. Install the bracket.



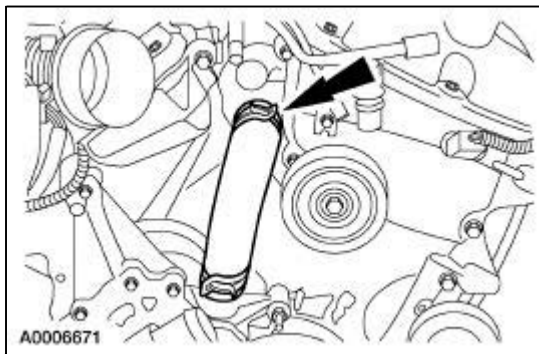
172. Attach the wiring harness retainer to the stud on the water pump.



173. If equipped, install the thermactor air control valve and bracket.
1. Install the valve and bracket.
 2. Install the nut and bolt.
 3. Connect the electrical connector.




174. Connect the water pump hose.



Engine

Special Tool(s)

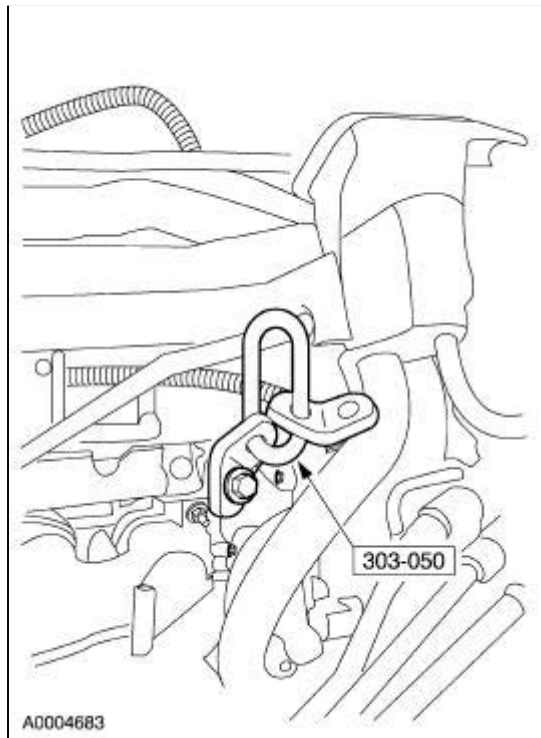
 <p>ST1595-A</p>	Engine Lifting Brackets 303-050
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Material

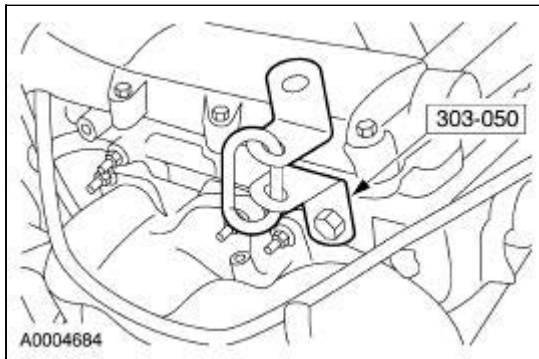
Item	Specification
Super Premium SAE 5W-20 Motor Oil XO-5W20-QSP or equivalent	WSS-M2C153- H

All vehicles

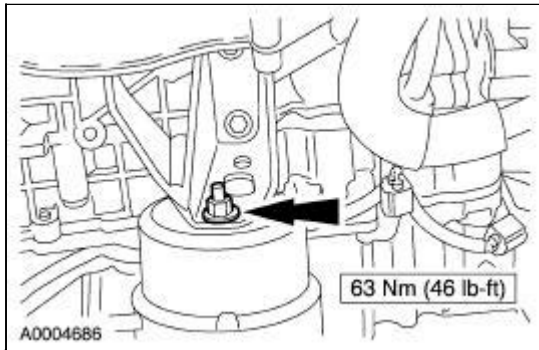
1. Install the special tool to the engine as shown.



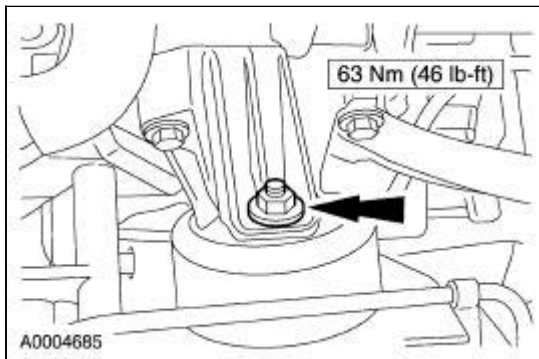
2. Install the special tool to the engine as shown.



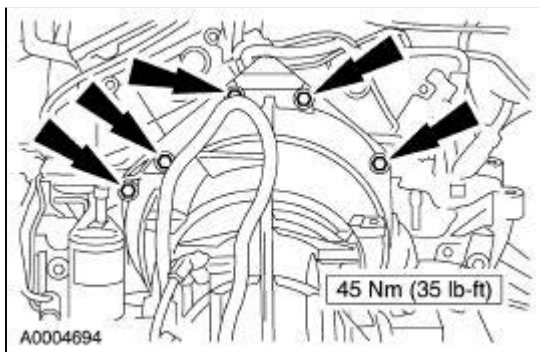
3. Using an engine crane, transfer the engine to the subframe.
4. Install the RH engine mount nut.



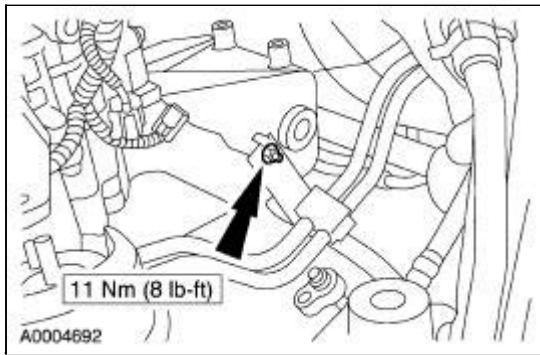
5. Install the LH engine mount nut.



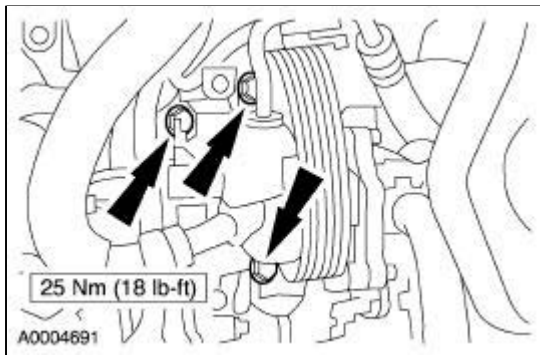
6. Install the transmission to the engine and install the bolts.



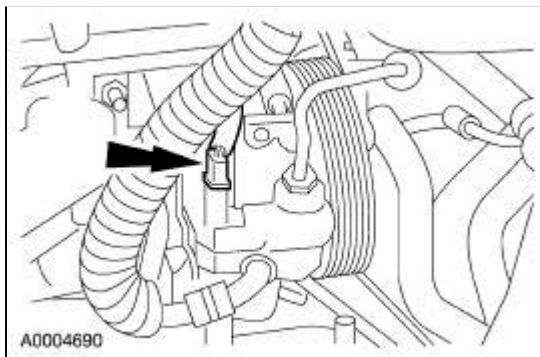
7. If equipped, position the transmission oil cooler lines to the oil pan and install the nut.



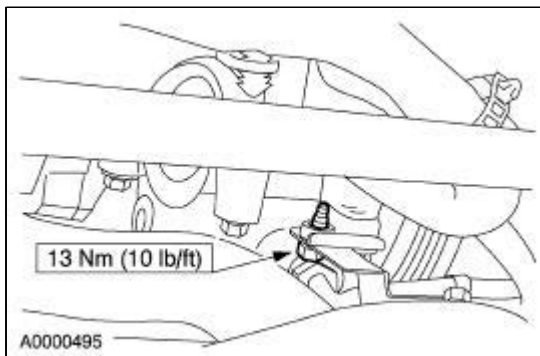
8. Position the hydraulic cooling fan pump and install the bolts.



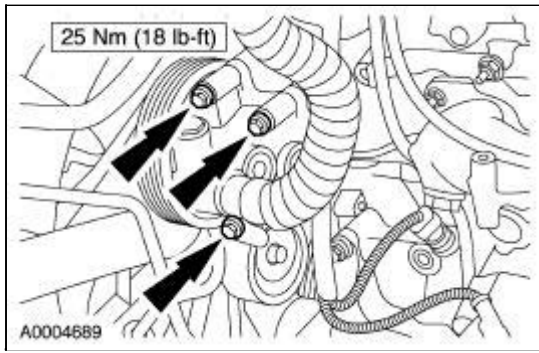
9. Connect the hydraulic cooling fan pump electrical connector.



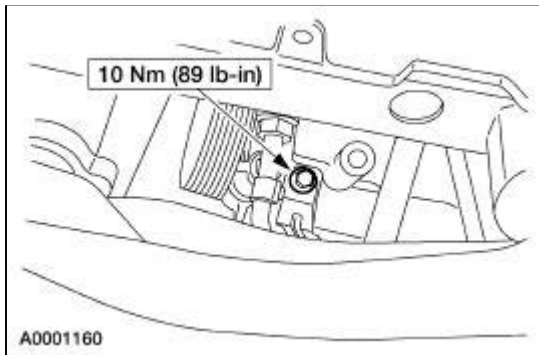
10. Install the hydraulic cooling fan high pressure tube bracket and retaining bolt.



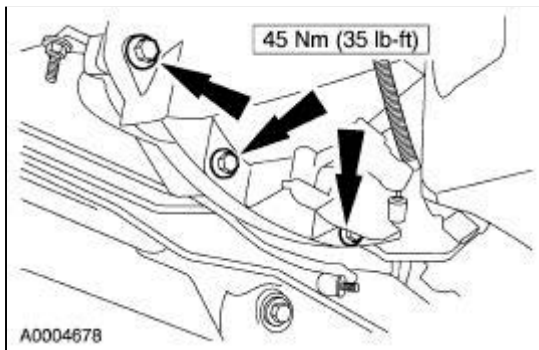
11. Position the power steering pump and install the bolts.



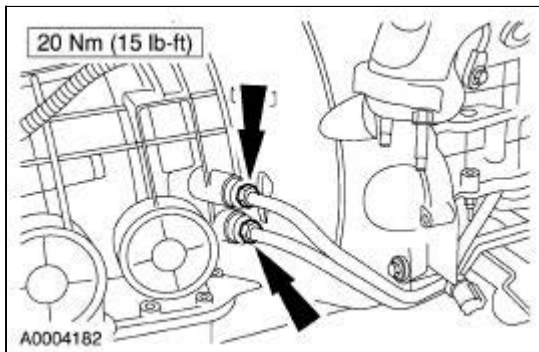
12. Install the power steering high pressure tube bracket and retaining bolt.



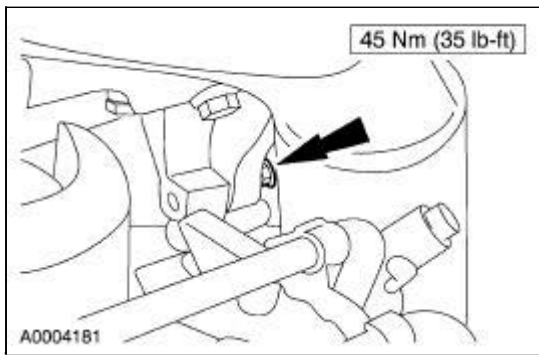
13. Install the four lower engine-to-transmission bolts.



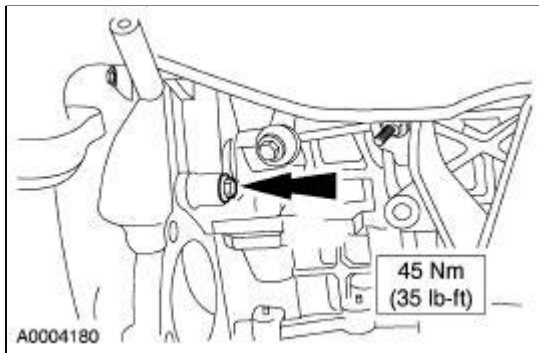
14. If equipped, connect the transmission oil cooler lines.



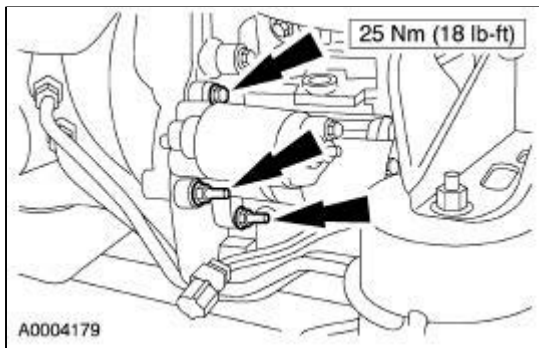
15. Install the transmission-to-engine bolt.



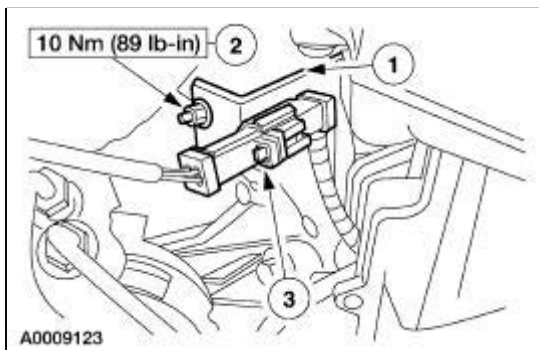
16. Install the transmission-to-engine bolt.



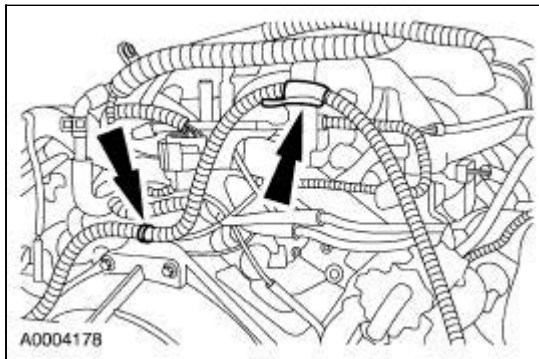
17. Position the starter and install the studs and bolt.



18. Install the heated oxygen sensor (HO2S) bracket.
1. Position the bracket.
 2. Install the nut.
 3. Clip the connector onto the bracket.

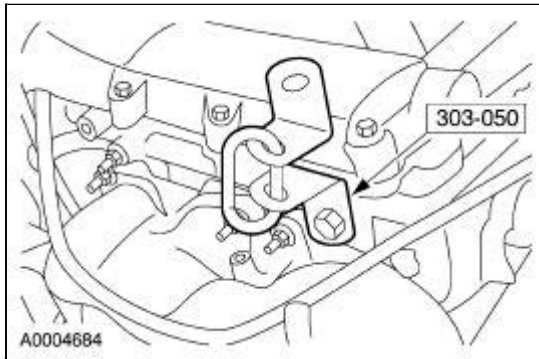


19. Position the wiring harness and attach the two harness retainers.

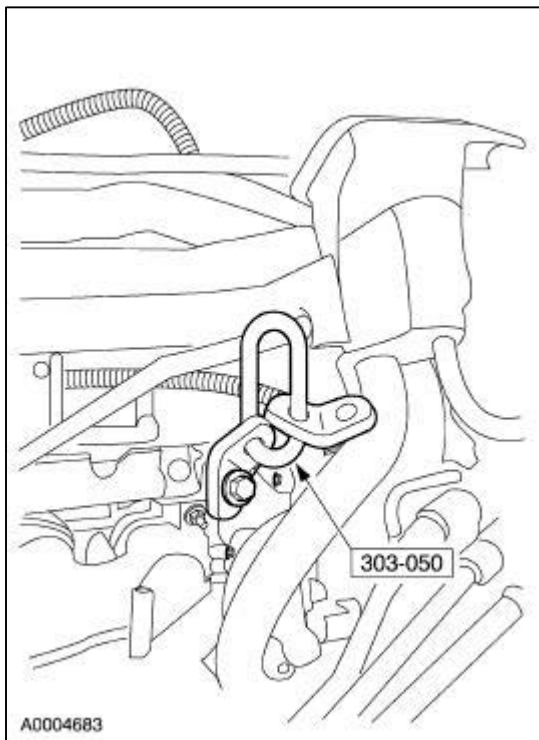


20. Remove the lifting equipment.

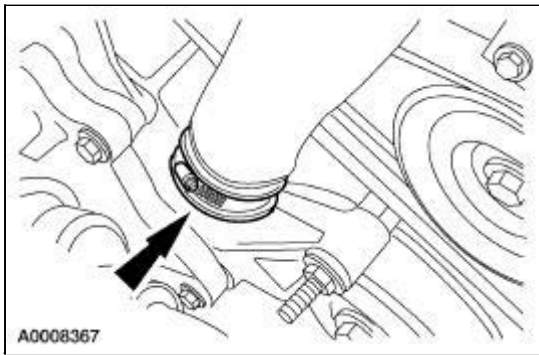
21. Remove the special tool.



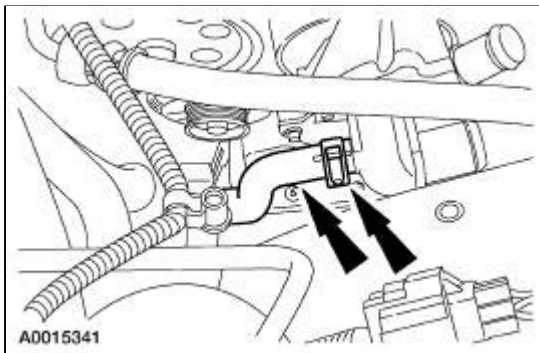
22. Remove the special tool.



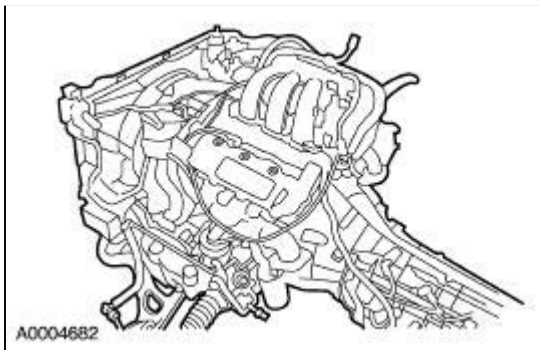
23. Connect the upper radiator hose to the water pump and the water outlet tube.



24. Connect the heater hose to the water pump.

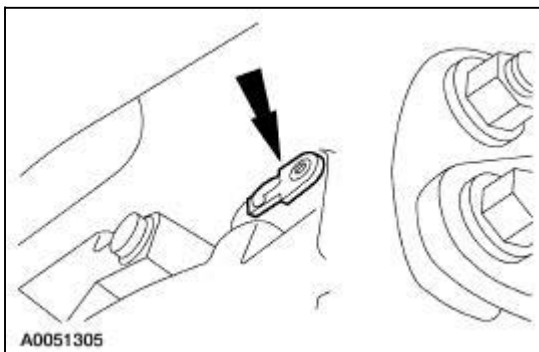


25. Position and carefully raise the entire engine, transmission, cooling and subframe assembly into the vehicle.

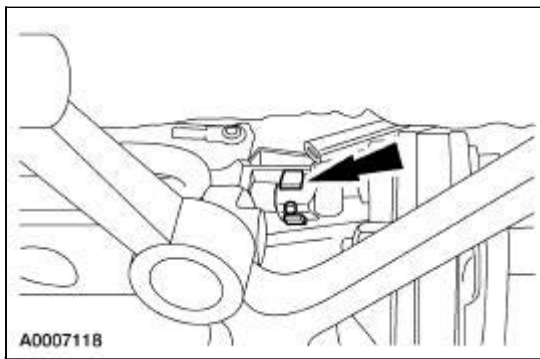


Vehicles with manual transmission

26. Connect the stabilizer shifter rod.

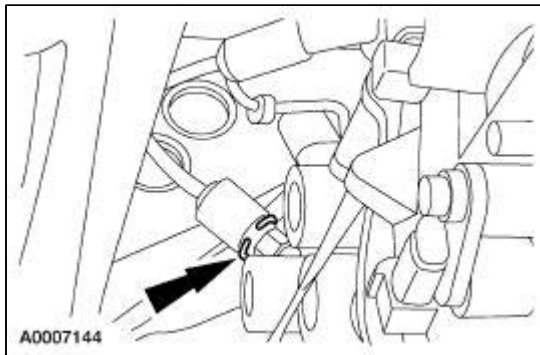


27. Connect the shifter selector rod.



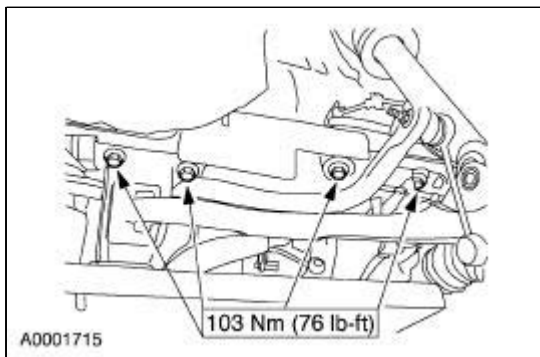
28. **NOTE:** Install a new O-ring seal and clip to the supply tube.

Connect the slave cylinder supply tube.

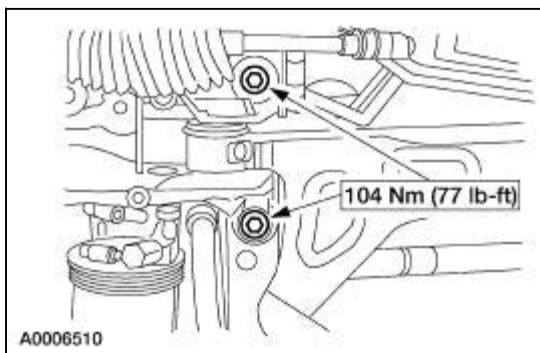


All vehicles

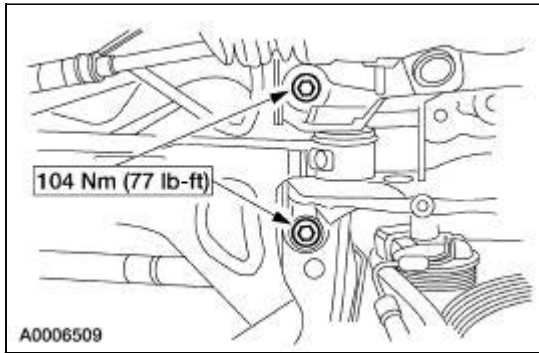
29. Install the crossmember bolts.



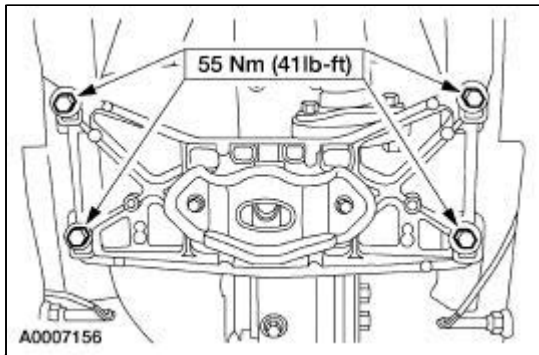
30. Install the RH subframe bolts.



31. Install the LH subframe bolts.



32. Install the transmission support bracket.



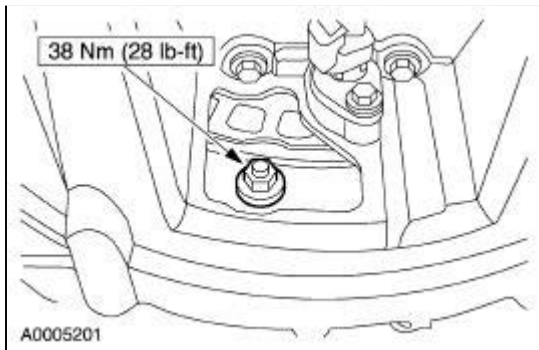
33. Remove the powertrain lift and transmission support bracket.

34. Remove the safety stands from the rear of the vehicle.

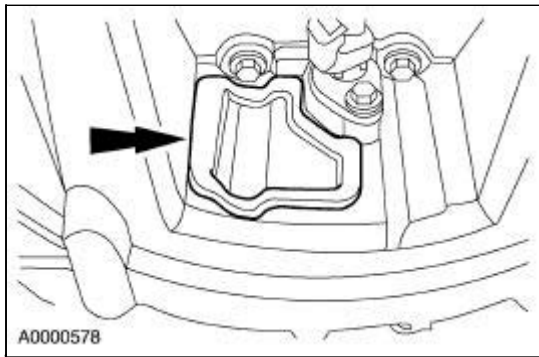
Vehicles with automatic transmission

35. **NOTE:** Align the reference marks made during removal.

Install the nuts.

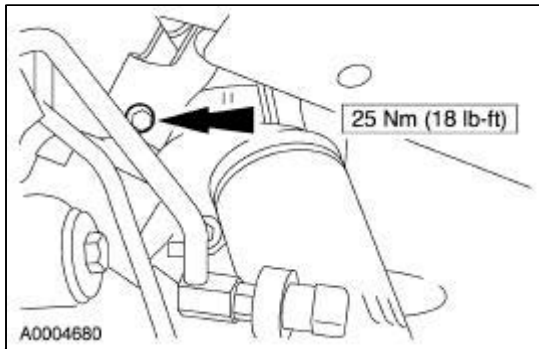


36. Install the access cover.

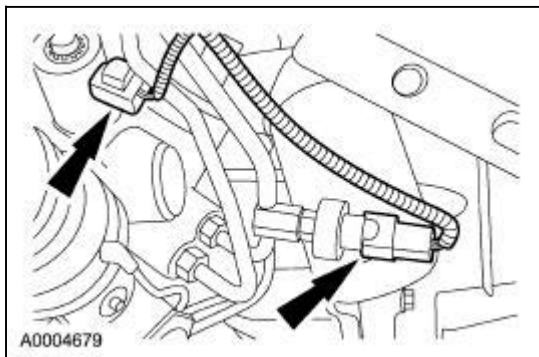


All vehicles

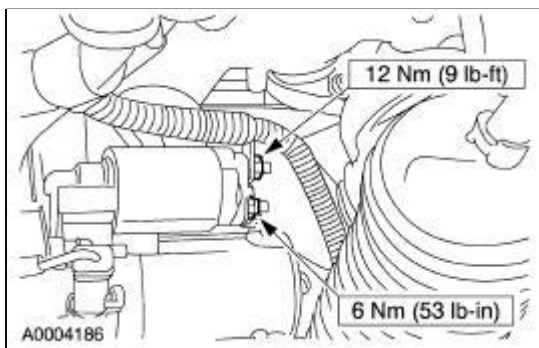
37. Install the steering shaft clamp bolt.



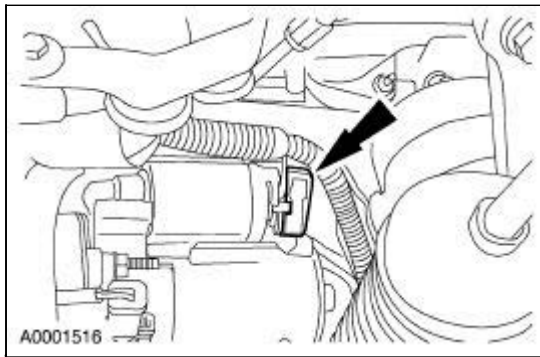
38. Connect the two power steering pressure electrical connectors.



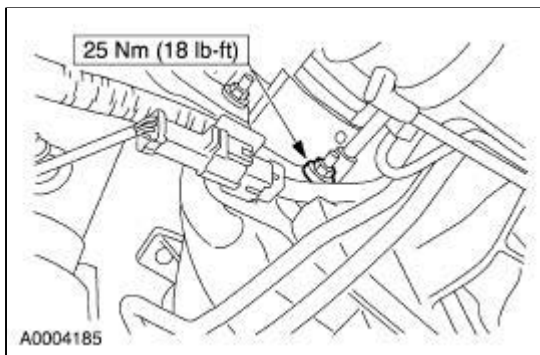
39. Connect the starter wiring.



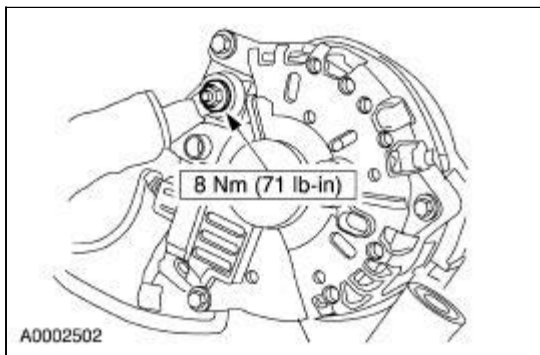
40. Install the starter wiring cover.



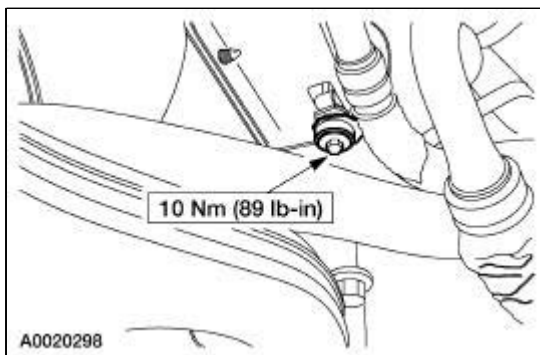
41. Connect the ground wire.



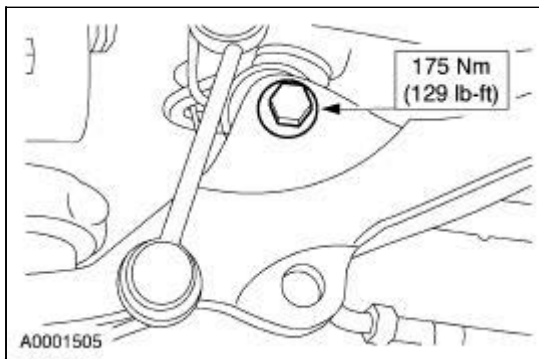
42. Connect the B+ terminal to the generator.



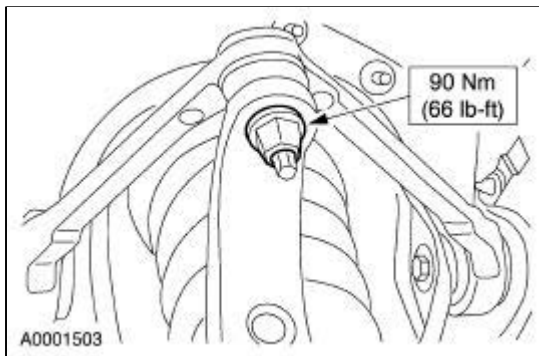
43. Install the power steering tube bracket to the LH frame rail.



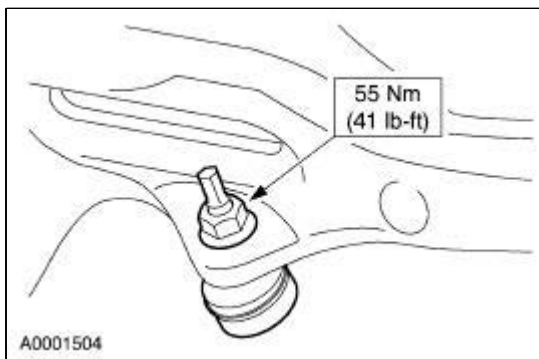
44. Install the lower strut mount bolts.



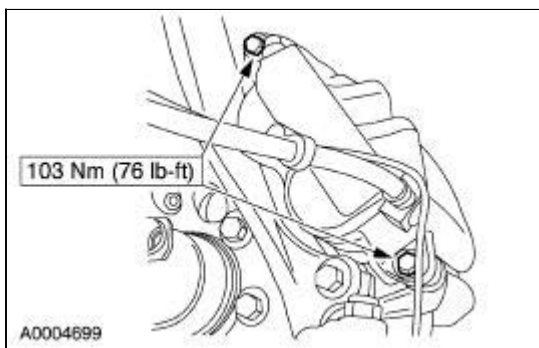
45. Install the upper ball joint nut.



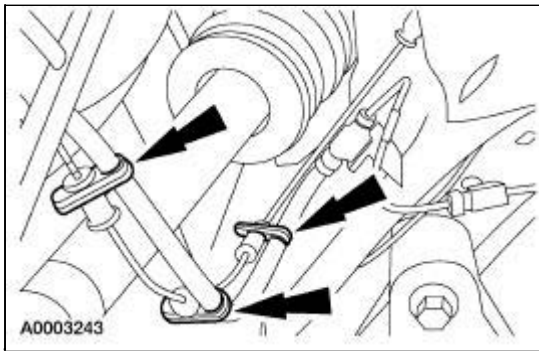
46. Connect the stabilizer link lower mounts and install the nuts.



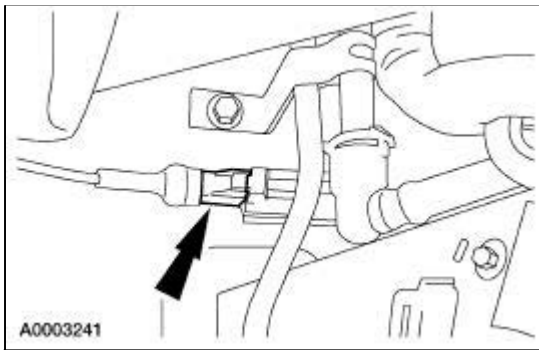
47. Install the front brake calipers.



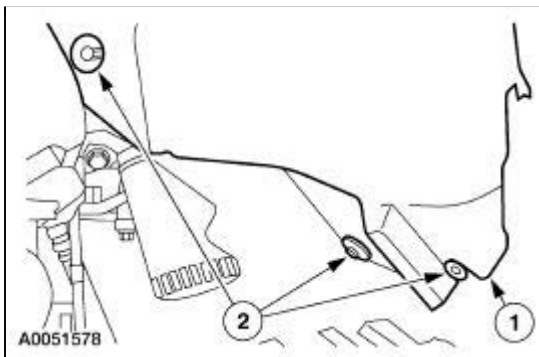
48. Connect the anti-lock brake sensor harness to the brake hose clips.



49. Connect the anti-lock brake sensor electrical connector.



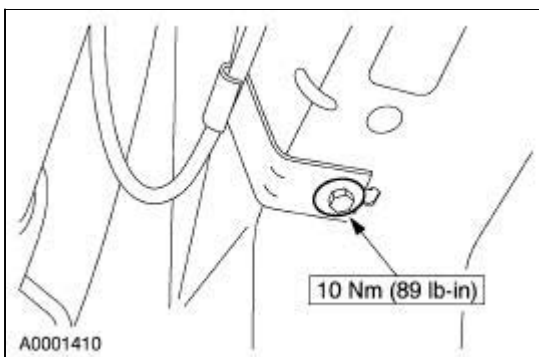
50. Install the inner splash shield.
1. Position the inner splash shield in the installed position.
 2. Install the pin-type retainers.



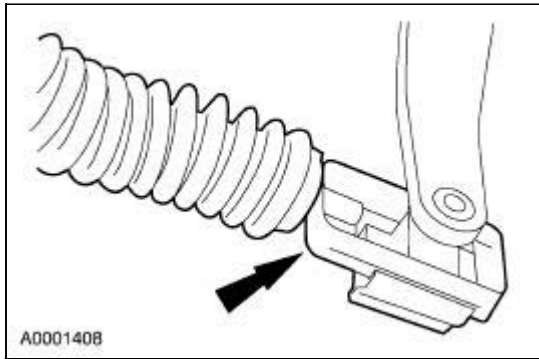
51. Install the front wheels and tires. For additional information, refer to [Section 204-04](#).

Vehicles with automatic transmission

52. Position the cable bracket and install the bolt.

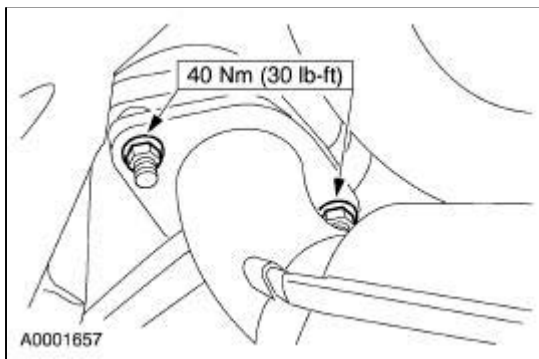


53. Connect the shift cable to the transmission. For cable adjustment, refer to [Section 307-05](#).

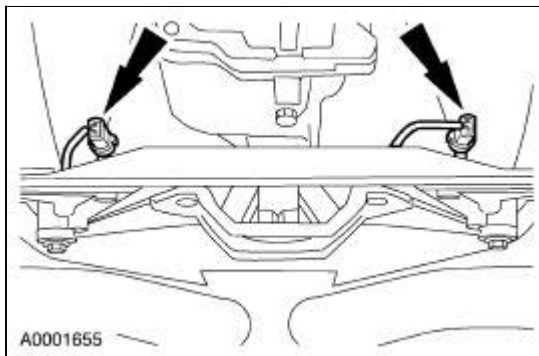


All vehicles

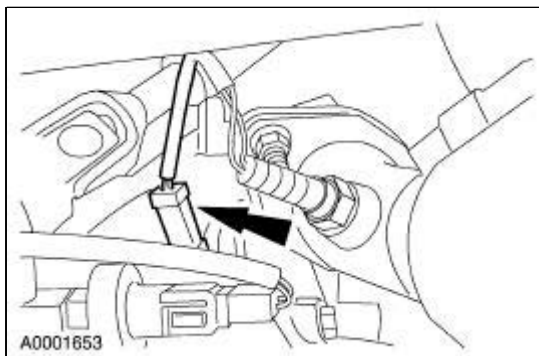
54. Install the three-way catalytic converter and the four nuts.



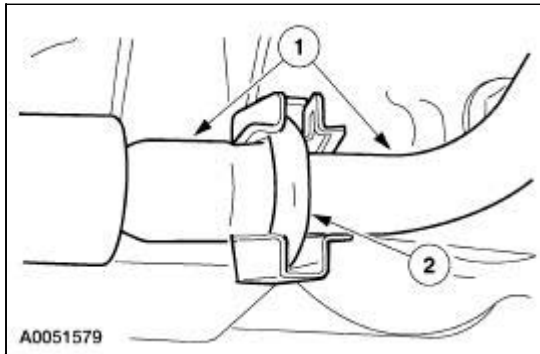
55. Connect the two catalyst monitor connectors.



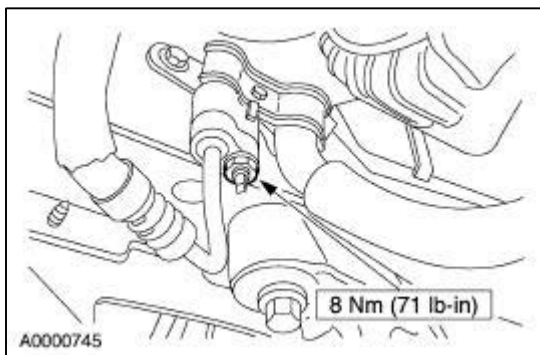
56. Connect the two oxygen sensor electrical connectors.



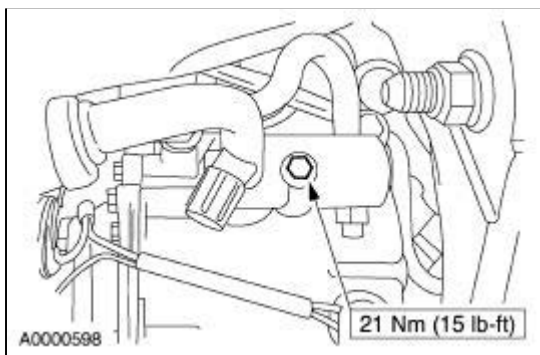
57. Install the driveshaft. For additional information, refer to [Section 205-01](#).
58. Connect the A/C suction tube.
 1. Connect the A/C tube.
 2. Install the safety clip.



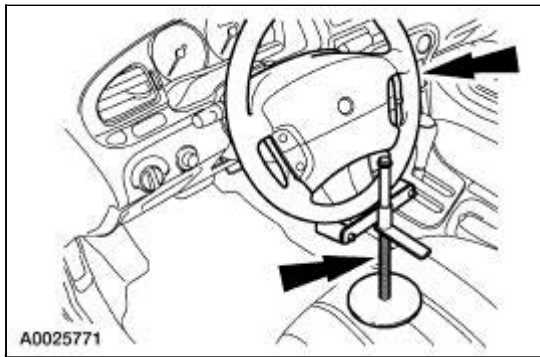
59. Connect the A/C high pressure tube at the right frame rail.



60. Position the A/C manifold assembly and install the bolt.



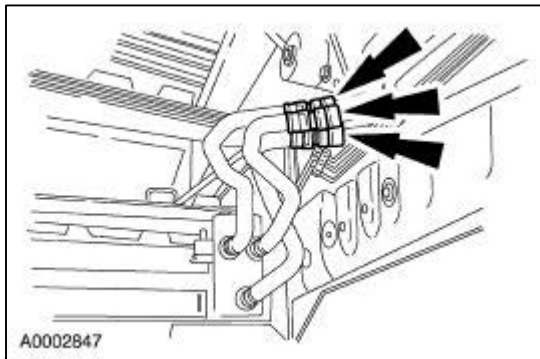
61. Install the center, LH and RH splash shields.
62. Lower the vehicle.
63. Remove the tool holding the steering wheel.



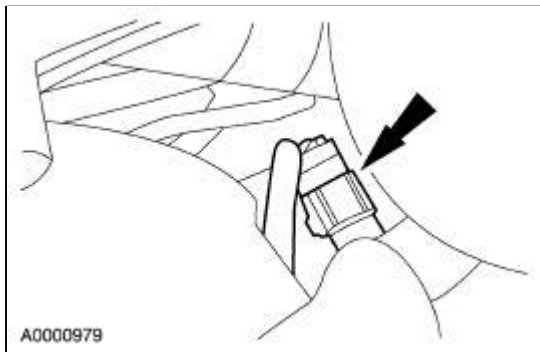
64. **NOTE:** The top heater hose has a green identifying mark to match the hose on the dual coolant flow valve. If the mark is not visible, identify the hoses for location. This will aid in the correct installation of the hose assemblies.

NOTE: Hose assemblies shown with components removed for clarity.

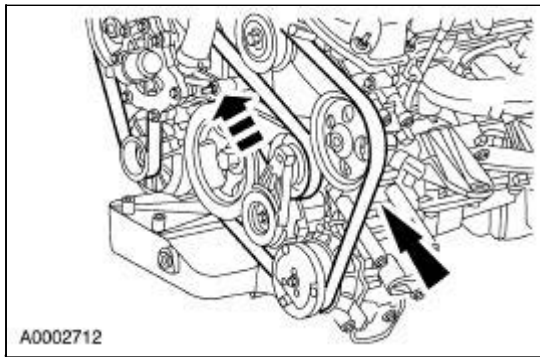
Connect the three quick-disconnect couplings from the coolant control valve hoses. For additional information, refer to [Section 412-00](#).



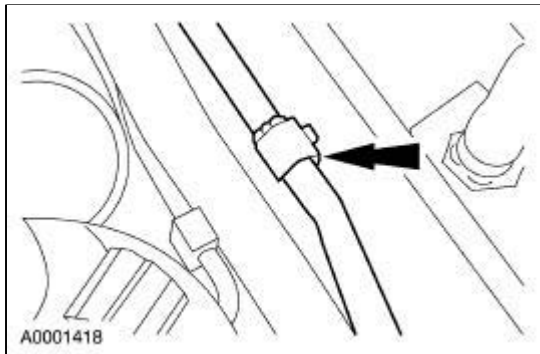
65. Connect the connector located at the end of the coolant valve harness pigtail.



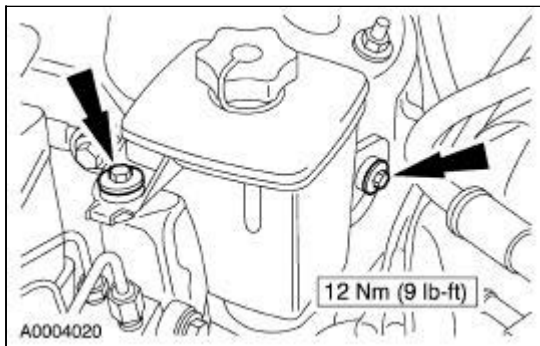
66. Install the front end accessory drive belt.



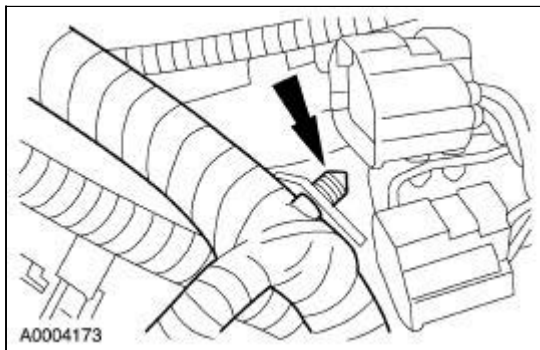
67. Attach the line to the frame.



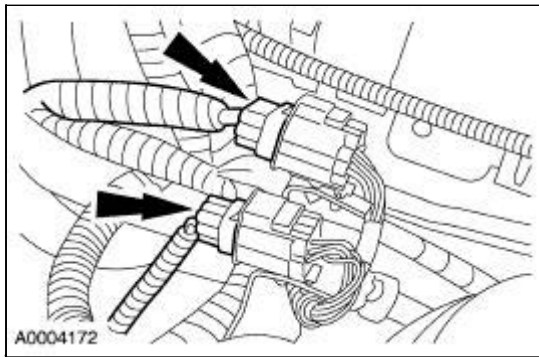
68. Position the hydraulic cooling fan reservoir and install the bolts.



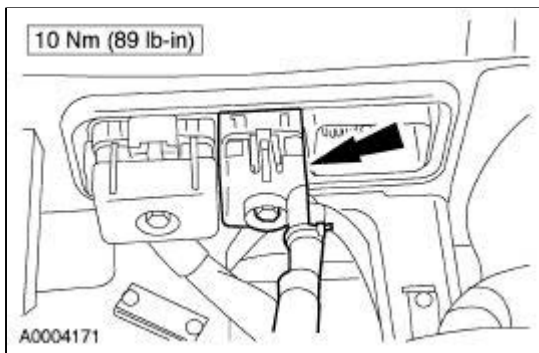
69. Attach the two wiring harness retainers to the bracket.



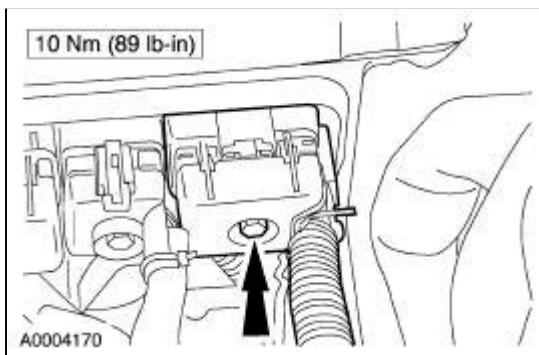
70. Connect the two fuel charging wiring harness electrical connectors.



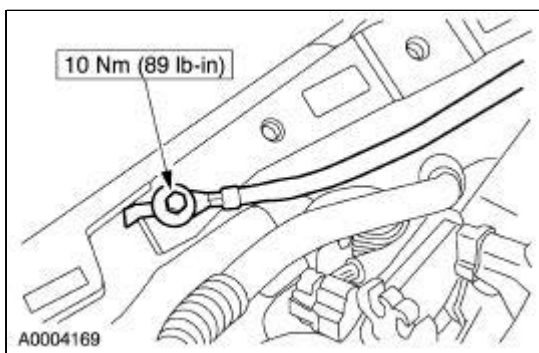
71. Connect the main transmission wiring harness connector and tighten the bolt.



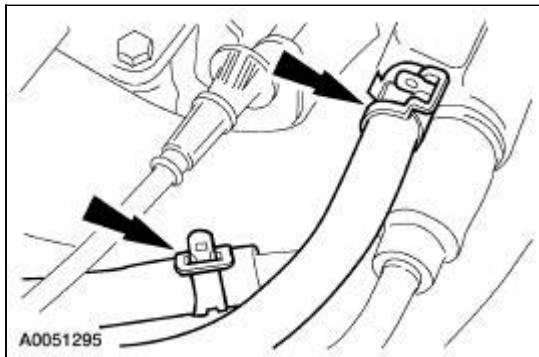
72. Connect the main engine wiring harness connector and tighten the bolt.



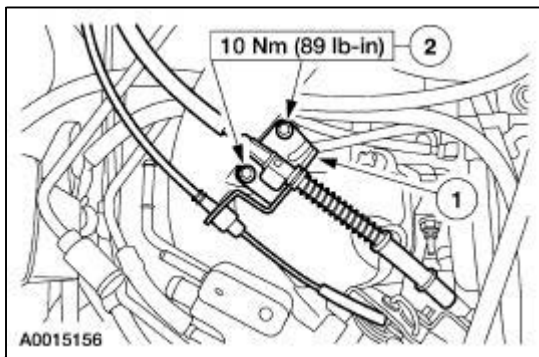
73. Install the ground strap bolt.



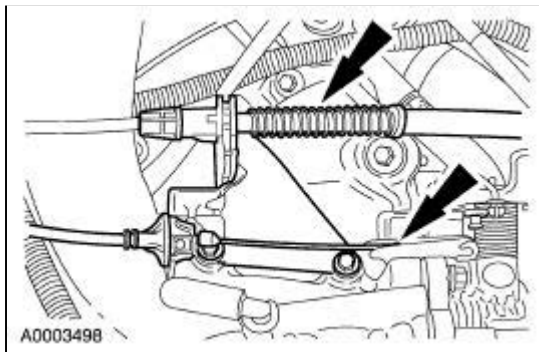
74. Connect the throttle body coolant hoses.



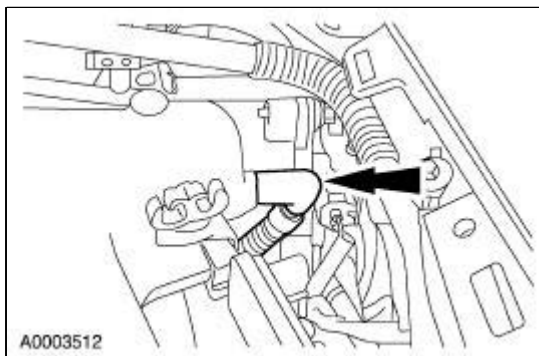
75. Install the cable bracket.
1. Install the bracket.
 2. Install the bolts.



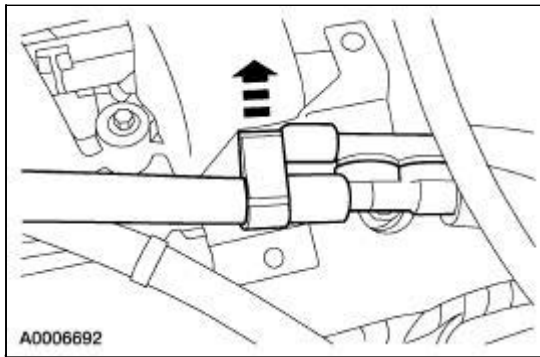
76. Connect the throttle and speed control cables.



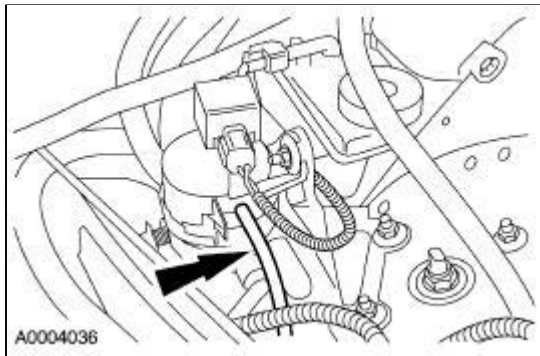
77. Connect the main vacuum hose to the rear of the upper intake manifold.



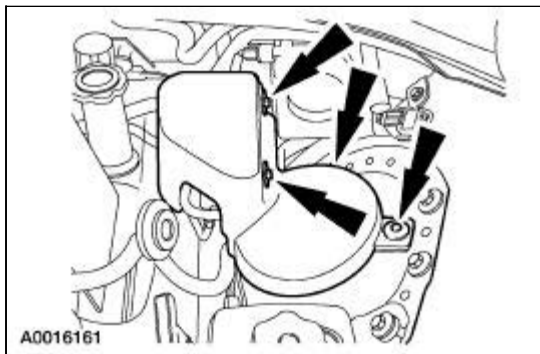
78. Connect the chassis vacuum lines and clip into the support bracket.



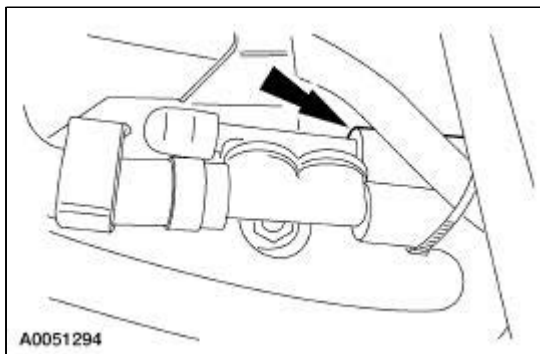
79. Connect the vacuum hose.



80. Install the vapor management valve (VMV) cover.

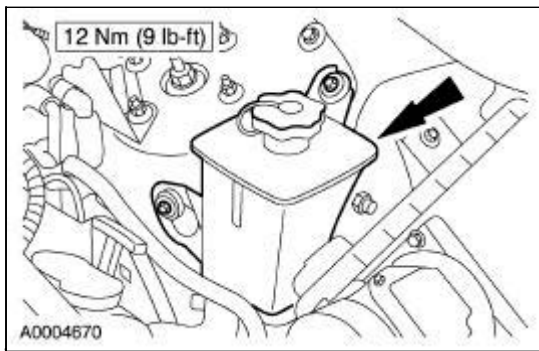


81. Connect the brake booster vacuum hose.

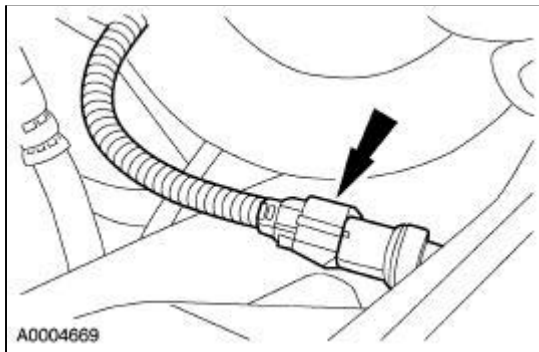


82. Connect the fuel tube spring lock coupling. For additional information, refer to [Section 310-00](#).

83. Position the steering reservoir and install the bolts.

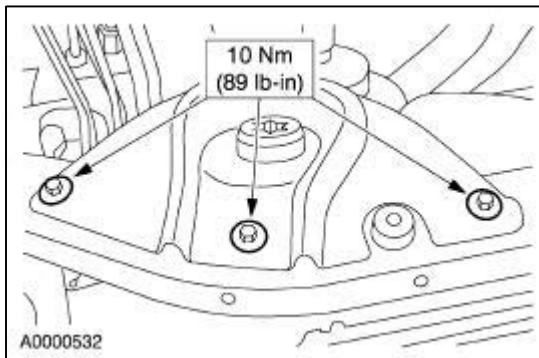


84. Connect the A/C pressure switch.

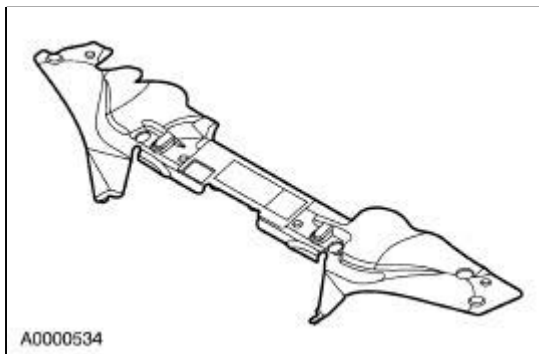


85. **NOTE:** Right side shown; left side similar.

Install the upper radiator support brackets.

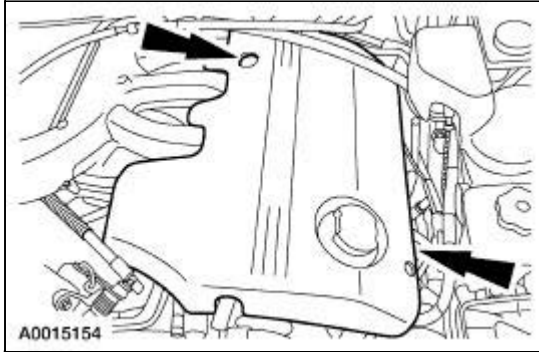


86. Install the upper radiator sight shield.



87. Install the air cleaner and air cleaner outlet tube. For additional information, refer to [Section 303-12](#).

88. Install the engine appearance cover.



89. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).

90. Install the fresh air inlet duct. For additional information, refer to [Section 412-01](#).

91. Fill engine with clean engine oil.

92. Fill and bleed power steering system. For additional information, refer to [Section 211-00](#).

93. Fill and bleed hydraulic cooling fan system. For additional information, refer to [Section 303-03](#).

94. Fill the cooling system. For additional information, refer to [Section 303-03](#).

95. Evacuate and charge the A/C system. For additional information, refer to [Section 412-00](#).

96. Check front end alignment. For additional information, refer to [Section 204-00](#).

General Specifications

Item	Specification
Silicone Gasket and Sealant F7AZ-19554-EA	WSE-M4G323-A4
Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP	WSS-M2C153-G
Metal Surface Cleaner F4AZ-19A536-RA	WSE-M5B392-A
Engine oil capacity (with filter change)	5.7 liters (6.0 quarts)

Torque Specifications

Description	Nm	lb-ft	lb-in
Intake manifold bolts	25	18	—
Throttle body bolts	9	—	80
Thermostat housing bolts	9	—	80
EVR solenoid bolts	6	—	53
EGR valve bolts	25	18	—
EGR valve to exhaust manifold tube nuts	40	30	—
Engine compartment brace bolts	9	—	80
Valve cover bolts	10	—	89
Fuel line bracket bolt	11	—	97
Oil level indicator tube nut	6	—	53
Power steering pump reservoir upper bolt	6	—	53
Power steering pump reservoir lower bolt	12	—	106
Wiring harness bolts	11	—	97
Ignition coil bolts	5	—	44
Coil cover bolts	5	—	44
Evaporative emission purge valve bracket nuts	10	—	89
Wiring harness nuts	11	—	97
Cylinder head bolts	a	—	—
Fresh air box nuts	10	—	89
Fresh air duct nuts	10	—	89
Wiring harness bracket bolts	5	—	44
Hydraulic cooling fan reservoir upper bolt	6	—	53
Hydraulic cooling fan reservoir lower bolt	12	—	106
EGR tube bracket bolts	11	—	97
Crankshaft pulley bolt	a	—	—

Idler pulley bolts	25	18	—
Engine front cover bolts	a	—	—
Power steering pump bracket bolts	25	18	—
Hydraulic cooling fan pump bracket bolts	25	18	—
Power steering pressure line nuts	10	—	89
Lower radiator hose bolts	10	—	89
Water pump bolts	a	—	—
Water pump pulley bolts	a	—	—
Timing chain tensioner bolts	11	—	97
Camshaft sprocket bolts	a	—	—
Timing chain guide bolts	11	—	97
Timing chain tensioner arm bolts	11	—	97
Crankshaft position sensor bolt	10	—	89
Camshaft bearing cap bolts	a	—	—
Exhaust manifold bolts	25	18	—
Exhaust manifold to catalytic converter nuts	40	30	—
Camshaft position sensor bolt	11	—	97
Cylinder head temperature sensor	11	—	97
Power steering pump bolts	25	18	—
Oil filter	b	—	—
Oil filter adapter bolts	25	18	—
Oil pan bolts	a	—	—
Oil pan drain plug	23	17	—
Oil pump bolts	a	—	—
Oil pump screen cover and tube bolts	10	—	89
Flexplate spacer nuts	38	28	—
Engine mount to frame bolts	40	30	—
Engine mount bracket to cylinder block bolts	46	34	—
Upper to lower cylinder block bolts	a	—	—
Connecting rod cap bolts	a	—	—
Oil sump bolts	a	—	—
Knock sensor bolts	20	15	—
Oil pan bolts	a	—	—
Heated oxygen sensor bracket bolts	6	—	53
Generator bolts and nut	a	—	—
Transmission to engine bolts	47	35	—
Transmission wiring harness nuts	10	—	89
Power steering line bracket bolt	20	15	—
Transmission cooler line nuts	10	—	89
Cowl panel support bracket bolts	9	—	80

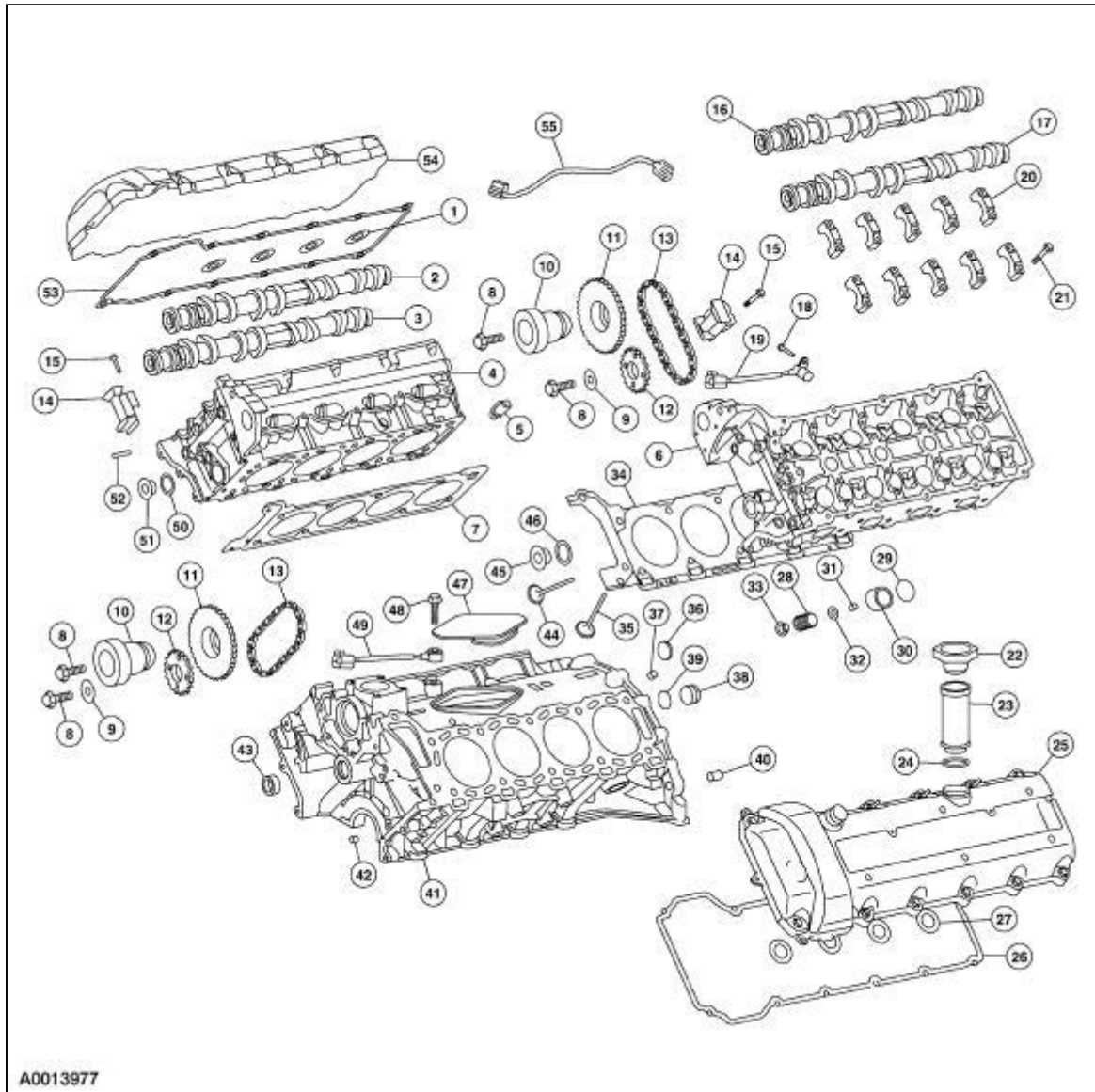
A/C compressor bracket bolts	25	18	—
A/C compressor bolts	25	18	—
Water crossover bolts	11	—	97
Oil cooler assembly	25	18	—
A/C high pressure line	8	—	71
Starter bracket nut	10	—	89
A/C manifold nut	21	15	—
Sub-frame bolts	103	76	—
Steering coupling bolt	35	26	—
Cooling fan line bracket bolt	10	—	89
Lower strut mount bolts	175	129	—
Upper ball joint nuts	90	66	—
Sway bar link nuts	55	41	—
Starter motor wiring harness nut	6	—	53
Oil cooler bolts	58	43	—
Shift cable bracket bolt	10	—	89
Heater hose bracket bolt	10	—	89
Ground strap bolt	10	—	89
Radiator support bracket bolts	10	—	89
Cylinder block flanged plug	20 + 10 degrees	15 + 10 degrees	—
Water jacket plug	25	18	—
M30 cylinder block plugs	50	37	—
EGR heat shield bolts	10	—	89
EGR valve adapter bolts	10	—	89
Radio interference capacitor nuts	6	—	53
Inlet tube support bracket bolts	11	—	97
Drive belt tensioner bolt	50	37	—

^a Refer to procedure for staged torque.

^b Install the oil filter until the seal makes contact. Tighten an additional 270 degrees.

Engine

Cylinder Head and Valve Train



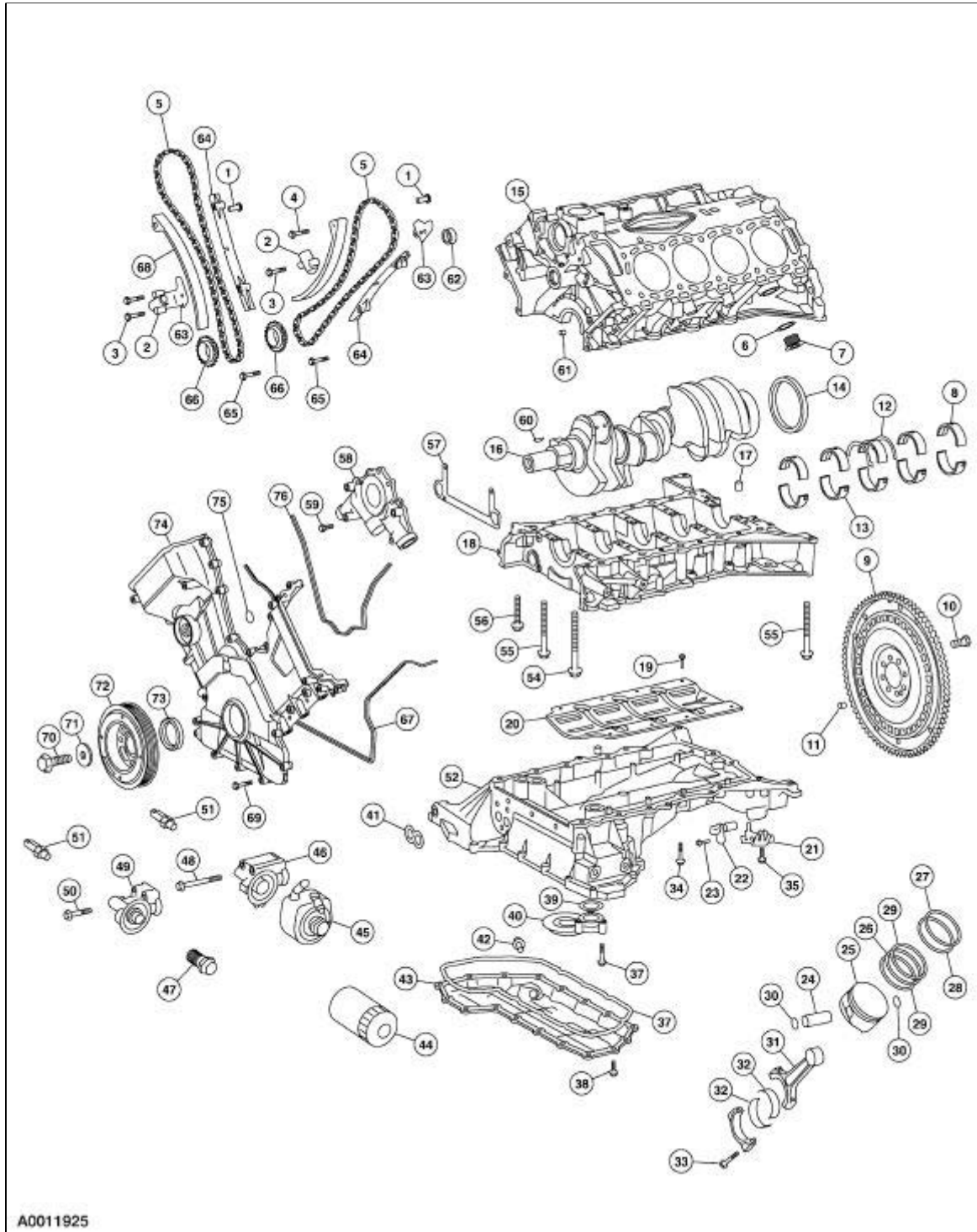
A0013977

Item	Part Number	Description
1	12A409	Valve cover gaskets (4 req'd)
2	6A270	Camshaft, intake — RH
3	6A272	Camshaft, exhaust — RH
4	6049	Cylinder head — RH
5	6G004	Cylinder head temperature sensor — RH
6	6050	Cylinder head — LH
7	6051	Head gasket — RH
8	W701512	Bolt (4 req'd)

9	W704842	Washer (2 req'd)
10	6M253	Camshaft damper
11	6256	Intake camshaft sprocket (2 req'd)
12	6C258	Exhaust camshaft sprocket (2 req'd)
13	6268	Secondary timing chain (2 req'd)
14	6B209	Secondary timing chain tensioner
15	W500302	Bolt (4 req'd)
16	6A271	Camshaft, intake — LH
17	6A273	Camshaft, exhaust — LH
18	W500214	Bolt
19	6B288	Camshaft position sensor
20	6A258	Camshaft bearing cap (20 req'd)
21	W701242	Bolt (40 req'd)
22	6766	Oil filler cap
23	6765	Oil filler tube
24	W705327	Seal
25	6P053	Valve cover — LH
26	6P054	Valve cover gasket — LH
27	12A409	Valve cover gasket — LH (4 req'd)
28	6513	Valve spring (32 req'd)
29	6K514	Valve shim (32 req'd)
30	6500	Bucket (32 req'd)
31	6518	Valve keeper key (64 req'd)
32	2762	Valve keeper (32 req'd)
33	6A536	Valve seal (32 req'd)
34	6083	Head gasket — LH
35	6507	Intake valve (16 req'd)
36	W528009	Cup plug (2 req'd)
37	W701705	Dowel (4 req'd)
38	W704848	Flanged plug
39	W703346	Sealing washer
40	6397	Dowel (2 req'd)
41	6L074	Cylinder block assembly
42	6L002	Dowel (2 req'd)
43	W703302	Pipe plug
44	6505	Exhaust valve
45	W704848	Flanged plug
46	W703346	Sealing washer
47	6L033	Valley plug
48	W500310	Bolt (2 req'd)
49	12A699	Knock sensor (2 req'd)
50		

	W703346	Sealing washer
51	W704848	Flanged plug
52	6K253	Dowel (2 req'd)
53	6K260	Valve cover gasket — RH
54	6P040	Valve cover — RH
55	14B102	Jumper harness

Lower End



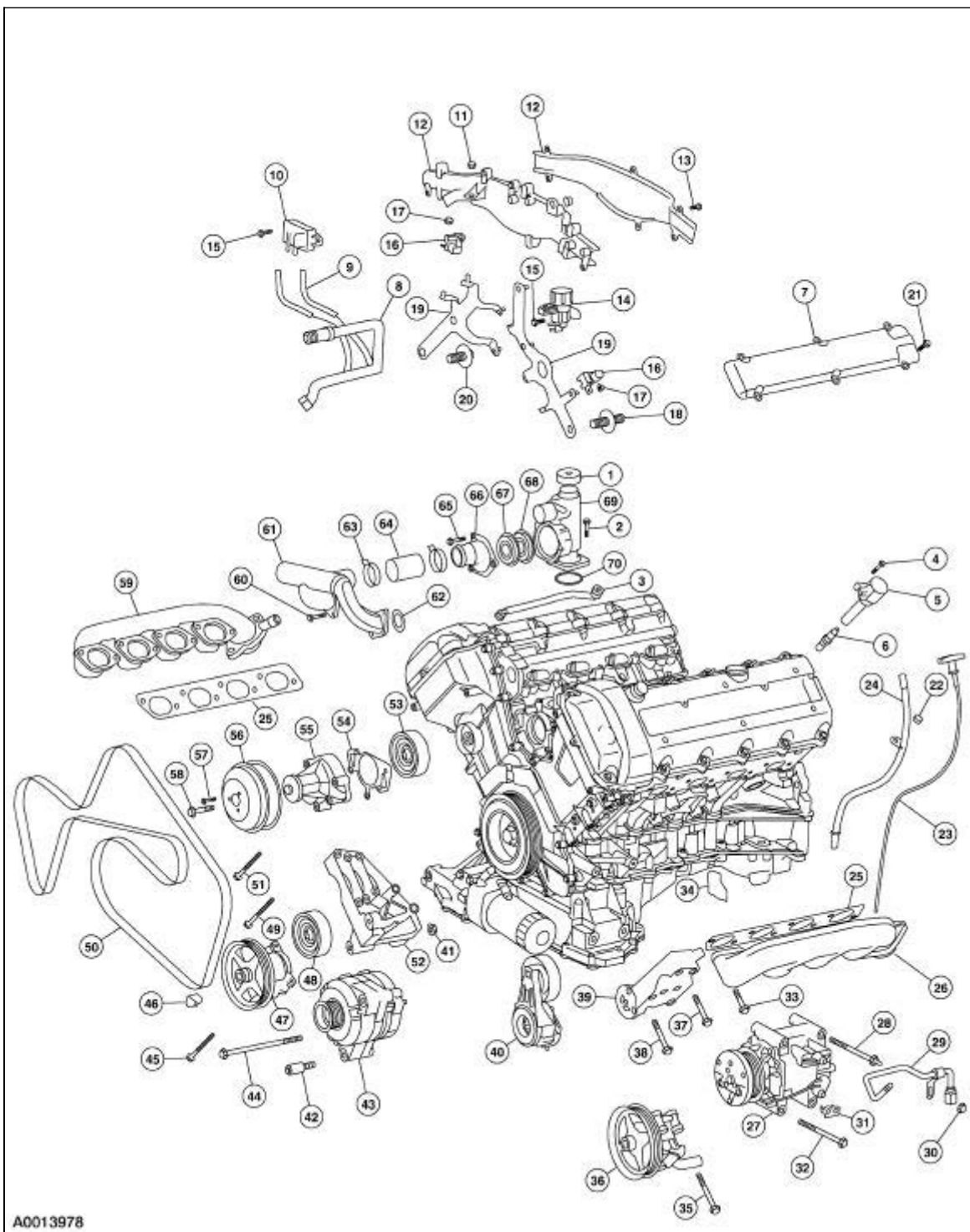
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	Part	
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Item	Number	Description
1	6P044	Sleeve (2 req'd)
2	6K254	Primary timing chain tensioner (2 req'd)
3	W500302	Bolt (4 req'd)
4	W701973	Bolt (2 req'd)
5	6268	Primary timing chain (2 req'd)
6	W703346	Sealing washer
7	W704846	Flanged plug
8	6333	Upper crankshaft bearing (5 req'd)
9	6K375	Flexplate
10	W704862	Bolt (8 req'd)
11	6253	Dowel
12	6308	Thrust washer (2 req'd)
13	6331	Lower crankshaft bearing (5 req'd)
14	6701	Crankshaft rear main seal
15	6L074	Cylinder block assembly
16	6303	Crankshaft
17	W701705	Dowel (10 req'd)
18	6L074	Cylinder block assembly
19	W500203	Bolt (8 req'd)
20	6L712	Oil pan baffle
21	14W163	Heated oxygen sensor bracket (2 req'd)
22	6C315	Crankshaft position sensor
23	W500214	Bolt
24	6135	Piston pin (8 req'd)
25	6110	Piston (8 req'd)
26	6161	Spacer/expander ring (8 req'd)
27	6150	Compression ring — Upper (8 req'd)
28	6152	Compression ring — Lower (8 req'd)
29	6152	Oil control ring, (16 req'd)
30	6140	Snap ring (16 req'd)
31	6200	Connecting rod (8 req'd)
32	6211	Connecting rod bearing (16 req'd)
33	6214	Bolt (16 req'd)
34	W704749	Bolt (16 req'd)
35	W701504	Bolt (2 req'd)
36	W500305	Bolt (3 req'd)
37	6B638	Oil pan gasket
38	W701504	Bolt (17 req'd)
39	6625	Gasket
40	6617	Oil pump screen cover and tube
41		

	6840	Gasket
42	W704995	Oil drain plug
43	6695	Oil pan assembly
44	6714	Oil filter
45	6A642	Oil cooler
46	6A644	Oil filter adapter (oil cooler equipped vehicles)
47	6884	Oil filter fitting (non-oil cooler equipped vehicles)
48	W701532	Bolt (oil cooler equipped vehicles) (3 req'd)
49	6A644	Oil filter adapter (non-oil cooler equipped vehicles)
50	W704816	Bolt (non-oil cooler equipped vehicles) (3 req'd)
51	9278	Oil pressure sensor
52	6C674	Upper sump assembly
53	6C002	Dowel
54	6345A	Bolt (10 req'd)
55	6345B	Bolt (12 req'd)
56	6345C	Bolt (12 req'd)
57	6659	Oil pump gasket
58	6600	Oil pump
59	W500304	Bolt (4 req'd)
60	W704975	Woodruff key
61	6C002	Dowel (2 req'd)
62	W703302	Pipe plug
63	6N089	Blanking plate (2 req'd)
64	6K297	Timing chain guide (2 req'd)
65	W500302	Bolt (2 req'd)
66	6306	Crankshaft timing chain sprocket (2 req'd)
67	6E009	Front cover gasket (outer)
68	6L266	Timing chain tensioner arm
69	W704751	Bolt (24 req'd)
70	W705542	Bolt
71	W704965	Washer
72	6316	Crankshaft pulley
73	6700	Front cover seal
74	6059	Engine front cover assembly
75	6D081	Idler pulley seal
76	6C075	Front cover seal (inner)

Lower End Exterior Dress



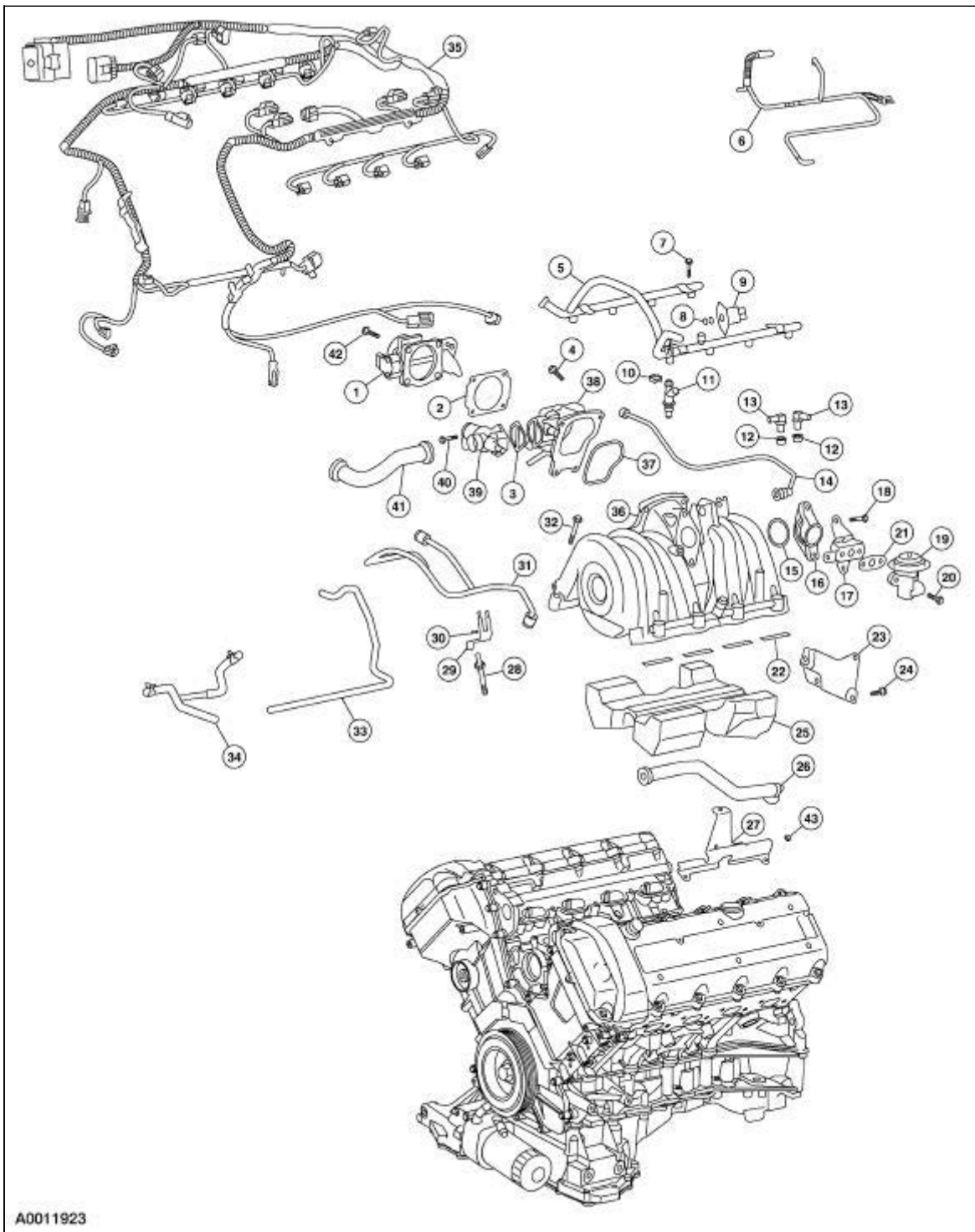
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Item	Part Number	Description
1	8A511	Thermostat housing cap
2	W500215	Bolt (4 req'd)
3	6C342	Breather hose part load
4	W500205	Bolt (8 req'd)
5	12A366	Ignition coil (8 req'd)
6	12405	Spark plug (8 req'd)
7	12025	Coil cover (2 req'd)

8	9D477	EGR valve to exhaust manifold tube
9	9P761	EGR valve to exhaust manifold vacuum line (2 req'd)
10	9J460	Differential pressure feedback EGR assembly
11	W700430	Nut (2 req'd)
12	14W163	Wire harness channel and cover
13	W500202	Bolt (6 req'd)
14	9J459	EGR vacuum regulator solenoid
15	W500202	Bolt (4 req'd)
16	18801	Radio ignition interference capacitor (2 req'd)
17	W705035	Nut (1 req'd)
18	W520411	Stud bolt
19	14W163	Wiring harness bracket (2 req'd)
20	W705036	Bolt
21	W500205	Bolt (12 req'd)
22	W520411	Nut
23	6752	Oil level indicator
24	6754	Oil level indicator tube
25	9448	Exhaust manifold gasket (2 req'd)
26	9431	Exhaust manifold — LH
27	19D629	A/C compressor
28	W705060	Stud bolt
29	3E576	Jumper tube
30	W520412	Nut
31	3R801	Bracket
32	W704750	Bolt (3 req'd)
33	W701240	Bolt (16 req'd)
34	7N840	Flexplate inspection cover
35	W704752	Bolt (4 req'd)
36	3A696	Power steering pump
37	W500315	Bolt (3 req'd)
38	W704752	Bolt (2 req'd)
39	3K738	PAS bracket
40	6B209	Drive belt tensioner
41	W520414	Nut
42	W70539	Bolt and bushing assembly
43	10300	Generator
44	W704756	Bolt
45	W704752	Bolt (4 req'd)
46	3R801	Bracket
47	8C648	Hydraulic cooling fan pump
48	19A216	Idler pulley — flanged

49	W704752	Bolt (2 req'd)
50	8620	Drive belt
51	W500315	Bolt (3 req'd)
52	3D743	Hydraulic cooling fan pump bracket
53	19A216	Idler pulley — non-flanged
54	8507	Water pump gasket
55	8501	Water pump
56	8509	Water pump pulley
57	W705629	Bolt (3 req'd)
58	W500304	Bolt (5 req'd)
59	9430	Exhaust manifold, RH
60	W500215	Bolt (4 req'd)
61	8A520	Water outlet pipe assembly
62	8255	O-ring seal
63	W525972	Clamp (2 req'd)
64	9F287	Hose
65	W500014	Bolt (3 req'd)
66	8594	Thermostat housing cover
67	8575	Thermostat
68	8A571	O-ring seal
69	8K515	Thermostat housing
70	9K462	O-ring seal

Upper End Exterior Dress



A0011923

Item	Part Number	Description
1	9E926	Throttle body
2	9E936	Throttle body gasket
3	9F670	Idle air control valve gasket
4	W701662	Bolt (4 req'd)
5	9S441	Fuel injection supply manifold
6	9E498	Vacuum harness
7	W500013	Bolt (4 req'd)
8	W705818	O-ring seals (2 req'd)

9	9F972	Fuel pressure sensor
10	9N976	Clip (8 req'd)
11	9F593	Fuel injector (8 req'd)
12	9H490	Seal (2 req'd)
13	9S497	Stub pipe(2 req'd)
14	9D289	Purge hose
15	6L438	Seal
16	9H450	EGR flange
17	9P962	EGR valve adapter
18	W701568	Bolt (3 req'd)
19	9D460	Exhaust recirculation valve
20	N807843	Bolt (2 req'd)
21	9D476	EGR valve gasket
22	9439	Intake manifold gasket (8 req'd)
23	9Y426	Heat shield
24	W500211	Bolt (4 req'd)
25	6N041	Noise insulator
26	9K617	Crankcase ventilation hose
27	6N081	Bracket
28	W705479	Stud bolt
29	14536	Bracket
30	W520411	Nut
31	9P903	Air assist hose
32	W500313	Bolt (9 req'd)
33	9F814	Throttle body heater return hose
34	9F813	Throttle body heater feed hose
35	12B637	Engine sensor control wiring harness
36	9425	Intake manifold
37	6C653	Throttle body adapter gasket
38	9632	Throttle body adapter
39	9F715	Idle air control valve
40	W701662	Bolt (2 req'd)
41	9P903	Air assist tube
42	W701568	Bolt (4 req'd)
43	W520411	Nut (2 req'd)

Identification

For quick identification refer to the safety certification decal.

- The decal is located on the LH front door lock face panel.
- Find the engine code (letter or number) on the decal, then refer to the Engine Identification Chart to determine engine type and size. For additional information, refer to [Section 100-01](#).

- The symbol code on the identification tag identifies each engine for determining parts usage; for instance, engine displacement in liters or cubic inch displacement and model year.

Engine Code Information

The engine code information label is located on the valve cover. The label contains, among other information:

- the engine calibration number
- the engine build date
- the engine plant code
- the engine code

Emission Calibration Label

NOTE: The engine codes and the calibration numbers must be used when making inquiries or ordering parts.

The emission calibration number label is located on the LH side door or LH door post pillar. It identifies:

- the engine calibration number
- the engine code number
- the revision level

These numbers are used to determine if parts are unique to specific engines.

Exhaust Emission Control System

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Induction System

The air/fuel mixture needed for burning in the cylinders is provided by the multiport fuel injection (MFI) system. Refer to [Section 303-04B](#) for additional information.

Fuel is:

- supplied from the fuel tank by the fuel pump.
- regulated by the fuel pressure sensor.
- delivered to the injector supply manifold.

A dual damper has been added to reduce pressure fluctuations caused by the fuel injectors.

Crankshaft

The crankshaft is supported on the bottom of the cylinder block by five steel-backed, over-plated, aluminum crankshaft main bearings.

To provide smooth engine operation, the piston crankpins are positioned to provide a power impulse every 90 degrees of crankshaft rotation. The spacing provides smooth and quiet operation.

Camshafts

The camshafts:

- are arranged in pairs, one each (intake and exhaust) on each cylinder head.
- are synchronized through a secondary timing chain.
- depress the direct acting mechanical tappets to actuate the valves.

Valve Train

The valves are actuated by a direct acting mechanical bucket and shim. The direct acting mechanical tappets and shims:

- provide lash adjustment through a shim selected by thickness.
- ride on the camshaft lobes.

Positive Crankcase Ventilation System

The engine is equipped with a positive, closed-type crankcase ventilation system which recycles the crankcase vapors to the throttle body.

Engine Lubrication System

The engine lubrication system is of the force-feed type in which oil is supplied under full pressure to the:

- crankshaft main bearings
- crankshaft thrust main bearing
- connecting rod bearings

All other parts are lubricated by gravity flow or splash of the oil.

Oil Pump

The rotary spur oil pump develops the oil pressure.

- The oil pump is bolted to the front of the cylinder block.
- The oil pump is rotated by the crankshaft.
- A full flow oil filter is externally mounted on the upper sump.

If the filter element should become blocked a spring-loaded bypass valve will open and allow an uninterrupted flow of oil to the engine.

Engine Cooling System

The engine is liquid-cooled:

- by a centrifugal water pump driven by the drive belt.
- a water thermostat is used to restrict coolant flow until the engine reaches normal operating temperature.

Drive Belt System

Accessories mounted on the front of the engine are belt-driven by the crankshaft and an automatically tensioned serpentine drive belt is routed over the following components:

- water pump
 - A/C compressor
 - generator (GEN)
 - drive belt tensioner
 - drive belt idler pulley
 - crankshaft pulley
 - power steering pump
 - hydraulic cooling fan pump
-

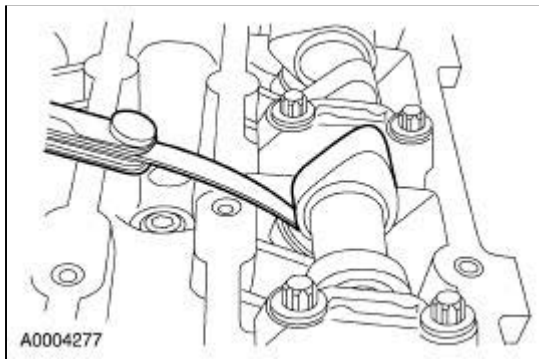
Engine

Refer to Section 303-00 .

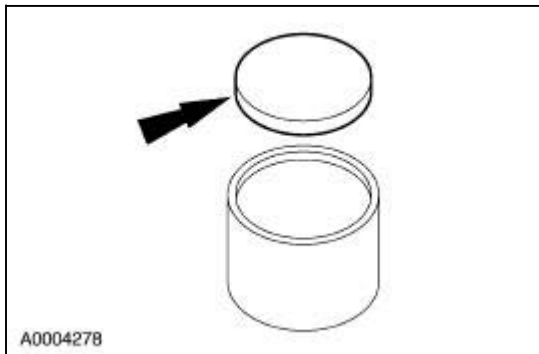
Valve — Clearance Adjust

1. Remove the timing chains. For additional information, refer to [Timing Drive Components—Secondary](#) in this section.
2. **NOTE:** Measure each valve clearance at base circle before removing the camshafts. The shims are not repairable with the camshafts in place. Failure to measure all clearances prior to removing the camshafts will cause unnecessary repetition of the procedure.

Use a feeler gauge to measure each valve clearance and record its location.



3. Remove the camshafts. For additional information, refer to [Camshaft](#) in this section.
4. Remove the shims.



5. **NOTE:** The shims are marked for thickness; example: 2.22 mm = 222 on shim.

NOTE: The corrected shims allow the following valve clearances.

- Intake valve clearance: 0.18-0.22mm (0.00709-0.00866 in)
- Exhaust valve clearance: 0.23-0.27mm (0.00906 - 0.01063 in)

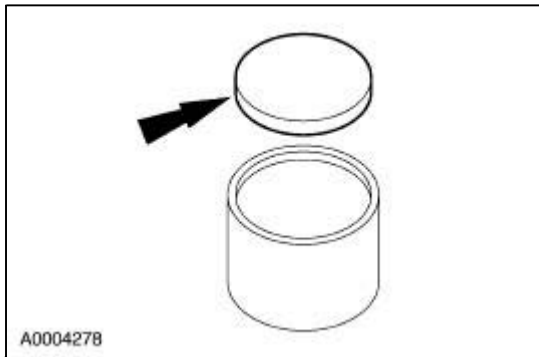
NOTE: A midrange clearance is the most desirable:

- Intake: 0.20 mm (0.00787 in)
- Exhaust: 0.25 mm (0.01 in)

NOTE: Select shims using this formula: required shim thickness = measured clearance plus the base shim thickness minus most desirable clearance.

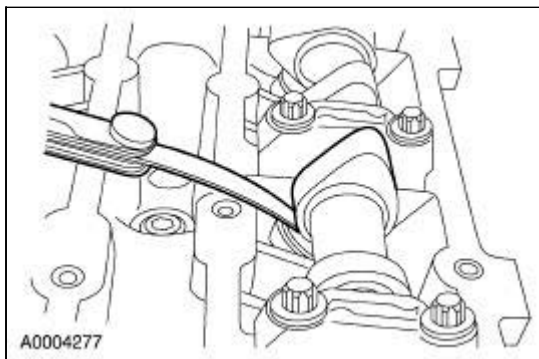
Select shims and mark the installation location.

6. Replace the shims.



7. Install the camshaft. For additional information, refer to [Camshaft](#) in this section.

8. Measure the new valve clearances.



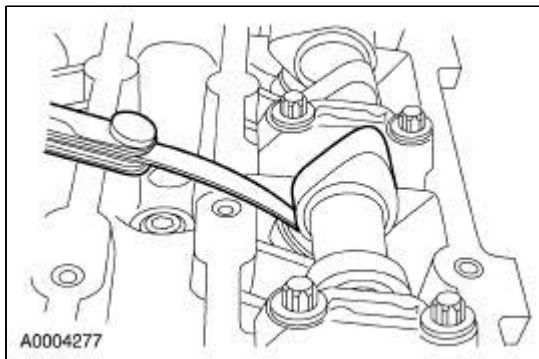
9. Install the timing chains. For additional information, refer to [Timing Drive Components—Secondary](#) in this section.
-

Valve —Clearance Inspection

1. Remove the valve covers. For additional information, refer to [Valve Cover—RH](#) and [Valve Cover—LH](#) in this section.
2. Remove the spark plugs.
3. **NOTE:** The engine will have to be rotated with the crankshaft pulley bolt to bring each valve to base circle.

NOTE: The valve clearance must be measured with the camshaft at base circle.


Measure and record all valve clearances.



4. If the valve clearances are out of specification, refer to [Valve —Clearance Adjust](#) in this section.
 5. To assemble, reverse the inspection procedure.
-

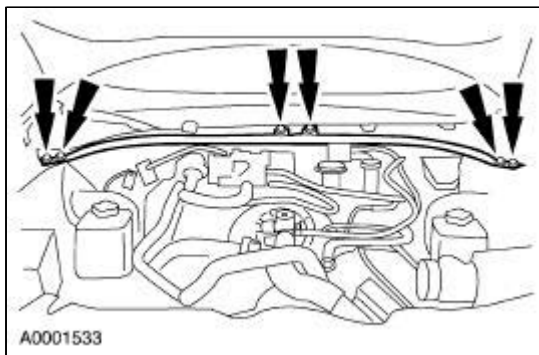
Intake Manifold

Removal

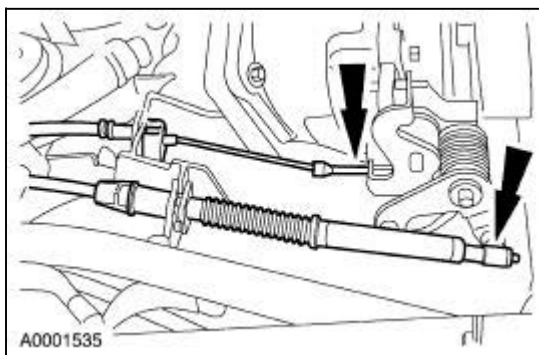
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
3.  **CAUTION: The coolant drain procedure must be followed exactly or damage to the engine may occur.**

Drain the engine cooling system. For additional information, refer to [Section 303-03](#).

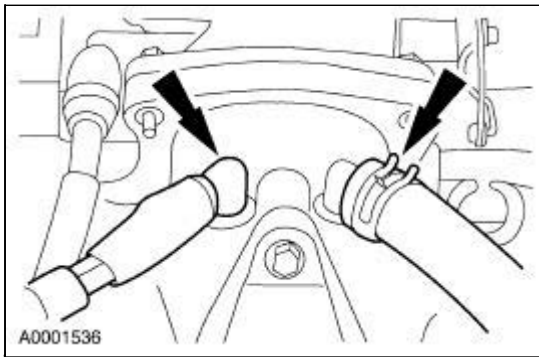
4. Remove the cowl vent screen. For additional information, refer to [Section 501-02](#).
5. Remove the engine compartment brace.



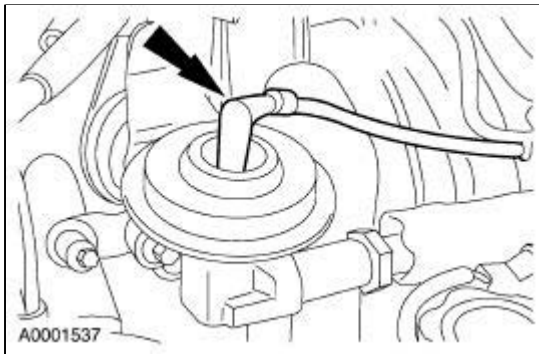
6. Disconnect the accelerator and speed control cables.



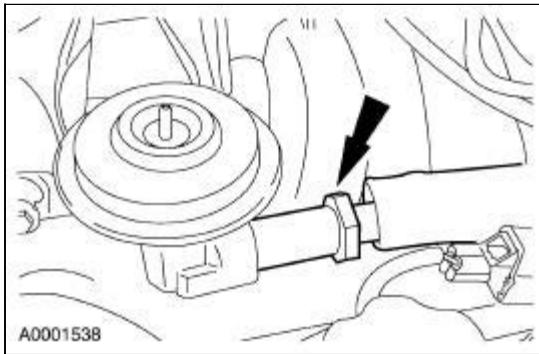
7. Disconnect the vacuum hoses.



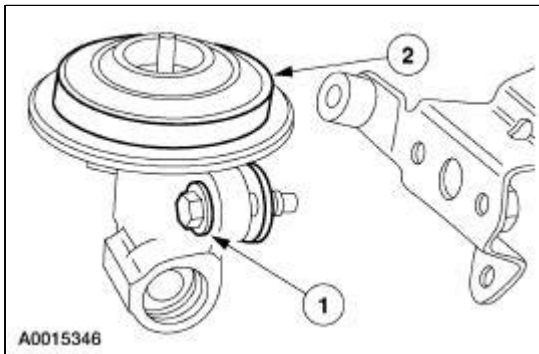
8. Disconnect the vacuum line.



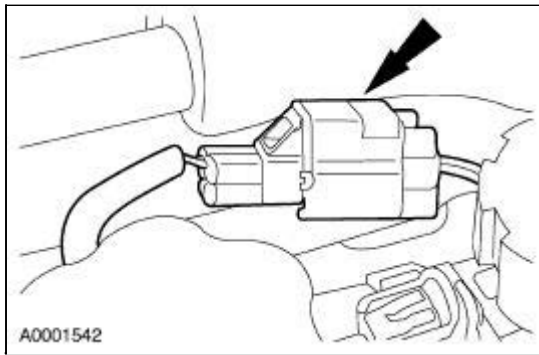
9. Disconnect the EGR valve to exhaust manifold tube.




10. Remove the EGR valve.
 1. Remove the two bolts.
 2. Remove the valve and discard the gasket.

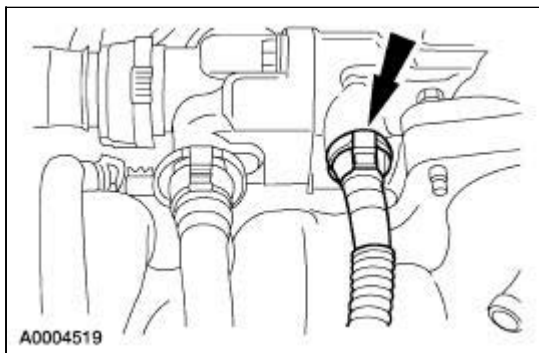


11. Disconnect the camshaft position (CMP) sensor electrical connector and separate the connector from the fuel injection supply manifold.

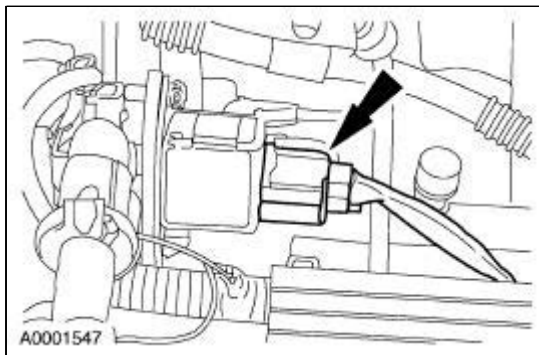


12.  **CAUTION:** To remove normal fittings, squeeze the tabs and pull straight out or damage to the fitting may occur.

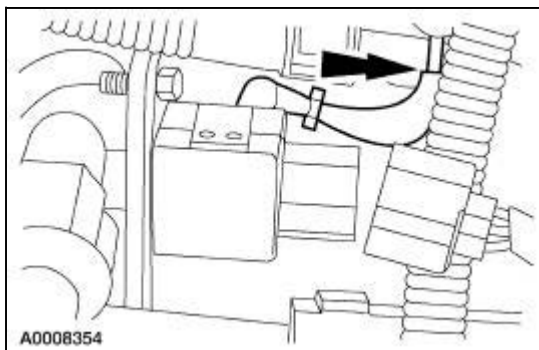
Disconnect the evaporative emission canister purge valve line.



13. Disconnect the fuel pressure sensor electrical connector.

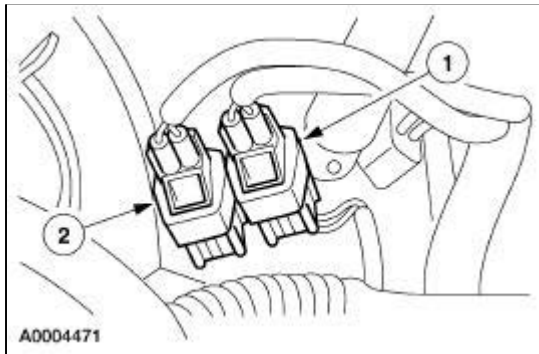


14. Disconnect the vacuum connector from the fuel pressure sensor.

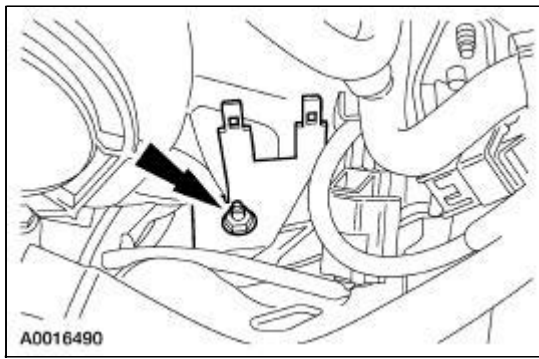


15. Disconnect the fuel line. For additional information, refer to [Section 310-00](#).

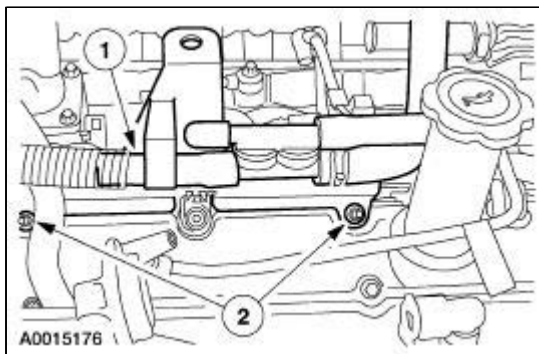
16. Remove the electrical connectors from the bracket.
 1. LH knock sensor (KS).
 2. Cylinder head temperature (CHT) sensor.



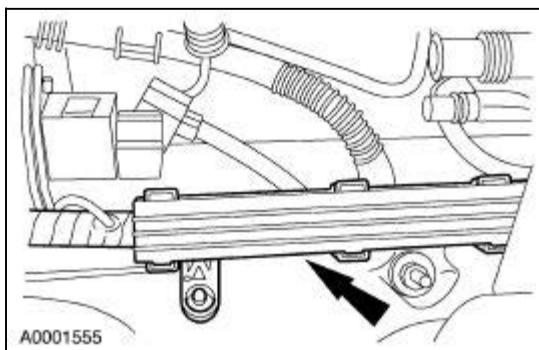
17. Remove the nut and the bracket.



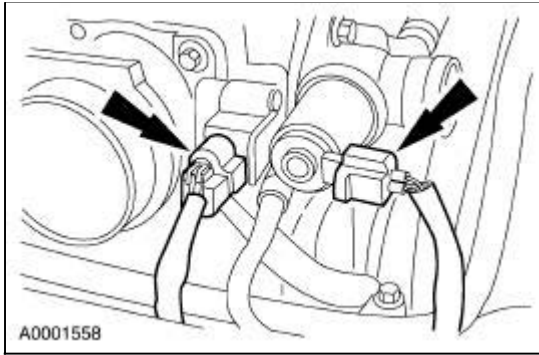
18. Remove the bracket.
 1. Remove the hose.
 2. Remove the nuts and the bracket.



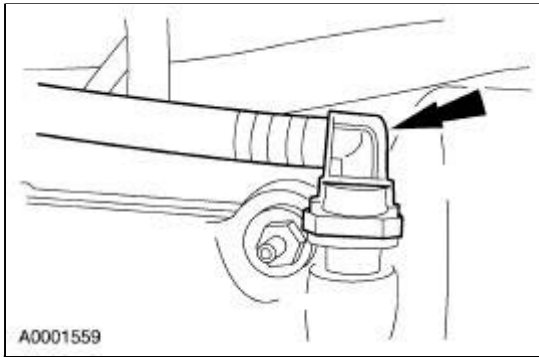
19. Raise the engine wiring harness and disconnect the LH fuel injector connectors.



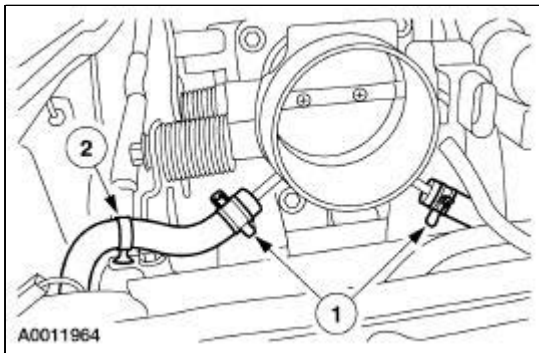
20. Disconnect the electrical connectors.
- Idle air control (IAC) valve.
 - Throttle position (TP) sensor.



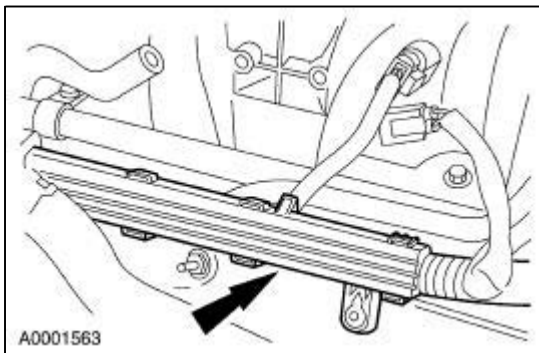
21. Disconnect the crankcase ventilation tube from the RH valve cover.



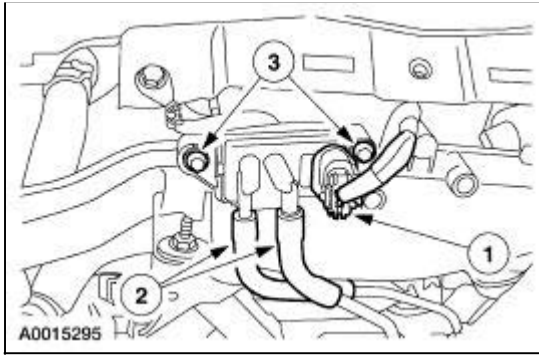
22. Disconnect the hoses (1) from the throttle body and the retaining clips (2).



23. Raise the engine wiring harness and disconnect the RH fuel injectors.

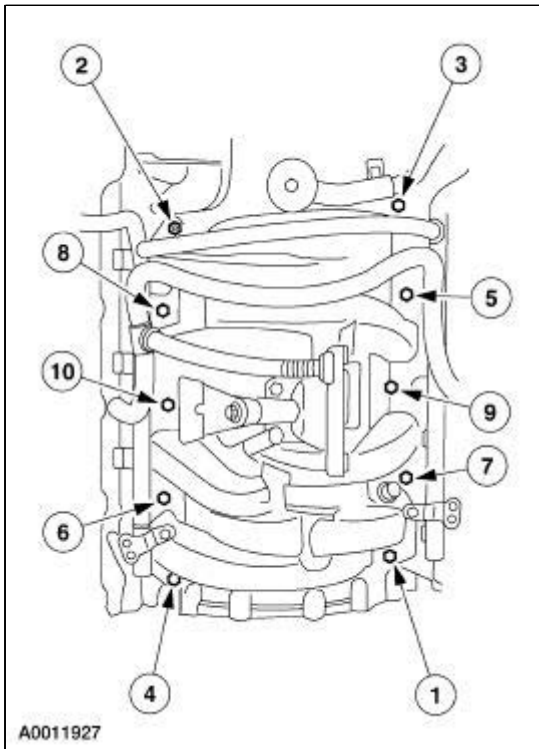


24. Remove the Delta PFE sensor.
1. Disconnect the electrical connector.
 2. Disconnect the hoses.
 3. Remove the bolts and the sensor.



25. **NOTE:** The throttle body and adapter are shown removed for clarity. It is not necessary to remove the throttle body and adapter to remove the intake manifold.

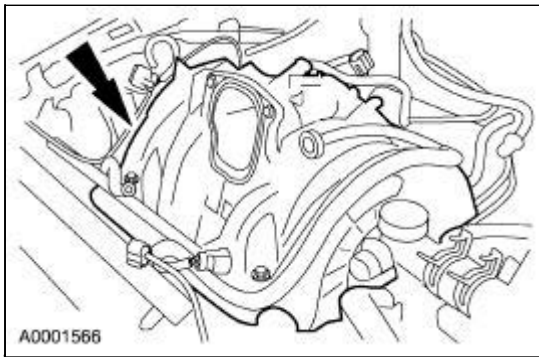
Remove the bolts and the stud (2) in the sequence shown.




26. **NOTE:** The throttle body, adapter and EGR valve are shown removed for clarity.

NOTE: Position the throttle body heater return hose out of the way before removing the throttle body.

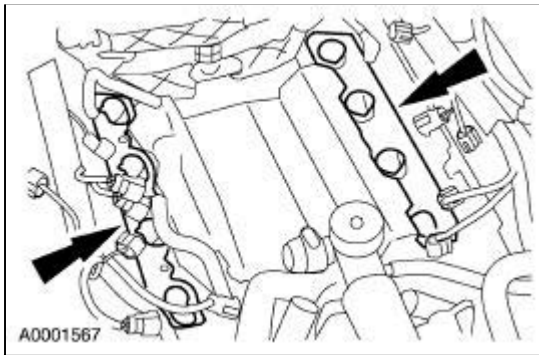
Remove the intake manifold.



27.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to clean the surfaces.

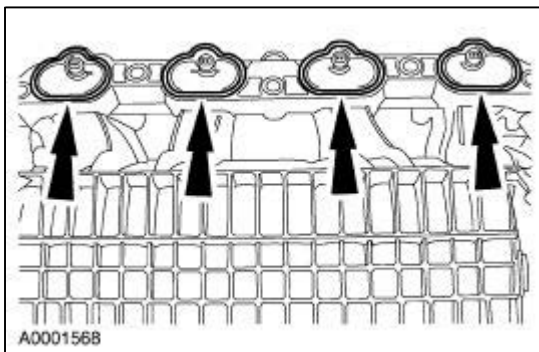
Clean the sealing surfaces.

- Inspect the gaskets and install new gaskets if necessary.



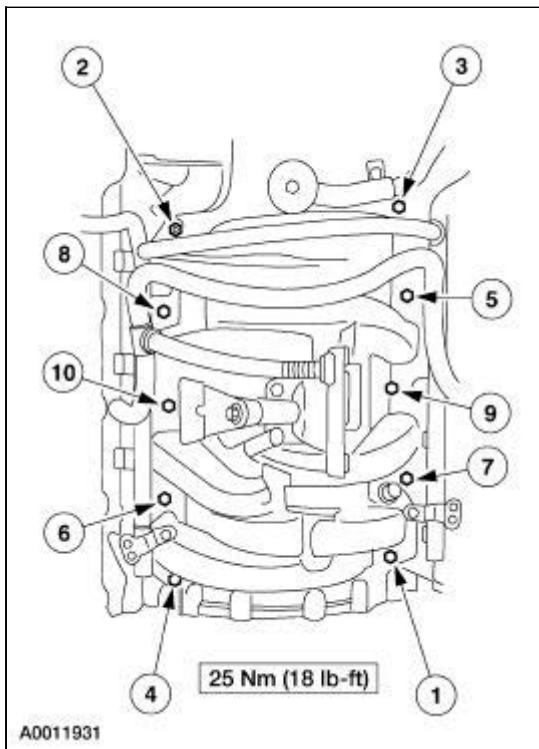
Installation

1. If removed, install the gaskets.

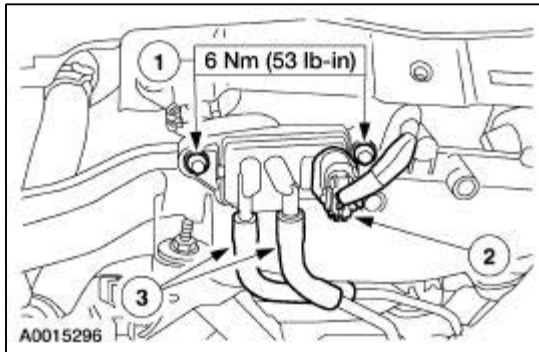


2. **NOTE:** Make sure that the throttle body heater return hose is positioned between the heat shield and the intake manifold.

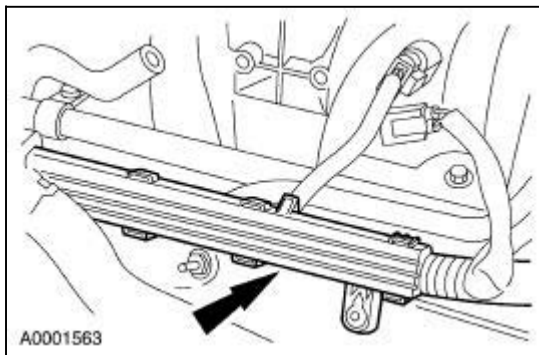
Install the intake manifold and tighten the bolts in the sequence shown.



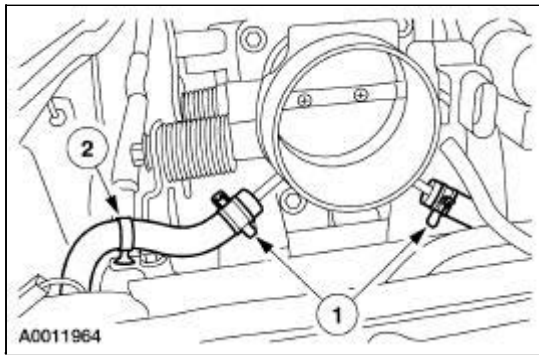
3. Install the Delta PFE sensor.
 1. Install the sensor and the bolts.
 2. Connect the electrical connector.
 3. Connect the hoses.



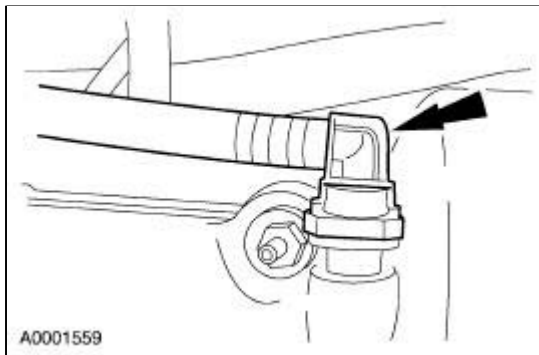
4. Connect the RH fuel injectors and position the engine wiring harness.



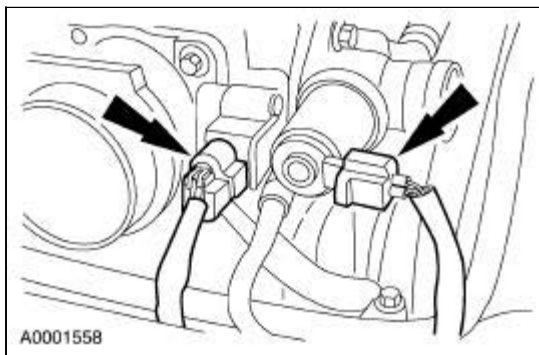
5. Connect the hoses (1) and install the hose in the clip (2).



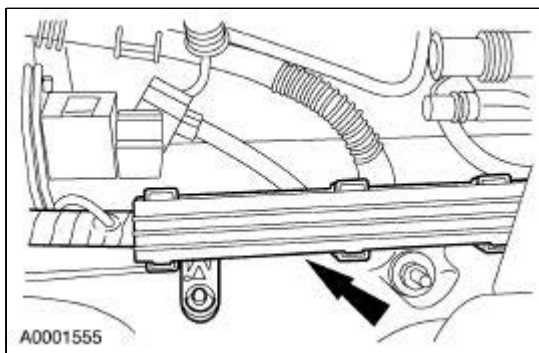
6. Connect the crankcase ventilation tube.



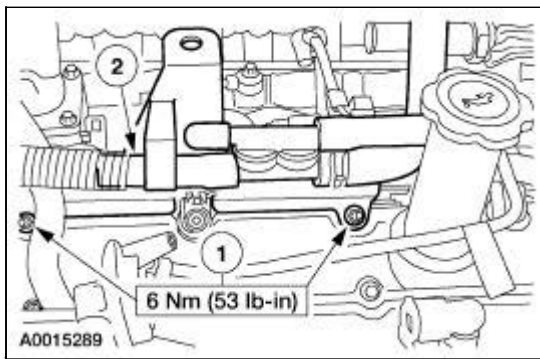
7. Connect the IAC valve and TPS electrical connectors.



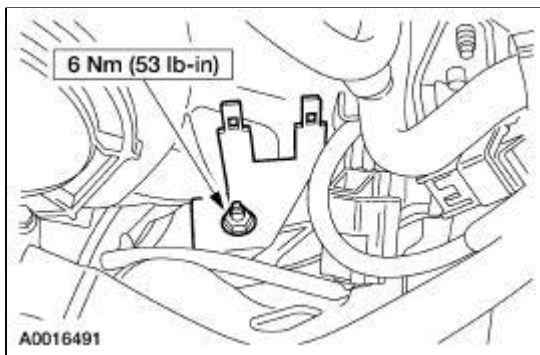
8. Connect the LH fuel injector connectors and position the engine wiring harness.



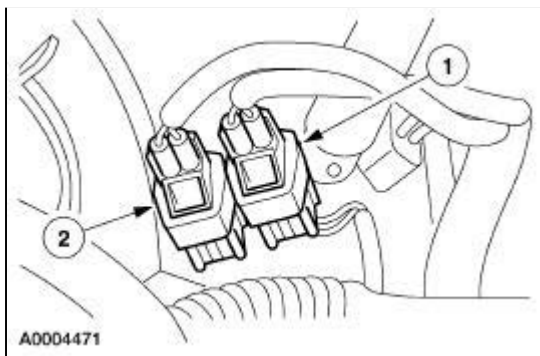
9. Install the bracket.
 1. Install the bracket and nuts.
 2. Install the hose.



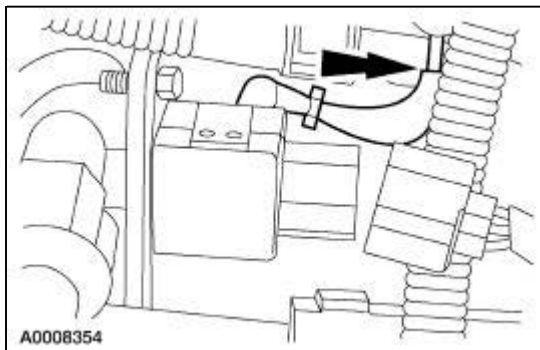
10. Install the bracket and the nut.



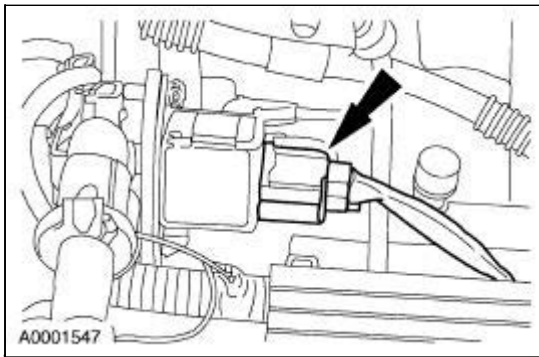
11. Install the electrical connectors on the bracket.
 1. Install the LH KS connector.
 2. Install the CHT sensor connector.



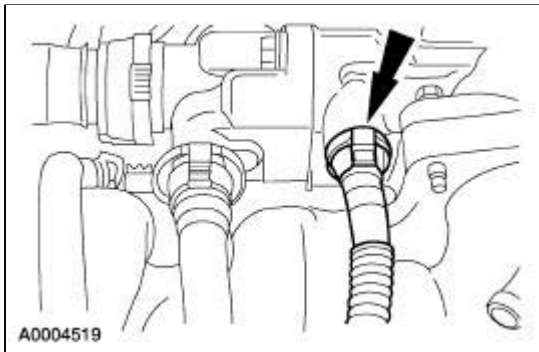
12. Connect the fuel line. For additional information, refer to [Section 310-00](#).
13. Connect the vacuum connector to the fuel pressure sensor.



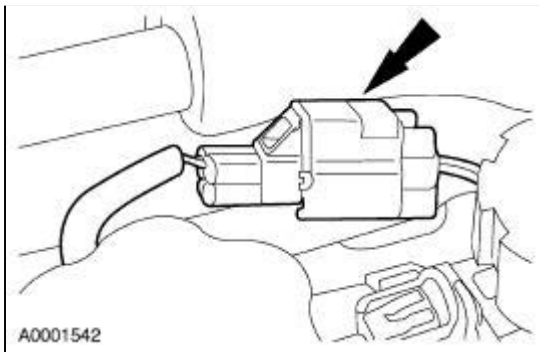
14. Connect the fuel pressure sensor electrical connector.



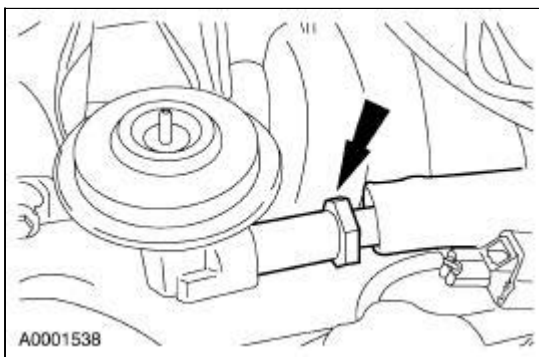
15. Connect the evaporative emission canister purge valve line.



16. Connect the CMP sensor electrical connector and position the connector on the fuel injection supply manifold.



17. Connect the EGR valve to exhaust manifold tube.

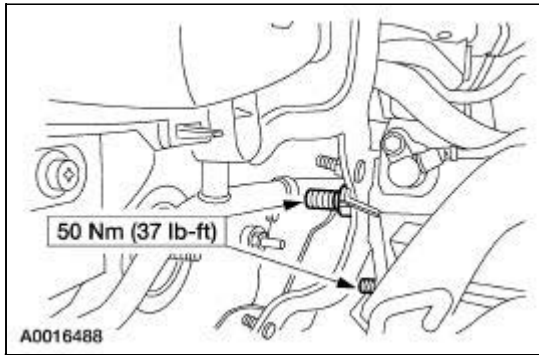


18. **NOTE:** EGR valve to exhaust manifold tube is removed for clarity.

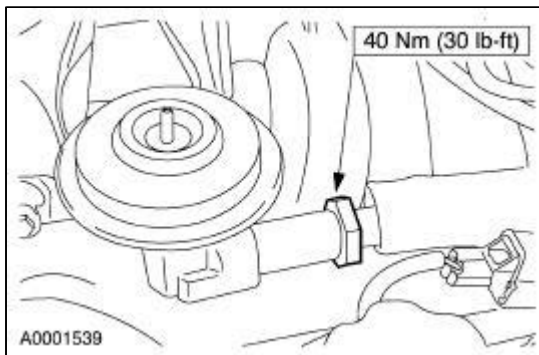
Install the EGR valve.

1. Install a new gasket and the valve.

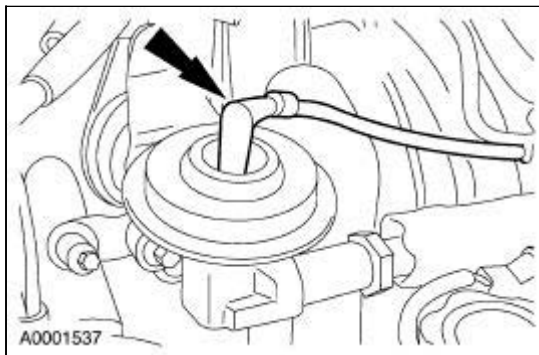
2. Install the two bolts.



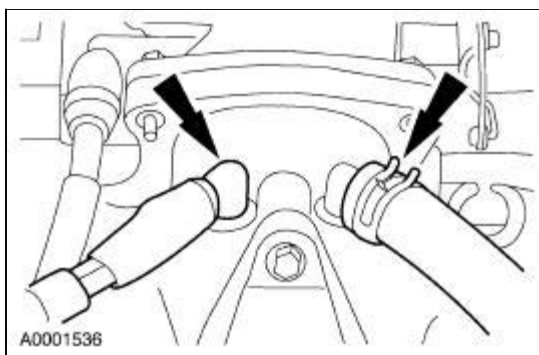
19. Tighten the tube.



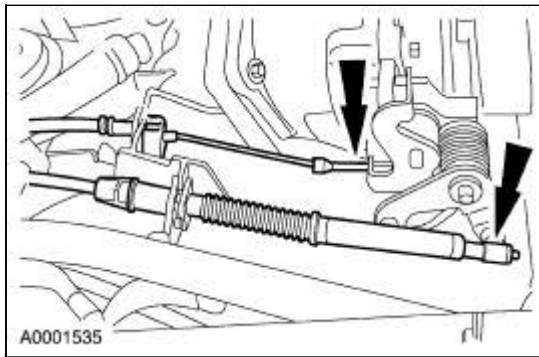
20. Connect the vacuum line.



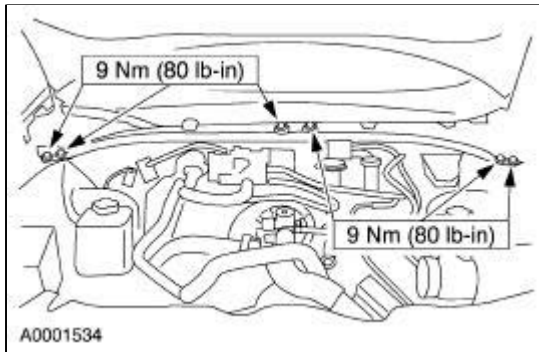
21. Connect the vacuum hoses.




22. Connect the accelerator and speed control cables.



23. Install the engine compartment brace.



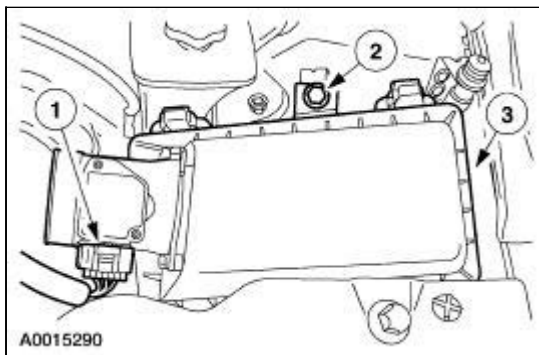
24. Install the cowl vent screen. For additional information, refer to [Section 501-02](#).
 25. Install the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
 26. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
 27.  **CAUTION: The cooling system filling and bleeding procedure must be followed exactly or damage to the engine may occur.**

Fill and bleed the engine cooling system. For additional information, refer to [Section 303-03](#).
-

Valve Cover —LH

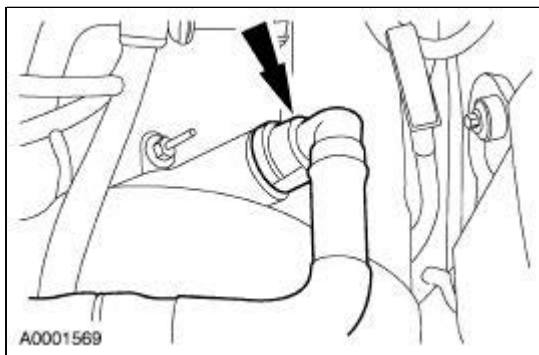
Removal

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
3. Remove the air cleaner housing.
 1. Disconnect the mass air flow (MAF) sensor electrical connector.
 2. Remove the bolt.
 3. Remove the housing.

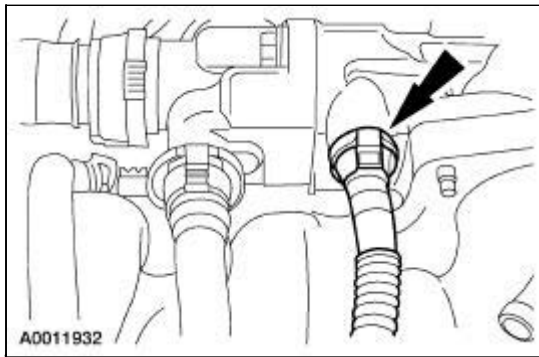


4.  **CAUTION:** To disconnect the normal fitting, squeeze the tabs and pull straight out or damage to the fitting may occur.

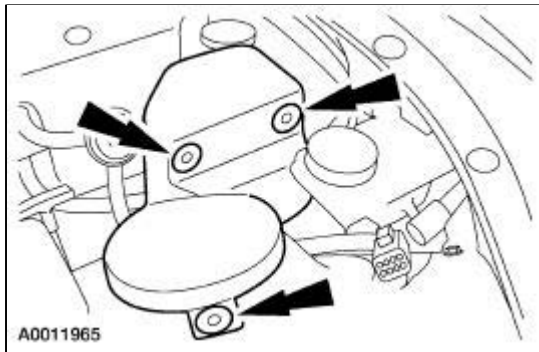
Disconnect the crankcase ventilation tube.



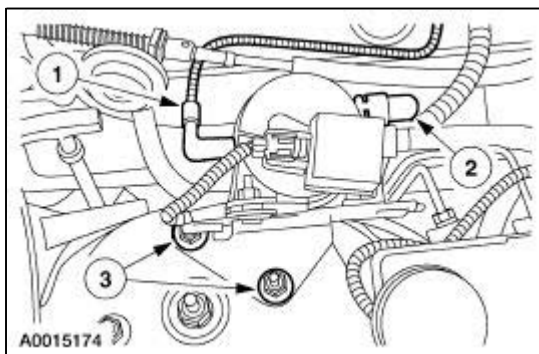
5. Disconnect the fuel line. For additional information, refer to [Section 310-00](#).
6. Disconnect the evaporative emission canister purge valve hose.



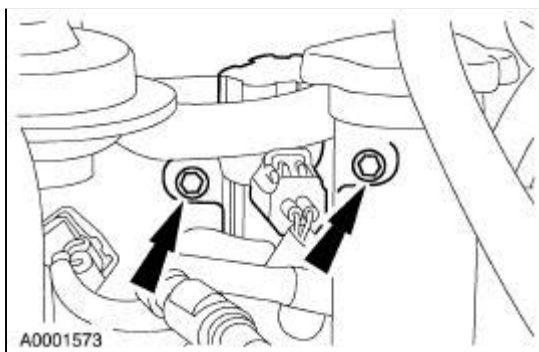
7. Remove the vapor management valve (VMV) cover.



8. Position the VMV aside.
 1. Disconnect the vacuum hose.
 2. Disconnect the purge line.
 3. Remove the nuts and position the valve aside.

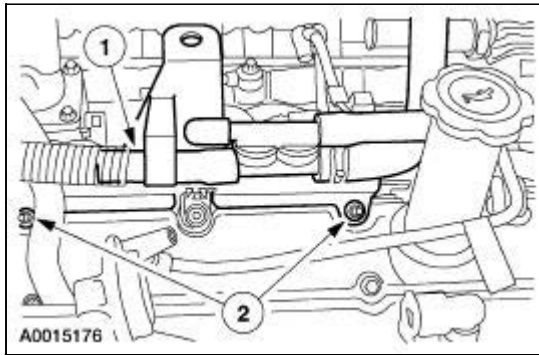


9. Position the engine vacuum regulator (EVR) solenoid aside.

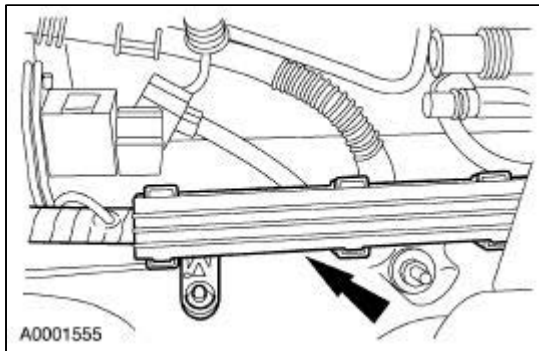


10. Remove the bracket.
 1. Remove the hose.

2. Remove the bracket.

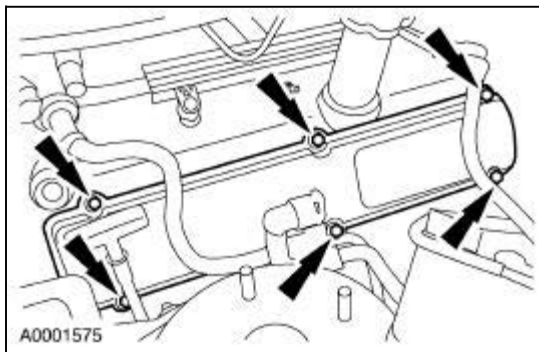


11. Position the engine wiring harness up.

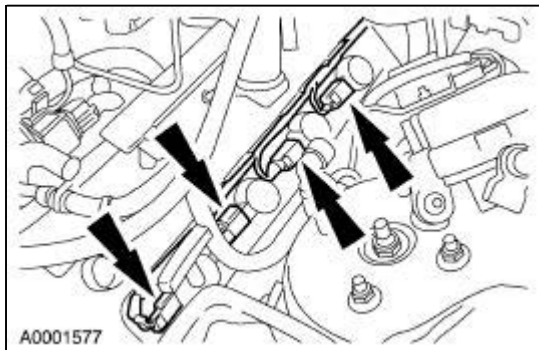


12. Remove the ignition coil cover.

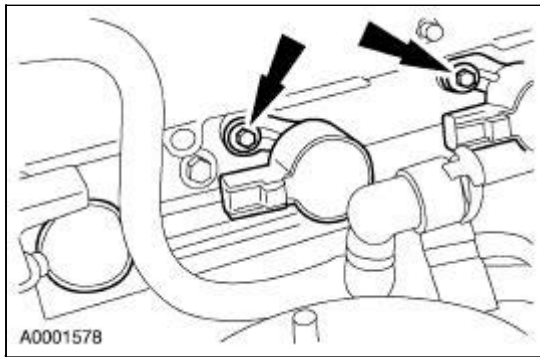
- Inspect the gasket and install a new gasket as necessary.



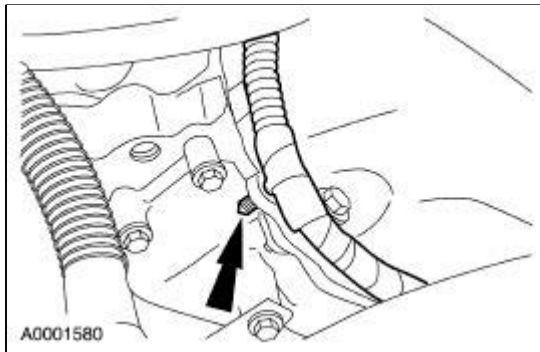
13. Disconnect the ignition coil electrical connectors.



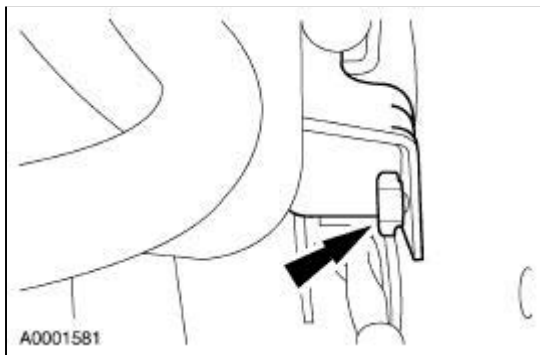
14. Remove the four LH ignition coils.



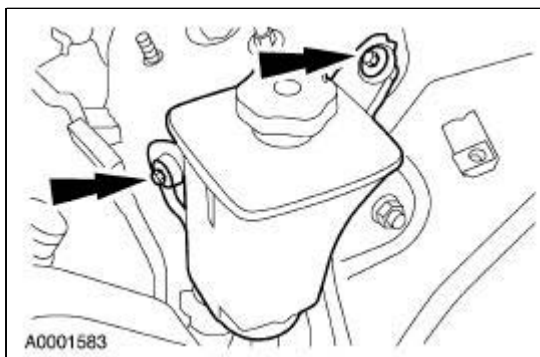
15. Disconnect the four wiring harness retainers.



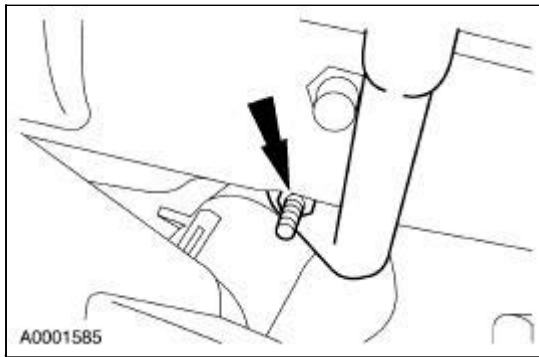
16. Remove the fuel line bracket bolt from the LH shock tower.



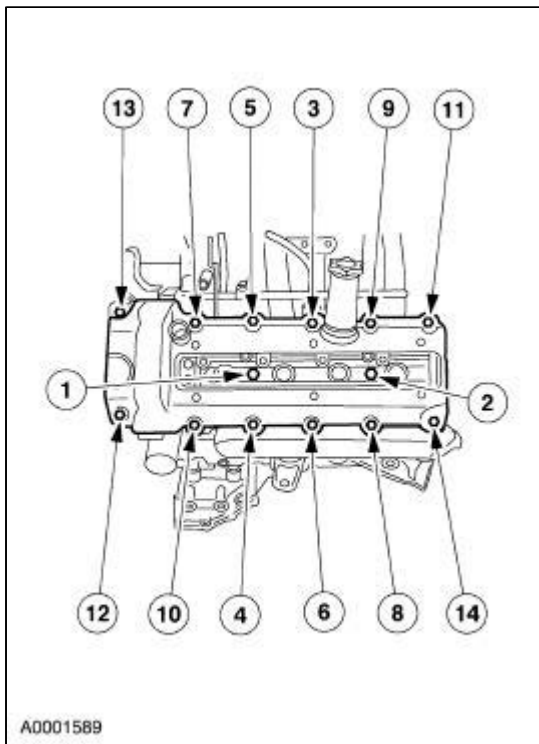
17. Remove the bolts and position the power steering pump reservoir aside.




18. Remove the nut and the oil level indicator tube.

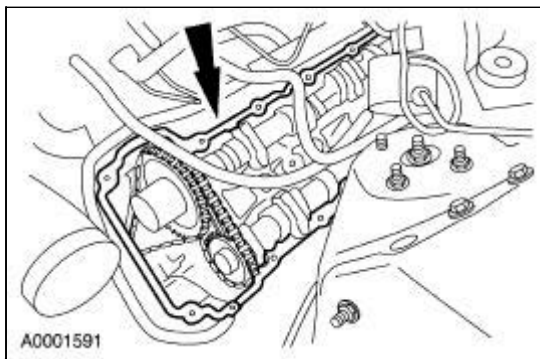


19. Remove the brake line bracket from the LH frame rail.
20. Remove the LH valve cover.
 - Loosen the bolts in the sequence shown.

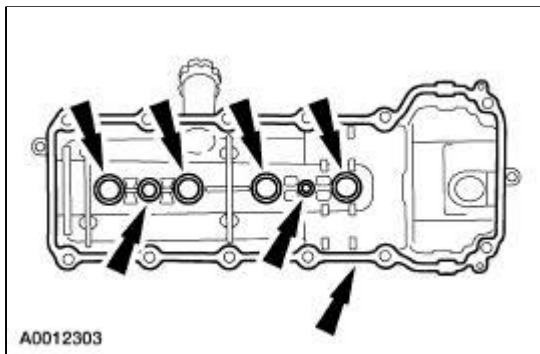


21.  **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.**

Clean the sealing surfaces.

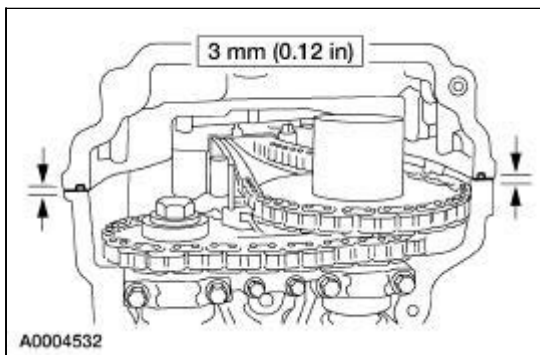


22. Inspect and install new gaskets if necessary.

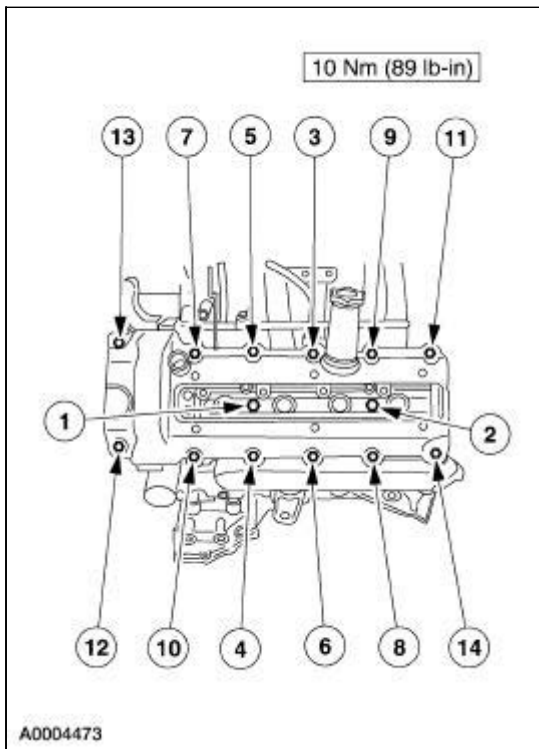


Installation

1. Apply two beads of Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4.



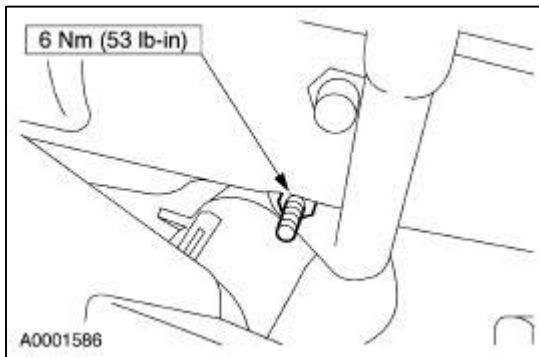
2. Install the LH valve cover.
 - Position the valve cover and tighten the bolts in the sequence shown.



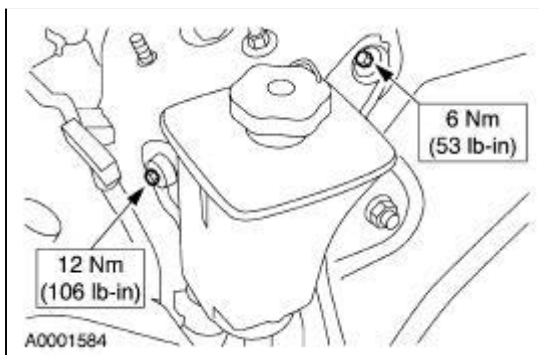
3. Install the brake line bracket.
4. **NOTE:** Lubricate the O-ring seal with Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.

Install the oil level indicator tube.

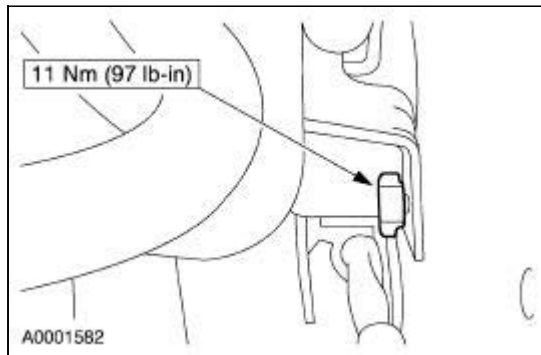
- Inspect the O-ring seal and install a new O-ring seal if necessary.



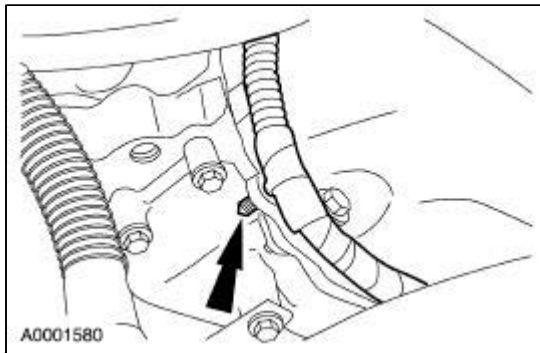
5. Install the power steering pump reservoir.



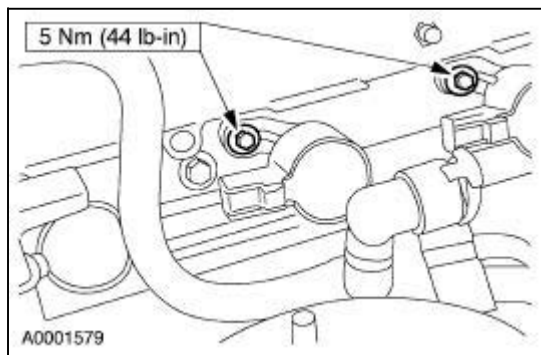
6. Install the fuel line bracket bolt.



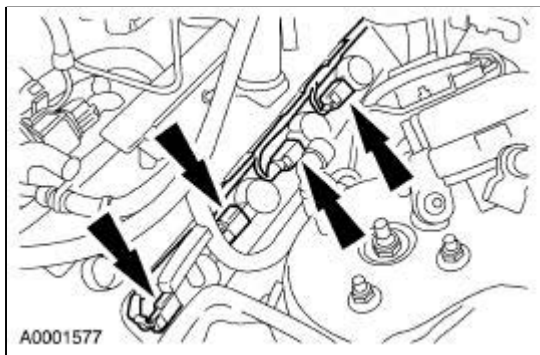
7. Connect the four wiring harness retainers.




8. Install the four LH ignition coils.

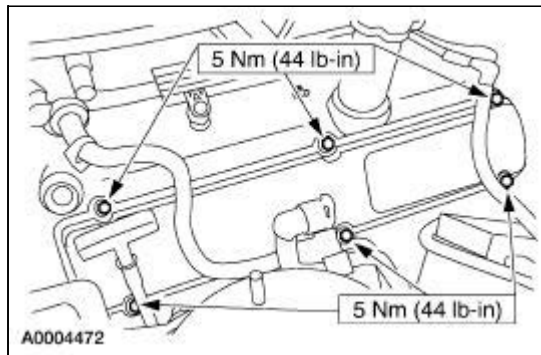


9. Connect the ignition coil electrical connectors.

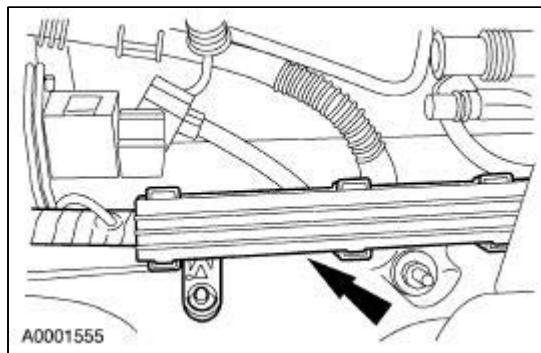


10.  **CAUTION:** Make sure that the wire harness inlet seal is seated on the valve cover or damage to the harness may occur.

Install the ignition coil cover.

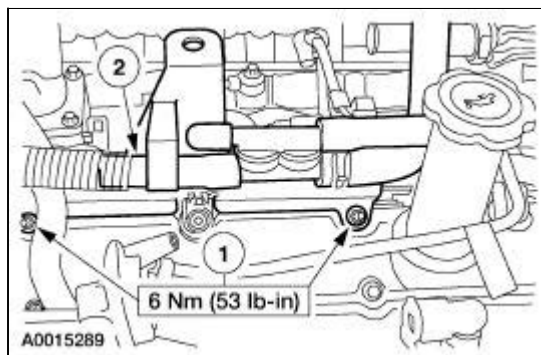


11. Install the engine wiring harness.

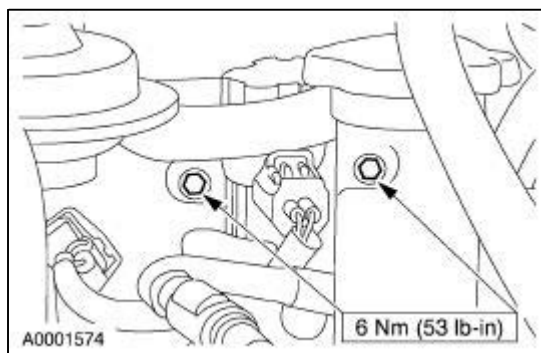


12. Install the bracket.

1. Install the bracket.
2. Install the hose.

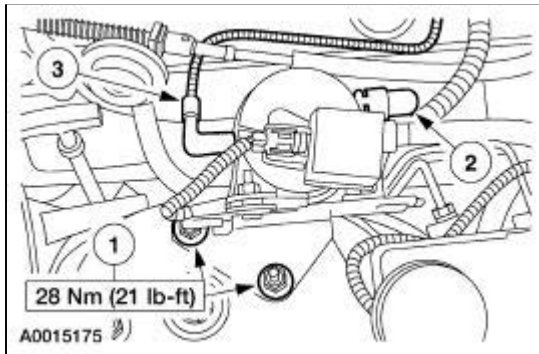


13. Install the EVR solenoid.

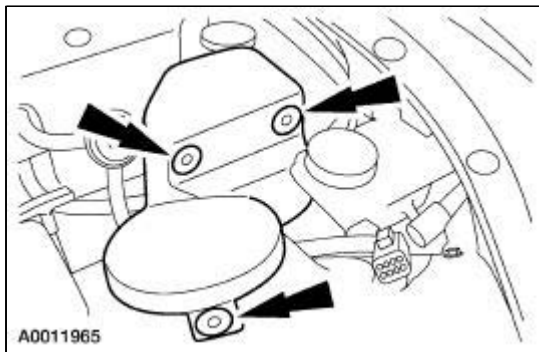


14. Install the VMV.

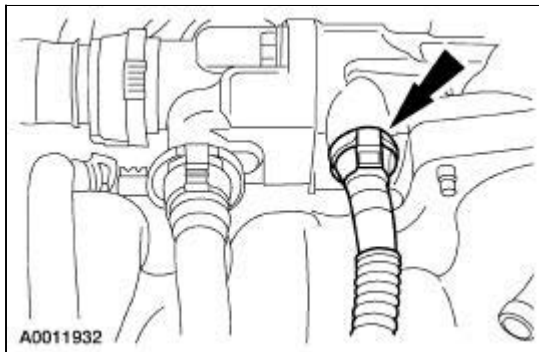
1. Install the nuts.
2. Connect the purge line.
3. Connect the vacuum hose.



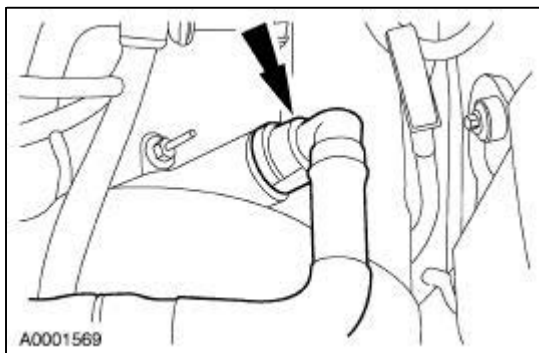
15. Install the VMV cover.



16. Connect the hose.

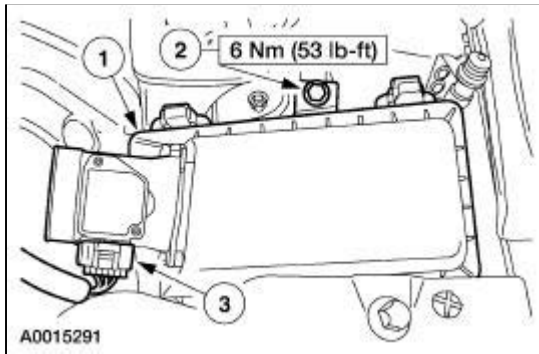


17. Connect the crankcase ventilation tube.



18. Connect the fuel line. For additional information, refer to [Section 310-00](#).

19. Install the air cleaner housing.
 1. Install the housing.
 2. Install the bolt.
 3. Connect the MAF sensor electrical connector.

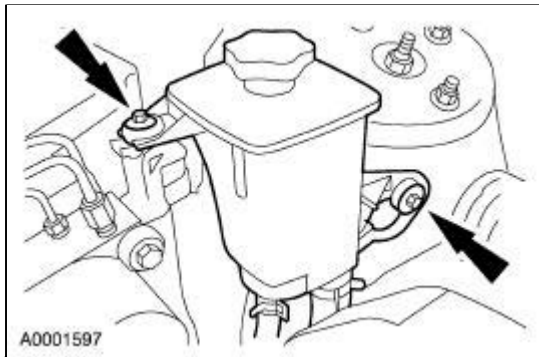


20. Install the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
 21. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
-

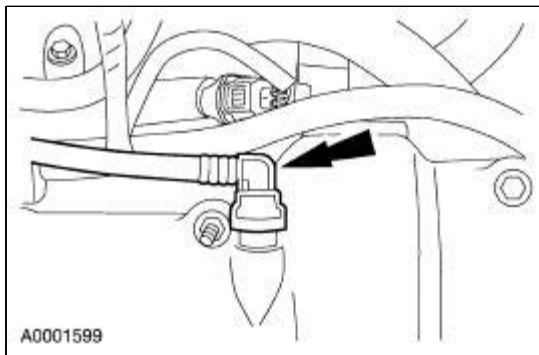
Valve Cover —RH

Removal

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
3. Remove the bolts and position the hydraulic cooling fan reservoir aside.

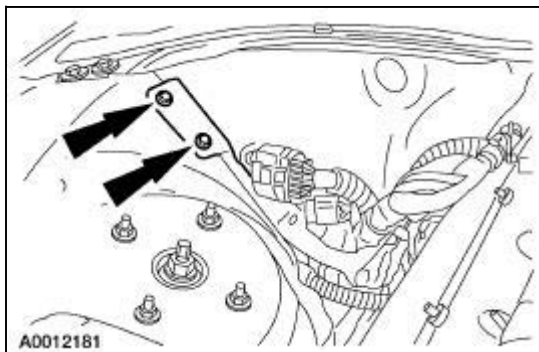


4. Disconnect the crankcase ventilation hose.



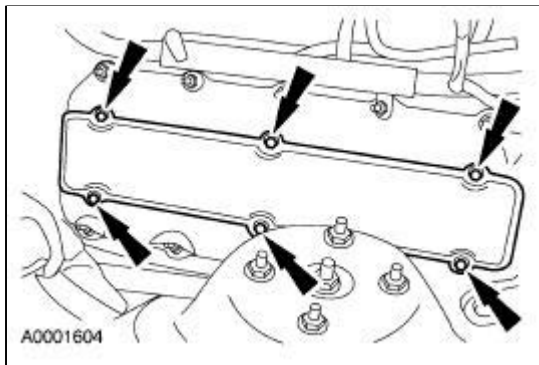
5. **NOTE:** The wiring harness bracket is located on the backside of the RH strut tower.

Remove the bolts and position the wiring harness bracket aside.

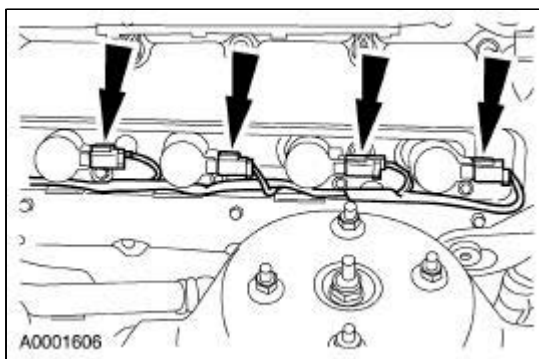


6. Remove the ignition coil cover.

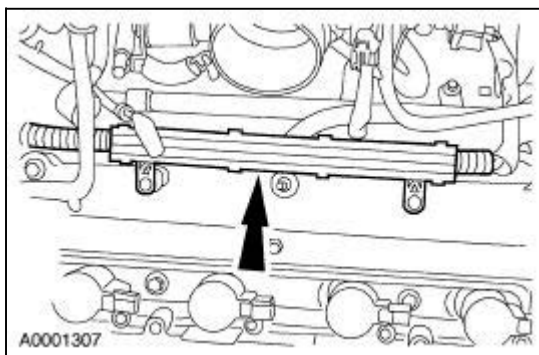
- Inspect the gasket and install a new gasket as necessary.



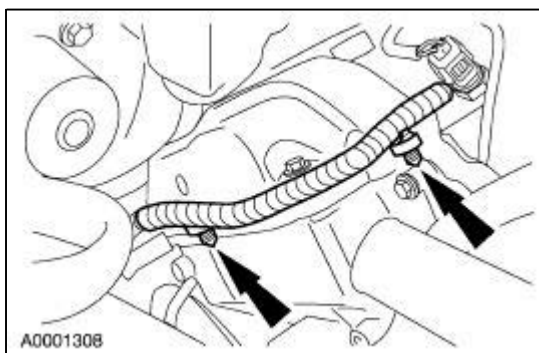
7. Disconnect the ignition coil connectors.



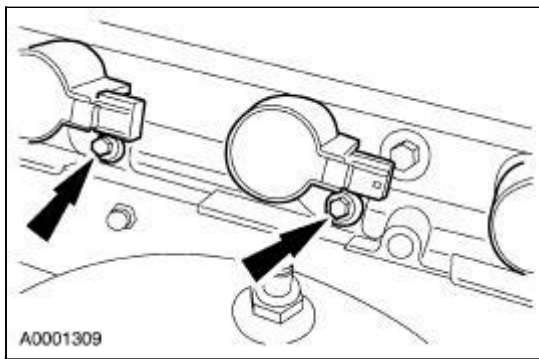
8. Raise the engine wiring harness and disconnect the four fuel injector connectors.



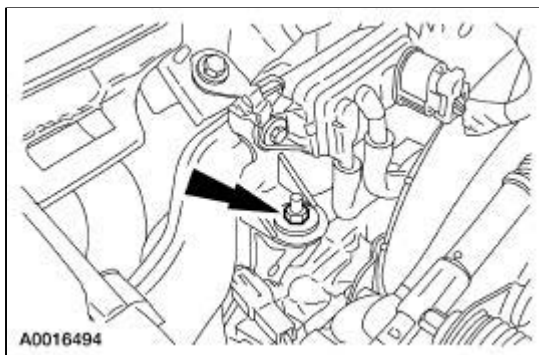
9. Disconnect the four wiring harness retainers.



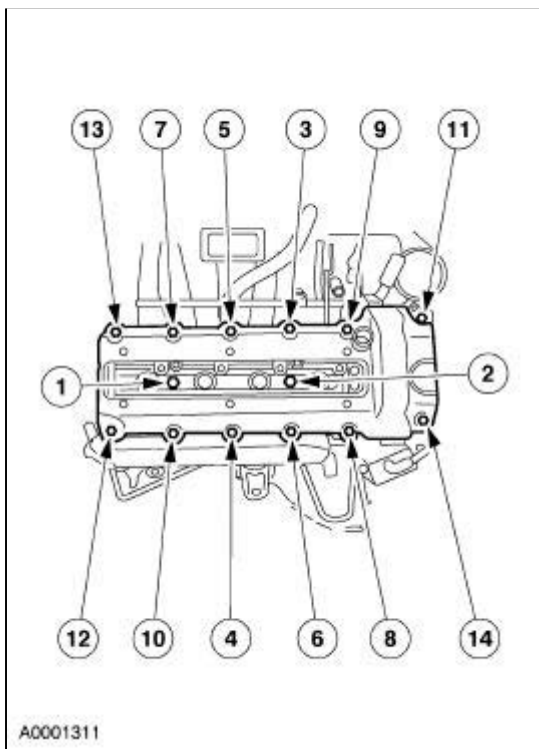
10. Remove the four RH ignition coils.




11. Remove the nut and position the wiring harness aside.

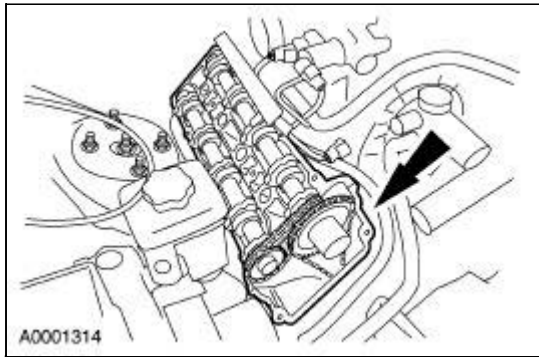


12. Remove the RH valve cover.
 - Loosen the bolts in the sequence shown.

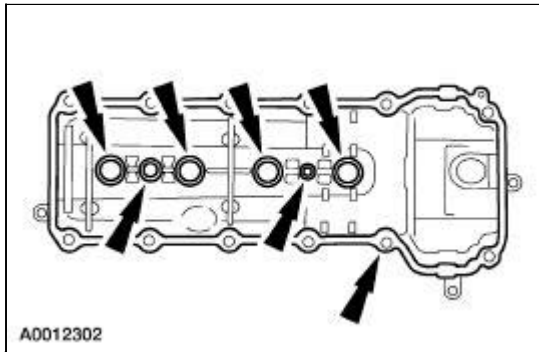


13.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.

Clean the sealing surfaces.

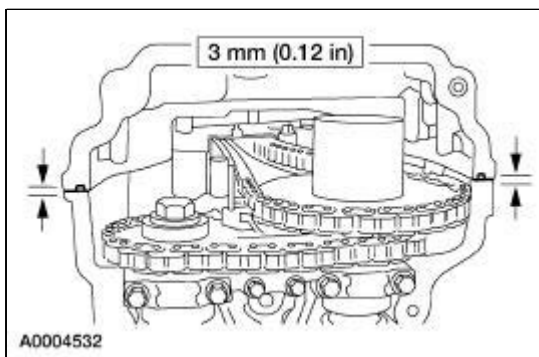


14. Inspect and install new gaskets as necessary.

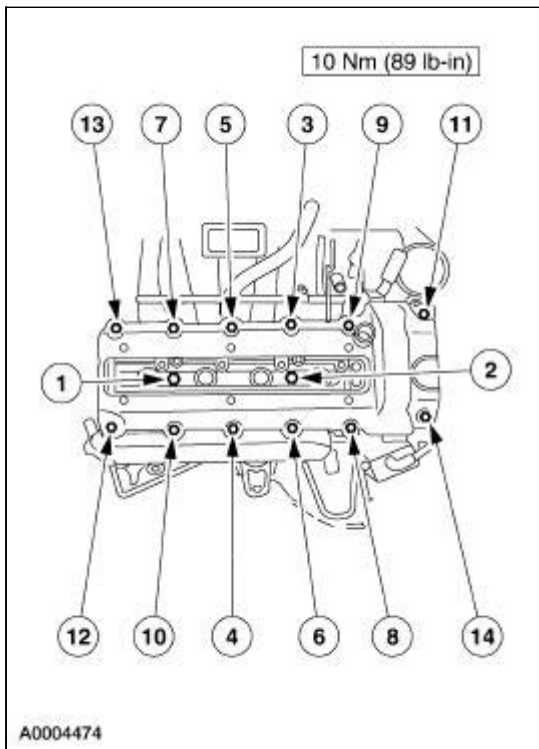


Installation

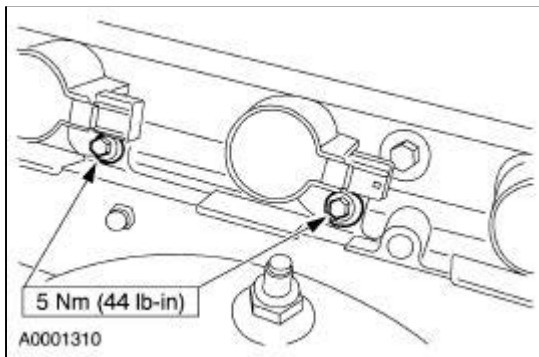
1. Apply two beads of Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4.



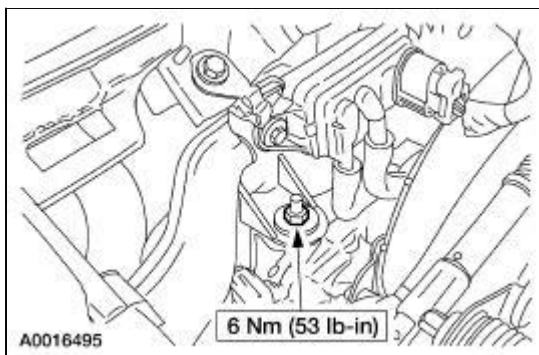
2. Install the RH valve cover.
 - Tighten the bolts in the sequence shown.



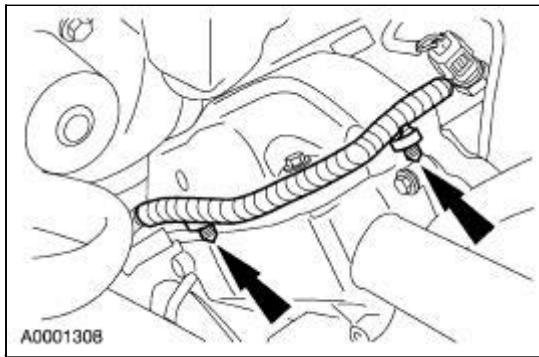
3. Install the ignition coils.



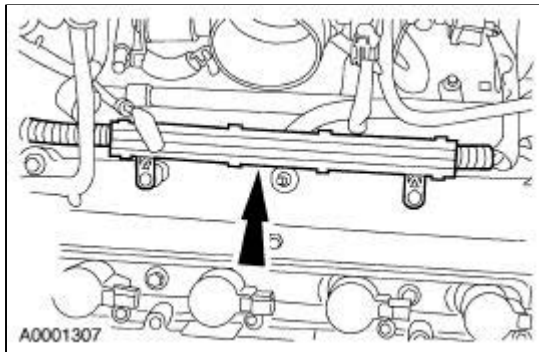
4. Position the wiring harness and install the nut.



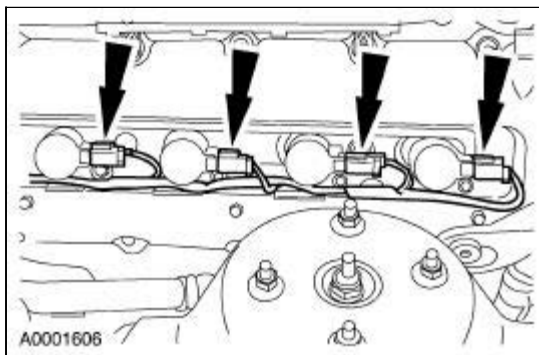
5. Install the four wiring harness retainers.




6. Connect the four fuel injector connectors and position the engine wiring harness.

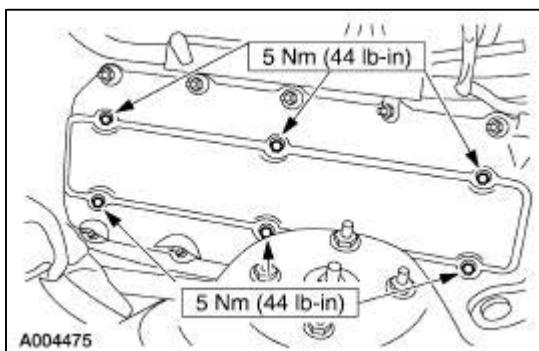


7. Connect the ignition coil connectors.



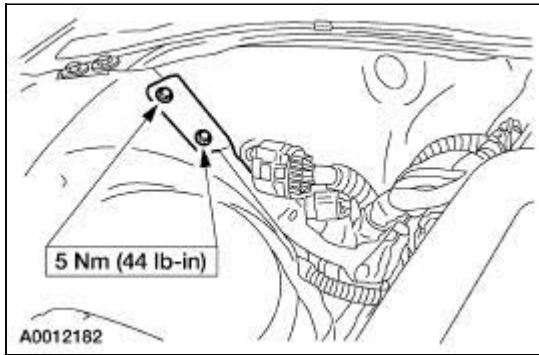
8.  **CAUTION:** Make sure that the wire harness inlet seal is seated in the valve cover or damage to the harness may occur.

Inspect the gasket and install a new gasket as necessary. Install the ignition coil cover.

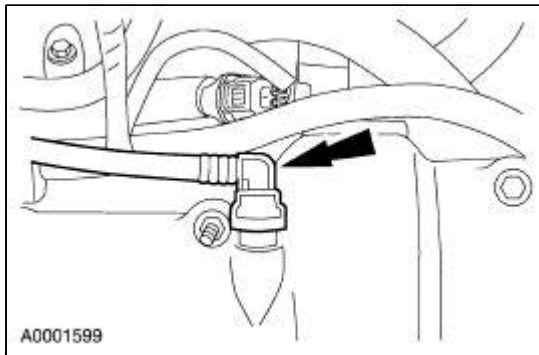


9. **NOTE:** The wiring harness bracket is located on the backside of the RH strut tower.

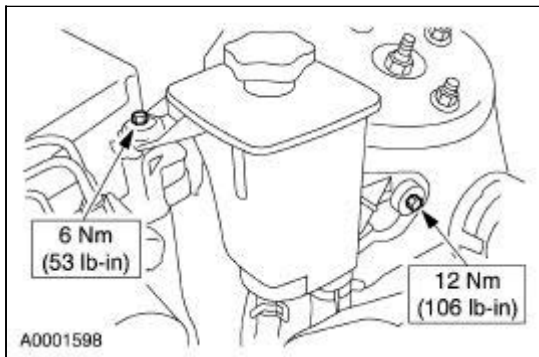
Install the wiring harness bracket.



10. Connect the crankcase ventilation hose.



11. Install the hydraulic cooling fan reservoir.



12. Install the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).

13. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).

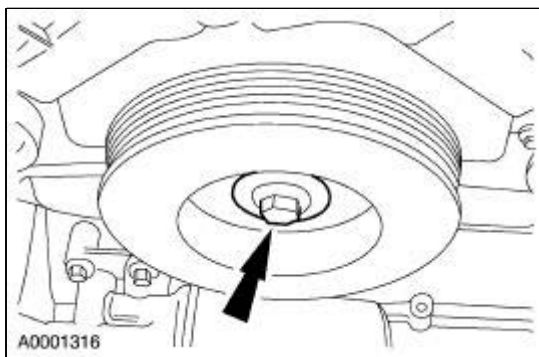
Crankshaft Pulley

Special Tool(s)

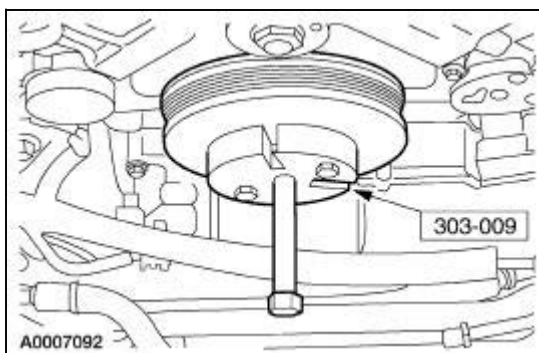
 ST1286-A	Crankshaft Damper Remover 303-009 (T58P-6316-D)
 ST1287-A	Crankshaft Damper Replacer 303-102 (T74P-6316-B)

Removal

1. Remove the hydraulic cooling fan assembly. For additional information, refer to [Section 303-03](#).
2. Remove the drive belt. For additional information, refer to [Section 303-05](#).
3. Remove the bolt.
 - Discard the bolt.

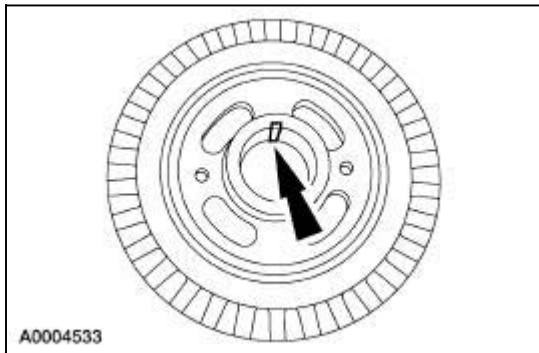


4. Using the special tool, remove the crankshaft pulley.

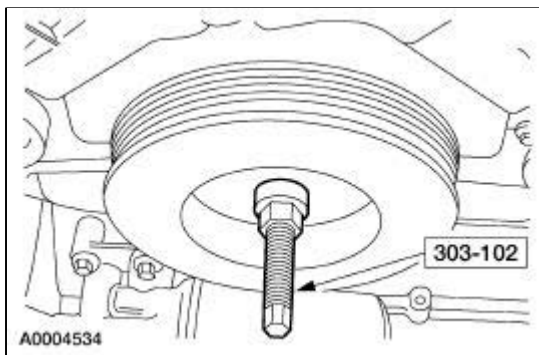


Installation

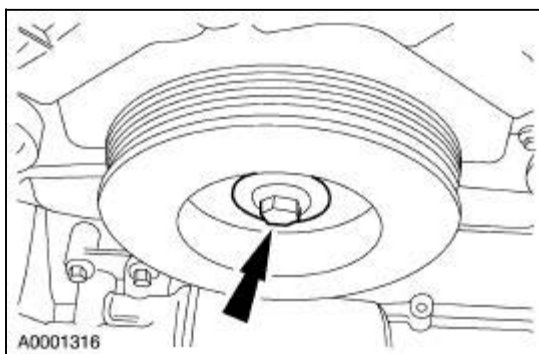
1. Apply a bead of Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4 to the keyway.



2. Using the special tool, install the crankshaft pulley.



3. Install a new bolt and tighten in four stages.
 - Stage 1: Tighten to 80 Nm (59 lb-ft).
 - Stage 2: Loosen the bolt two complete turns.
 - Stage 3: Tighten to 50 Nm (37 lb-ft).
 - Stage 4: Tighten an additional 90 degrees.



4. Install the drive belt. For additional information, refer to [Section 303-05](#).
 5. Install the hydraulic cooling fan assembly. For additional information, refer to [Section 303-03](#).
-

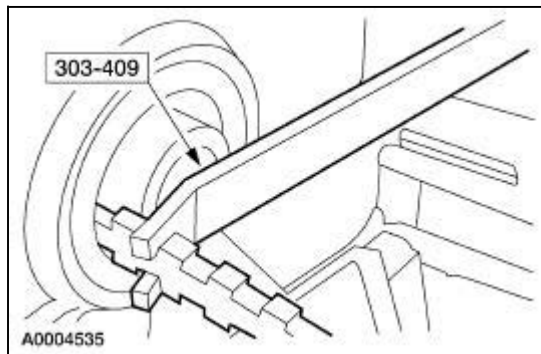
Crankshaft Front Oil Seal

Special Tool(s)

 ST1385-A	Remover, Oil Seal 303-409 (T92C-6700-CH)
 ST2423-A	Installer, Crankshaft Front Oil Seal 303-646

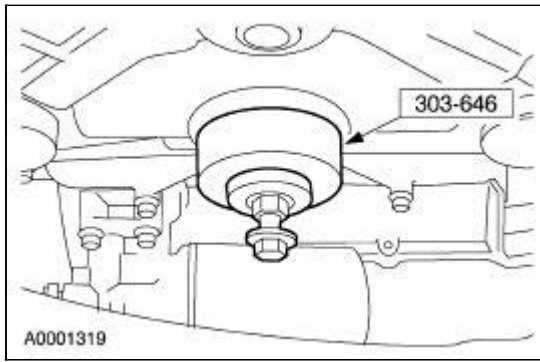
Removal

1. Remove the front crankshaft pulley. For additional information, refer to [Crankshaft Pulley](#) in this section.
2. Using the special tool, remove the front crankshaft seal.
 - Discard the seal.



Installation

1. Using the special tool, install a new front crankshaft seal.

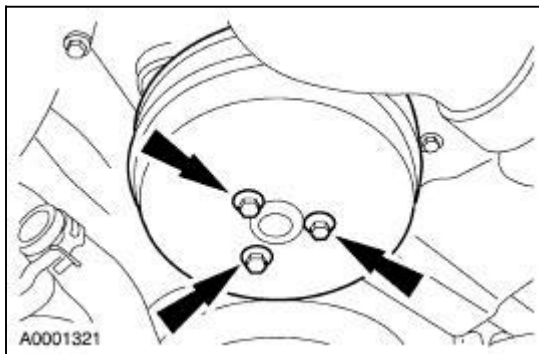


2. Install the crankshaft pulley. For additional information, refer to [Crankshaft Pulley](#) in this section.
-

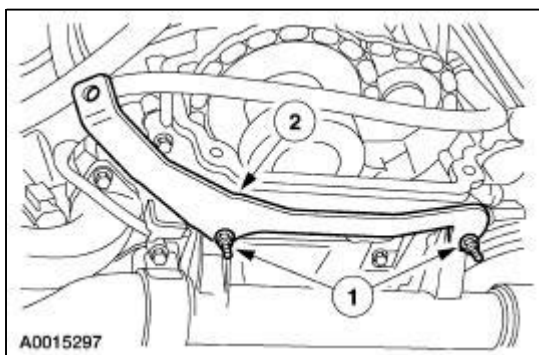
Engine Front Cover

Removal

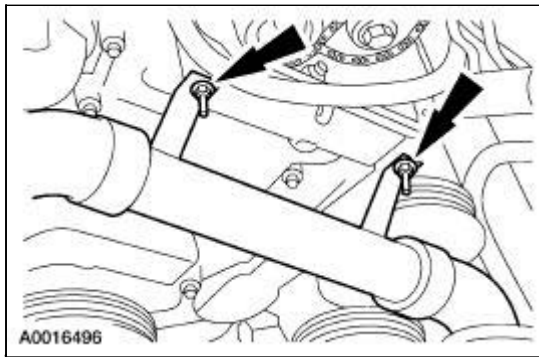
1. Drain the engine cooling system. For additional information, refer to [Section 303-03](#).
2. Remove the LH valve cover. For additional information, refer to [Valve Cover—LH](#) in this section.
3. Remove the RH valve cover. For additional information, refer to [Valve Cover—RH](#) in this section.
4. Remove the engine cooling fan assembly. For additional information, refer to [Section 303-03](#).
5. Loosen the water pump pulley bolts.
6. Remove the generator. For additional information, refer to [Section 414-02](#).
7. Remove the water pump pulley.
 - Discard the bolts.



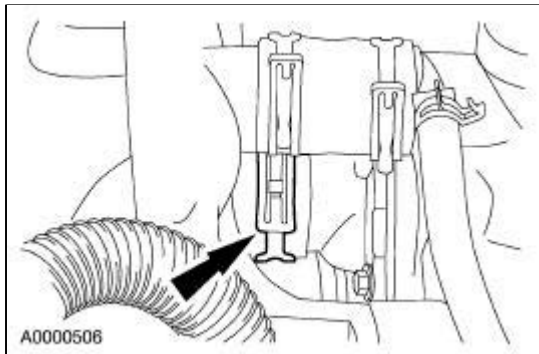
8. Remove the bracket.
 1. Remove the nuts.
 2. Remove the bracket.



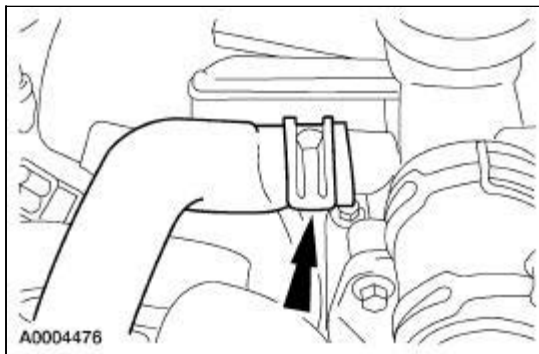
9. Remove the lower radiator hose stud bolts.



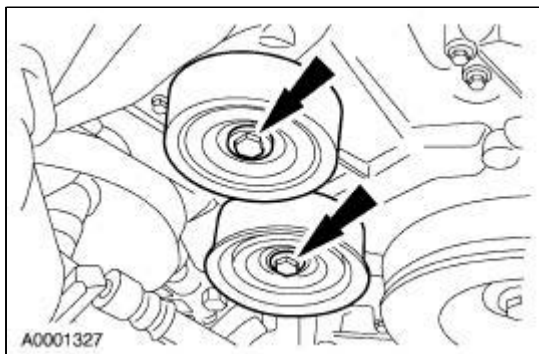
10. Disconnect the lower radiator hose from the thermostat housing.



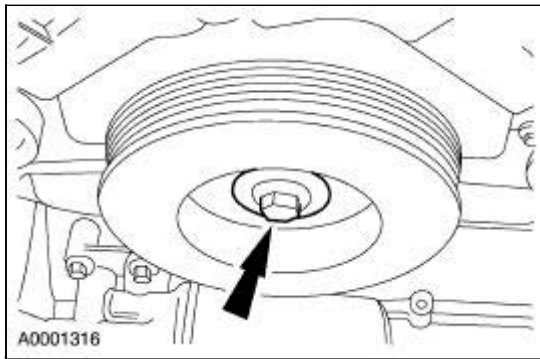
11. Disconnect the heater hose.



12. Remove the idler pulleys.

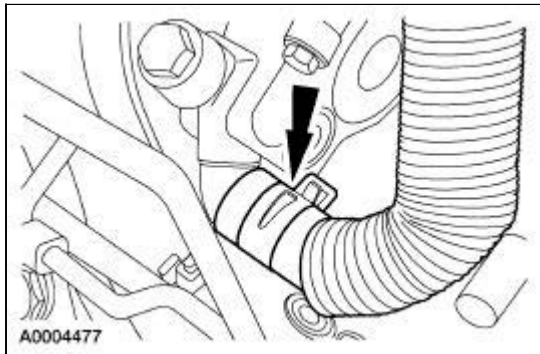


13. Remove the crankshaft pulley. For additional information, refer to [Crankshaft Pulley](#) in this section.



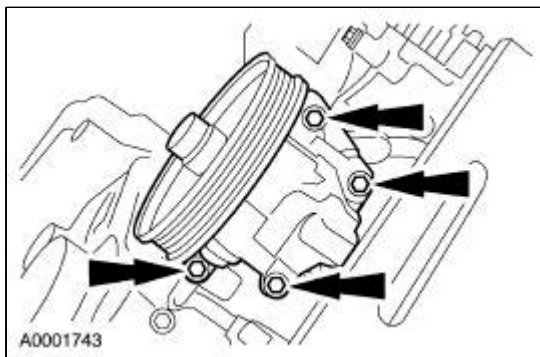
14. Remove the A/C compressor. For additional information, refer to [Section 412-03](#).

15. Disconnect the power steering reservoir hose and drain the reservoir

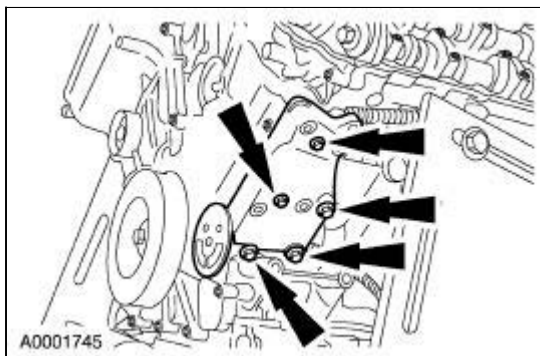


16. **NOTE:** One bolt is blocked by the power steering pressure line and will have to be removed in stages.

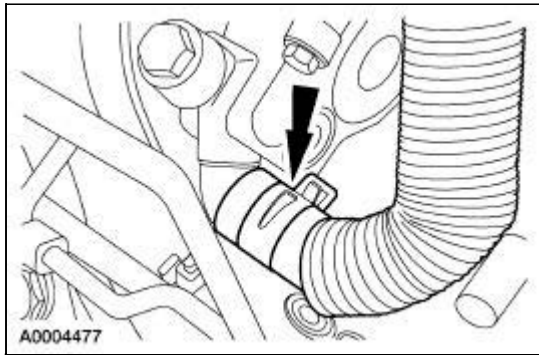
Remove the bolts and position the power steering pump aside.



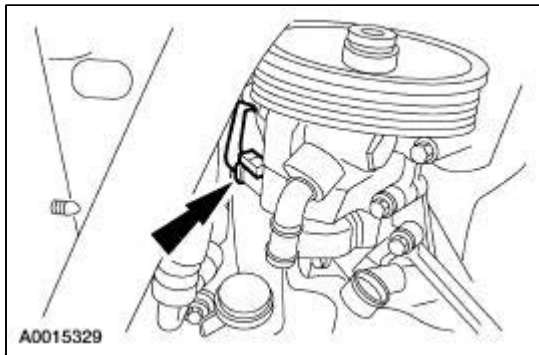
17. Remove the power steering pump bracket.



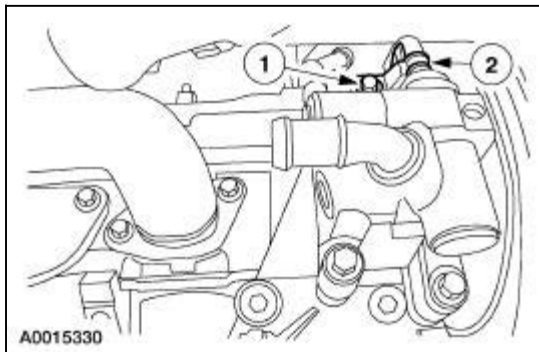
18. Disconnect the hydraulic cooling fan pump reservoir hose and drain the reservoir.



19. Disconnect the electrical connector.

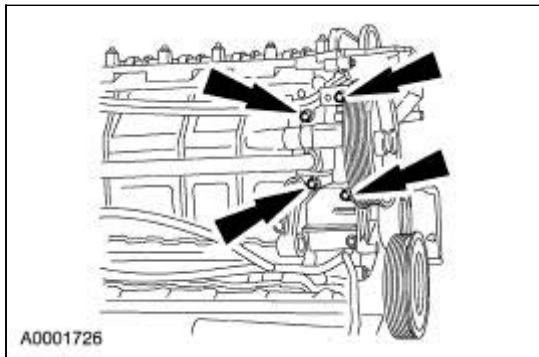


20. Remove the hydraulic fan pump reservoir line bracket.
1. Remove the bolt.
2. Remove the bracket.

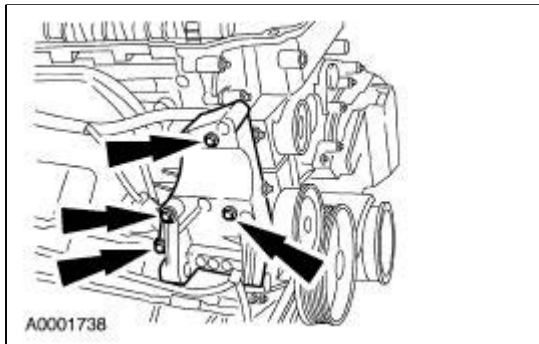


21. **NOTE:** One bolt is blocked by the hydraulic cooling fan pressure line and will have to be removed in stages.

Remove the hydraulic cooling fan pump.

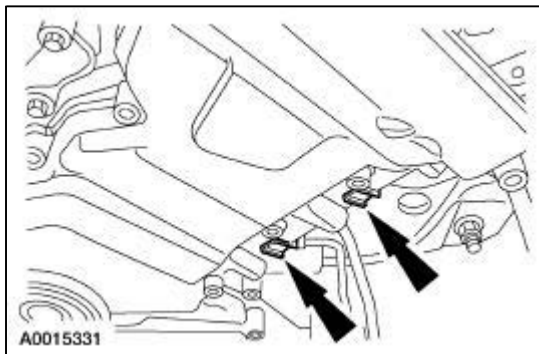


22. Remove the hydraulic cooling fan pump bracket.



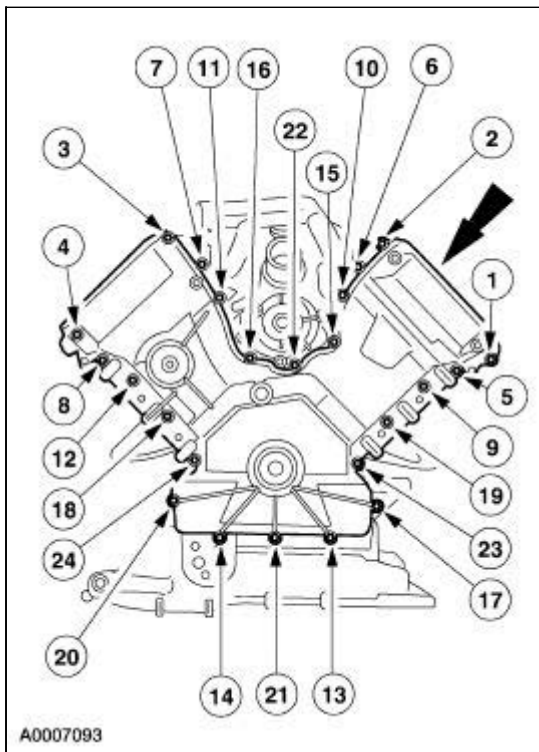
23. Lower the vehicle.


24. Disconnect the five wiring harness clips.



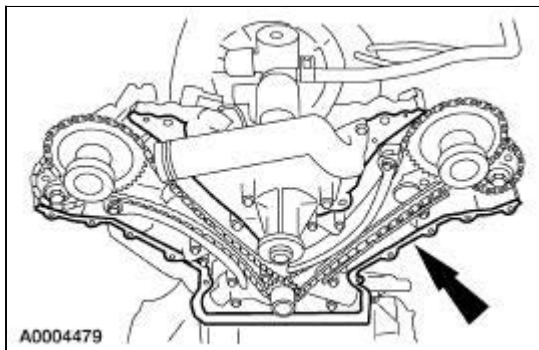
25. Remove the engine front cover.

- Remove the bolts in the sequence shown.
- Remove the engine front cover.



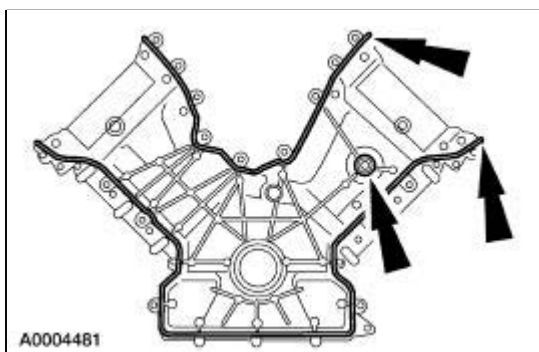
26.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.

Clean the sealing surfaces.

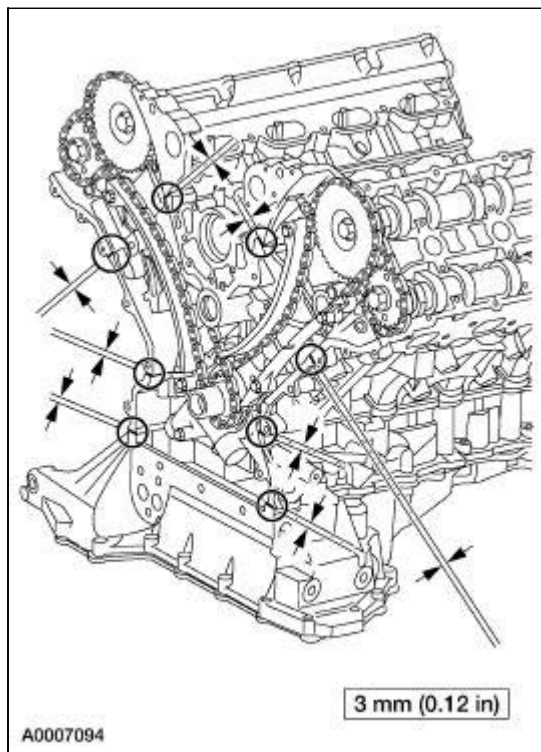


Installation

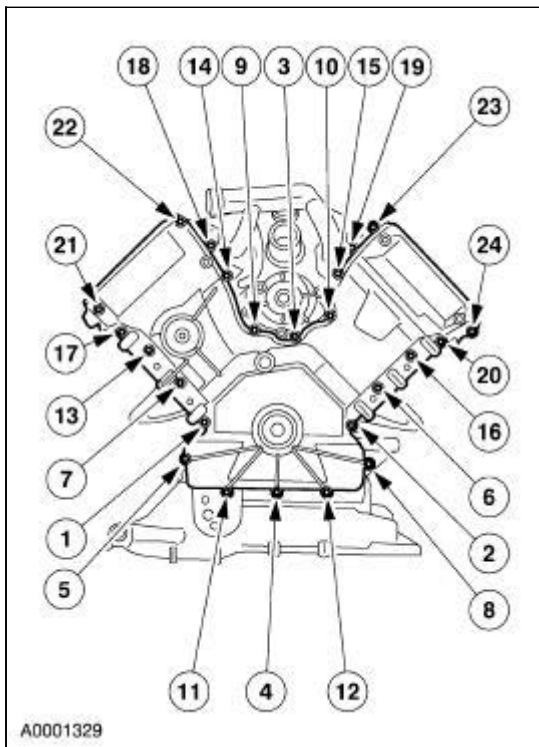
1. Install new gaskets.



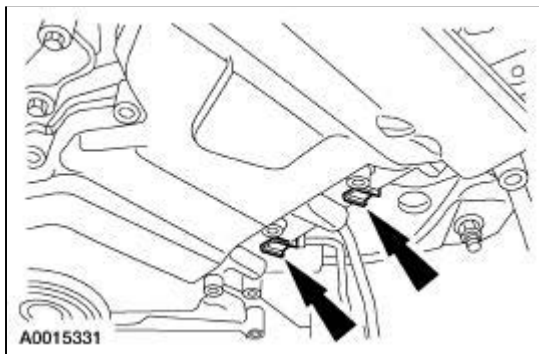
2. Apply Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4 in eight places.



3. Install the engine front cover.
 - Position the engine front cover on the cylinder block.
 - Loosely install the bolts.
 - Tighten the bolts in two stages in the sequence shown.
 - Stage 1: Tighten to 5 Nm (44 lb-in).
 - Stage 2: Tighten to 10 Nm (89 lb-in).

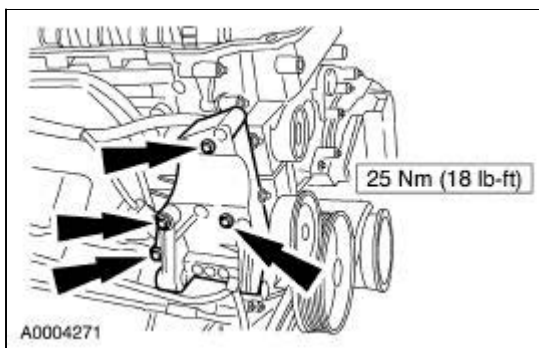


4. Connect the five wiring harness clips.



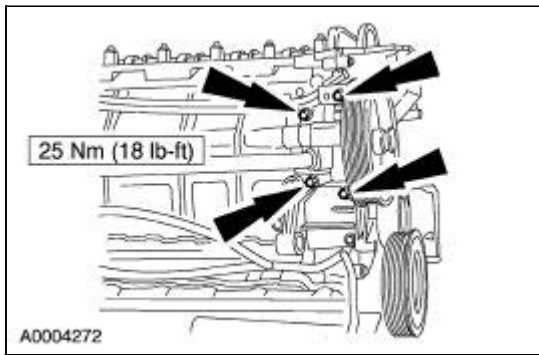
5. Raise the vehicle.
6. **NOTE:** The wiring harness is positioned behind the bracket.

Install the hydraulic cooling fan pump bracket.

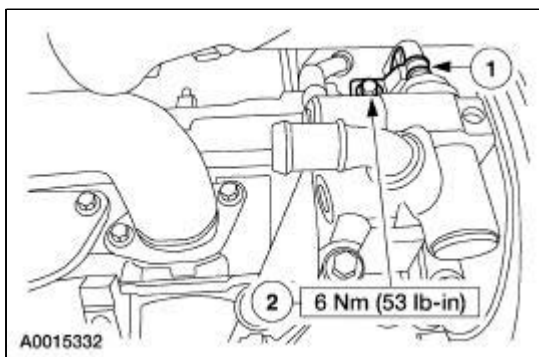


7. **NOTE:** One bolt is blocked by the hydraulic cooling fan pressure line and will have to be installed in stages.

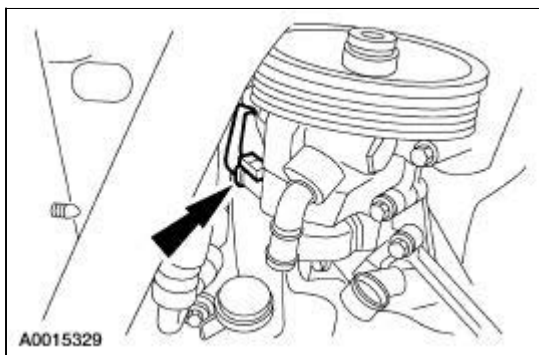
Install the hydraulic cooling fan pump.



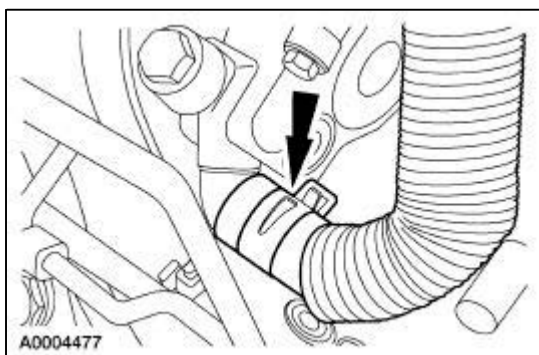
8. Install the hydraulic fan pump reservoir line bracket.
 1. Install the bracket.
 2. Install the bolt.



9. Connect the electrical connector.

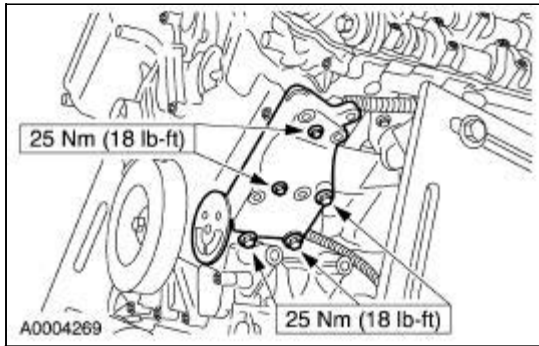


10. Connect the hydraulic cooling fan reservoir hose.



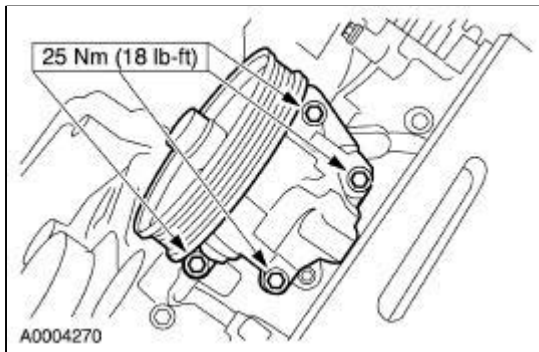
11. **NOTE:** The wiring harness is positioned behind the bracket.

Install the power steering pump bracket.

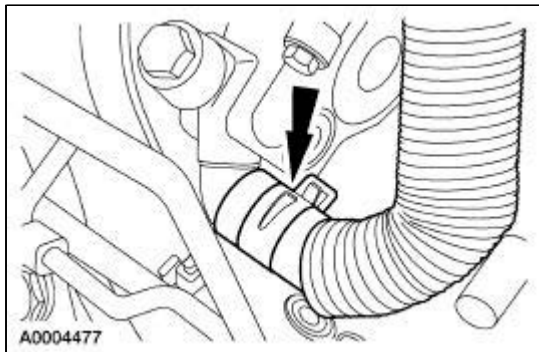


12. **NOTE:** One bolt is blocked by the power steering pressure line and will have to be installed in stages.

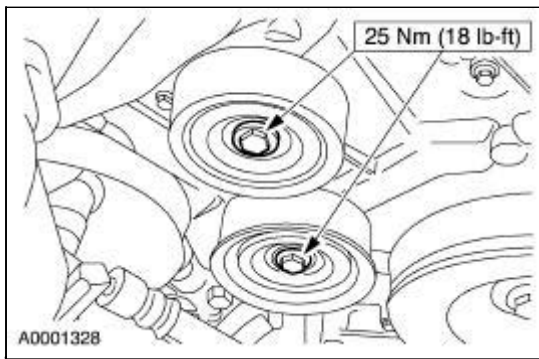
Install the power steering pump.



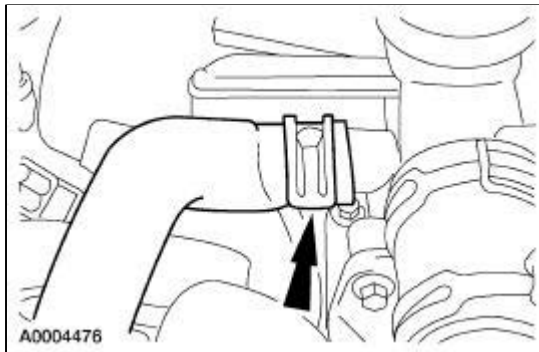
13. Connect the power steering reservoir hose.



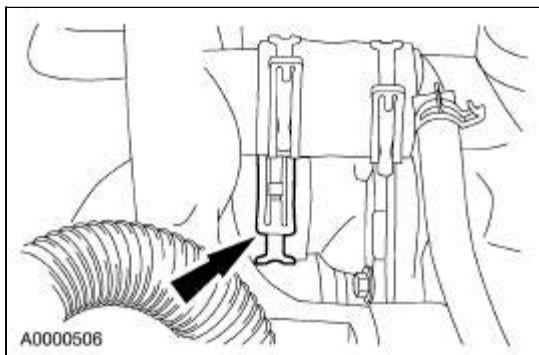
14. Install the A/C compressor. For additional information, refer to [Section 412-03](#).
15. Install the crankshaft pulley. For additional information, refer to [Crankshaft Pulley](#) in this section.
16. Install the idler pulleys.



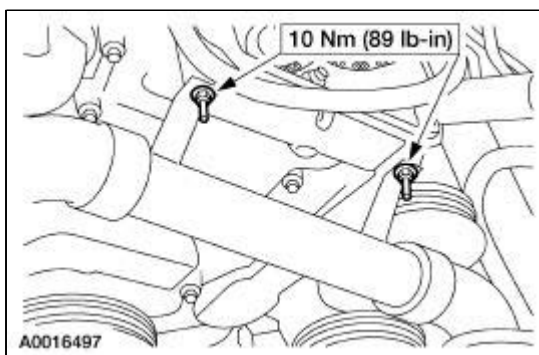
17. Connect the heater hose.



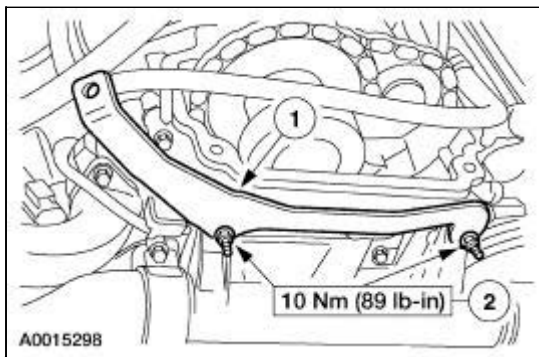
18. Connect the lower radiator hose to the thermostat housing.



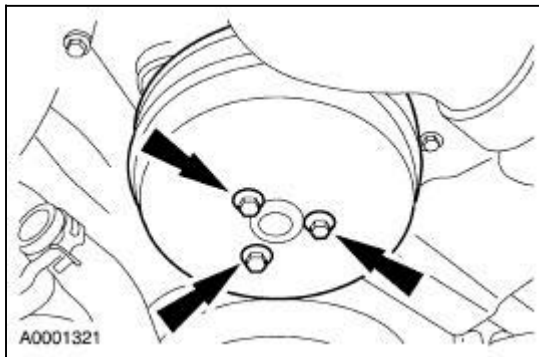
19. Install the stud bolts.



20. Install the bracket.
1. Install the bracket.
2. Install the nuts.





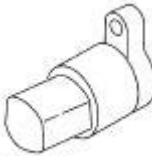
21. Position the water pump pulley and loosely install new bolts.
22. Install the generator. For additional information, refer to [Section 414-02](#).
23. Tighten the bolts in two stages.
 - Stage 1: Tighten to 10 Nm (89 lb-in).
 - Stage 2: Tighten an additional 45 degrees.



24. Install the engine cooling fan assembly. For additional information, refer to [Section 303-03](#).
 25. Install the RH valve cover. For additional information, refer to [Valve Cover—RH](#) in this section.
 26. Install the LH valve cover. For additional information, refer to [Valve Cover—LH](#) in this section.
 27. Fill and bleed the engine cooling system. For additional information, refer to [Section 303-03](#).
 28. Fill and bleed the hydraulic cooling fan. For additional information, refer to [Section 303-03](#).
 29. Fill the power steering system. For additional information, refer to [Section 211-00](#).
-

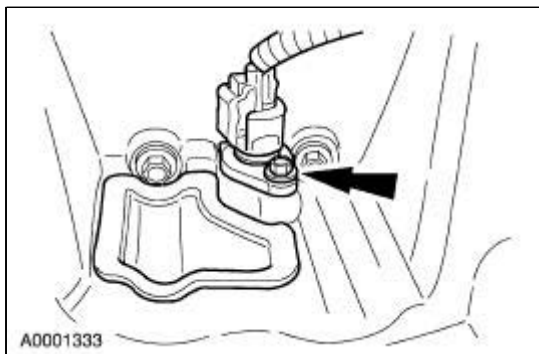
Timing Drive Components —Primary

Special Tool(s)

 ST2398-B	Camshaft Setting/Locking Tool 303-530
 ST2399-A	Timing Chain Tensioning Tool 303-532
 ST2401-A	Crankshaft Positioning Tool 303-645

Removal

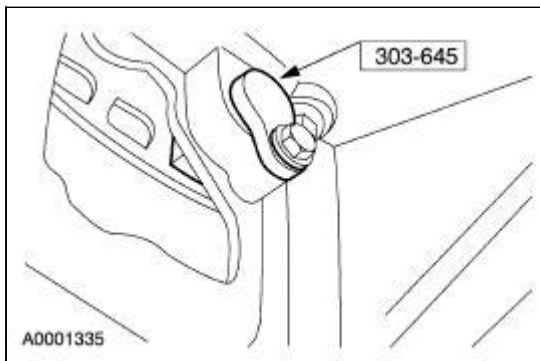
1. Remove the engine front cover. For additional information, refer to [Engine Front Cover](#) in this section.
2. Raise the vehicle.
3. Remove the crankshaft position (CKP) sensor and the torque converter cover.



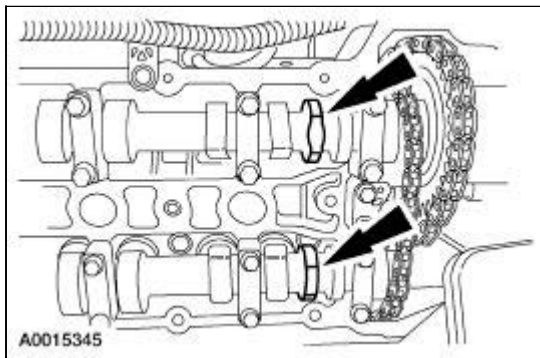
4. **NOTE:** There is one window on the ignition pulse wheel that is unique to accept the special tool.

Install the special tool.

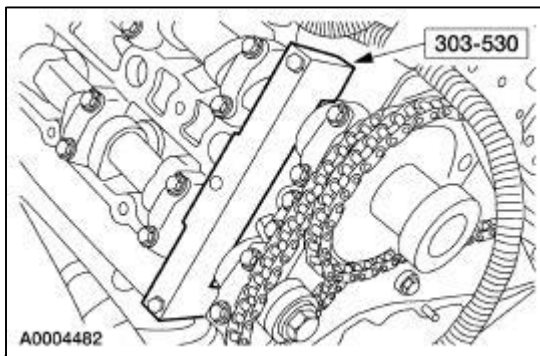
- Turn the crankshaft to 45 degrees ATDC. The crankshaft keyway will be in the 6 o'clock position.
- Install the special tool.



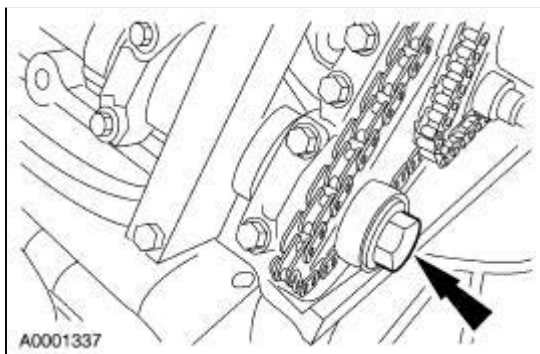
5. Lower the vehicle.
6. Make sure the lobes of the camshaft are facing upwards. If not, repeat Step 4.



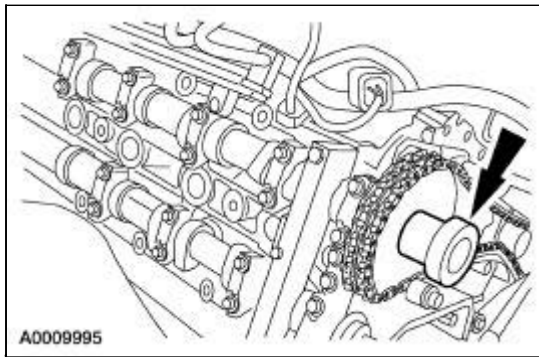
7. Install the special tool on the RH cylinder head.



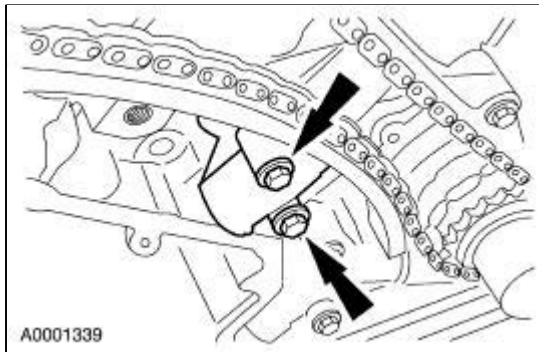
8. Loosen the exhaust camshaft sprocket bolt.



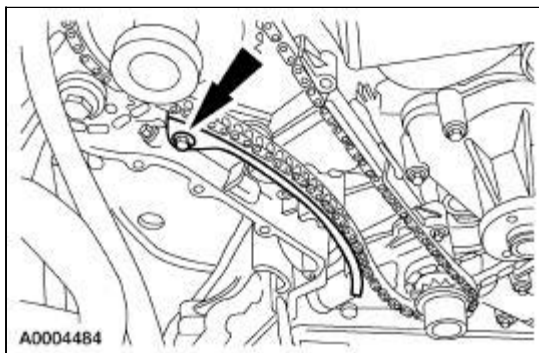
9. Loosen the intake camshaft sprocket bolt and slide the camshaft sprockets forward on the bolts.



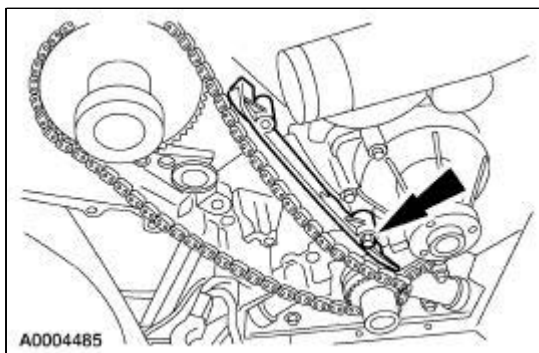
10. Remove the RH timing chain tensioner and blanking plate.



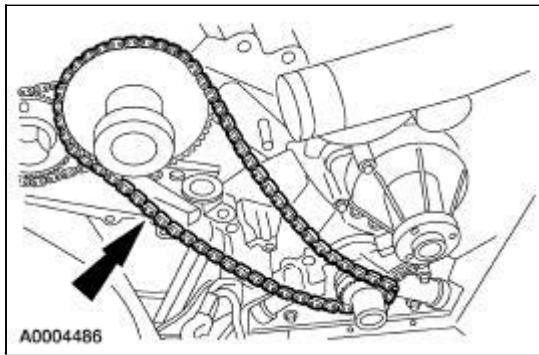
11. Remove the tensioner arm.



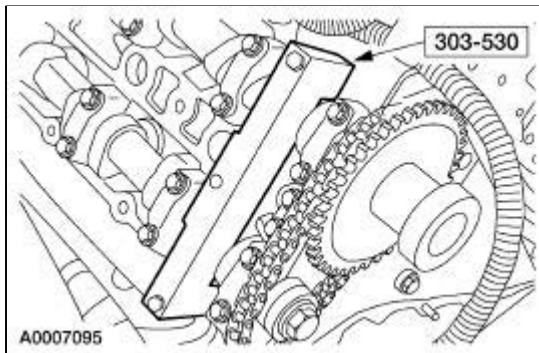
12. Remove the timing chain guide.



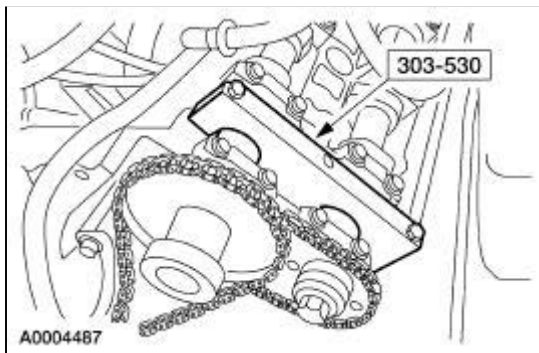
13. Remove the RH primary timing chain and crankshaft sprocket as an assembly.



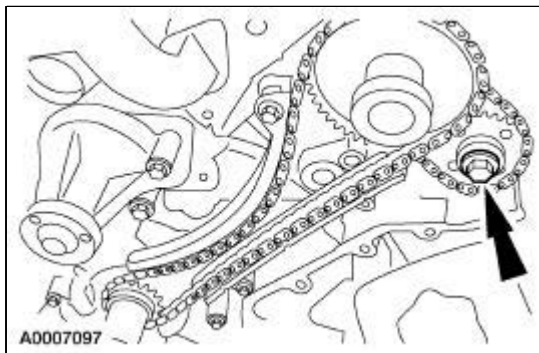
14. Remove the special tool from the RH head.



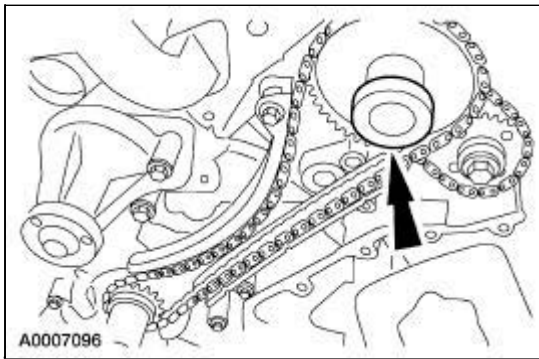
15. Install the special tool on the LH head.



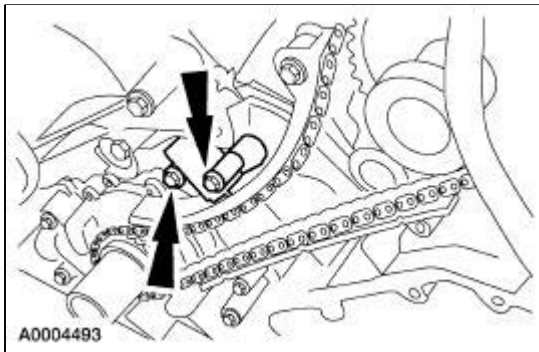
16. Loosen the exhaust camshaft sprocket bolt.



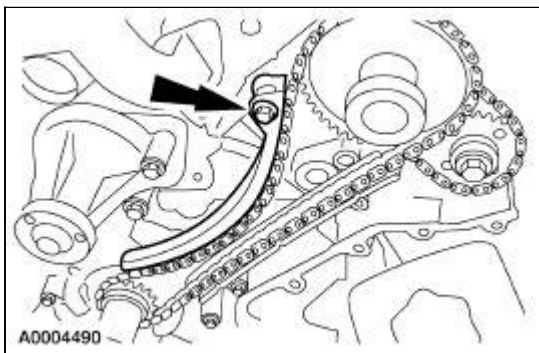
17. Loosen the intake sprocket bolt and slide the camshaft sprockets forward on the bolts.



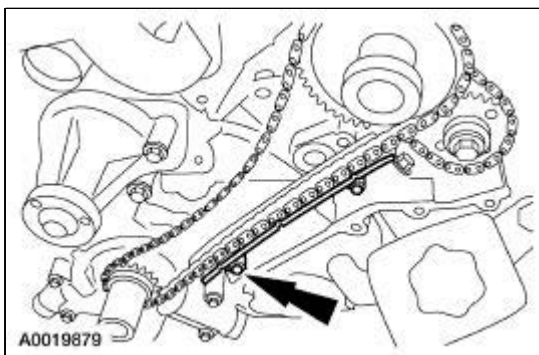
18. Remove the LH timing chain tensioner and blanking plate.



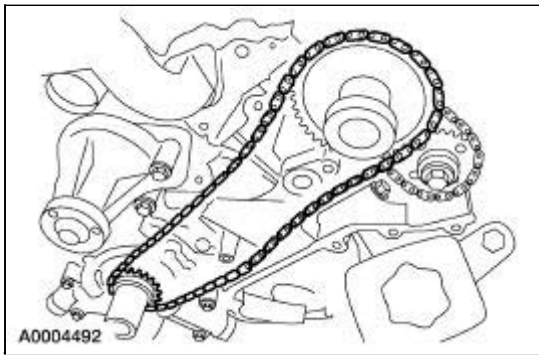
19. Remove the tensioner arm.



20. Remove the timing chain guide.

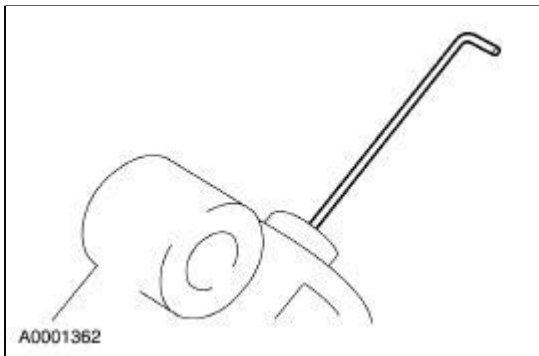


21. Remove the LH primary timing chain and crankshaft sprocket as an assembly.



Installation

1. Reset the timing chain tensioners.
 - Insert a fine wire and dislodge the check ball.
 - Using finger pressure, compress the tensioner.
 - Remove the wire.

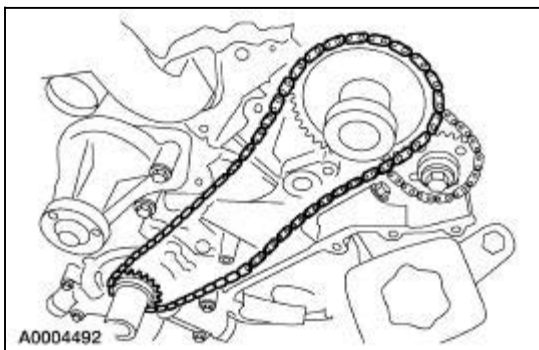


2. **NOTE:** If the timing mark on the LH timing chain crankshaft gear is facing toward the rear of the engine, install the RH timing chain crankshaft gear with the mark facing forward. If the timing mark on the LH timing chain crankshaft gear is facing toward the front of the engine, install the RH timing chain crankshaft gear with the mark facing toward the rear of the engine.

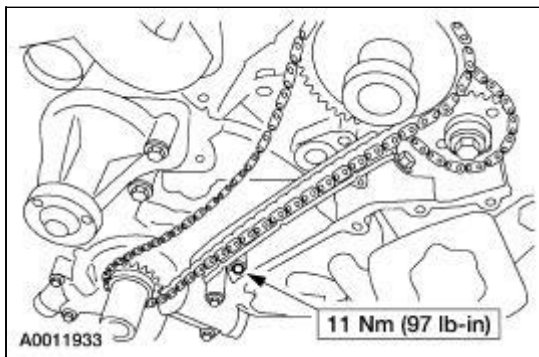
NOTE: The camshaft holding tool should still be installed on the LH cylinder head.

Position the LH timing chain and crankshaft gear.

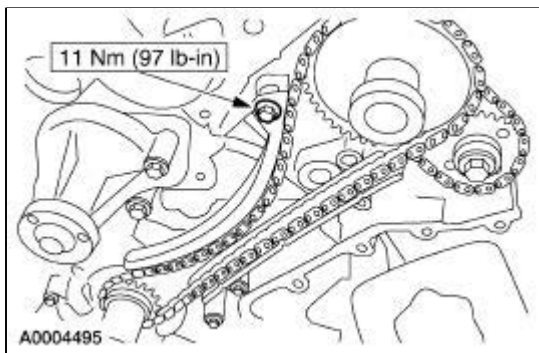
- Position the timing chain over the LH intake camshaft sprocket.
- Position the crankshaft gear in the timing chain.
- Position the timing chain and crankshaft gear over the crankshaft as an assembly.



3. Install the LH timing chain guide.



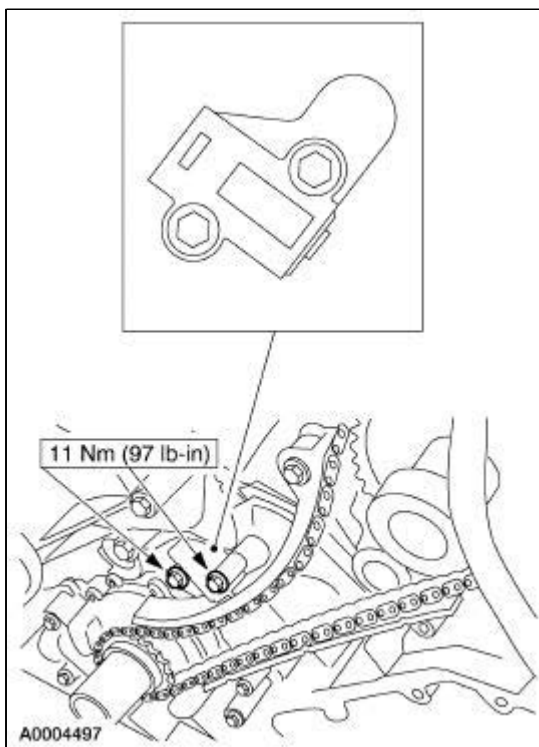
4. Install the LH timing chain tensioner arm.



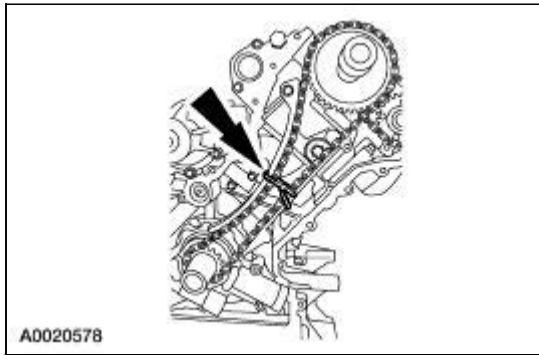
5.  **CAUTION:** The orientation of the blanking plate must be as shown or the oil galley will not seal, resulting in low oil pressure and possible engine damage.

Install the LH timing chain tensioner.

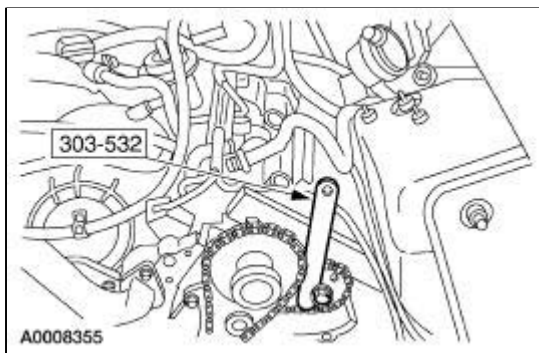
- Position the blanking plate.
- Install the LH timing chain tensioner and blanking plate.



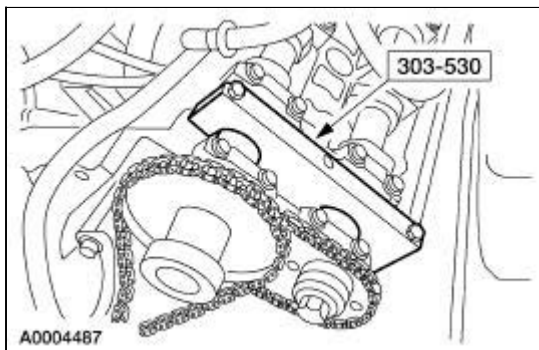
6. Install a tie strap to take up the slack in the timing chain.



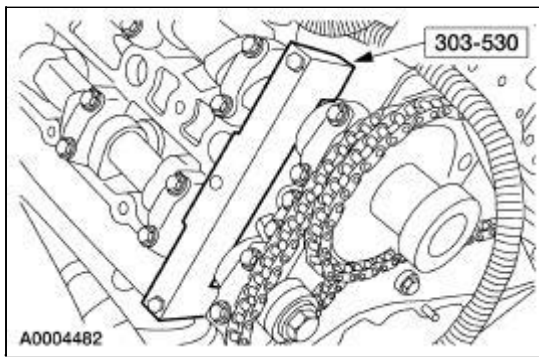
7. Using the special tool, apply tension to the LH exhaust camshaft sprocket and tighten the camshaft sprocket bolts in two stages.
- Stage 1: Tighten to 20 Nm (15 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.



8. Remove the special tool.



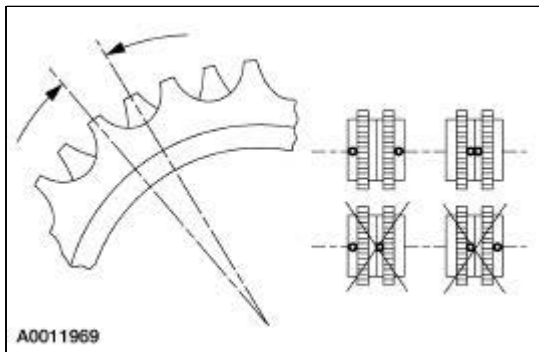
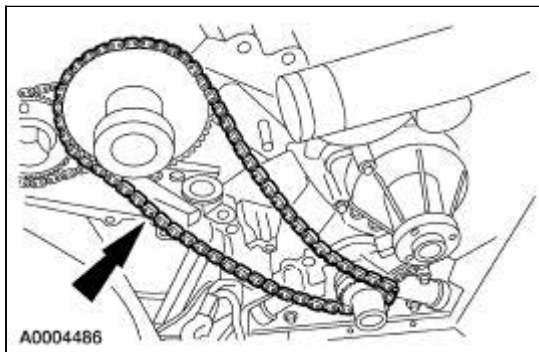
9. Remove the tie strap.
10. Install the special tool on the right cylinder head.



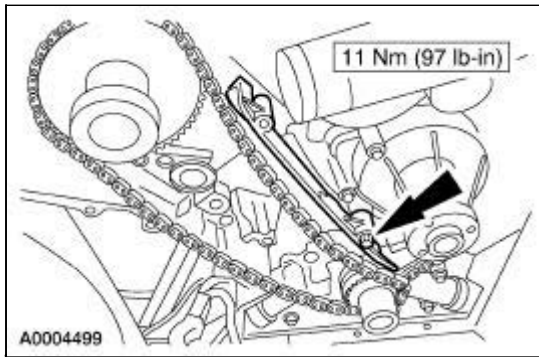
11. **NOTE:** If the timing mark on the LH timing chain crankshaft gear is facing toward the rear of the engine, install the RH timing chain crankshaft gear with the mark facing forward. If the timing mark on the LH timing chain crankshaft gear is facing toward the front of the engine, install the RH timing chain crankshaft gear with the mark facing toward the rear of the engine.

Position the RH timing chain and crankshaft gear.

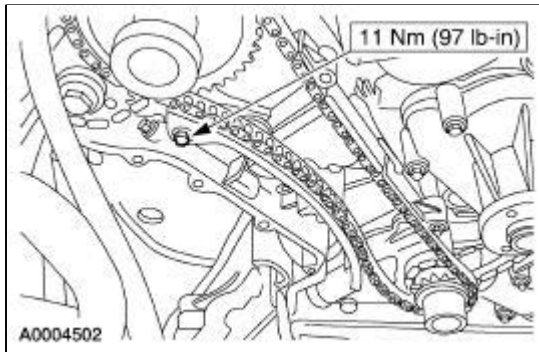
- Position the timing chain over the RH intake camshaft sprocket.
- Position the crankshaft gear in the timing chain.
- Position the timing chain and crankshaft gear over the crankshaft as an assembly.




12. Install the RH timing chain guide.



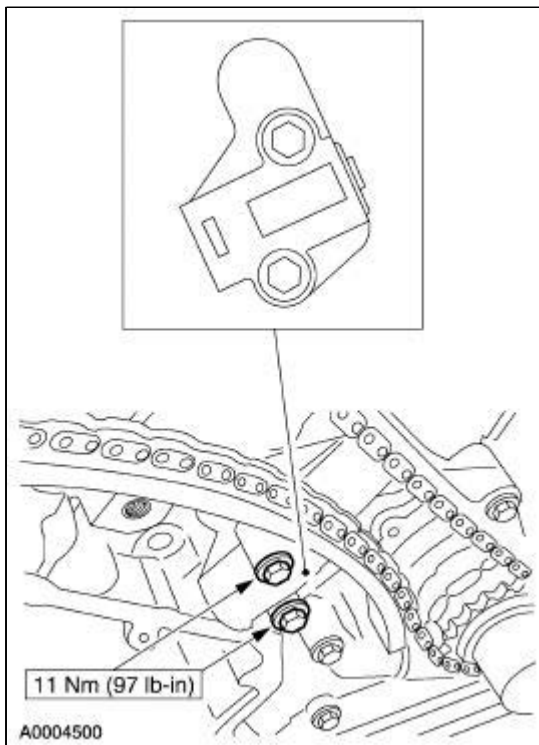
13. Install the RH timing chain tensioner arm.



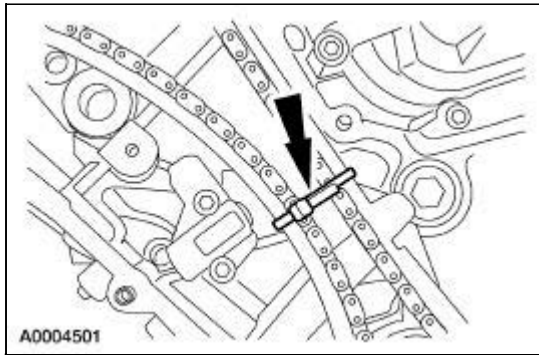
14.  **CAUTION:** The orientation of the blanking plate must be as shown or the oil galley will not seal, resulting in low oil pressure and possible engine damage.

Install the RH timing chain tensioner.

- Position the blanking plate.
- Install the RH timing chain tensioner and blanking plate.



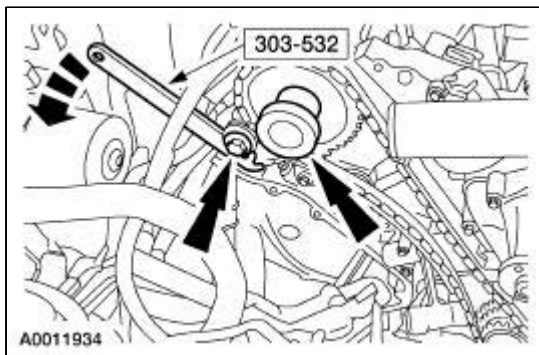
15. Install a tie strap to take up the slack in the timing chain.



16. **NOTE:** The exhaust camshaft sprocket bolt must be fully tightened before tightening the intake camshaft sprocket bolt.

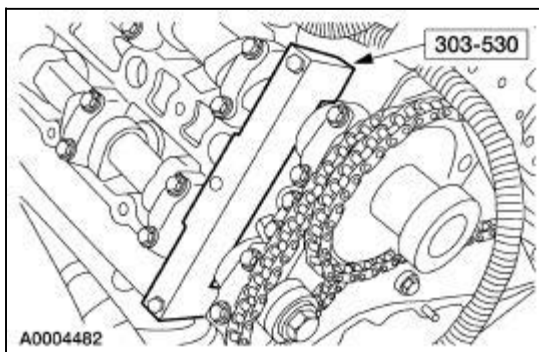
Using the special tool, apply tension to the RH exhaust camshaft sprocket and tighten the camshaft sprocket bolts in two stages.

- Stage 1: Tighten to 20 Nm (15 lb-ft).
- Stage 2: Tighten an additional 90 degrees.



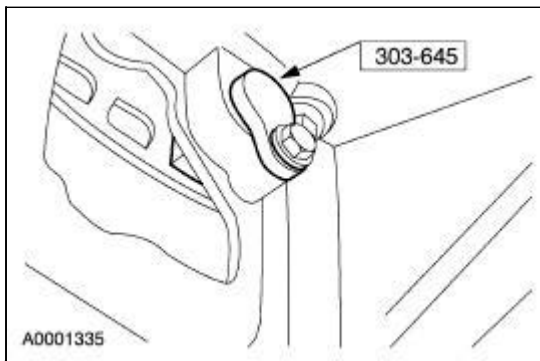
17. Remove the special tool.

- Remove the tie strap.

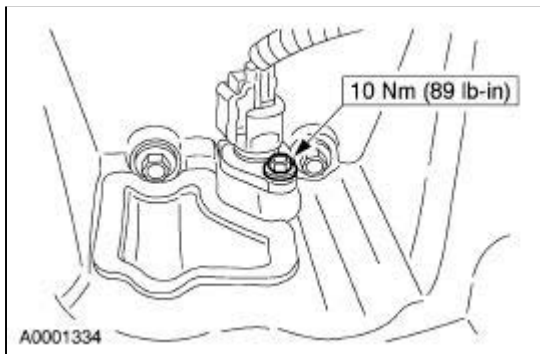


18. Raise the vehicle.

19. Remove the special tool.



20. Install the CKP sensor and the torque converter cover.



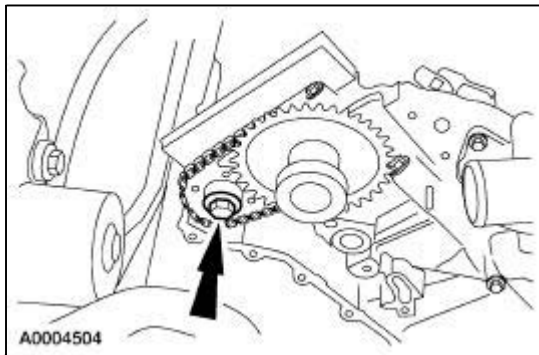
21. Lower the vehicle.
 22. Install the engine front cover. For additional information, refer to [Engine Front Cover](#) in this section.
-

Timing Drive Components —Secondary

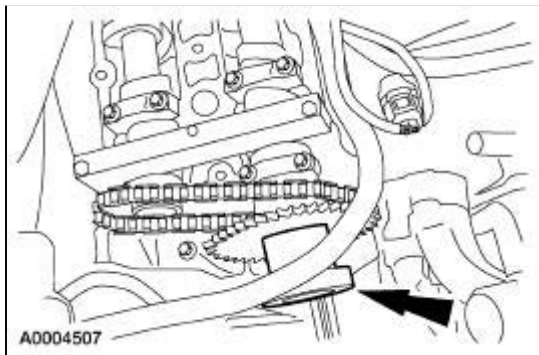
Removal

NOTE: The RH secondary timing chains are shown; the LH secondary timing chains are similar.

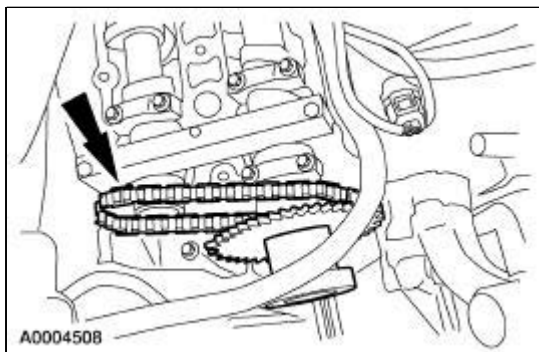
1. Remove the primary timing chains. For additional information, refer to [Timing Drive Components—Primary](#) in this section.
2. Remove the exhaust sprocket bolt.



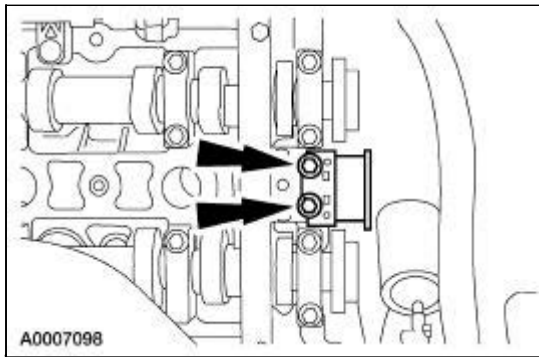
3. Remove the intake sprocket bolt and remove the camshaft damper.



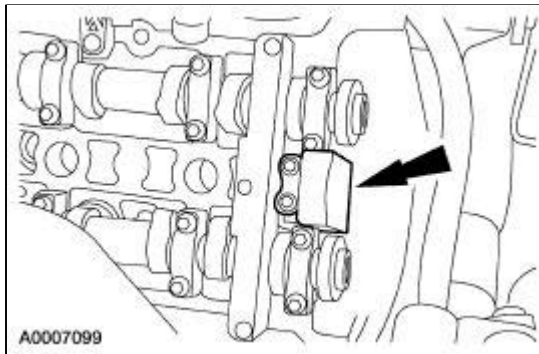
4. Remove the sprockets, damper, and chain as an assembly.



5. Remove the secondary timing chain tensioner bolts.

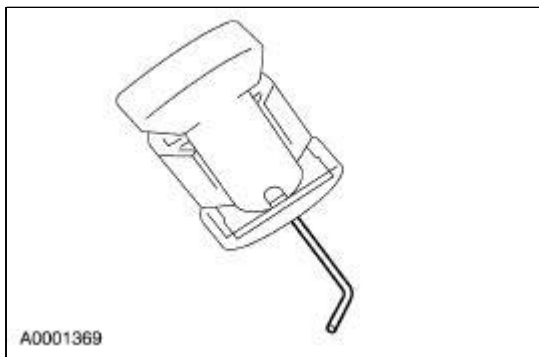


6. Remove the tensioner.

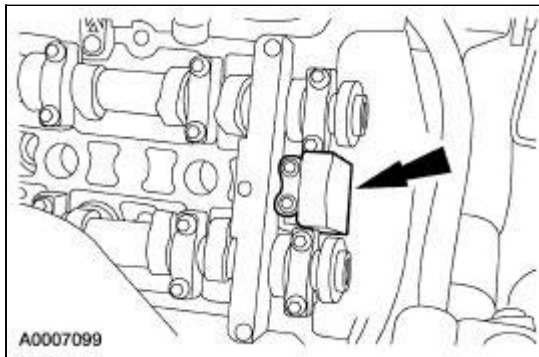


Installation

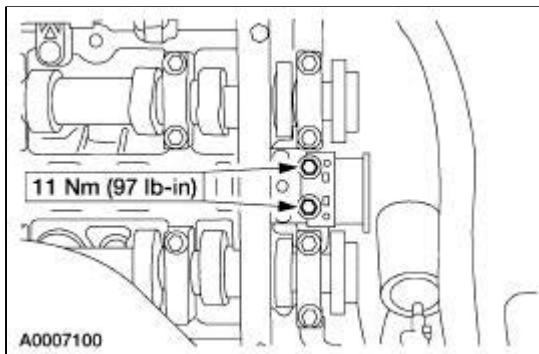
1. Collapse the tensioners.
 - Insert a thin wire into the check valve.
 - Apply hand pressure until the tensioner is fully collapsed.
 - Remove the wire.



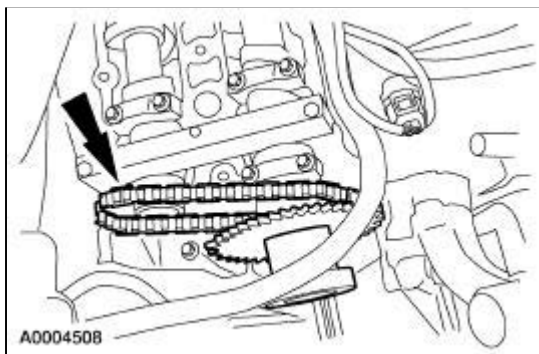
2. Position the tensioner.



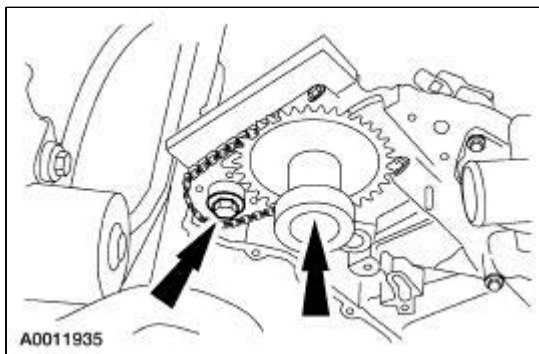
3. Install the timing chain tensioner bolts.



4. Position the intake sprocket, damper, chain and exhaust sprocket on the intake camshaft as an assembly.




5. Loosely install the intake and exhaust sprocket bolts.



6. Install the primary timing chains. For additional information, refer to [Timing Drive Components—Primary](#) in this section.


Valve —Valve Springs

Special Tool(s)

 ST2489-A	Valve Spring Compressor 303-648
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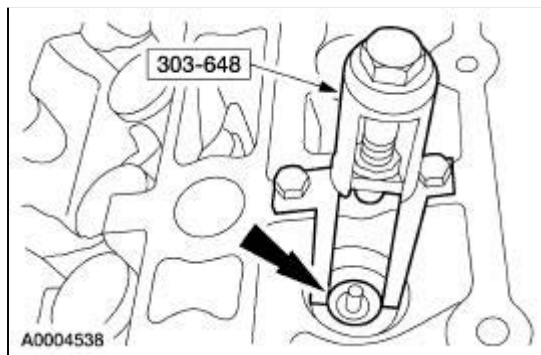
Removal

1. Remove the camshaft. For additional information, refer to [Camshaft](#) in this section.
2. Position the piston at the top of the stroke on the appropriate cylinder.
3. Remove the spark plug and apply compressed air in the cylinder to hold both valves in position.

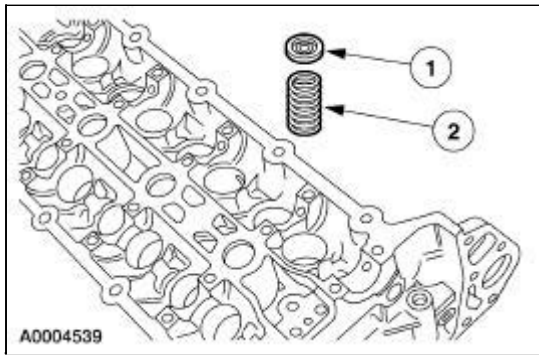
4.  **CAUTION:** If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve to fall into the cylinder. If air pressure must be removed, support the valve prior to removal.

Remove the bucket tappet and shim from the valve.

5. Using the special tool, remove the retainer keys.



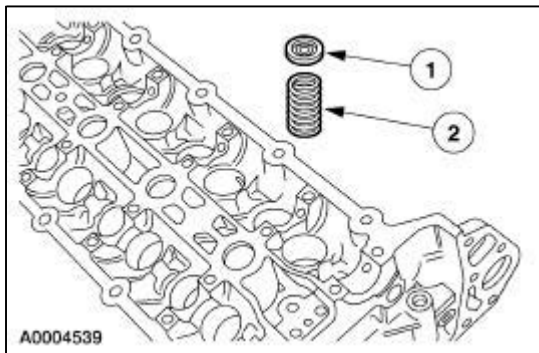
6. Remove the valve springs.
 1. Remove the spring retainers.
 2. Remove the valve springs.



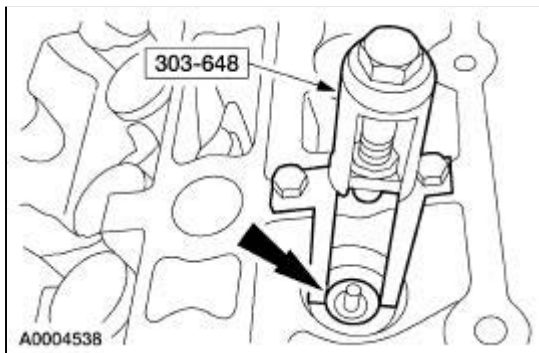
7. Repeat the procedure until all of the valve springs are removed.

Installation

1. Position the valve springs.
 1. Position the spring retainers.
 2. Position the valve springs.



2. Using the special tool, install the retainer keys.

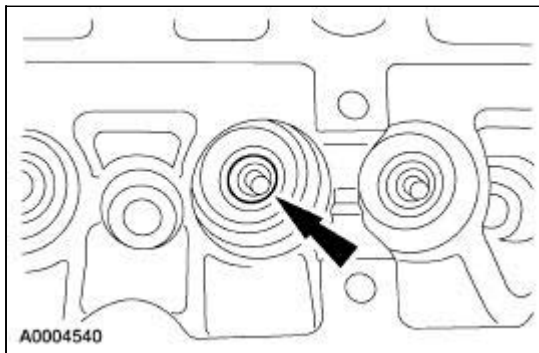


3. Repeat the procedure until all of the valve springs are installed.
 4. Install the camshaft. For additional information, refer to [Camshaft](#) in this section.
-

Valve —Valve Seals

Removal

1. Remove the valve springs. For additional information, refer to [Valve —Valve Springs](#) in this section.
2. Remove the valve stem seals.



Installation

1. **NOTE:** The valve stem seal must be bottomed on the valve seat.


NOTE: Make sure that the garter spring is present in the valve stem seal.

Install the valve stem seals over the valve stems.

2. Install the valve springs. For additional information, refer to [Valve —Valve Springs](#) in this section.
-

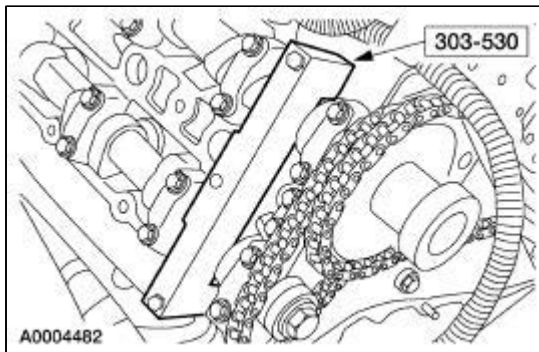
Camshaft


Special Tool(s)

 ST2398-B	Camshaft Setting/Locking Tool 303-530
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Removal

1. Remove the primary timing chains. For additional information, refer to [Timing Drive Components—Primary](#) in this section.
2. Remove the secondary timing chains. For additional information, refer to [Timing Drive Components—Secondary](#) in this section.
3. Remove the special tool.



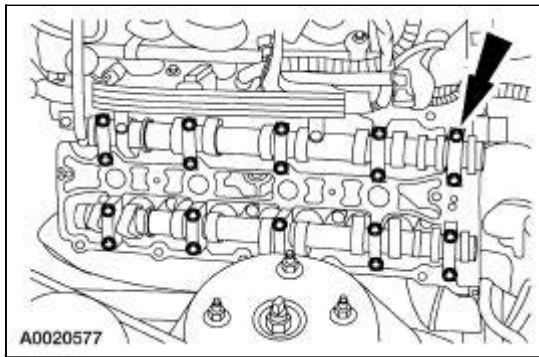
4.  **CAUTION:** Record the camshaft bearing cap locations. The camshaft bearing caps are positional and must be installed in their original locations and orientations or engine damage may occur.

 **CAUTION:** Do not use any means of marking the shims other than a permanent type marker. Any scratches or paint on the shims may result in incorrect lash adjustments and severe engine damage.

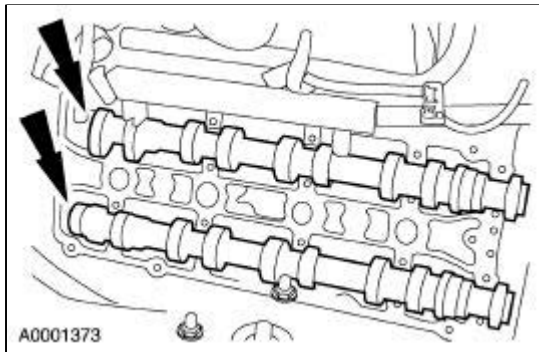
 **CAUTION:** Record the shim and bucket tappet location. The shim and bucket tappet are positional and if installed in the incorrect location, engine damage may occur.


Remove the RH camshaft bearing caps.

- Remove the bolts.
- Remove the RH camshaft bearing caps.




5. Remove the RH camshafts (6A270 intake and 6A272 exhaust).



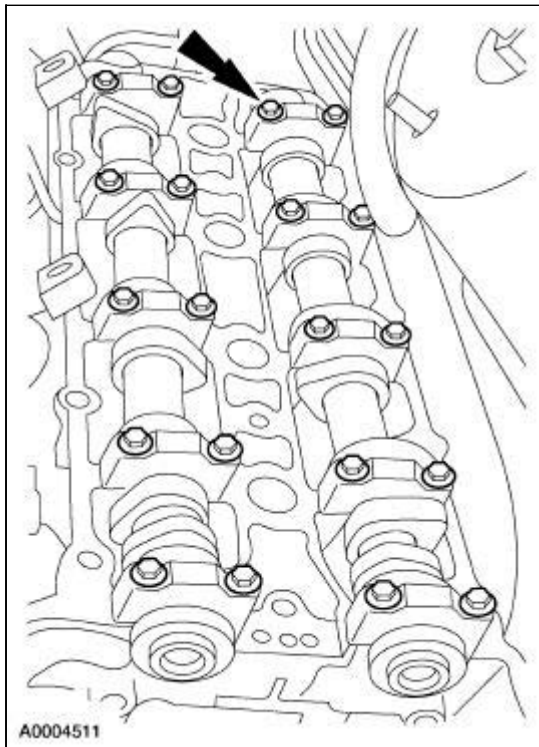
6.  **CAUTION:** Record the camshaft bearing cap locations. The camshaft bearing caps are positional and must be installed in their original locations and orientations or engine damage may occur.

 **CAUTION:** Do not use any means of marking the shims other than a permanent type marker. Any scratches or paint on the shims may result in incorrect lash adjustments and severe engine damage.

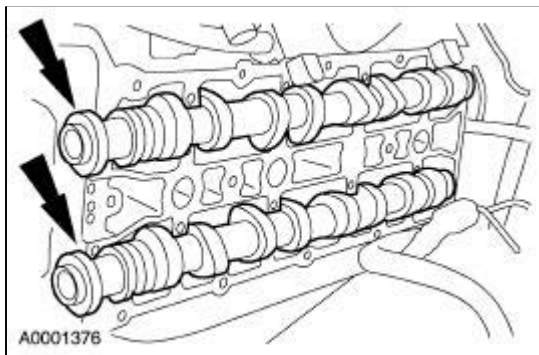
 **CAUTION:** Record the location of the shims and bucket tappets. The bucket tappets and shims are positional and if installed in the incorrect location, engine damage may occur.

Remove the LH camshaft bearing caps.

- Remove the bolts.
- Remove the LH camshaft bearing caps.



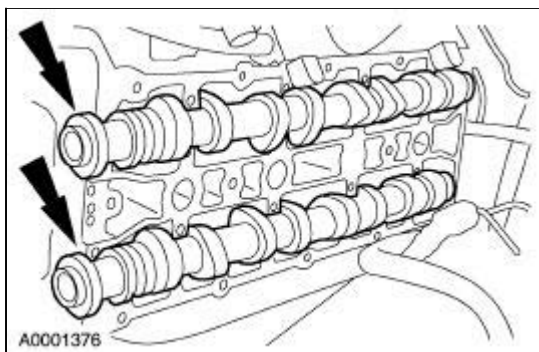
7. Remove the LH camshafts.



Installation

1. **NOTE:** Apply Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G to the camshaft journals, the camshaft caps and the camshaft lobes prior to installing the camshafts.

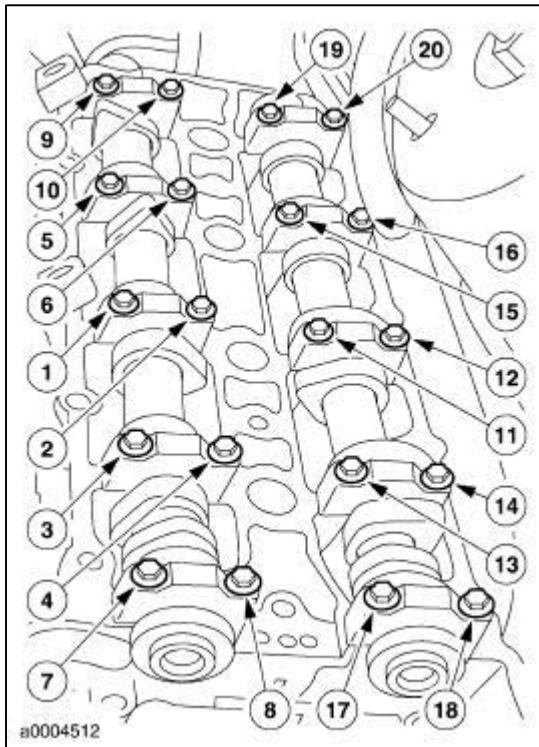
Position the LH camshafts on the camshaft journals.



2.  **CAUTION:** Install the camshaft bearing caps. The camshaft bearing caps are positional and must be installed in their original locations and orientations or engine damage may occur.

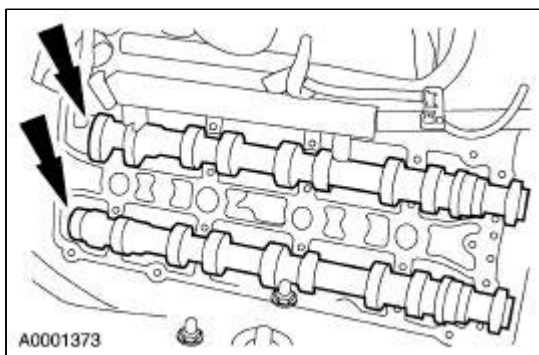
Install the LH camshaft bearing caps.

- Position the bearing caps.
- Install the bearing cap bolts. Tighten the bolts in three stages in the sequence shown.
 - Stage 1: Hand-tighten.
 - Stage 2: Tighten to 6 Nm (53 lb-in).
 - Stage 3: Tighten an additional 90 degrees.



3. **NOTE:** Apply Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G to the camshaft journals, the camshaft caps and the camshaft lobes prior to installing the camshafts.

Install the RH camshafts.

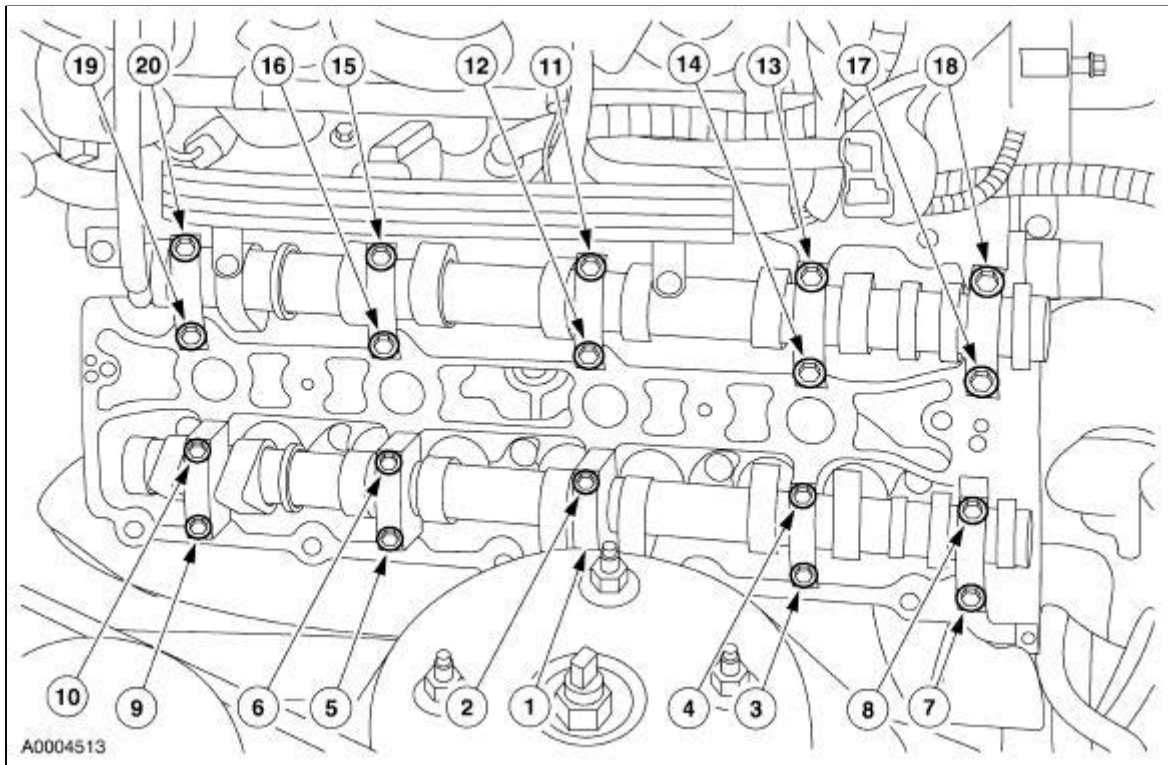



4.  **CAUTION:** Install the camshaft bearing caps. The camshaft bearing caps are positional and must be installed in their original locations and orientations or engine

damage may occur.

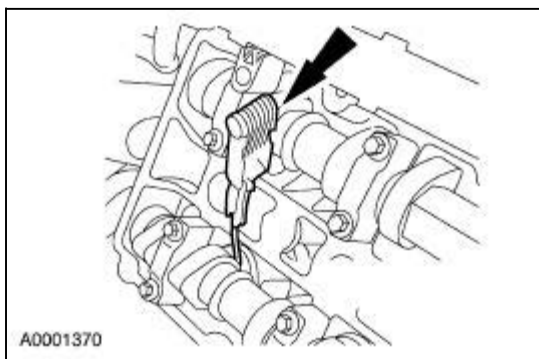
Install the RH camshaft bearing caps.

- Position the bearing caps.
- Install the bolts. Tighten the bolts in three stages in the sequence shown.
 - Stage 1: Hand-tighten.
 - Stage 2: Tighten to 6 Nm (53 lb-in).
 - Stage 3: Tighten an additional 90 degrees.

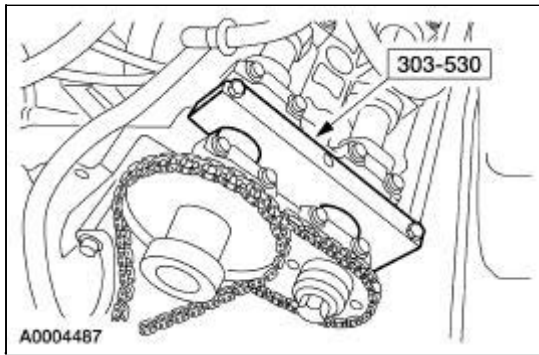


5.  **CAUTION:** If any of the following components are replaced, the engine must be reshimmed or engine damage may occur: The camshafts, the valves, cylinder heads, or bucket tappets .

Using feeler gages, confirm that the tappet and shim clearances are within specification.



6. Install the special tool on the LH head.

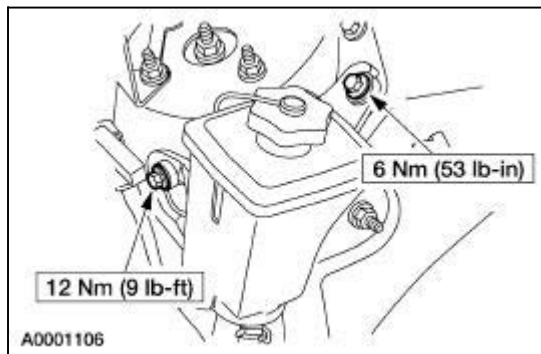


7. Install the primary and secondary timing chains. For additional information, refer to [Timing Drive Components—Primary](#) and [Timing Drive Components—Secondary](#) in this section.
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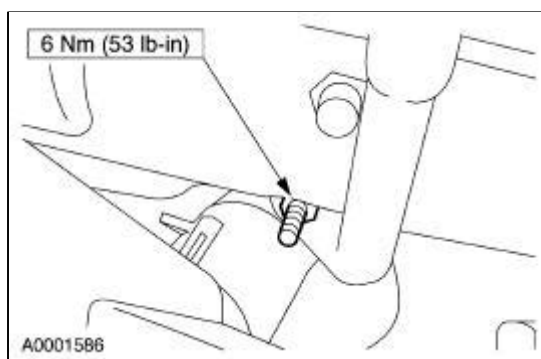
Exhaust Manifold —LH

Removal

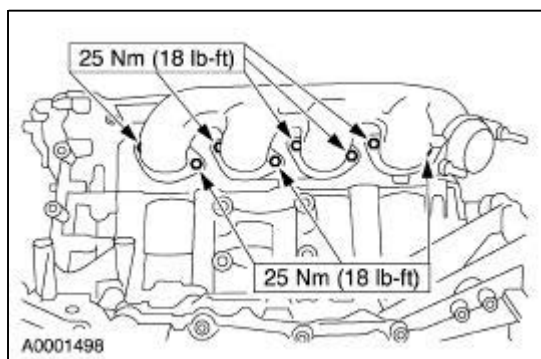
1. Remove the bolts and position the power steering reservoir aside.



2. Remove the nut and position the oil level indicator tube aside.



3. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
4. Disconnect the three-way catalytic (TWC) converter from the exhaust manifold. For additional information, refer to [Section 309-00](#).
5. Remove the exhaust manifold.
 - Remove the eight bolts.
 - Remove the exhaust manifold and discard the gasket.



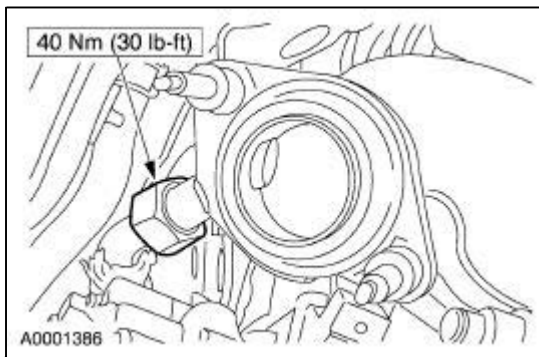
Installation

1. To install, reverse the removal procedure.
 - Install a new gasket.
-

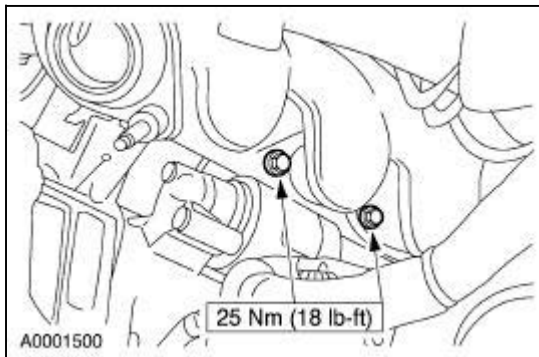
Exhaust Manifold —RH

Removal

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Disconnect the three-way catalytic (TWC) converter from the exhaust manifold. For additional information, refer to [Section 309-00](#).
3. Disconnect the EGR valve to exhaust manifold tube nut at the exhaust manifold.



4. Remove the exhaust manifold.
 - Remove the eight bolts.
 - Remove the exhaust manifold and discard the gasket.




Installation


1. To install, reverse the removal procedure.
 - Install a new gasket.

Cylinder Head

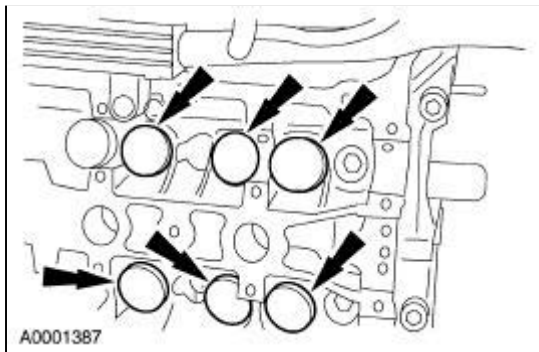
Removal

1. Remove the intake manifold. For additional information, refer to [Intake Manifold](#) in this section.
2. Remove the engine sound insulator.
3. Remove the camshafts. For additional information, refer to [Camshaft](#) in this section.

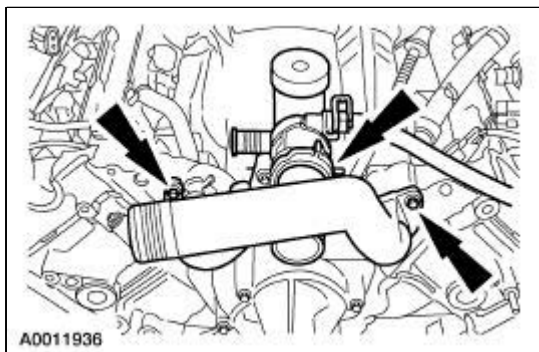
4.  **CAUTION:** The shim and tappets are location-specific. Note the location so that they can be installed in their original locations or shims will have to be reselected during installation.

 **CAUTION:** Do not use any means of marking the shims other than a permanent type marker. Any scratches or paint on the shims can result in incorrect lash adjustments and severe engine damage.

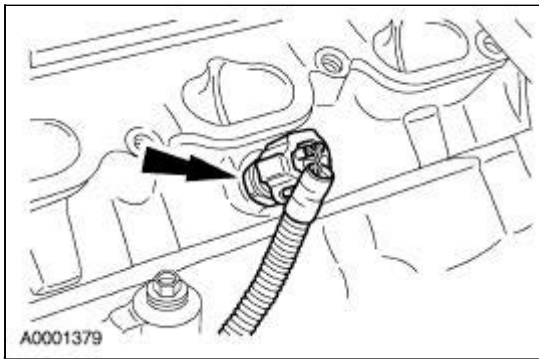
If necessary, remove the tappet bucket and shims.



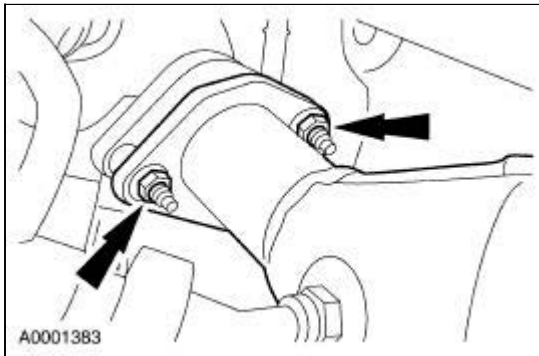
5. Disconnect the clamp, remove the four bolts and the water outlet pipe.



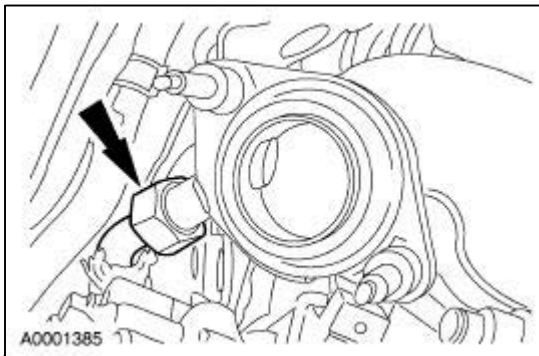
6. Disconnect the cylinder head temperature (CHT) sensor electrical connector.



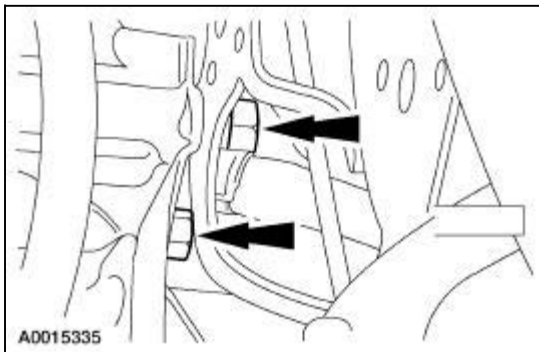
7. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
8. Disconnect the three-way catalytic (TWC) converter from the exhaust manifolds.



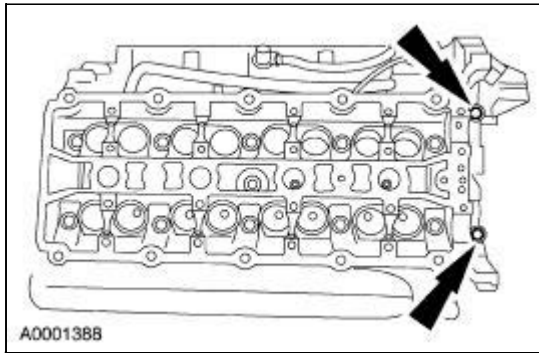
9. Disconnect the EGR valve to exhaust manifold tube.



10. Lower the vehicle.
11. Remove the bolts from the rear of the cylinder head.

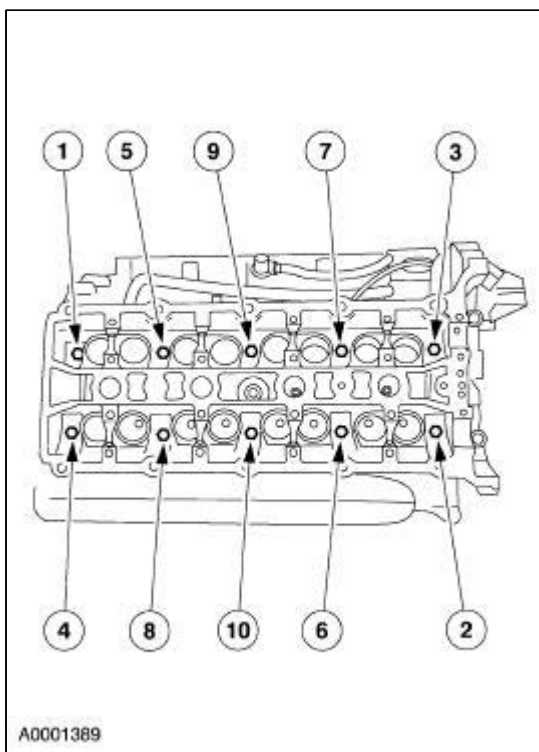


12. Remove and discard the bolts.



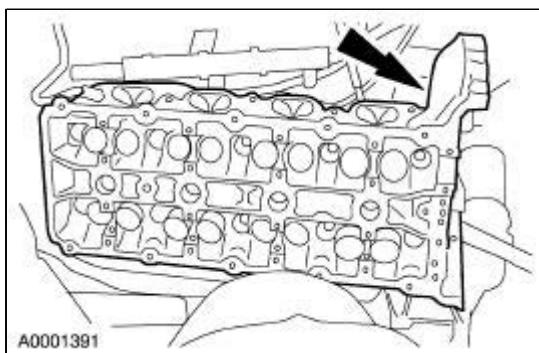
13. Remove the RH bolts in the sequence shown.


- Discard the bolts.



14. Remove the RH cylinder head.

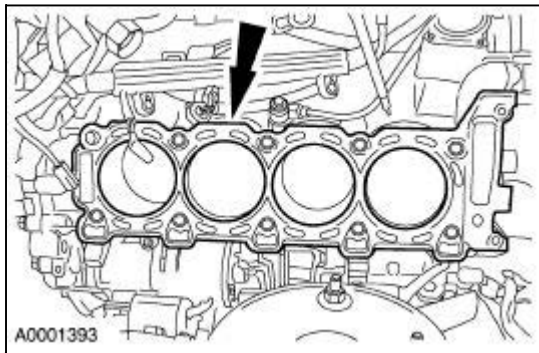
- Discard the gasket.



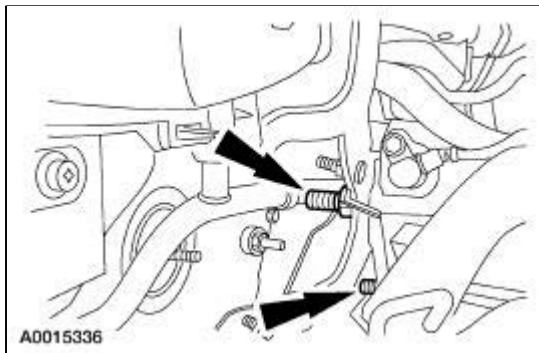
15.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other

abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.

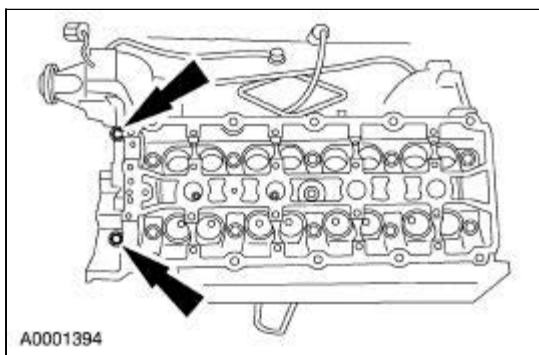
Clean the sealing surfaces.



16. Remove the stud bolts from the rear of the cylinder head.



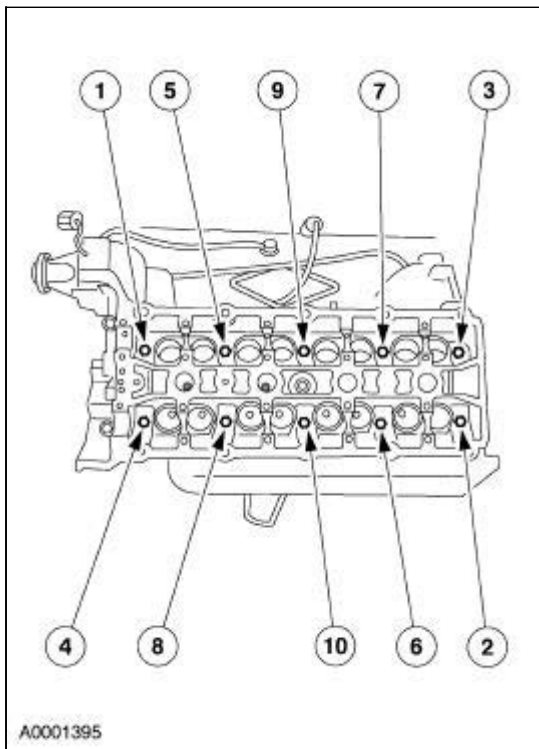
17. Remove and discard the bolts.



18. **NOTE:** The lower rear bolt cannot be fully removed. This bolt must be retained above the decking surface with a rubber band to remove the LH cylinder head.

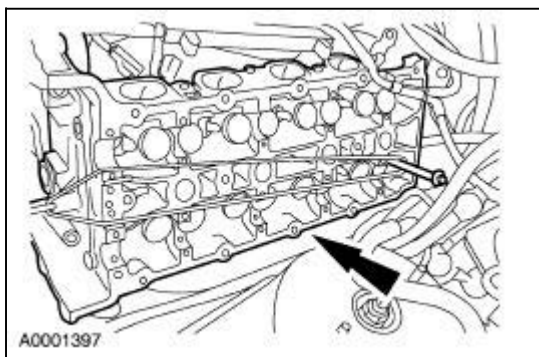
Remove the bolts in the sequence shown.


- Discard the bolts.



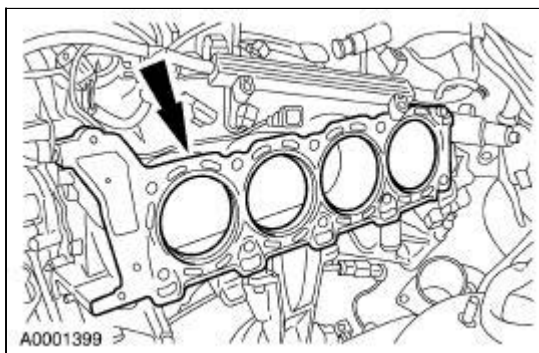
19. Remove the LH cylinder head.

- Discard the gasket.



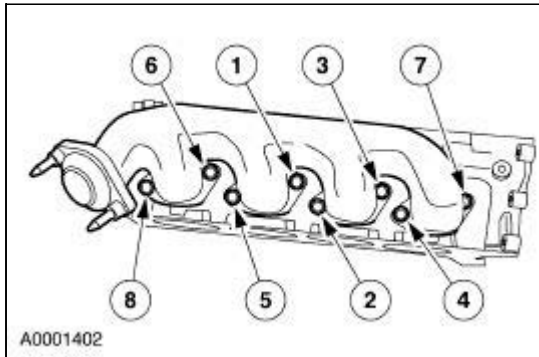
20.  **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.**


Clean the sealing surfaces.



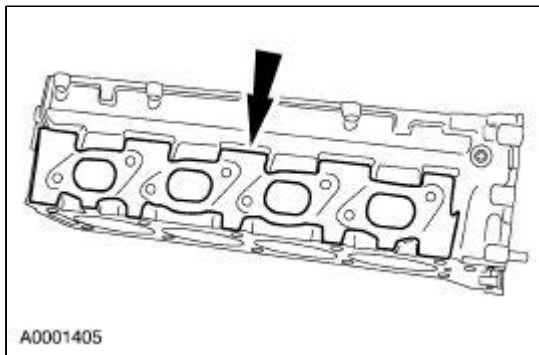
21. Remove the RH exhaust manifold bolts.

- Discard the gasket.



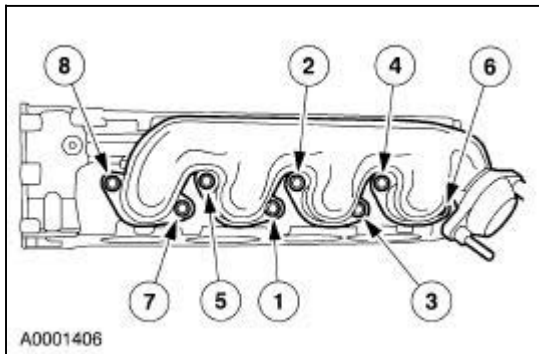
22.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.


Clean the sealing surfaces.



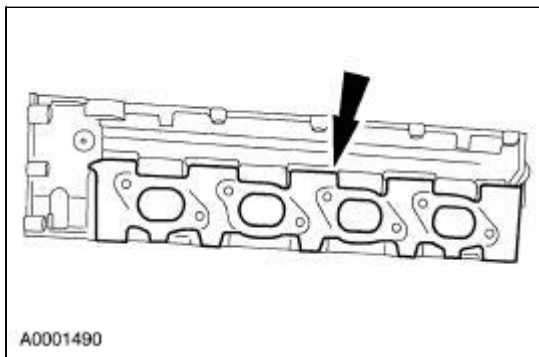
23. Remove the LH exhaust manifold.

- Discard the gasket.



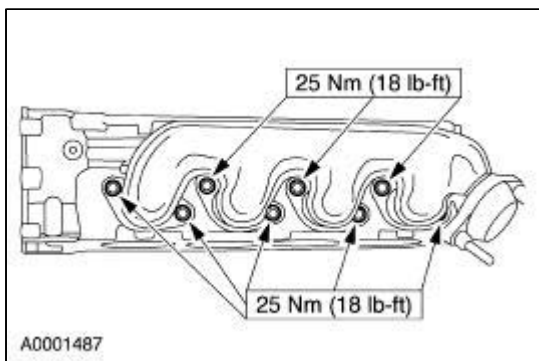
24.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.

Clean the sealing surfaces.

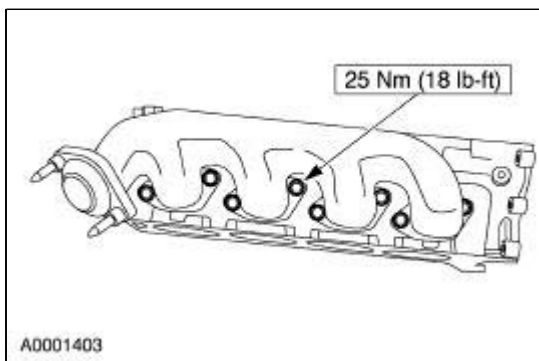


Installation

1. Install the LH exhaust manifold.
 - Install a new gasket.



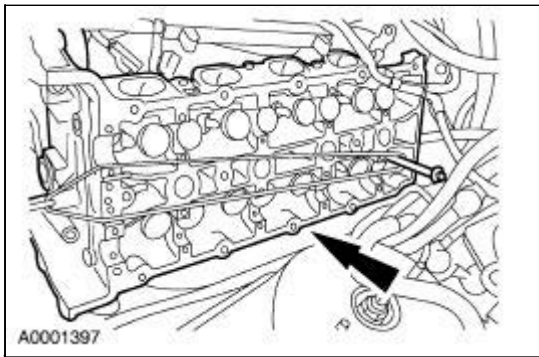
2. Install the RH exhaust manifold.
 - Install a new gasket.



3. **NOTE:** The lower rear bolt cannot be installed with the cylinder head in place. Secure the bolt above deck height with a rubber band prior to cylinder head installation.

Position the LH cylinder head.

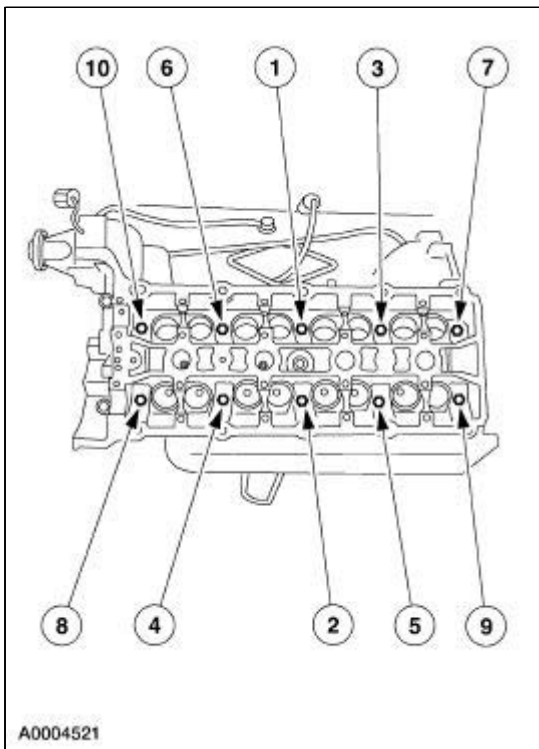
- Install a new gasket.



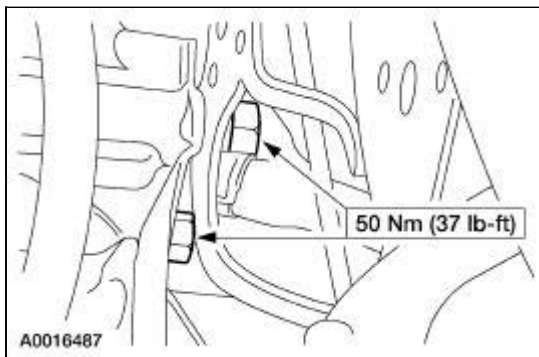
4. **NOTE:** The cylinder head bolts are a torque-to-yield design and must not be reused. Always install new bolts.

Install and tighten the bolts in five stages in the sequence shown.

- Stage 1: Install finger-tight.
- Stage 2: Tighten to 20 Nm (15 lb-ft).
- Stage 3: Tighten to 35 Nm (26 lb-ft).
- Stage 4: Tighten to 45 Nm (33 lb-ft) and an additional 90 degrees.
- Stage 5: Tighten an additional 90 degrees.



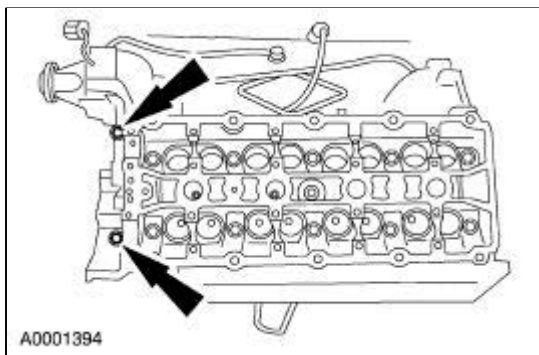
5. Install the bolts on the rear of the cylinder head.



6. **NOTE:** The cylinder head bolts are a torque-to-yield design and must not be reused. Always install new bolts.

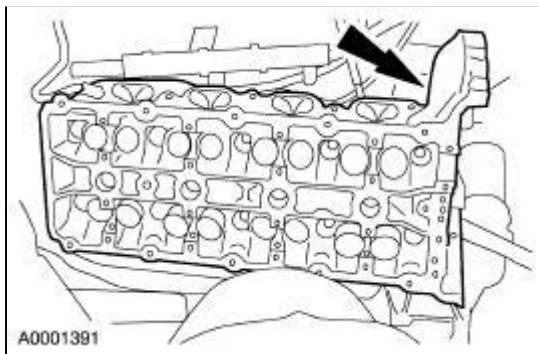
Install and tighten the bolts in two stages.

- Stage 1: Tighten to 20 Nm (15 lb-ft).
- Stage 2: Tighten an additional 90 degrees.



7. Position the RH cylinder head.

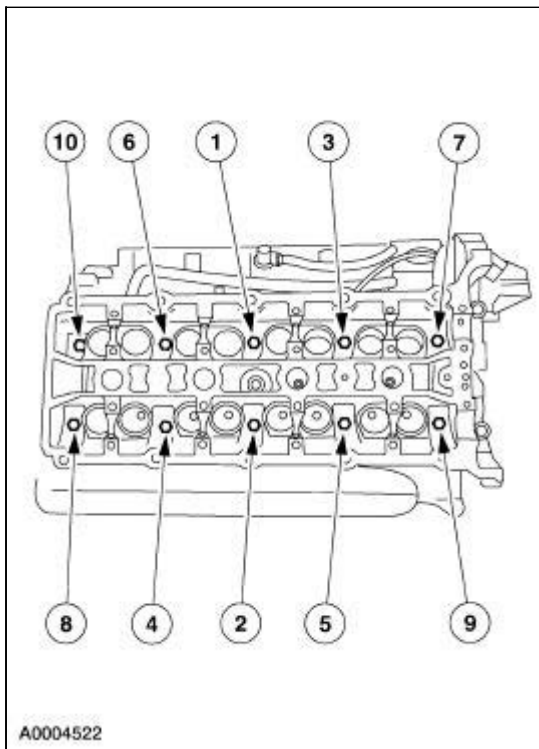
- Install a new gasket.



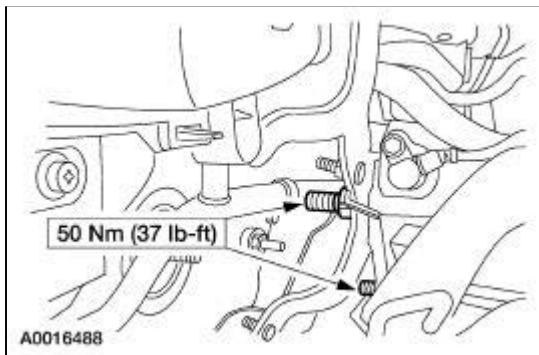
8. **NOTE:** The cylinder head bolts are a torque-to-yield design and must not be reused. Always install new bolts.

Install and tighten the bolts in five stages in the sequence shown.

- Stage 1: Install finger-tight.
- Stage 2: Tighten to 20 Nm (15 lb-ft).
- Stage 3: Tighten to 35 Nm (26 lb-ft).
- Stage 4: Tighten to 45 Nm (33 lb-ft) and an additional 90 degrees.
- Stage 5: Tighten an additional 90 degrees.



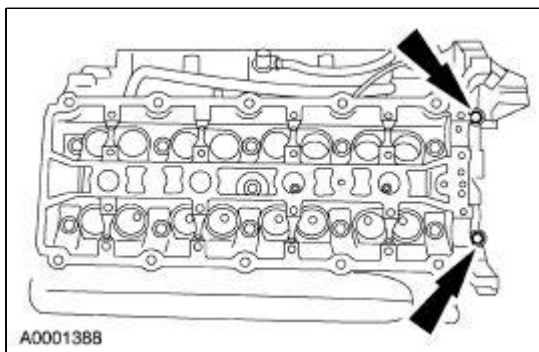
9. Install the stud bolts on the rear of the cylinder head.





10. **NOTE:** The cylinder head bolts are a torque-to-yield design and must not be reused. Always install new bolts.


Install and tighten the bolts in two stages.

- Stage 1: Tighten to 20 Nm (15 lb-ft).
- Stage 2: Tighten an additional 90 degrees.

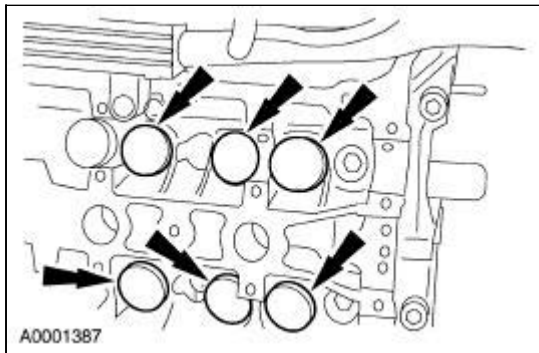


11.  **CAUTION:** The shim and tappets are location-specific. They must be installed in their original locations or shims will have to be reselected during installation.

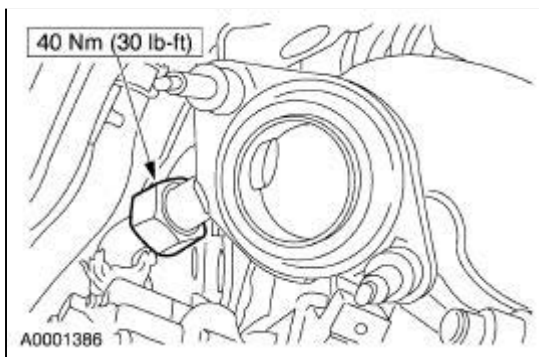
 **CAUTION:** Do not use any means of marking the shims other than a permanent type marker. Any scratches or paint on the shims can result in incorrect lash adjustments and severe engine damage.

 **CAUTION:** If a new cylinder head assembly is being installed, valve clearances must be adjusted or damage to the engine can occur.

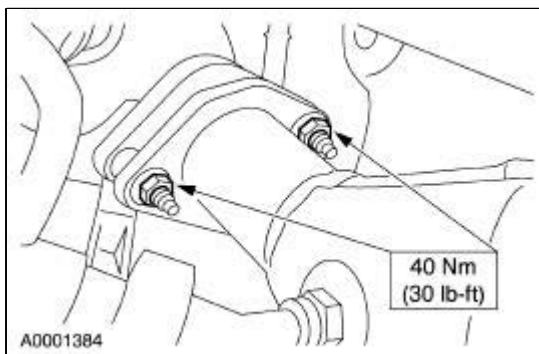
Install the tappets and shims.



12. Raise the vehicle.
13. Connect the EGR valve to exhaust manifold tube.

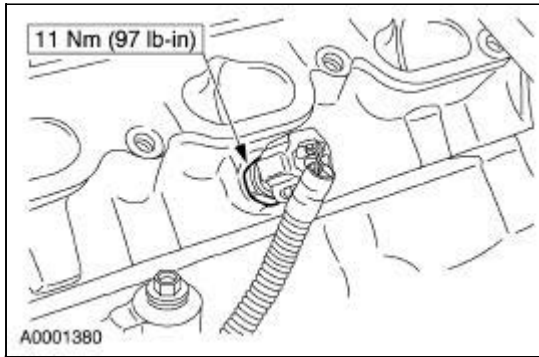


14. Connect the TWC to the exhaust manifolds.



15. Lower the vehicle.

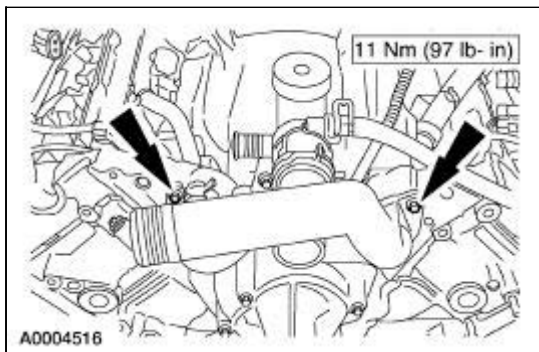
16. Connect the CHT sensor electrical connector.



17. **NOTE:** Make sure that the insulator is clear of the intake manifold sealing surfaces.

Install the engine sound insulator.

18. Install the water crossover and tighten the four bolts and connect the hose.



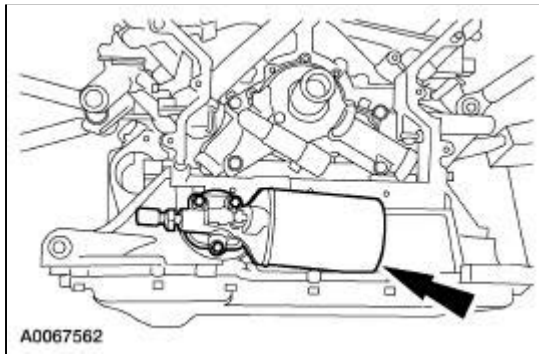
19. Install the camshafts. For additional information, refer to [Camshaft](#) in this section.

20. Install the intake manifold. For additional information, refer to [Intake Manifold](#) in this section.
-

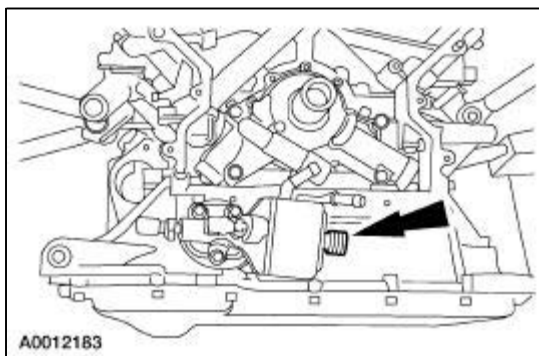
Oil Cooler

Removal

1. Drain the cooling system. For additional information, refer to [Section 303-03](#).
2. Raise the vehicle. For additional information, refer to [Section 100-02](#).
3. Remove the lower splash shield.
4. Drain the engine oil.
5. Remove and discard the oil filter.



6. Disconnect the oil cooler hoses.
7. Remove the oil cooler.
 - Inspect the seal and install a new seal as necessary.

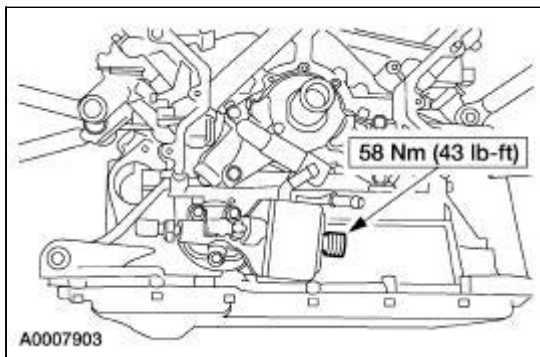


Installation

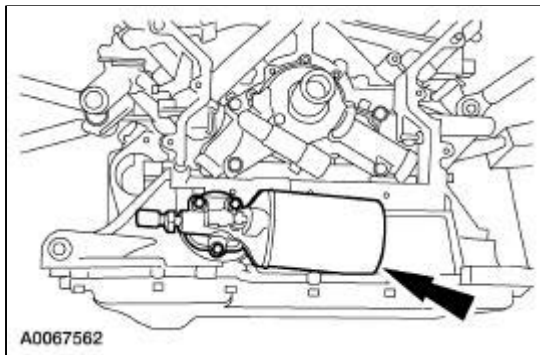
1. **NOTE:** Inspect the gasket and surfaces for contamination prior to installation.

Position the oil cooler and gasket and install the bolt.

- Rotate the cooler clockwise until the locating pin hits the stop.



2. Install the oil cooler hoses.
3. Install the oil filter.
 - Install the oil filter until the seal makes contact.
 - Tighten an additional 270 degrees.

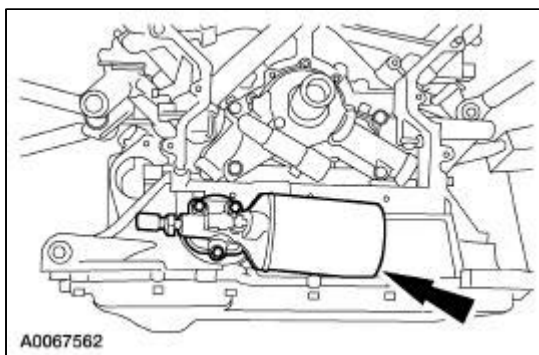


4. Install the lower splash shield.
 5. Lower the vehicle. For additional information, refer to [Section 100-02](#).
 6. Fill the engine with Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.
 7. Fill and bleed the engine cooling system. For additional information, refer to [Section 303-03](#).
-

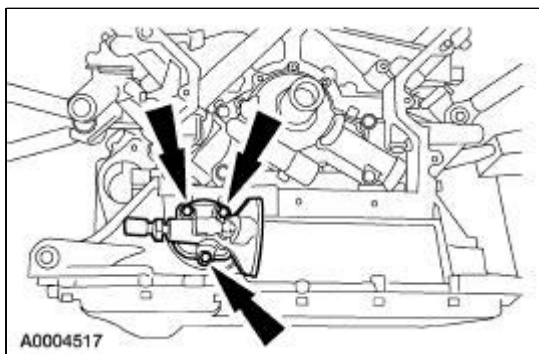
Oil Filter Adapter


Removal

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Drain the engine oil.
3. Remove the lower splash shield.
4. Remove and discard the oil filter.



5. Remove the oil cooler assembly, if equipped. For additional information, refer to [Oil Cooler](#) in this section.
6. Disconnect the oil pressure sender.
7. Remove the oil filter adapter assembly.
 - Discard the seal.

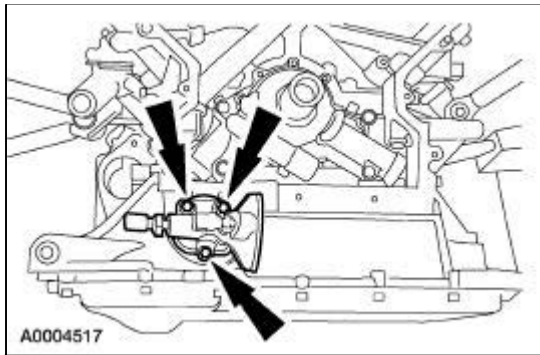


8.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs, or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool.

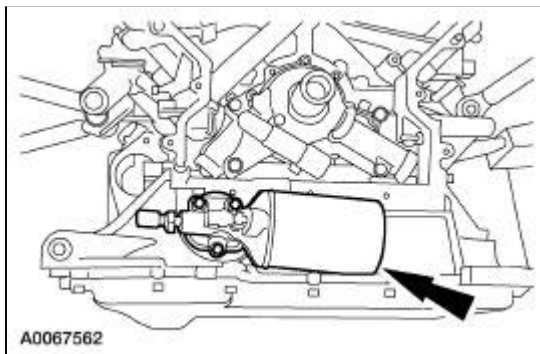
Clean the sealing surfaces.

Installation

1. Install a new seal and the oil filter adapter. Tighten the bolts in two stages.
 - Stage 1: Tighten to 13 Nm (10 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.



2. Connect the oil pressure sender.
3. Install the oil cooler, if equipped. For additional information, refer to [Oil Cooler](#) in this section.
4. Install the oil filter.
 - Install the oil filter until the seal makes contact.
 - Tighten an additional 270 degrees.

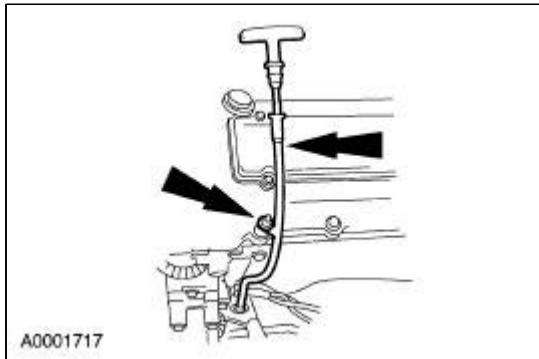


5. Install the lower splash shield.
 6. Lower the vehicle.
 7. Fill the engine with Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.
-

Oil Level Indicator and Tube

Removal

1. Remove the oil level indicator.
2. Remove the nut and the oil level indicator and tube.

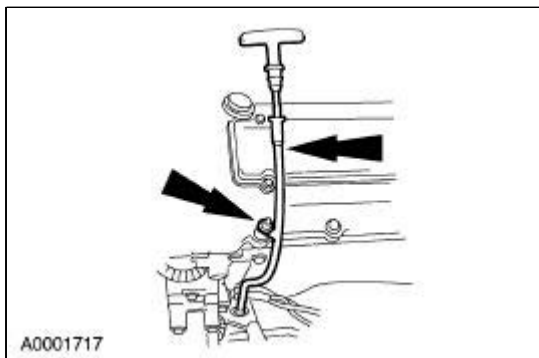


Installation

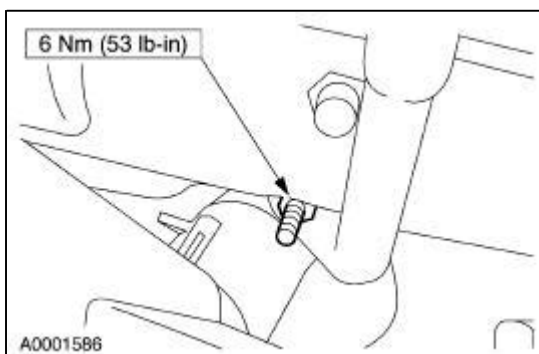
1. **NOTE:** Lubricate the O-ring seal with Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.

Inspect the O-ring seal and install a new O-ring seal as necessary.

- Install the oil level indicator tube.



2. Install the nut.

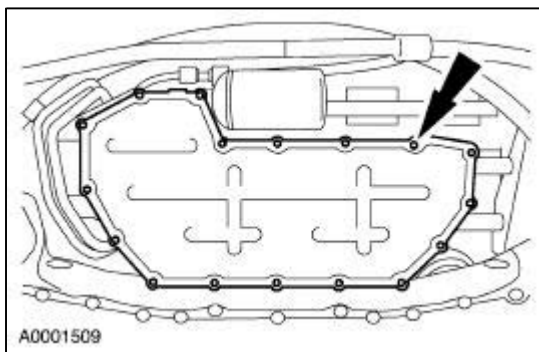


3. Install the oil level indicator.

Oil Pan

Removal

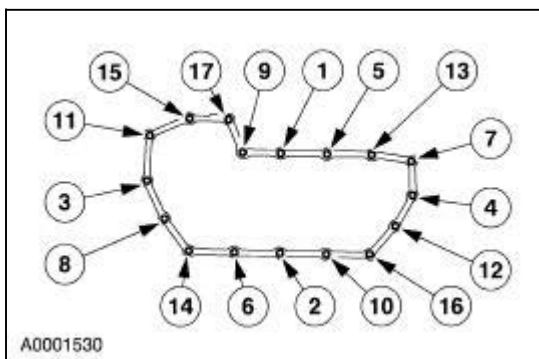
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Drain the engine oil.
3. Remove the oil pan.
 - Inspect the gasket and install a new one if necessary.



Installation

NOTE: Make sure all gasket sealing surfaces are clean and dry.

1. Install the oil pan. Tighten the bolts in the sequence shown in two stages.
 - Stage 1: Tighten to 5 Nm (44 lb-in).
 - Stage 2: Tighten to 12 Nm (9 lb-ft).

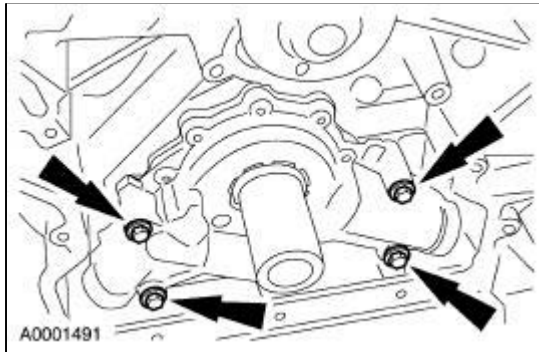



2. Lower the vehicle.
3. Fill the crankcase to the specified level with Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.

Oil Pump

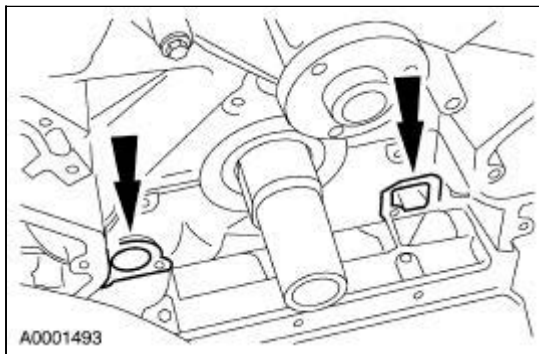
Removal

1. Remove the primary timing chains. For additional information, refer to [Timing Drive Components—Primary](#) in this section.
2. Remove the bolts and the oil pump.
 - Discard the gasket.



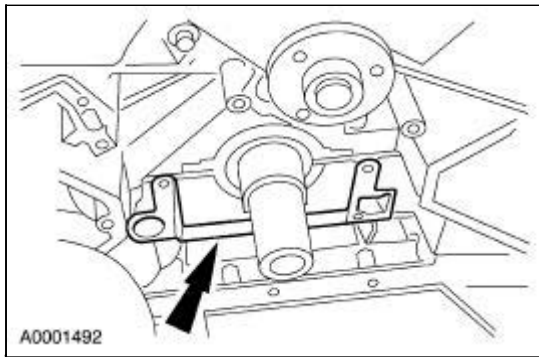
3.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.

Clean the sealing surfaces.

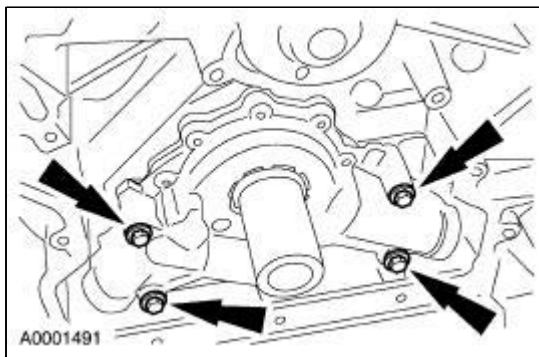


Installation

1. Install a new gasket.



2. Install the oil pump and tighten the bolts in two stages.
 - Stage 1: Tighten to 6 Nm (53 lb-in).
 - Stage 2: Tighten an additional 90 degrees.

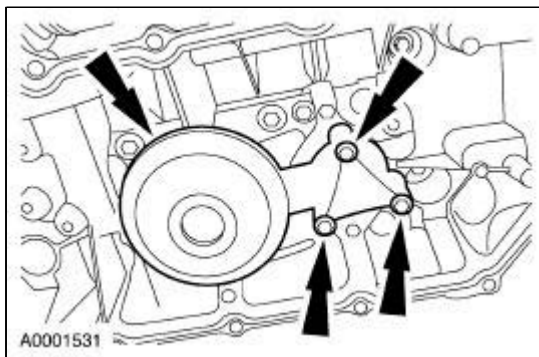


3. Install the primary timing chains. For additional information, refer to [Timing Drive Components—Primary](#) in this section.
-

Oil Pump Screen and Pickup Tube

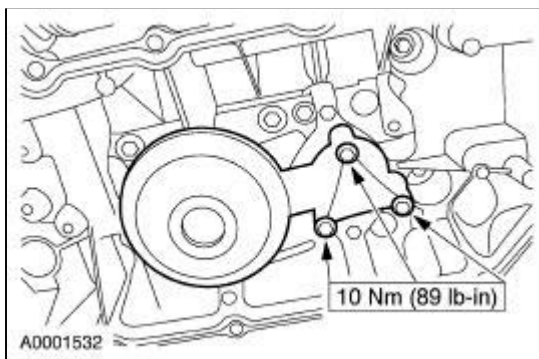
Removal

1. Remove the oil pan. For additional information, refer to [Oil Pan](#) in this section.
2. Remove the bolts and the pump screen cover and tube.
 - Inspect the O-ring seal and install a new one if necessary.



Installation

1. Install the oil pump screen cover and tube.

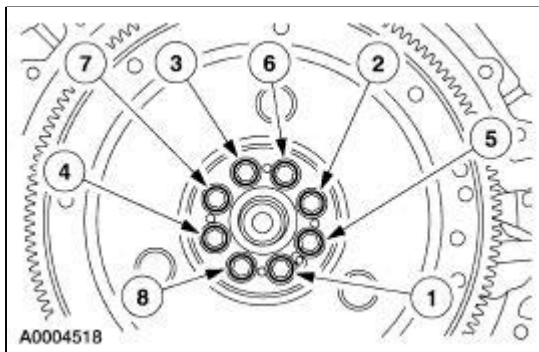


2. Install the oil pan. For additional information, refer to [Oil Pan](#) in this section.

Flexplate

Removal

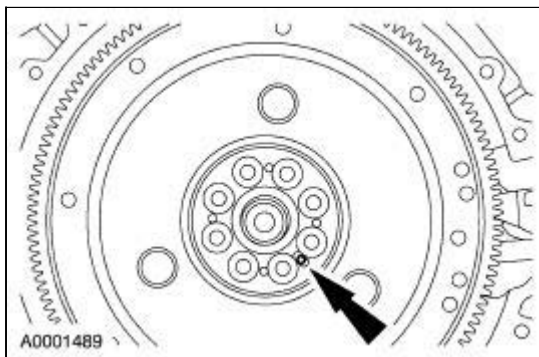
1. Remove the transmission. For additional information, refer to [Section 307-01](#).
2. Remove the flexplate.
 - Remove the bolts in the sequence shown.
 - Remove the flexplate.



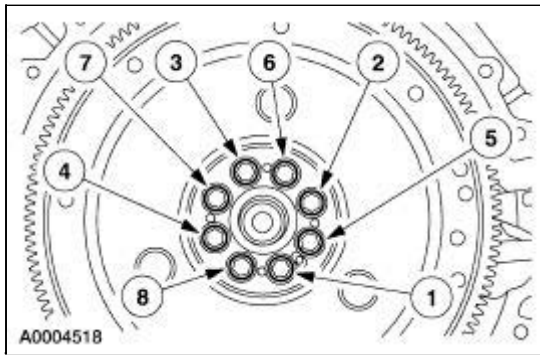
Installation

NOTE: The crankshaft dowel must be positioned below the outer face of the flexplate.

1. Install the flexplate with the elongated hole over the crankshaft dowel.



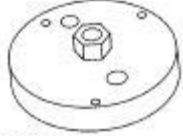
2. Install the flexplate bolts and tighten in two stages in the sequence shown.
 - Stage 1: Tighten to 15 Nm (11 lb-ft).
 - Stage 2: Tighten to 110 Nm (81 lb-ft).



3. Install the transmission. For additional information, refer to [Section 307-01](#).
-

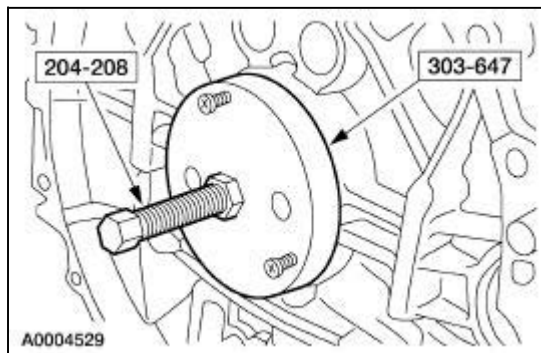
Crankshaft Rear Oil Seal

Special Tool(s)

 ST2495-B	Rear Crankshaft Seal Remover/Installer 303-647
 ST2441-A	Screw 204-208 (T95T-5310-AR2)

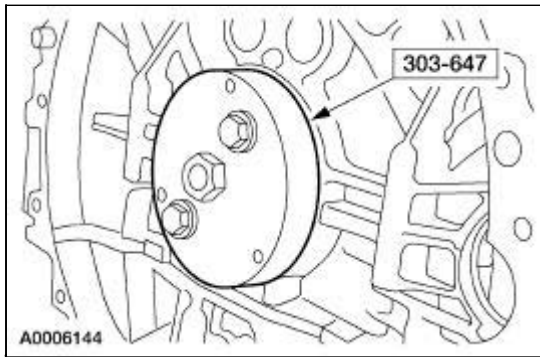
Removal

1. Remove the flexplate. For additional information, refer to [Flexplate](#) in this section.
2. Using the special tools, remove the crankshaft rear oil seal.
 - Discard the seal.



Installation


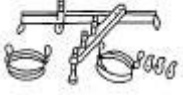
1. Lubricate the outer lips and the inner seal on the crankshaft rear oil seal with Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.
2. Using the special tool, install a new crankshaft rear oil seal.



3. Install the flexplate. For additional information, refer to [Flexplate](#) in this section.
-

Engine Mount

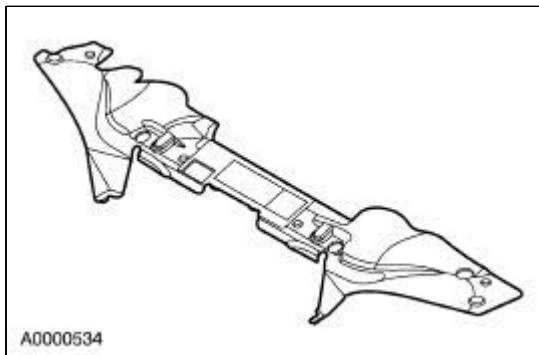
Special Tool(s)

 <p>ST1595-A</p>	Lifting Bracket, Engine 303-050 (T70P-6000)
 <p>ST1703-A</p>	Support Bar, Engine 303-D063 (D88L-6000-A)

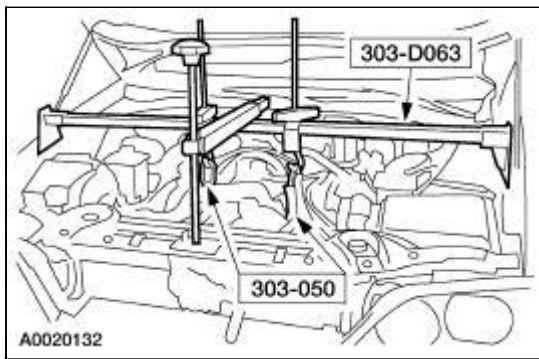
Removal

For LH and RH

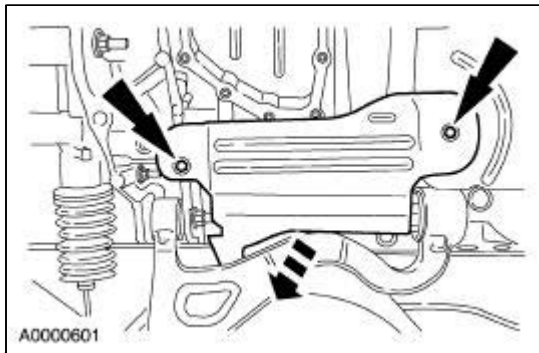
1. Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).
2. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
3. Remove the upper radiator sight shield.



4. Install the special tools and support the engine.

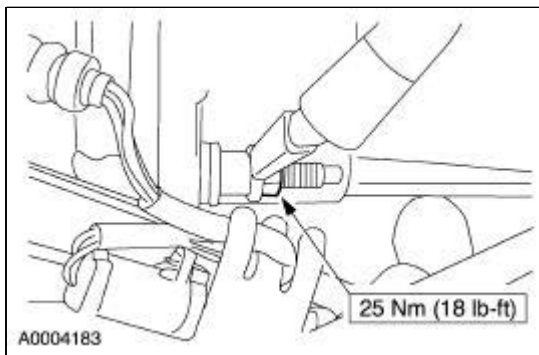


5. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
6. Remove the LH and the RH lower splash shield.

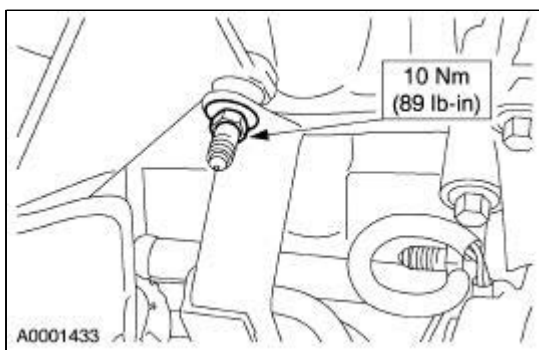


For RH

7. Remove the nut and disconnect the starter motor ground cable.

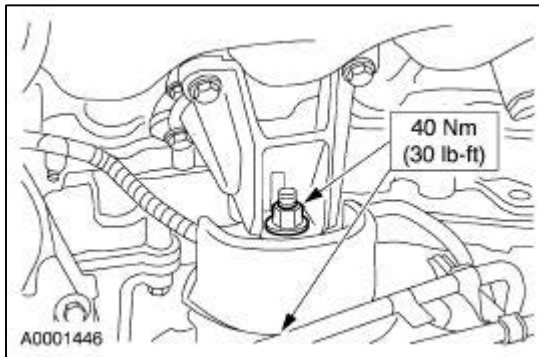


8. Remove the nut and disconnect the wiring harness support bracket from the engine mount bracket.

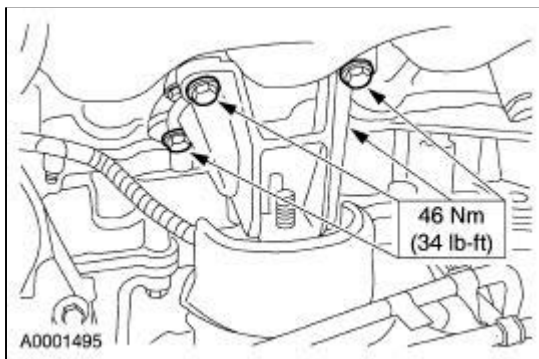


For LH and RH

9. Remove the two nuts from the top and bottom of the engine mounts.




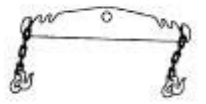
10. Remove the four bolts, the engine mounts and the brackets.



11. To install, reverse the removal procedure.
-


Engine

Special Tool(s)

 ST1595-A	Engine Lifting Brackets 303-050 (T70P-6000)
 ST1602-A	Spreader Bar 303-D089 (D93P-6001-A3)

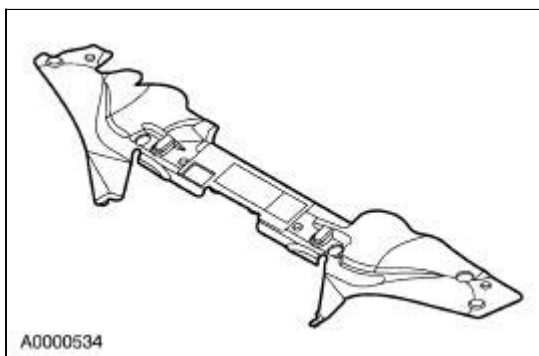
Removal

1. Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).
2. Remove the air cleaner inlet. For additional information, refer to [Section 303-12](#).

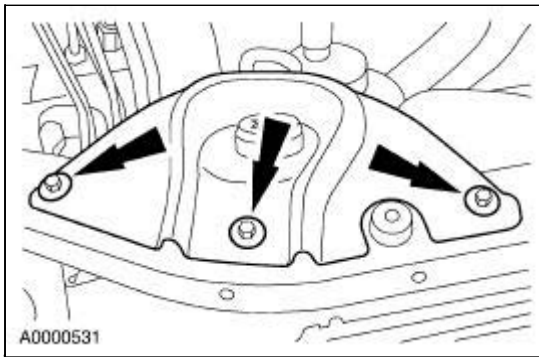
3.  **CAUTION: The coolant drain procedure must be followed exactly or damage to the engine may occur.**

Drain the engine coolant. For additional information, refer to [Section 303-03](#).

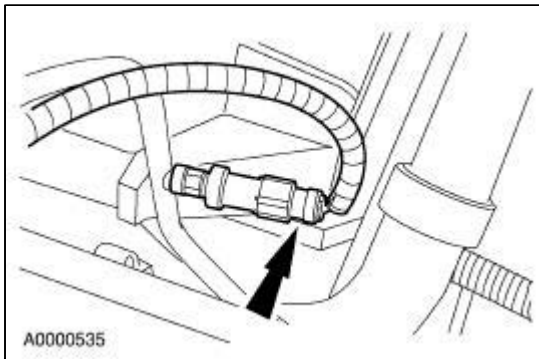
4. Remove the upper radiator sight shield.



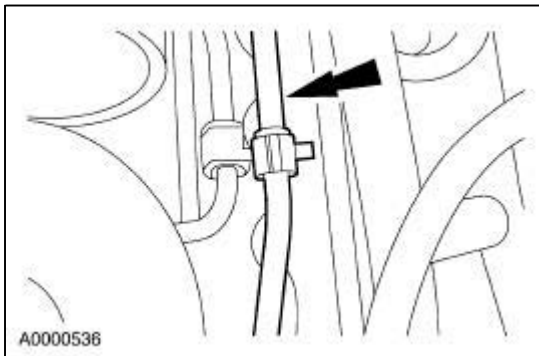
5. Remove the two upper radiator support brackets.



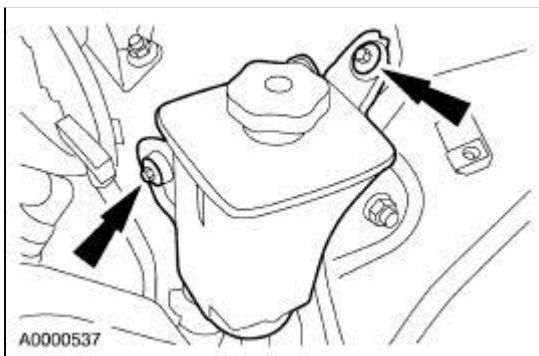
6. Discharge the A/C system. For additional information, refer to [Section 412-00](#).
7. Disconnect the A/C pressure switch electrical connector.



8. Release the power steering return line from the pressure line clip.

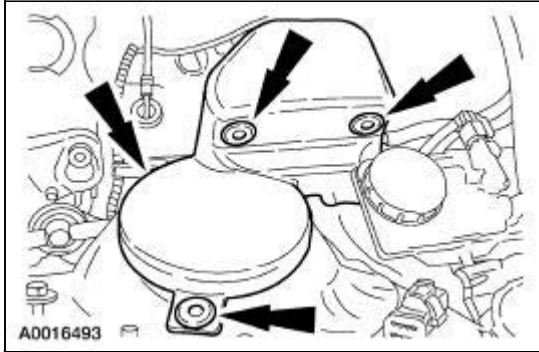


9. Remove the power steering pump reservoir and secure the reservoir to the engine.



10. Disconnect the fuel line. For additional information, refer to [Section 310-00](#).

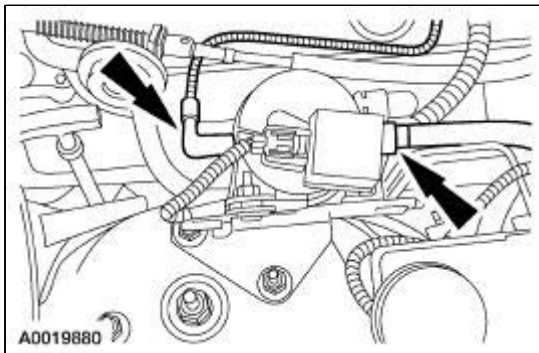
11. Remove the vapor management valve (VMV) cover.



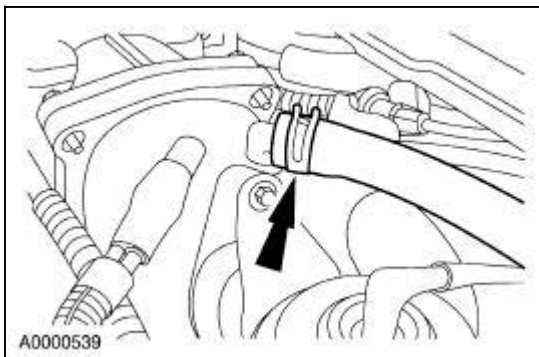
12.  **CAUTION:** To disconnect the fitting, squeeze the tabs and pull straight out or damage to the fitting may occur.

Disconnect the VMV.

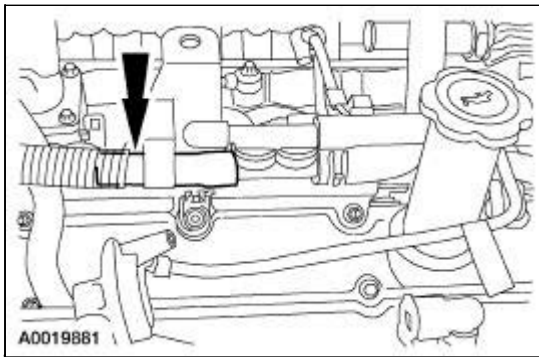
- Canister purge hose.
- Vacuum hose.



13. Disconnect the main vacuum supply hose.

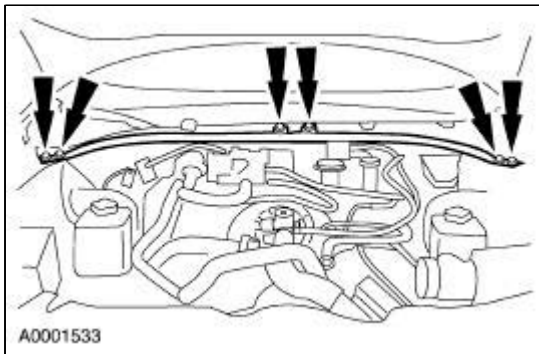


14. Remove the cowl vent screens. For additional information, refer to [Section 501-02](#).
15. Unclip the hose and position aside.

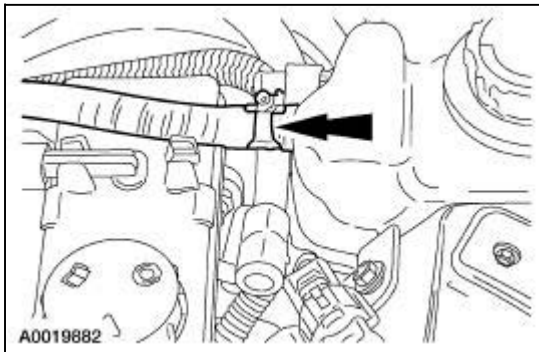


16. Remove the bracket.

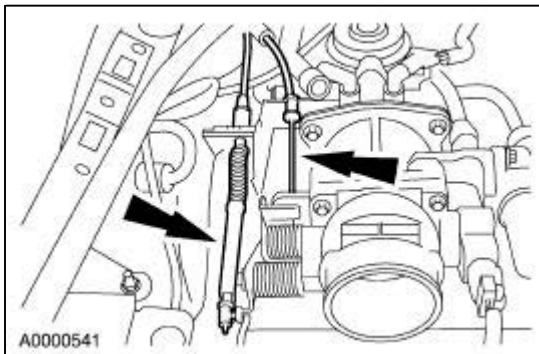
- Remove the seven bolts and one nut.
- Remove the windshield washer hose.
- Remove the bracket.



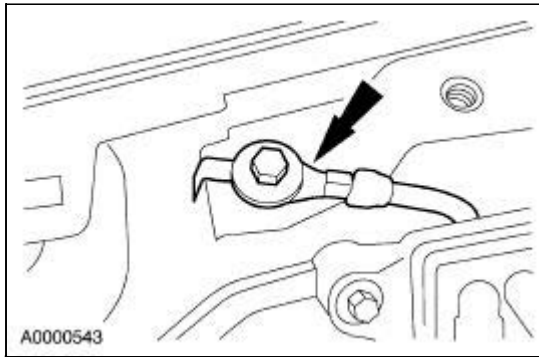
17. Disconnect the degas bottle.



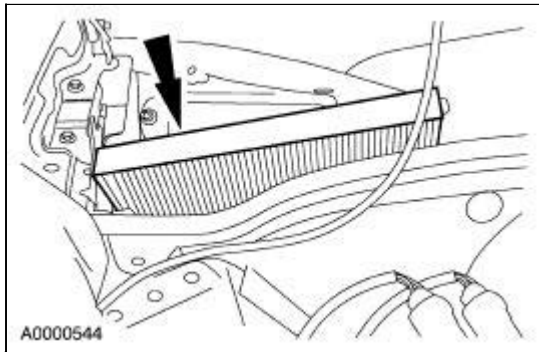
18. Disconnect the accelerator cable and the speed control cable.



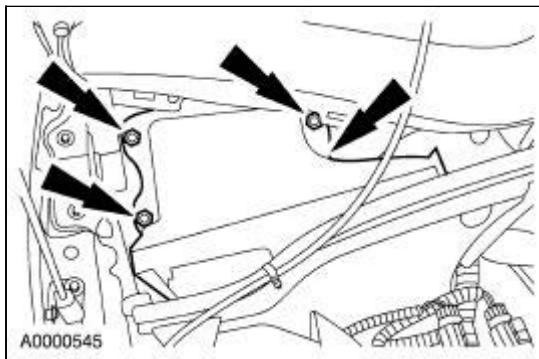
19. Disconnect the ground strap.



20. Remove the fresh air filter.

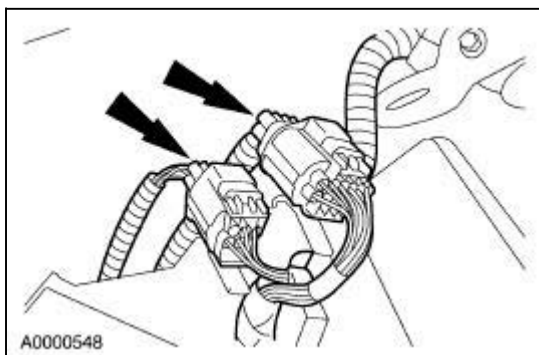


21. Remove the fresh air filter housing.

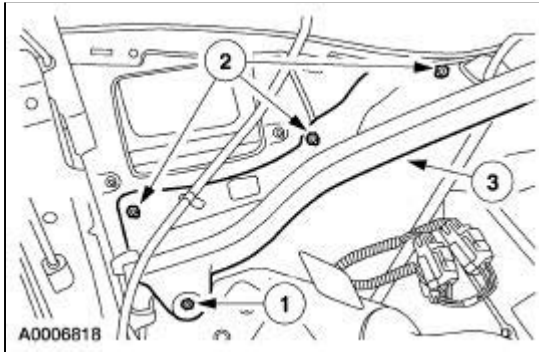


22. **NOTE:** The connectors are located on the backside of the RH strut tower.

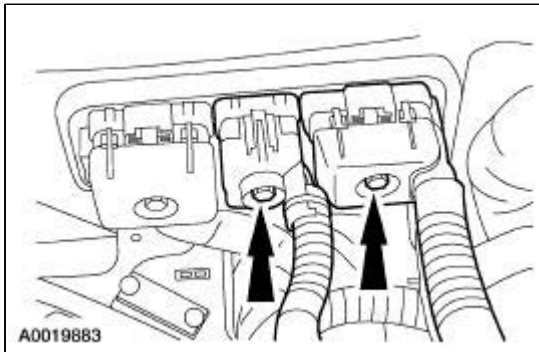
Disconnect the powertrain bulkhead electrical connectors.



23. Remove the fresh air filter panel.
1. Remove the pin-type retainer.
 2. Remove the nuts.
 3. Remove the panel.

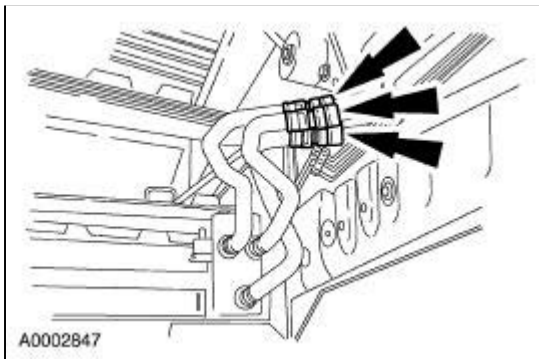


24. Disconnect the connectors.

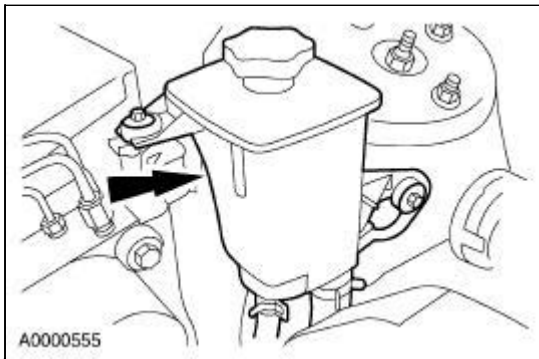


25. **NOTE:** Mark the position of the heater hoses for correct installation.

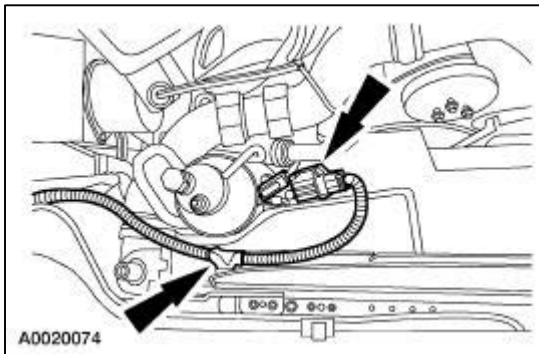
Disconnect the heater hoses from the water control valve.



26. Remove the hydraulic cooling fan reservoir and secure the reservoir to the engine.



27. Disconnect the water valve electrical connector, unclip from the radiator support and position the harness aside.

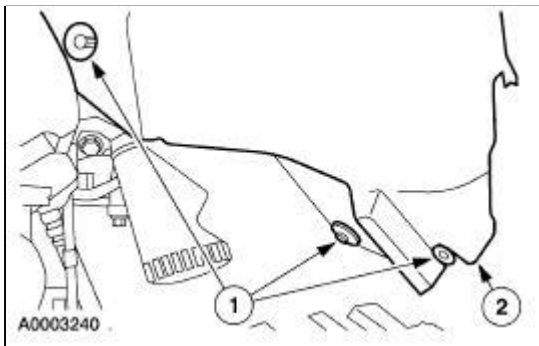


28. Remove the front wheels and tires. For additional information, refer to [Section 204-04](#) .

29. **NOTE:** LH shown; RH similar.

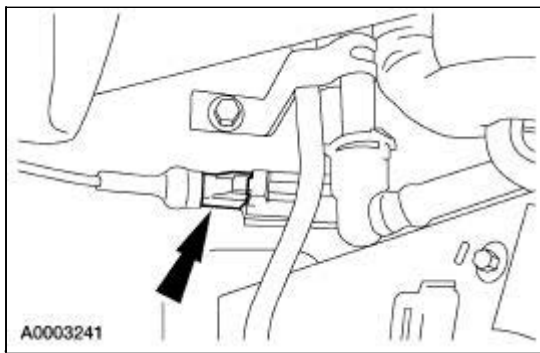
Position the LH and the RH inner splash shields aside.

1. Remove the pin-type retainers.
2. Position the shields aside.



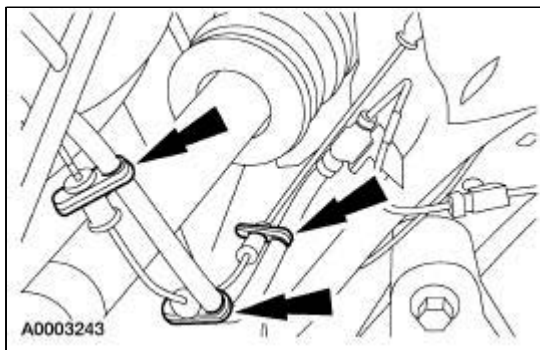
30. **NOTE:** LH shown; RH similar.

Disconnect the LH and the RH anti-lock brake sensor electrical connectors.



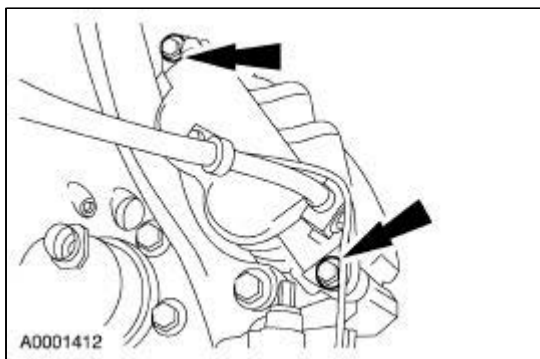
31. **NOTE:** LH shown; RH similar.

Unclip the LH and the RH anti-lock brake harness from the brake hoses.



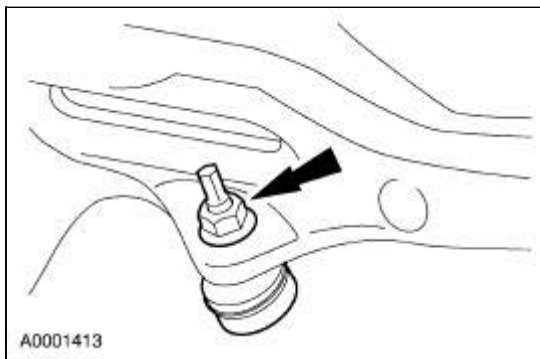
32. **NOTE:** LH shown; RH similar.

Remove the LH and the RH brake calipers and position the calipers aside.



33. **NOTE:** LH shown; RH similar.

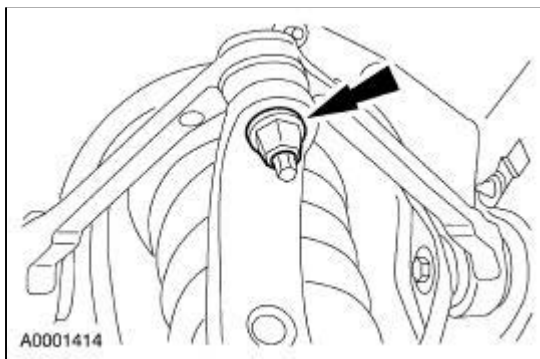
Remove the LH and the RH sway bar lower nuts.



34. **NOTE:** LH shown; RH similar.

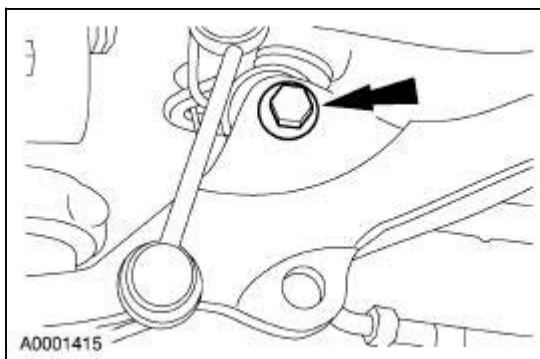
NOTE: Hold external hex when removing the ball joint nuts to prevent damage to the ball joints.

Remove the LH and the RH nuts and separate the ball joints from the spindles.



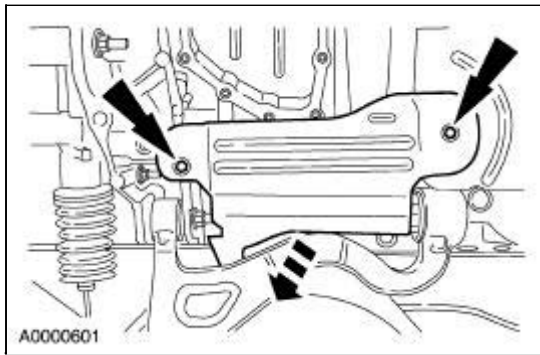
35. **NOTE:** LH shown; RH similar.

Remove the LH and the RH lower strut mount bolts.

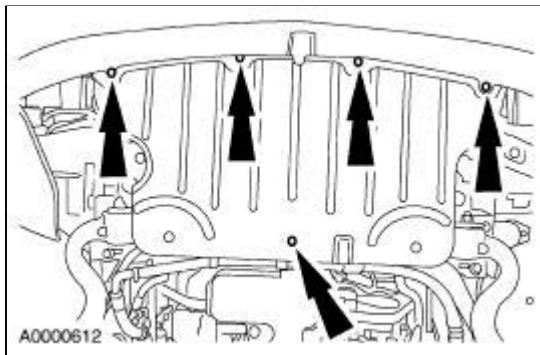


36. **NOTE:** LH shown; RH similar.

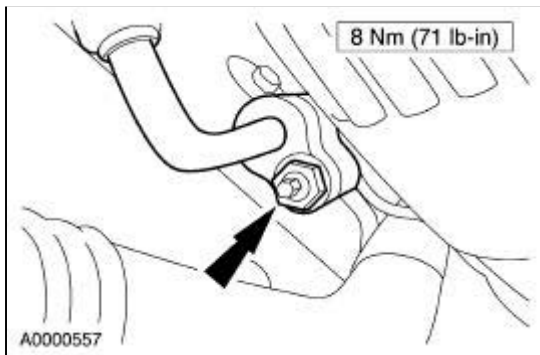
Remove the LH and the RH splash shields.



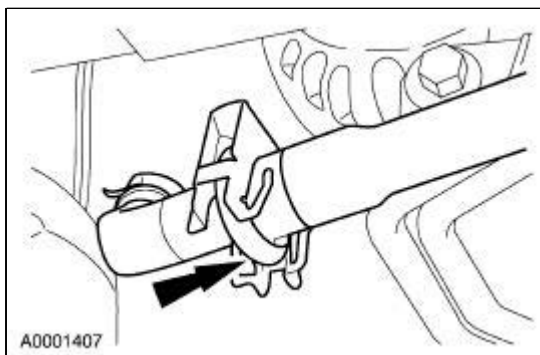
37. Remove the center splash shield.



38. Remove the nut and disconnect the A/C high pressure line.

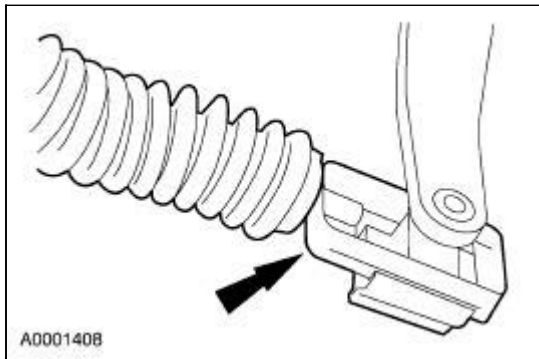


39. Disconnect the low pressure A/C line.

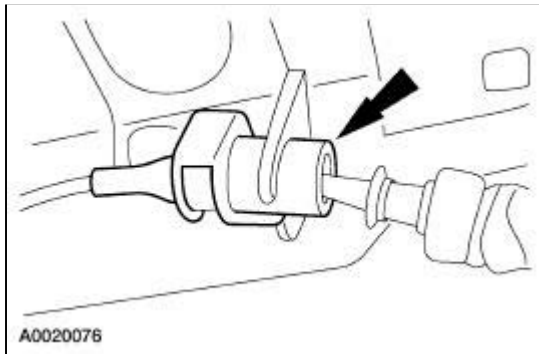


40. Remove the driveshaft. For additional information, refer to [Section 205-01](#).

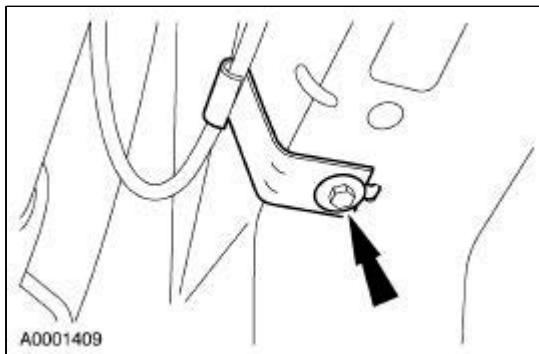
41. Disconnect the shift cable from the shifter.



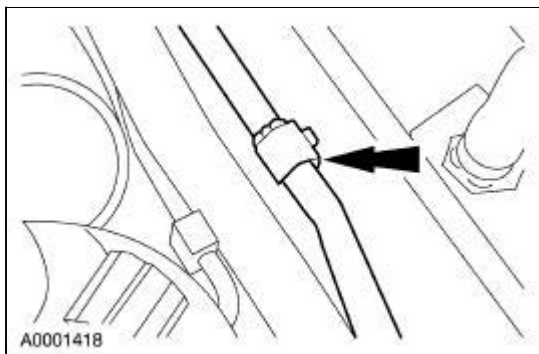
42. Unclip the shift cable from the bracket.



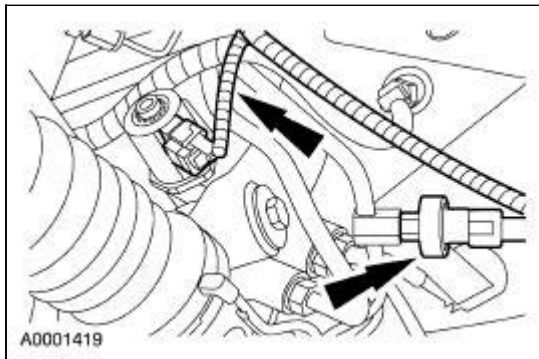
43. Remove the shift cable bracket.



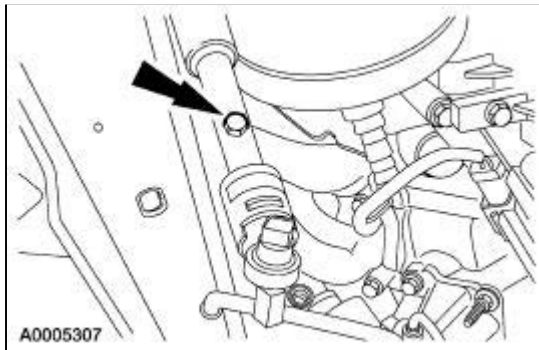
44. Release the power steering lines from the LH frame rail.



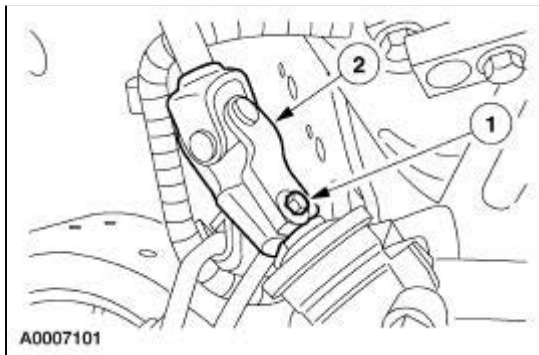
45. Disconnect the rack and pinion steering unit electrical connectors.



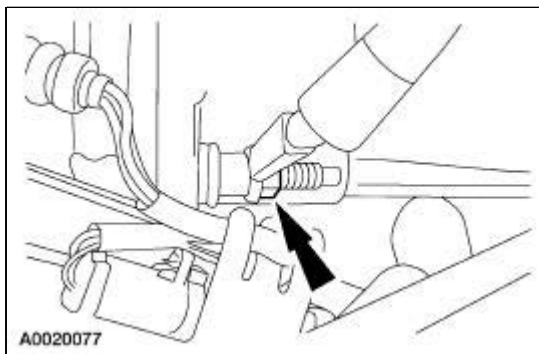
46. Remove the steering shaft bolt.



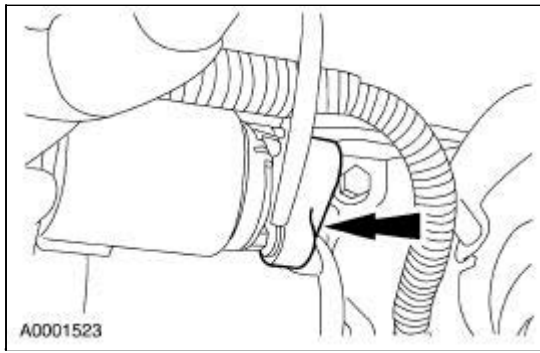
47. Disconnect the steering coupling.
1. Remove the bolt.
2. Disconnect the coupling.



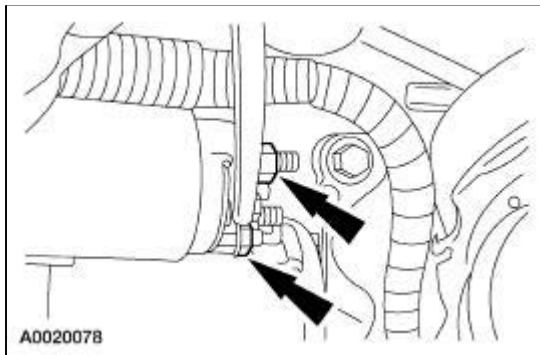
48. Remove the starter motor ground cable.



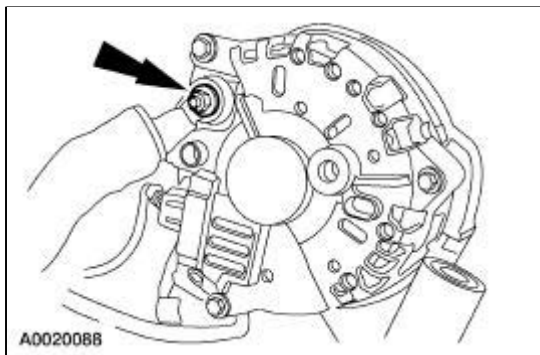
49. Remove the cover.



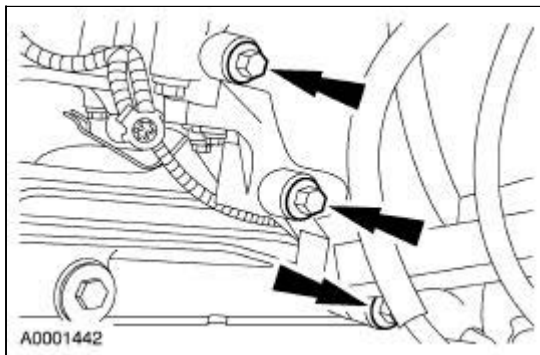
50. Disconnect the starter motor electrical connectors.



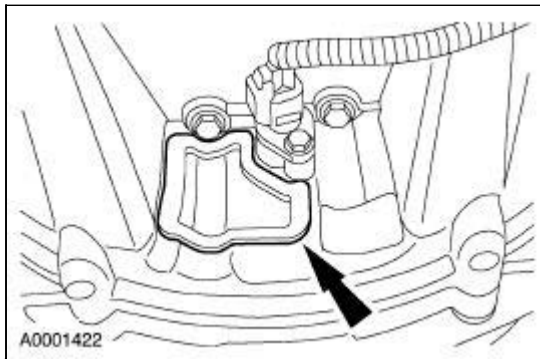
51. Disconnect the generator electrical connector.



52. Remove the six lower transmission to engine bolts.

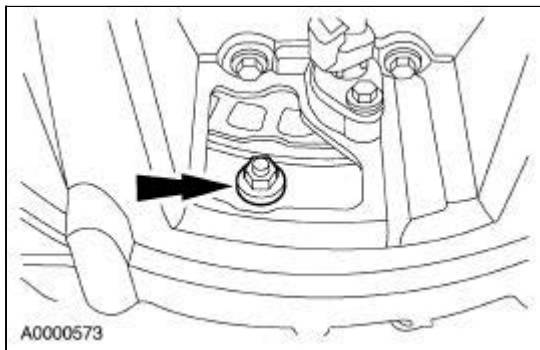


53. Remove the cover.

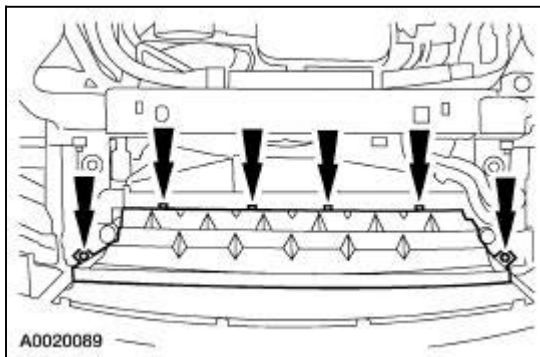


54. **NOTE:** Make an identifying mark on the nut, stud, and adapter plate to allow for correct installation.

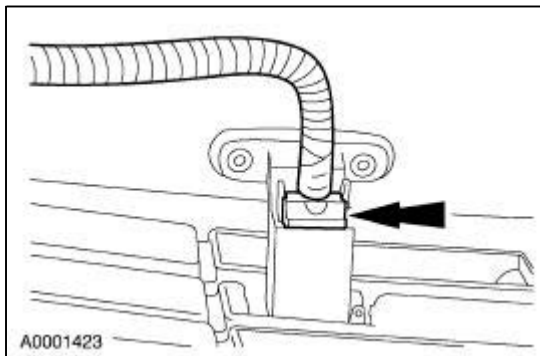
Remove the eight torque converter nuts.



55. Remove the inner air deflector.

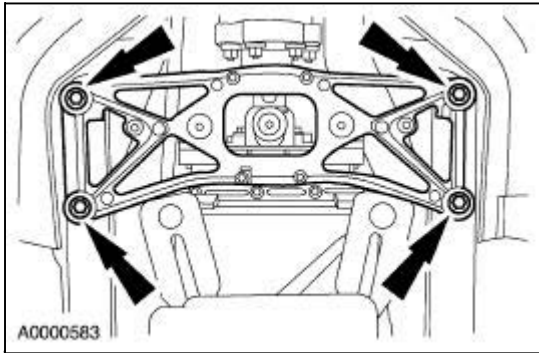


56. Remove the engine block heater plug, if equipped.

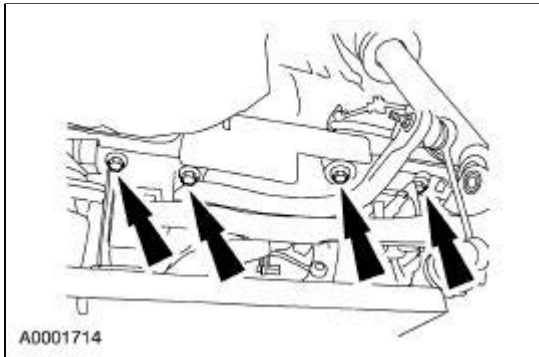


57. Support the rear of the vehicle with suitable safety stands.

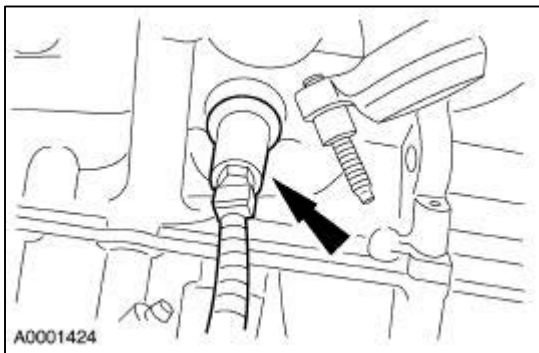
58. Support the engine, transmission, front and center crossmembers, and the cooling system with a powertrain lift and a transmission support bracket.
59. Remove the transmission crossmember bolts.



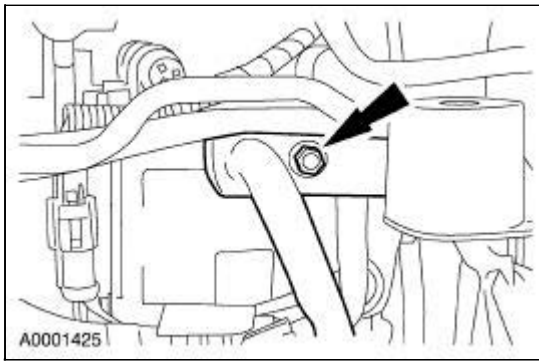
60. Remove the four front and the four center crossmember bolts.



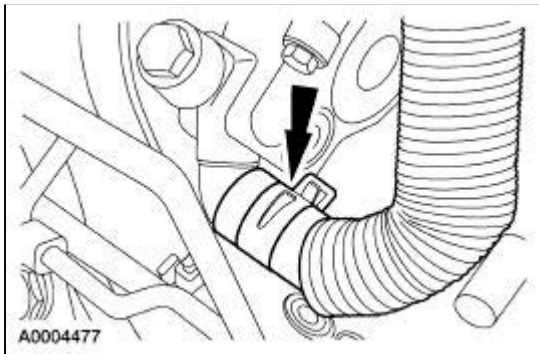
61. Carefully lower the entire assembly from the vehicle.
62. Disconnect the block heater, if equipped.



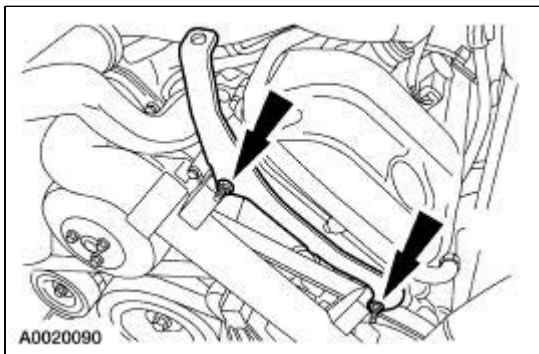
63. Disconnect the A/C manifold and tube.



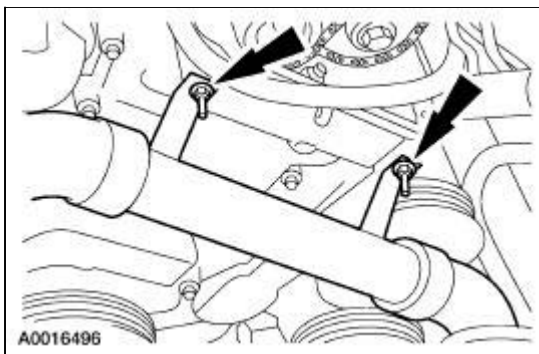
64. Disconnect the power steering pump and hydraulic cooling fan pump return hoses.



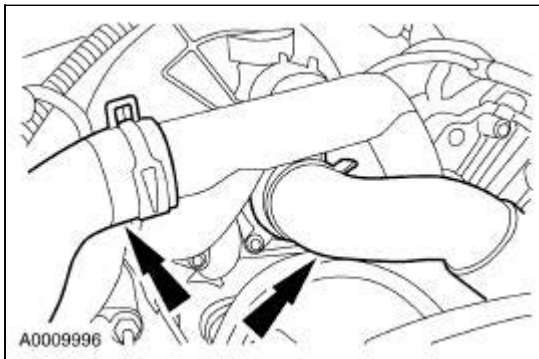
65. Remove the bracket.



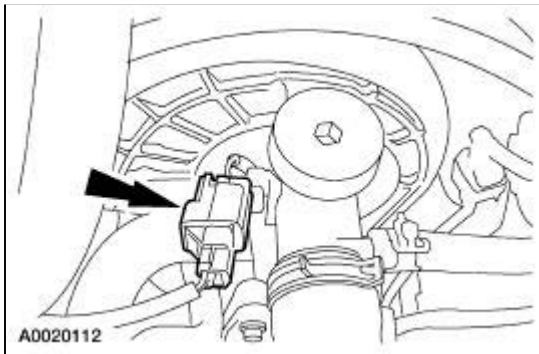
66. Remove the lower radiator hose.



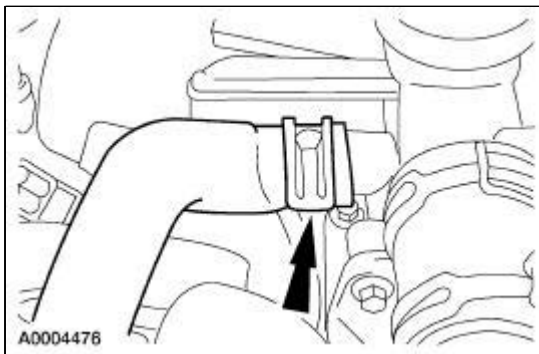
67. Disconnect the radiator hoses.



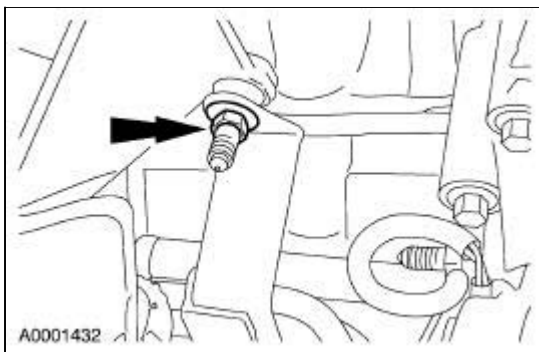
68. Disconnect the knock sensor (KS) electrical connector.



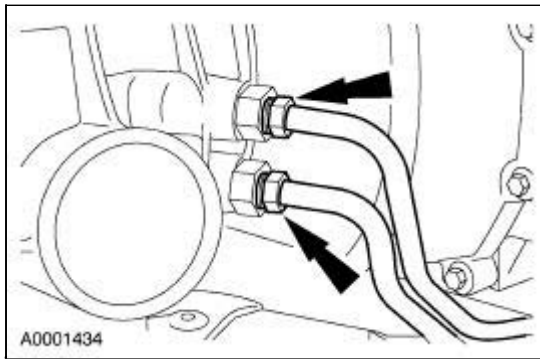
69. Disconnect the heater hose.



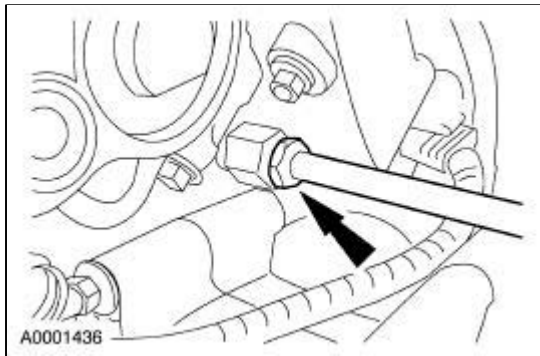
70. Remove the transmission cooler line bracket.



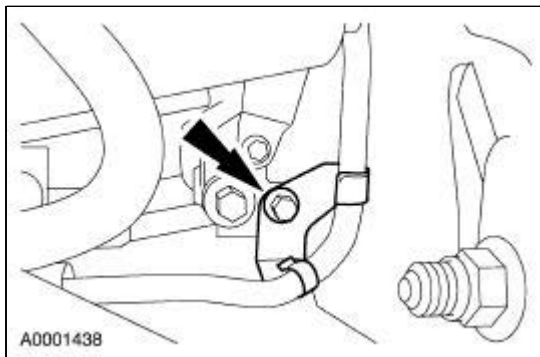
71. Disconnect the transmission cooler lines.



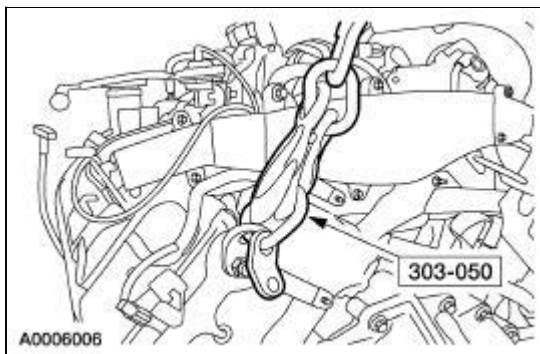
72. Disconnect the power steering pressure line.



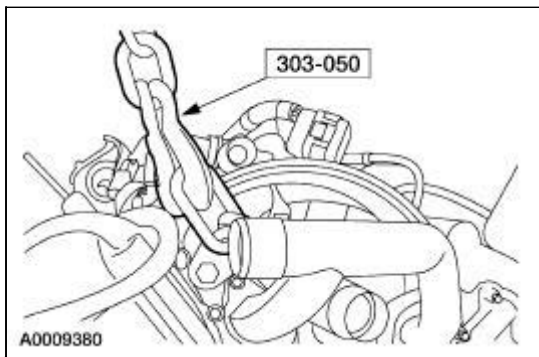
73. Remove the power steering line bracket.



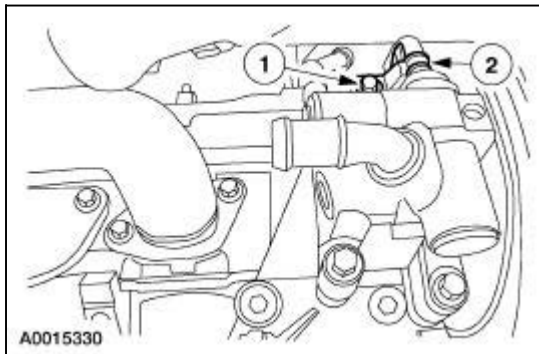
74. Install the special tool.



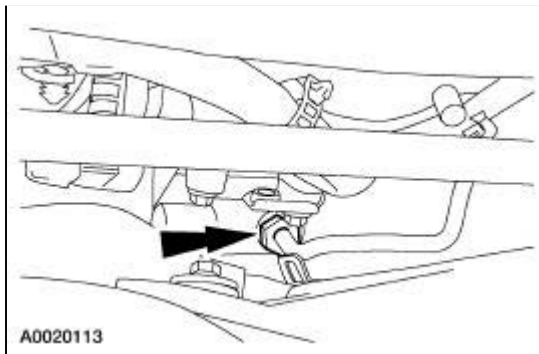
75. Install the special tool.



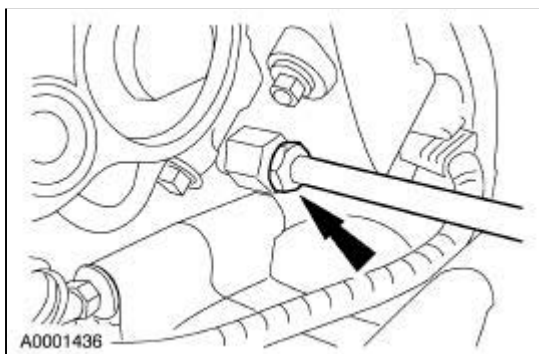
76. Remove the hydraulic fan pump bracket.
1. Remove the bolt.
 2. Remove the bracket.



77. Disconnect the hydraulic fan pump line.

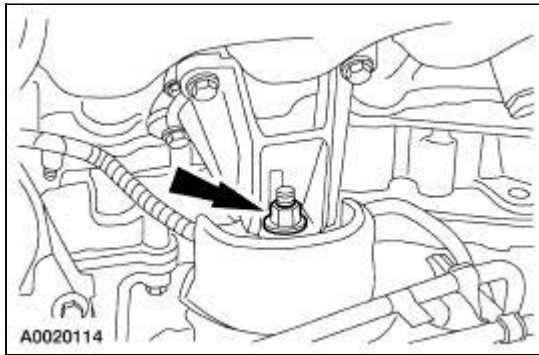


78. Using the special tool and an engine crane, support the engine and transmission in the front sub-frame.

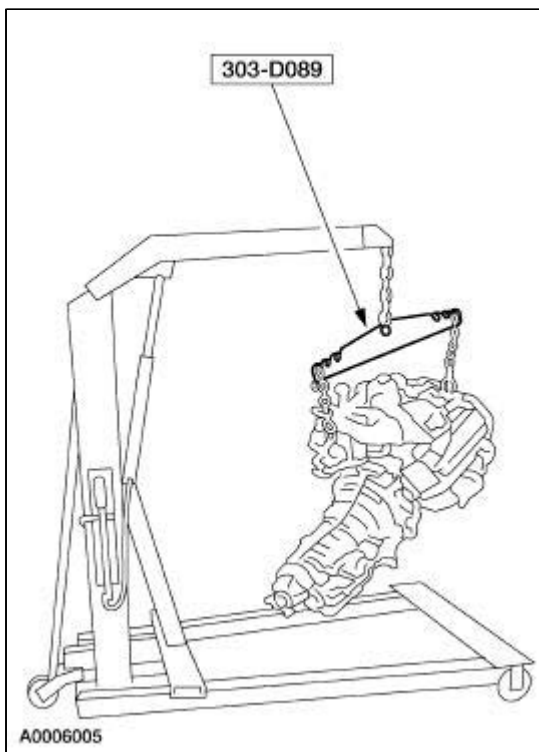


79. **NOTE:** LH shown; RH similar.

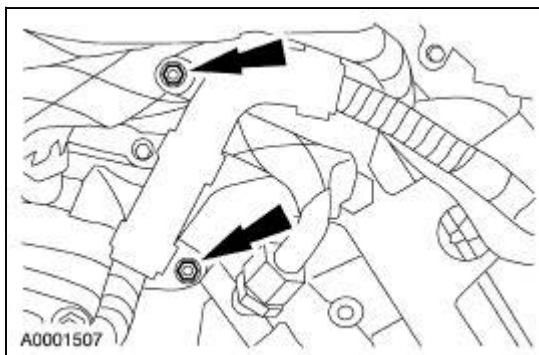
Remove the LH and the RH upper engine mount nuts.



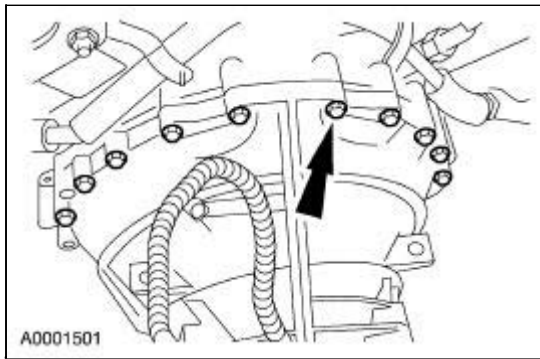
80. Using the special tool and an engine crane, move the engine and transmission from the sub-frame to rest on the floor or on a bench.



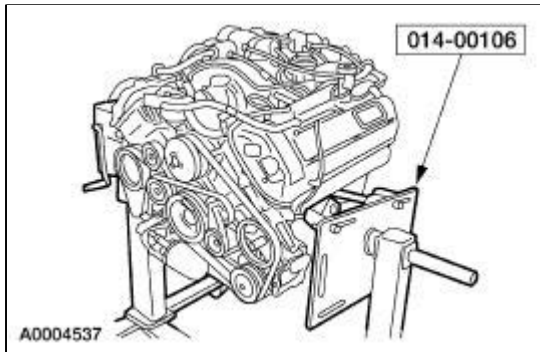
81. Remove the nuts and position the wiring harness aside.



82. Remove the bolts and separate the engine from the transmission.



83. Mount the engine on an engine stand.



84. Remove the engine lifting equipment.

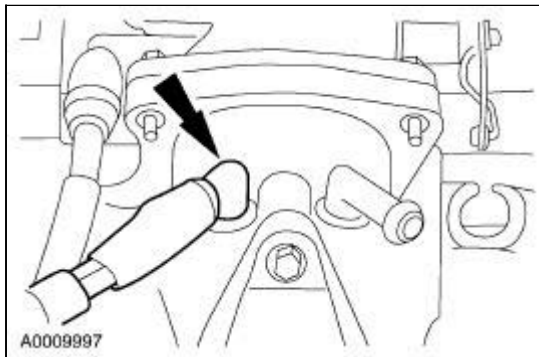
Engine

Special Tool(s)

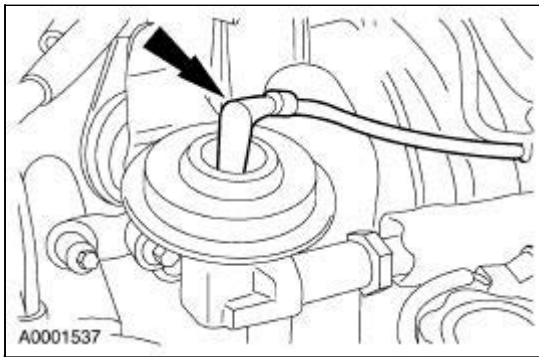
 ST1286-A	Crankshaft Damper Remover 303-009 (T58P-6316-D)
 ST2495-B	Crankshaft Rear Seal Remover/Installer 303-647
 ST2441-A	Screw 204-208 (T95T-5310-AR2)

Disassembly

1. Disconnect the vacuum harness.

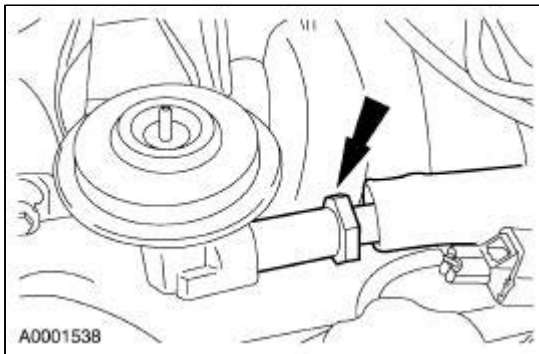


2. Disconnect the vacuum line.

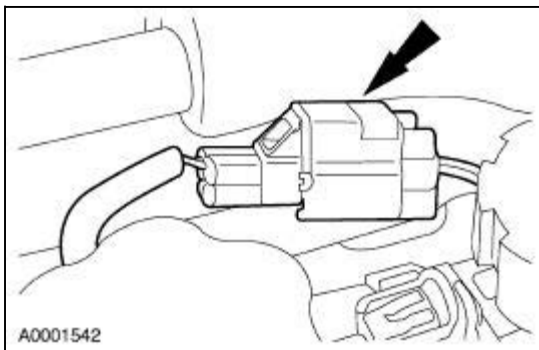


3. Remove the EGR valve to exhaust manifold tube.

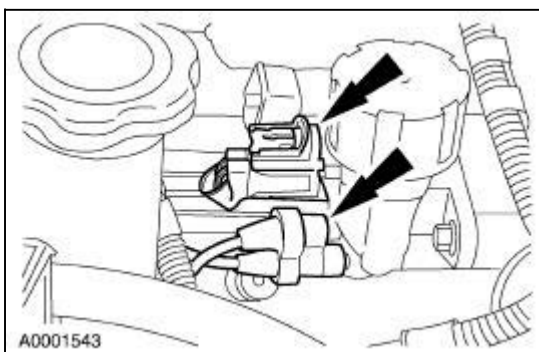
- Disconnect the upper fitting.
- Disconnect the hoses.
- Disconnect the lower fitting.



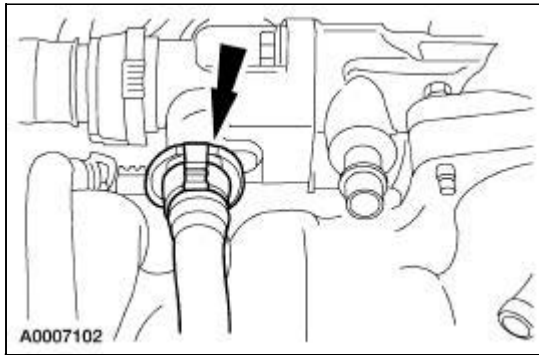
4. Disconnect the camshaft position (CMP) sensor electrical connector and separate the connector from the fuel injection supply manifold.



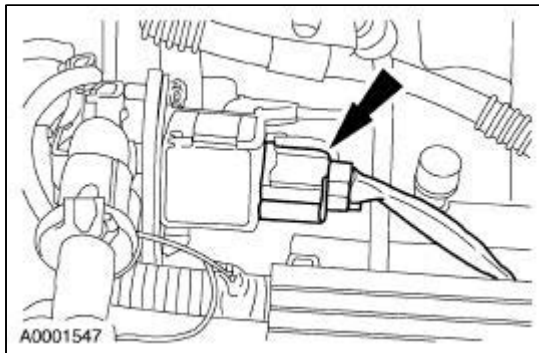
5. Disconnect the EGR vacuum regulator (EVR) electrical connector and the vacuum line.



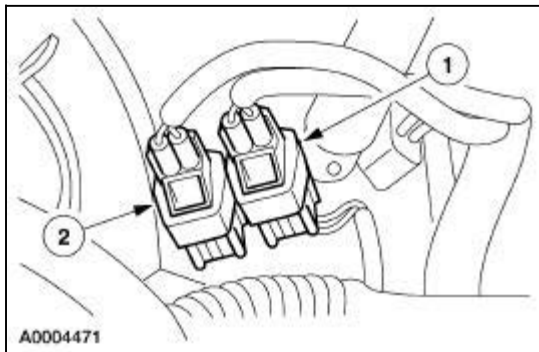
6. Disconnect the air assist tube.



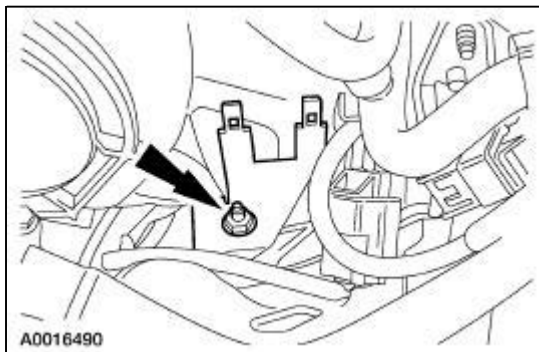
7. Disconnect the fuel pressure sensor electrical connector.



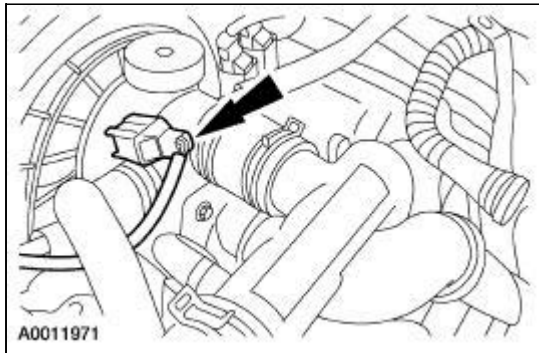
8. Remove the electrical connectors from the bracket.
 1. LH knock sensor (KS).
 2. Cylinder head temperature (CHT) sensor.



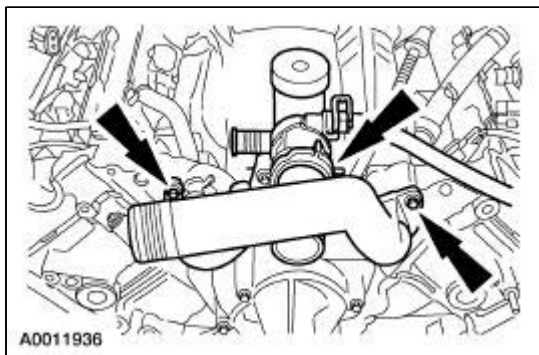
9. Remove the nut and the bracket.



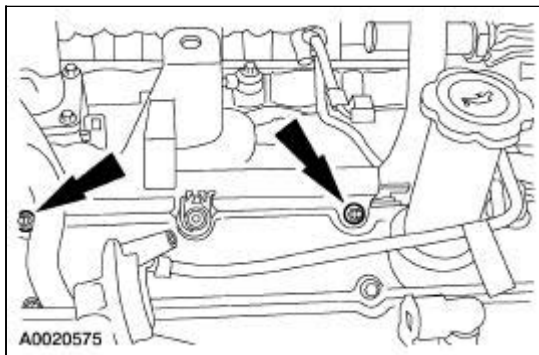
10. Disconnect the RH KS and remove the electrical connector from the bracket.



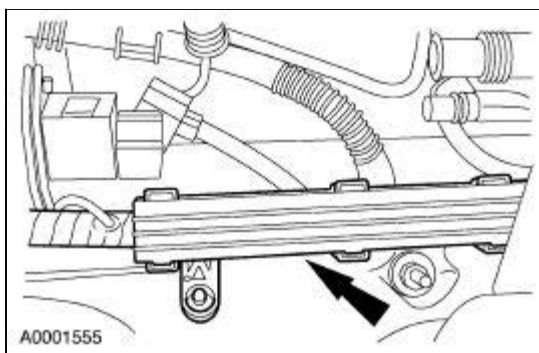
11. Remove the four bolts. Disconnect the hoses and remove the coolant outlet pipe.



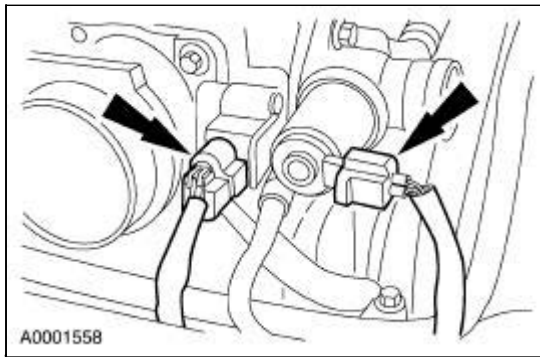
12. Remove the two nuts and the bracket.



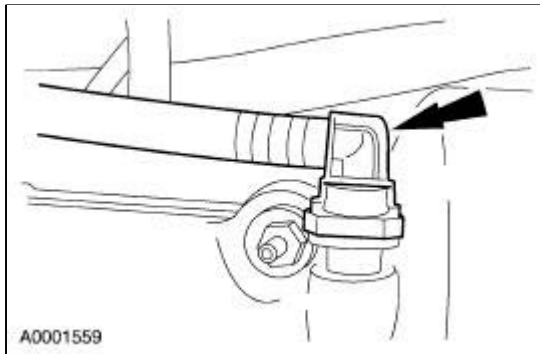
13. Raise the engine wiring harness and disconnect the LH fuel injector connectors.



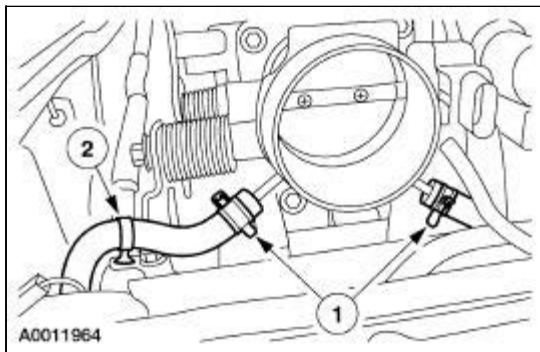
14. Disconnect the idle air control (IAC) valve and the throttle position sensor (TPS) electrical connectors.



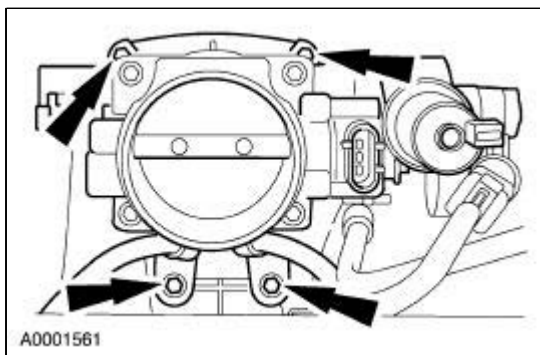
15. Disconnect the PCV tube.



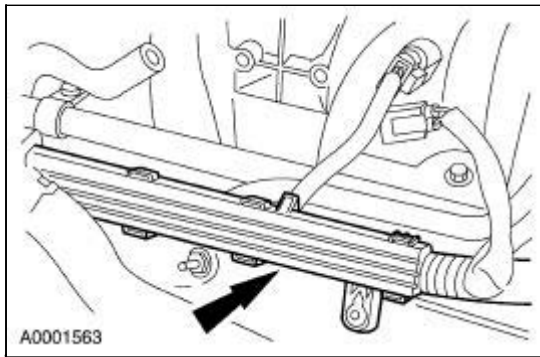
16. Disconnect the hoses (1) from the throttle body and the clip (2).



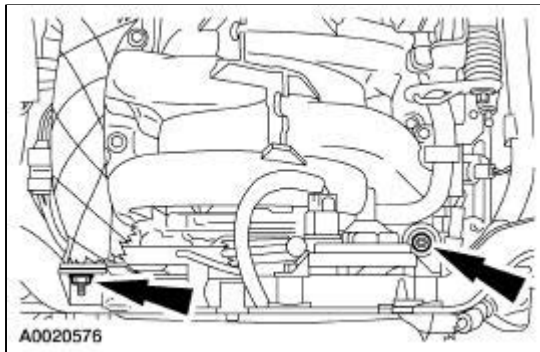
17. Remove the throttle body.



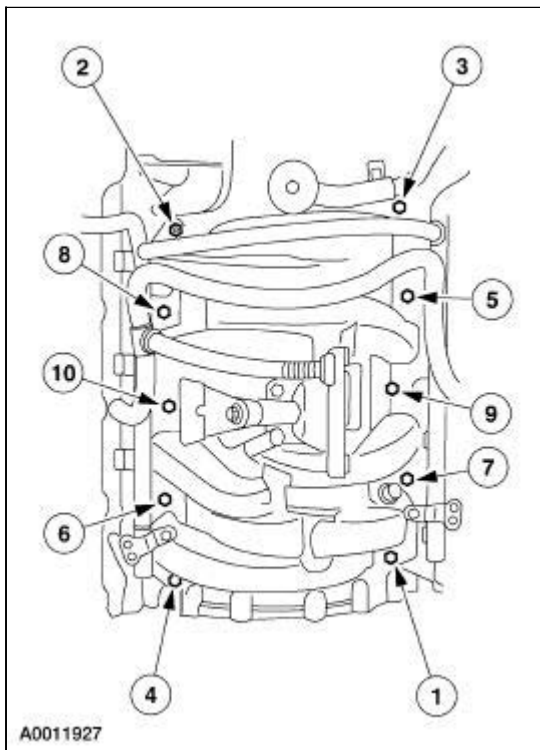
18. Raise the engine wiring harness and disconnect the RH fuel injectors.



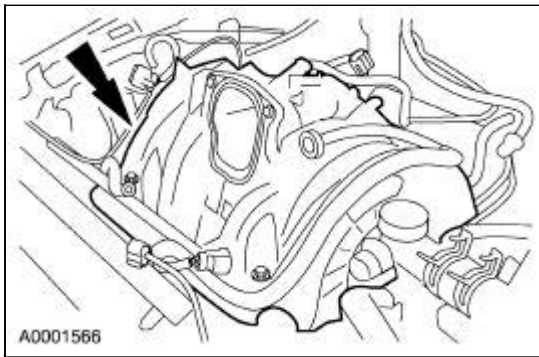
19. Remove the nuts and position the wiring harness aside.



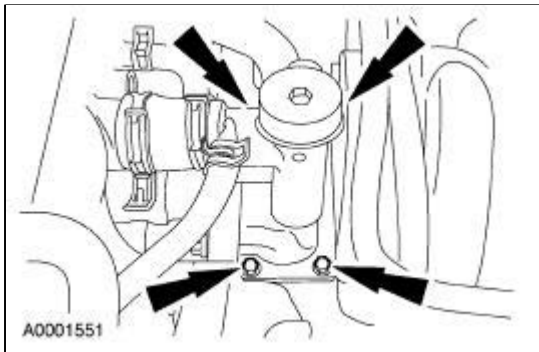
20. Remove the nine bolts and one stud (2) in the sequence shown.




21. Remove the intake manifold.

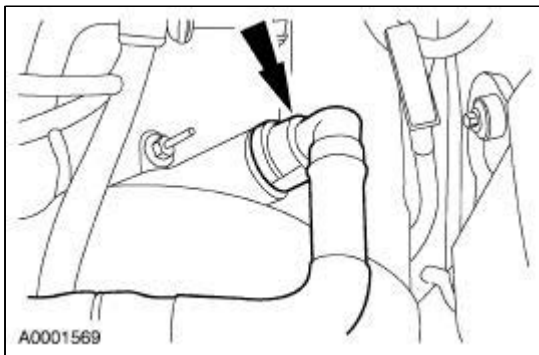


22. Remove the four bolts and the thermostat housing.

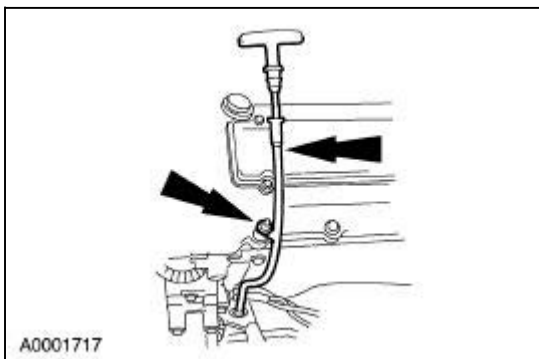


23.  **CAUTION:** To remove normal fittings, squeeze the tabs and pull straight out or damage to the fitting may occur.

Disconnect the crankcase ventilation tube.

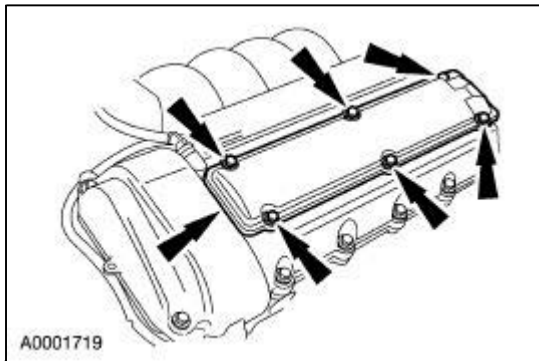


24. Remove the nut and the oil level indicator and tube.



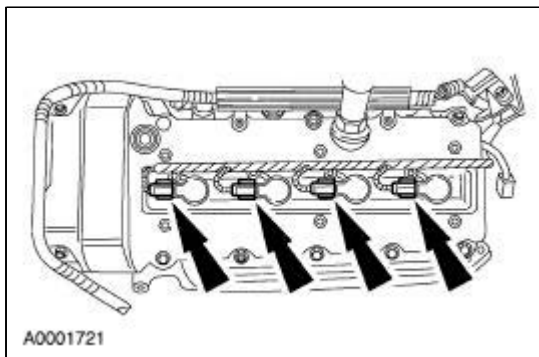
25. **NOTE:** LH shown; RH similar.

Remove the RH and LH coil covers.



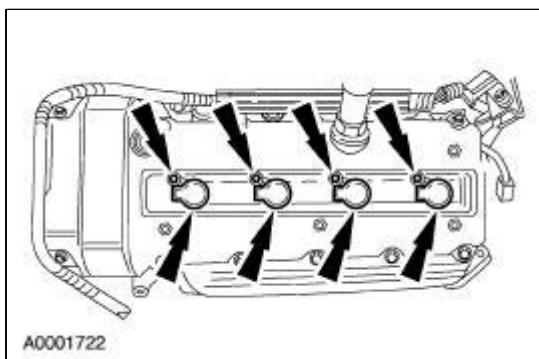
26. **NOTE:** LH shown; RH similar.

Disconnect the RH and LH ignition coil connectors.

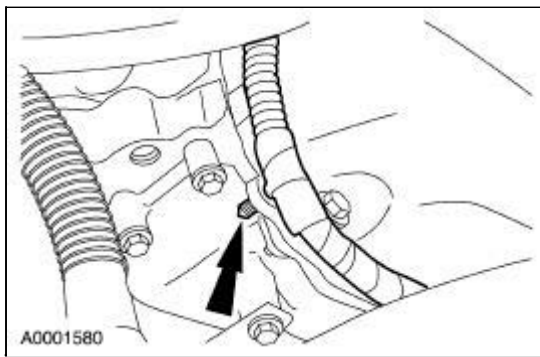


27. **NOTE:** LH shown; RH similar.

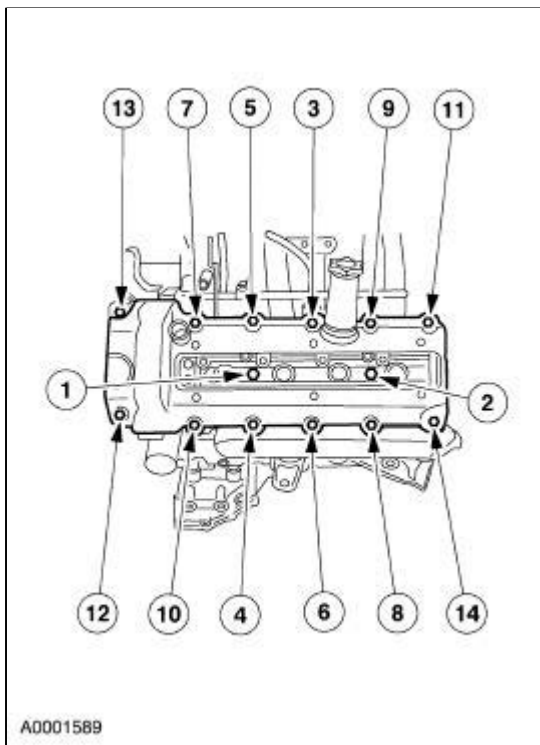
Remove the RH and LH ignition coils.



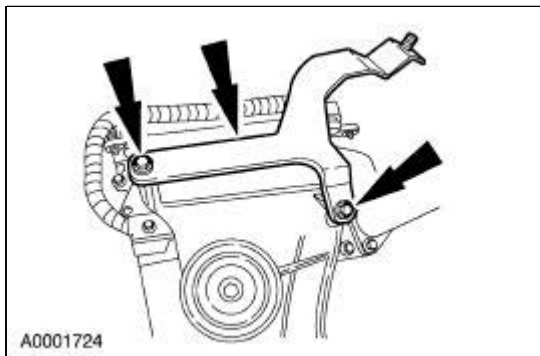
28. Disconnect the wiring harness retainers from the LH valve cover.



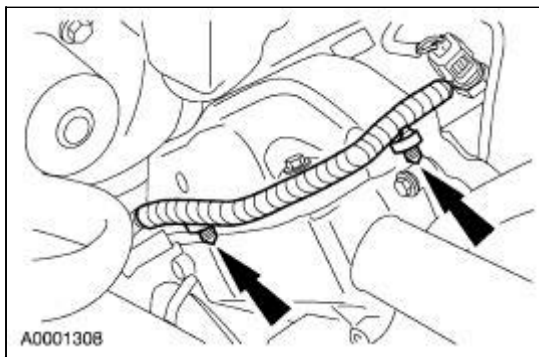
29. Remove the bolts in the sequence shown and remove the LH valve cover.



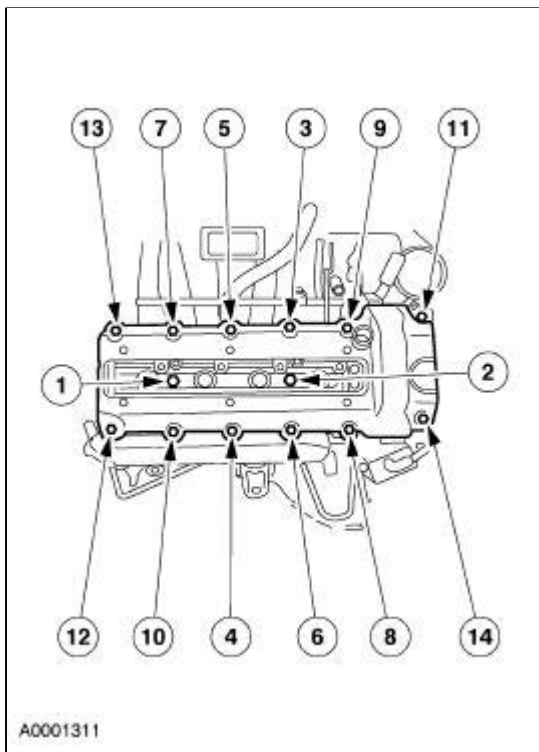
30. Remove the bracket.



31. Disconnect the four wiring harness retainers from the RH valve cover.



32. Remove the bolts in the sequence shown and remove the RH valve cover.

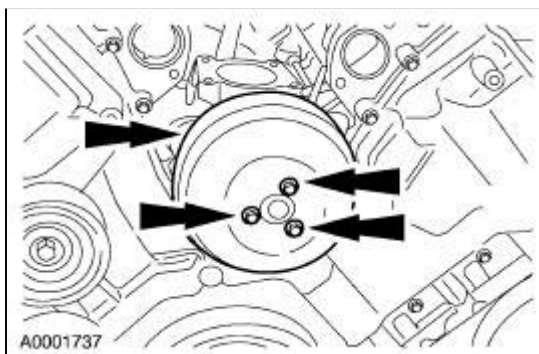



33. Loosen the water pump pulley bolts.

34. Remove the drive belt and tensioner. For additional information, refer to [Section 303-05](#).

35. Remove the water pump pulley.

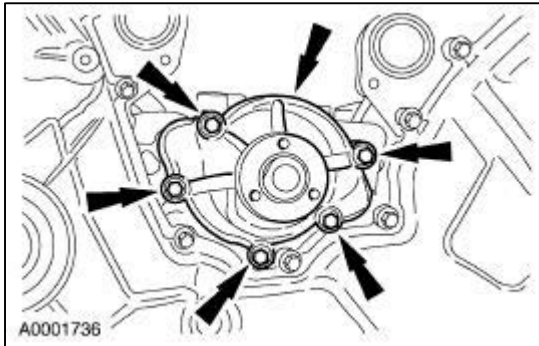
- Remove and discard the bolts.
- Remove the pulley.



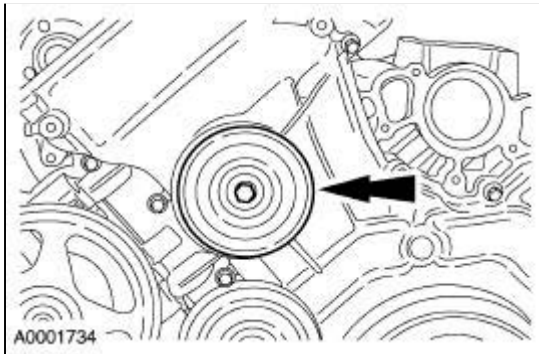
36.  **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of the gasket.**

Remove the water pump.

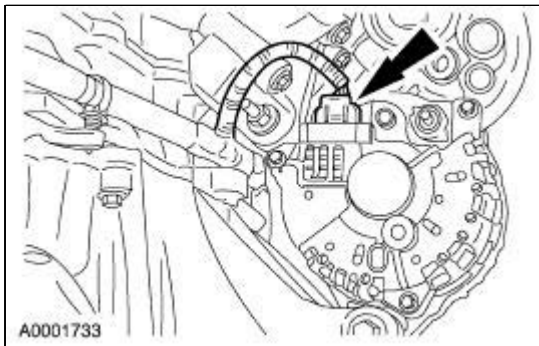
- Remove the bolts.
- Remove the water pump.
- Discard the gasket.
- Clean and inspect the O-ring seal. Install a new seal if necessary.



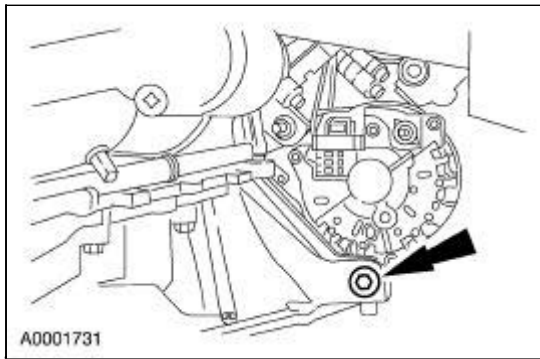
37. Remove the two idler pulleys.



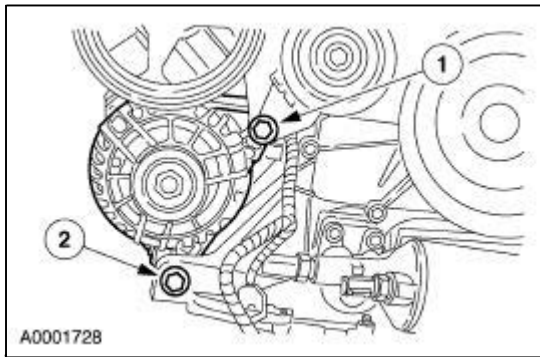
38. Disconnect the electrical connector at the rear of the generator.



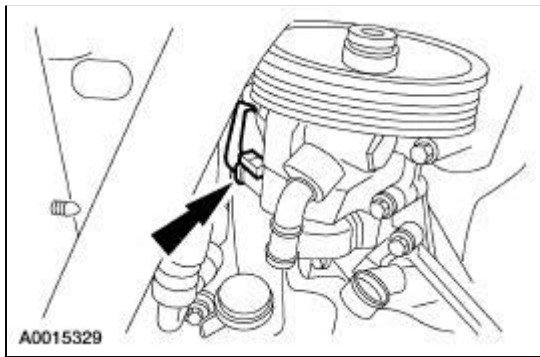
39. Remove the bolt.



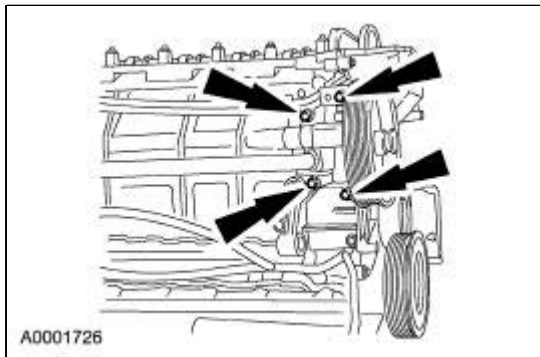
- 40. Remove the generator.
 - 1. Remove the upper bolt.
 - 2. Remove the lower bolt.



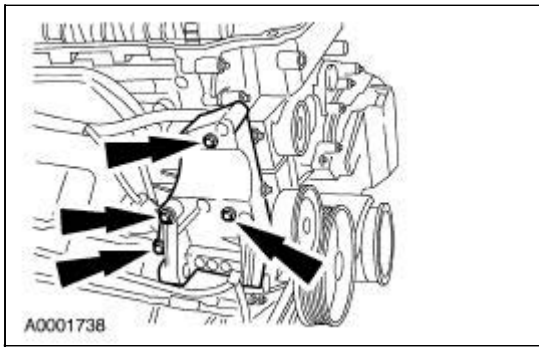
- 41. Disconnect the electrical connector.



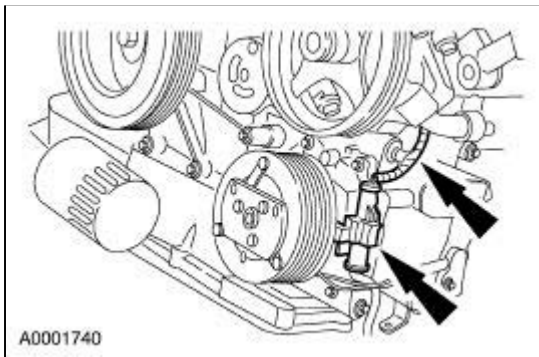
- 42. Remove the hydraulic cooling fan pump.



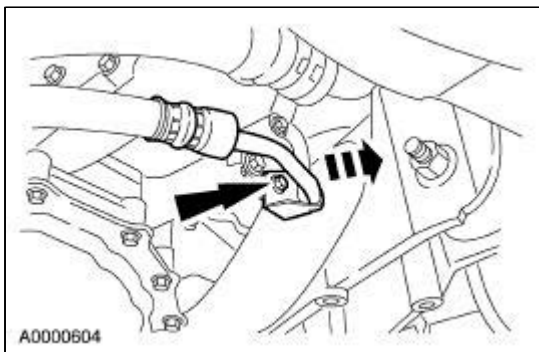
- 43. Remove the hydraulic pump bracket.



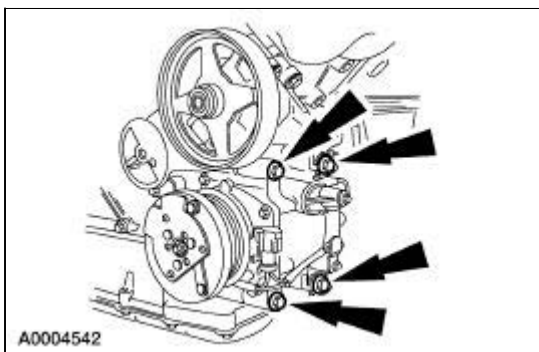
44. Disconnect the A/C electrical connector and the retaining clip.



45. Remove the two power steering hose brackets.

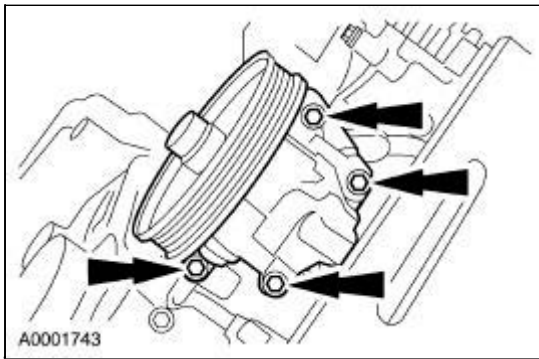


46. Remove the A/C compressor (19703).

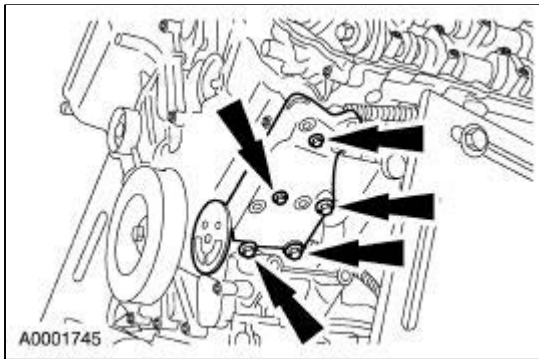


47. **NOTE:** One bolt is blocked by the power steering pressure line and will have to be removed in stages.

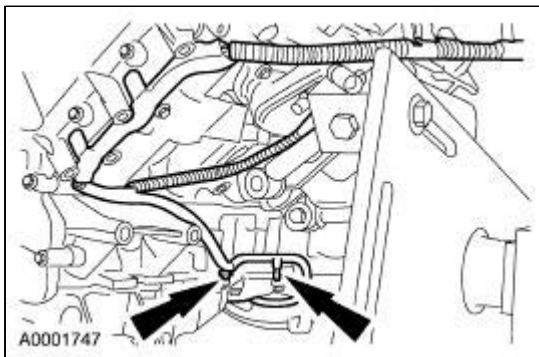
Remove the power steering pump.



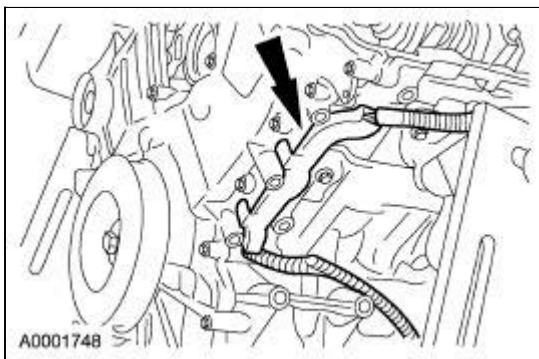
48. Remove the power steering pump bracket.



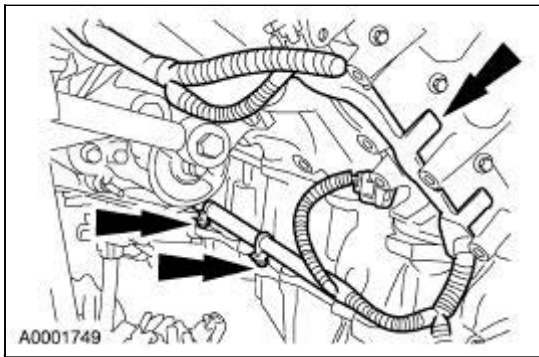
49. Disconnect the two pin-type retainers.



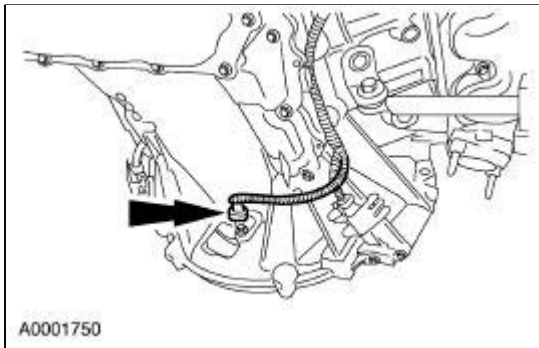
50. Remove the wiring harness from the front cover.



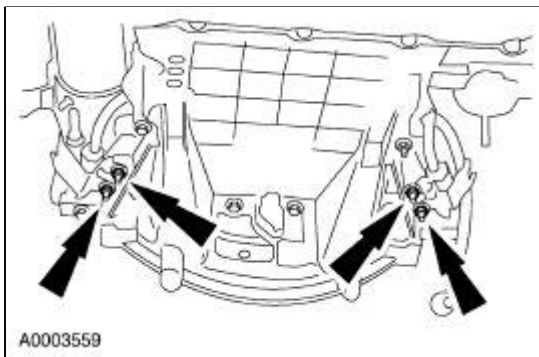
51. Remove the wiring harness from the front cover.



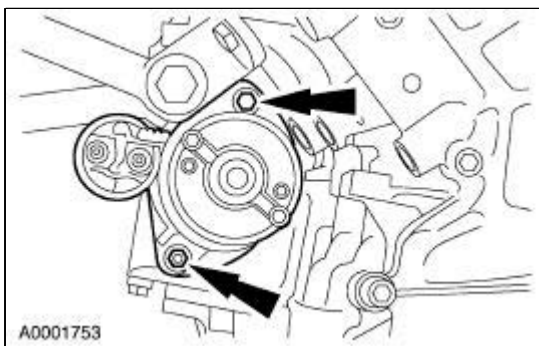
52. Disconnect the crankshaft position (CKP) sensor electrical connector.



53. Remove the exhaust gas oxygen sensor (HO2S) connectors from the brackets.

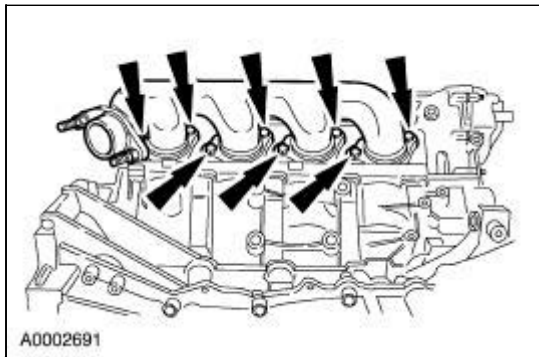


54. Remove the starter motor.

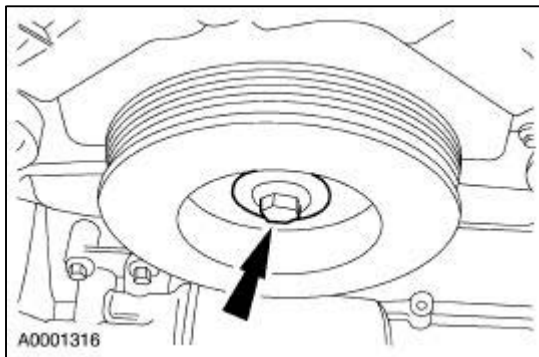


55. **NOTE:** RH shown; LH similar.

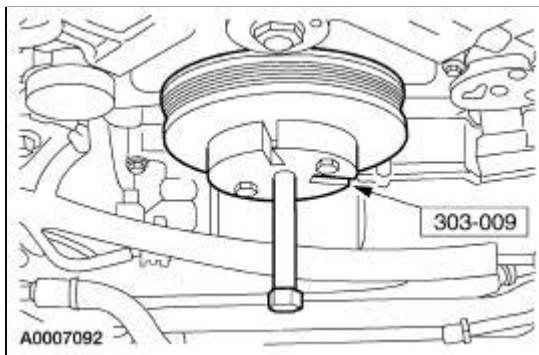
Remove the RH and LH exhaust manifolds.



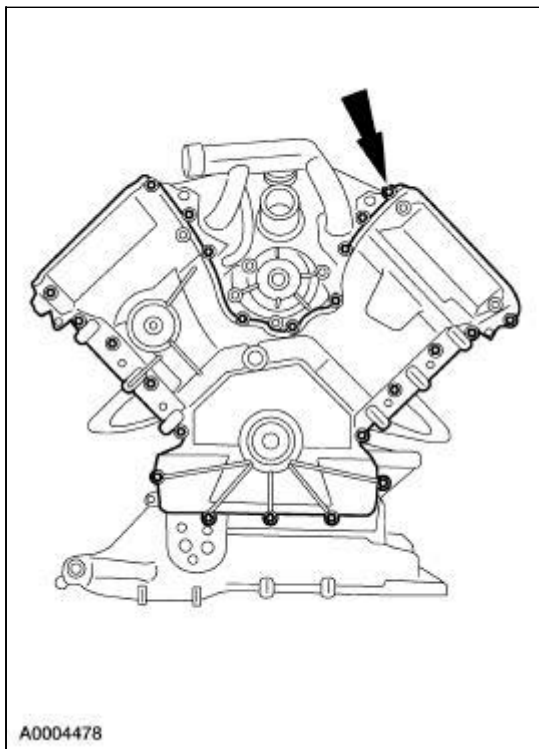
56. Remove the bolt and washer.
- Discard the bolt.



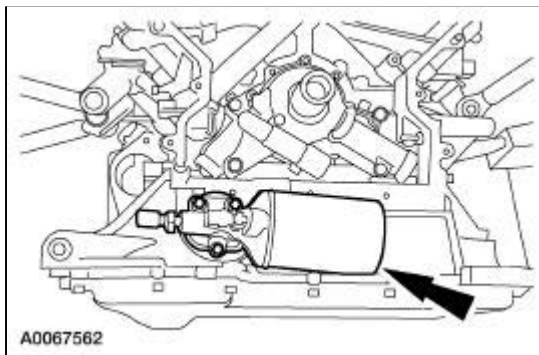
57. Using the special tool, remove the crankshaft damper.



58. Remove the bolts and remove the front cover.

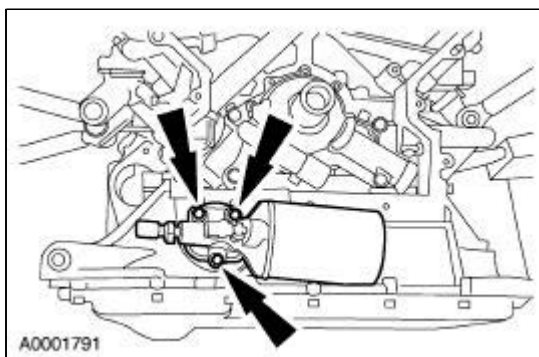


59. Remove and discard the oil filter.



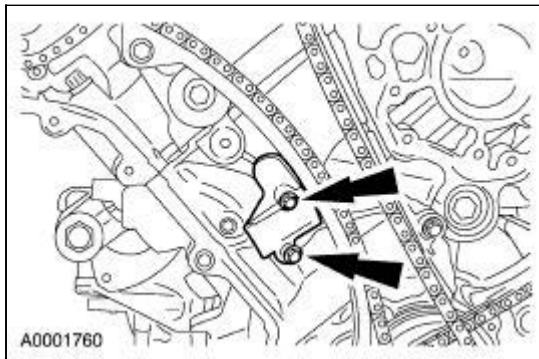
60. Remove the oil filter adapter.

- Discard the seal.

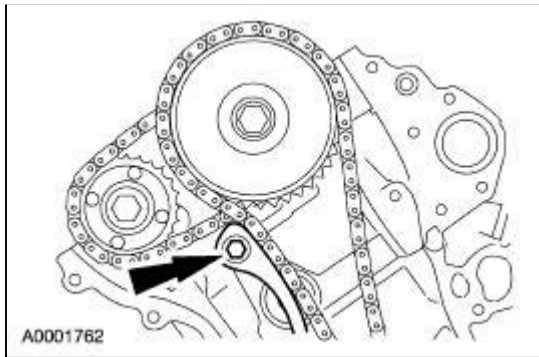


61. Turn the crankshaft to 45 degrees ATDC. The crankshaft keyway will be in the 6 o'clock position.

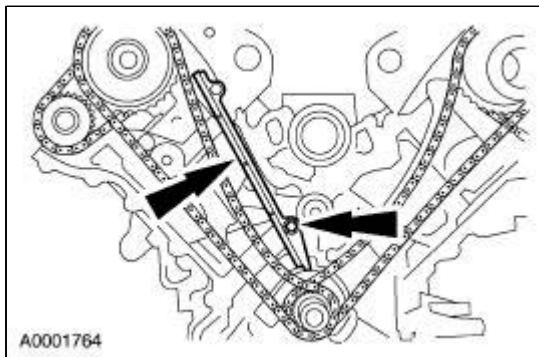
62. Remove the RH primary chain tensioner and the blanking plate.



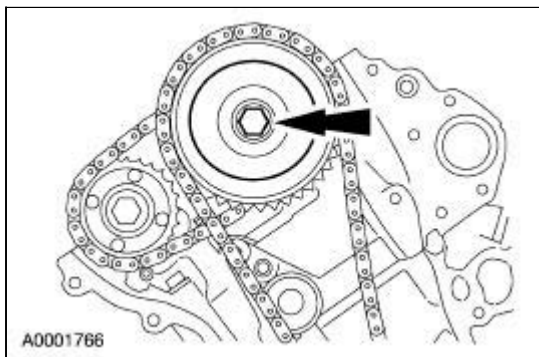
63. Remove the RH lower primary chain tensioner arm.



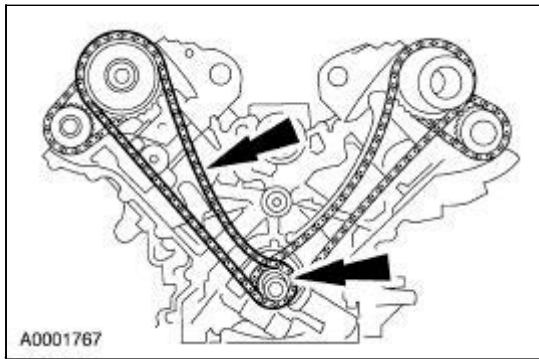
64. Remove the RH upper primary chain tensioner guide.



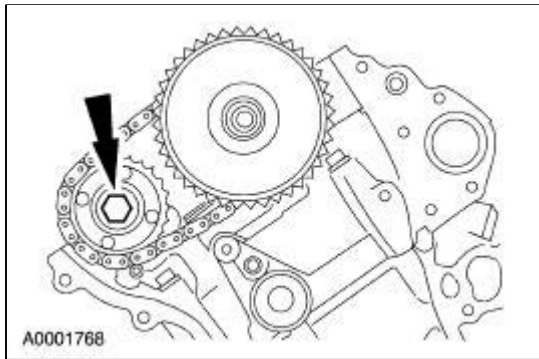
65. Remove the bolt and the RH camshaft damper.



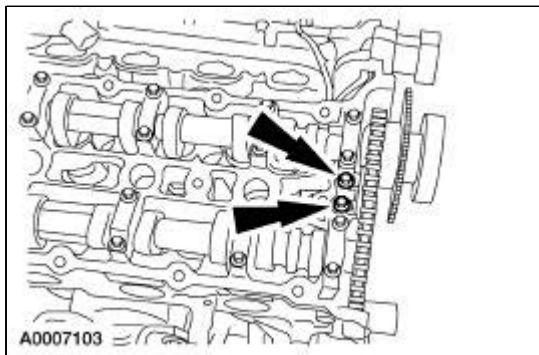
66. Remove the RH primary chain (6268) and crankshaft sprocket.



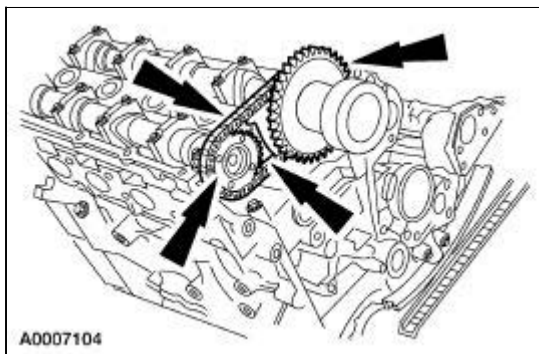
67. Remove the exhaust camshaft sprocket bolt.



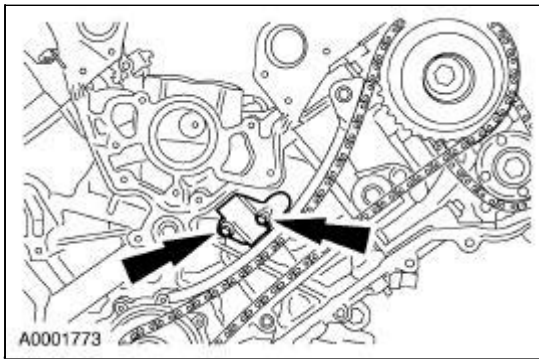
68. Remove the secondary timing chain tensioner bolts.



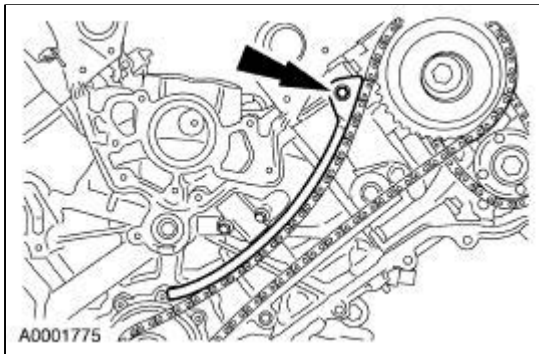
69. Remove the RH camshaft chain, tensioner and sprockets as an assembly.



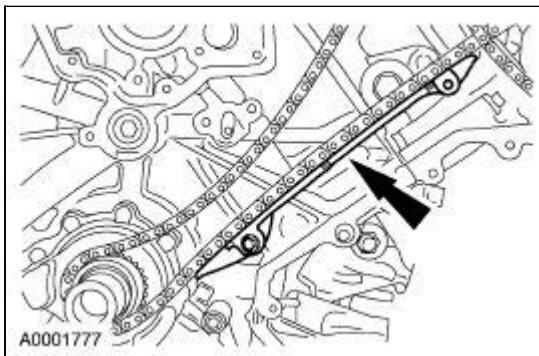
70. Remove the bolts and the LH primary chain tensioner and the blanking plate.



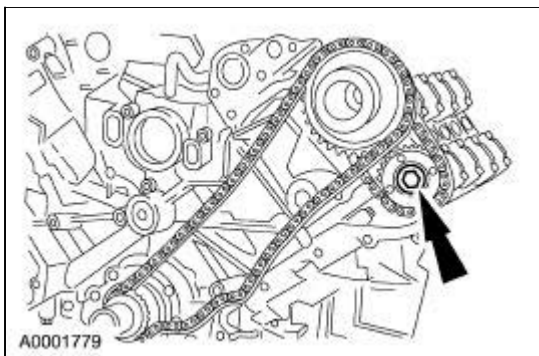
71. Remove the LH upper primary chain tensioner arm.



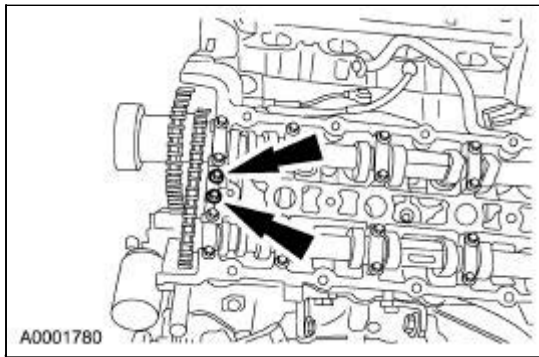
72. Remove the LH lower primary chain tensioner guide.



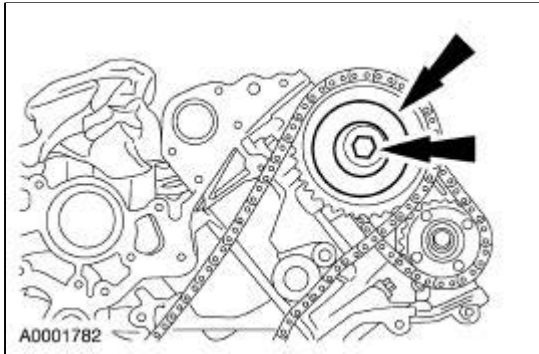
73. Remove the exhaust camshaft sprocket bolt.



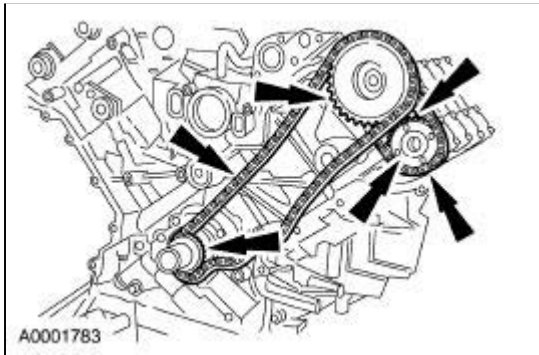
74. Remove the secondary timing chain tensioner bolts.



75. Remove the intake sprocket bolt and the camshaft damper.



76. Remove the LH camshaft chain, tensioner sprockets, primary chain and crankshaft sprocket as an assembly.

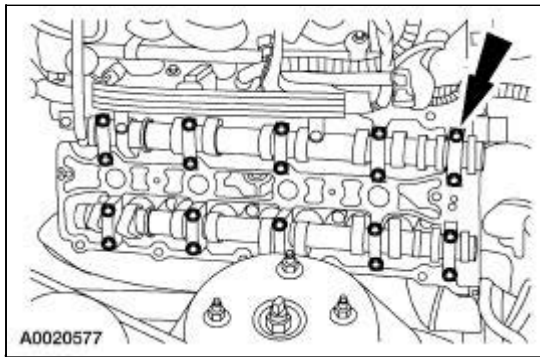


77.  **CAUTION: Mark the camshaft caps for correct location and orientation during assembly.**

NOTE: RH shown; LH similar.

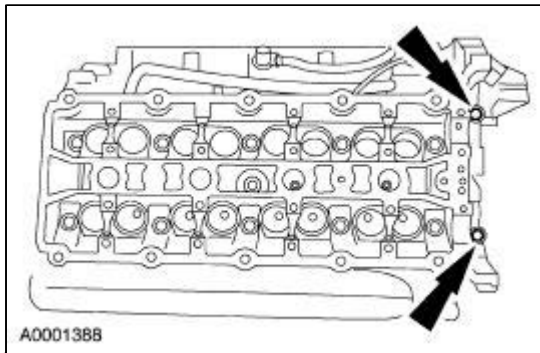
Remove the camshafts from the RH and LH cylinder heads.

- Remove the bolts.
- Remove the caps.
- Remove the camshafts.

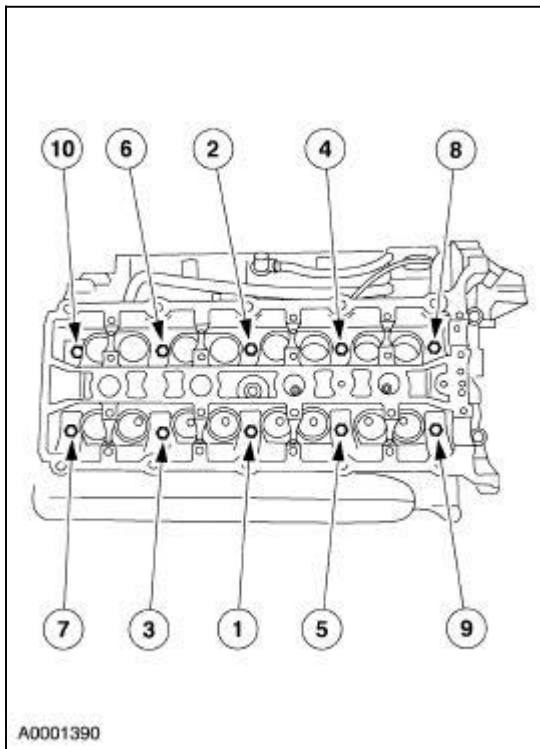


78. **NOTE:** RH shown; LH similar.

Remove the bolts from the RH and LH cylinder heads.

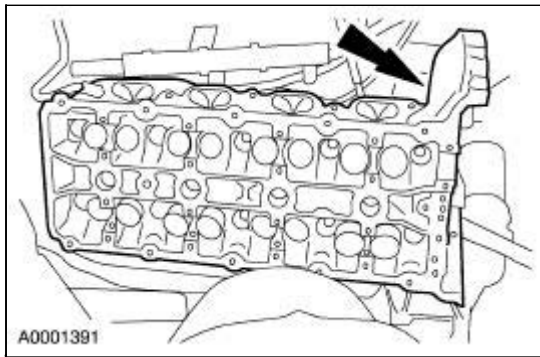



79. Remove the bolts in sequence shown from both cylinder heads.



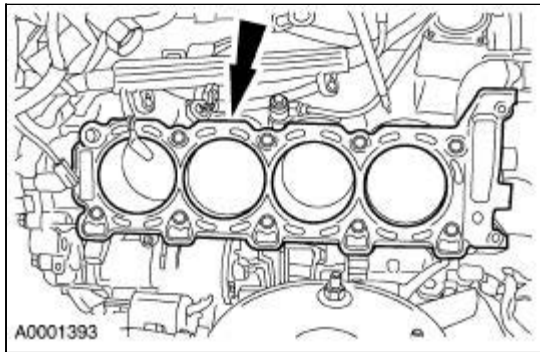
80. Remove the cylinder heads.

- Discard the gaskets.

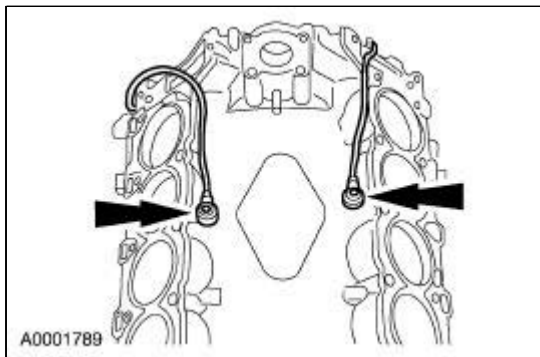


81.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of sealant.

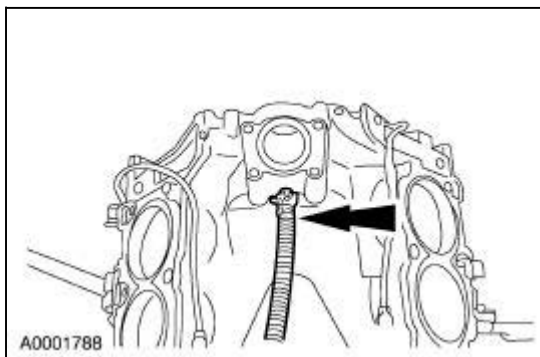
Clean the sealing surfaces.



82. Remove the knock sensors.

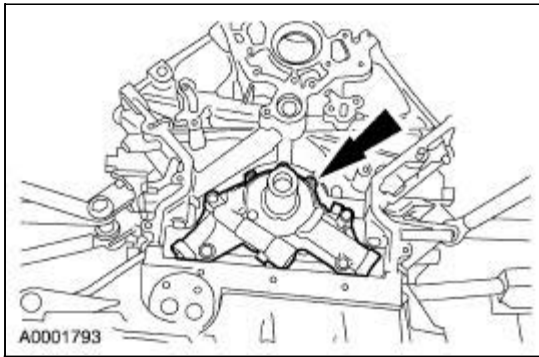


83. Remove the throttle body heater return hose.

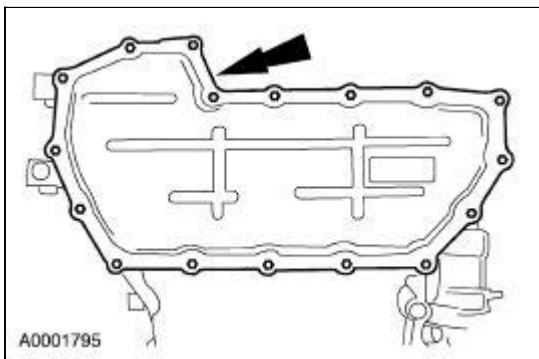


84. Remove the four bolts and the oil pump.

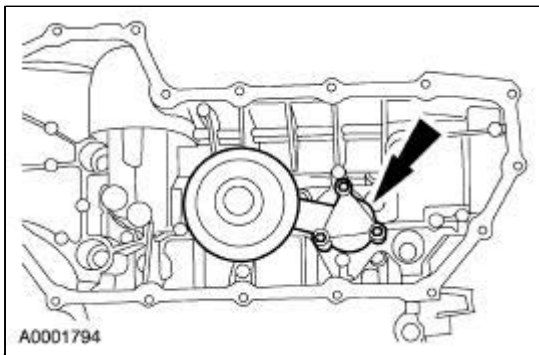
- Discard the gasket.



85. Remove the bolts and the oil pan.

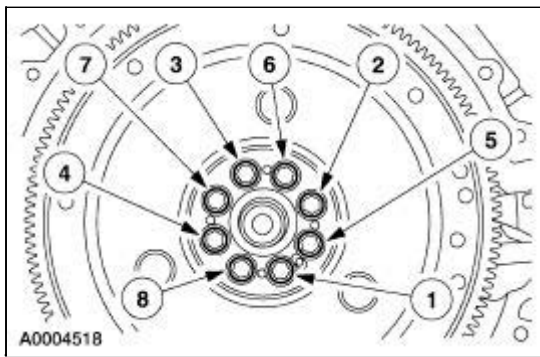


86. Remove the oil pump screen cover and tube and seal.

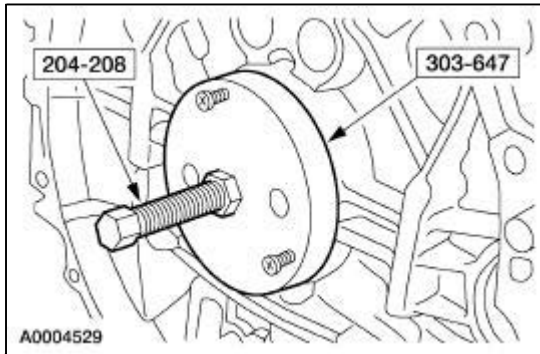


87. Remove the flexplate.

- Remove the bolts in the sequence shown.
- Remove the flexplate.

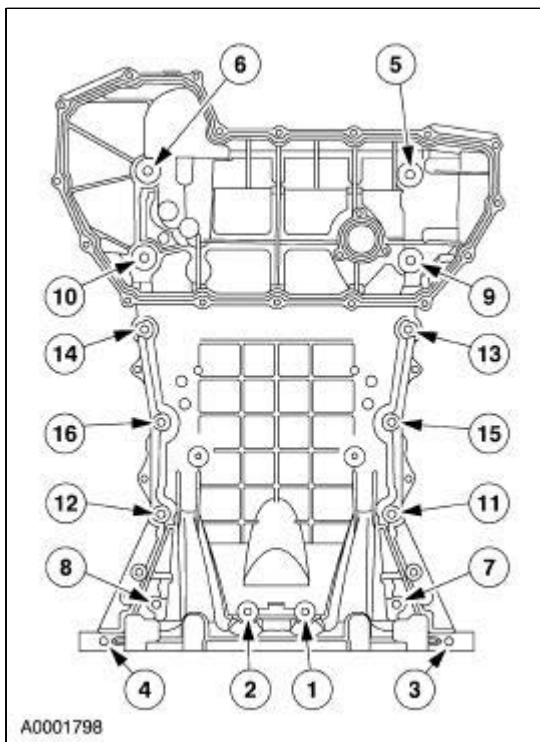


88. Using the special tool, remove the rear main seal.
- Discard the seal.



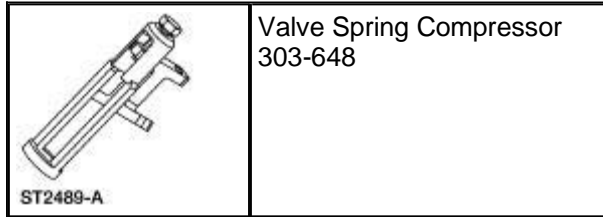
89. **⚠ CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of the sealant.

Remove the bolts in the sequence shown and remove the sump body.



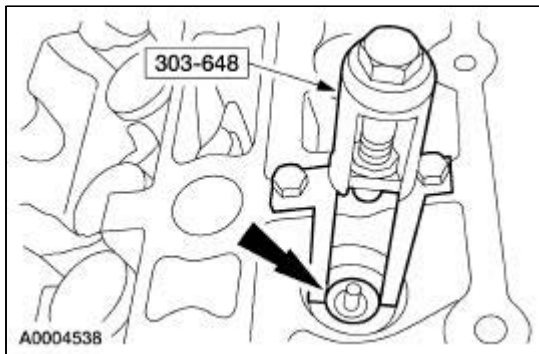
Cylinder Head

Special Tool(s)

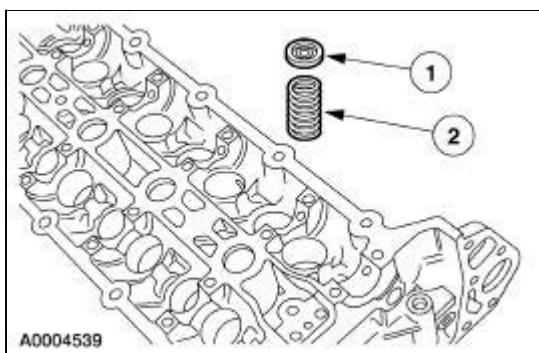


Disassembly

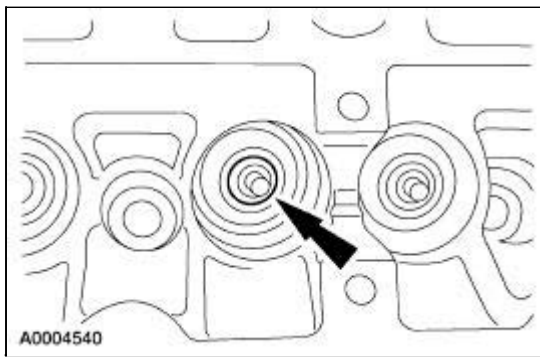
1. Using the special tool, remove the valve spring retainer keys.



2. Remove the valve spring assemblies.
 1. Remove the valve spring retainers.
 2. Remove the valve springs.
 - For component tests for the valve spring refer to [Section 303-00](#).

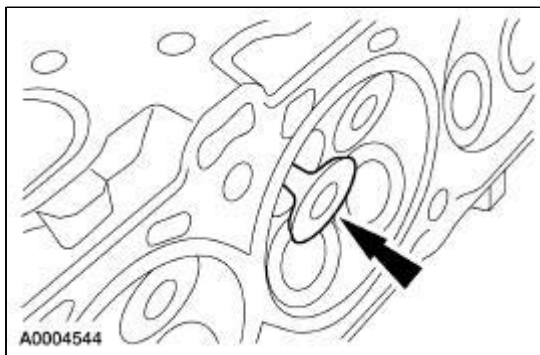


3. Remove the valve stem seal.



4. Remove the valve.

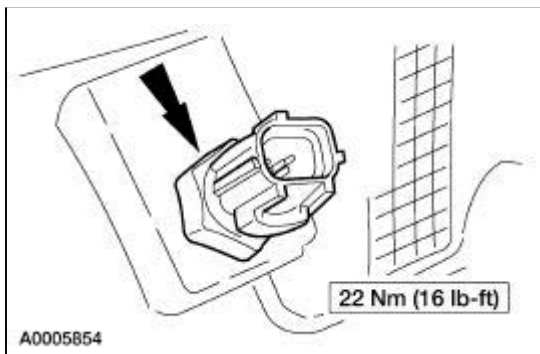
- For component tests for the valve, refer to [Section 303-00](#).
- For component tests for the cylinder head, refer to [Section 303-00](#).



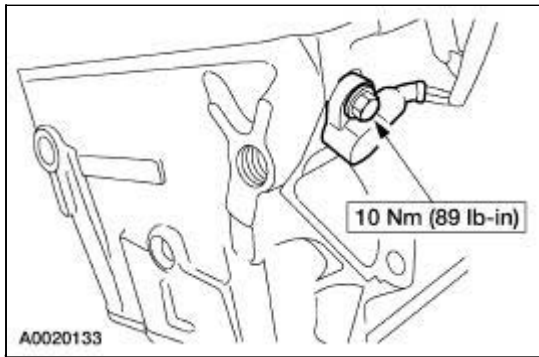
5. Repeat the procedure until all of the valves are removed from the cylinder head.

6. Remove the spark plugs. For additional information, refer to [Section 303-07B](#).

7. Remove the cylinder head temperature sensor (CHT) sensor.



8. Remove the camshaft position (CMP) sensor.





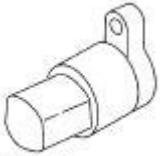
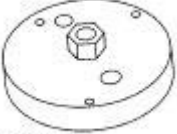



Assembly

1. To assemble, reverse the disassembly procedure.
 - Lubricate the valve stem and the valve stem seal with Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.
-

Engine

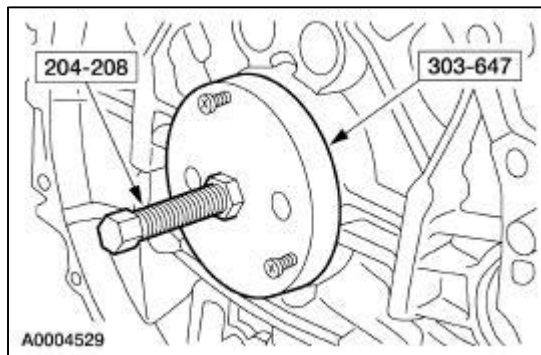
Special Tool(s)


 ST2423-A	Front Crankshaft Seal Installer 303-646
 ST1287-A	Crankshaft Damper Replacer 303-102 (T74P-6316-B)
 ST2398-B	Camshaft Position Tool 303-530
 ST2399-A	Timing Chain Tensioning Tool 303-532
 ST2401-A	Crankshaft Position Tool 303-645
 ST2495-B	Crankshaft Rear Seal Remover/Installer 303-647
 ST2441-A	Screw 204-208 (T95T-5310-AR2)

1. **NOTE:** Lubricate the outer lips and the inner seal on the crankshaft rear oil seal with Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-

M2C153-G.

Using the special tool, install the rear main seal.

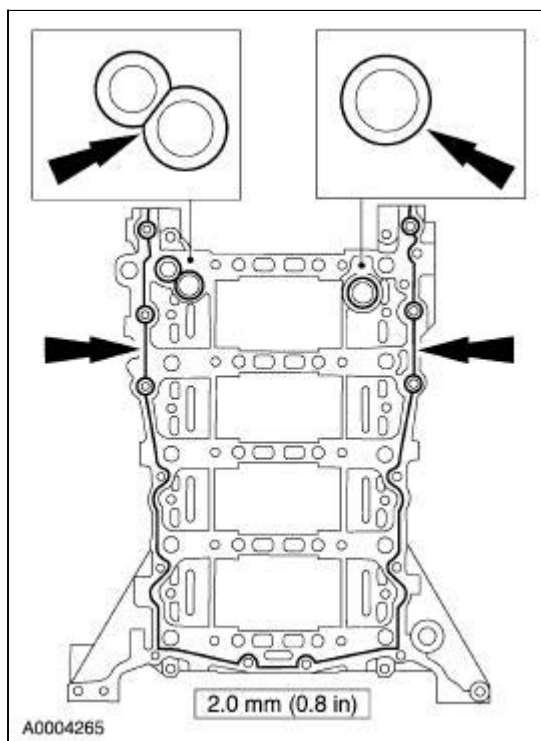


2.  **CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs, or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

NOTE: If the sump is not secured within 20 minutes of sealant application the sealant must be removed and the sealing area cleaned with Metal Surface Cleaner F4AZ-19A536-RA or equivalent meeting Ford specification WSE-M5B392-A. Allow to dry until there is no sign of wetness, or four minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

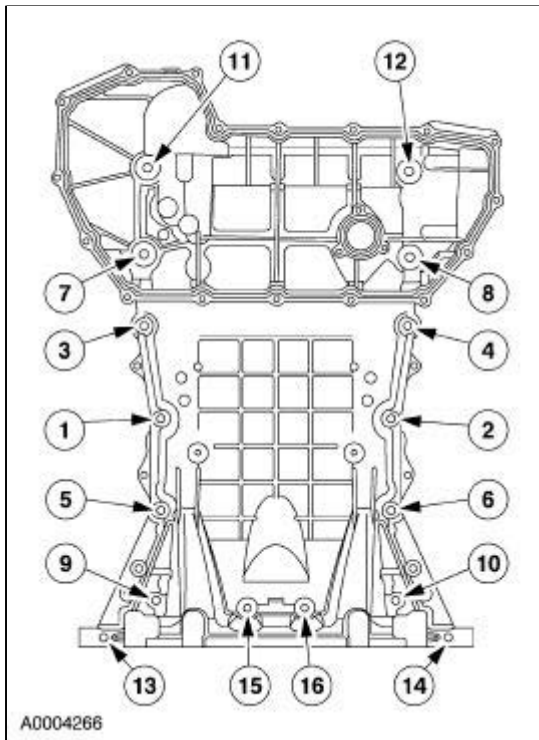
Apply three continuous beads of sealer.

- Use Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4.

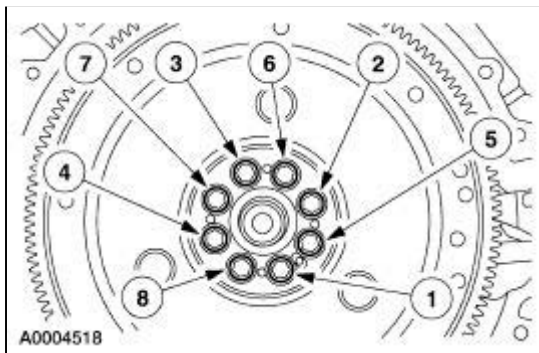


3. Install the oil sump. Using a straightedge, align the sump to the lower cylinder block. Tighten the bolts in sequence in two stages.
- Tighten the bolts to 15 Nm (11 lb-ft).

- Tighten the bolts to 25 Nm (18 lb-ft).



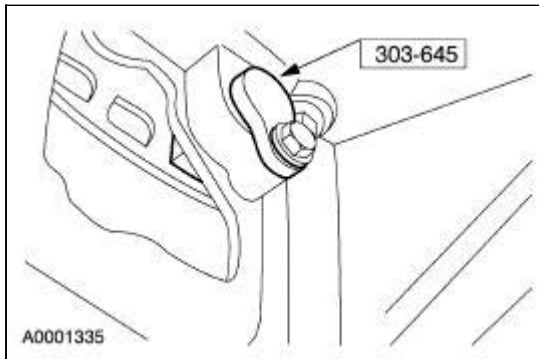
4. Install the flexplate and tighten the bolts in two stages in the sequence shown.
 - Stage 1: Tighten to 15 Nm (11 lb-ft).
 - Stage 2: Tighten to 110 Nm (81 lb-ft).



5. **NOTE:** There is one window on the ignition pulse wheel that is unique to accept the special tool.

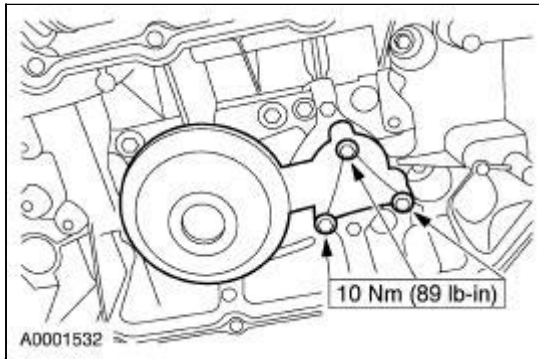
Install the special tool.

- Turn the crankshaft to 45 degrees ATDC. The crankshaft keyway will be in the 6 o'clock position.
- Install the special tool.



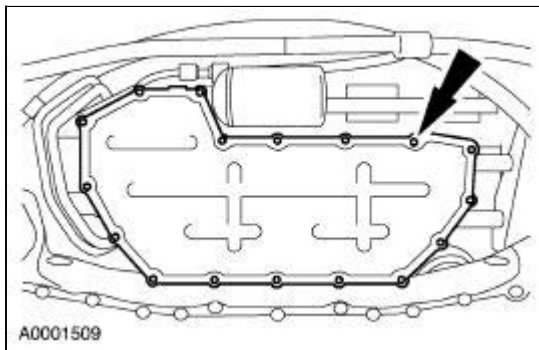
6. **NOTE:** Inspect the seal. Install a new seal if necessary.

Install the oil pump screen cover and tube.



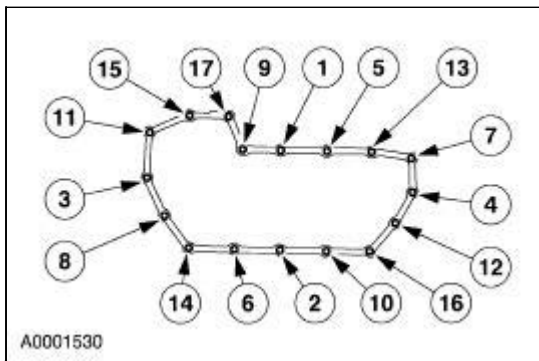
7. **NOTE:** Inspect and install a new oil pan gasket if necessary.

Install the oil pan.



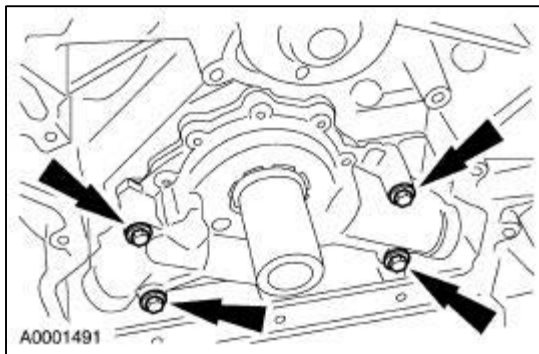
8. Tighten the bolts in the sequence shown in two stages.

- Stage 1: Tighten to 5 Nm (44 lb-in).
- Stage 2: Tighten to 12 Nm (9 lb-ft).

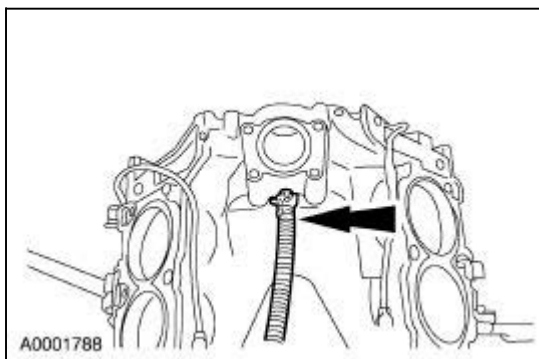


9. Install a new gasket, the oil pump and tighten the bolts in two stages.

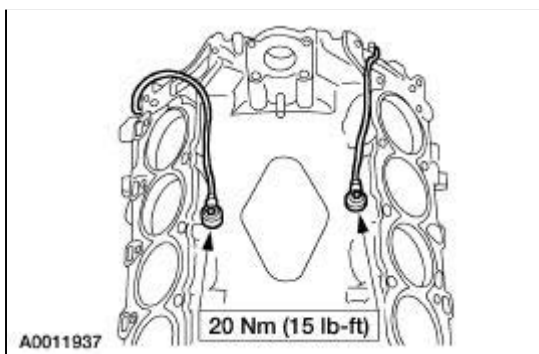
- Stage 1: Tighten to 6 Nm (53 lb-in).
- Stage 2: Tighten an additional 90 degrees.



10. Install the throttle body heater return hose.

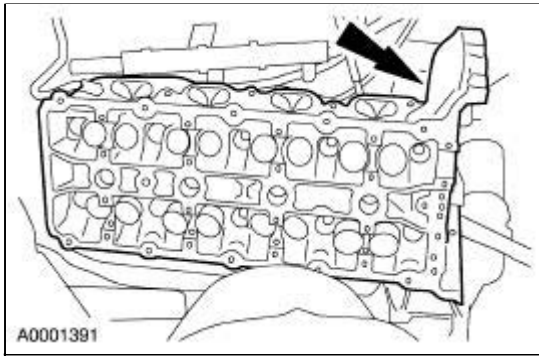


11. Install the knock sensors.



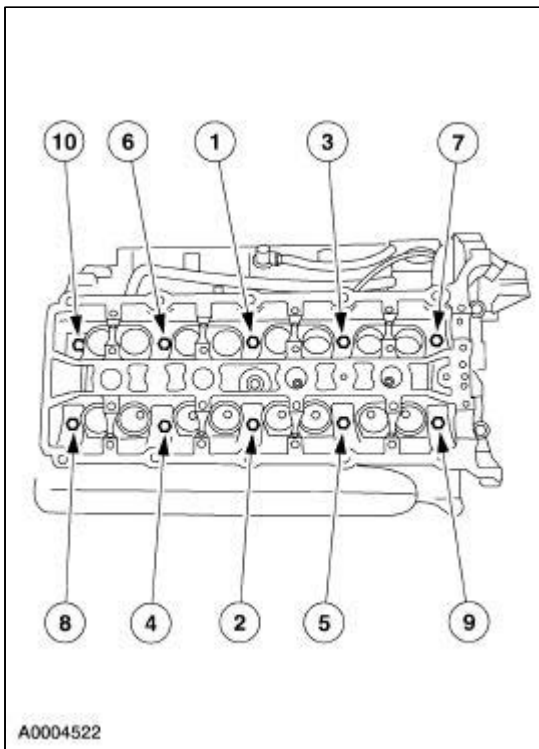
12. Position the cylinder heads.

- Install new gaskets.



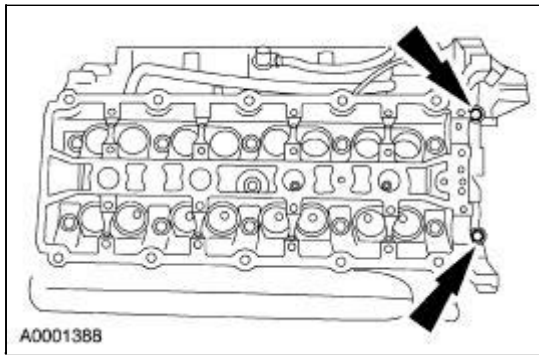
13. Install and tighten the RH head bolts in six stages in the sequence shown.

- Stage 1: Tighten bolts 1–10 to 20 Nm (15 lb-ft).
- Stage 2: Tighten bolts 1–10 to 35 Nm (26 lb-ft).
- Stage 3: Tighten bolts 1-10 to 45 Nm (33 lb-ft) and an additional 90 degrees.
- Stage 4: Tighten bolts 1-10 an additional 90 degrees.
- Stage 5: Tighten bolts 11 and 12 to 20 Nm (15 lb-ft).
- Stage 6: Tighten bolts 11 and 12 an additional 90 degrees.



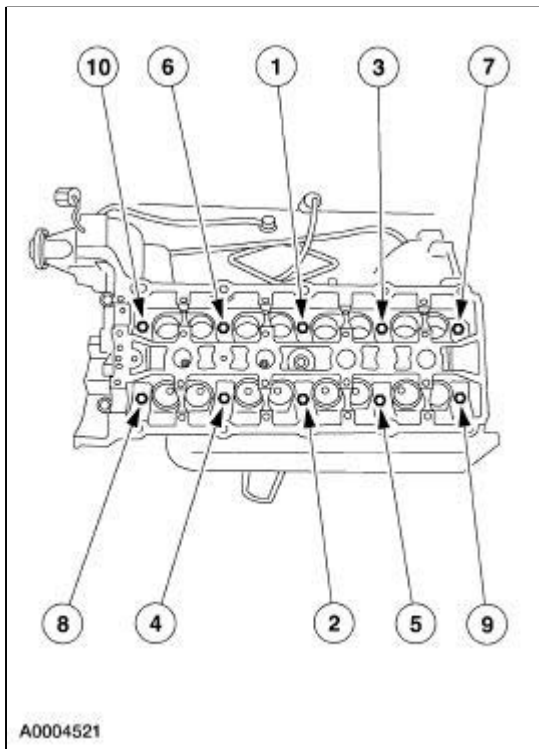
14. Install and tighten the bolts in two stages.

1. Tighten to 20 Nm (15 lb-ft).
2. Tighten an additional 90 degrees.



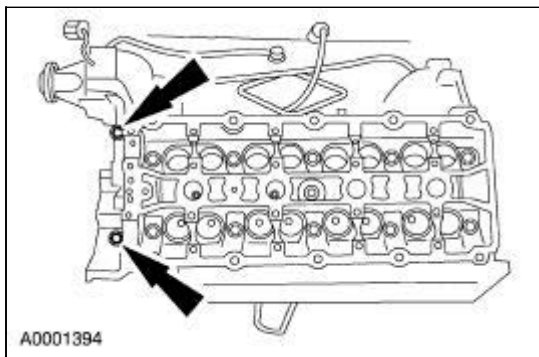
15. Install and tighten the LH head bolts in six stages in the sequence shown.


- Stage 1: Tighten bolts 1–10 to 20 Nm (15 lb-ft).
- Stage 2: Tighten bolts 1–10 to 35 Nm (26 lb-ft).
- Stage 3: Tighten bolts 1–10 to 45 Nm (33 lb-ft) and an additional 90 degrees.
- Stage 4: Tighten bolts 1–10 an additional 90 degrees.
- Stage 5: Tighten bolts 11 and 12 to 20 Nm (15 lb-ft).
- Stage 6: Tighten bolts 11 and 12 an additional 90 degrees.



16. Install and tighten the bolts in two stages.

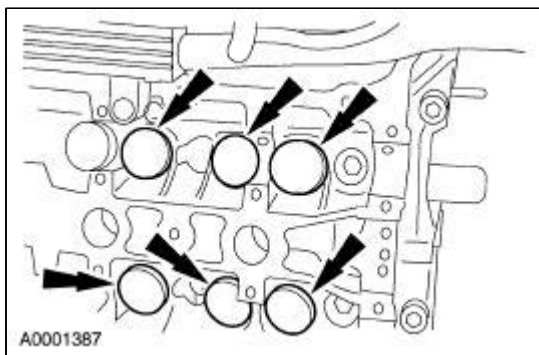
1. Tighten to 20 Nm (15 lb-ft).
2. Tighten an additional 90 degrees.



17.  **CAUTION:** The shim and tappets are location-specific. They must be installed in their original locations or shims will have to be reselected during installation.

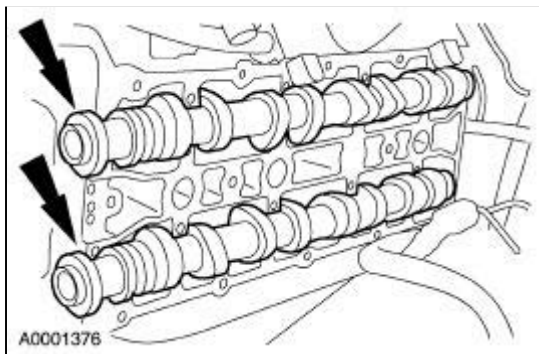
 **CAUTION:** Do not use any means of marking the shims other than a permanent type marker. Any scratches or paint on the shims may result in incorrect lash adjustments and severe engine damage.


If removed, install the tappets and shims. If new tappets and shims are to be installed or if they cannot be identified, refer to [Valve —Clearance Adjust](#) in this section.



18. **NOTE:** Apply Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G to the camshaft journals, the camshaft caps and the camshaft lobes prior to installing the camshafts.

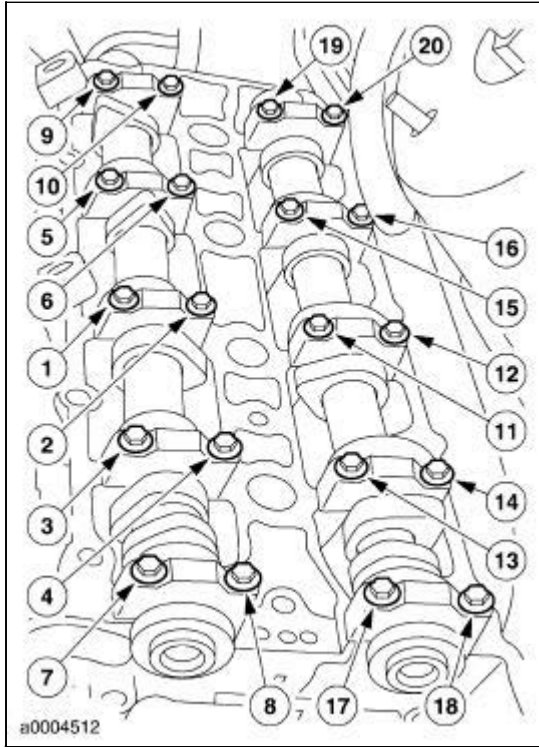
Position the LH camshafts on the camshaft journals.



19.  **CAUTION:** Install the camshaft bearing cap locations. The camshaft bearing caps are positional and must be installed in their original locations and orientation or engine damage may occur.

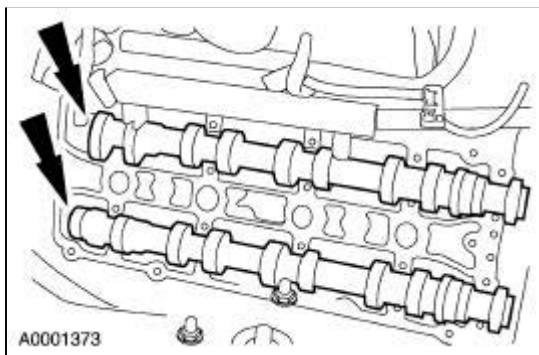
Install the LH camshaft bearing caps.

- Position the bearing caps.
- Install the bolts. Tighten the bolts in three stages in the sequence shown.
 - Stage 1: Hand-tighten.
 - Stage 2: Tighten to 6 Nm (53 lb-in).
 - Stage 3: Tighten an additional 90 degrees.



20. **NOTE:** Apply Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G to the camshaft journals, the camshaft caps and the camshaft lobes prior to installing the camshafts.

Position the RH camshafts on the camshaft journals.

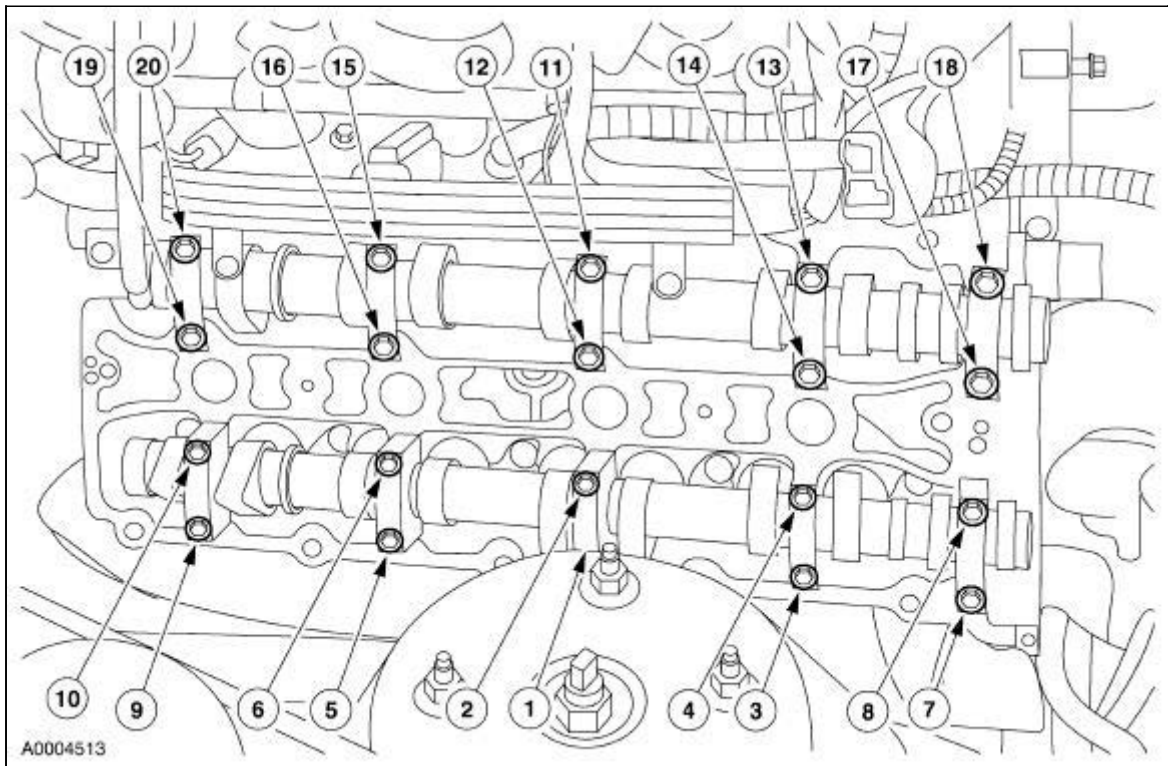


21. **CAUTION:** Install the camshaft bearing caps in their original locations. The camshaft bearing caps are positional and must be installed in their original locations and orientations or engine damage may occur.

Install the RH camshaft bearing caps.

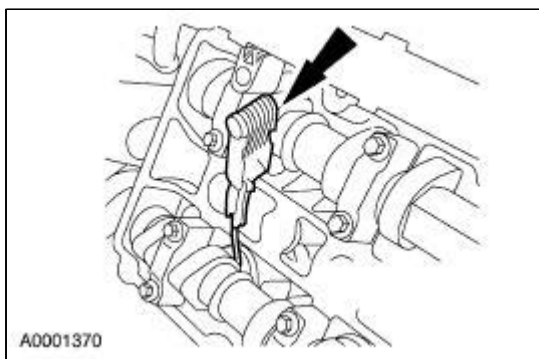
- Position the bearing caps.

- Install the bolts. Tighten the bolts in three stages in the sequence shown.
 - Stage 1: Hand-tighten.
 - Stage 2: Tighten to 6 Nm (53 lb-in).
 - Stage 3: Tighten an additional 90 degrees.



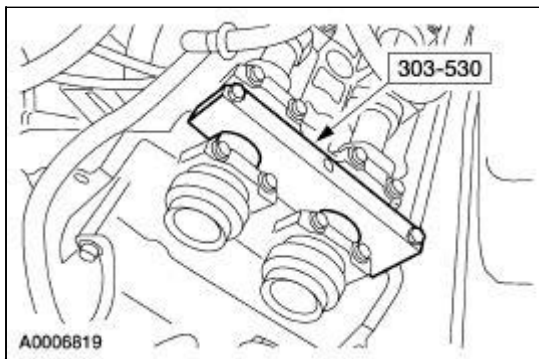
22. **NOTE:** The crankshaft must be at 45 degrees ATDC with crankshaft position tool installed.

Using a feeler gage, confirm that the bucket tappet and shim clearances are within specification.



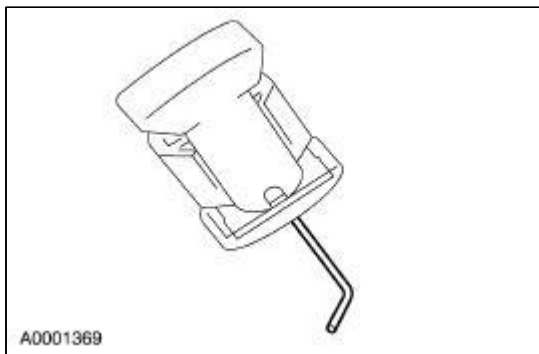
23. **NOTE:** LH shown; RH similar.

Install the special tool on the LH head.

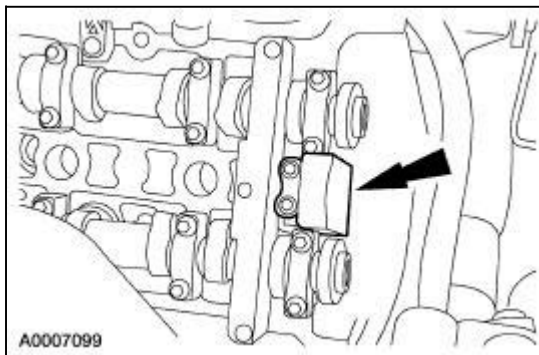


24. Collapse the tensioners.

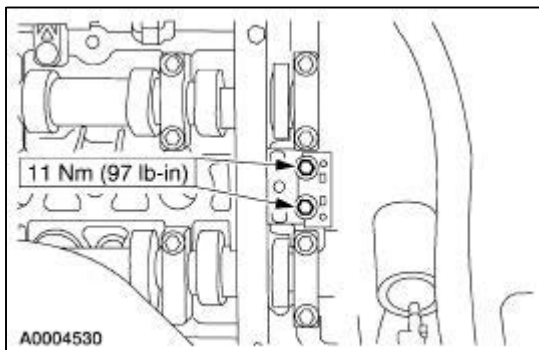
- Insert a thin wire into the check valve.
- Apply hand pressure until the tensioner is fully collapsed.
- Remove the wire.



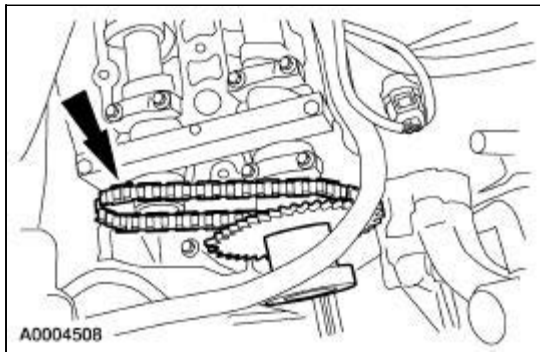
25. Position the tensioner.



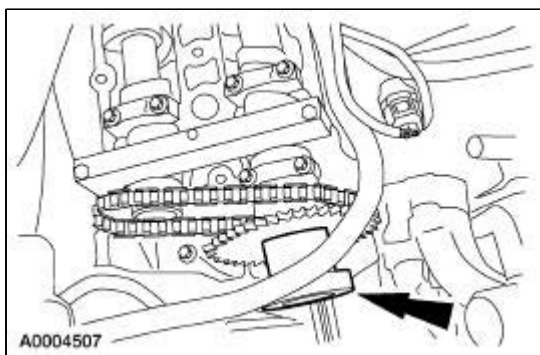
26. Install the secondary timing chain tensioner bolts.



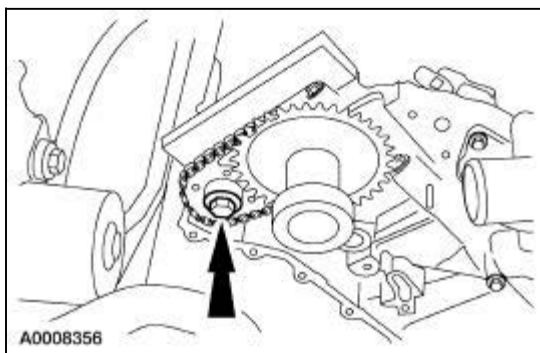
27. Position the intake sprocket, damper, chain and exhaust sprocket on the camshaft as an assembly.



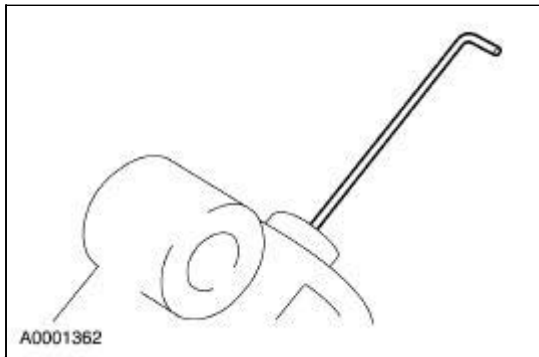
28. Install the intake camshaft sprocket bolt.



29. Install the exhaust camshaft sprocket bolt and washer.



30. Reset the timing chain tensioner.
- Insert a fine wire and dislodge the check ball.
 - Using finger pressure, compress the tensioner.
 - Remove the wire.

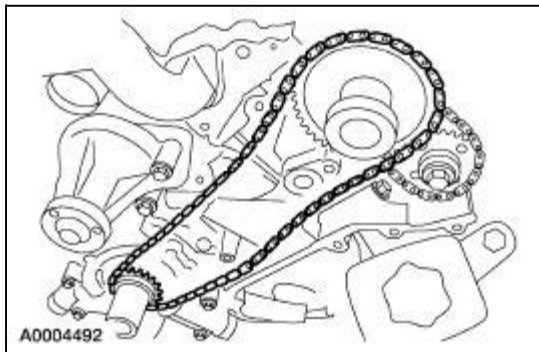


31. **NOTE:** The timing mark on the LH timing chain crankshaft gear faces forward.

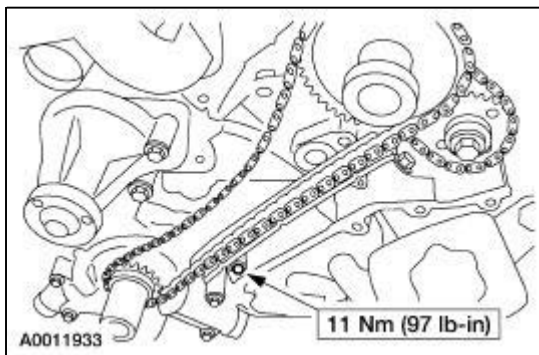
NOTE: The special tool should still be installed on the LH cylinder head.

Position the LH timing chain and crankshaft gear.

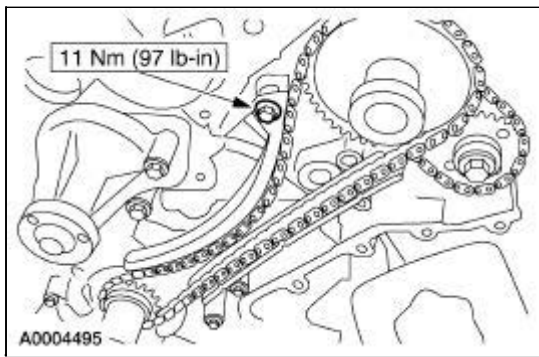
- Position the timing chain over the LH intake camshaft sprocket.
- Position the crankshaft gear in the timing chain.
- Position the timing chain and crankshaft gear over the crankshaft as an assembly.



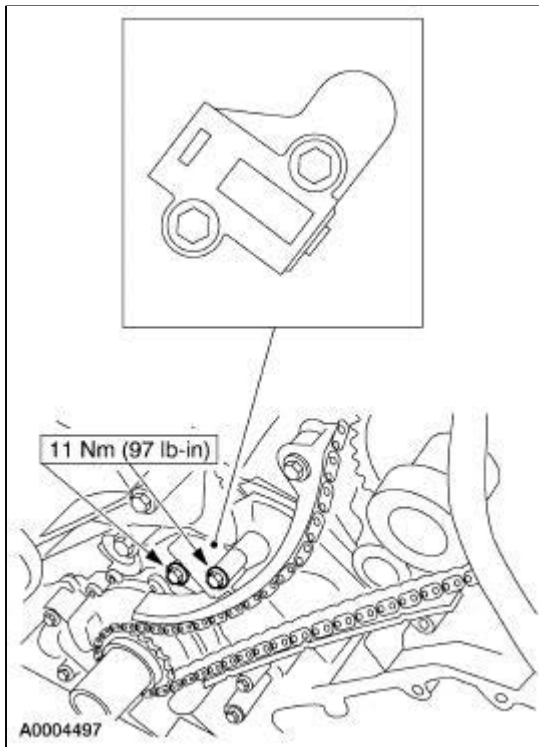
32. Install the LH timing chain guide.



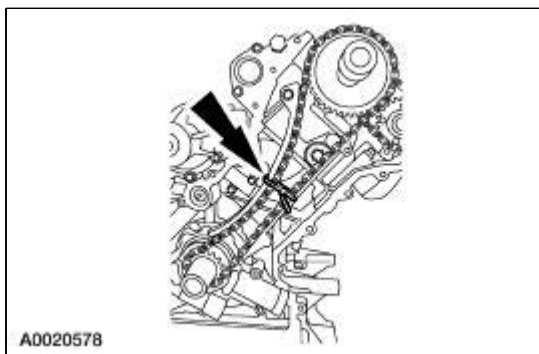
33. Install the LH timing chain tensioner arm.



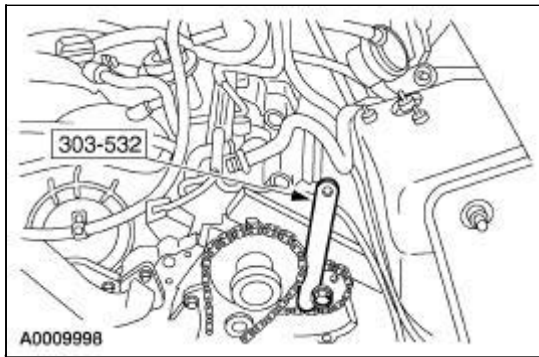
34. Install the LH timing chain tensioner.



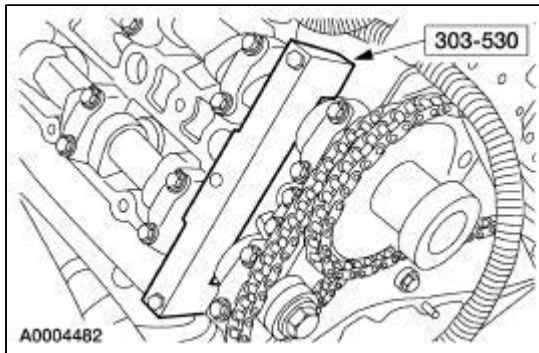
35. Install a tie strap to take up the slack in the timing chain.



36. Using the special tool, apply tension to the LH exhaust camshaft sprocket and tighten the camshaft sprocket bolts in two stages.
- Stage 1: Tighten to 20 Nm (15 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.



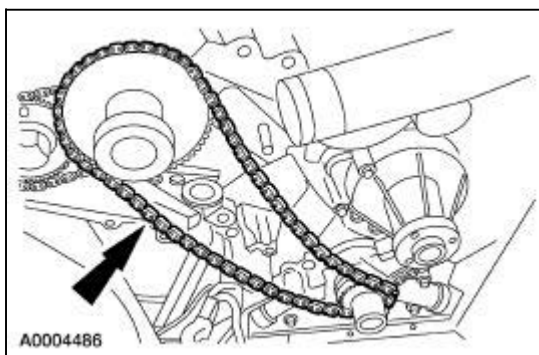
37. Remove the special tool.
38. Install the special tool on the right cylinder head.

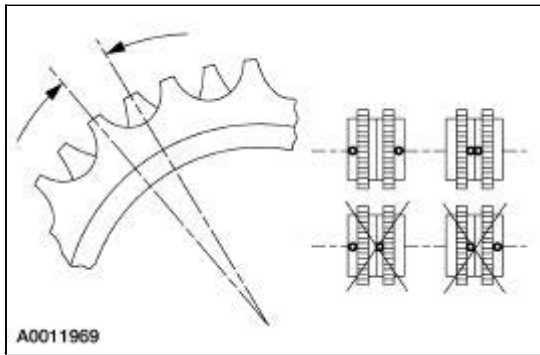


39. **NOTE:** The timing mark on the RH timing chain crankshaft gear faces forward.

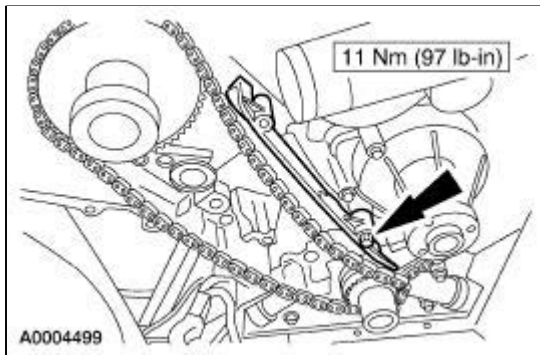
Position the RH timing chain and crankshaft gear.

- Position the timing chain over the RH intake camshaft sprocket.
- Position the crankshaft gear in the timing chain.
- Position the timing chain and crankshaft gear over the crankshaft as an assembly.

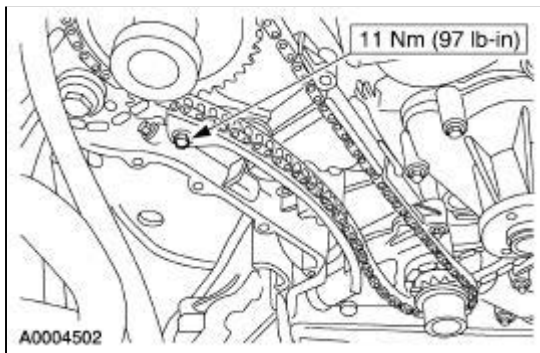




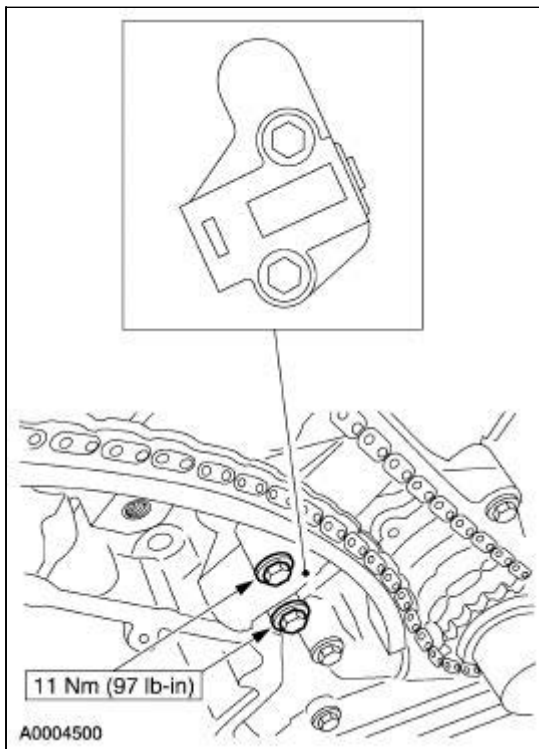
40. Install the RH timing chain guide.



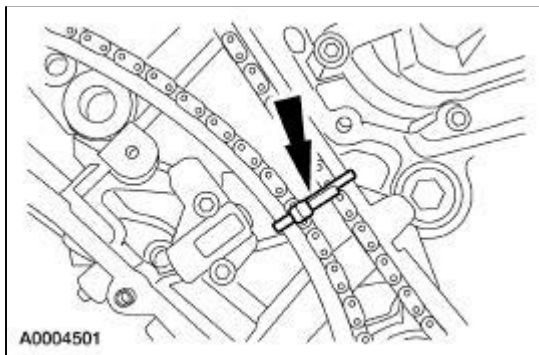
41. Install the RH timing chain tensioner arm .



42. Install the RH timing chain tensioner and blanking plate.

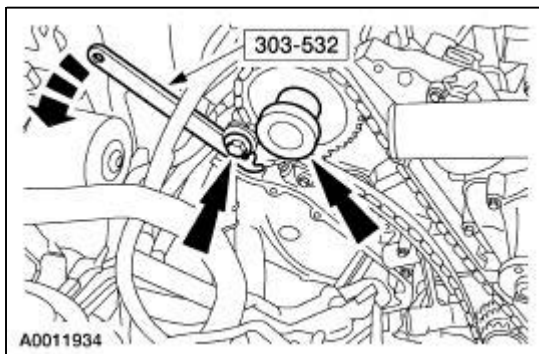


43. Install a tie strap to take up the slack in the timing chain.



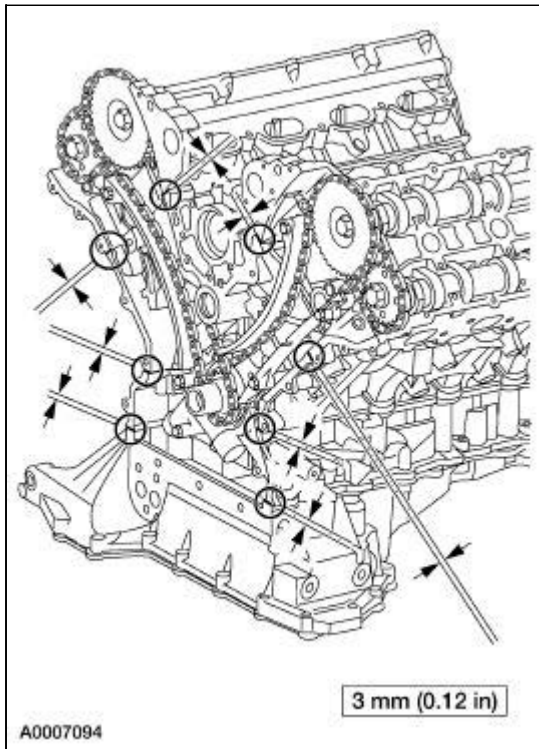
44. Using the special tool, apply tension to the RH camshaft sprockets and tighten the bolts in two stages.

- Stage 1: Tighten to 20 Nm (15 lb-ft).
- Stage 2: Tighten an additional 90 degrees.

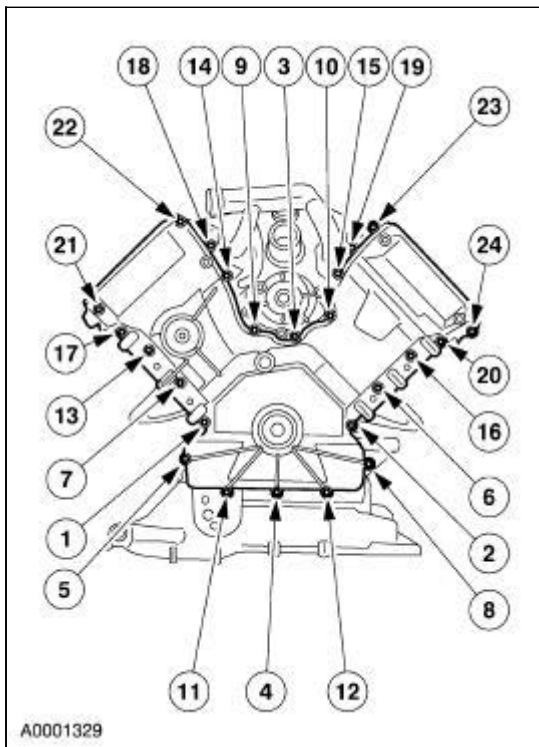


45. Remove the special tool and the two tie straps.

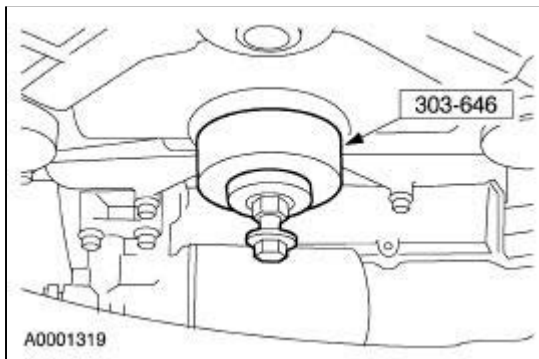
46. Apply Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4 in eight places.



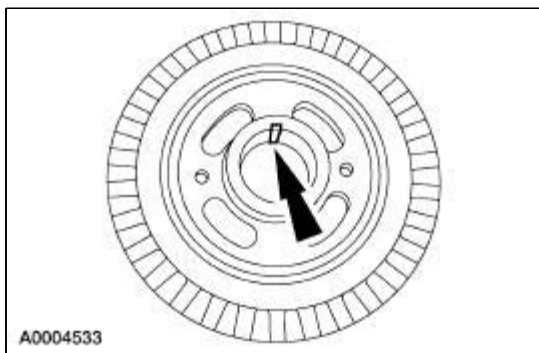
47. Install the engine front cover.
- Install new gaskets.
 - Position the engine front cover on the cylinder block.
 - Loosely install the bolts.
 - Tighten the bolts in two stages in the sequence shown.
 - Stage 1: Tighten to 5 Nm (44 lb-in).
 - Stage 2: Tighten to 10 Nm (89 lb-in).



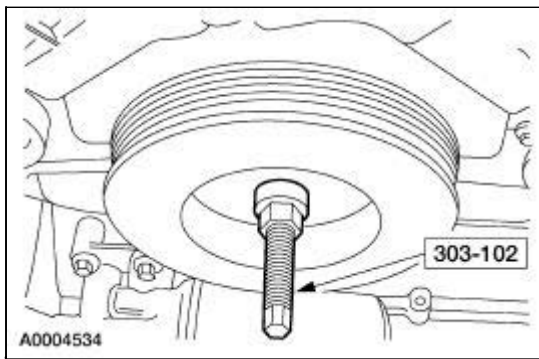
48. Using the special tool, install the front crankshaft seal.



49. Apply Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4 to the crankshaft pulley keyway.



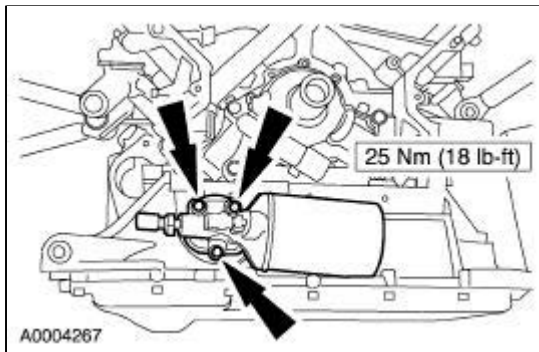
50. Using the special tool, install the crankshaft pulley.



51. Install the washer and a new bolt and tighten in two stages.

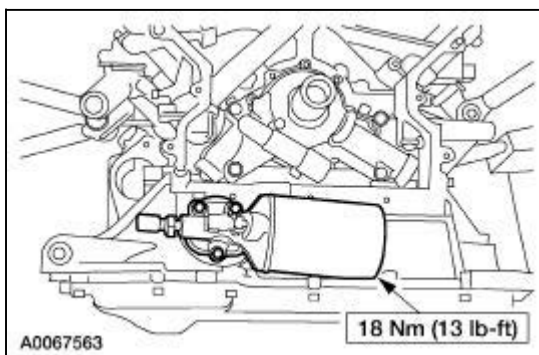
- Stage 1: Tighten to 80 Nm (59 lb-ft).
- Stage 2: Tighten an additional 80 degrees.
- Remove the flexplate holding tool.

52. Install a new seal, the oil filter adapter, and the oil cooler (if equipped).



53. Install the oil filter.

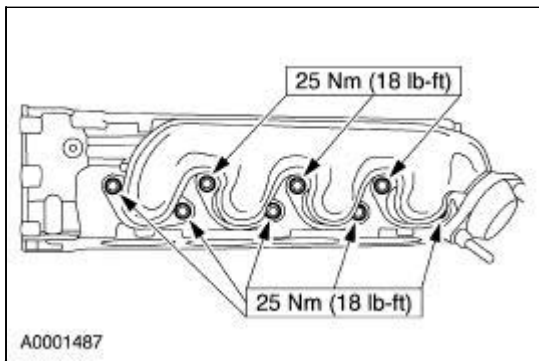
- Install the oil filter until the seal makes contact.
- Tighten an additional 270 degrees.



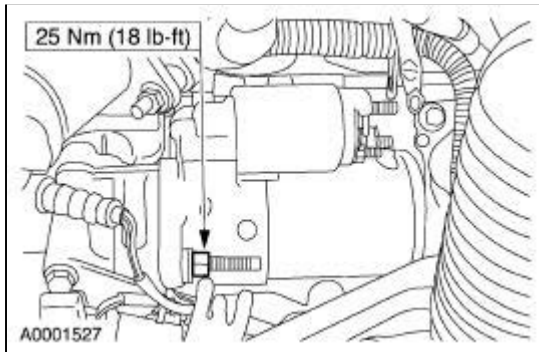
54. **NOTE:** The gaskets are marked top to aid in installation.

NOTE: LH shown; RH similar.

Install the new exhaust manifold gaskets and the exhaust manifolds.



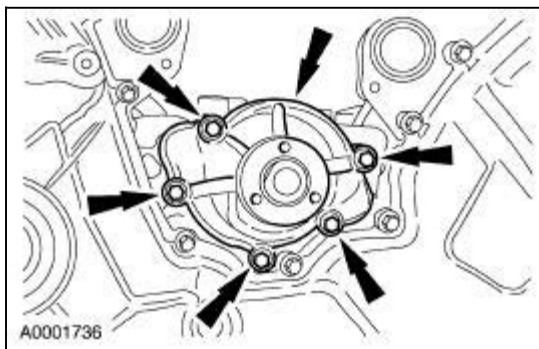
55. Install the starter motor.



56. **NOTE:** Lubricate the water pump O-ring seal with Premium Engine Coolant E2FZ-19549-AA or equivalent meeting Ford specification ESE-M97B44-A.

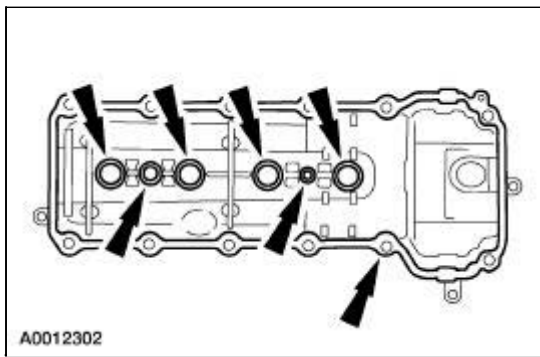
Install the water pump.

- Inspect the O-ring seal and install a new O-ring seal as necessary.
- Position a new water pump gasket.
- Position the water pump.
- Install the bolts and tighten in two stages.
 - Stage 1: Tighten to 8 Nm (72 lb-in).
 - Stage 2: Tighten an additional 90 degrees.



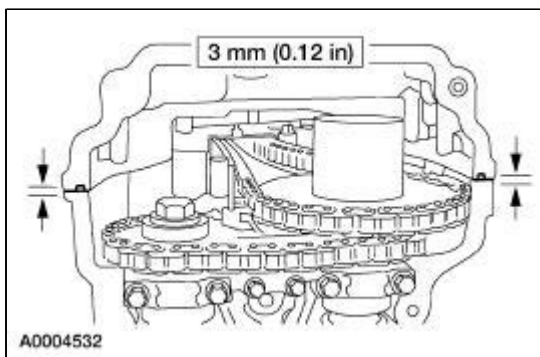
57. **NOTE:** RH shown; LH similar.

Inspect and install new gaskets as necessary.



58. **NOTE:** RH shown; LH similar.

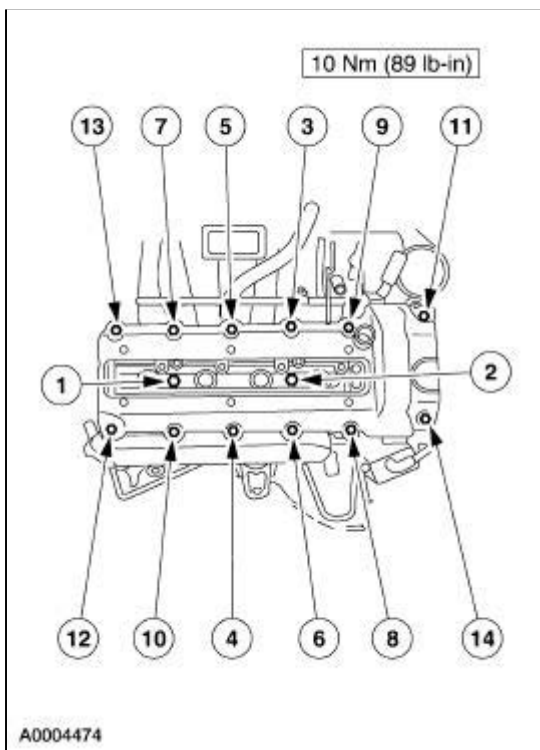
Apply four beads of Silicone Gasket and Sealant F7AZ-19554-EA or equivalent meeting Ford specification WSE-M4G323-A4.



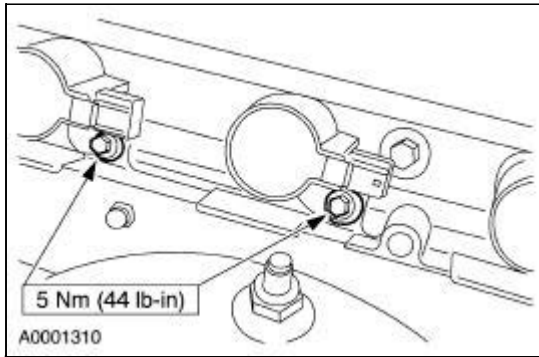
59. **NOTE:** RH shown; LH similar.

Install the valve covers.

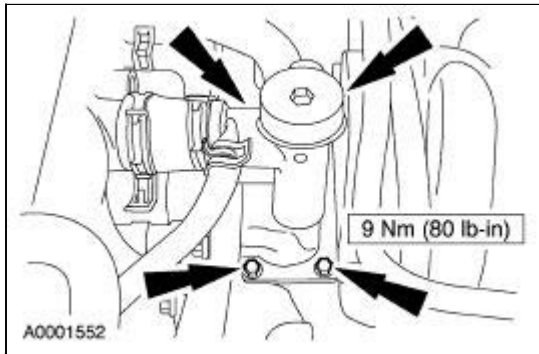
- Tighten the bolts in the sequence shown.



60. Install the eight ignition coils.

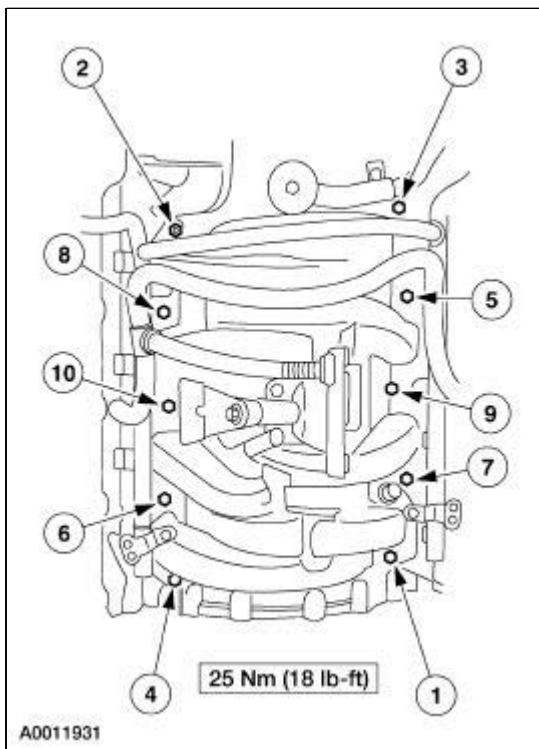


61. Install the four bolts and the thermostat housing.

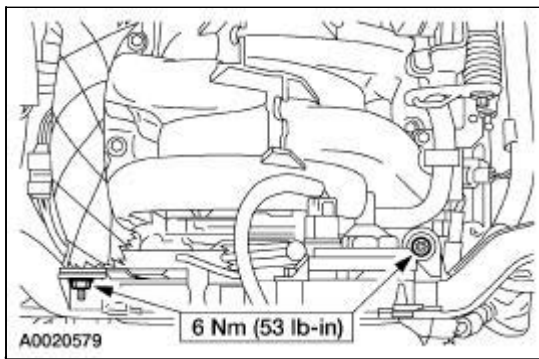


62. Install the intake manifold and tighten the bolts and stud bolt (2) in the sequence shown.

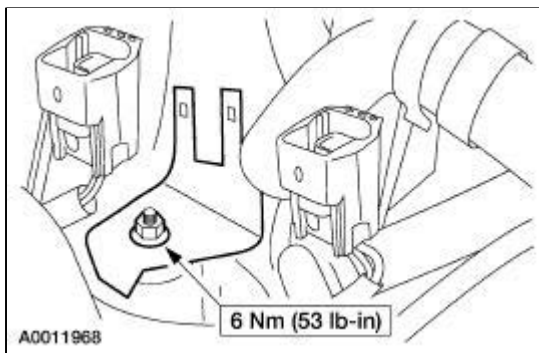
- Inspect and install a new gasket if necessary.



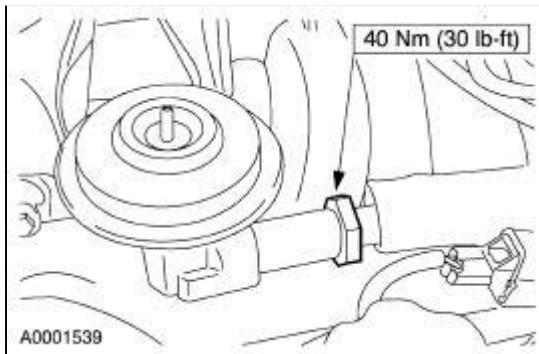
63. Position the wiring harness and install the nuts.



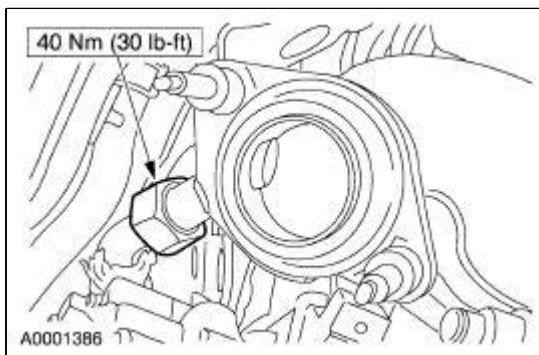
64. Install the bracket.



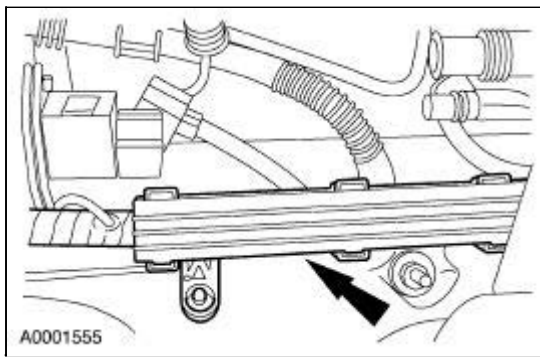
65. Install the EGR valve to exhaust manifold tube. Finger-tighten both fittings. Tighten the upper fitting.



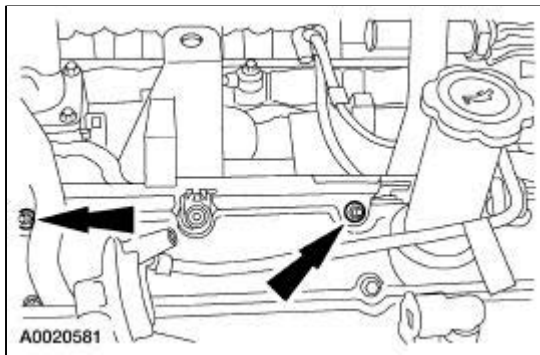
66. Tighten the lower fitting.



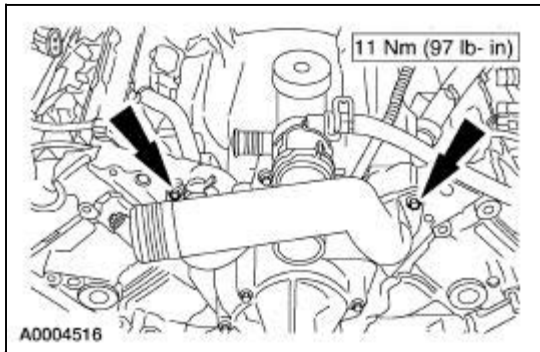
67. Connect the fuel injector connectors and position the engine wiring harness.



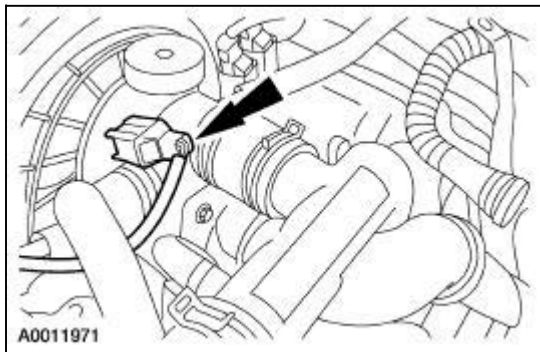
68. Install the bracket and the two nuts.



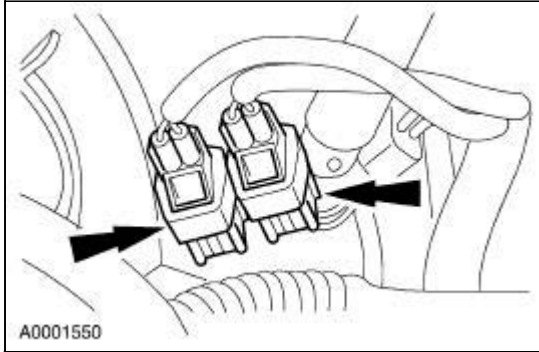
69. Install the water outlet pipe.
- Inspect and install a new gasket if necessary.
 - Install the four bolts.
 - Connect the hoses.



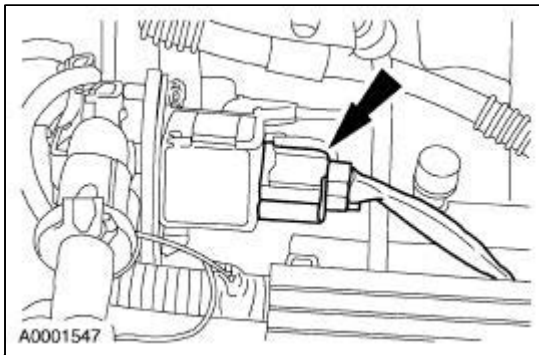
70. Connect the knock sensor connector and install onto the bracket.



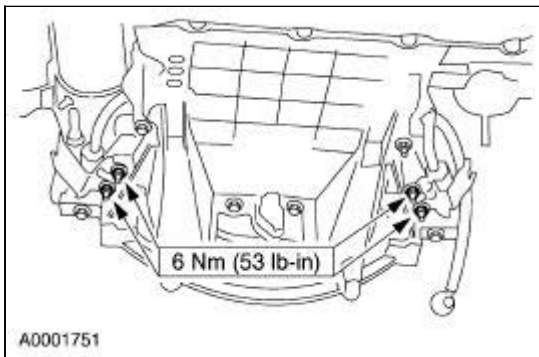
71. Install the CHT sensor and KS electrical connectors on the bracket.



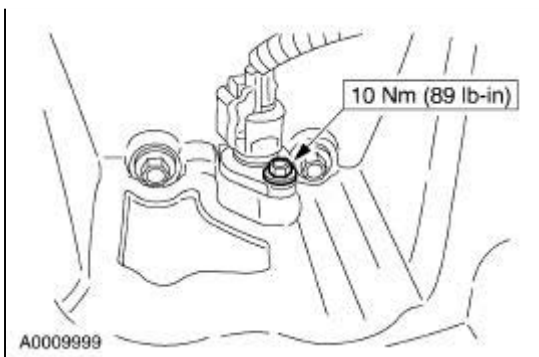
72. Connect the fuel pressure sensor electrical connector.



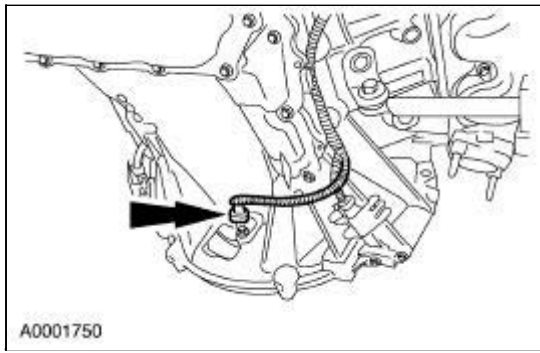
73. Connect the HO2S connectors to the brackets.



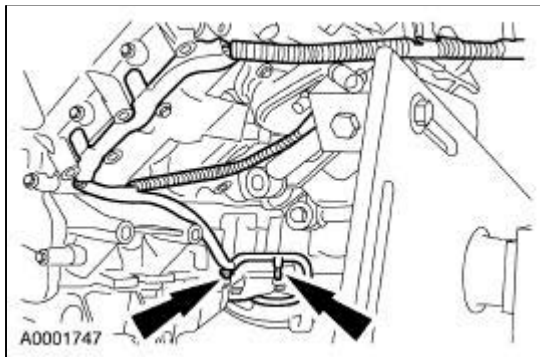
74. Remove the special tool, install the CKP sensor.



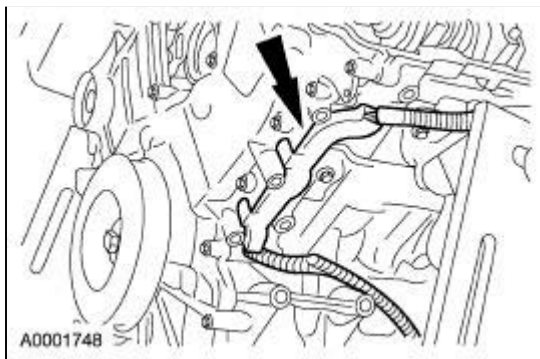
75. Connect the CKP sensor connector.



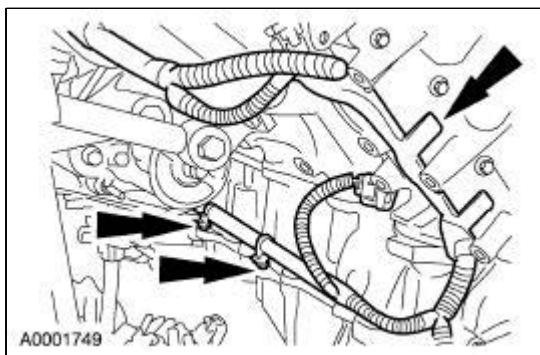
76. Connect the two pin-type retainers.



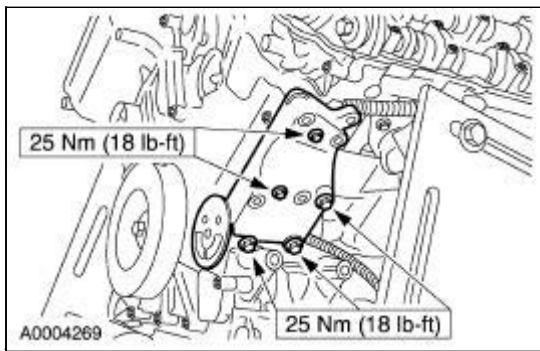
77. Install the wiring harness to the front cover on the LH side.



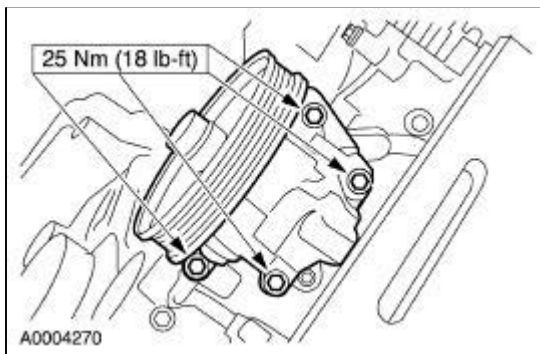
78. Install the wiring harness to the front cover on the RH side.



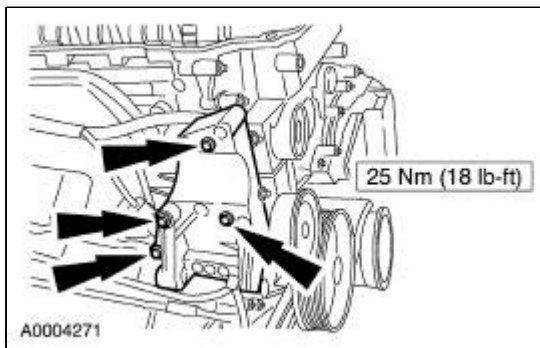
79. Install the power steering pump bracket.



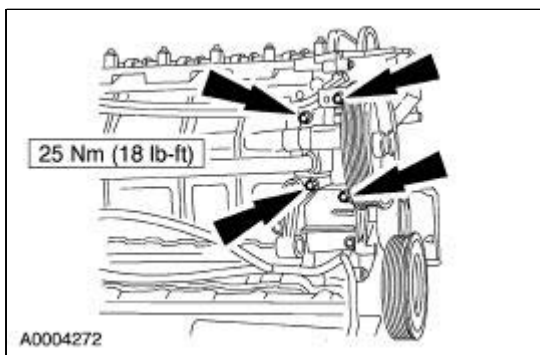
80. Install the power steering pump.



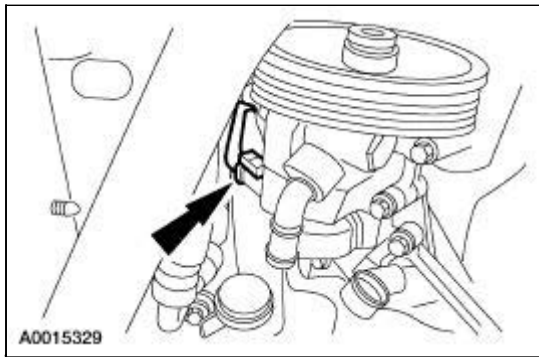
81. Install the hydraulic cooling fan pump bracket.



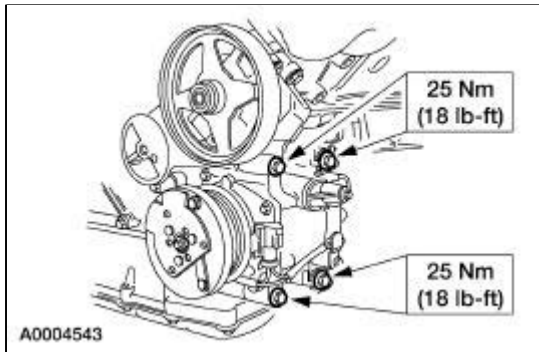
82. Install the hydraulic cooling fan pump.



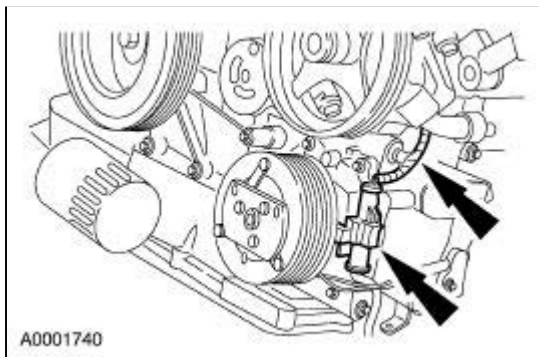
83. Connect the electrical connector.



84. Install the A/C compressor.



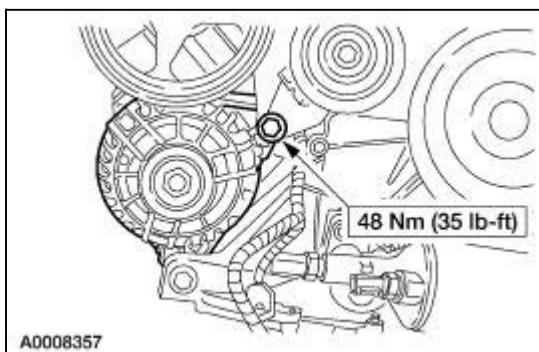
85. Connect the electrical connector and the retaining clip.



86.  **CAUTION:** The generator must be installed in the order shown or damage to the drive belt may occur.

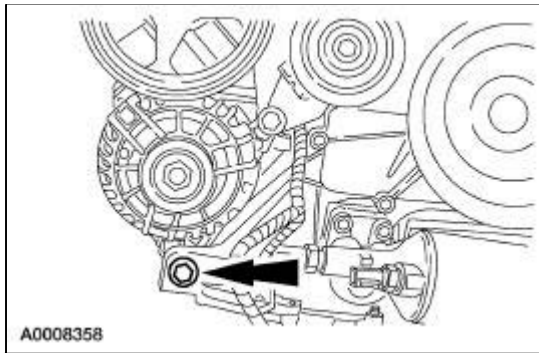
Position the generator and loosely install the bolts and nut.

- Tighten the upper bolt and nut.

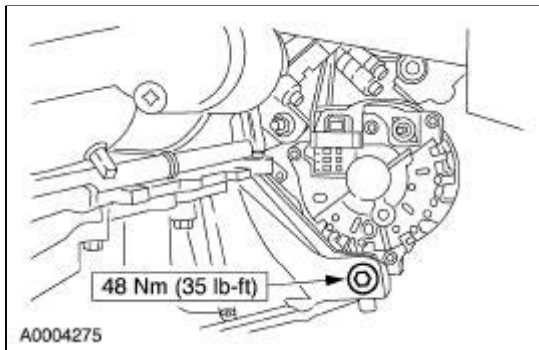


87. Tighten the lower expanding bushing and bolt in two stages.

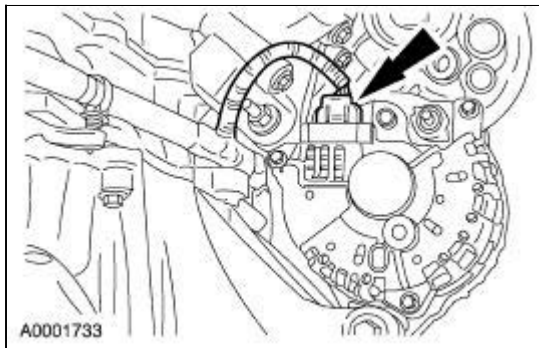
- Stage 1: Tighten to 20 Nm (15 lb-ft).
- Stage 2: Tighten an additional 90 degrees.



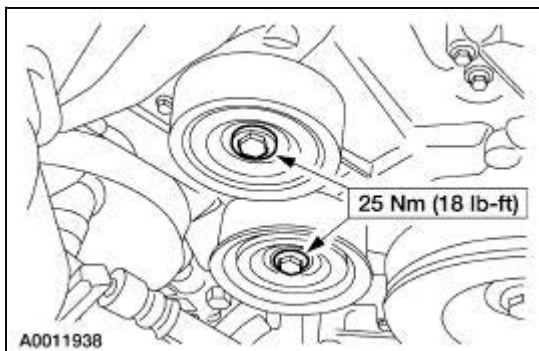
88. Tighten the bolt.



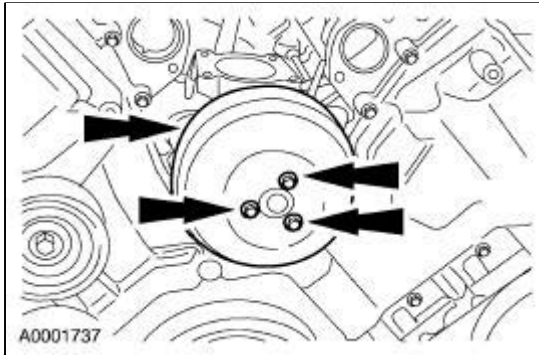
89. Connect the electrical connector.



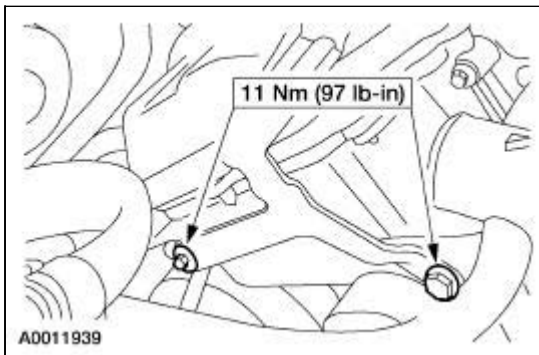
90. Install the two idler pulleys.



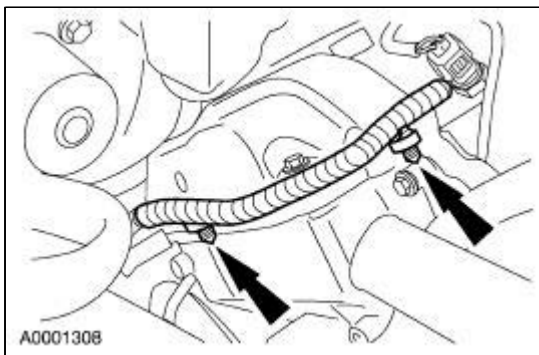
91. Position the water pump pulley and loosely install new bolts.
92. Install the drive belt tensioner. For additional information, refer to [Section 303-05](#).
93. Tighten the water pump pulley bolts in two stages.
 - Stage 1: Tighten to 10 Nm (89 lb-in).
 - Stage 2: Tighten an additional 45 degrees.



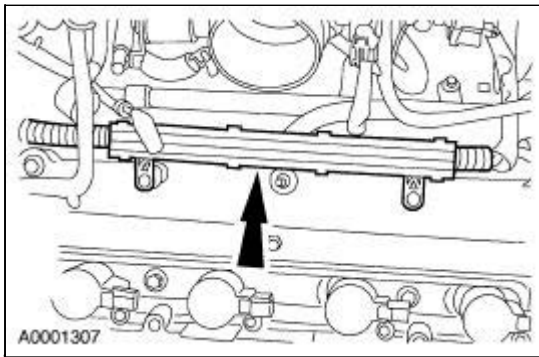
94. Install the inlet tube support bracket.



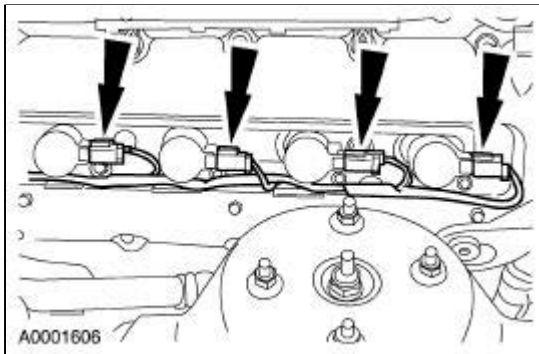
95. Install the eight wiring harness retainers.




96. Connect the fuel injector connectors and position the engine wiring harness.

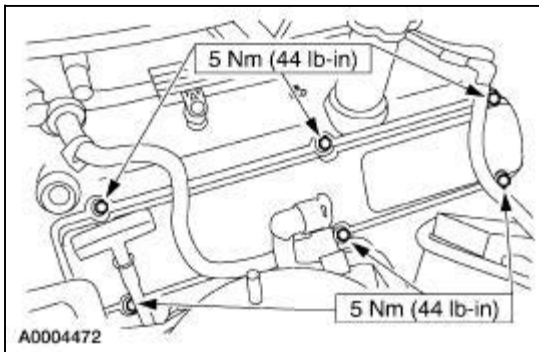


97. Connect the eight ignition coil connectors.



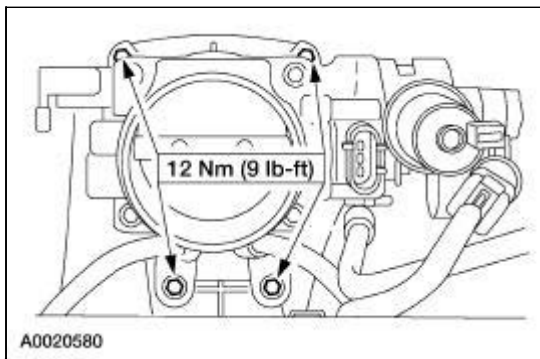
98.  **CAUTION:** Make sure that the wiring harness inlet seals are seated in the valve covers or damage to the wiring harness may occur.

Install the ignition coil covers.

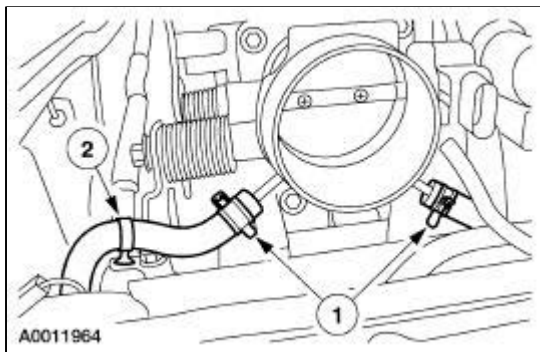


99. **NOTE:** Clean and inspect the gasket. Install a new gasket if necessary.

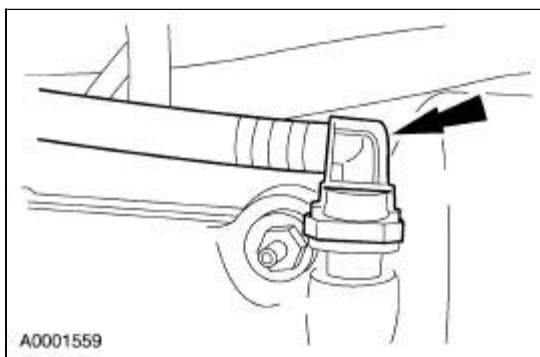
Install the throttle body.



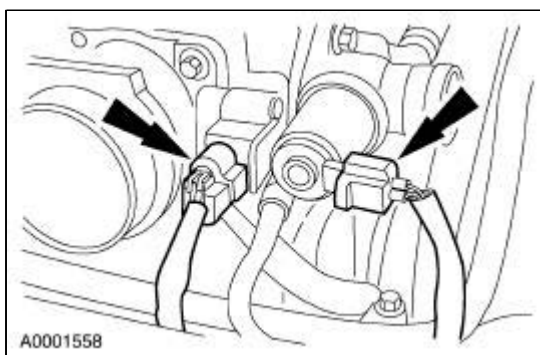
100. Connect the hoses (1) and install the hose in the clip (2).



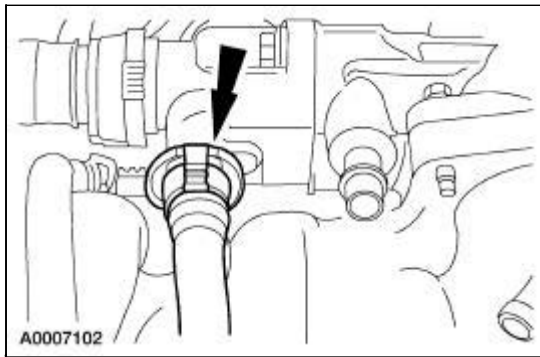
101. Connect the positive crankcase ventilation (PCV) line.



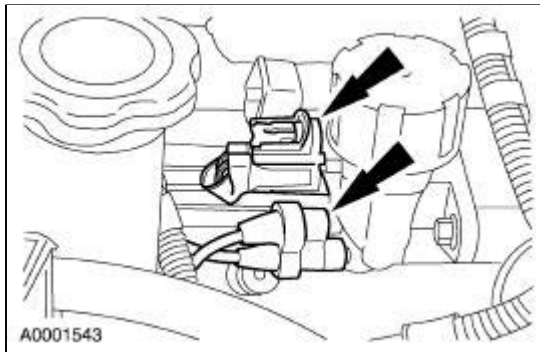
102. Connect the IAC and TPS connectors.



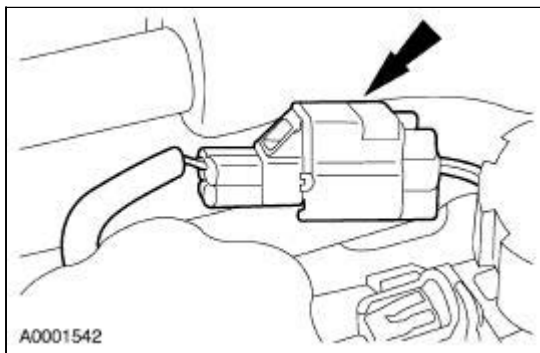
103. Connect the air assist valve hose.



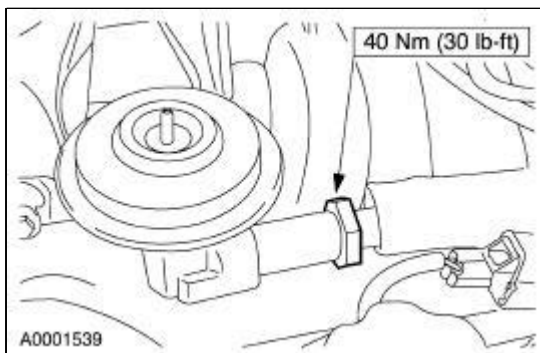
104. Connect the EGR vacuum regulator vacuum and electrical connections.



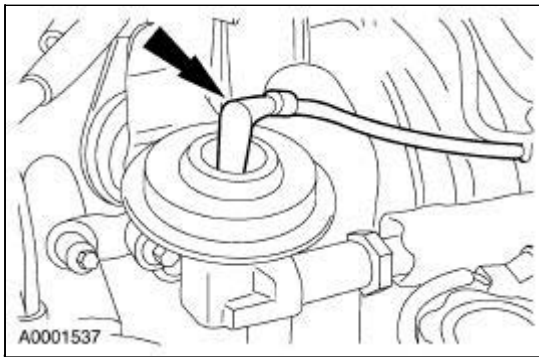
105. Connect the CMP sensor connector and connect the connector locator.



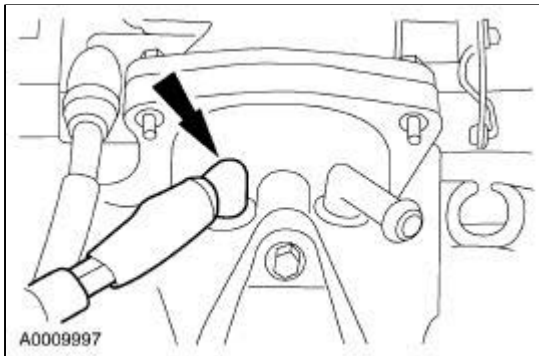
106. Connect the EGR valve to exhaust manifold tube.



107. Connect the vacuum line.


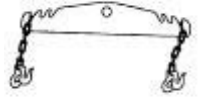


108. Connect the vacuum harness.

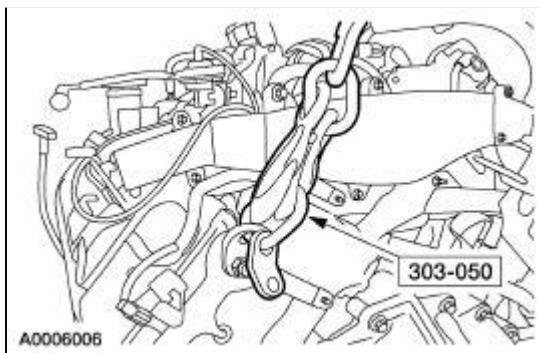


Engine

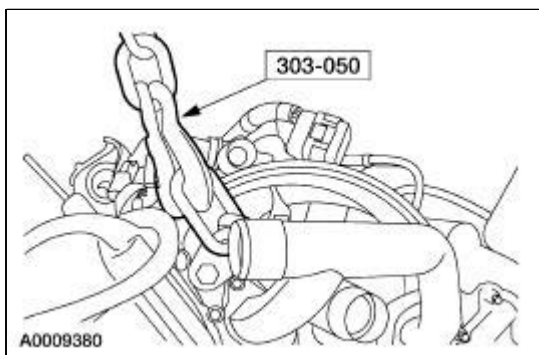
Special Tool(s)

 <p>ST1595-A</p>	Engine Lifting Brackets 303-050 (T70P-6000)
 <p>ST1602-A</p>	Spreader Bar 303-D089 (D93P-6001-A3)

1. Install the special tool.

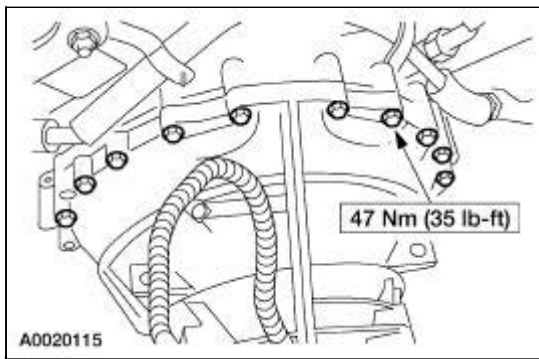


2. Install the special tool.

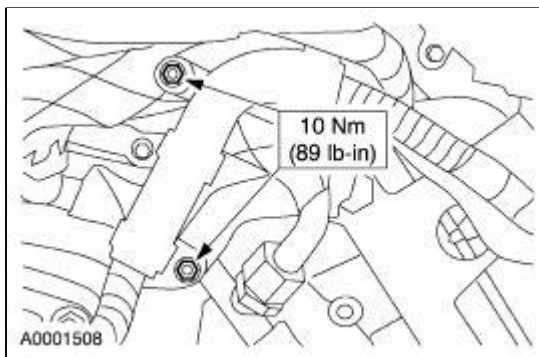


3. Using a floor crane and a spreader bar (303-D089) to support the engine, remove the engine from the engine stand.
4. **NOTE:** Align the flexplate to converter marks made at removal.

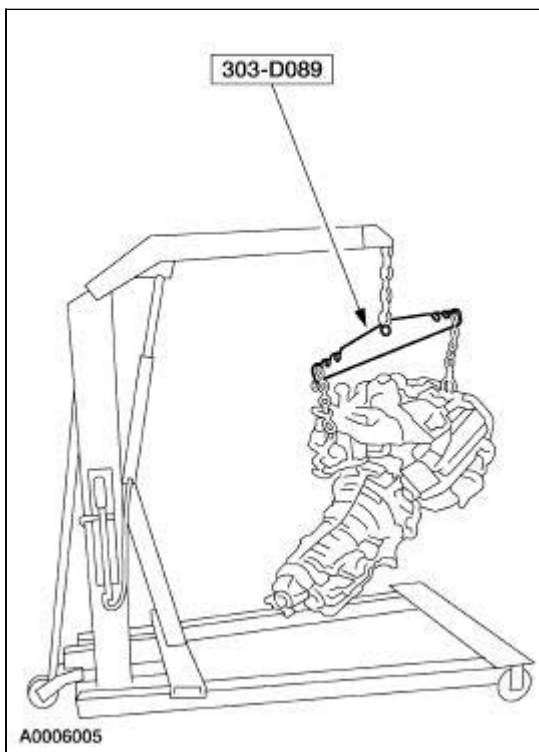
Install the engine to the transmission and install the bolts.



5. Install the wiring harness.

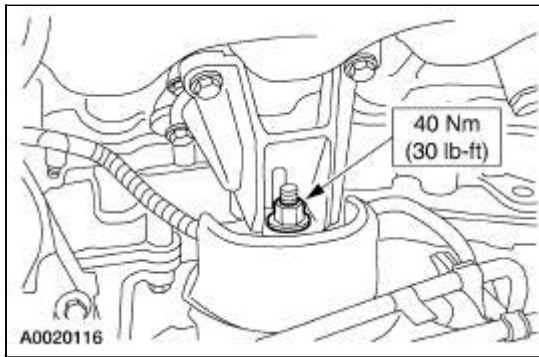


6. Using a floor crane and the special tool,, install the engine onto the sub-frame.

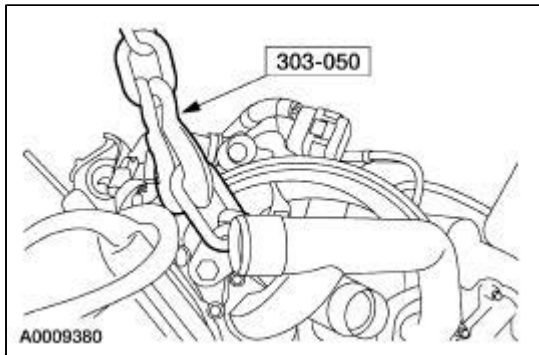


7. **NOTE:** LH shown; RH similar.

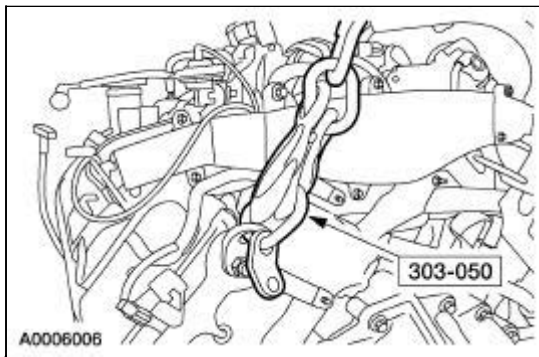
Install the LH and the RH upper engine mounts.



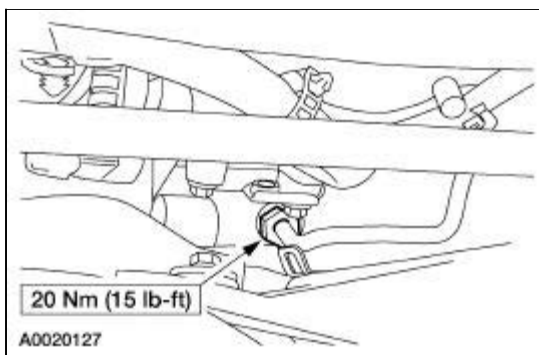
8. Remove the engine lifting equipment.
9. Remove the special tool.



10. Remove the special tool.

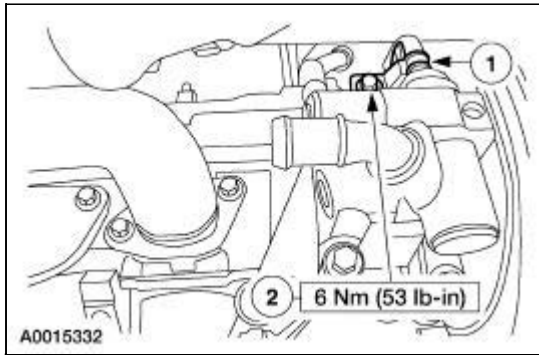


11. Connect the hydraulic fan pump line.

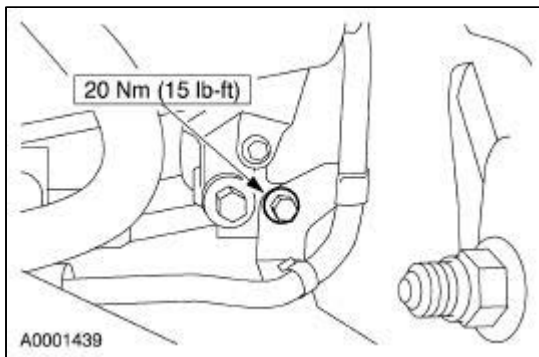


12. Install the hydraulic fan pump line bracket.
 1. Install the bracket.

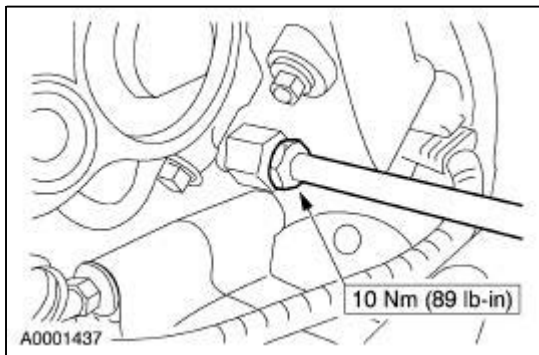
2. Install the bolt.



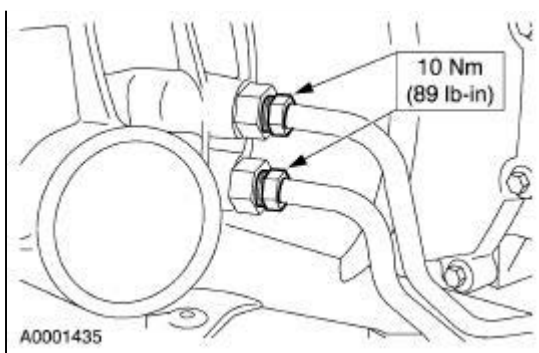
13. Install the power steering line bracket.



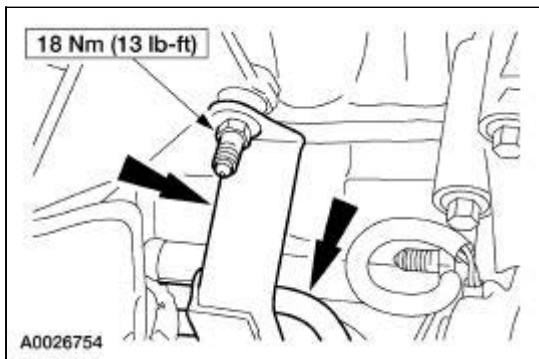
14. Connect the power steering line.



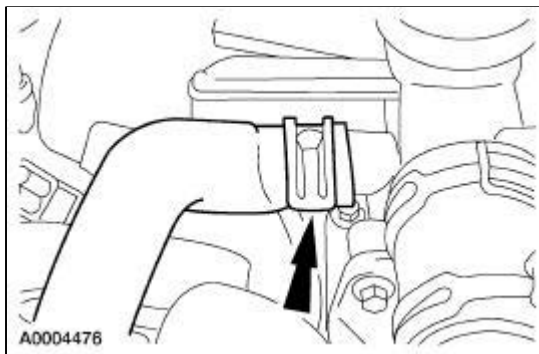
15. Connect the transmission cooler lines.



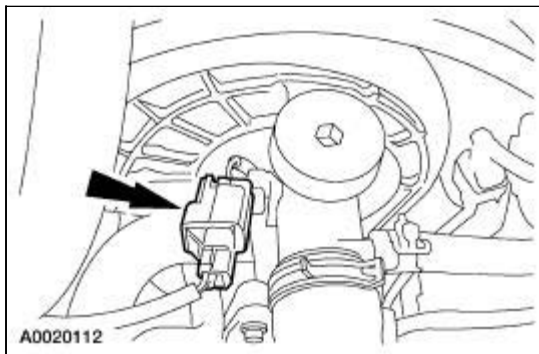
16. Install the transmission cooler line bracket.



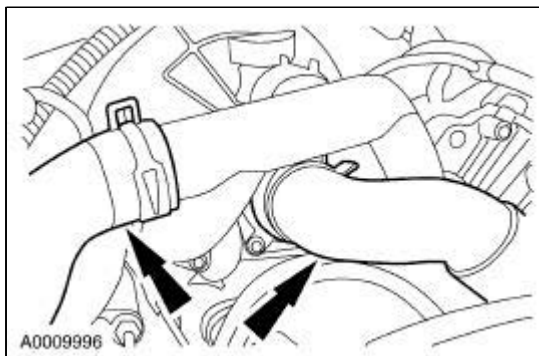
17. Connect heater hose.



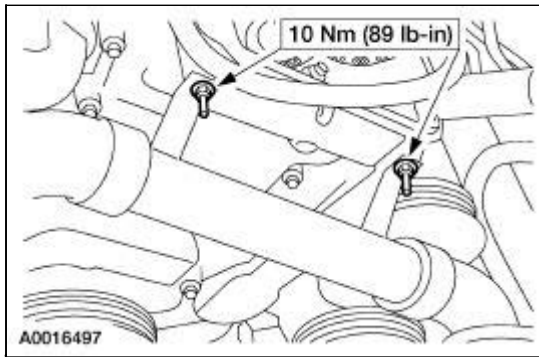
18. Connect the KS electrical connector.



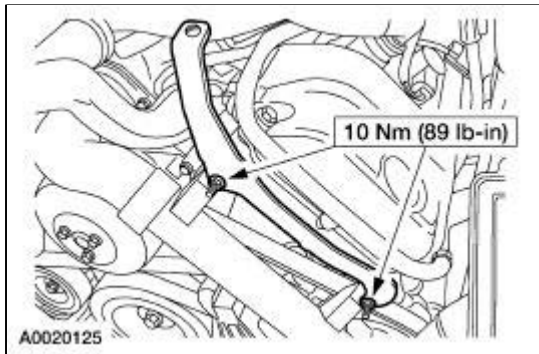
19. Connect the radiator hoses.



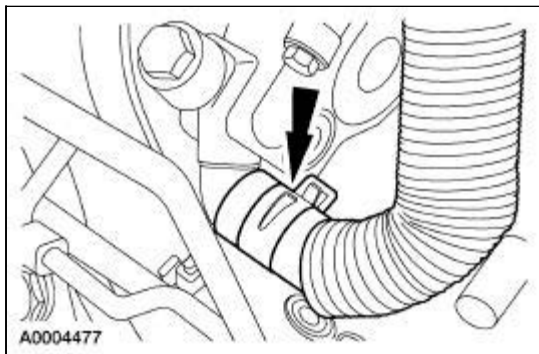
20. Install the lower radiator hose.



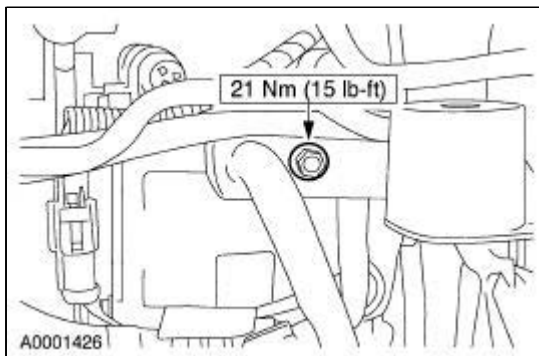
21. Install the bracket.



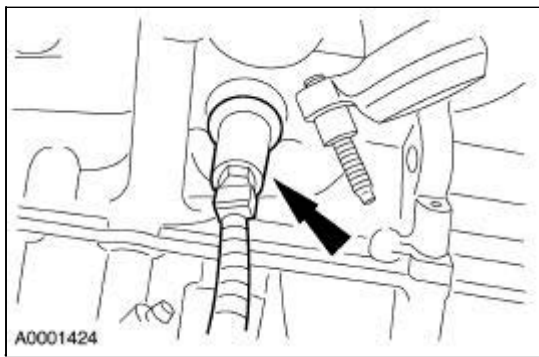
22. Connect the power steering pump and the hydraulic cooling fan pump return hoses.



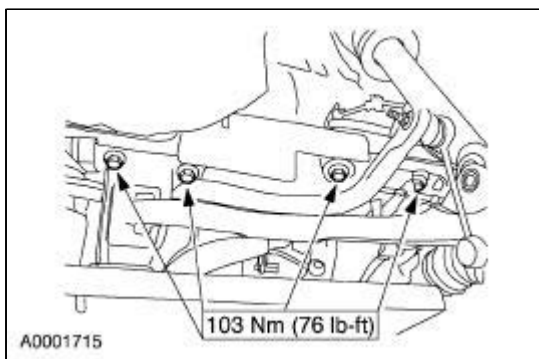
23. Connect the A/C manifold and tube.



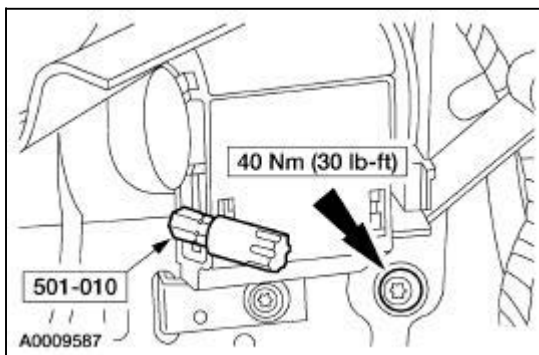
24. Connect the block heater, if equipped.



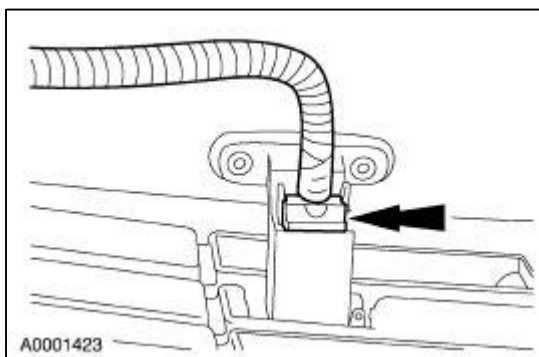
25. Using the powertrain lift and the transmission support bracket, carefully raise the entire assembly into the vehicle.
26. Install the four front and the four center crossmember bolts.



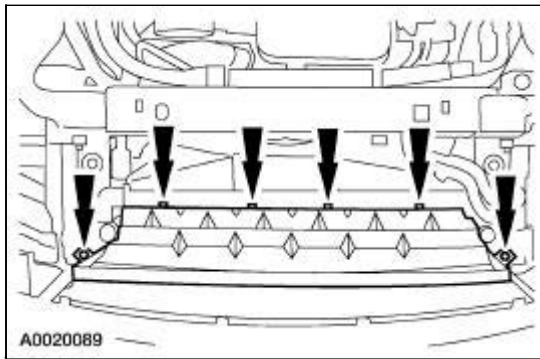
27. Install the transmission crossmember bolts.



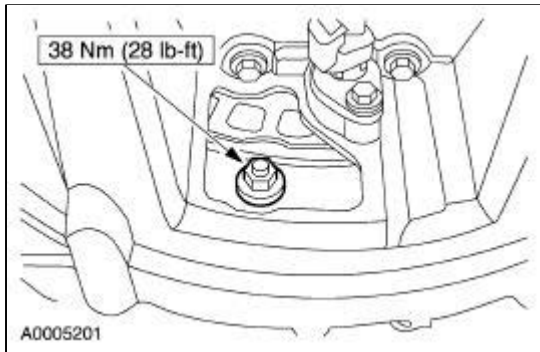
28. Install the engine block heater plug, if equipped.



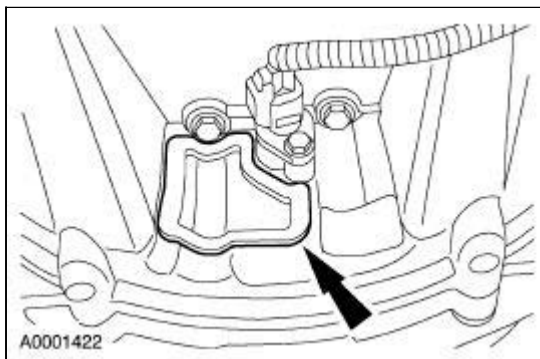
29. Install the inner air deflector.



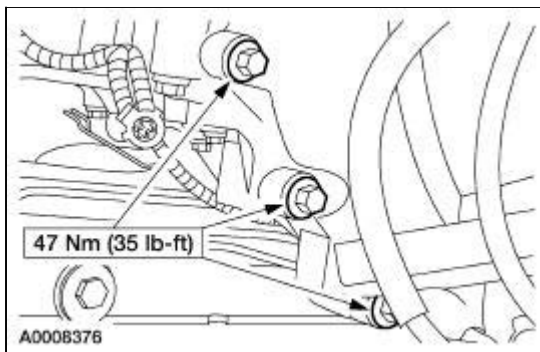
30. Install the eight torque converter nuts.



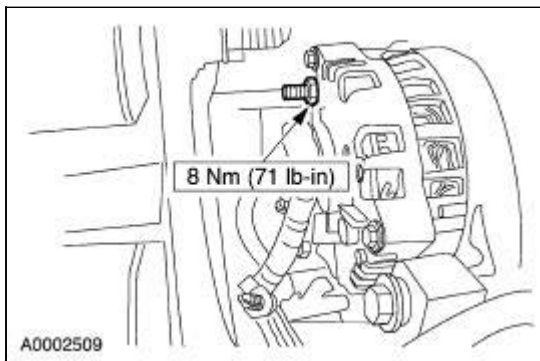
31. Install the cover.



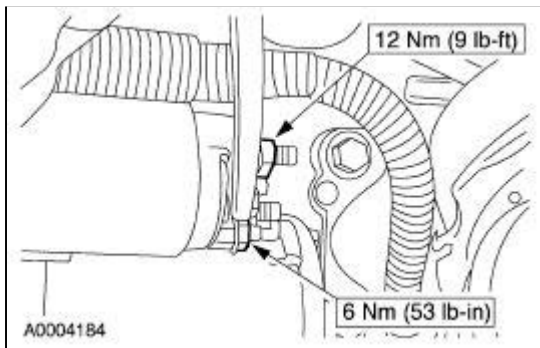
32. Install the six lower transmission to engine bolts.



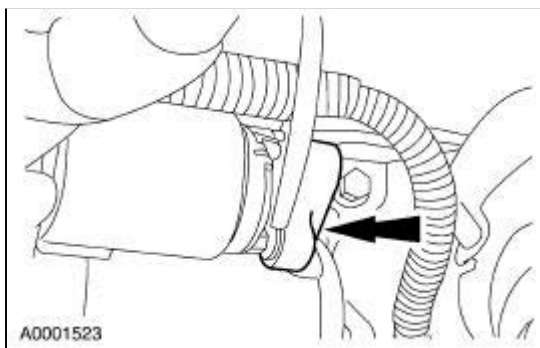
33. Connect the generator electrical connector.



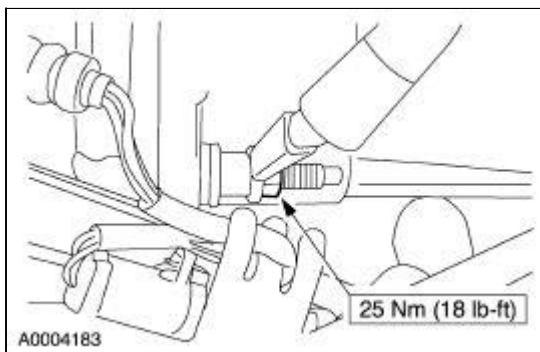
34. Connect the starter motor electrical connectors.



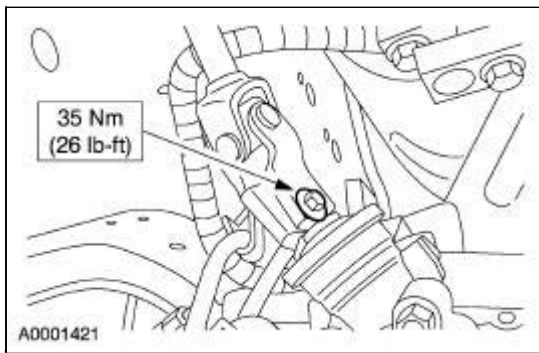
35. Install the cover.



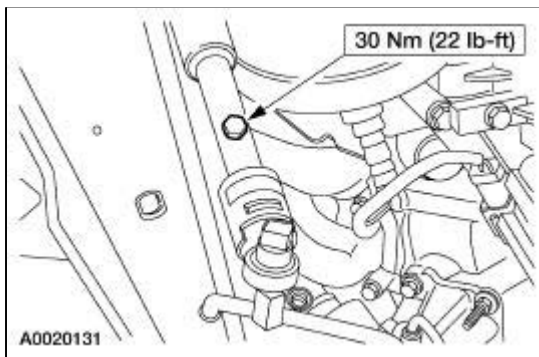
36. Install the starter motor ground cable.



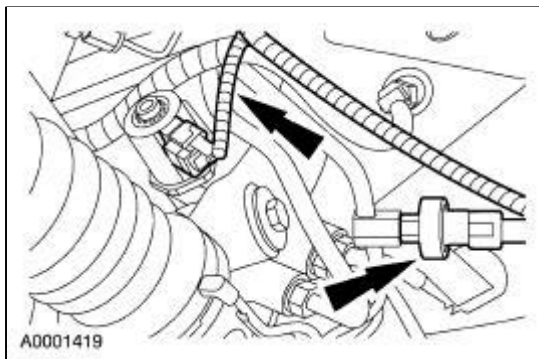
37. Connect the steering coupling.



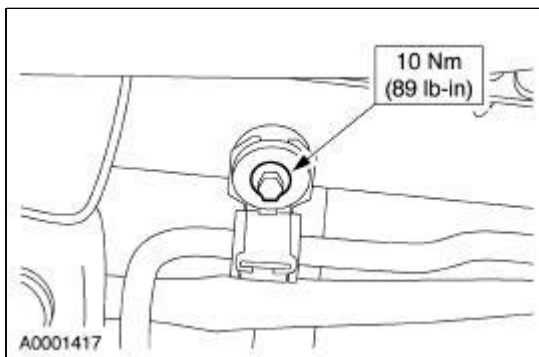
38. Install the steering shaft bolt.



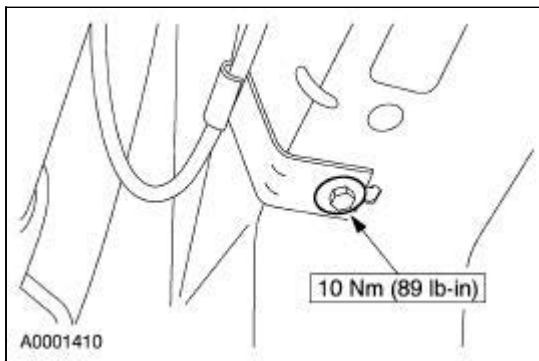
39. Connect the rack and pinion steering unit electrical connectors.



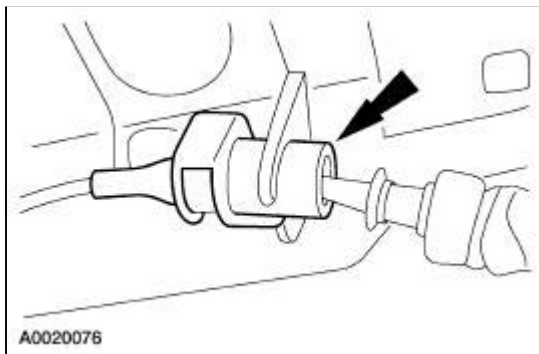
40. Install the hydraulic cooling fan lines to the RH frame rail.



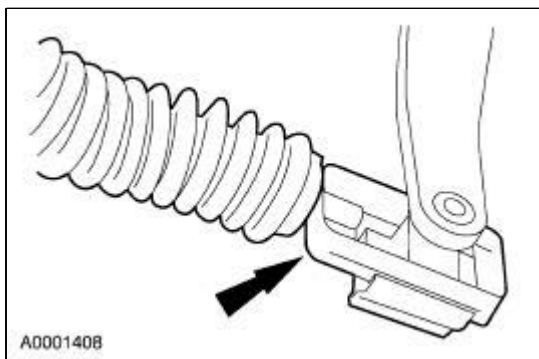
41. Install the shift cable bracket.



42. Reclip the shift cable to the bracket.

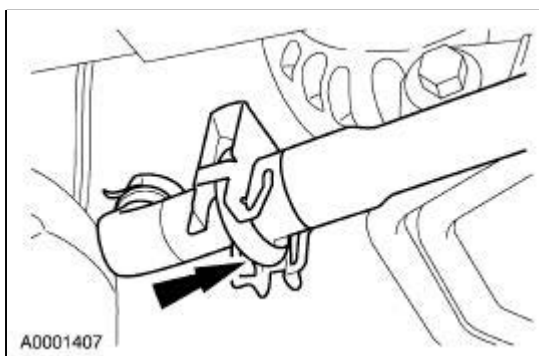


43. Connect the shift cable to the shifter.

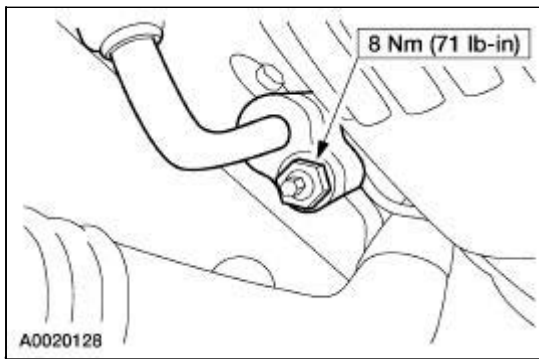


44. Install the driveshaft. For additional information, refer to [Section 205-01](#).

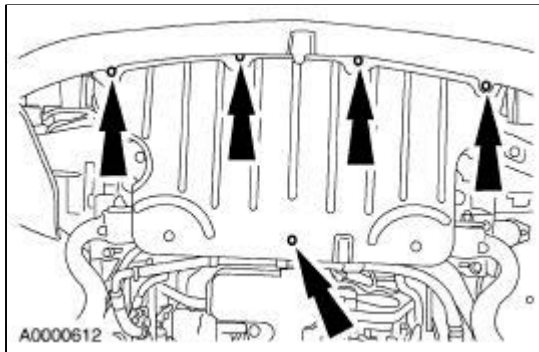
45. Connect the A/C low pressure line.



46. Connect the A/C high pressure line.

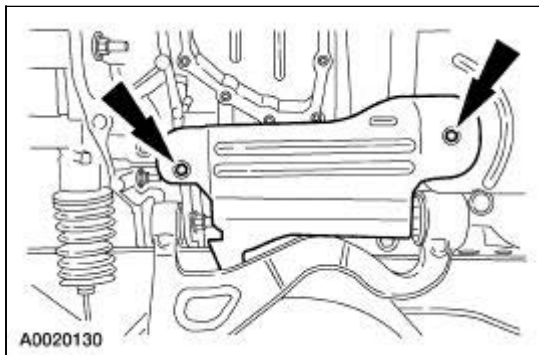


47. Install the center splash shield.



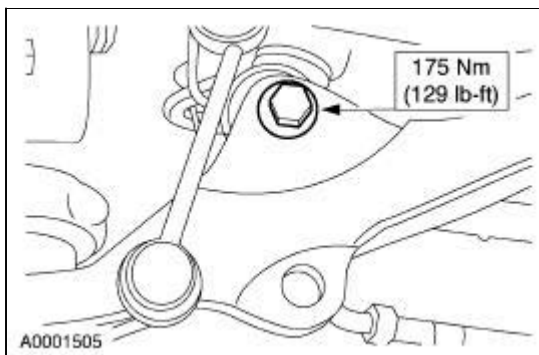
48. **NOTE:** LH shown; RH similar.

Install the LH and the RH splash shields.



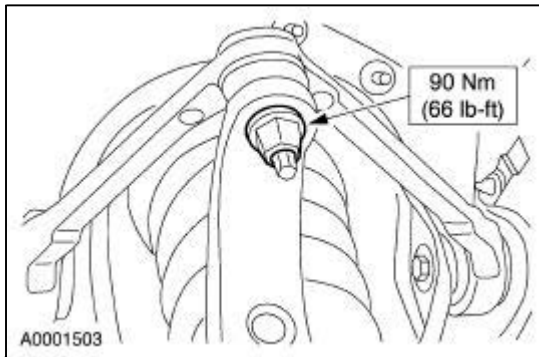
49. **NOTE:** LH shown; RH similar.

Install the LH and the RH lower strut mount bolts.



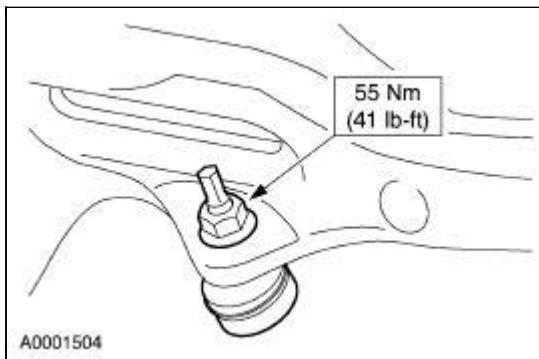
50. **NOTE:** LH shown; RH similar.

Install the LH and the RH ball joints to the spindles and install the nuts.



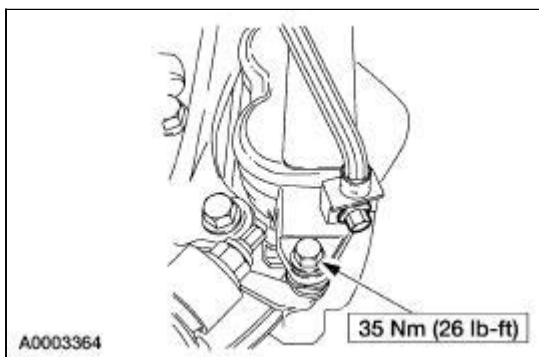
51. **NOTE:** LH shown; RH similar.

Install the LH and the RH sway bar lower nuts.



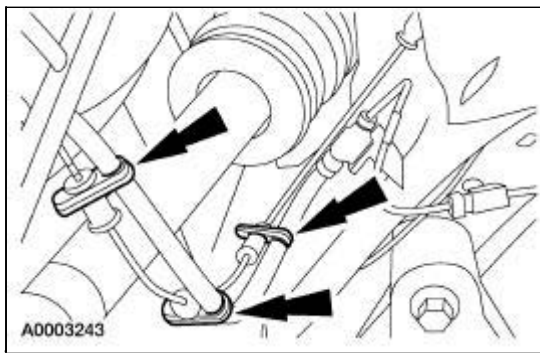
52. **NOTE:** LH shown; RH similar.

Install the LH and the RH brake calipers.



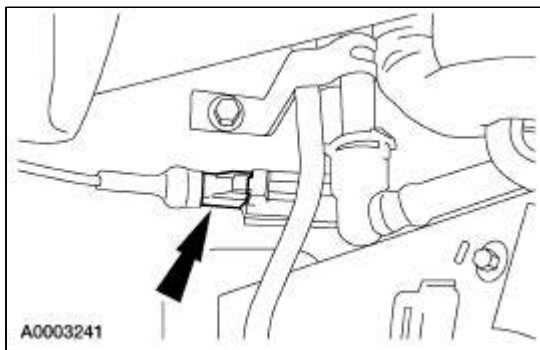
53. **NOTE:** LH shown; RH similar.

Position the LH and the RH anti-lock brake sensor harness and reclip to the brake hoses.



54. **NOTE:** LH shown; RH similar.

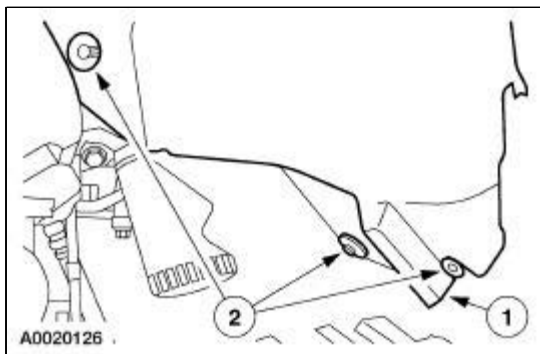
Connect the LH and the RH anti-lock brake sensor electrical connectors.



55. **NOTE:** LH shown; RH similar.

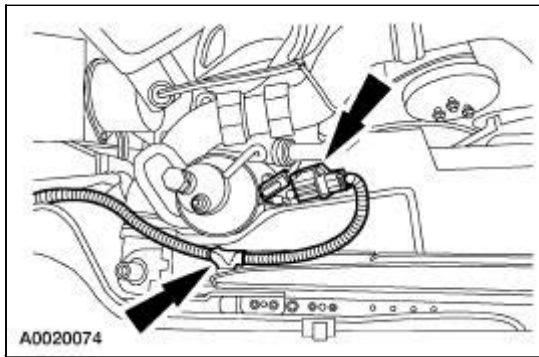
Install the LH and the RH inner splash shields.

1. Position the shield.
2. Install the pin-type retainers.

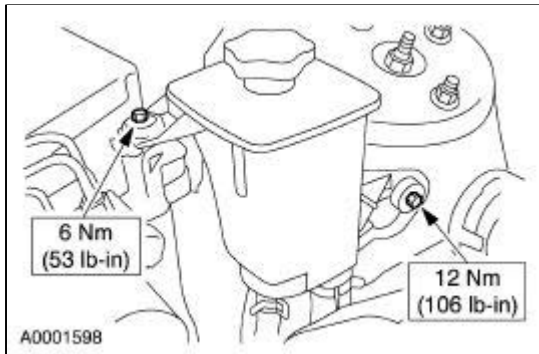


56. Install the front wheels and tires. For additional information, refer to [Section 204-04](#).

57. Clip the harness to the radiator support and connect the water valve electrical connector.

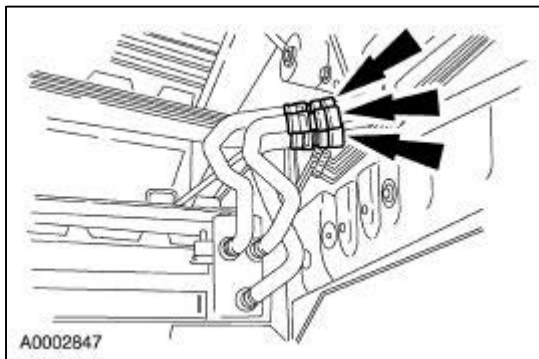


58. Install the hydraulic cooling fan reservoir.

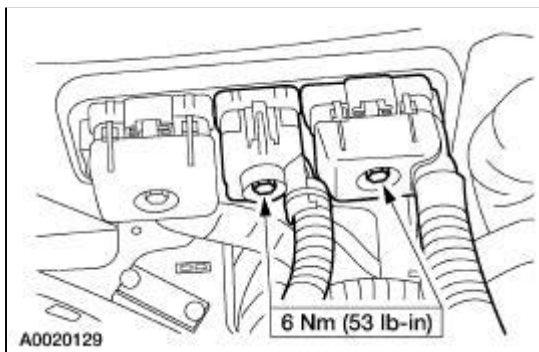


59. **NOTE:** Install the two hoses to the marks made during removal.

Connect the hoses to the water control valve.

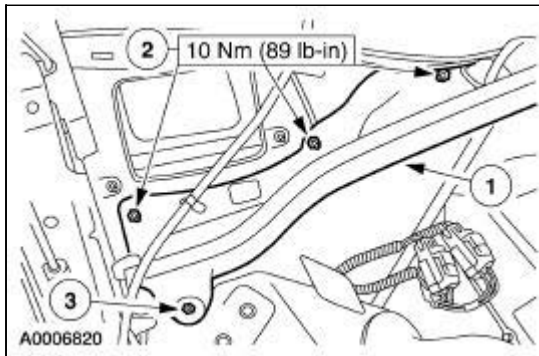


60. Connect the connectors.



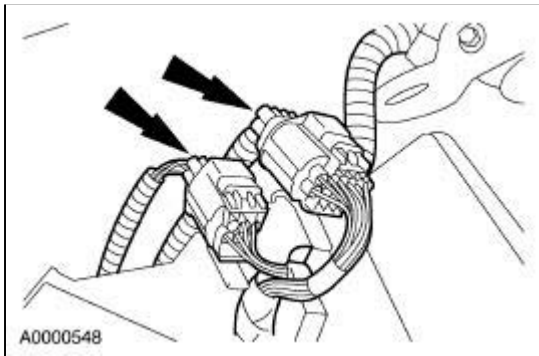
61. Install the fresh air filter panel.
1. Position the panel.

2. Install the nuts.
3. Install the pin-type retainer.

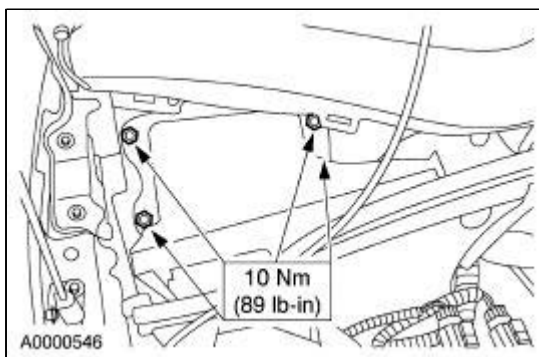


62. **NOTE:** The connectors are located on the backside of the RH strut tower.

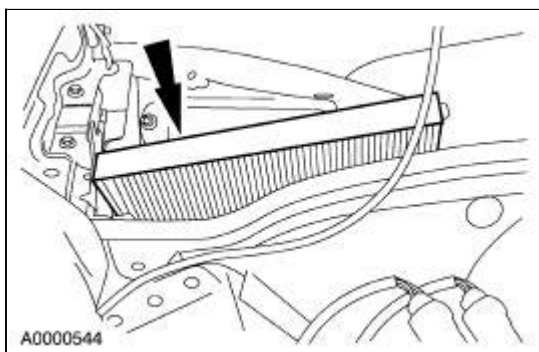
Connect the powertrain bulkhead electrical connectors.



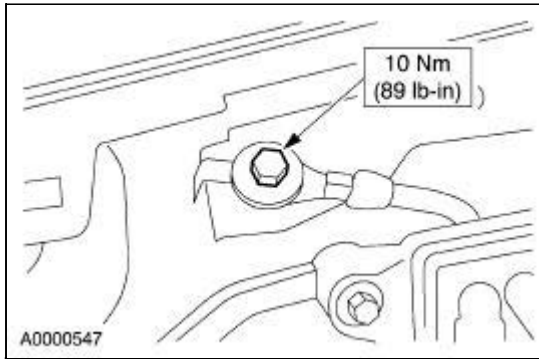
63. Install the fresh air filter housing.



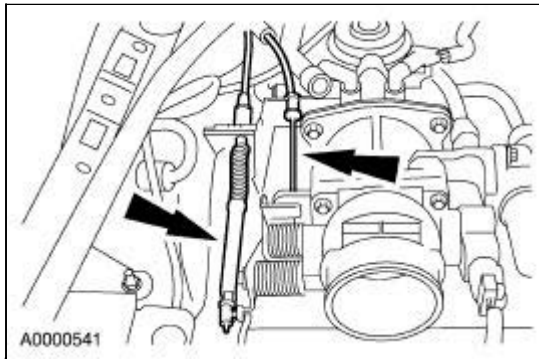
64. Install the fresh air filter.



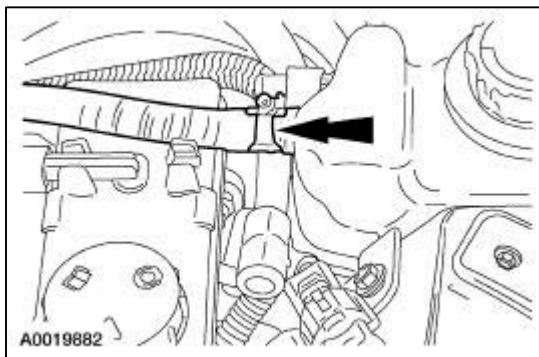
65. Connect the ground strap.



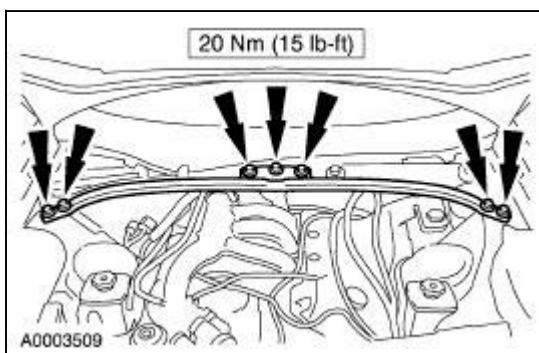
66. Connect the accelerator cable and the speed control cable.



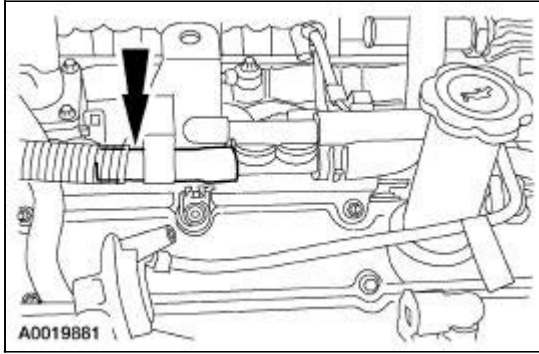
67. Connect the degas bottle hose.



68. Install the bracket.
1. Install the bracket.
 2. Install the seven bolts and one nut.
 3. Install the windshield washer hose.

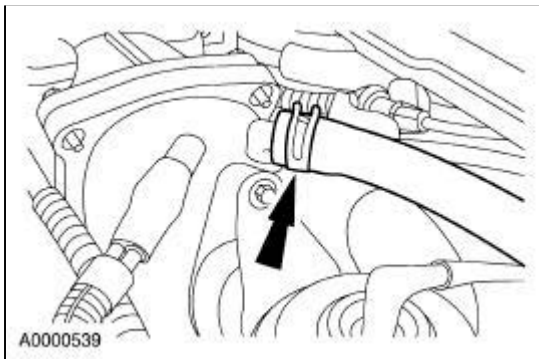


69. Reclip the hose.



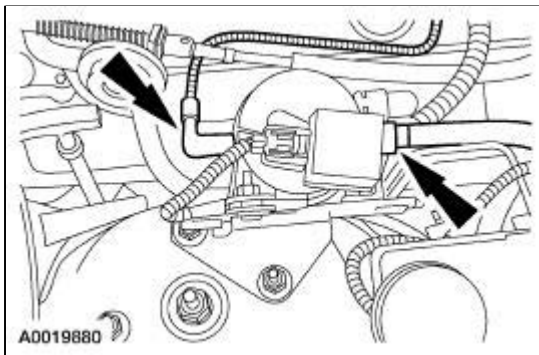
70. Install the cowl vent screen. For additional information, refer to [Section 501-02](#).

71. Connect the main vacuum supply hose.

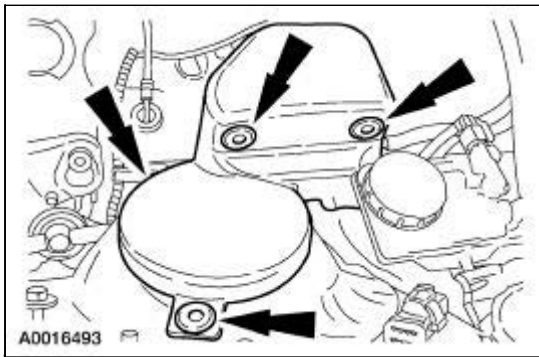


72. Connect the VMV.

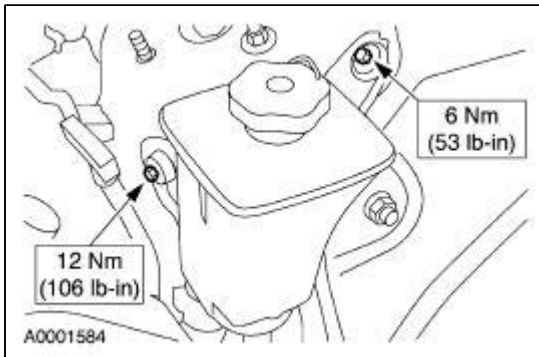
- Vacuum hose.
- Canister purge valve.



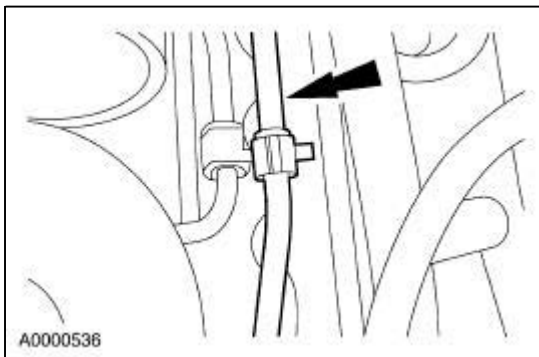
73. Install the VMV cover.



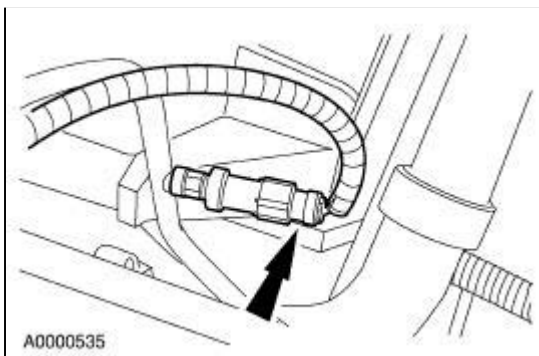
74. Connect the fuel line. For additional information, refer to [Section 310-00](#).
75. Install the power steering pump reservoir.



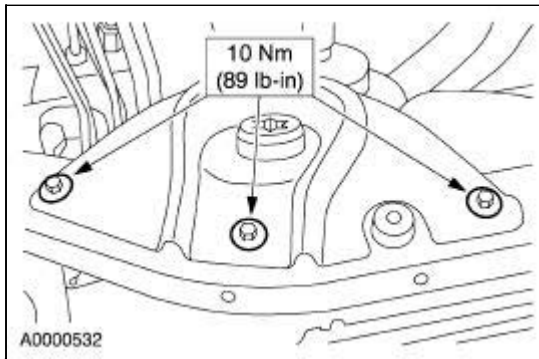
76. Attach the power steering return line to the pressure line.



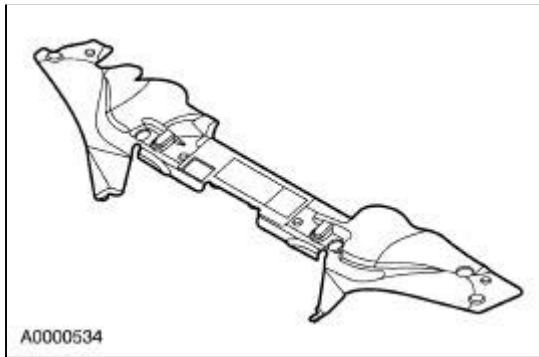
77. Connect the A/C pressure switch electrical connector.




78. Install the two upper radiator support brackets.



79. Install the upper radiator sight shield.



80. Fill the engine with Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.
 81. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
 82. Install the air cleaner inlet. For additional information, refer to [Section 303-12](#).
 83.  **CAUTION: The cooling system filling and bleeding procedure must be followed exactly or damage to the engine may occur.**

Fill the engine cooling system. For additional information, refer to [Section 303-03](#).
 84. Fill the power steering reservoir to the correct level. For additional information, refer to [Section 211-02](#).
 85. Fill and bleed the hydraulic cooling fan. For additional information, refer to [Section 303-03](#).
 86. Charge the A/C system. For additional information, refer to [Section 412-00](#).
-

General Specifications

Item	Specification
3.9L	11.3
3.0L	10.6
Cooling fan MAX speed	2,300 ± 100 rpm
Cooling fan MAX pressure output	1,200 psi
Cooling fan operating pressure	900 psi
Cooling fan operating flow rate	4.0 ± 0.25 gpm
Coolant mixture with water	50% ^a
Pressure relief cap opening pressure kPa (psi)	110 (16)
Water thermostat start to open temperature	87-93°C (192-199°F)
Water thermostat full open temperature	104° C(219°F)
Lubrication	
Premium Cooling System Flush F1AZ-19A503-A	ESR-M14P7-A
Premium Long Life Grease XG-1-C	ESA-M1C75-B

^a Premium Engine Coolant E2FZ-19549-AA (F5FZ-19549-CC in Oregon), or equivalent meeting Ford specification ESE-M97B44-A.

Torque Specifications

Description	Nm	lb-ft	lb-in
Engine appearance cover bracket	10	—	89
Lower radiator hose	13	10	—
Water outlet adapter 3.9L	11	8	—
Thermostat housing 3.9L	11	8	—
Coolant outlet pipe 3.0L	25	18	—
Coolant outlet pipe	11	8	—
Water pump assembly 3.0L	25	18	—
Water pump 3.9L	^a		
Upper radiator support brackets	10	—	89
Receiver/drier bracket	11	8	—
Auxiliary water pump 3.9L	10	—	89
Hydraulic cooling fan high pressure line	20	15	—
Hydraulic cooling fan high pressure line bracket	8	—	71
Condenser to radiator bolts	10	—	89
Hydraulic cooling fan pump	25	18	—
Hydraulic cooling fan high pressure line support bracket	13	10	—
Cross vehicle support	20	15	—

Degas bottle	6	—	53
Engine fill cap 3.9L	9	—	80
Water pump pulley (3.9L)	a	a	a

^a Refer to the procedure in this section.

Engine Cooling

The cooling system components include the:

- block heater (optional)
- cylinder head temperature sensor
- fan blade, fan motor and fan shroud assembly
- radiator
- pressure relief cap
- degas bottle
- radiator draincock
- water pump
- oil cooler (optional)
- water thermostat

The water thermostat:

- controls the engine coolant temperature.
- allows quicker engine warm-up.

The degas bottle:

- provides a location for system fill.
- contains coolant expansion and system pressurization.
- provides air separation during operation.
- replenishes the engine coolant to the system.

The fan blade draws air through the radiator to help cool the engine coolant.

The fan motor:

- operates only when the engine is running.
- will not operate when the engine is off.

The engine coolant flows:

- from the lower radiator hose to the water pump.
- from the water pump to the engine block and the cylinder heads.

A closed water thermostat returns the engine coolant to the water pump. An open water thermostat allows the engine coolant to flow to the radiator.

Unsatisfactory coolant materials:

- Alcohol-type antifreeze does not provide adequate water pump lubrication.
 - has lower boiling point
 - reduced antifreeze protection
- Alkaline brine solutions will cause serious engine cooling system damage.

The cylinder head temperature sensor provides a signal to the temperature gauge.

- will invoke failsafe cooling.

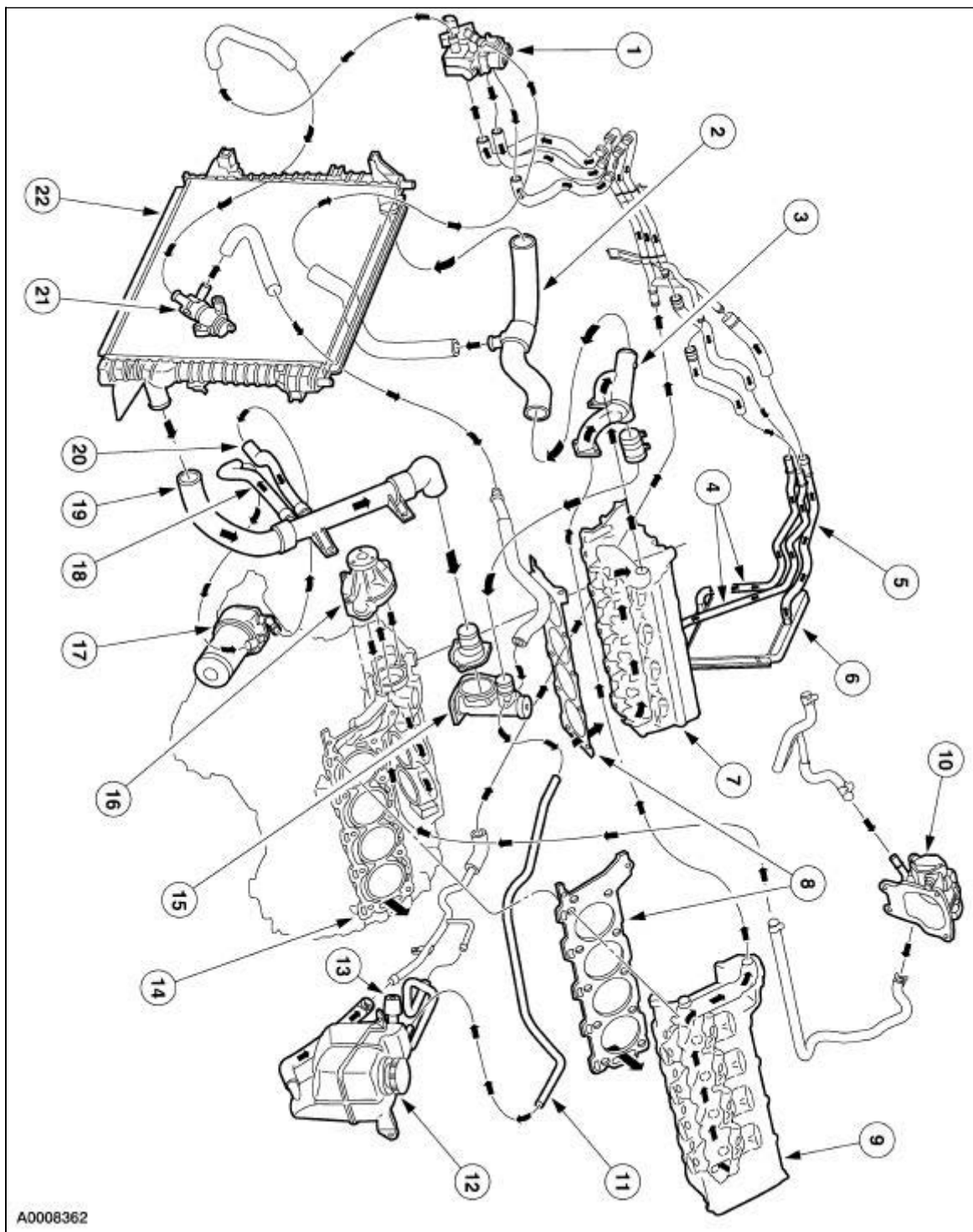
The optional block heater:

- electrical heating element is installed in the block cooling jacket.
 - uses a standard 110V (220V in Europe) electrical supply
- keeps the engine coolant warm during cold weather.

The auxiliary water pump (3.9L only):

- provides heater coolant flow boost.
- has a secondary function of providing engine-off cooling.

Coolant Flow 3.9L

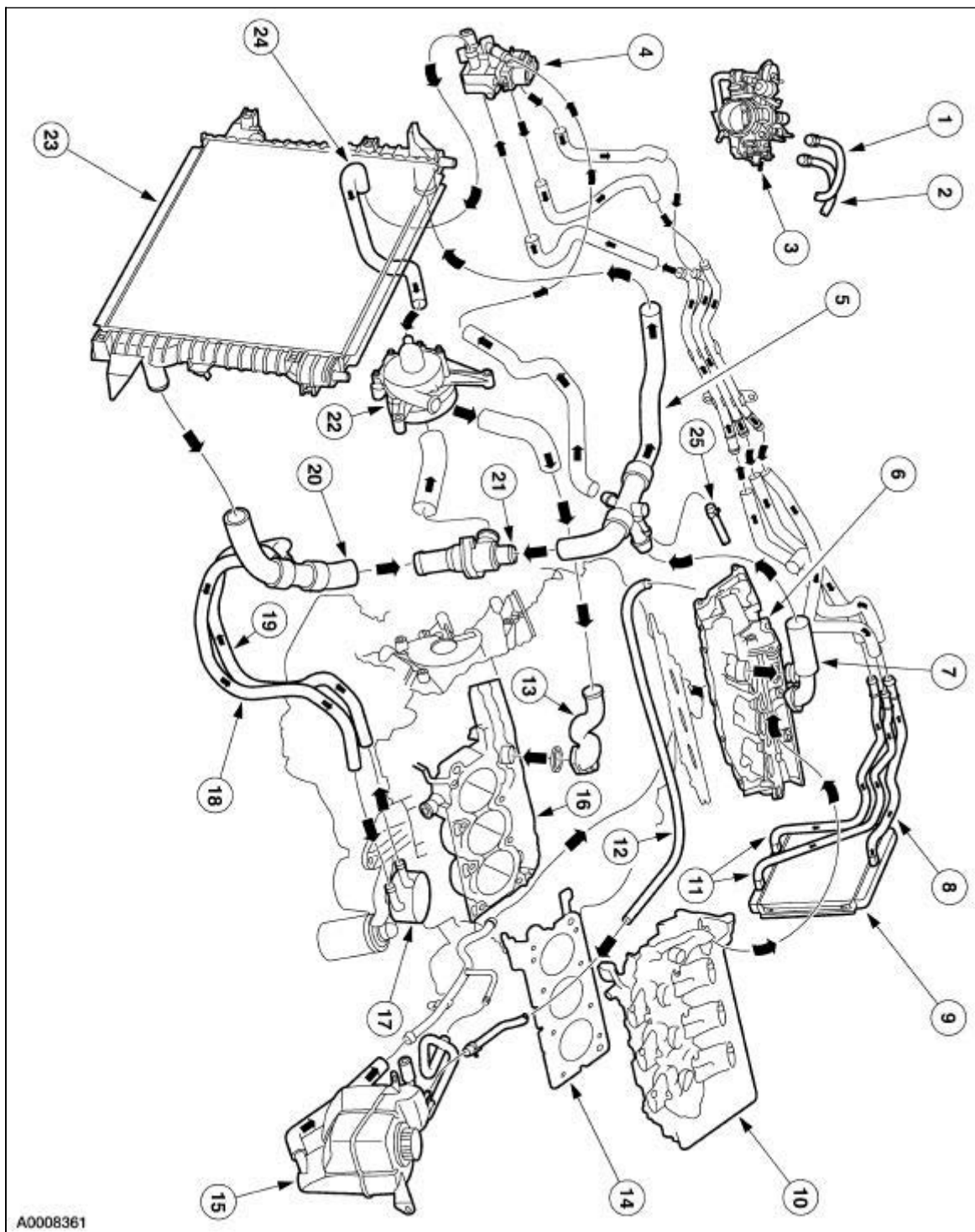


A0008362

Item	Part Number	Description
1	—	Coolant control valve
2	8260	Upper radiator hose
3	8A520	Coolant outlet tube
4	18472	Heater inlet hoses (2 req)
5	18472	Heater outlet hose
6	18476	Heater core
7	6049	Cylinder head RH
8	—	Cylinder head gasket (2 req)

9	6050	Cylinder head LH
10	—	Throttle body adapter
11	—	Engine vent hose
12	—	Degas bottle
13	—	Relief valve
14	6015	Cylinder block
15	8A587	Thermostat housing
16	8501	Water pump
17	6A642	Oil cooler
18	—	Oil cooler inlet hose
19	8286	Lower radiator hose
20	—	Oil cooler outlet hose
21	—	Auxiliary coolant pump
22	8005	Radiator

Coolant Flow 3.0L







A0008361

Item	Part Number	Description
1	—	From degas vent
2	—	From upper radiator inlet
3	9E926	Throttle body
4	—	Coolant control valve
5	—	Upper radiator hose
6	6051	Cylinder head RH
7	8555	Coolant outlet tube
8	18472	Heater outlet hose

9	18476	Heater core
10	6049	Cylinder head LH
11	18472	Heater inlet hoses (2 req)
12	—	Engine vent hose (to throttle body)
13	—	Coolant outlet tube
14	—	Cylinder head gasket (2 req)
15	—	Degas bottle
16	6015	Cylinder block
17	6A642	Oil cooler
18	—	Oil cooler inlet hose
19	—	Oil cooler outlet hose
20	—	Lower radiator hose
21	8A857	Thermostat housing
22	8501	Water pump
23	8005	Radiator
24	—	Water pump inlet hose
25	—	To throttle body
26	—	Vent hose (to throttle body)

Engine Cooling

Special Tool(s)

 <p>ST1474-A</p>	<p>Pressure Test Kit 014-R1072 or equivalent</p>
 <p>ST1217-A</p>	<p>New Generation STAR Tester (NGS) 418-F052 (007-00520) or equivalent</p>
 <p>ST1477-A</p>	<p>Power Steering Analyzer 014-00207 (D79L-33610-A)</p>
 <p>ST1396-A</p>	<p>Dial Thermometer 0-220°F 023-R0007</p>


Inspection and Verification

1. Verify the customer concern by operating the engine to duplicate the condition.
2. Inspect to determine if any of the following mechanical or electrical concerns apply.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Leaks ● Restricted airflow through the condensor/radiator ● Damaged hoses ● Loose/damaged hose clamps ● Damaged water gasket ● Damaged head gaskets ● Damaged water pump ● Damaged radiator 	<ul style="list-style-type: none"> ● Damaged cylinder head temperature sensor ● Damaged wiring ● Hydraulic cooling fan pump solenoid/solenoid wiring

<ul style="list-style-type: none"> ● Damaged degas bottle ● Damaged heater core ● Hydraulic cooling fan system <ul style="list-style-type: none"> ■ Fluid level ■ Hydraulic line or joint leaks ■ Kinked hydraulic lines 	
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 **CAUTION:** The cylinder head temperature sensor is not reusable after removal on 3.9L engines. For electrical concern testing refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

3. If the inspection reveals an obvious concern that can be readily identified, repair it as necessary.
4. If the concern remains after the inspection, determine the symptom(s) and go to the Symptom Chart.
5. Verify the cooling system is correctly filled and bled. For additional information, refer to Cooling System Draining, Filling And Bleeding in this section.

Symptom Chart



Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Loss of engine coolant 	<ul style="list-style-type: none"> ● Radiator. ● Thermostat housing assembly. ● Auxiliary water pump (3.9L only). ● Heater control valve. ● Oil cooler. ● PCV heater system. ● Throttle body adapter heating (3.9L). ● Water pump seal. ● Radiator hoses. ● Heater hoses. ● Heater core. ● Engine gaskets. ● Degas bottle. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test A.</u>
<ul style="list-style-type: none"> ● The engine overheats 	<ul style="list-style-type: none"> ● Water thermostat. ● Airlock in the system. ● Water pump. ● Internal engine coolant leak. ● Radiator. ● Radiator airflow obstruction. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test B.</u>

	<ul style="list-style-type: none"> ● Heater core. ● Cooling fan. ● Pressure relief cap. 	
<ul style="list-style-type: none"> ● The engine does not reach normal operating temperature 	<ul style="list-style-type: none"> ● Water thermostat. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test C.
<ul style="list-style-type: none"> ● The block heater does not operate correctly 	<ul style="list-style-type: none"> ● Block heater power cable. ● Block heater. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D.
<ul style="list-style-type: none"> ● Noisy cooling fan operation 	<ul style="list-style-type: none"> ● Incorrect fluid level. ● Kinked or leaking line. ● Blocked reservoir screen. ● Hydraulic motor. ● Hydraulic pump. 	<ul style="list-style-type: none"> ● REFILL fluid to specified level. REFER to Hydraulic Cooling Fan System Filling and Bleeding. CHECK for leaks and retest. ● INSTALL a new line. RETEST and CHECK for leaks. ● REFER to Component Tests in this section.

Pinpoint Tests

PINPOINT TEST A: LOSS OF COOLANT

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK THE ENGINE COOLANT LEVEL	
NOTE: Allow the engine to cool before checking the engine coolant level.	
<p>1</p> 	<p>2 Visually check the engine coolant level at the degas bottle.</p> <ul style="list-style-type: none"> ● Is the engine coolant level within specification? <p>→ Yes GO to A2.</p> <p>→ No REFILL the engine coolant as necessary. GO to A6.</p>
A2 DEGAS BOTTLE PRESSURE RELIEF CAP	
	<p>1  WARNING: Never remove the pressure relief cap under any conditions while the engine is operating. Failure to follow these instructions could result in damage to the cooling system or engine and/or personal injury. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap from a hot degas bottle. Wait until the engine has</p>

cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When certain all the pressure has been released, remove the pressure relief cap (still with a cloth).

Allow the engine to cool.

2 Remove the pressure relief cap.

3 Inspect the pressure relief cap for foreign material between the sealing gasket and the diaphragm.

● **Is the pressure relief cap OK?**

→ **Yes**
REFER to Component Tests.

→ **No**
CLEAN or INSTALL a new pressure relief cap. TEST the system for normal operation. GO to A1.

A3 CHECK THE ENGINE COOLANT FOR INTERNAL LEAK

1



2 Inspect the engine coolant in the degas bottle for signs of engine oil.

● **Is oil evident in the coolant?**

→ **Yes**
If engine oil is evident, GO to Section 303-00.

→ **No**
GO to A4.

A4 CHECK THE ENGINE FOR COOLANT

1 Remove the oil level indicator from the engine.

● **Is coolant evident in the oil?**

→ **Yes**
If coolant is in the engine, GO to Section 303-00.

→ **No**
GO to A5.

A5 PRESSURE TEST THE ENGINE COOLING SYSTEM



1 Pressure test the engine cooling system; refer to the Component Tests in this section.

● **Does the engine cooling system leak?**

→ **Yes**
REPAIR or INSTALL new components. TEST the system for normal operation.

	<p>→ No The cooling system is operational. RETURN to the Symptom Chart.</p>
A6 CHECK THE DEGAS BOTTLE	
	<p>1 NOTE: The engine must be cool when coolant is added to the degas bottle.</p> <p>Add coolant to the degas bottle until fluid is between the coolant fill level marks.</p> <ul style="list-style-type: none"> ● Does the degas bottle leak? <p>→ Yes INSTALL a new degas bottle. TEST the system for normal operation.</p> <p>→ No CARRY OUT the cooling system pressure test. REFER to the Component Tests in this section. REPAIR as necessary. TEST the system for normal operation.</p>

PINPOINT TEST B: THE ENGINE OVERHEATS

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK THE ENGINE COOLANT LEVEL	
NOTE: If the engine is hot, allow the engine to cool before proceeding.	
<p>1</p> 	<p>1  WARNING: Never remove the pressure relief cap under any conditions while the engine is operating. Failure to follow these instructions could result in damage to the cooling system or engine and/or personal injury. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap from a hot degas bottle. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When certain all the pressure has been released, remove the pressure relief cap (still with a cloth).</p> <p>2 Check the engine coolant level at the degas bottle.</p> <ul style="list-style-type: none"> ● Is the engine coolant OK? <p>→ Yes GO to <u>B2</u>.</p> <p>→ No REFILL the engine coolant at the degas bottle. GO to <u>Pinpoint Test A</u>.</p>
B2 CHECK THE COOLANT CONDITION	
	<p>1 Check the coolant for contaminants such as rust, corrosion, or discoloration.</p> <ul style="list-style-type: none"> ● Is the coolant condition OK? <p>→ Yes GO to <u>B3</u>.</p>

→ **No**
FLUSH the engine cooling system; REFER to Flushing—Engine and Radiator in this section. TEST the system for normal operation.

B3 CHECK FOR AN AIRFLOW OBSTRUCTION

1 Inspect the A/C condenser core and radiator for obstructions such as leaves or dirt.

● **Is there an obstruction?**

→ **Yes**
REMOVE the obstruction. CLEAN the A/C condenser core and radiator. TEST the system for normal operation.

→ **No**
GO to B4.

B4 CHECK THE HEATER CORE OPERATION

2



1 Install the pressure relief cap.

3 As the engine starts to heat up, feel the inlet and outlet heater water hoses. They should feel approximately the same after three or four minutes.

● **Is the outlet heater water hose approximately the same temperature as the inlet heater water hose?**

→ **Yes**
GO to B5.

→ **No**
TURN the engine off. REPAIR or INSTALL a new heater core. REFER to Section 412-00. TEST the system for normal operation.

B5 CHECK THE WATER THERMOSTAT OPERATION

1



2




1 Start the engine and allow the engine to run for 10 minutes.



3 Feel the upper and lower radiator hoses.

● **Are the upper and lower radiator hoses cold?**

→ **Yes**
INSTALL a new water thermostat. TEST the system for normal operation.

	→ No GO to <u>B6</u> .
B6 CHECK THE COOLING FAN OPERATION	
1 	1 Carry out the cooling fan component tests; refer to the Component Tests in this section. <ul style="list-style-type: none"> ● Is the cooling fan operation OK? → Yes GO to <u>Section 303-00</u> for diagnosis and testing of the engine. → No INSTALL a new fan component as necessary. TEST the system for normal operation.

PINPOINT TEST C: THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE ENGINE TEMPERATURE	
1 	1 Start the engine and allow the engine to idle for 10 minutes. 2 Feel the upper and lower radiator hoses. <ul style="list-style-type: none"> ● Are the upper and lower radiator hoses cold? → Yes INSTALL a new water thermostat. TEST the system for normal operation. → No GO to <u>Section 413-01</u> for diagnosis and testing of the engine coolant temperature gauge.
2 	

PINPOINT TEST D: THE BLOCK HEATER DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK THE POWER CABLE	
1	

Block Heater

Q4195-A

3 Check the resistance in circuits 1, 2, and 3 of the block heater.


- Are the resistances in circuits 1, 2, and 3 less than 5 ohms?

→ **Yes**
INSTALL a new block heater. TEST the system for normal operation.

→ **No**
INSTALL a new power cable. TEST the system for normal operation.

Component Tests

Pressure Test


1. Turn the engine OFF.
2. Remove the cowl vent screen. For additional information, refer to [Section 501-02](#).
3.  **WARNING: Never remove the pressure relief cap under any conditions while the engine is operating. Failure to follow these instructions could result in damage to the cooling system or engine and/or personal injury. To avoid having scalding hot coolant or steam blow out of the cooling system, never remove the pressure relief cap from a hot degas bottle. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When certain all the pressure has been released, remove the pressure relief cap (still with a cloth).**

Check the engine coolant level. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.

4. Connect the Radiator/Heater Core Pressure Tester to the degas bottle nipple and overflow hose. Install a pressure test pump to the quick-connect fitting of the test adapter.
5. **NOTE:** If the plunger of the pump is depressed too fast, an erroneous pressure reading will result.

Slowly depress the plunger of the pressure test pump until the pressure gauge reading stops increasing and note the highest pressure reading obtained.

6. If the pressure relief cap does not hold pressure, remove and wash the pressure relief cap in clean water to dislodge all foreign particles from the gaskets. Check the sealing surface in the filler neck.
7. If 8-9 kPa (13 psi) cannot be reached, install a new pressure relief cap. If more than 12 kPa (18 psi) shows on the gauge, install a new pressure relief cap.

8.  **CAUTION: If the pressure drops, check for leaks at the engine to heater core hoses, engine-to-radiator hoses, water valve hose (if applicable), oil cooler return tube gasket, radiator and heater core or other system components and connections. Any leaks which are found must be corrected and the system rechecked.**

Pressurize the engine cooling system as described in Step 4 (using a pressure relief cap that operates within the specified upper and lower pressure limits). Observe the gauge reading for approximately two minutes; refer to General Specifications. Pressure should not drop during this time.

9. Release the system pressure by loosening the pressure relief cap. Check the engine coolant level and replenish, if necessary, with the correct engine coolant mixture. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.

Cap



WARNING: Never remove the pressure relief cap under any conditions while the engine is operating. Failure to follow these instructions could result in damage to the cooling system or engine and/or personal injury. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap from a hot degas bottle. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When certain all the pressure has been released, remove pressure relief cap (still with a cloth).

1. Remove the pressure relief cap from the degas bottle.
2. Immerse the pressure relief cap in water and install it on the shallow filler neck of Radiator/Heater Core Pressure Tester and Radiator Cap Adapter, part of the Radiator/Heater Core Pressure Tester.
3. Immerse the filler neck seal in water and install it in the filler neck adapter.
4. Install the filler neck adapter with the filler neck seal to the Radiator Cap Adapter.
5. Connect the female quick-connect fitting of the pressure test pump to the male quick-connect fitting of the filler neck adapter.
6. **NOTE:** If the plunger of the pump is depressed too fast, an erroneous pressure reading will result.

Slowly depress the plunger of the pressure test pump until the pressure gauge reading stops increasing and note the highest pressure reading obtained.

7. Release the pressure by turning the relief screw counterclockwise. Then tighten the pressure relief screw and repeat Step 6 (at least twice) to make sure the reading is repeatable within the specifications of the pressure relief cap.
8. If the pressure test gauge readings are not within specifications, install a new pressure relief cap. If the pressure test gauge readings are within specifications, carry out the cooling system Pressure Test.

Thermostat—Water

A new water thermostat should be installed only after the following electrical and mechanical tests have been carried out.

Thermostat—Electrical Test

NOTE: The electrical thermostat test is most accurate if carried out indoors at less than 37.8°C (100°F) ambient air. This test may be carried out with or without the hood open and with the engine warm or cold.

1. Check the engine coolant level. Fill as needed.
2. With the ignition OFF, attach the Rotunda 73 Digital Multimeter. It may be used to monitor sensor voltage values between 0-5 volts.
New Generation STAR (NGS) Tester or the Service Bay Diagnostic System (SBDS) may be used to monitor the CHT on vehicles equipped with data link connector (DLC). The SBDS sequence to use for the screen is: Toolbox-Electronic Engine Control and DCL-Item.
3. **NOTE:** Running this test with the vehicle in gear or with the A/C compressor clutch engaged (running) will cause incorrect diagnosis.

Place the transmission in PARK (P) or NEUTRAL (N).

4. Start the engine and allow the engine to idle throughout this test. Allow the engine to run for two minutes, then record the CHT voltage. Record the CHT voltage every 60 seconds. When the CHT voltage trend changes direction or only changes slightly (0.03 volt or less) from the previous reading, record this as the thermostat opening voltage. Use the voltage and corresponding coolant temperature chart listed below.

Coolant Temp °C (°F)	CHT Min (Volts)	CHT Nom (Volts)	CHT Max (Volts)
0 (32)	4.7714	4.8032	4.8723
25 (77)	4.3428	4.4148	4.4727
50 (122)	3.5354	3.6495	3.7473
80 (176)	2.3049	2.4201	2.5260
110 (230)	1.3021	1.3808	1.4562
140 (284)	0.6960	0.7414	0.7857
170 (338)	0.3784	0.4024	0.4261

5. If the thermostat opening voltage is less than 2.3049 volts and less than 80°C (176°F), install a new water thermostat.

6. If the thermostat opening voltage is greater than 2.3049 volts 82°C (180°F), the water thermostat is good and a new water thermostat should not be installed. Refer to the Symptom Chart for further instructions.

Thermostat—Mechanical Test

1. Remove the water thermostat.
2. Check the water thermostat for seating. Hold the water thermostat up to a lighted background. Leakage of light around the thermostat valve at room temperature indicates a new water thermostat should be installed. Some water thermostats have a small leakage notch at one location on the perimeter of the thermostat valve, which is considered normal.
3. Immerse the water thermostat in a boiling antifreeze and water mixture.
4. See the General Specifications chart for water thermostat opening temperatures.

Radiator Leak Test, Removed From the Vehicle



CAUTION: Never leak test an aluminum radiator in the same water that copper/brass radiators are tested in. Flux and caustic cleaners may be present in the cleaning tank and they will damage aluminum radiators.

NOTE: Always install plugs in the oil cooler fittings before leak testing or cleaning any radiator.

NOTE: Clean the radiator before leak testing to avoid contamination of tank.

1. Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.

Hydraulic Cooling Fan Reservoir

1. Reduce the fluid in the reservoir by half.
2. Attach the New Generation STAR (NGS) Tester to the vehicle.
3. Start the engine and command MAX fan.
4. Maintain 2,500 rpm. Fluid should be observed through the reservoir returning. The internal return also functions as a relief valve; fluid must be observed through the sides of the return. If the fluid is not returning through the sides the screen is plugged. If no or little return is observed or the fluid is returning through the pressure relief, install a new reservoir.

Hydraulic Cooling Fan Motor

1. Inspect the fan blade and shroud for any foreign materials. Clear the obstruction and continue the test procedure.
2. Rotate the fan to see if any contact between the shroud and blade exists. If contact is observed install a new fan shroud assembly.

3. Rotate the fan by hand; the fan should rotate freely (no resistance should be felt, the fan will free wheel with minimum effort). If any resistance is present install a new fan assembly.
4. Attempt to move the fan blade and shaft in and out and side to side; if any movement is detected install a new fan assembly.

Hydraulic Cooling Fan Pump




WARNING: Do not touch the flowmeter during the test procedure or severe burns and serious injury may occur.

1.  **CAUTION:** Make sure that the connection point will not interfere with any of the engine accessory drive components or drive belts.

NOTE: On some vehicles the port may not be easily accessible. The power steering analyzer should then be hooked up at the hydraulic cooling fan motor or at a point in the high pressure line between the motor and the hydraulic cooling fan pump.

Install the power steering analyzer at the high pressure port of the hydraulic cooling fan pump. Make sure the power steering analyzer gate is fully open.

2.  **CAUTION:** A noisy fan system must be bled and refilled before proceeding with any of the test procedures. For additional information, refer to [Hydraulic Cooling Fan System Filling and Bleeding in this section](#).


Check the cooling fan hydraulic fluid level. If necessary, add fluid.


- Use MERCON® Multi-Purpose (ATF) Transmission Fluid XT-2-QDX meeting Ford specification MERCON® or equivalent.
3. Remove the reservoir screen and place the dial thermometer in the hydraulic cooling fan reservoir.
 4. Start the engine and allow the engine to warm up until the fan turns on.
 5. Allow fluid temperature to reach 74-80°C (165-175°F).
 6. Record the flow rate and pressure readings.
 7. **NOTE:** The pressure relief valve will open at 1,050 ± 100 psi (7,240 kPa ± 689.5 kPa). If the pressure is above 1,200 psi (8,275 kPa), a new pump pressure relief valve must be installed.


Turn the A/C on MAX, and record the flow and pressure readings. The flow and pressure readings should increase.
 - If the flow and pressure readings do not increase, install a new hydraulic cooling fan pump.
 8. Partially close the gate valve to achieve 300 psi (2,068.5 kPa). The flow rate should be 1.65 ±.25 gpm.
 - If the flow rate is less than specified, install a new hydraulic cooling fan pump.
-

Cooling System Inspection

Special Tool(s)

 ST1720-A	Fluid Tester 014-R1060 or equivalent
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-  **WARNING:** Never remove the pressure relief cap while the engine is operating or when the cooling system is hot. Failure to follow these instructions can result in damage to the cooling system or engine or personal injury. To avoid having scalding hot coolant or steam blow out of the degas bottle when removing the pressure relief cap, wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, (still with a cloth) turn and remove the pressure relief cap.

 **CAUTION:** If there is engine coolant in the engine oil, the cause must be corrected and the oil changed or engine damage may occur.

NOTE: If vehicle has not been allowed to reach normal operating temperature, check the engine coolant in the degas bottle. This will make sure sufficient engine coolant exchange has occurred.

Allow the engine to cool. Once pressure is released, remove the pressure relief cap.

- Inspect the coolant in the degas bottle for coolant color:
 - If Premium Engine Coolant E2FZ-19549-AA or equivalent meeting Ford specification ESE-M97B44-A has a clear, light green or blue color, this indicates higher water content than necessary.
 - Dark brown indicates unauthorized stop leak may have been used.
 - A light or reddish-brown color indicates rust in the cooling system. Flush the system and refill with the correct mixture of water and Premium Engine Coolant E2FZ-19549-AA (in Oregon F5FZ-19549-CC) or equivalent meeting Ford specification ESE-M97B44-A.
 - An iridescent sheen on top of the coolant indicates a trace of oil is entering the cooling system.
 - A milky brown color may indicate that engine oil is entering the cooling system.
 - Or if engine coolant is present in the engine oil, the causes of the leak might be:
 - a blown head gasket.
 - a cracked or warped cylinder head.
 - a crack in the engine oil gallery and cooling passageways.
 - an internal leak in the engine oil cooler.
- If the engine coolant appearance is good, test the engine coolant range with the Fluid Tester:

- maximum range is 60/40
- minimum range is 45/55

4. Check the engine coolant system conditions:

- If the engine cooling fluid is low, add the specified coolant mixture only.
 - If the engine coolant fluid tests weak, add straight engine coolant until the readings are within acceptable levels.
 - If the engine coolant tests strong, remove some of the engine coolant and add water until readings are within acceptable levels.
-

Cooling System Draining, Filling And Bleeding

Draining

⚠ WARNING: Never remove the pressure relief cap while the engine is operating or when the cooling system is hot. Failure to follow these instructions can result in damage to the cooling system or engine or personal injury. To avoid having scalding hot coolant or steam blow out of the degas bottle when removing the pressure relief cap, wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, (still with a cloth) turn and remove the pressure relief cap.

⚠ CAUTION: The coolant must be recovered in a suitable, clean container for reuse. If the coolant is contaminated it must be recycled or disposed of correctly.

⚠ CAUTION: Care must be taken to ensure the accessory drive belt does not become contaminated with engine coolant.

1. Release the pressure in the cooling system by slowly turning the pressure relief cap one half turn counterclockwise. When the pressure is released, remove the pressure relief cap.
2. **NOTE:** Approximately four liters will drain from the radiator.

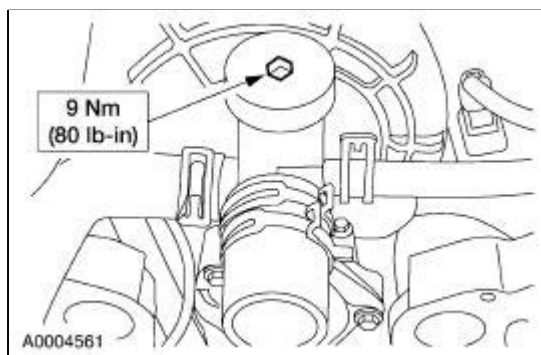
Place a suitable container below the radiator draincock. If equipped, disconnect the coolant return hose at the oil cooler.

- Close the radiator draincock when finished.

Filling—Bleeding

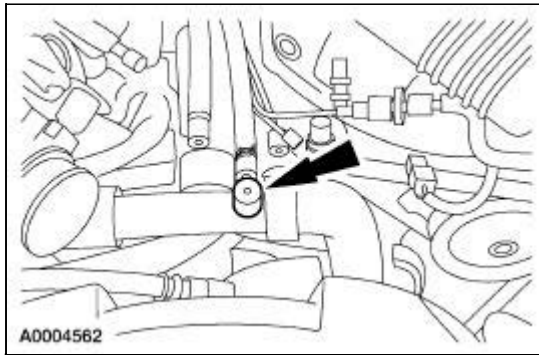
On 3.9L engines

1. Remove the engine fill cap.



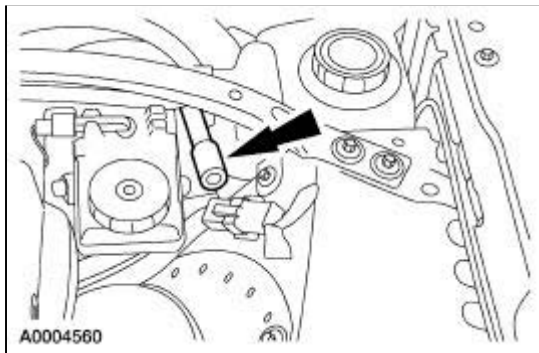
On 3.0L engines

2. Open the engine air bleed.



On all engines

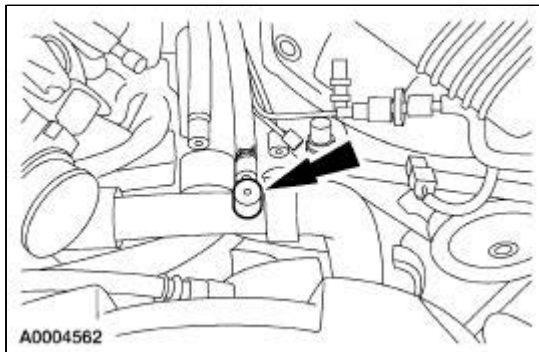
3. Open the heater air bleed.



4. Add coolant to the degas bottle allowing the system to equalize until no more coolant can be added.

On 3.0L engines


5. Close the engine air bleed when coolant begins to escape.



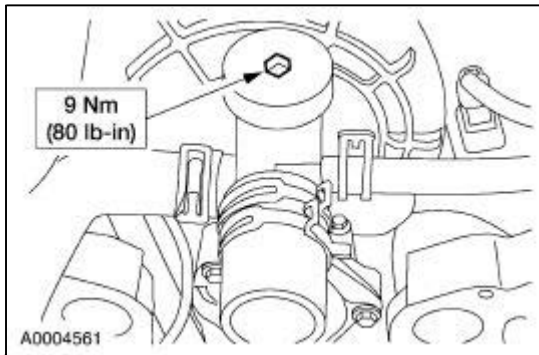
On all engines

6. Replace the degas bottle cap.

On 3.9L engines

 **CAUTION:** Care must be taken to ensure the accessory drive belt does not become contaminated with engine coolant.

7. Add as much coolant as possible to the engine fill. The heater air bleed will remain open.
8. Replace the engine fill cap.

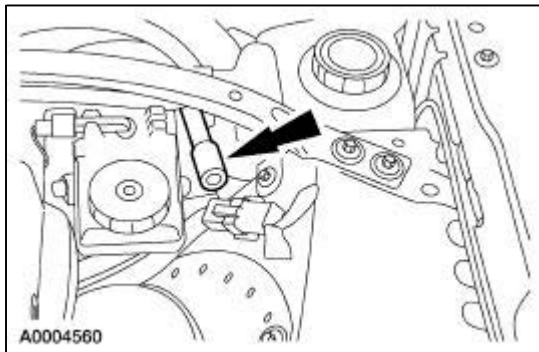


On all engines

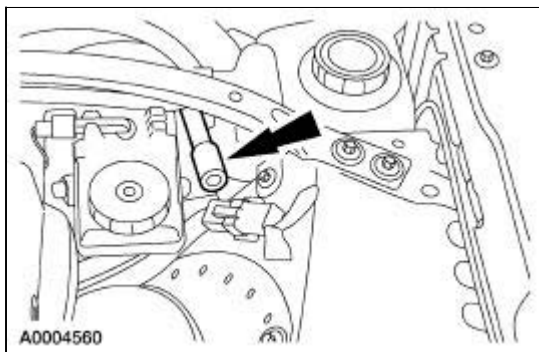
9. **NOTE:** The heater air bleed remains open.

Start the engine and turn the heater to MAX position.

10. Close the heater air bleed when a steady stream of coolant comes from it, during engine idle.



11. Allow the engine to idle for five minutes, add coolant to the degas bottle as needed to maintain the cold fill MAX mark.
12. Reopen the heater air bleed to release any entrapped air and close again.



On 3.9L engines

13. Maintain engine speed of 2,000 rpm for 3-5 minutes or until hot air comes from the heater.
14. Return to idle and verify hot air is still coming from the heater.

On 3.0L engines

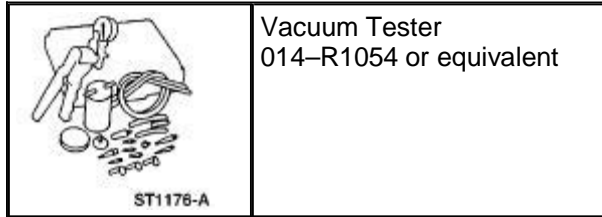
15. Maintain engine speed of 1,500 rpm for 3-5 minutes or until hot air comes from the heater.
16. Return to idle and verify hot air is still coming from the heater.

On all engines

17. Set the heater temperature setting to 24° C (75° F) and allow the vehicle to idle for two minutes.
 18. Shut the engine off and allow to cool.
 19. After the engine has cooled, add coolant to the degas bottle to bring the level to the cold fill MAX mark.
-

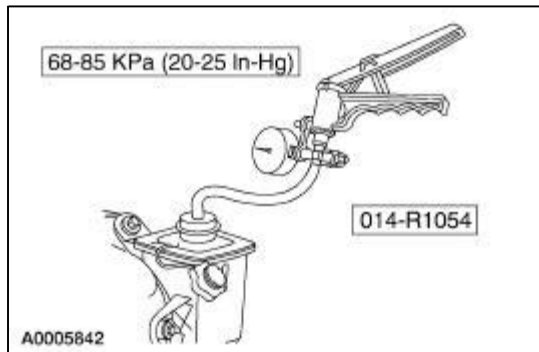
Hydraulic Cooling Fan System Filling and Bleeding

Special Tool(s)



NOTE: It is not uncommon to repeat this procedure three times.




1. Fill the hydraulic cooling fan reservoir to the MAX level.
 - Use Motorcraft MERCON® Multi-Purpose (ATF) Transmission Fluid XT-2-QDX meeting Ford specification MERCON® or equivalent.
2. Apply vacuum for two to three minutes.
 - Remove the vacuum pump.




3. Start the engine and turn the A/C on MAX. This will run the hydraulic fan. If a whining noise is heard, repeat the procedure.

Flushing —Engine and Radiator

Special Tool(s)

 ST1168-A	Coolant Flush Kit 164-R3658 or equivalent
 ST1167-A	Drain Kit 164-R3662 or equivalent
 ST2421-A	Coolant Flush and Fill 023-00154 or equivalent

-  **WARNING:** Never remove the pressure relief cap while the engine is operating or when the cooling system is hot. Failure to follow these instructions can result in damage to the cooling system or engine or personal injury. To avoid having scalding hot coolant or steam blow out of the degas bottle when removing the pressure relief cap, wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, (still with a cloth) turn and remove the pressure relief cap.

Once pressure is released, remove the pressure relief cap.

- Drain the cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#).
- Remove the water thermostat. For additional information, refer to [Thermostat—Housing, 3.0L](#), or [Thermostat—Housing, 3.9L](#) in this section.
- Install the water hose connection without the water thermostat.
- NOTE:** Refer to the cooling system Flush-All operating instructions for specific vehicle hook-up.




Use cooling system Flush-All, Coolant Flush Kit and Drain Kit to flush the engine and radiator. Use Premium Cooling System Flush F1AZ-19A503-A meeting Ford specification ESR-M14P7-A for vehicles filled with Premium Engine Coolant E2FZ-19549-AA or equivalent meeting Ford specification ESE-M971B44-A (green color).


- Install the water thermostat.

7. Backflush the heater core if necessary. For additional information, refer to [Backflushing—Heater Core](#).
 8. Fill the cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.
-

Backflushing —Heater Core

Special Tool(s)

 ST1168-A	Coolant Flush Kit 164-R3658 or equivalent
 ST1167-A	Drain Kit 164-R3662 or equivalent
 ST2421-A	Coolant Flush and Fill 023-00154 or equivalent

-  **WARNING:** Never remove the pressure relief cap while the engine is operating or when the cooling system is hot. Failure to follow these instructions can result in damage to the cooling system or engine or personal injury. To avoid having scalding hot coolant or steam blow out of the degas bottle when removing the pressure relief cap, wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, (still with a cloth) turn and remove the pressure relief cap.

Once pressure is released, remove the pressure relief cap.

- Partially drain the cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.
- NOTE:** Refer to the cooling system Flush-All operating instructions for particular vehicle hook-up.

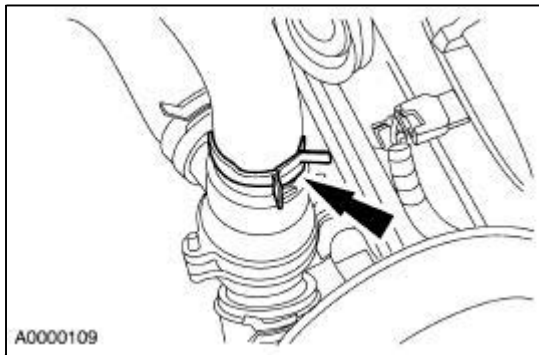
Use cooling system Flush-All, Coolant Flush Kit and Drain Kit to backflush the heater core. Use Premium Cooling System Flush F1AZ-19A503-A meeting Ford specification ESR-M14P7A for vehicles filled with Premium Engine Coolant E2FZ-19549-AA or equivalent meeting Ford specification ESE-M97B44-A (green color).

- Fill the cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.

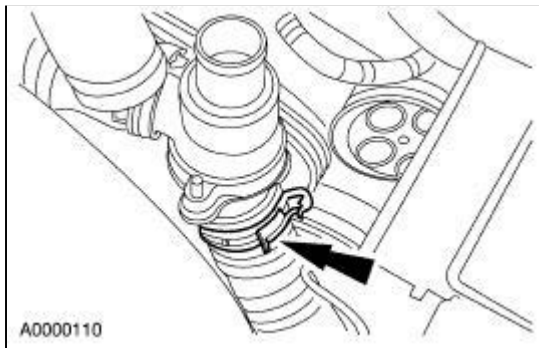
Thermostat —Housing, 3.0L

Removal

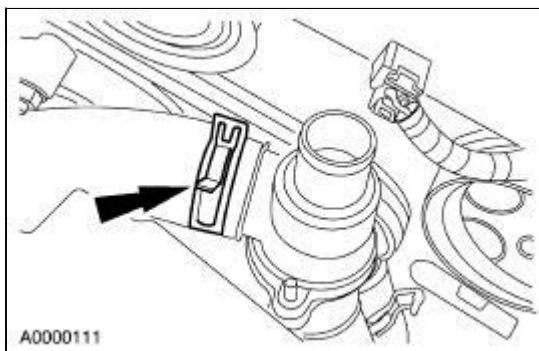
1. Drain the engine cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.
2. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
3. Disconnect the hose.



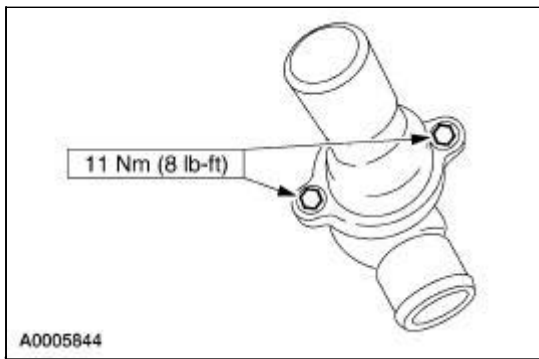
4. Disconnect the hose.



5. Disconnect the hose and remove the thermostat housing assembly.



6. Remove the bolts, separate the housing and remove the thermostat and seal.



Installation

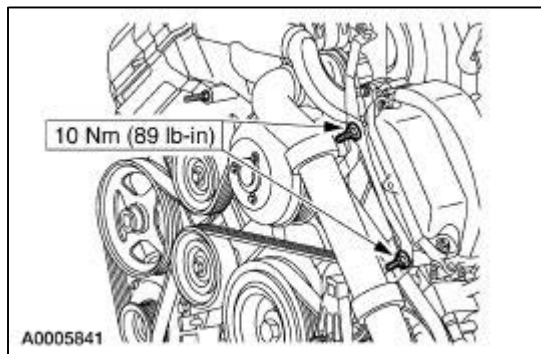
1. **NOTE:** Clean all the sealing surfaces and inspect the O-ring seals thoroughly.

To install, reverse the removal procedure.

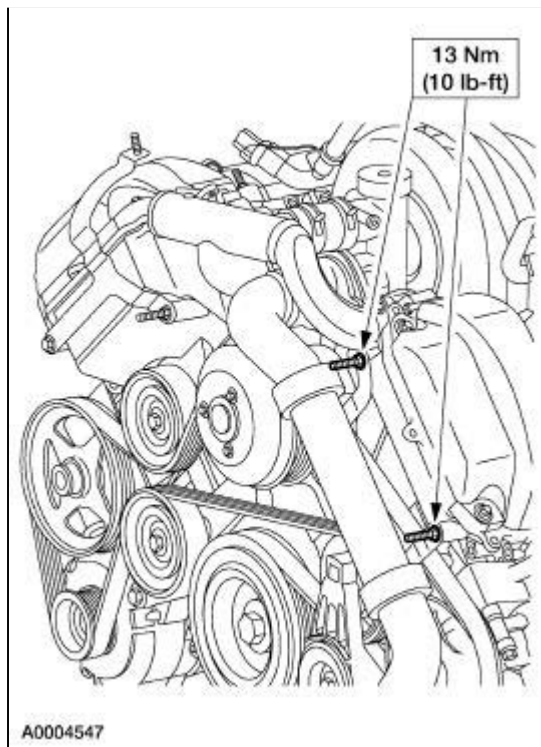
Thermostat —Housing, 3.9L

Removal

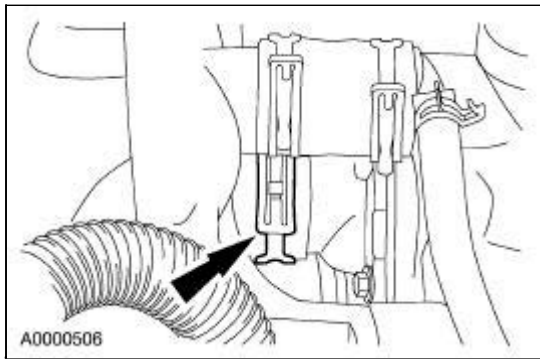
1. Drain the engine cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.
2. Remove the intake manifold. For additional information, refer to [Section 303-01B](#).
3. Remove the nuts and remove the bracket.



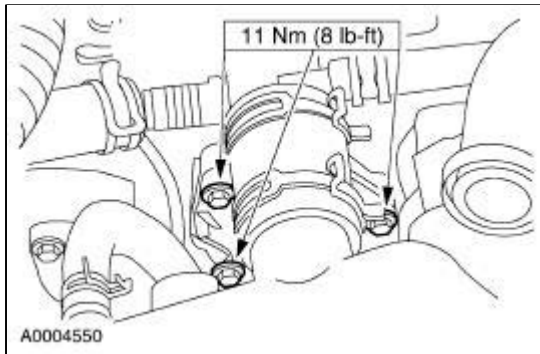
4. Remove the studbolts.



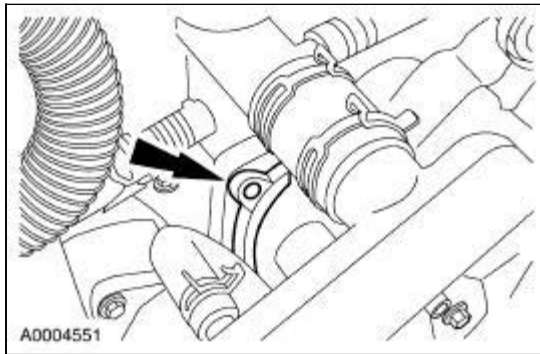
5. Disconnect the lower radiator hose from the thermostat housing.



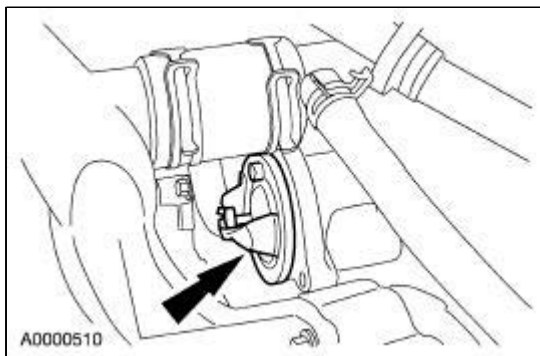
6. Remove the bolts.



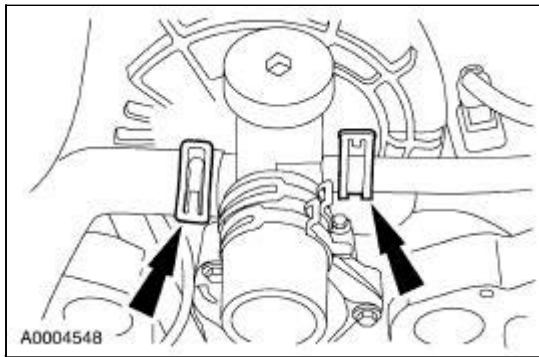
7. Remove the thermostat housing cover.



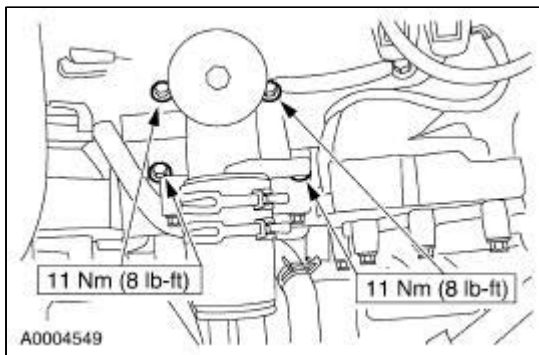
8. Remove the water thermostat.



9. Disconnect the hoses.



10. Remove the coolant outlet pipe. For additional information, refer to [Coolant Outlet Pipe—3.9L](#) in this section.
11. Remove the four bolts and the thermostat housing.



Installation

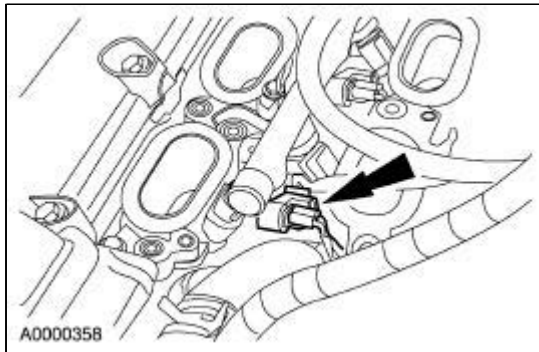
1. **NOTE:** Clean all the sealing surfaces, and inspect the O-ring seals thoroughly.

To install, reverse the removal procedure.

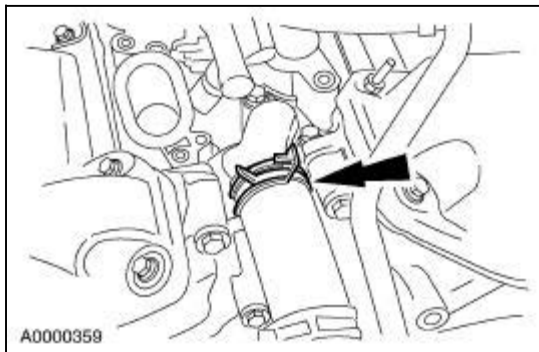
Coolant Outlet Pipe —3.0L

Removal

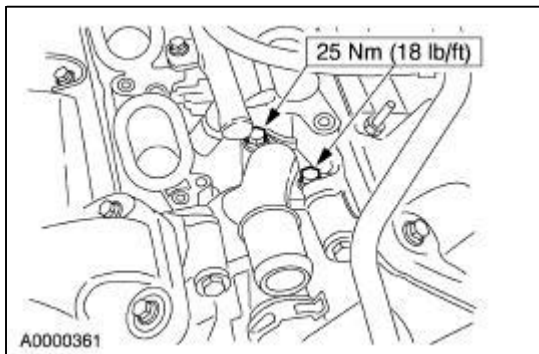
1. Remove the upper intake manifold. For additional information, refer to [Section 303-01A](#).
2. Disconnect the fuel injector electrical connector.



3. Disconnect the hose.



4. Remove the bolts and the coolant outlet pipe.



Installation

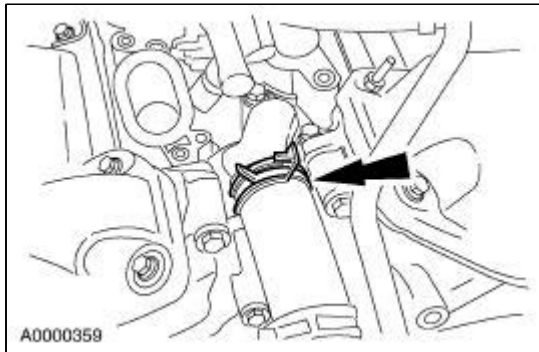
1. **NOTE:** Clean all the sealing surfaces and inspect the O-ring seals thoroughly.

To install, reverse the removal procedure.

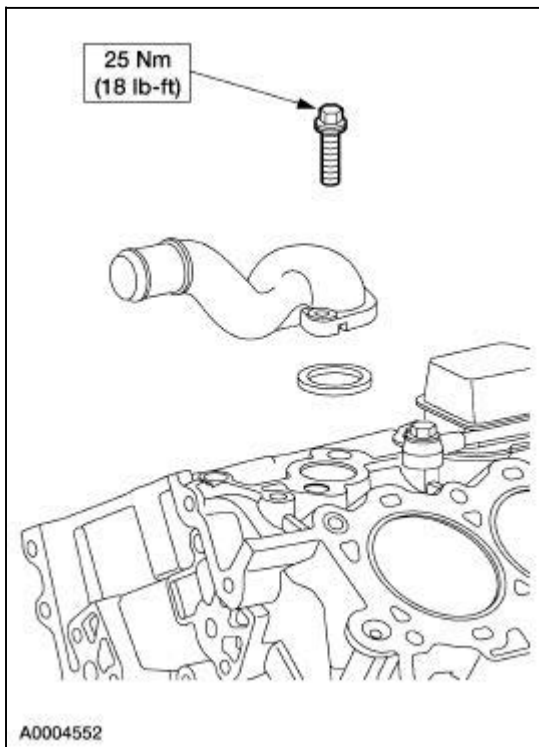
Coolant Inlet Pipe —3.0L

Removal

1. Remove the lower intake manifold. For additional information, refer to [Section 303-01A](#).
2. Disconnect the hose.



3. Remove the bolts and the coolant inlet pipe.



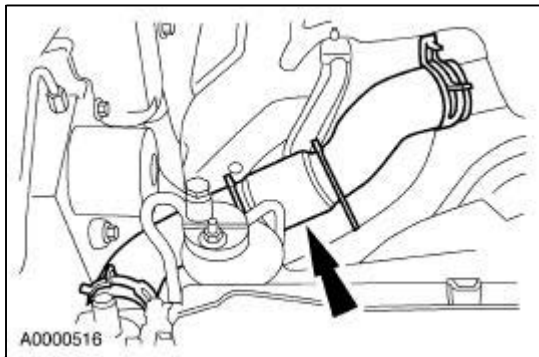
Installation

1. **NOTE:** Clean all the sealing surfaces and inspect the O-ring seals thoroughly.
To install, reverse the removal procedure.

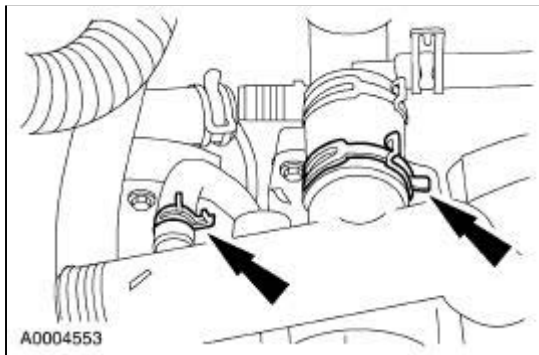
Coolant Outlet Pipe —3.9L

Removal

1. Drain the engine cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.
2. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
3. Remove the upper radiator hose.

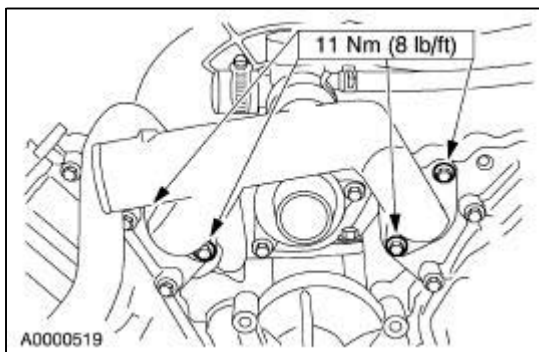


4. Disconnect the hoses.

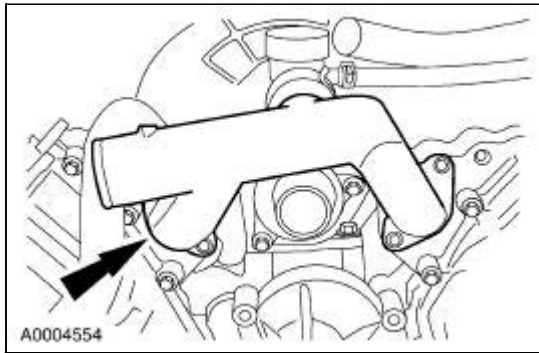


5. **NOTE:** Lower radiator hose not shown for illustration purposes.

Remove the four bolts.

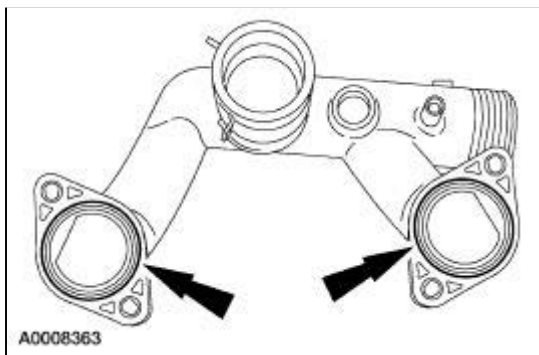


6. Remove the coolant outlet pipe.



7. **NOTE:** Lower radiator hose not shown for illustration purposes.

Remove the O-ring seals, inspect and clean the sealing surfaces.



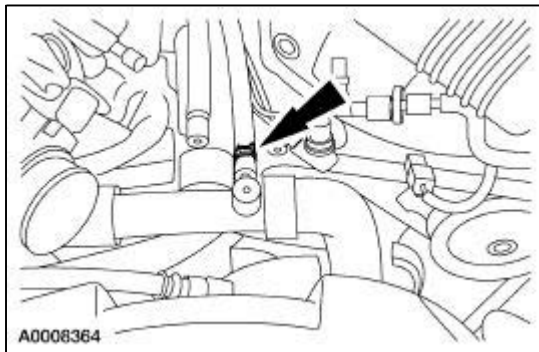
Installation

1. To install, reverse the removal procedure.
-

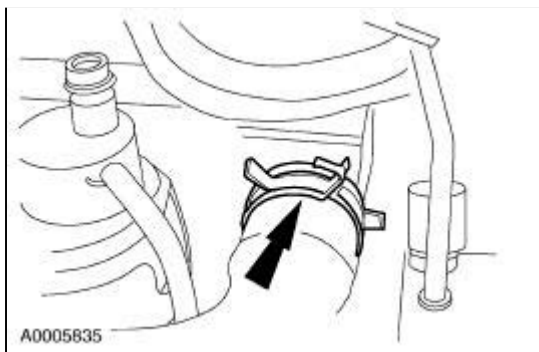
Water Pump —3.0L

Removal

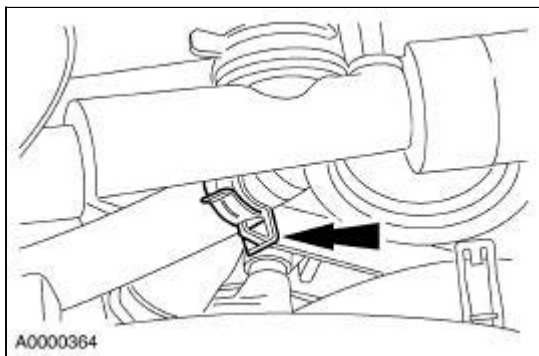
1. Drain the engine cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.
2. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
3. Disconnect the engine vent hose.



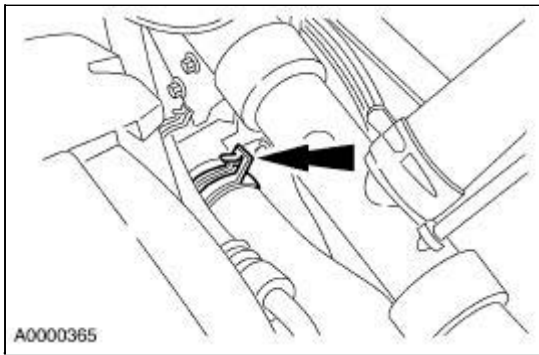
4. Disconnect the upper radiator hose.



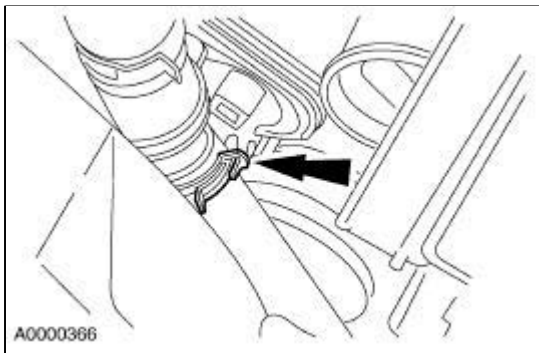
5. Disconnect the heater supply hose.



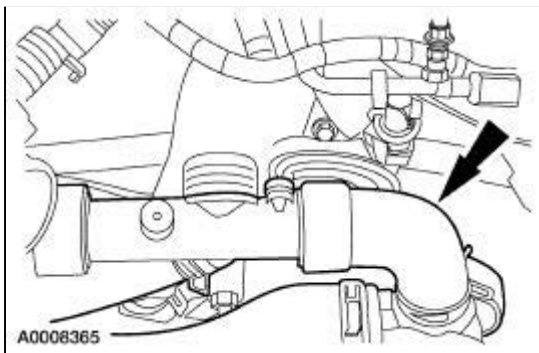
6. Disconnect the water pump hose.



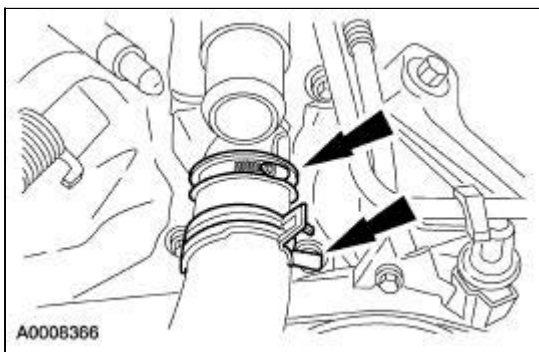
7. Disconnect the lower radiator hose from the thermostat housing.



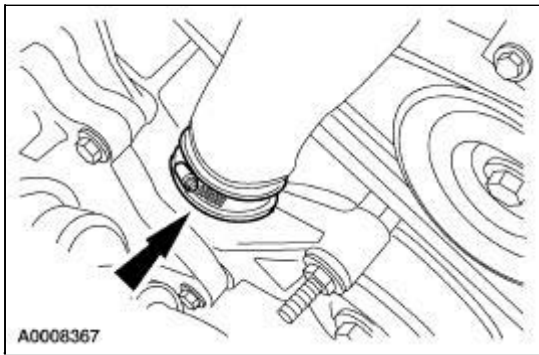
8. Remove the water crossover assembly.



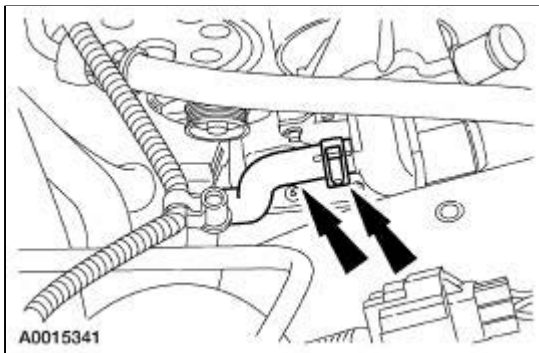
9. Disconnect the water inlet hose from the coolant outlet pipe.



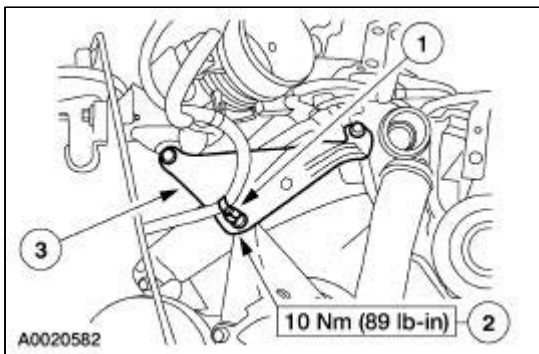
10. Disconnect and remove the water inlet hose from the pump.



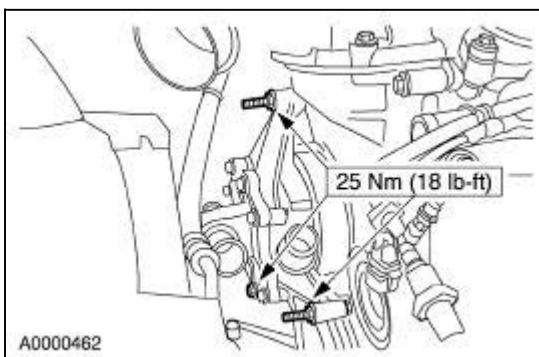
11. Disconnect the heater water hose from the water pump.



12. Remove the belt idler pulley. For additional information, refer to [Section 303-05](#).
13. Remove the bracket.
 1. Unclip the wiring harness.
 2. Remove the two studbolts and the bolt.
 3. Remove the bracket.



14. Remove the bolt and the studs. Remove the water pump assembly.



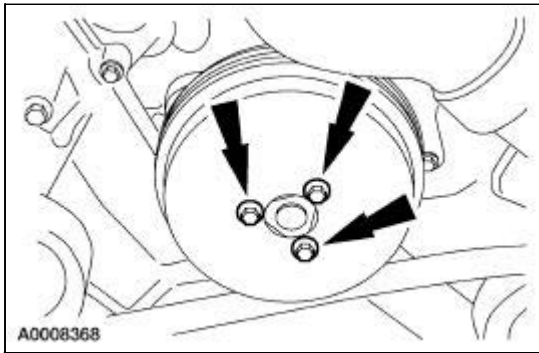
Installation

1. To install, reverse the removal procedure.
-

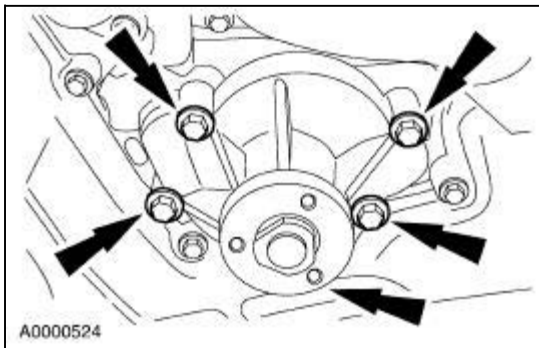
Water Pump —3.9L

Removal

1. Drain the engine cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.
2. Loosen the water pump pulley bolts.



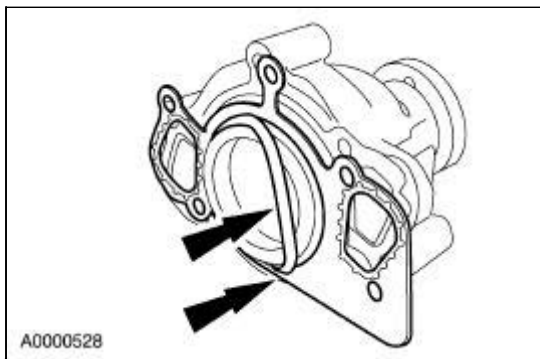
3. Remove the accessory drive belt. For additional information, refer to [Section 303-05](#).
4. Remove the water pump pulley bolts and the pulley.
5. Remove the five bolts and the water pump.



6. **NOTE:** Clean and inspect the sealing surfaces.

Remove the gasket and discard.

- Inspect the O-ring seal. Install a new O-ring seal as necessary.
- Visually inspect the rotors in the water pump.



Installation

1. **NOTE:** Lubricate the water pump O-ring using Premium Engine Coolant E2FZ-19549-AA (F5FZ-19549-CC in Oregon), or equivalent meeting Ford specification ESE-M97B44-A.

Install the water pump and tighten the bolts in two stages:

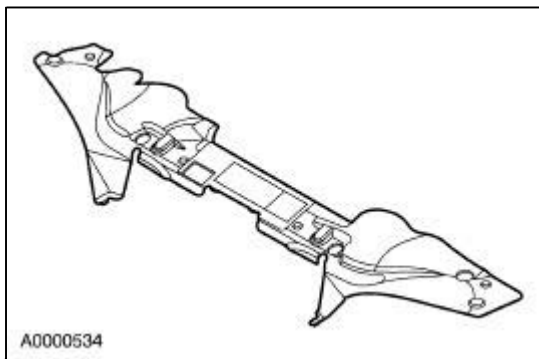
- Stage 1: Tighten to 8 Nm (71 lb-in).
 - Stage 2: Tighten an additional 90 degrees.
2. Install and tighten the water pump pulley in two stages:
 - Stage 1: Tighten to 10 Nm (89 lb-in).
 - Stage 2: Tighten an additional 45 degrees.
 3. Install the accessory drive belt. For additional information, refer to [Section 303-05](#) .
 4. Refill the engine cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.
-

Radiator —Fan Motor and Shroud

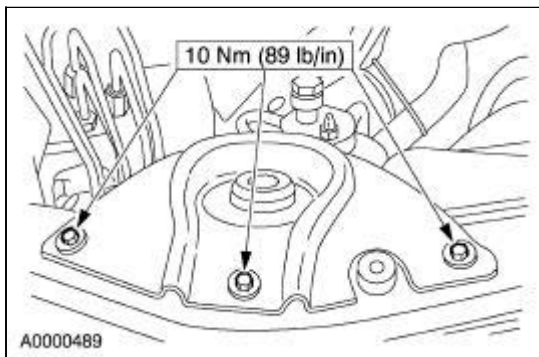
Removal

On all engines

1. Drain the engine cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.
2. Remove the upper radiator sight shield.

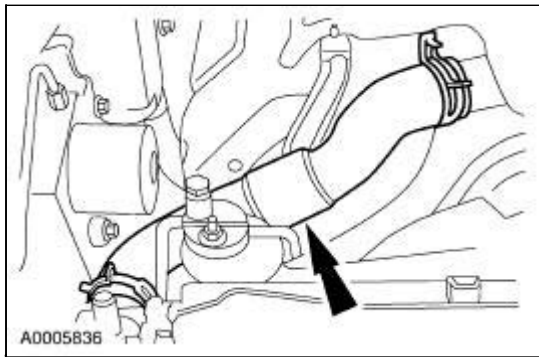


3. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
4. Remove the six bolts and the two radiator upper support brackets.

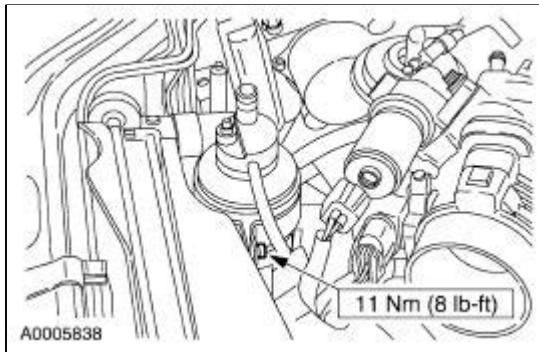


5. **NOTE:** 3.9L shown; 3.0L similar.

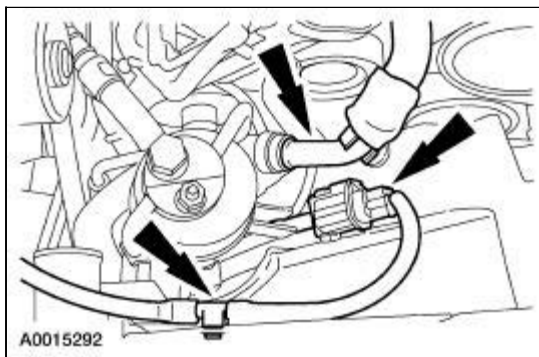
Remove the upper radiator hose.



6. Remove the bolt and position the receiver drier aside.

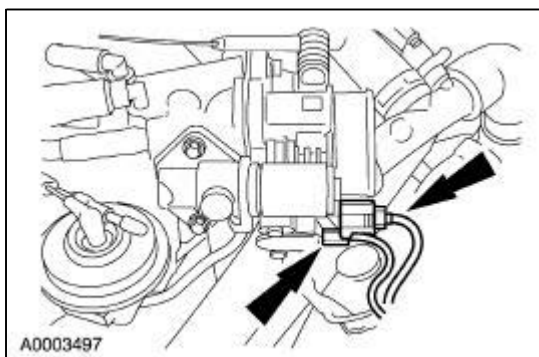


7. Disconnect the dual flow coolant valve electrical connector and the A/C line from the fan shroud.



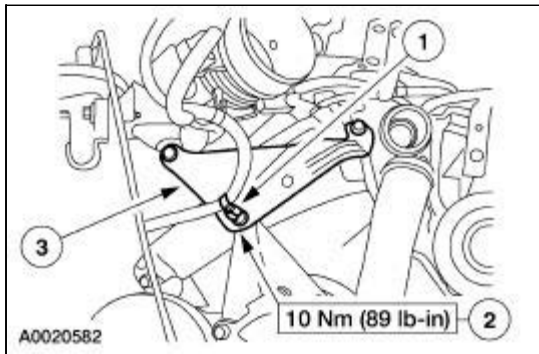
On 3.0L engines

8. Disconnect the throttle position (TP) sensor and the idle air control (IAC) valve electrical connectors.



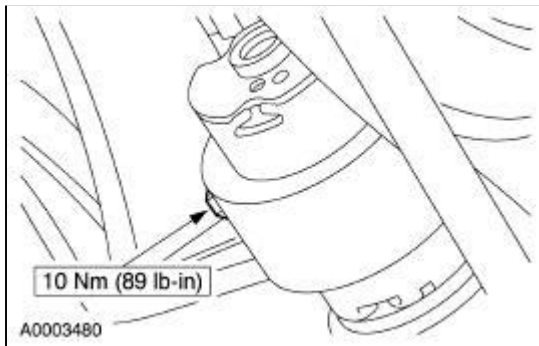
9. Remove the bracket.

1. Remove the bolts.
2. Remove the bracket.



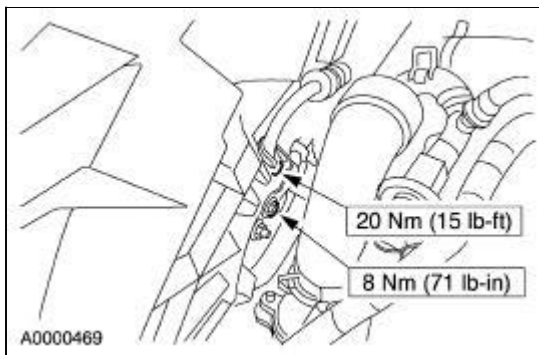
On 3.9L engines

10. Remove the bolt and position the electric water pump aside.

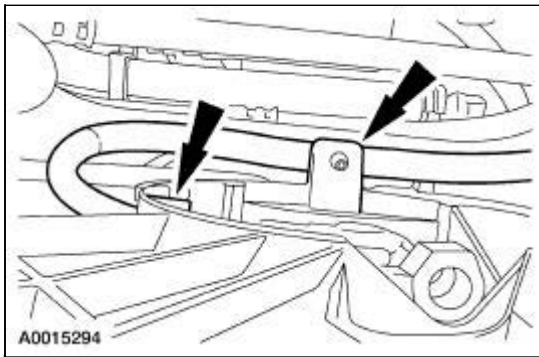


On all engines

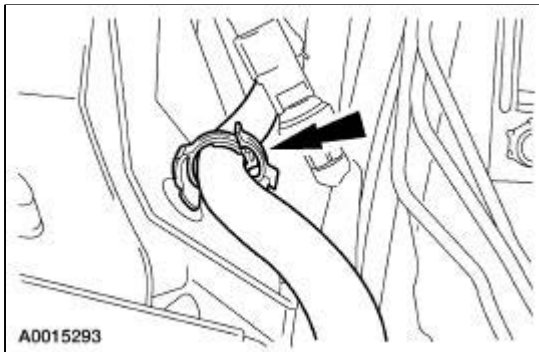
11. Disconnect the high pressure cooling fan bracket and line.
 - Inspect the seal and install a new seal if necessary. For additional information, refer to [Section 211-02](#).



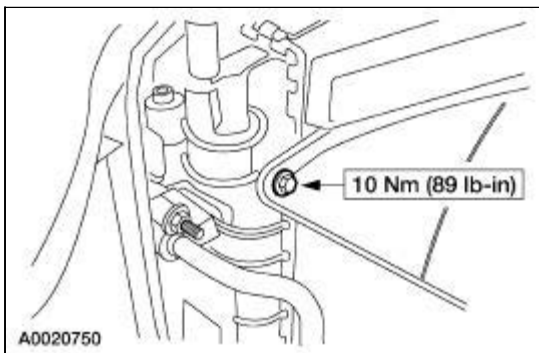
12. Disconnect the return hose from the cooling fan and shroud.



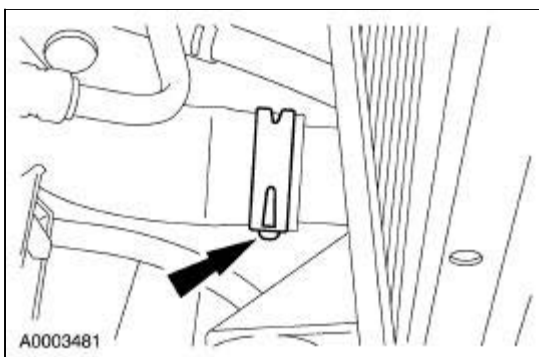
13. Separate the return hose from the fan shroud and position aside.



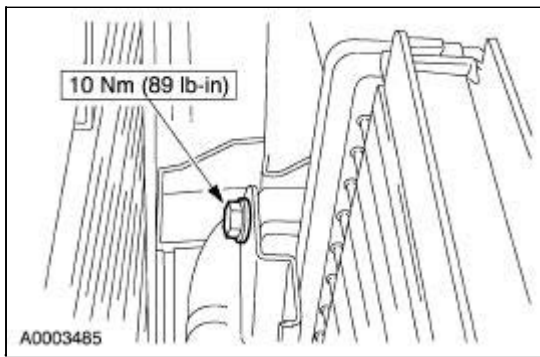
14. Remove the two bolts and the fan shroud assembly.



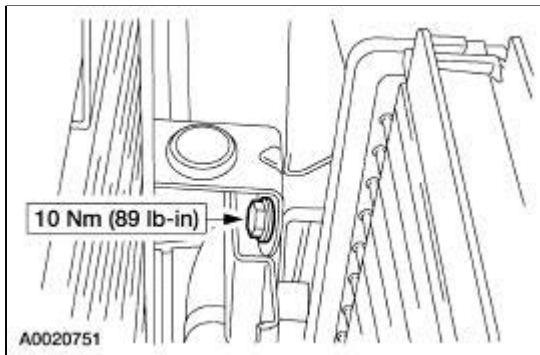
15. Remove the A/C condensor. For additional information, refer to [Section 412-03](#).
16. Disconnect the lower radiator hose.



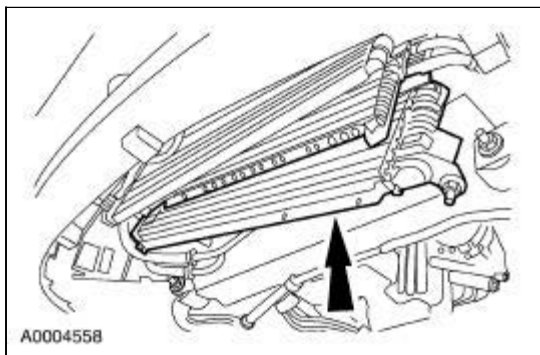
17. Remove the two bolts and position the multi-cooler assembly aside.



18. Remove the bolts and the condenser support brackets.



19. Remove the radiator.



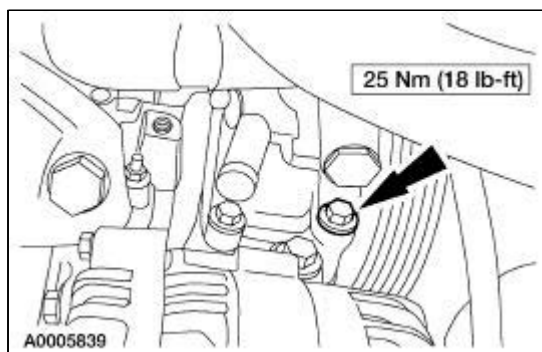
Installation

1. To install, reverse the removal procedure.
-

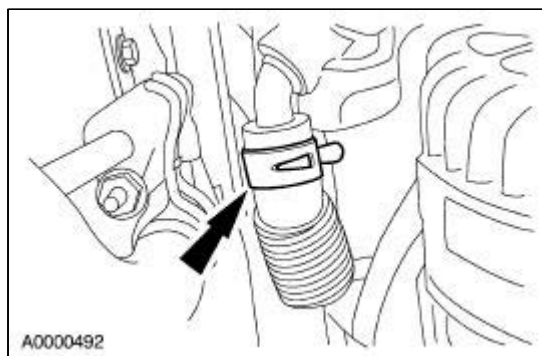
Fan — Pump, 3.0L

Removal and Installation

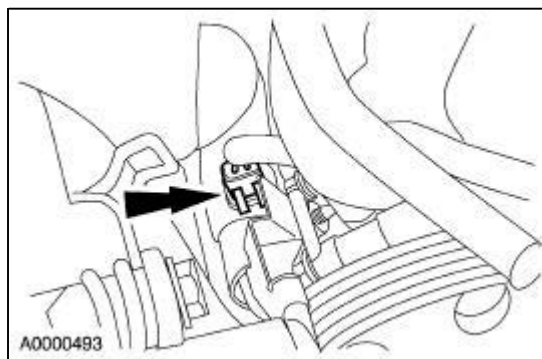
1. Remove the accessory drive belt. For additional information, refer to [Section 303-05](#).
2. Remove the lower bolt.



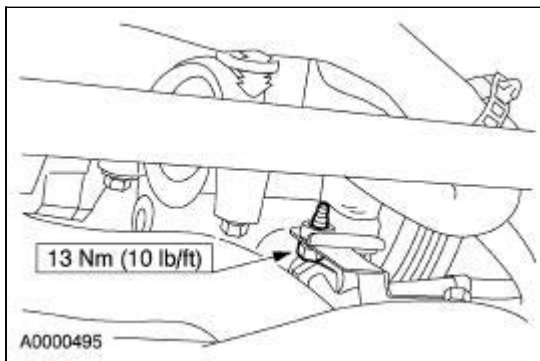
3. Disconnect the hose and allow to drain.



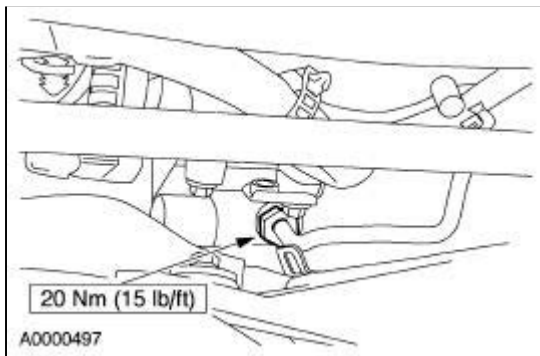
4. Disconnect the electrical connector.



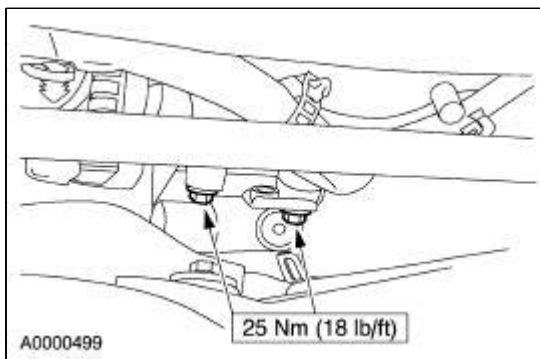
5. Remove the bolt and the high pressure line bracket.



6. Disconnect the high pressure line.



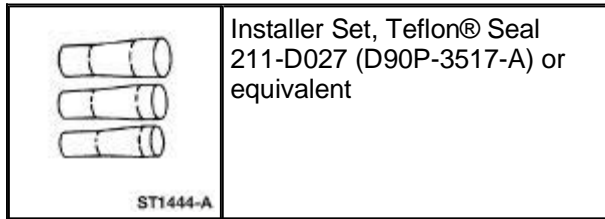
7. Remove the two upper bolts and the cooling fan pump.



8. To install, reverse the removal procedure.
-

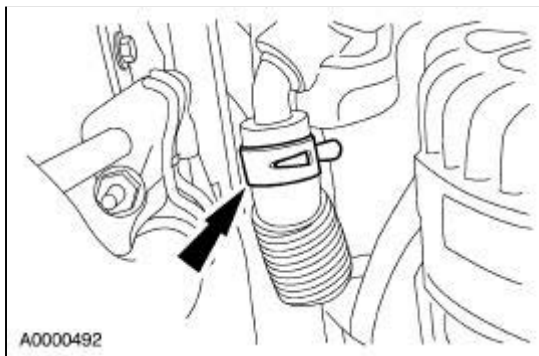
Fan — Pump, 3.9L

Special Tool(s)

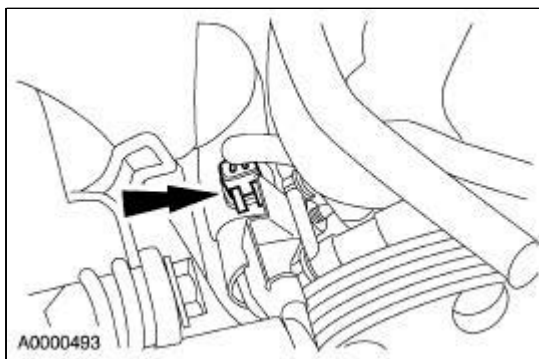


Removal and Installation

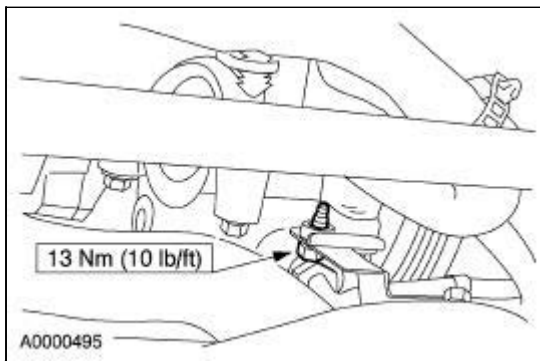
1. Remove the generator. For additional information, refer to [Section 414-02](#).
2. Disconnect the hose and allow to drain.



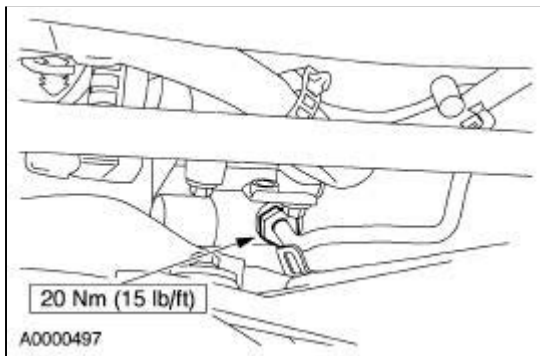
3. Disconnect the electrical connector.



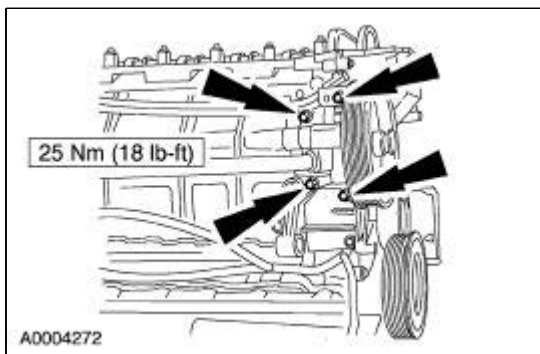
4. Remove the bolt and the high pressure line bracket.



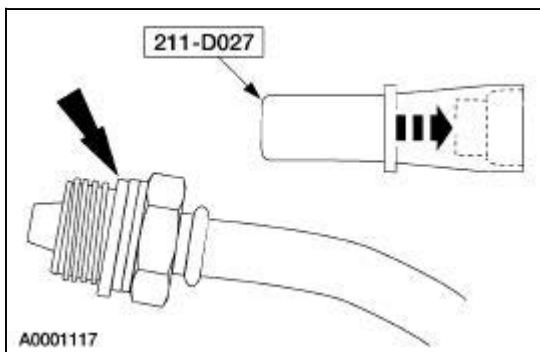
5. Disconnect the high pressure line.



6. Remove the bolts and the cooling fan pump.



7. To install, reverse the removal procedure.
8. Using the appropriate special tool, install a new O-ring on the hydraulic cooling fan pressure hose fitting.



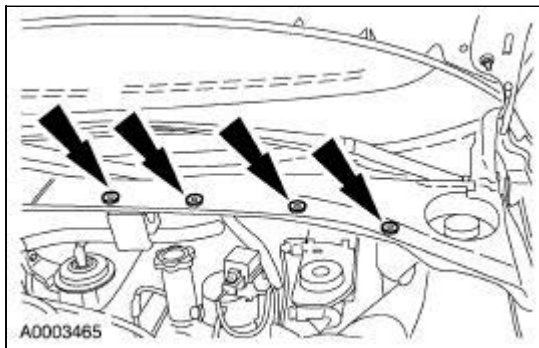
9. Fill and bleed the hydraulic cooling fan system. For additional information, refer to [Section 303-](#)



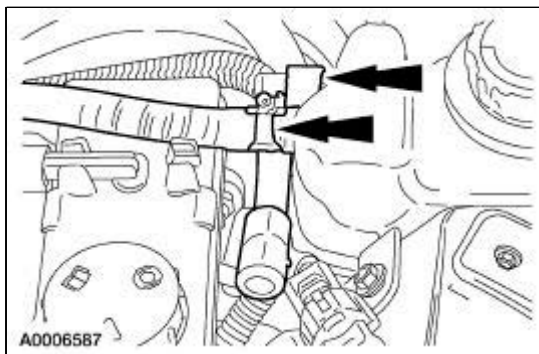
Degas Bottle

Removal and Installation

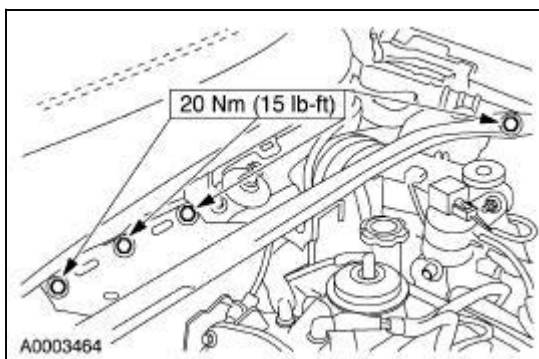
1. Drain the engine cooling system. For additional information, refer to [Cooling System Draining, Filling And Bleeding](#) in this section.
2. Remove the cowl vent screen. For additional information, refer to [Section 501-02](#).



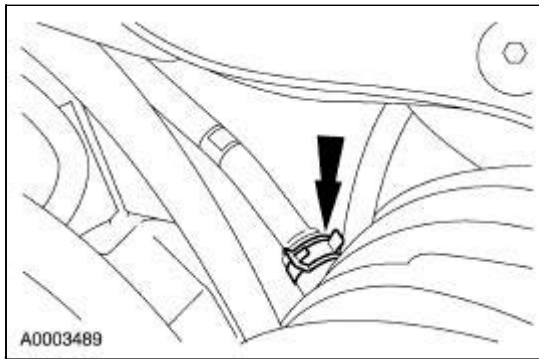
3. Disconnect the engine vent hose, and separate the air bleed hose from the degas bottle.



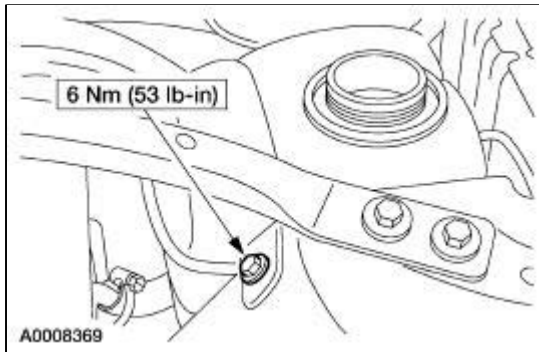
4. Remove the seven bolts and reposition the cross vehicle support.



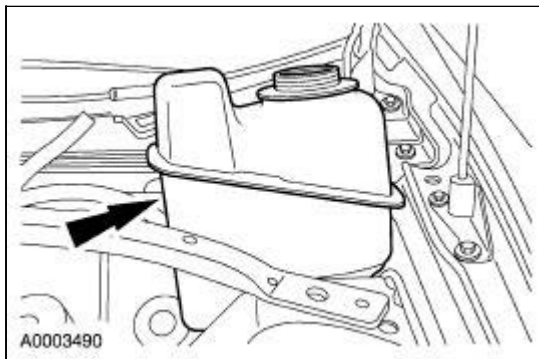
5. Disconnect the degas return hose from the degas return tube.



6. Remove the two bolts.



7. Remove the degas bottle from the vehicle.



8. To install, reverse the removal procedure.
-

Sensor —Cylinder Head Temperature (CHT)

Removal and Installation

For additional information, refer to [Section 303-14](#) .

General Specifications

Item	Specification
Super Premium SAE 5W30 Motor Oil XO-5W30-QSP	WSS-M2C153-G

Torque Specifications

Description	Nm	lb-ft	lb-in
Fuel injection supply manifold bolts	10	—	89
Fuel pressure relief valve	7	—	62
Fuel pressure sensor shield bolt	10	—	89
Fuel pressure sensor shield nut	6	—	53
Fuel rail bolts	10	—	89
Throttle body bolts	10	—	89

Fuel Charging and Controls

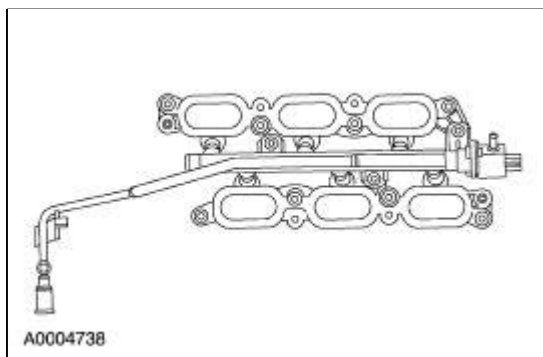
The fuel charging and controls system consists of the:

- throttle body
- fuel injectors
- fuel charging wiring
- fuel supply manifold
- fuel pressure relief (Schrader) valve

The fuel charging and controls system is:

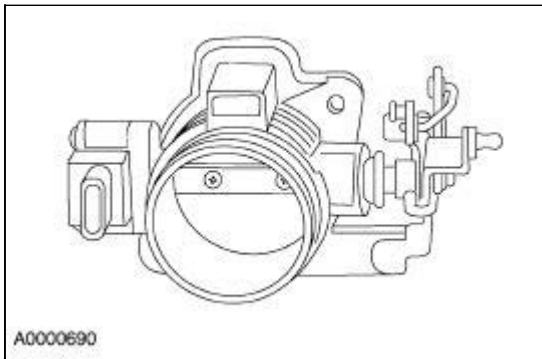
- a sequential multiport fuel injection (SFI) system.
- pulse width modulated.
- mass airflow-controlled.

The powertrain control module (PCM) controls the fuel injection system. Injector pulse-width is varied to control the amount of fuel flow. Varying fuel pump output controls fuel pressure. The PCM commands the fuel pump driver module, which directly controls the fuel pump. At low speeds, the idle air control (IAC) valve controls the bypass air around the throttle plate.



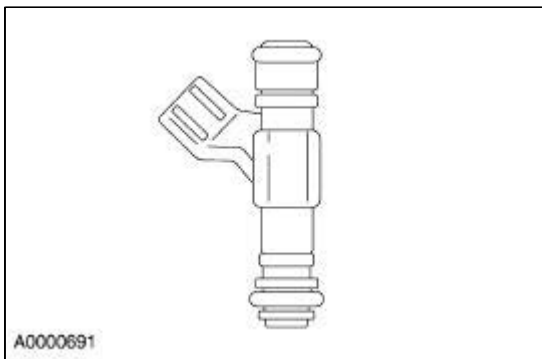
The fuel supply manifold:

- delivers fuel to the individual fuel injectors.
- receives fuel from the fuel supply line.



The throttle body:

- controls air supply to the upper intake manifold by positioning the throttle plate.
- connects the accelerator cable and the speed control actuator cable to the throttle plate.
- is not adjustable.
- must not be cleaned.
- has a different linkage ratio depending on the type of transmission (automatic or manual).

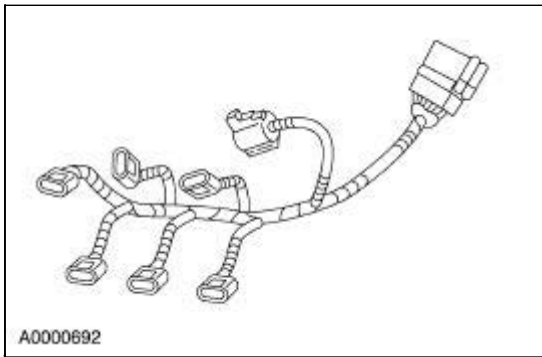


The fuel injectors:

- use new O-ring seals.
- are electrically operated by the powertrain control module (PCM).
- each have an internal solenoid that opens a needle valve to inject fuel into the lower intake manifold.
- atomize the fuel as the fuel is delivered.
- are deposit-resistant.
 - Do not clean the fuel injectors.

The fuel pressure relief valve:

- is used as a test port and to relieve fuel pressure.



The fuel charging wiring:


- connects the fuel injectors and fuel pressure sensor to the engine wiring harness and the powertrain control module.
 - Connectors on the right side fuel injectors are gray.
 - Connectors on the left side fuel injectors are black.
 - receives signals from the powertrain control module and transfers the signals to the fuel injectors.
-

Fuel Charging and Controls

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

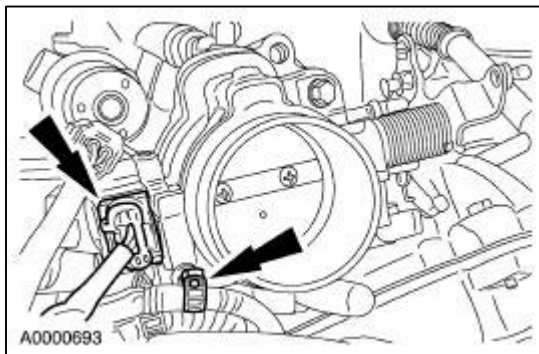
Throttle Body

Removal and Installation

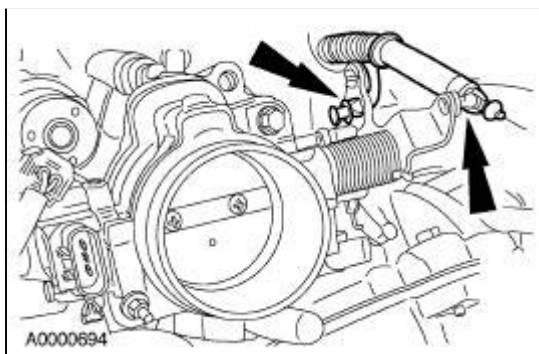
 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

 **CAUTION:** The throttle body bore and plate area have a special coating and cannot be cleaned.

1. Remove the air cleaner outlet tube from the throttle body. For additional information, refer to [Section 303-12](#).
2. Disconnect the throttle position sensor electrical connector and the wiring harness retainer.

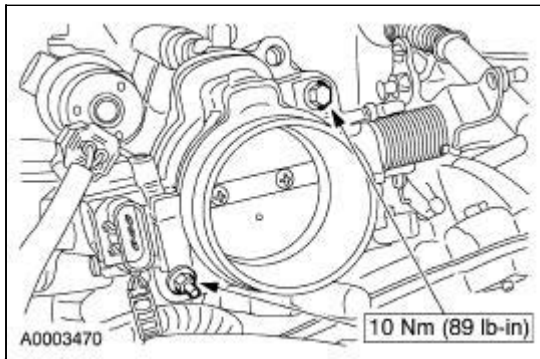


3. Disconnect the accelerator cable and the speed control actuator cable from the throttle body.



4. **NOTE:** The throttle body (TB) gasket is reusable.


Remove the bolts and the throttle body.




5. To install, reverse the removal procedure.
-

Fuel Injectors

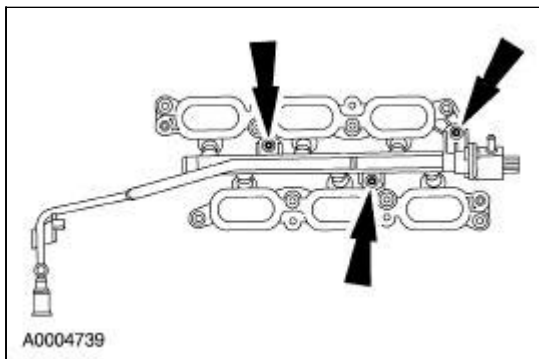
Removal

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

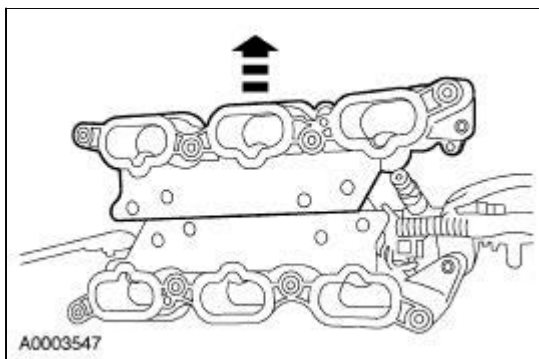
 **CAUTION:** To remove the fuel injectors the lower intake manifold assembly must be removed.

 **CAUTION:** The fuel injectors must be removed from the fuel supply manifold in the correct sequence. Failure to follow this procedure could result in damage to the fuel supply manifold.

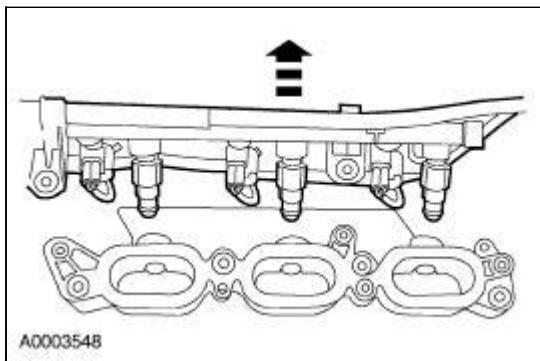
1. Remove the fuel supply manifold assembly. Refer to [Supply Manifold—Assembly](#).
2. Remove the fuel rail attachment bolts.



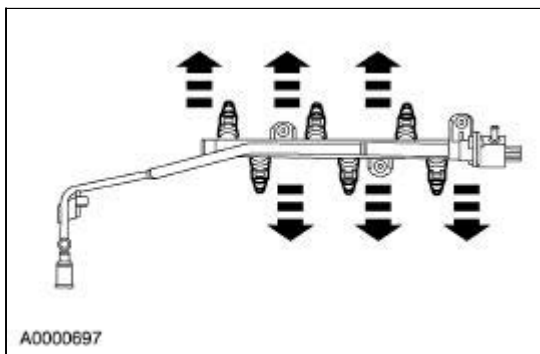
3. Turn the assembly over. Separate the two halves of the intake manifold and pull the left bank of the lower intake manifold from the supply manifold assembly and the fuel injectors.



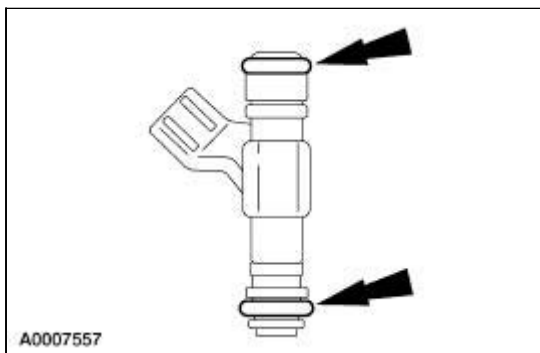
4. Remove the supply manifold and fuel injectors from the right bank of the lower intake manifold.



5. Disconnect the electrical connector from each fuel injector. For additional information, refer to Wiring Harness in this section.
6. Remove the fuel injectors from the fuel rail.



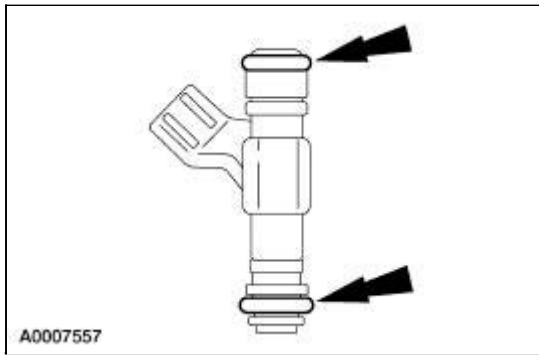
7. Remove and discard the O-ring seals from each fuel injector.



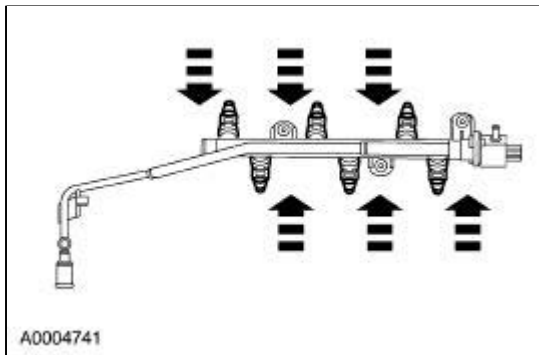
Installation

1. **NOTE:** Install new fuel injector O-ring seals.

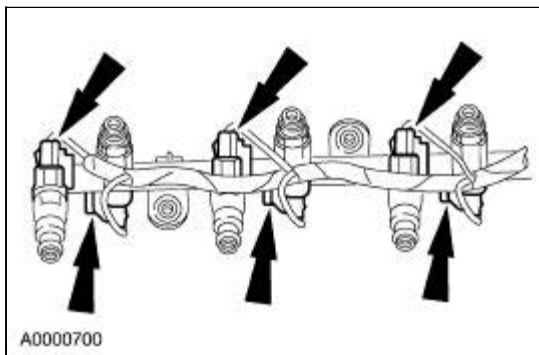
Lubricate the new fuel injector O-ring seals with Super Premium SAE 5W30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.




2. Install the fuel injectors into the fuel rail.

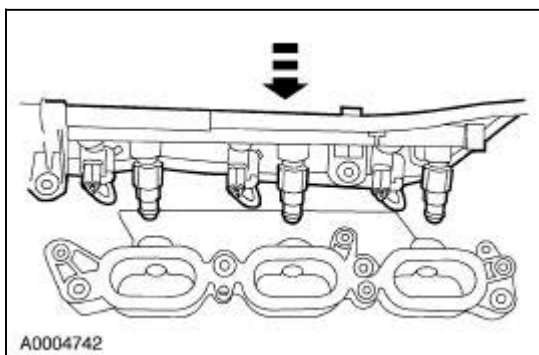


3. Connect the electrical connectors to each fuel injector.

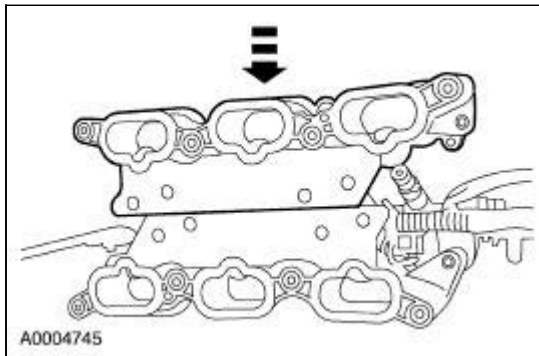


4.  **CAUTION:** The fuel injectors must be installed into the fuel supply manifold in the correct sequence. Failure to follow the procedure could result in damage to the fuel supply manifold.

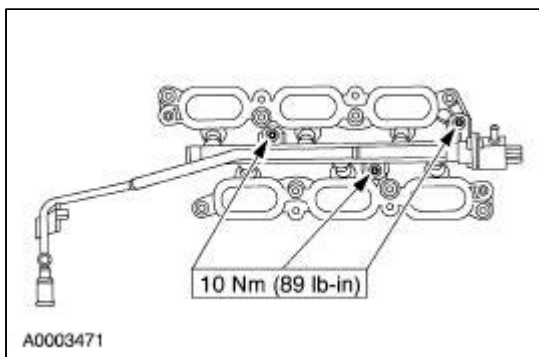
Install the supply manifold and fuel injectors into the right half of the intake manifold.



5. Turn the assembly over. Assemble the two halves of the lower intake manifold as the fuel injectors are installed into the left half of the lower intake manifold.




6. Install the fuel rail attachment bolts.




7. Install the fuel supply manifold. For additional information, refer to [Supply Manifold—Assembly](#) in this section.
-

Wiring Harness

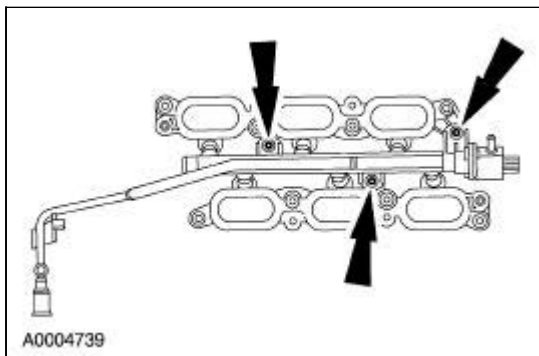
Removal

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

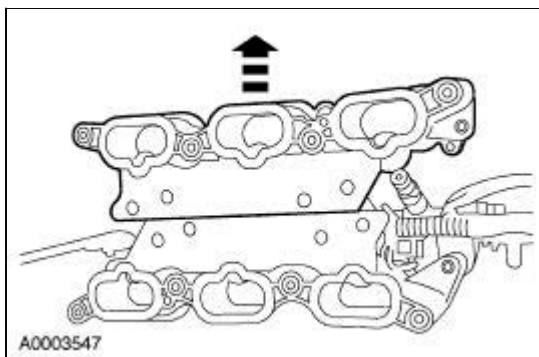
 **CAUTION:** To remove the wiring harness the lower intake manifold must be removed.

 **CAUTION:** The wiring harness must be removed from the fuel supply manifold in the correct sequence. Failure to follow this procedure could result in damage to the fuel supply manifold.

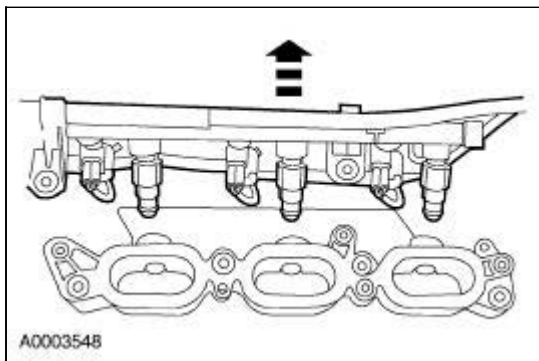
1. Remove the fuel injection supply manifold assembly. Refer to [Supply Manifold—Assembly](#) .
2. Remove the fuel rail attachment bolts.



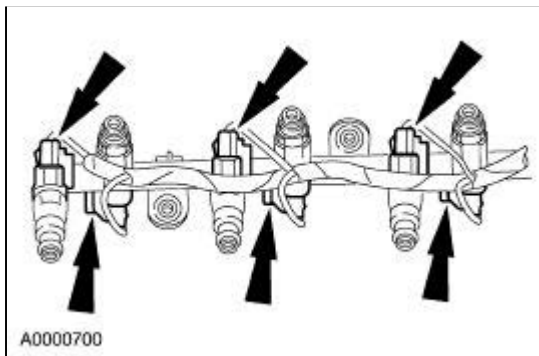
3. Turn the assembly over. Separate the two halves of the intake manifold and pull the left half away from the supply manifold and the fuel injectors.



4. Remove the supply manifold and fuel injectors from the right half of the intake manifold.

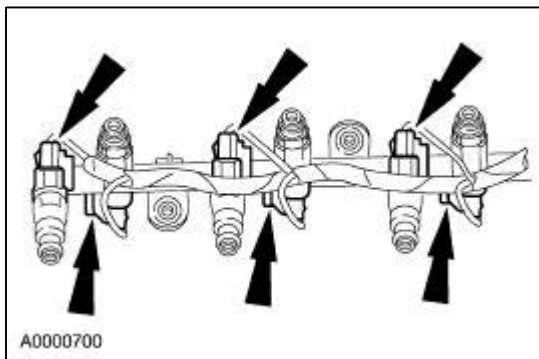


5. Disconnect the fuel injector electrical connectors.

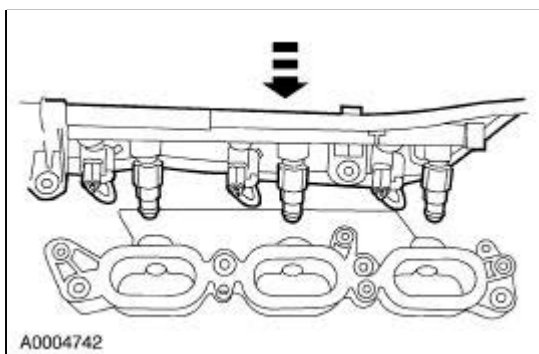


Installation

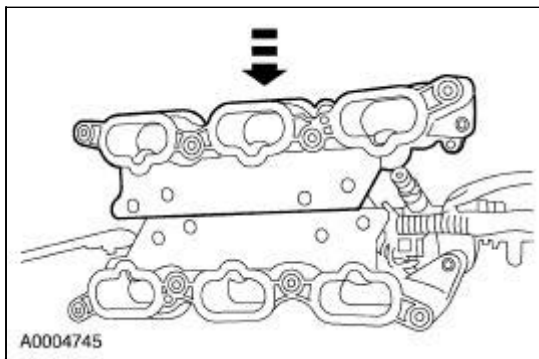
1. Connect the fuel injector electrical connectors.



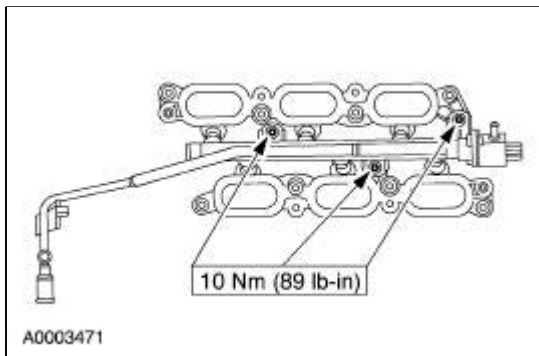
2. Install the supply manifold and fuel injectors into the right half of the intake manifold.



3. Assemble the two halves of the lower intake manifold as the fuel injectors are installed into the left half of the lower intake manifold.




4. Install the fuel rail attachment bolts.




5. Install the fuel supply manifold. For additional information, refer to [Supply Manifold—Assembly](#) in this section.
-

Supply Manifold —Assembly

Removal

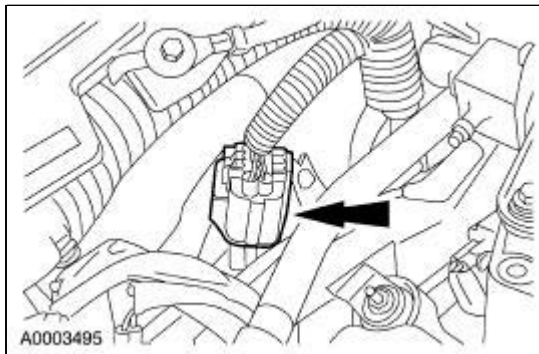
 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel injection components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Use care when working on the fuel system or personal injury may occur.

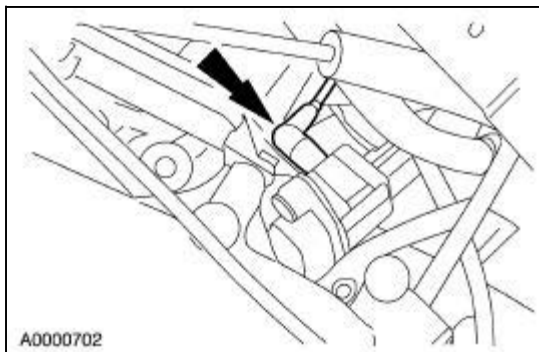
 **WARNING:** Before working on or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent possible personal injury.

1. Remove the upper intake manifold. For additional information, refer to [Section 303-01A](#) .
2. Relieve the fuel system pressure. For additional information, refer to [Section 310-00](#) .
3. **NOTE:** The fuel charging wiring to engine control sensor wiring harness connector is located behind the lower intake manifold on the rear side of the wiring shield.

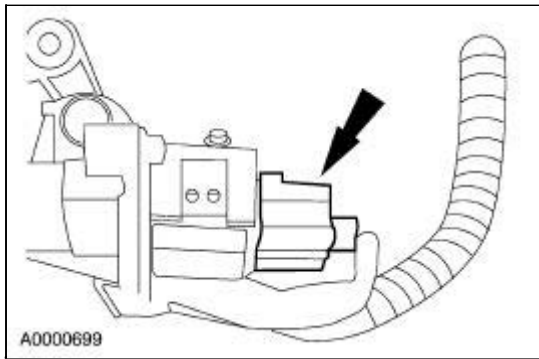
Disconnect the fuel charging wiring connector from the engine control sensor electrical connector.




4. Disconnect the fuel pressure sensor vacuum hose.



5. Disconnect the fuel pressure sensor electrical connector.

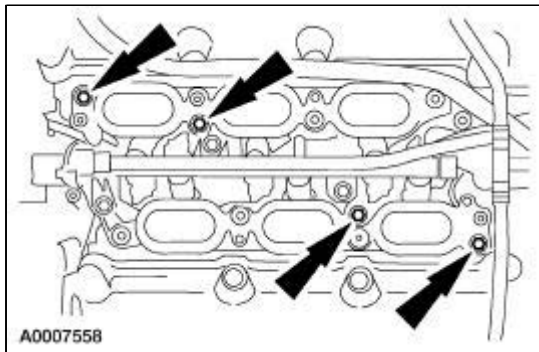


6.  **CAUTION: After disconnecting, plug the fuel line to prevent leakage.**

Disconnect the fuel line. Refer to [Section 310-00](#).

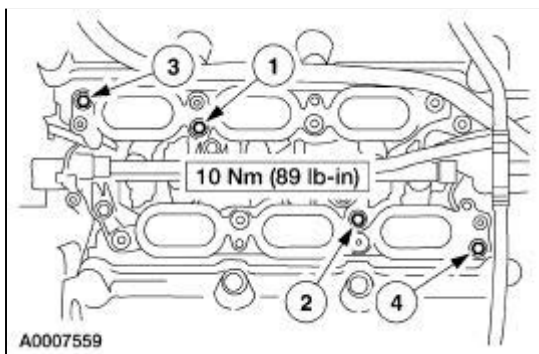
7.  **CAUTION: The lower intake manifold assembly must be removed from the engine.**

Remove the four bolts and the fuel supply manifold assembly.

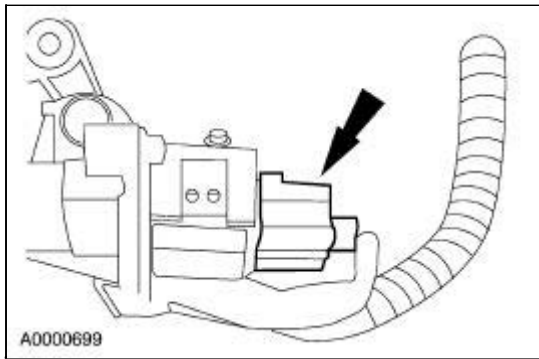


Installation

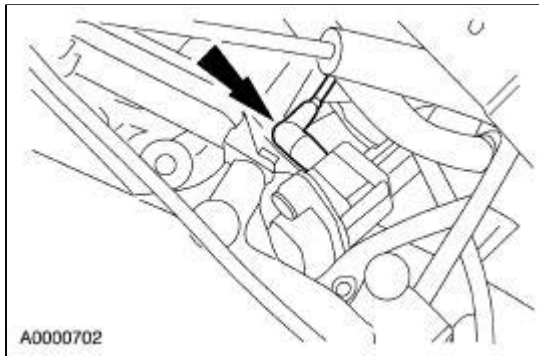
1. Position the fuel supply manifold assembly and tighten the four bolts using the sequence shown.



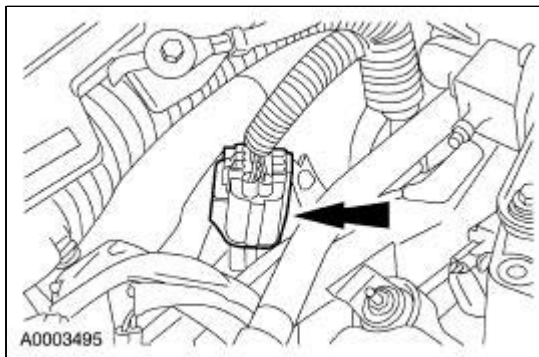
2. Connect the fuel line. For additional information, refer to [Section 310-00](#).
3. Connect the fuel pressure sensor electrical connector.



4. Connect the fuel pressure sensor vacuum hose.




5. Connect the fuel charging wiring connector from the engine control sensor electrical connector.





6. Test the fuel system pressure. For additional, information, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
-

Pressure Relief Valve

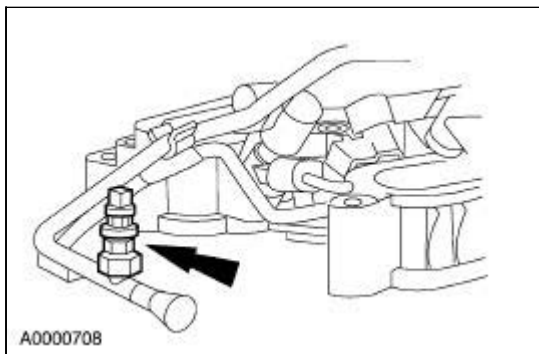
Removal and Installation

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

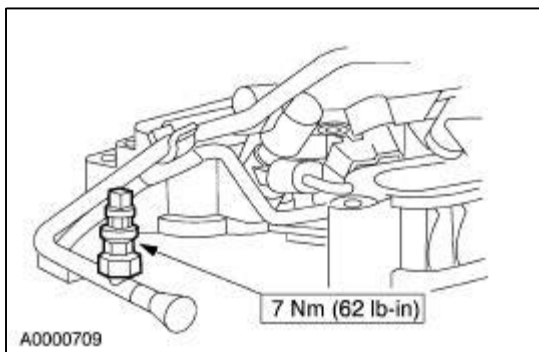
 **WARNING:** Fuel in the system remains under high pressure even when the engine is not running. Use care when working on the fuel system or personal injury may occur.

 **WARNING:** Before working on or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent possible personal injury.

1. Relieve the fuel system pressure. For additional information, refer to [Section 310-00](#).
2. Remove the fuel pressure relief valve cap and the fuel pressure relief valve.



3. To install, reverse the removal procedure.



General Specifications

Item	Specification
Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP	WSS-M2C153-G

Torque Specifications

Description	Nm	lb-ft	lb-in
Engine appearance cover bracket nuts	6	—	53
Fuel injection supply manifold bolts	13	10	—
Throttle body bolts	12	9	—

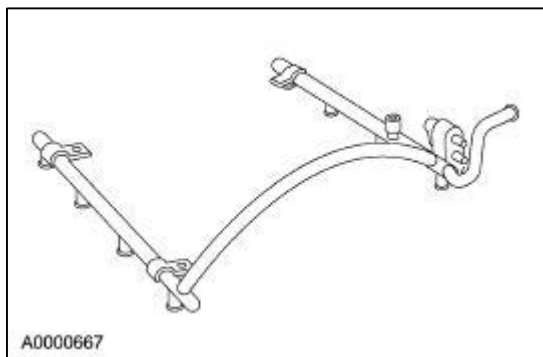
Fuel Charging and Controls

The fuel charging and controls system consists of the:

- throttle body (9E926)
- fuel injectors (9F593)
- engine wiring harness (12B637)
- fuel injection supply manifold (9F792)
- fuel pressure relief valve (9H321)

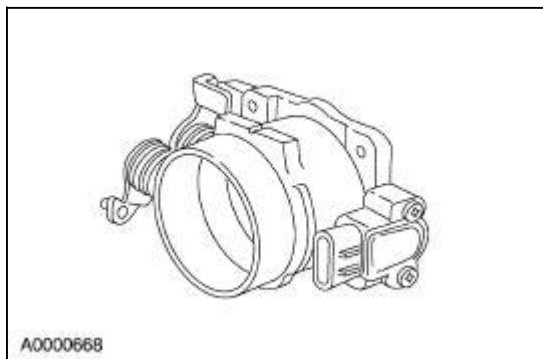
The fuel charging and controls system is:

- a sequential multiport fuel injection (SFI) system.
- pulse width modulated.
- mass airflow controlled.



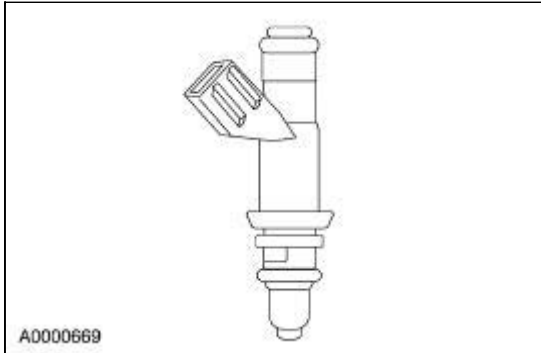
The fuel injection supply manifold:

- delivers fuel to the individual fuel injectors.
- receives fuel from the fuel supply line.



The throttle body:

- controls air supply to the intake manifold (9C633) by positioning the throttle plate.
- connects the accelerator cable (9A758) and the speed control actuator cable (9A825) to the throttle plate.
- is not adjustable.
- must not be cleaned.



The fuel injectors:

- are electrically operated by the powertrain control module (PCM) (12A650).
- have an air assist feature to aid in atomization of the fuel.
- each have an internal solenoid which opens a needle valve to inject fuel into the lower intake manifold.
- atomize the fuel as the fuel is delivered.
- are deposit-resistant.
- do not need cleaning.

The fuel pressure relief valve:

- is used to relieve fuel pressure.

The engine wiring harness:


- connects the fuel injectors and other electronic engine controls, such as the throttle position (TP) sensor (9B989), to the powertrain control module.
 - receives fuel injector signals from the powertrain control module and transfers the signals to the fuel injectors.
-

Fuel Charging and Controls

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

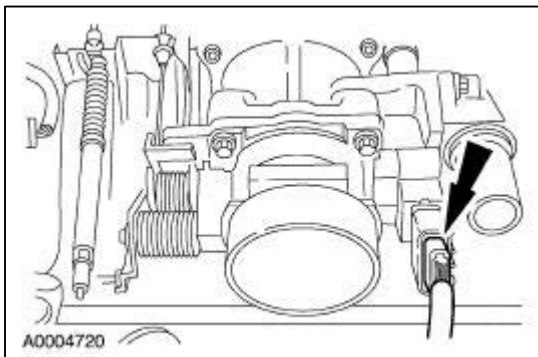
Throttle Body

Removal

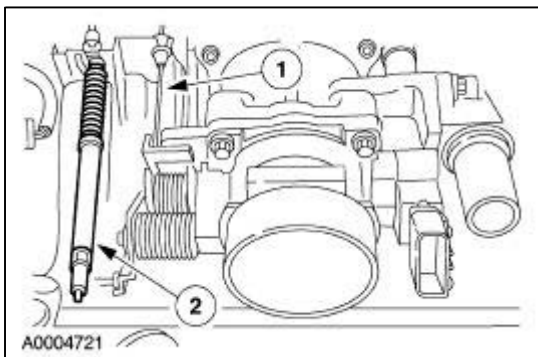
 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

 **CAUTION:** Throttle body bore and plate area have a special coating and cannot be cleaned.

1. Remove the air cleaner outlet tube from the throttle body. For additional information, refer to [Section 303-12](#).
2. Disconnect the throttle position (TP) sensor electrical connector.



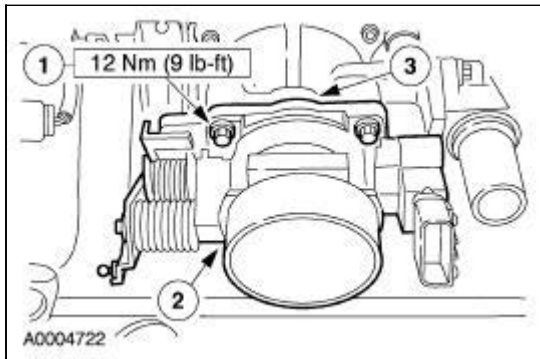
3. Disconnect the throttle body linkages.
 1. Disconnect the speed control actuator cable.
 2. Disconnect the accelerator cable.



4. **NOTE:** Discard the throttle body (TB) gasket.

Remove the throttle body.

1. Remove the four bolts.
2. Remove the throttle body.
3. Remove the throttle body gasket.




Installation

1. **NOTE:** Use a new throttle body gasket.

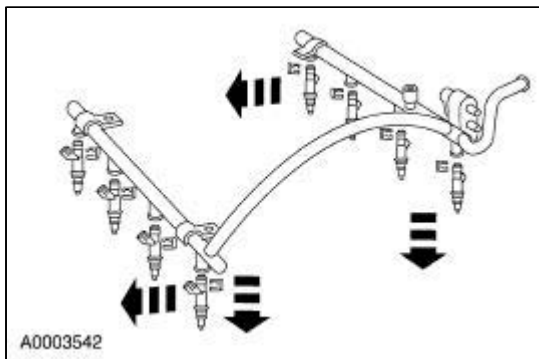
To install, reverse the removal procedure.

Fuel Injectors

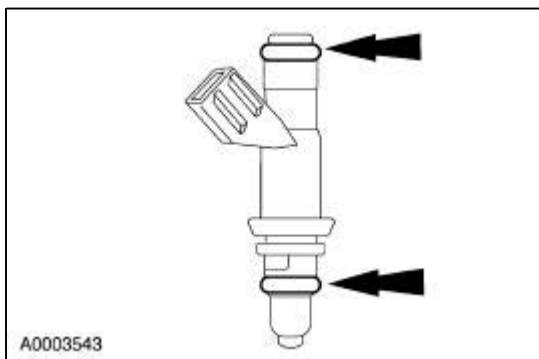
Removal

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

1. Remove the fuel injection supply manifold. For additional information, refer to [Supply Manifold—Fuel Injection](#) in this section.
2. Remove the retaining clip and the fuel injectors from the fuel injection supply manifold.



3. Remove and discard the two O-ring seals from each fuel injector.



Installation


1.  **CAUTION:** Install new O-ring seals.


NOTE: Lubricate new fuel injector O-ring seals with Super Premium SAE 5W30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.

To install, reverse the removal procedure.

Supply Manifold — Fuel Injection

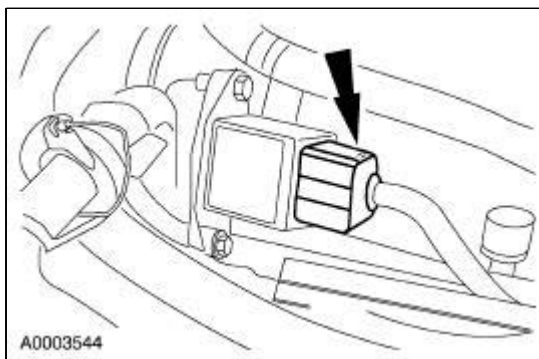
Removal

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Use care when working on the fuel system or personal injury may occur.

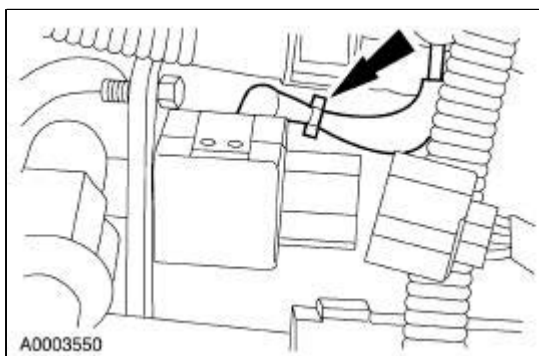
 **WARNING:** Before working on or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent possible personal injury.

1. Remove the engine appearance cover.
2. Relieve the fuel pressure. For additional information, refer to [Section 310-00](#).
3. Remove the air cleaner outlet tube from the throttle body. For additional information, refer to [Section 303-12](#).
4. Disconnect the electrical connector from the fuel pressure sensor.

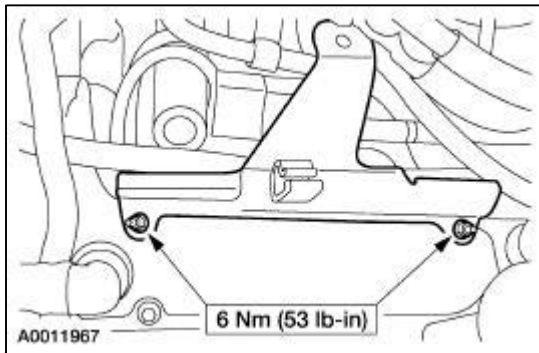


5. **NOTE:** The fuel pressure sensor vacuum hose must be disconnected at the jumper connection, not at the sensor.

Disconnect the fuel pressure sensor vacuum hose.

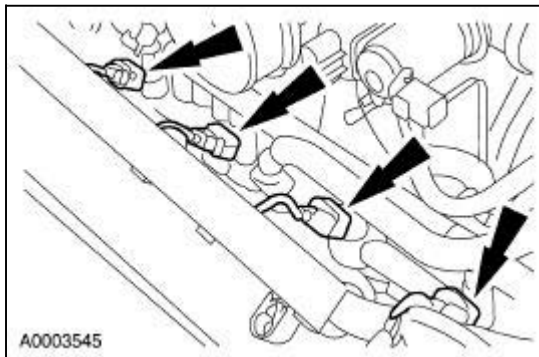


6. Disconnect the fuel line. For additional information, refer to [Section 310-00](#).
7. Remove the nuts and the engine appearance cover bracket.

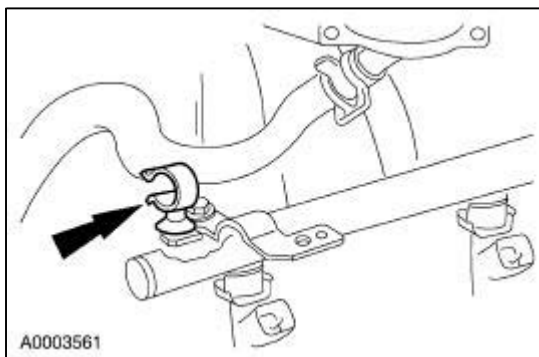


8. **NOTE:** RH side shown; LH side similar.

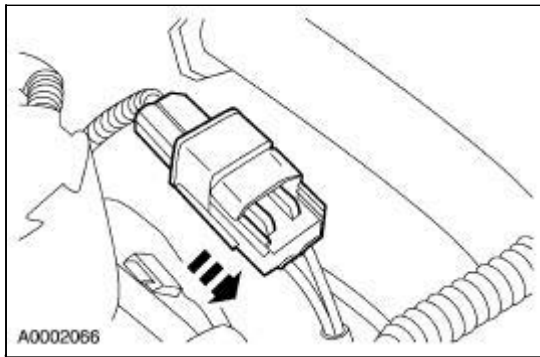
Disconnect the eight fuel injector electrical connectors.



9. Remove the throttle body heater return hose from the retaining clip.

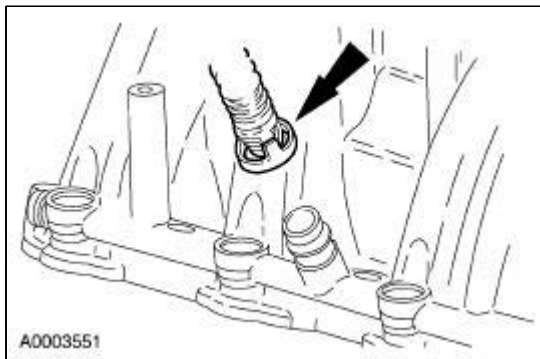


10. Disconnect the camshaft position (CMP) sensor.

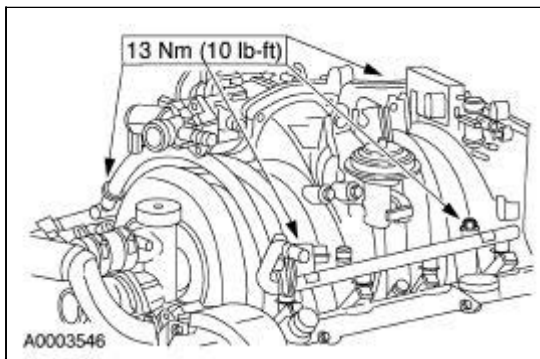


11. **NOTE:** Do not use tools to remove the air assist hose fittings. Squeeze the fitting by hand to disconnect the air assist hose.

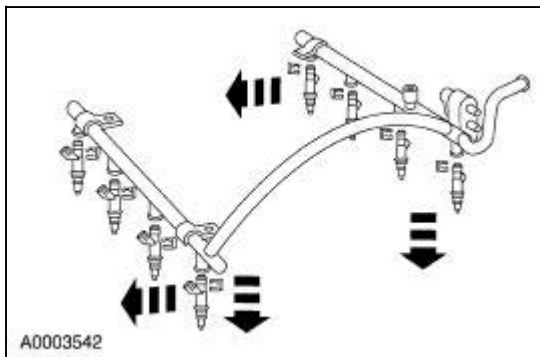
Remove the air assist hose from both sides of the intake manifold and the idle air control (IAC) valve.



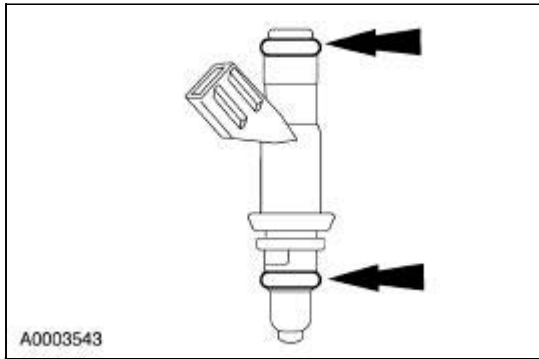
12. Remove the four bolts and the fuel injection supply manifold.



13. Remove the retaining clip and the fuel injectors from the fuel injection supply manifold.



14. Remove and discard the two O-ring seals from each fuel injector.



Installation

1.  **CAUTION: Install new O-ring seals.**

NOTE: Lubricate new fuel injector O-ring seals with Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G.

To install, reverse the removal procedure.

General Specifications

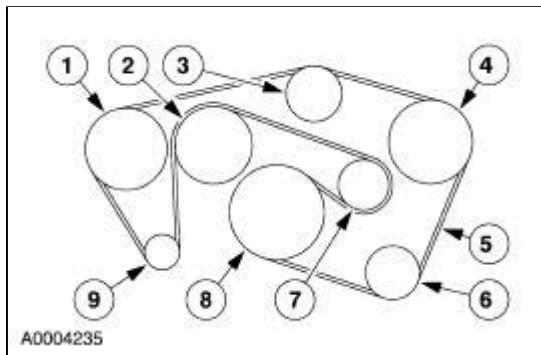
Item	Specification
Drive belt	Non neoprene 6K poly v belt
Press-on pulleys power steering pump and hydraulic cooling fan	Flush to end of shaft \pm 0.25 mm (0.0010 inch)

Torque Specifications

Description	Nm	lb-ft
Belt idler pulley bolt	25	18
Drive belt tensioner bolt	50	37

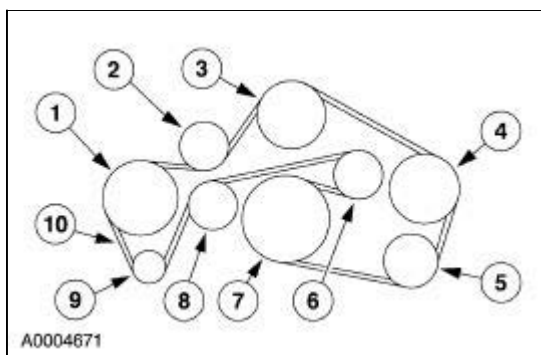
Accessory Drive

Component Locations —3.0L



Item	Part Number	Description
1	8C647	Hydraulic fan pump pulley
2	8A528	Water pump pulley
3	6C348	Belt idler pulley
4	3D673	Power steering pump pulley
5	8620	Drive belt
6	19D784	A/C clutch pulley
7	6B209	Drive belt tensioner
8	6316	Crankshaft vibration damper
9	10A352	Generator pulley

Component Locations —3.9L



Item	Part Number	Description
1	8C647	Hydraulic fan pump pulley
2	19A216	Belt idler pulley—unflanged
3	8509	Water pump pulley
4	3D673	Power steering pump pulley
5	19D748	A/C clutch pulley
6	6B209	Drive belt tensioner

7	6316	Crankshaft vibration damper
8	19A216	Belt idler pulley—flanged
9	10A352	Generator pulley
10	8620	Drive belt

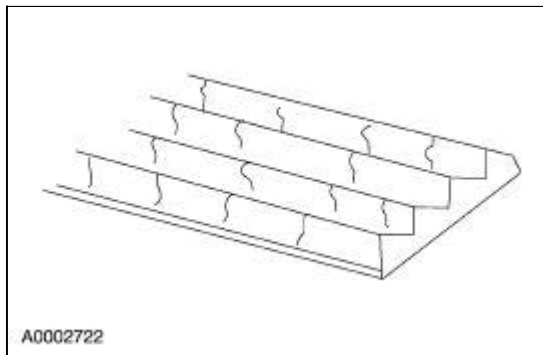
Accessory Drive

Inspection and Verification

1. Verify customer concern by running the engine.
2. Inspect the drive belt for chunking, fraying, wear, and pilling.
3. Check the drive belt for correct routing.

Drive Belt Cracking/Chunking/Wear

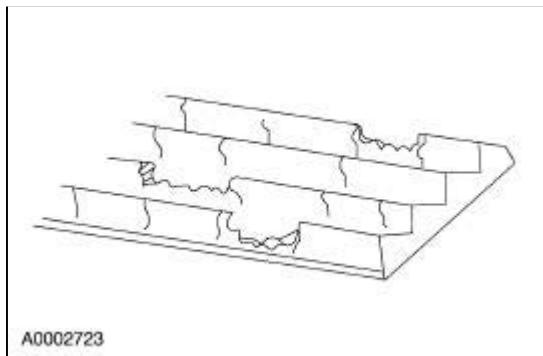
V Ribbed Serpentine Drive Belt With Cracks Across Ribs



The accessory drive:

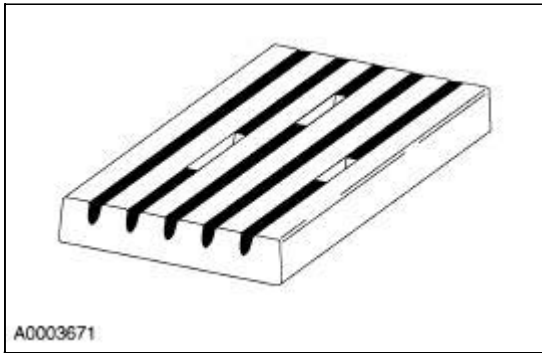
- has a single serpentine drive belt.
- has an automatic drive belt tensioner.
- does not require adjustment.

V Ribbed Belt With Chunks of Rib Missing



V Ribbed Belt With Pilling

NOTE: Pilling is an excessive build up in the V grooves of the belt.



Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Drive belt noise, chirping, flutter 	<ul style="list-style-type: none"> ● Defective/worn drive belt. ● Misaligned pulley. ● Pulley runout. ● Damaged accessories. ● Fluid contamination of drive belt. ● Damaged or worn drive belt tensioner. 	<ul style="list-style-type: none"> ● REFER to Component Tests, Drive Belt, Noise/Flutter in this section. ● REFER to Component Tests, Belt Tensioner, Automatic in this section.
<ul style="list-style-type: none"> ● Premature drive belt wear 	<ul style="list-style-type: none"> ● Defective drive belt. ● Misaligned pulley. ● Pulley runout. ● Damaged accessories. ● Incorrectly installed drive belt. ● Fluid contamination. 	<ul style="list-style-type: none"> ● REFER to Component Tests, Drive Belt Noise/Flutter and Drive Belt Misalignment diagnosis in this section.

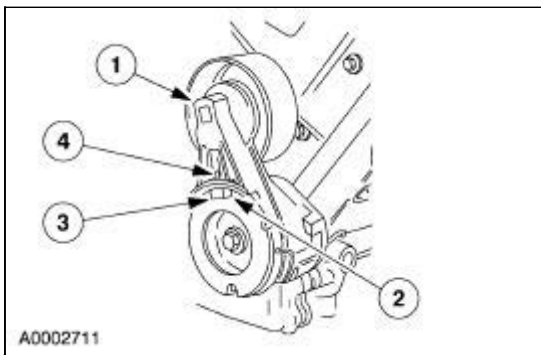
Component Tests

Drive Belt Noise/Flutter

NOTE: Tensioner is shown in free-state position against arm travel stops.

Drive Belt Tensioner/Belt Length Indicator

NOTE: The 3.0L and the 3.9L drive belt tensioners are the same.



Item	Part Number	Description
1	—	Belt tension relief point
2	—	Unacceptable belt wear range
3	—	Acceptable belt installation and wear range
4	—	Belt length indicator

Drive belt chirp occurs due to pulley misalignment or excessive pulley runout. It can be the result of a damaged pulley or an incorrectly aligned pulley.

To correct, determine the area where the noise comes from. Check each of the pulleys in that area with a straightedge to the crankshaft pulley. Look for accessory pulleys out of position in the fore/aft direction or at an angle to the straightedge.

NOTE: Do not apply any fluids or belt dressing to the belt or pulleys.

Drive belt squeal is an intermittent noise that occurs when the drive belt slips on a pulley during certain conditions, such as: engine start up, rapid engine acceleration, A/C clutch engagement, 1-2 shift and power steering loading.

Drive belt squeal can occur under certain conditions:

- if the A/C discharge pressure goes above specifications:
 - the A/C system is overcharged.
 - the A/C condenser core airflow is blocked.
- if the A/C OFF equalized pressure (the common discharged and suction pressure that occurs after several minutes) exceeds specifications.
- if any of the accessories are damaged, have a worn or damaged bearing, or internal torsional resistance above normal. All accessories should be rotatable by hand in the unloaded condition. If not, inspect the accessory.
- if fluid gets on the drive belt. This includes power steering fluid, engine coolant, engine oil or air conditioning system lubricant. If excessive fluid does get on the drive belt during repair, install a new drive belt.
- if the drive belt is too long. A drive belt that is too long will allow the drive belt tensioner arm to go all the way to the arm travel stop under certain load conditions, which will release tension to the drive belt. If the drive belt tensioner indicator is outside the normal installation wear range window, install a new drive belt.
- **NOTE:** The drive belt tensioner arm should rotate freely without binding.

Install a new drive belt tensioner if the drive belt tensioner is worn or damaged.

Belt Tension

NOTE: Drive belt tension is not adjustable.

The drive belt tensioner automatically adjusts drive belt tension.

Belt Tensioner, Automatic

Check the automatic drive belt tensioner:

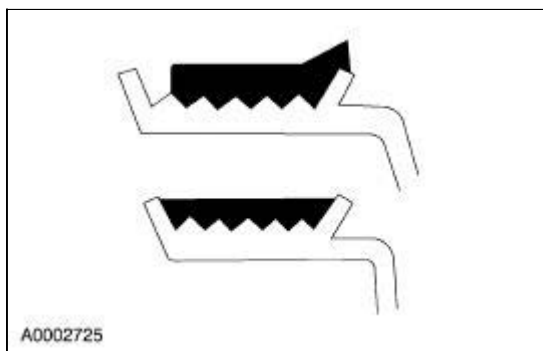
1. With the engine off, check for correct drive belt routing. For additional information, refer to [Belt—3.0L](#) or [Belt—3.9L](#) in this section. Repair as necessary.
2. Rotate the drive belt tensioner and check for a binding or frozen condition. Install new components as necessary.

Drive Belt Misalignment



CAUTION: Incorrect drive belt installation will cause excessive drive belt wear and may cause the drive belt to come off the drive pulleys.

Non-standard drive belts may track differently or incorrectly. If a drive belt tracks incorrectly, install a new drive belt to avoid performance failure or loss of the drive belt.



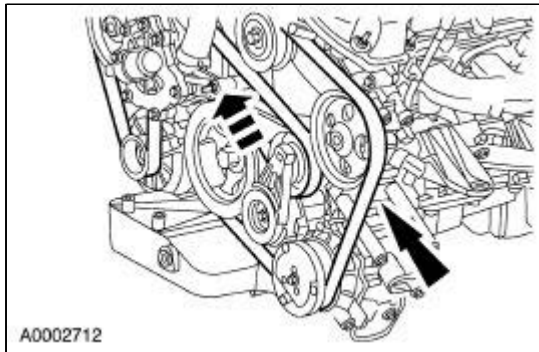
With the engine running, check drive belt tracking. If the edge of the drive belt rides beyond the edge of the pulleys, noise and premature wear may occur. Make sure the drive belt rides correctly on the pulley. If a drive belt tracking condition exists, proceed with the following:

- Visually check the drive belt tensioner for damage, especially the mounting pad surface. If the drive belt tensioner is not installed correctly, the mounting surface pad will be out of position. This will result in chirp and squeal noises.
 - With the engine running, visually observe the grooves in the pulleys (not the pulley flanges or the pulley forward faces) for excessive wobble. Install new components as necessary.
 - Check all accessories, mounting brackets and the drive belt tensioner for any interference that would prevent the component from mounting correctly. Correct any interference condition and recheck the drive belt tracking.
 - Tighten all accessories, mounting brackets, and drive belt tensioner retaining hardware to specification. Recheck the drive belt tracking.
-

Belt —3.0L

Removal

1. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
2. Rotate the tensioner counterclockwise and remove the drive belt.



Installation

1.  **CAUTION: Incorrect drive belt installation will cause premature drive belt failure.**

NOTE: Make sure the drive belt (8620) is correctly installed on each pulley.

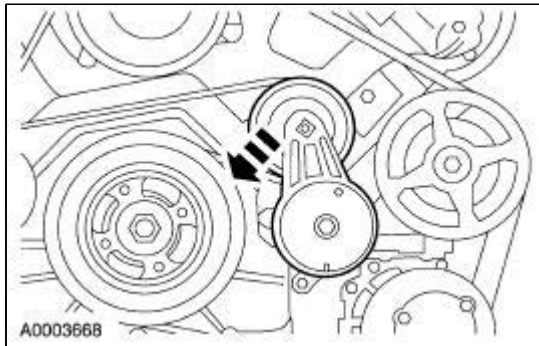
To install, reverse the removal procedure.

- Refer to component locations —3.0L for correct drive belt routing.
-

Belt —3.9L

Removal

1. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
2. Rotate the tensioner counterclockwise and remove the drive belt from the pulley.



3. Remove the belt tensioner. For additional information, refer to [Belt Tensioner](#) in this section.

Installation

1.  **CAUTION: Incorrect drive belt installation will cause premature drive belt failure.**

NOTE: Make sure the drive belt (8620) is correctly installed on each pulley.

To install, reverse the removal procedure.

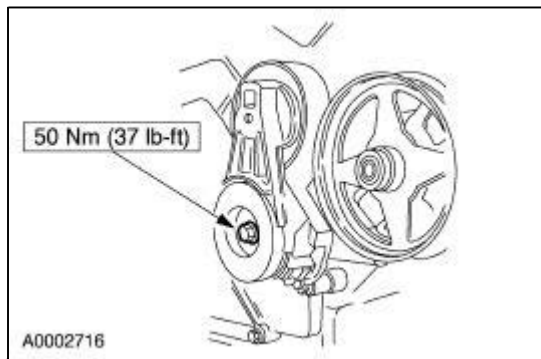
- Refer to component locations —3.9L for correct drive belt routing.
-

Belt Tensioner

Removal

1. Position the drive belt out of the way. For additional information, refer to [Belt—3.0L](#) or [Belt—3.9L](#) in this section.
2. **NOTE:** The 3.9L is shown, and the 3.0L is similar.

Remove the bolt and the drive belt tensioner.



Installation

1. **NOTE:** Make sure locating pins are aligned with the holes in the front cover, and the belt is installed around the belt tensioner pulley.

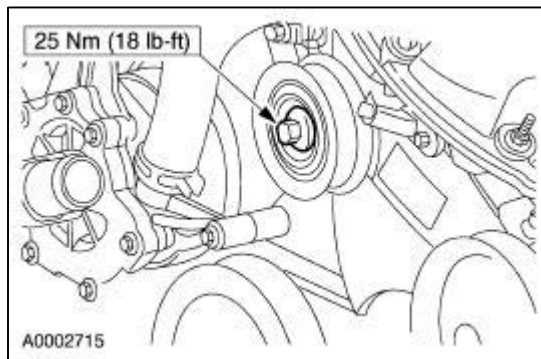
To install, reverse the removal procedure.

Belt Idler Pulley

Removal

1. Position the drive belt out of the way. For additional information, refer to [Belt—3.0L](#) or [Belt—3.9L](#) in this section.
2. **NOTE:** The 3.0L belt idler pulley is shown, and the 3.9L is similar.

Remove the bolt and the belt idler pulley.



Installation

1. To install, reverse the removal procedure.
-

General Specifications

Item	Specification
Starter motor normal load current draw (amperes)	130-220
Starting circuit maximum voltage drop (volts)	0.5

Torque Specifications

Description	Nm	lb-ft	lb-in
Starter motor bolts	25	18	—
Starter motor ground cable nut	25	18	—
Starter solenoid terminal nut (S-terminal)	6	—	53
Starter solenoid terminal nut (B-terminal)	12	9	—

Starting System


The starting system consists of the following components:

- starter motor (11002)
 - ignition switch
 - digital transmission range (TR) sensor (7F293)
 - starter relay
-

Starting System

Refer to Wiring Diagrams Section 303-06, Starting System for schematic and connector information.

Special Tool(s)

 <p>ST1137-A</p>	<p>73III Automotive Meter 105-R0057 or equivalent</p>
---	---

Principles of Operation

Anti-Theft Intervention

The starting system is electronically controlled by the passive anti-theft system (PATS). The PATS recognizes the correct electronically coded ignition key and signals the instrument cluster to provide a ground for the starter relay. The energized relay provides voltage to the starter solenoid, thereby allowing the starter motor to activate.

Insection and Verification



WARNING: When carrying out underhood work in the vicinity of the starter motor, be aware that the heavy gauge battery input lead at the starter solenoid is "electrically hot" at all times. A protective cap or boot is provided over the terminal of this lead and must be installed after the repair procedure is completed. Failure to follow these instructions may result in personal injury.



WARNING: When working in area of the starter motor, be careful to avoid touching hot exhaust components. Failure to follow these instructions may result in personal injury.

NOTE: When working on the starter system, make sure the anti-theft system is deactivated.

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Starter motor ● Brackets 	<ul style="list-style-type: none"> ● Battery ● Auxiliary junction box (AJB) fuse F121 (30A) ● Battery junction box (BJB) fuse F22 (20A)

- Central junction box (CJB) fuse F201 (5A)
- Starter relay
- Loose or corroded connectors
- Damaged wiring

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern remains after the inspection, determine the symptom(s) and go to the Symptom Chart.

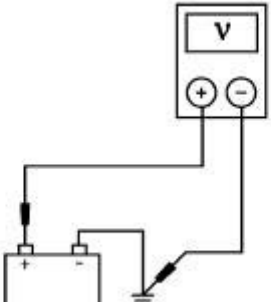
Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● The engine cranks slowly 	<ul style="list-style-type: none"> ● Battery. ● Ignition switch. ● Starter motor. ● Circuitry. 	<ul style="list-style-type: none"> ● CARRY OUT the starter motor-motor feed circuit and/or the starter motor-ground circuit test. REFER to Component Tests in this section.
<ul style="list-style-type: none"> ● The engine does not crank 	<ul style="list-style-type: none"> ● Battery. ● Central junction box (CJB) fuse F201 (5A). ● Auxiliary junction box (AJB) fuse F121 (30A). ● Battery junction box (BJB) fuse F422 (20A). ● Ignition switch. ● Starter relay. ● Anti-theft system. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.
<ul style="list-style-type: none"> ● Unusual starter noise 	<ul style="list-style-type: none"> ● Starter motor. ● Starter motor mounting. ● Incorrect starter motor drive engagements. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B.
<ul style="list-style-type: none"> ● The starter spins but the engine does not crank 	<ul style="list-style-type: none"> ● Starter motor. ● Broken flywheel/ring gear teeth. 	<ul style="list-style-type: none"> ● INSPECT the starter motor mounting and engagement. ● INSPECT the flywheel/ring gear for broke, missing or worn teeth. REPAIR as necessary.
<ul style="list-style-type: none"> ● Engine cranks with clutch pedal not applied (manual transmission) 	<ul style="list-style-type: none"> ● Starter clutch pedal position (CPP) switch. 	<ul style="list-style-type: none"> ● INSTALL a new clutch pedal position (CPP) switch.

Pinpoint Tests

PINPOINT TEST A: THE ENGINE DOES NOT CRANK

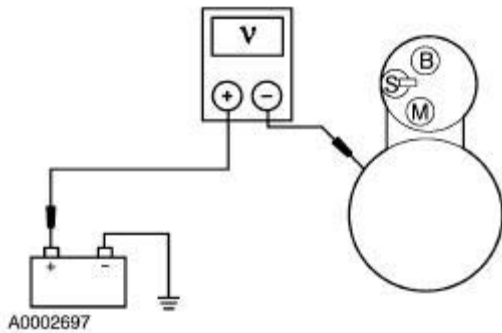
CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK FOR INSTRUMENT CLUSTER DIAGNOSTIC TEST CODES	
	<p>1 NOTE: The instrument cluster PATS DTCs are the only DTCs of concern in this step. Only repair retrieved non-PATS DTCs if a customer concern is reported.</p> <p>Carry out the instrument cluster self-test. Refer to Section 413-01.</p> <ul style="list-style-type: none"> • Were any PATS DTCs retrieved from the instrument cluster? <p>→ Yes GO to Section 419-01B to diagnose the PATS DTCs.</p> <p>→ No GO to A2.</p>
A2 CHECK THE BATTERY	
	<p>1 Check the battery condition and charge. For additional information, refer to Section 414-00.</p> <ul style="list-style-type: none"> • Is the battery OK? <p>→ Yes GO to A3.</p> <p>→ No CHARGE or INSTALL a new battery as necessary. For additional information, refer to Section 414-00. TEST the system for normal operation.</p>
A3 CHECK THE BATTERY GROUND CABLE	
<p>1</p>  <p>A0002696</p>	<p>1 Measure the voltage between the positive battery post and the battery ground cable connection on the engine.</p> <ul style="list-style-type: none"> • Is the voltage greater than 10 volts?

→ **Yes**
GO to A4.

→ **No**
INSTALL a new battery ground cable.
REFER to Section 414-01. TEST the
system for normal operation.

A4 CHECK THE STARTER MOTOR GROUND

1



1 Measure the voltage between the battery
positive post and the starter motor case.

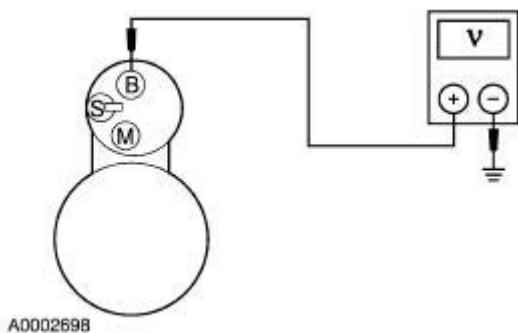
● Is the voltage greater than 10 volts?

→ **Yes**
GO to A5.

→ **No**
CLEAN the starter motor mounting flange
and make sure the starter motor is
correctly mounted. TEST the system for
normal operation.

A5 CHECK THE POWER SUPPLY TO THE STARTER MOTOR

1



1 Measure the voltage between starter
motor B-terminal and ground.

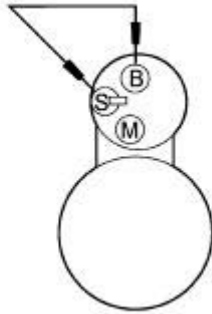
● Is the voltage greater than 10 volts?

→ **Yes**
GO to A6.

→ **No**
REPAIR circuit 30-BB10 (RD). TEST the
system for normal operation.

A6 CHECK THE STARTER MOTOR B-TERMINAL

1



A0002699

1

Connect a fused jumper wire to the B-terminal of the starter motor. Momentarily connect the other lead of the jumper wire to the starter motor S-terminal.

• **Did the starter motor engage and the engine crank?**

→ **Yes**
GO to A7.

→ **No**
INSTALL a new starter motor; REFER to Starter Motor—3.0L or Starter Motor—3.9L in this section. TEST the system for normal operation.

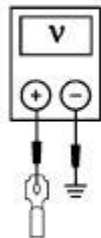
A7 CHECK THE START INPUT TO THE STARTER MOTOR

1



Starter motor C197

2



A0002700

3



2

Measure the voltage between starter motor C197, circuit 50-BB12 (GY/BK), harness side and ground while holding the ignition switch in the START position.

• **Is the voltage greater than 10 volts in START?**

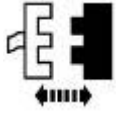
→ **Yes**
CLEAN the starter motor S-terminal and connector. CHECK the wiring and the starter motor for a loose or intermittent connection. TEST the system for normal

operation.

→ **No**
GO to A8.

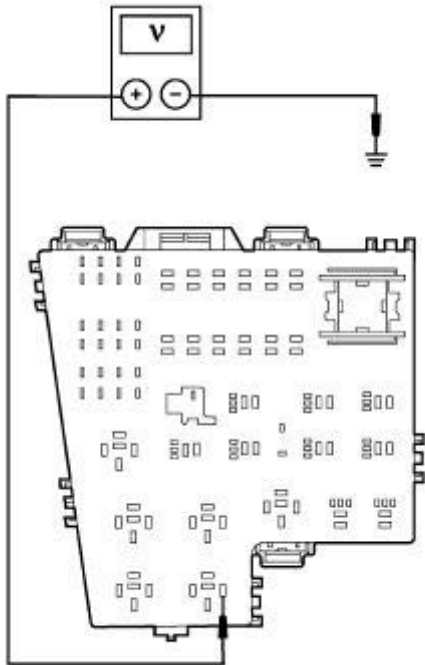
A8 CHECK THE START INPUT TO THE STARTER RELAY

1



Starter relay

5



A0003577

- 2 For manual transmissions, depress the clutch pedal position (CPP) switch.
- 3 Make sure the vehicle is in PARK or NEUTRAL.
- 4 Turn the ignition switch to START and hold.
- 5 Measure the voltage between starter relay pin 86, circuit 50–SBB12 (GY), harness side and ground.

● Is the voltage greater than 10 volts?

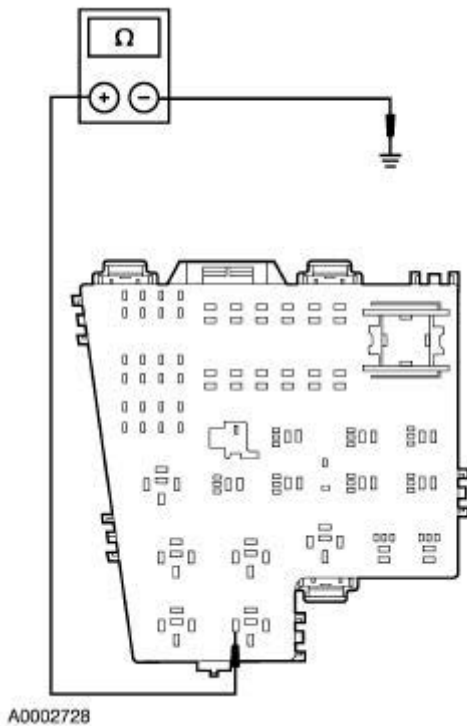
→ **Yes**
GO to A9.

→ **No**
GO to A17.

A9 CHECK THE GROUND SUPPLY TO THE STARTER RELAY

- 1 For manual transmissions, depress the clutch pedal position (CPP) switch.
- 2 Make sure the vehicle is in PARK or NEUTRAL.

4



3 Turn the ignition switch to START and hold.

4 Measure the resistance between the starter relay pin 85, circuit 31-SBB12 (BK/YE), harness side and ground.

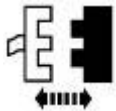
● Is the resistance less than 5 ohms?

→ **Yes**
GO to A14.

→ **No**
If automatic transmission, GO to A10. If manual transmission, GO to A11.

A10 CHECK THE CIRCUIT 31S-BB12 FOR AN OPEN

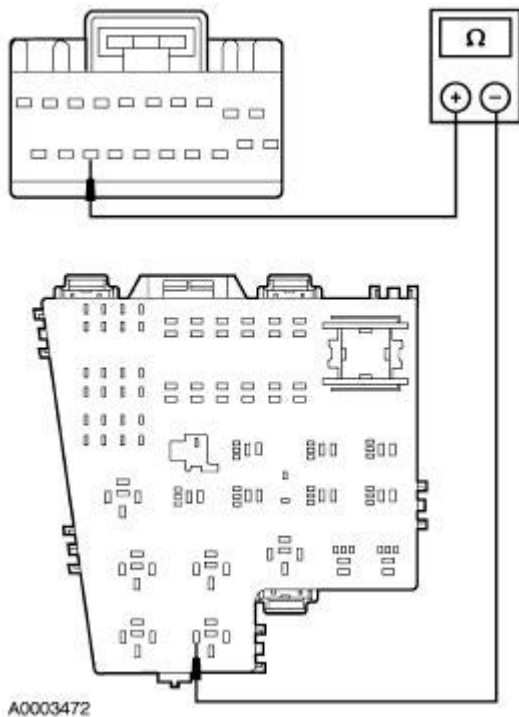
1



Instrument cluster C220b

2

2 Measure the resistance between the starter relay pin 85, circuit 31S-BB12 (BK/YE), harness side and the instrument cluster C220B pin 18, circuit 31S-BB12, harness side.



A0003472

● Is the resistance less than 5 ohms?

→ **Yes**

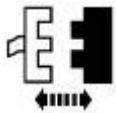
INSTALL a new instrument cluster;
REFER to [Section 413-01](#).

→ **No**

REPAIR the circuit. TEST the system for normal operation.

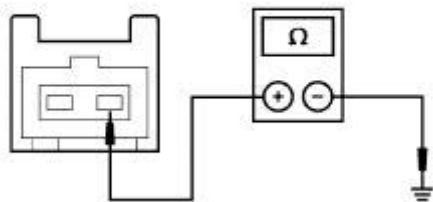
A11 CHECK THE GROUND SUPPLY TO THE CLUTCH PEDAL POSITION (CPP) SWITCH

1



CPP switch C257

3



A0002086

2

Turn the ignition switch to START and hold.

3

Measure the resistance between clutch pedal position (CPP) switch C257 pin 2, circuit 31S-BB6 (BK/YE), harness side and ground.

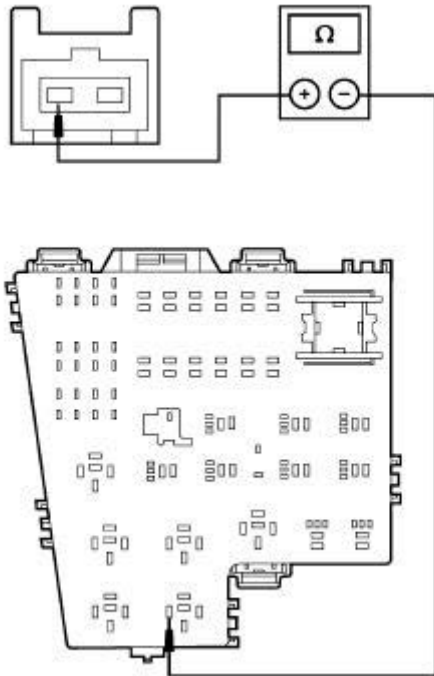
● Is the resistance less than 5 ohms?

→ **Yes**
GO to [A12](#).

→ **No**
GO to [A13](#).

A12 CHECK CIRCUIT 31S-BB12 FOR AN OPEN

1



A0000678

1

Measure the resistance between clutch pedal position (CPP) switch C257 pin 1, circuit 31S-BB12 (BK/YE), harness side and the starter relay pin 85, circuit 31S-BB12 (BK/YE), harness side.

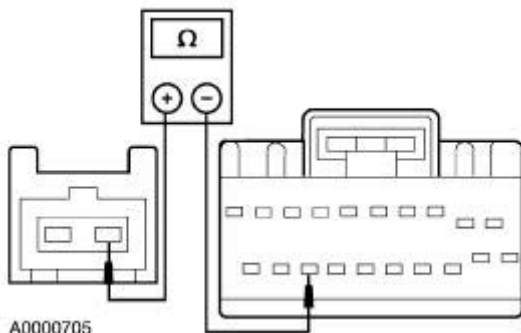
● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new clutch pedal position switch (CPP); REFER to [Section 303-14](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation.

A13 CHECK CIRCUIT(S) 31S-BB12 AND 31S-BB6 FOR AN OPEN

1



A0000705

1

Measure the resistance between instrument cluster C220b pin 18, circuit 31S-BB12 (BK/YE), harness side and clutch pedal position (CPP) switch C257 pin 2, circuit 31S-BB6 (BK/YE), harness side.

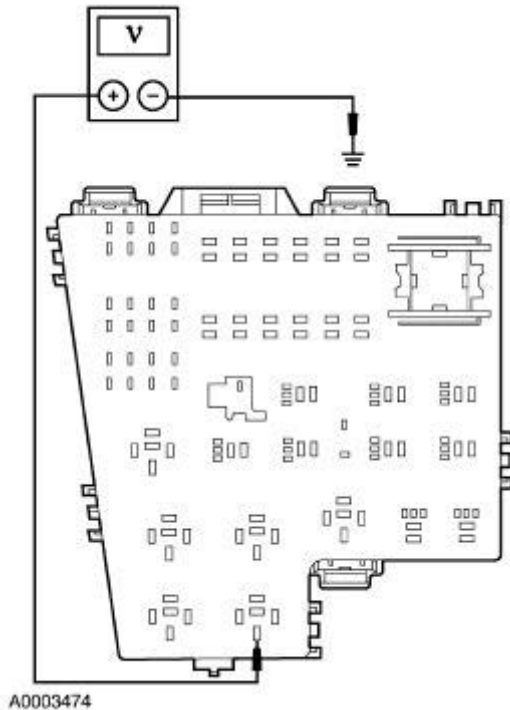
● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new instrument cluster;
REFER to Section 413-01 . TEST the
system for normal operation.

→ **No**
REPAIR the circuit(s). TEST the system
for normal operation.

A14 CHECK THE BATTERY SUPPLY TO THE STARTER RELAY

1



1 Measure the voltage between the starter
relay pin 30, circuit 30-BB13 (RD),
harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to A15 .

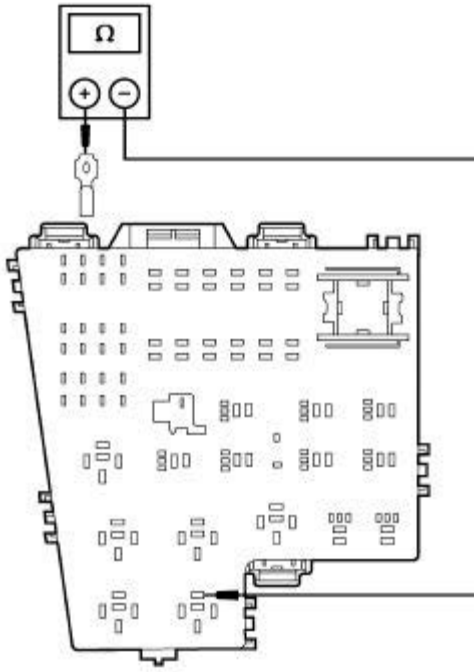
→ **No**
REPAIR the circuit. TEST the system for
normal operation.

A15 CHECK CIRCUIT 50-BB10 AND 50-BB12 FOR AN OPEN

2

1 Disconnect the eyelet from the starter S-
terminal.

2 Measure the resistance between the
starter relay pin 87, circuit 50-BB10
(GY/BK), harness side and the S-
terminal eyelet C197, circuit 50-BB12
(GY/BK), harness side.



A0000706

● Is the resistance less than 5 ohms?

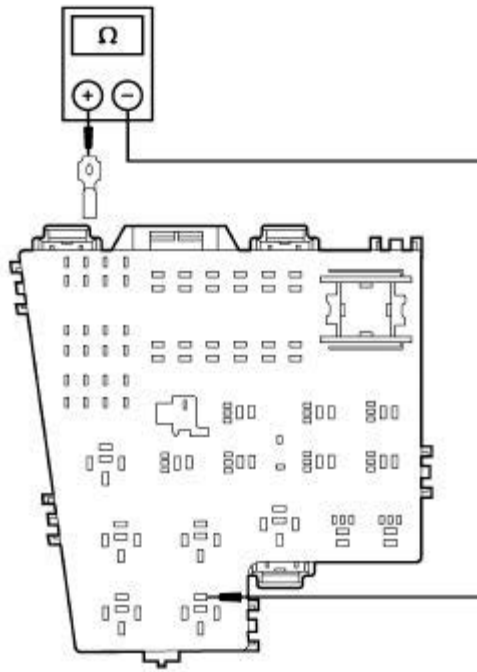
→ **Yes**
GO to A16.

→ **No**
REPAIR the circuit(s). TEST the system for normal operation.

A16 CHECK CIRCUIT 50-BB10 AND 50-BB12 FOR A SHORT TO GROUND

1

1 Measure the resistance between the starter relay pin 87, circuit 50-BB10 (GY/BK), harness side and the S-terminal eyelet C197, circuit 50-BB12 (GY/BK), harness side.



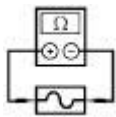
A0000706

- Is the resistance greater than 10,000 ohms?

- **Yes**
INSTALL a new starter relay. TEST the system for normal operation.
- **No**
REPAIR the circuit. TEST the system for normal operation.

A17 CHECK FUSE 1 (5A)

1



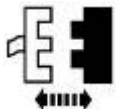
CJB Fuse F201 (5A)

- Is CJB fuse F201 (5A) open?

- **Yes**
GO to A24.
- **No**
GO to A18.

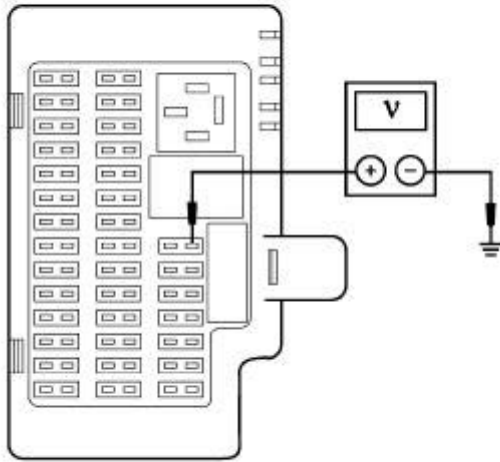
A18 CHECK THE START INPUT TO FUSE 1

1



CJB Fuse F201 (5A)

3



A0000670

- 2 Turn the ignition switch to the START position and hold.
- 3 Measure the voltage between CJB fuse F201 (5A) input terminal and ground.

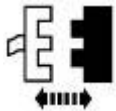
• Is the voltage greater than 10 volts?

→ **Yes**
GO to A22.

→ **No**
GO to A19.

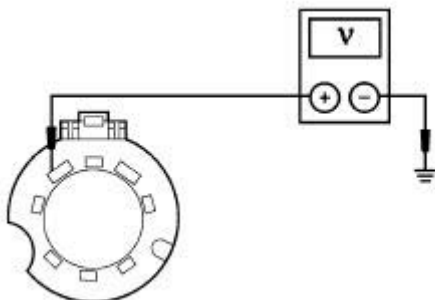
A19 CHECK THE BATTERY INPUT TO THE IGNITION SWITCH

1



Ignition switch C250

2



A0000685

- 2 Measure the voltage between ignition switch C250 pin 1, circuit 30-BB9 (RD), harness side and ground.

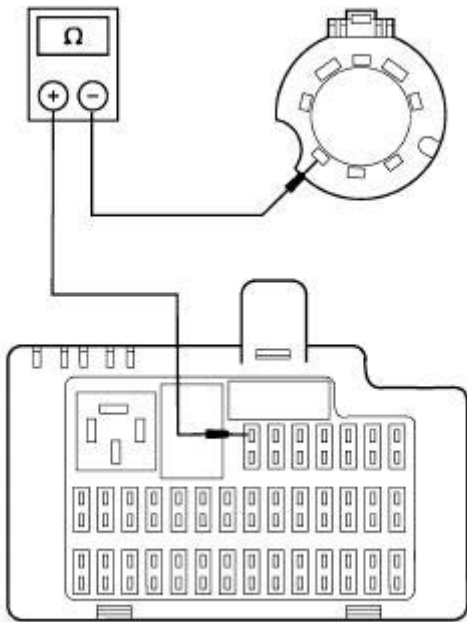
• Is the voltage greater than 10 volts?

→ **Yes**
GO to [A20](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation.

A20 CHECK CIRCUIT 50-DD5 FOR AN OPEN

1



A0004195

1 Measure the resistance between the ignition switch C250 pin 3, circuit 50-DD5 (GY/BK), harness side and the CJB fuse F201 (5A) input terminal, circuit 50-DD5, harness side.

● **Is the resistance less than 5 ohms?**

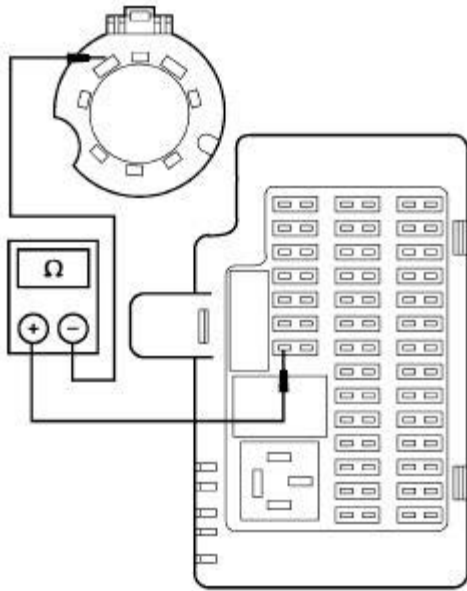
→ **Yes**
GO to [A21](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation.

A21 CHECK CIRCUIT 50-DD5 FOR A SHORT TO GROUND

1

1 Measure the resistance between ignition switch C250 pin 3, circuit 50-DD5 (GY/BK), harness side and the CJB fuse F201 (5A) input terminal, circuit 50-DD5, harness side.



A0002692

- Is the resistance greater than 10,000 ohms?

→ **Yes**
 INSTALL a new ignition switch; [Section 211-05](#). TEST the system for normal operation.

→ **No**
 REPAIR the circuit. TEST the system for normal operation.

A22 CHECK CIRCUIT 50-BB15 FOR AN OPEN

1



CJB Fuse F201 (5A)

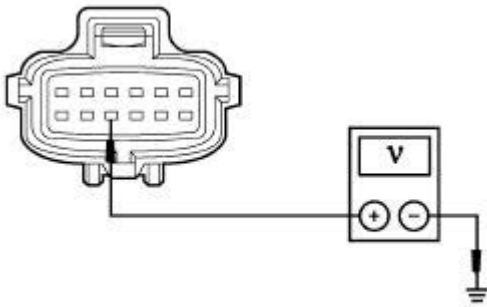
2



Digital TR sensor C167

4

- 3 Turn the ignition switch to the START position and hold.
- 4 Measure the voltage between digital TR sensor C167 pin 10, circuit 50-BB15 (GY/OG), harness side and ground.



A0002693

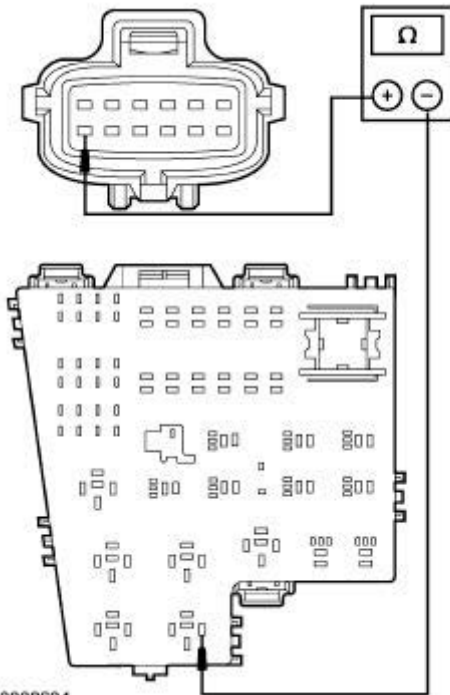
- Is the voltage greater than 10 volts?

→ **Yes**
GO to [A23](#) .

→ **No**
REPAIR the circuit. TEST the system for normal operation.

A23 CHECK CIRCUIT 50S-BB12 FOR AN OPEN

1



A0002694

1 Measure the resistance between the digital TR sensor C167 pin 12, circuit 50S-BB12 (GY), harness side and the starter relay pin 86, circuit 50S-BB12, harness side.

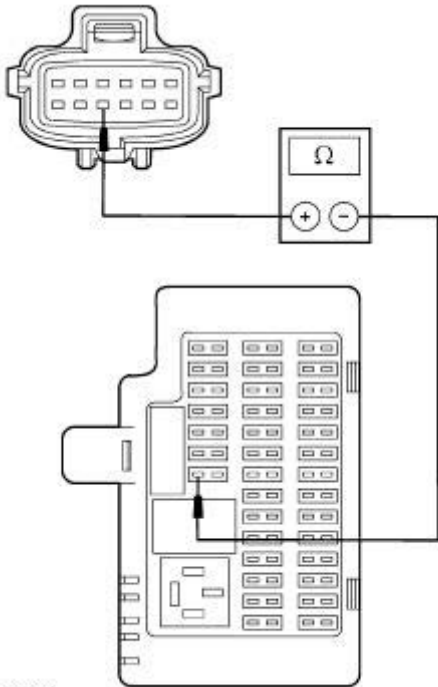
- Is the resistance less than 5 ohms?

→ **Yes**
ADJUST the digital TR sensor. For additional information, REFER to [Section 307-05](#) .

→ **No**
REPAIR the circuit. TEST the system for normal operation.

A24 CHECK CIRCUIT 50-BB15 FOR A SHORT TO GROUND

1



A0009036

1

Measure the resistance between digital TR sensor C167 pin 10, circuit 50S-BB15 (GY/OR), harness side and CJB fuse F201 (5A) output terminal C270b pin 3, circuit 50S-BB15 (GY/OR), harness side.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to [A25](#).

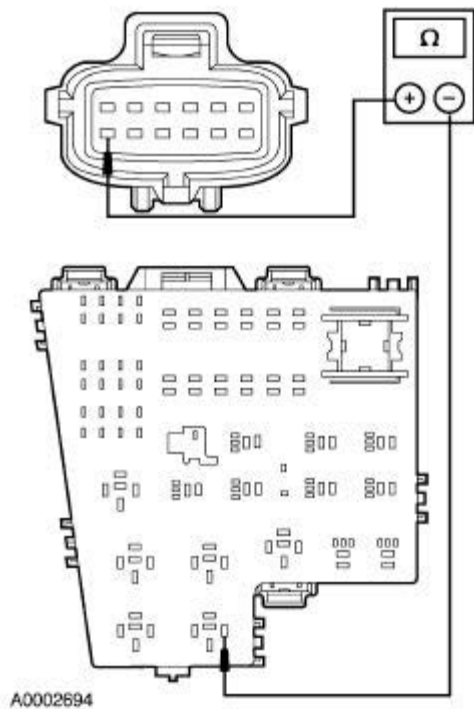
→ **No**
REPAIR the circuit. TEST the system for normal operation.

A25 CHECK CIRCUIT 50S-BB12 FOR A SHORT TO GROUND

1

1

Measure the resistance between the digital TR sensor switch C167 pin 12, circuit 50S-BB12 (GY), harness side and the starter relay pin 86, circuit 50S-BB12 (GY), harness side.



- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to A26.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

A26 INSTALL A NEW FUSE 1 (5A)

1



Digital TR sensor switch C167

2 Install a new CJB fuse F201 (5A). Retest the system.

- Does the fuse open?

→ **Yes**
ADJUST the digital TR sensor. For additional information, REFER to Section 307-05.

→ **No**
RETEST for normal operation. VERIFY the symptom.

PINPOINT TEST B: UNUSUAL STARTER NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK THE STARTER MOUNTING	
	<p>1 Inspect the starter motor mounting bolts and brackets for looseness.</p> <ul style="list-style-type: none"> ● Is the starter motor mounted correctly? <p>→ Yes GO to <u>B2</u>.</p> <p>→ No INSTALL the starter motor correctly. For additional information, REFER to <u>Starter Motor—3.0L</u> or <u>Starter Motor—3.9L</u> in this section. TEST the system for normal operation.</p>
B2 CHECK FOR ENGINE NOISE	
	<p>1 Turn the ignition switch to the OFF position.</p> <p>2 Connect a fused jumper wire from the B-terminal to the S-terminal of the starter motor. Engage the starter motor and verify the noise is due to the starter operation.</p> <ul style="list-style-type: none"> ● Is the noise due to the starter motor engagement? <p>→ Yes GO to <u>B3</u>.</p> <p>→ No REFER to <u>Section 303-01A</u> or <u>Section 303-01B</u> to continue the diagnosis.</p>
B3 CHECK FOR UNUSUAL WEAR	
	<p>1 Remove the starter motor. For additional information, refer to <u>Starter Motor—3.0L</u> or <u>Starter Motor—3.9L</u> in this section.</p> <p>2 Inspect the ring gear for damaged or worn teeth.</p> <ul style="list-style-type: none"> ● Is the noise due to flywheel ring gear tooth damage? <p>→ Yes INSTALL a new flywheel ring gear. EXAMINE the starter pinion teeth. If damaged, INSTALL a new starter motor. For additional information, REFER to <u>Starter Motor—3.0L</u> or <u>Starter Motor—3.9L</u> in this section. TEST the system for normal operation.</p> <p>→ No INSTALL a new starter motor. For additional information, REFER to <u>Starter Motor—3.0L</u> or <u>Starter Motor—3.9L</u> in this section. TEST the system for normal operation.</p>

Component Tests



WARNING: When repairing the starter motor or carrying out other underhood work in the vicinity of the starter motor, be aware that the heavy gauge battery input lead at the starter solenoid is "electrically hot" at all times. Failure to follow these instructions may result in personal injury.

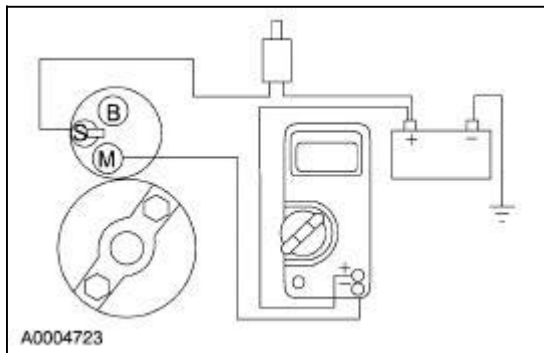


CAUTION: A protective cap or boot is provided over the battery input terminal on all vehicle lines and must be installed after repairing. Be sure to disconnect the battery ground cable before repairing the starter motor.

Connect the 73III Automotive Meter at the component terminal rather than at the wiring end connector. Making a connection at the wiring end connector could result in false readings because the meter will not pick up a high resistance between the wiring connector and the component.

Starter Motor—Motor Feed Circuit

1. Make sure the battery is fully charged. Carry out a battery load test. For additional information, refer to [Section 414-00](#).
2. Disconnect the inertia fuel shutoff (IFS) switch (9341).
3. Connect a remote starter switch between the starter solenoid S-terminal and the battery positive (+) terminal.
4. Connect the 73III Automotive Meter positive lead to the battery positive (+) post. Connect negative lead to the M-terminal.

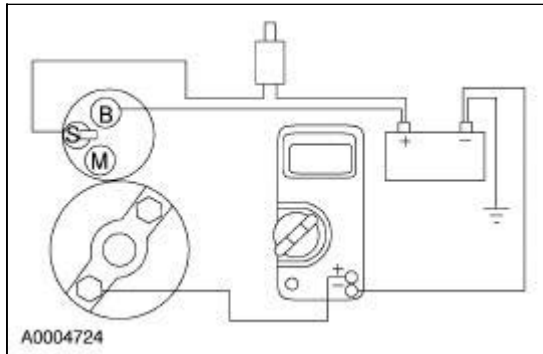


5. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.8 volt or less.
6. If the voltage reading is 0.8 volt or less, go to the Starter Motor-Ground Circuit Component Test.
7. If the voltage reading is greater than 0.8 volt, this is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Move the 73III Automotive Meter negative lead to the starter solenoid B-terminal and repeat the test. If the voltage reading at the B-terminal is lower than 0.8 volt, the concern is either in the connections at the starter solenoid or in the solenoid contacts.
8. Remove the cables from solenoid B-, S- and M-terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6. If the voltage drop reading is still greater than 0.8 volt when checked at the M-terminal or less than 0.8 volt when checked at the B-terminal, the concern is in the solenoid contacts. Install a new starter motor.
9. If the voltage reading taken at the solenoid B-terminal is still greater than 0.8 volt after cleaning the cables and the connections at the solenoid, the concern is either in the positive (+) battery cable connection or in the positive battery cable itself. Clean the positive (+) battery cable connection. If this does not solve the problem, install a new positive battery cable. Refer to [Section 414-01](#).

Starter Motor—Ground Circuit

A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. Check the voltage drop in the ground circuit as follows:

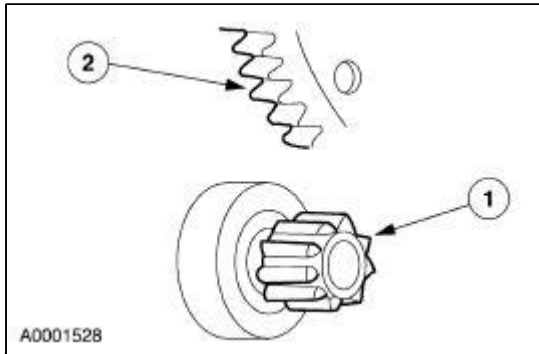
1. Connect the 73III Automotive Meter positive lead to the starter motor housing (the connection must be clean and free of rust or grease). Connect the negative lead to the negative (-) battery terminal.



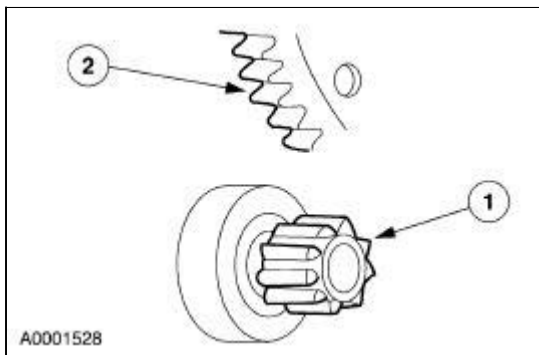
2. Engage the remote starter switch and crank the engine. Read and record the voltage reading. The reading should be 0.5 volt or less.
 3. If the voltage is more than 0.5 volt, clean the negative cable connections at the battery, the body ground connections, and the starter ground connections. Retest.
 4. If the voltage is more than 0.5 volt, install a new cable. If the voltage reading is less than 0.5 volt and the engine still cranks slowly, install a new starter motor.
-

Starter Drive and Flywheel Ring Gear Inspection

1. Remove the starter motor (11002). For additional information, refer to [Starter Motor—3.0L](#) and [Starter Motor—3.9L](#) in this section.
2. Check the wear patterns on the (1) starter drive gear and the (2) flywheel ring gear. If the wear pattern is normal, install the starter motor. For additional information, refer to [Starter Motor—3.0L](#) and [Starter Motor—3.9L](#) in this section.



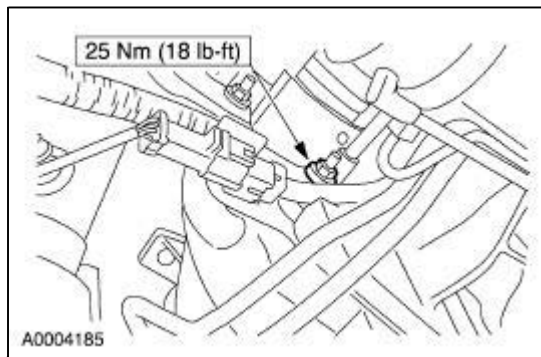
3. If the (1) starter drive gear and the (2) flywheel ring gear are not fully meshing or the gears are milled or damaged, install a new starter motor and, if necessary, a new flywheel gear. For additional information, refer to [Starter Motor—3.0L](#) and [Starter Motor—3.9L](#) in this section or [Section 303-01A](#).



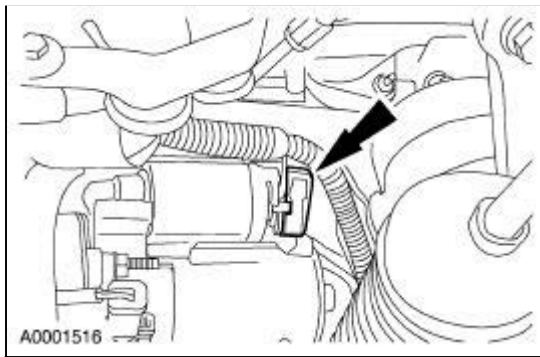
Starter Motor —3.0L

Removal

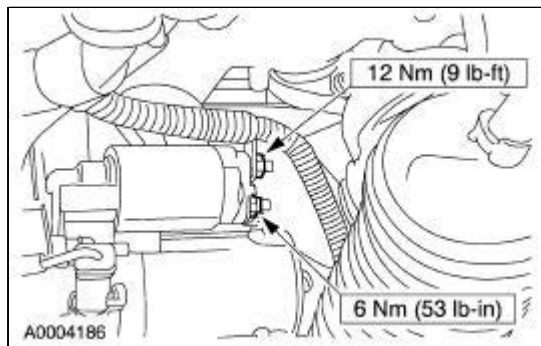
1. Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Disconnect the ground strap.



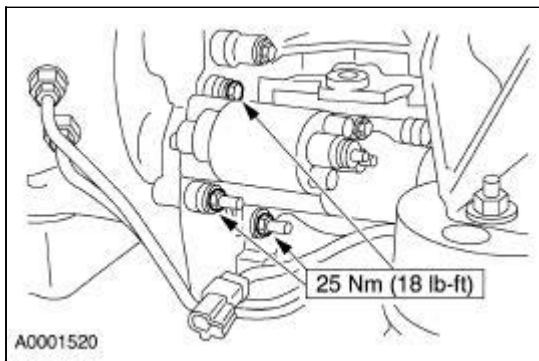
4. Remove the cover.



5. Remove the nuts and position the cables aside.



6. Remove the bolts, two stud bolts and the starter motor (11002).



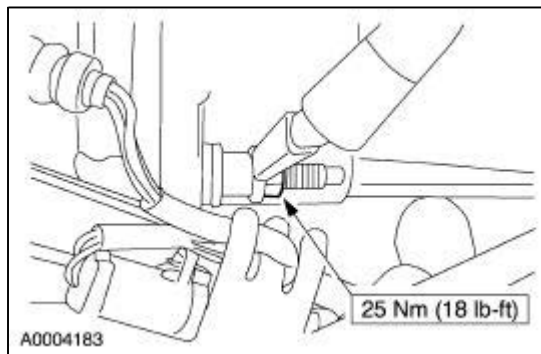
Installation

1. To install, reverse the removal procedure.
-

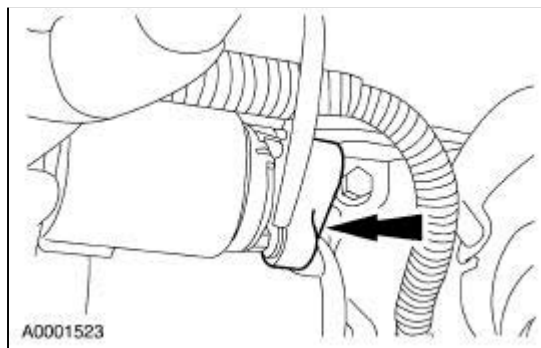
Starter Motor —3.9L

Removal

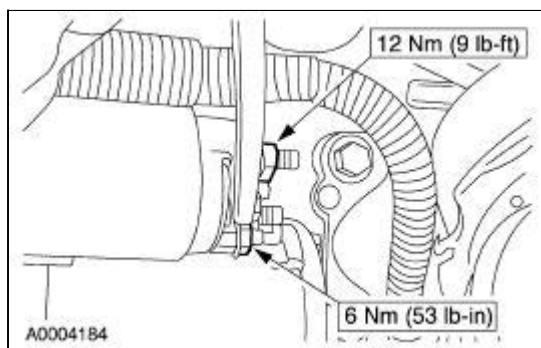
1. Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Disconnect the ground strap.



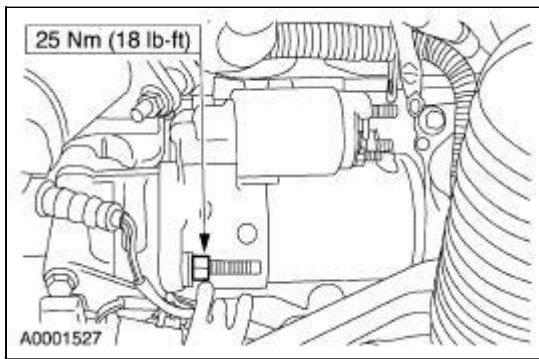
4. Remove the cover.



5. Remove the nuts and position the cables aside.



6. Remove the bolt, stud bolt and the starter motor (11002).



Installation

1. To install, reverse the removal procedure.
-

General Specifications

Item	Specification
Firing order	1-4-2-5-3-6
Spark plug type	AGSF-32FS
Spark plug gap	1.30-1.45 mm (0.051-0.057 inch)

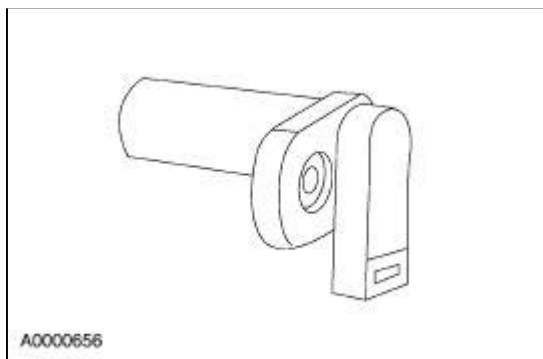
Torque Specifications

Description	Nm	lb-ft	lb-in
Spark plugs	15	11	—
Ignition coil bolts	6	—	53

Engine Ignition

The electronic ignition (EI) system is a coil-on-plug (COP) ignition system. The COP ignition system consists of the following components:

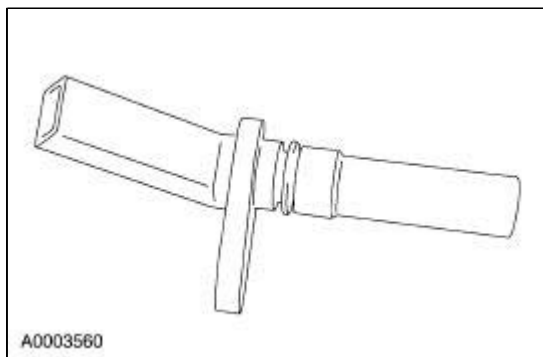
- crankshaft position (CKP) sensor
- camshaft position (CMP) sensor
- ignition coils
- spark plugs



The crankshaft position sensor:

- is a variable reluctance sensor.
- is mounted on the engine front cover.
- is triggered by a 36-minus-1 tooth trigger wheel mounted on the crankshaft.
- provides base timing and crankshaft speed (rpm) to the powertrain control module (PCM).

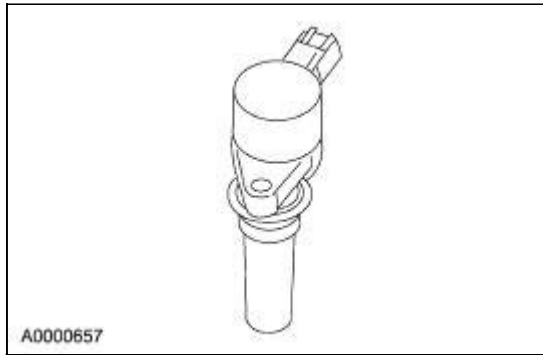
Refer to [Section 303-14](#) for removal and installation of the crankshaft position sensor.



The camshaft position sensor:

- sends the powertrain control module (PCM) a signal indicating camshaft position used for fuel synchronization.

Refer to [Section 303-14](#) for removal and installation of the camshaft position sensor.



The six separate ignition coils:

- convert low voltage signals from the powertrain control module to high voltage pulses.
- produce the high voltage pulses for the spark plugs.
- are connected directly to each spark plug.

The spark plugs:

- convert a high voltage pulse into a spark which ignites the fuel and air mixture.
 - originally installed on the vehicle have a platinum-enhanced active electrode for long life.
-

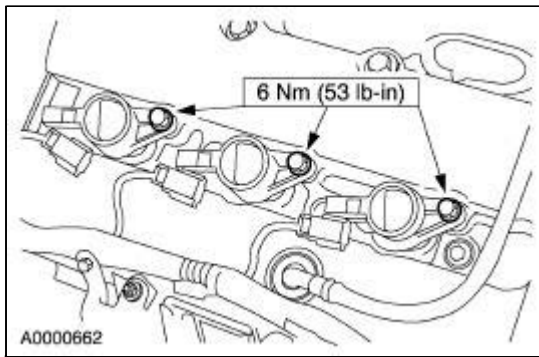
Engine Ignition

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Ignition Coil

Removal

1. Remove the engine appearance cover.
2. To access the RH bank ignition coils, remove the upper intake manifold. For additional information, refer to [Section 303-01A](#).
3. Disconnect the electrical connector from the ignition coils.
4. Remove the bolts.



5. Remove the ignition coils.

Installation

1. **NOTE:** Verify the ignition coils are seated and the boots are not damaged. If the boots are damaged, install a new ignition coil.

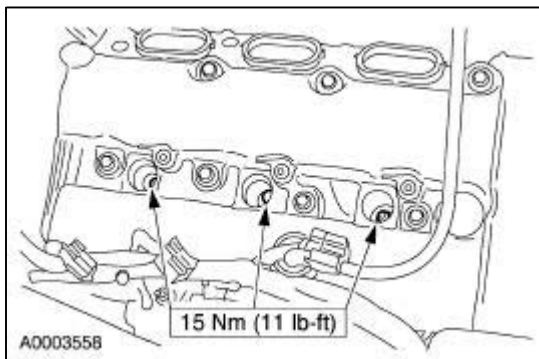
To install, reverse the removal procedure.

Spark Plug

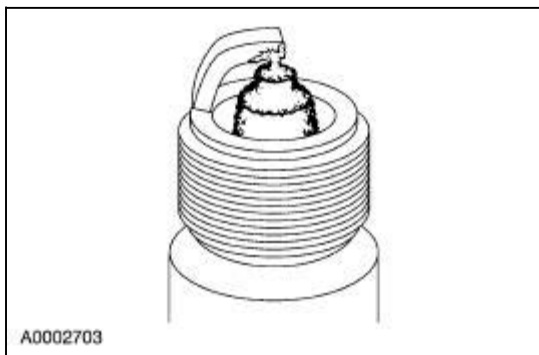
Removal

1. Remove the ignition coil. For additional information, refer to [Ignition Coil](#) in this section.
2. **NOTE:** Use compressed air to remove any foreign material from the spark plug well before removing the spark plugs.

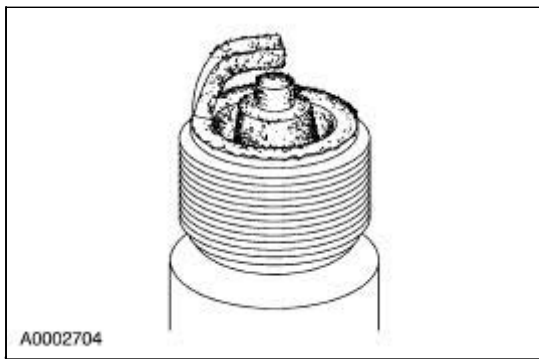
Remove the spark plugs.



3. Inspect for a bridged gap.
 - Check for deposit build-up closing the gap between electrodes. Deposits are caused by oil or carbon fouling.
 - Clean the spark plug.

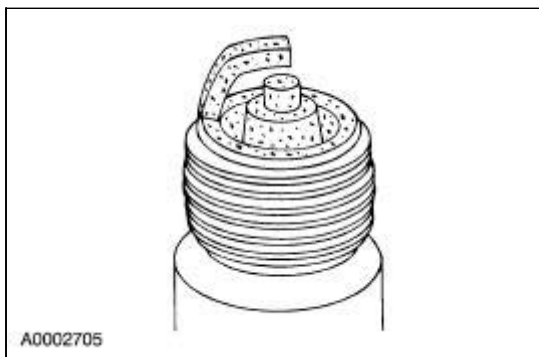


4. Inspect for oil fouling, identified by wet, black deposits on the insulator shell bore electrodes. This is caused by excessive oil entering the combustion chamber through worn rings and pistons, excessive valve-to-guide clearance or worn or loose bearings.
 - Correct the oil leak concern.
 - Install a new spark plug.



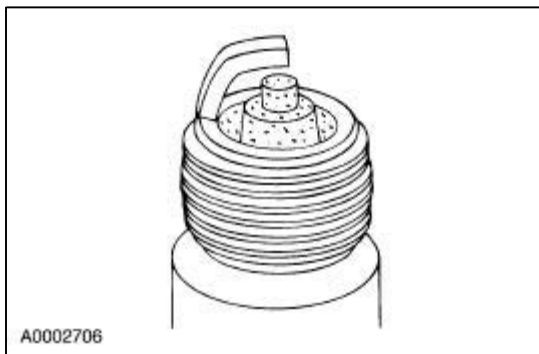
5. Inspect for carbon fouling, identified by black, dry, fluffy carbon deposits on the insulator tips, exposed shell surfaces and electrodes. This is caused by a spark plug with an incorrect heat range, dirty air cleaner, too rich a fuel mixture or excessive idling.

- Clean the spark plug.



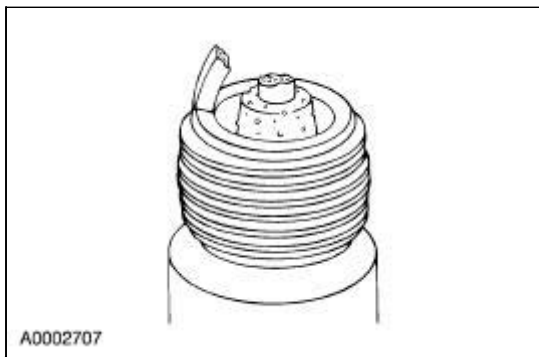
6. Inspect for normal burning.

- Check for light tan or gray deposits on the firing tip.



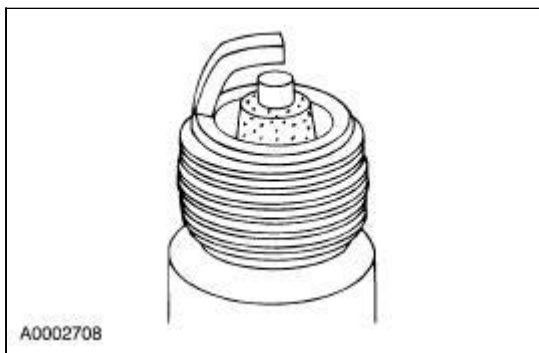
7. Inspect for pre-ignition, identified by melted electrodes and possibly a damaged insulator. Metallic deposits on the insulator indicate engine damage. Pre-ignition may be caused by incorrect ignition timing, wrong type of fuel or the installation of a heli-coil insert in place of the spark plug threads.

- Install a new spark plug.



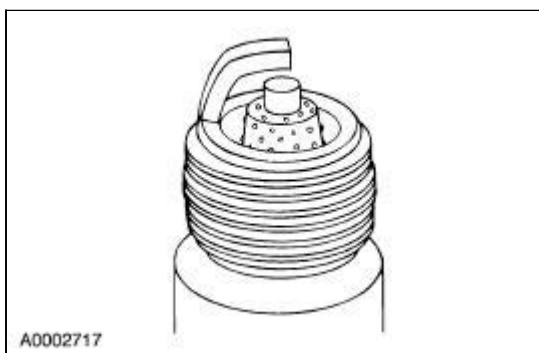
8. Inspect for overheating, identified by a white or light gray insulator with small black or gray-brown spots with bluish-burnt appearance of electrodes. This is caused by engine overheating, wrong type of fuel, loose spark plugs, spark plugs with an incorrect heat range, low fuel pump pressure or incorrect ignition timing.

- Install a new spark plug.

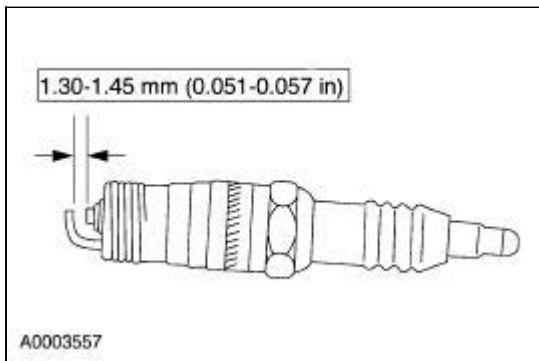


9. Inspect for fused spot deposits, identified by melted or spotty deposits resembling bubbles or blisters. This is caused by sudden acceleration.

- Clean the spark plug.



10. Adjust the spark plug gap as necessary.



Installation

1. To install, reverse the removal procedure.
-

General Specifications

Item	Specification
Firing order	1-5-4-2-6-3-7-8
Spark plug type	AGSP-32F
Spark plug gap	0.99-1.09 mm (0.039-0.043 inch)
Silicone Brake Caliper Grease and Dielectric Compound D7AZ-19A331-A	ESE-M1C171-A

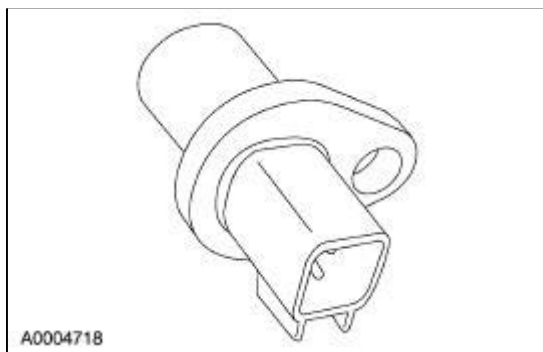
Torque Specifications

Description	Nm	lb-ft	lb-in
Ignition coil cover bolts	5	—	44
Spark plugs	26	19	—
Ignition coil bolts	5	—	44

Engine Ignition

The electronic ignition (EI) system is a coil-on-plug (COP) ignition system. The COP ignition system consists of the following components:

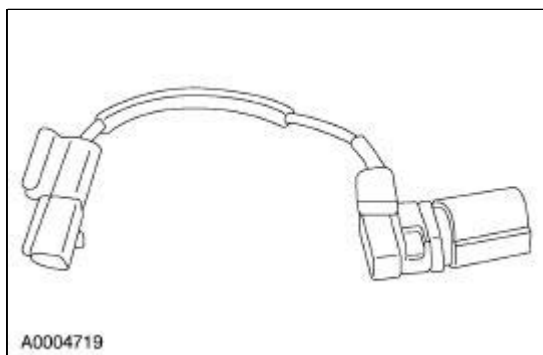
- crankshaft position (CKP) sensor
- camshaft position (CMP) sensor
- ignition coils
- spark plugs



The crankshaft position sensor:

- is a variable reluctance sensor.
- is mounted on the sump body under the engine.
- is triggered by the flywheel.
- provides base timing and crankshaft speed (rpm) to the powertrain control module (PCM).

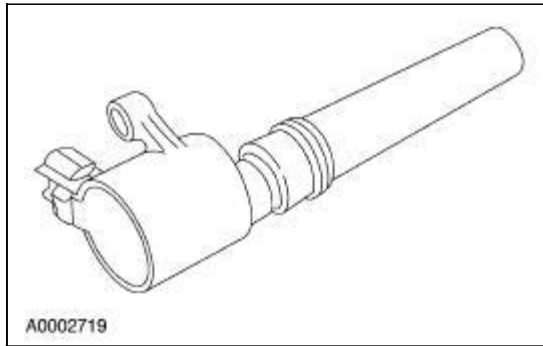
Refer to [Section 303-14](#) for removal and installation of the crankshaft position sensor.



The camshaft position sensor:

- sends the powertrain control module (PCM) a signal indicating camshaft position used for fuel synchronization.
- indicates top dead center.

Refer to [Section 303-14](#) for removal and installation of the camshaft position sensor.



The eight separate ignition coils:

- convert low voltage signals from the powertrain control module to high voltage pulses.
- produce the high voltage pulses for the spark plugs.
- are connected directly to each spark plug.

The spark plugs:

- convert the high voltage pulse into a spark which ignites the fuel and air mixture.
 - originally installed on the vehicle have a platinum-enhanced active electrode for long life.
-

Engine Ignition

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Ignition Coil

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound D7AZ-19A331-A	ESE-M1C171-A

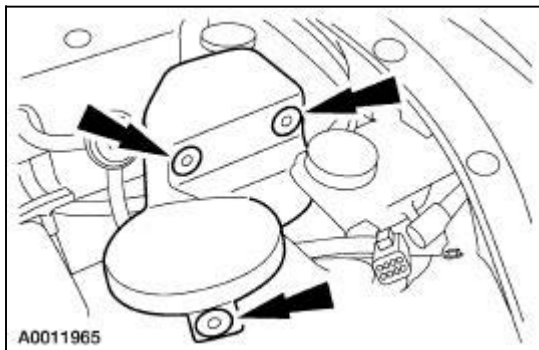
Removal and Installation

Right side ignition coils

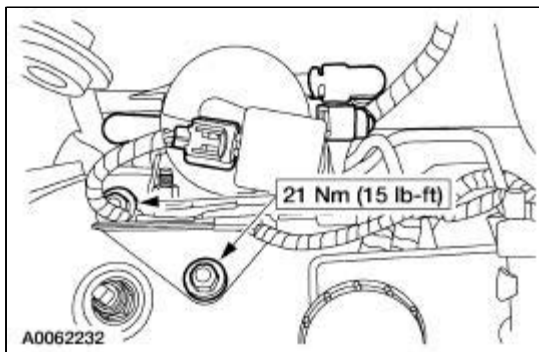
1. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).

Left side ignition coils

2. Remove the evaporative emission canister purge valve cover.



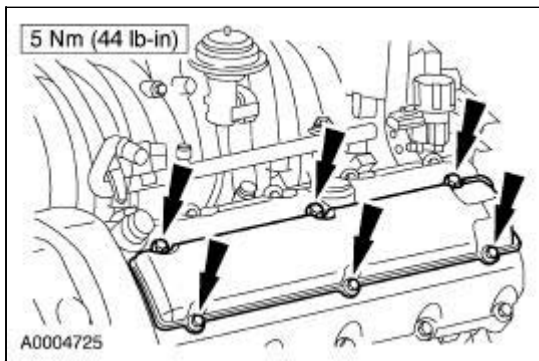
3. Remove the evaporative emission canister purge valve bracket nuts and position aside.



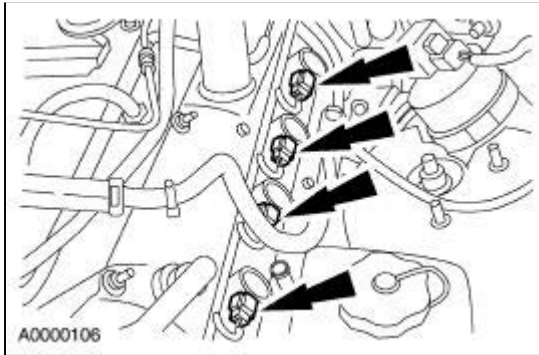
Left and right side ignition coils

4. **NOTE:** Left side shown, right side similar.

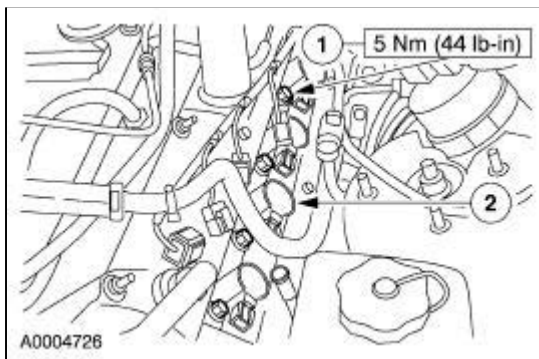
Remove the bolts and the ignition coil cover.



5. Disconnect the electrical connector from each ignition coil.



6. Remove the ignition coils.
 1. Remove the bolts.
 2. Remove the ignition coils.



7. **NOTE:** Apply silicone brake caliper grease and dielectric compound to the inside of ignition coil boots.

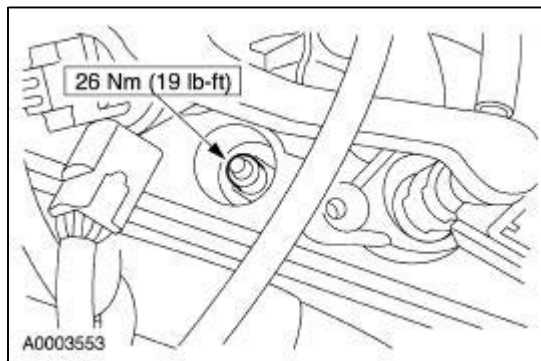
To install, reverse the removal procedure.

Spark Plug

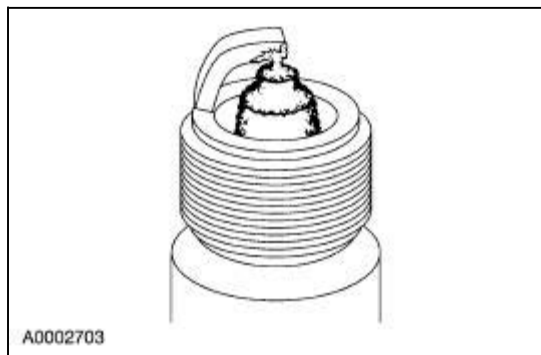
Removal

1. Remove the ignition coil. For additional information, refer to [Ignition Coil](#) in this section.
2. **NOTE:** Use compressed air to remove any foreign material from the spark plug well before removing the spark plugs.

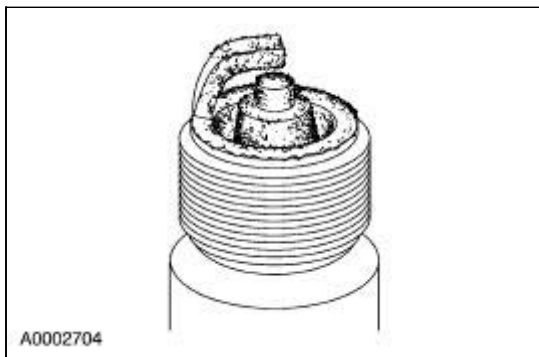
Remove the spark plugs.



3. Inspect for a bridged gap.
 - Check for deposit build-up closing the gap between electrodes. Deposits are caused by oil or carbon fouling.
 - Clean the spark plug.

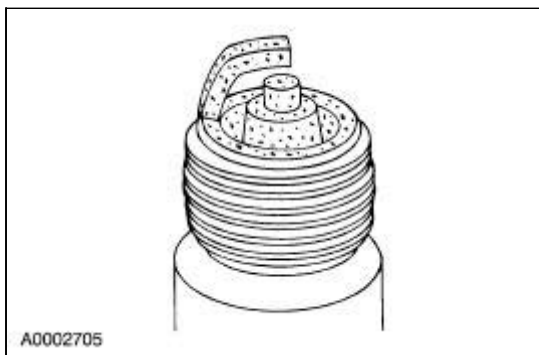


4. Inspect for oil fouling, identified by wet, black deposits on the insulator shell bore electrodes. This is caused by excessive oil entering the combustion chamber through worn rings and pistons, excessive valve-to-guide clearance or worn or loose bearings.
 - Correct the oil leak concern.
 - Install a new spark plug.



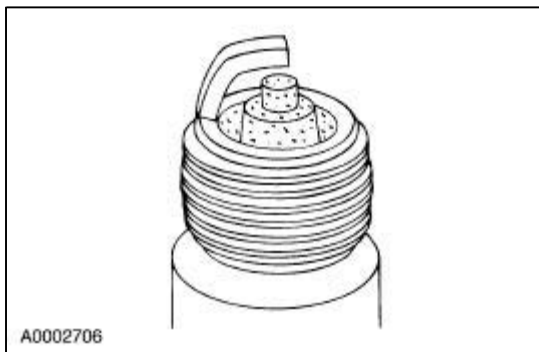
5. Inspect for carbon fouling, identified by black, dry, fluffy carbon deposits on the insulator tips, exposed shell surfaces and electrodes. This is caused by a spark plug with an incorrect heat range, dirty air cleaner, too rich a fuel mixture or excessive idling

- Clean the spark plug.



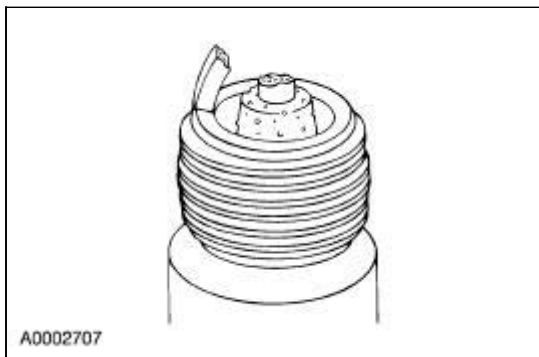
6. Inspect for normal burning.

- Check for light tan or gray deposits on the firing tip.



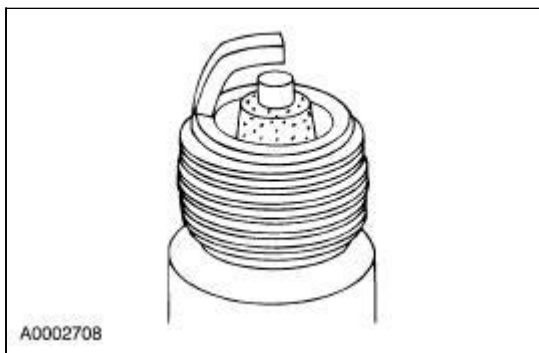
7. Inspect for pre-ignition, identified by melted electrodes and possibly a damaged insulator. Metallic deposits on the insulator indicate engine damage. Pre-ignition may be caused by incorrect ignition timing, wrong type of fuel or the installation of a heli-coil insert in place of the spark plug threads.

- Install a new spark plug.



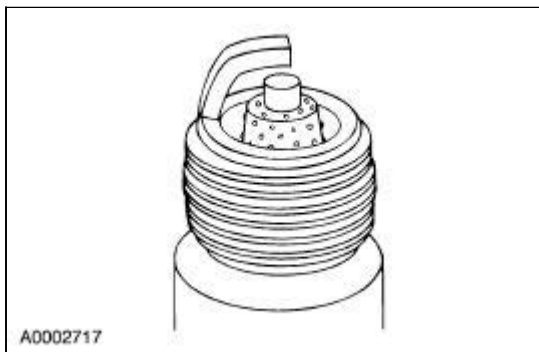
8. Inspect for overheating, identified by a white or light gray insulator with small black or gray-brown spots with bluish-burnt appearance of electrodes. This is caused by engine overheating, wrong type of fuel, loose spark plugs, spark plugs with an incorrect heat range, low fuel pump pressure or incorrect ignition timing.

- Install a new spark plug.



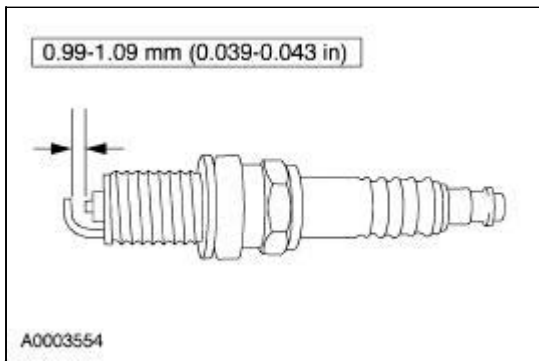
9. Inspect for fused spot deposits, identified by melted or spotty deposits resembling bubbles or blisters. This is caused by sudden acceleration.

- Clean the spark plug.



10. Inspect to make sure the platinum tip is present.

11. Adjust the spark plug gap as necessary.



Installation


1. To install, reverse the removal procedure.
-

Torque Specifications

Description	Nm	lb-ft	lb-in
EGR valve bolts	25	18	—
EGR valve to exhaust manifold tube fittings	^a	—	—
EVR solenoid	5	—	44
Differential pressure feedback EGR	6	—	53
Cross vehicle support	20	15	—
Crankcase vent oil separator	10	—	89
Secondary air tube	38	28	—
Secondary air tube bolt	10	—	89
Secondary air valve	10	—	89
Secondary air pump	10	—	89

^a Refer to the procedure in this section.

Engine Emission Control

 **CAUTION:** Do not remove any part of the engine emission control system. Operating the engine without the engine emission control system will reduce fuel economy and engine ventilation. This will weaken engine performance and shorten engine life.

The engine emission control consists of the:

- positive crankcase ventilation (PCV) system.
- exhaust gas recirculation (EGR) system.
- secondary air system (3.0L only).

The Vehicle Emission Control Information (VECI) decal shows:

- the components of the emission control system.
- the correct vacuum hose routing.

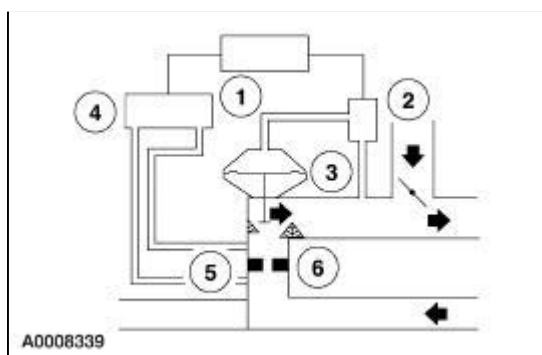
For additional information, refer to [Section 100-01](#).

The PCV system uses intake manifold vacuum to ventilate the crankcase and return the fumes to the intake manifold for combustion.

The PCV valve (3.0L only):

- controls the amount of ventilating air and blow-by gases going to the intake manifold.
- prevents a backfire from reaching the crankcase.

EGR System Components



Item	Part Number	Description
1	12A650	Powertrain control module
2	9J459	EGR vacuum regulator solenoid
3	9D475	EGR valve
4	9J433	Differential pressure feedback EGR
5	—	Metering orifice (part of 9D477)

The EGR system returns a portion of the exhaust gas to the intake manifold to reduce the combustion temperature. This results in lower nitrous oxide formation.

The EGR vacuum regulator solenoid (9J459) uses input from the PCM to change the EGR valve operation.

The EGR valve-to-exhaust manifold tube:

- connects the exhaust manifold (9430) to the EGR valve.
- has two tubes connecting to the differential pressure feedback EGR for EGR flow monitoring.

The differential pressure feedback EGR:

- monitors the EGR flow rate through the EGR valve-to-exhaust manifold tube.
- sends an EGR flow rate signal to the PCM.

The powertrain control module (PCM) (12A650) controls the EGR vacuum regulator solenoid. The EGR vacuum regulator solenoid controls the vacuum to the EGR valve. When the EGR valve opens, exhaust gas flows to the intake manifold. The differential pressure feedback EGR (9J433) measures the flow through the EGR valve from the exhaust manifold tube (9D477) and sends a signal to the PCM. A metering orifice in the EGR valve-to-exhaust manifold tube restricts the flow rate when the EGR valve (9D475) is open.

The secondary air system is used to reduce hydrocarbons (HC) by introducing oxygen into the exhaust gas stream. It operates at startup for the first 90 seconds.

Engine Emission Control

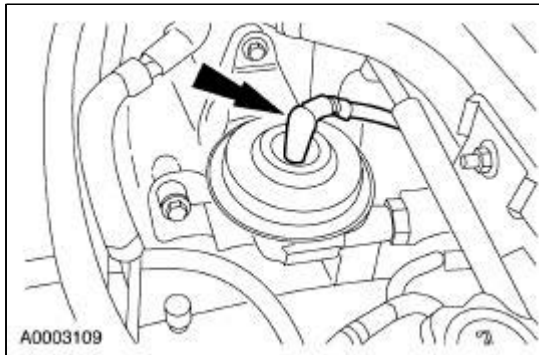
Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

EGR Valve

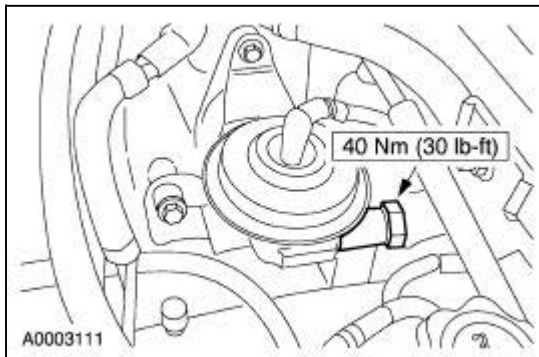
Removal and Installation

NOTE: The 3.9L is shown, the 3.0L is similar.

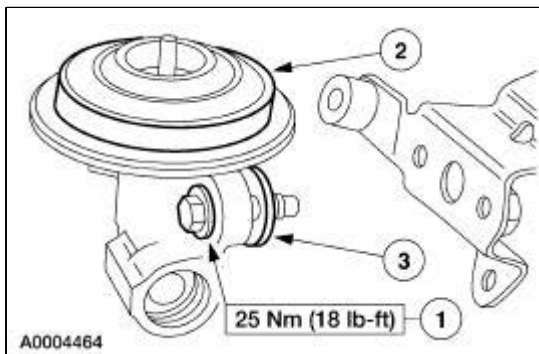
1. Disconnect the vacuum hose.



2. Disconnect the exhaust gas recirculation (EGR) tube from the EGR valve.



3. Remove the EGR valve.
 1. Remove the bolts.
 2. Remove the EGR valve.
 3. Remove and discard the gasket and clean the sealing surfaces.

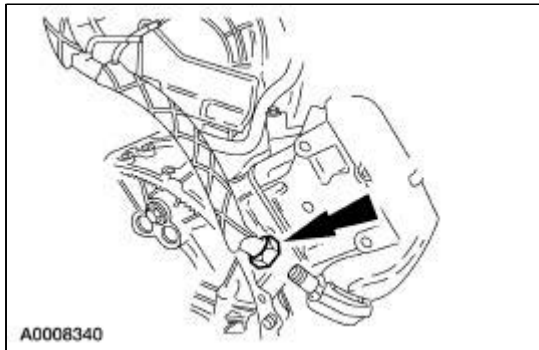


4. To install, reverse the removal procedure.
 - Install a new gasket.

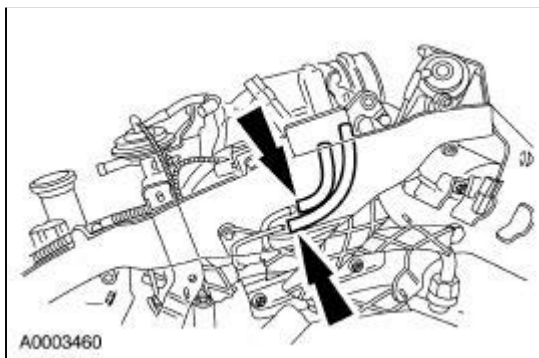
EGR Valve Tube —3.0L

Removal

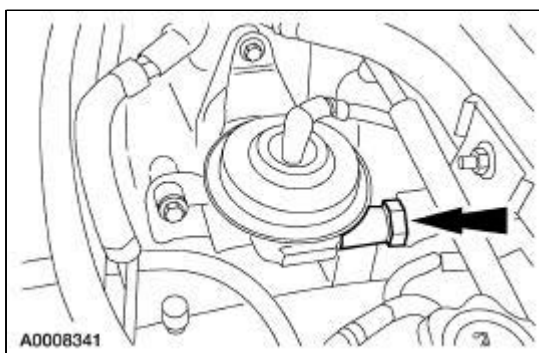
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Disconnect the EGR tube from the exhaust manifold.



3. Lower the vehicle.
4. Disconnect the differential pressure feedback EGR hoses.

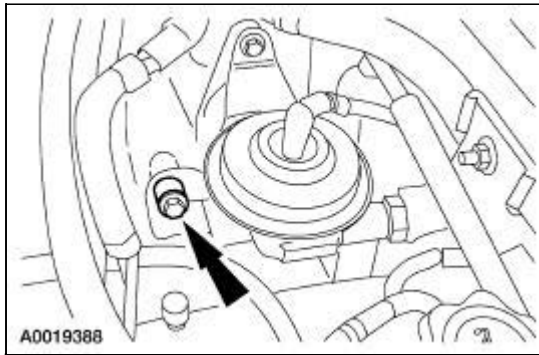


5. Disconnect the EGR tube from the EGR valve.
 - Remove the tube from the vehicle.

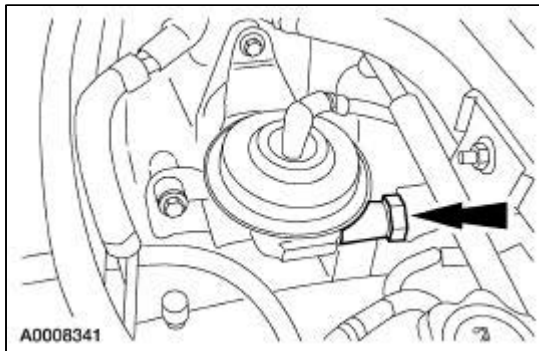


Installation

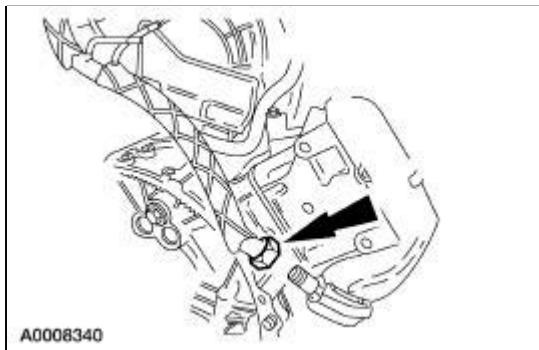
1. Loosen the two EGR valve bolts.



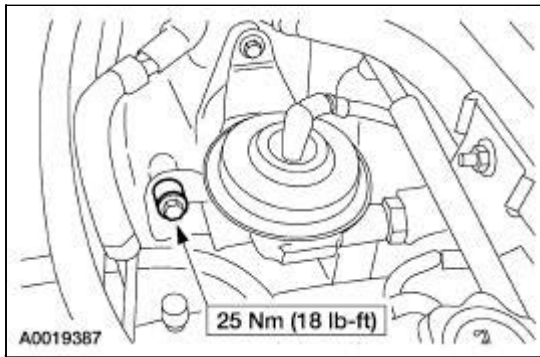
2. Hand-tighten the EGR valve tube to the EGR valve.



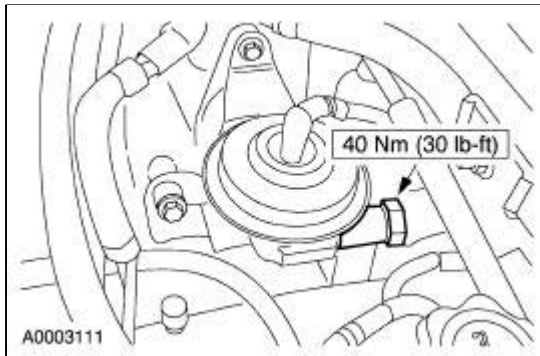
3. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
4. Tighten the EGR valve tube to the exhaust manifold in two stages:
 - Stage 1: Hand-tighten the EGR valve tube to the exhaust manifold.
 - Stage 2: Tighten the EGR valve tube to 40 Nm (30 lb-ft).



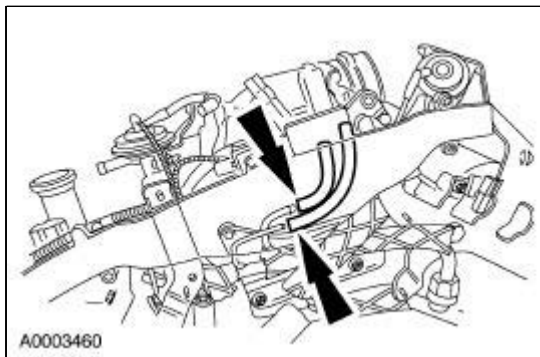
5. Lower the vehicle.
6. Tighten the two EGR valve bolts.



7. Tighten the EGR valve tube to the EGR valve.



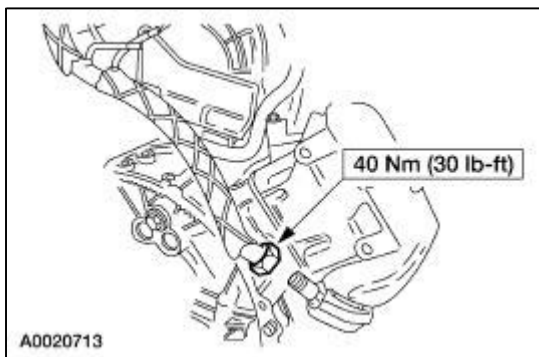
8. Connect the differential pressure feedback EGR hoses.



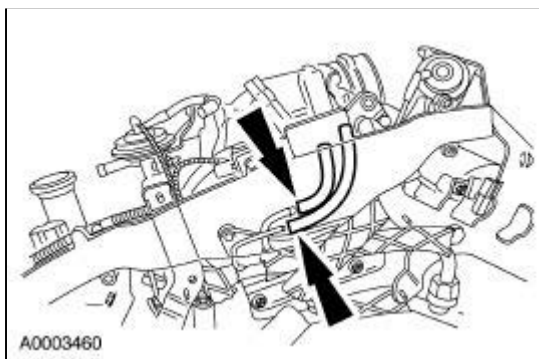
EGR Valve Tube —3.9L

Removal and Installation

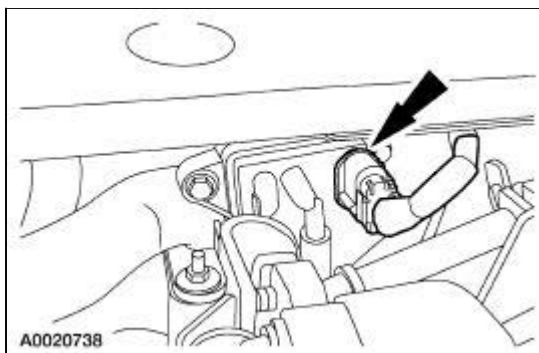
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the cabin air filter. For additional information, refer to [Section 412-01](#).
3. Disconnect the exhaust gas recirculation (EGR) tube from the exhaust manifold.
 - Loosen the compression nut.



4. Disconnect the differential pressure feedback EGR (DPFE) hoses.

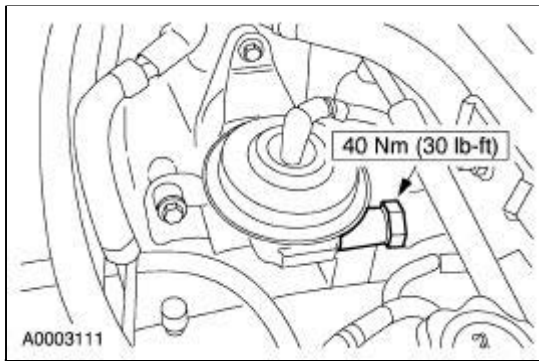


5. Disconnect the DPFE electrical connector.

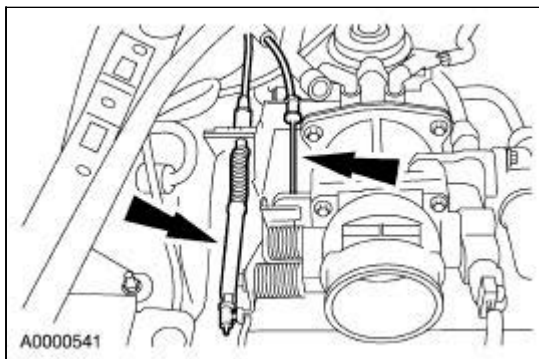


6. Disconnect the EGR tube from the EGR valve.

- Loosen the compression nut.

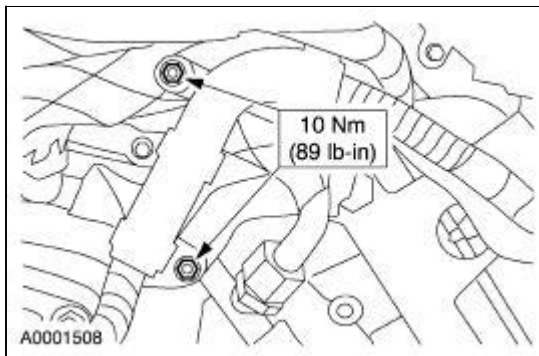


7. Disconnect the accelerator and speed control cables.



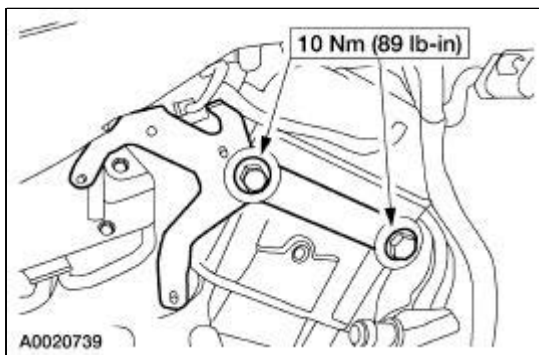
8. Position the wire harness bracket aside.

- Remove the nuts.



9. Position the bracket aside.

- Remove the bolts.

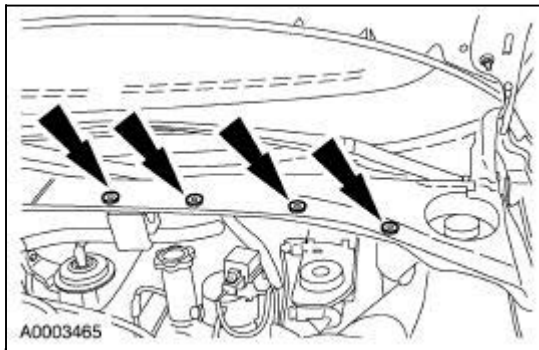


10. Remove the EGR tube from the vehicle.
 11. To install, reverse the removal procedure.
-

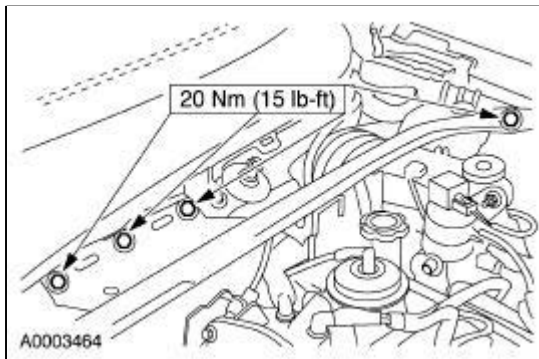
Differential Pressure Feedback EGR —3.0L

Removal and Installation

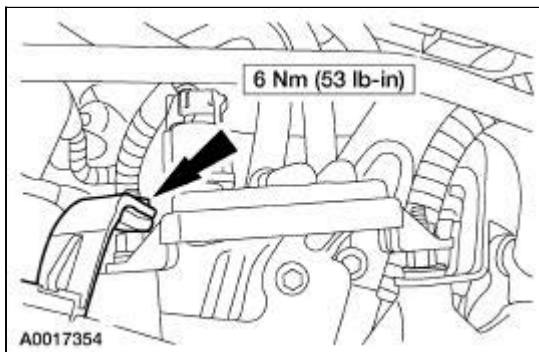
1. Remove the cowl vent screen. For additional information, refer to [Section 501-02](#).



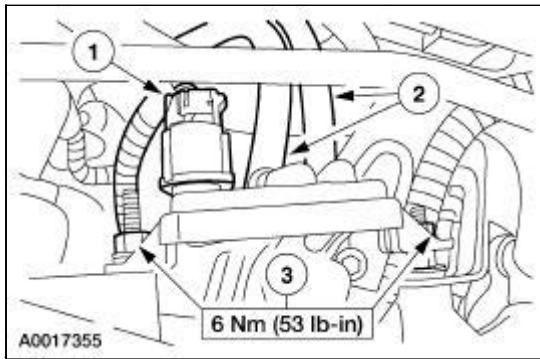
2. Remove the seven bolts and position the cross vehicle support out of the way.



3. Remove the nut and the throttle cable bracket.



4. Remove the differential pressure feedback EGR.
 1. Disconnect the electrical connector.
 2. Disconnect the hoses.
 3. Remove the bolts and the differential pressure feedback EGR.

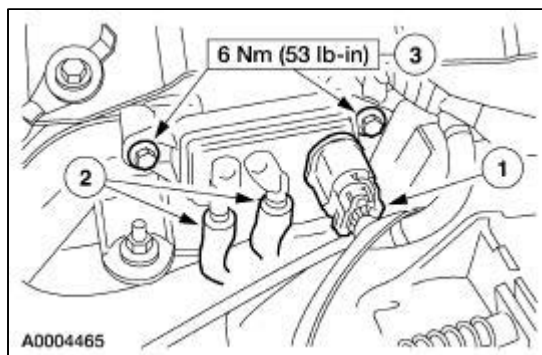


5. To install, reverse the removal procedure.
-

Differential Pressure Feedback EGR —3.9L

Removal and Installation

1. Remove the differential pressure feedback EGR.
 1. Disconnect the electrical connector.
 2. Disconnect the hoses.
 3. Remove the bolts and the differential pressure feedback EGR.

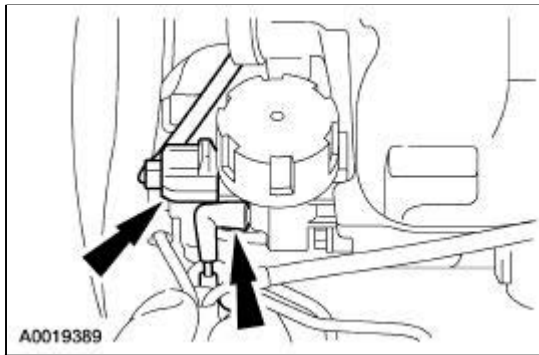


2. To install, reverse the removal procedure.
-

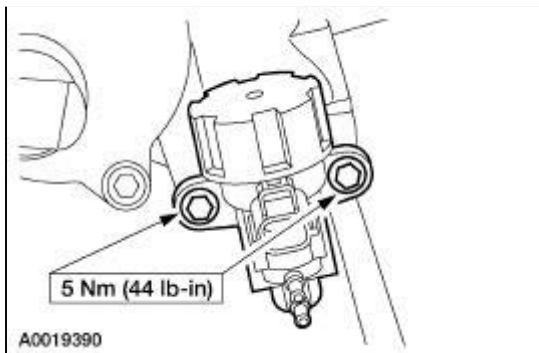
Solenoid —Electric Vacuum Regulator, 3.0L

Removal and Installation

1. Remove the cabin air filter plenum. For additional information, refer to [Section 412-01](#).
2. Disconnect the EGR vacuum regulator (EVR).
 - Disconnect the electrical connector.
 - Disconnect the vacuum hoses.



3. Remove the EVR.
 - Remove the bolts.

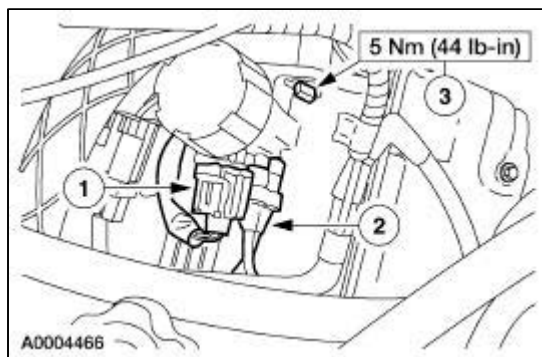


4. To install, reverse the removal procedure.

Solenoid —Electric Vacuum Regulator, 3.9L

Removal and Installation

1. Remove the EGR vacuum regulator (EVR).
 1. Disconnect the electrical connector.
 2. Disconnect the vacuum hoses.
 3. Remove the bolts and EVR.

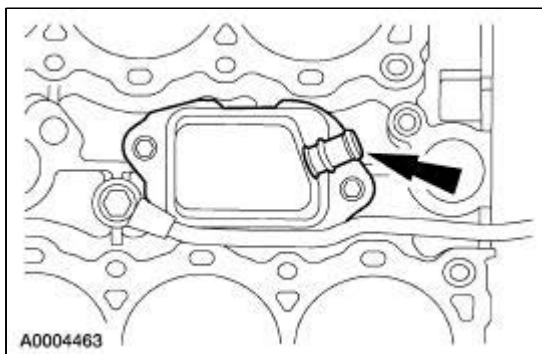


2. To install, reverse the removal procedure.
-

PCV Valve —3.0L

Removal and Installation

1. Remove the lower intake manifold. For additional information, refer to [Section 303-01A](#).
2. Remove the positive crankcase ventilation (PCV) valve from the oil separator.

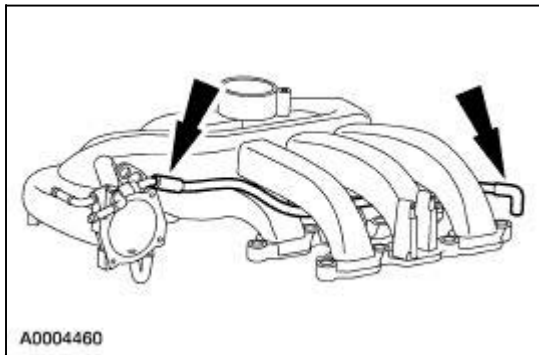


3. To install, reverse the removal procedure.
-

PCV Ventilation Hose —3.0L

Removal and Installation

1. Disconnect and remove the PCV ventilation hose.

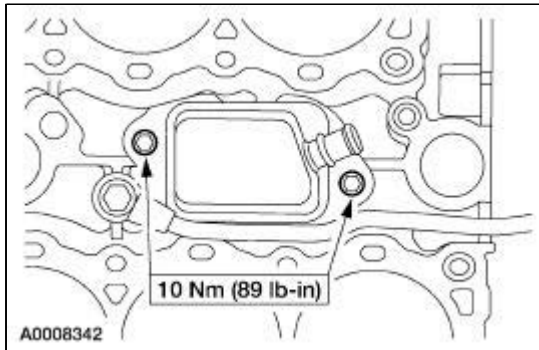


2. To install, reverse the removal procedure.
-

Crankcase Vent Oil Separator —3.0L

Removal and Installation

1. Remove the LH cylinder head. For additional information, refer to [Section 303-01A](#).
2. Remove the bolts and the oil separator. Discard the gasket.

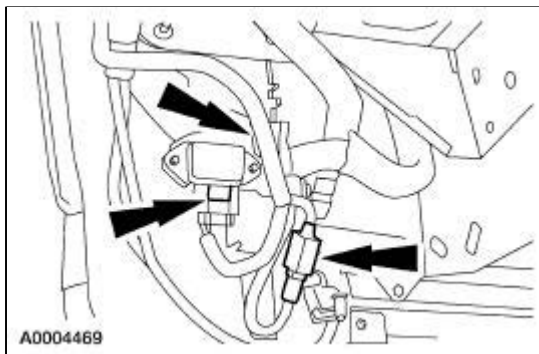


3. To install, reverse the removal procedure.
 - Install a new gasket.
-

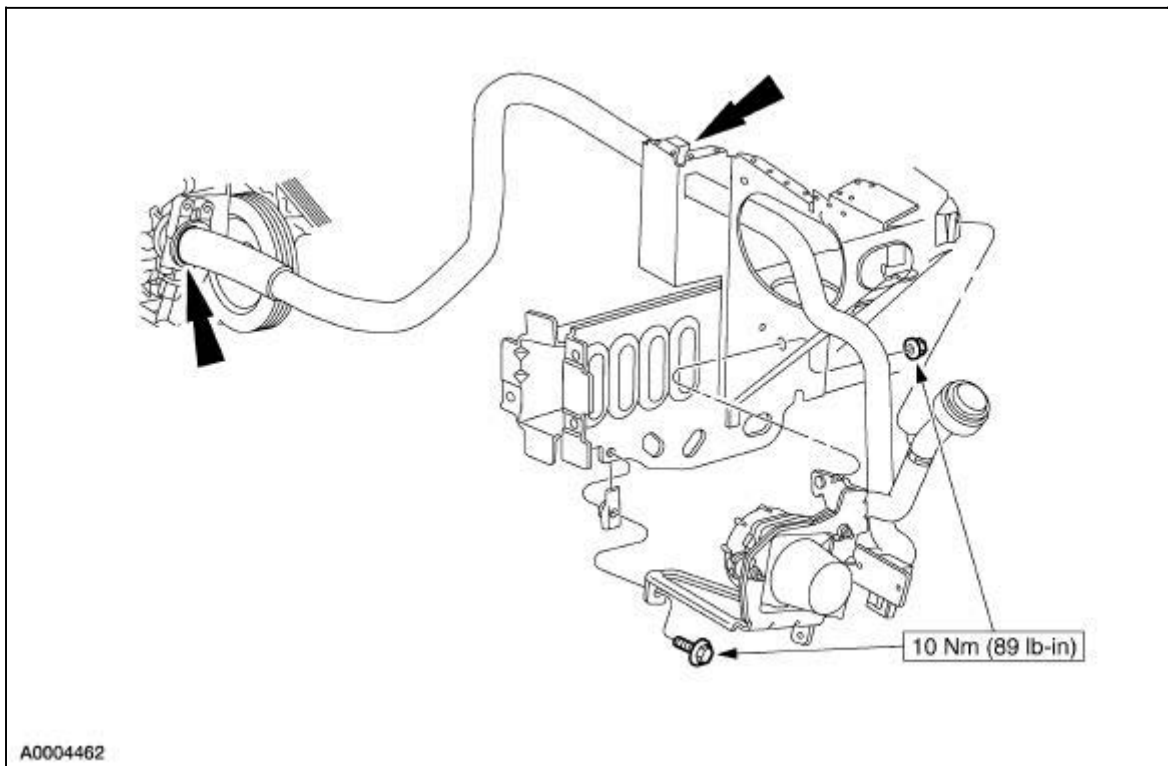
Secondary Air Pump —3.0L

Removal and Installation

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the inner fender splash shield.
3. Disconnect the electrical connectors and separate the wiring from the secondary air pump.



4. Remove the secondary air pump.
 - Disconnect and remove the pump-to-valve air tube.
 - Remove the bolt and nut, remove the secondary air pump.

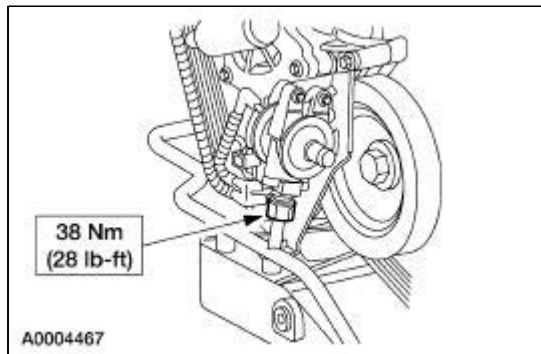


5. To install, reverse the removal procedure.

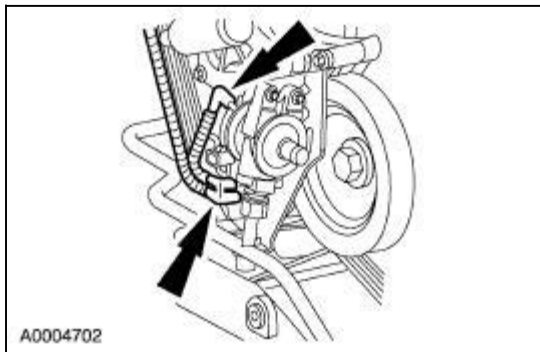
Secondary Air Valve —3.0L

Removal and Installation

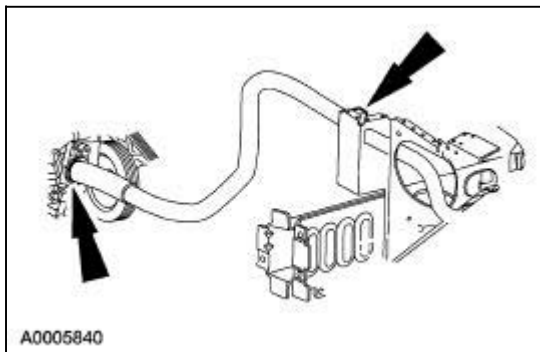
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Disconnect the secondary air tube from the valve.



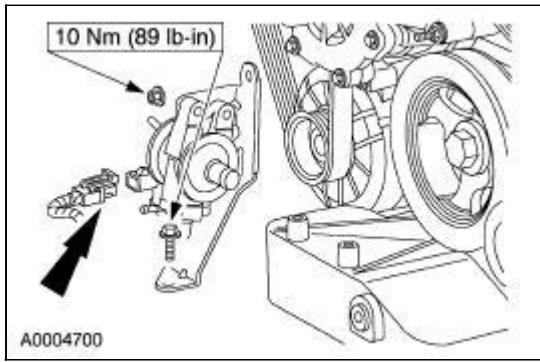
3. Disconnect the vacuum lines from the secondary air valve.



4. Disconnect and remove the pump-to-valve air tube.



5. Disconnect the electrical connector. Remove the nut and bolt. Remove the valve.

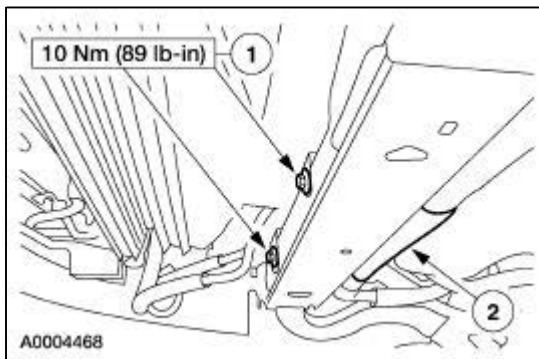


6. To install, reverse the removal procedure.
-

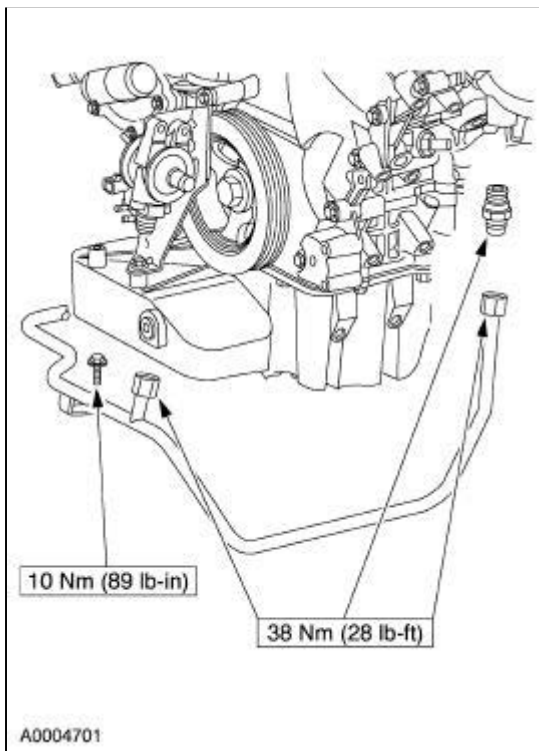
Secondary Air Valve —Tube, 3.0L

Removal and Installation

1. Remove the accessory drive belt from the generator pulley. For additional information, refer to [Section 303-05](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Disconnect the A/C line.



4. Remove the secondary air tube.



5. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-in
ACL outlet tube clamp screws	5	44
ACL outlet tube support nut	4	35

Intake Air Distribution and Filtering

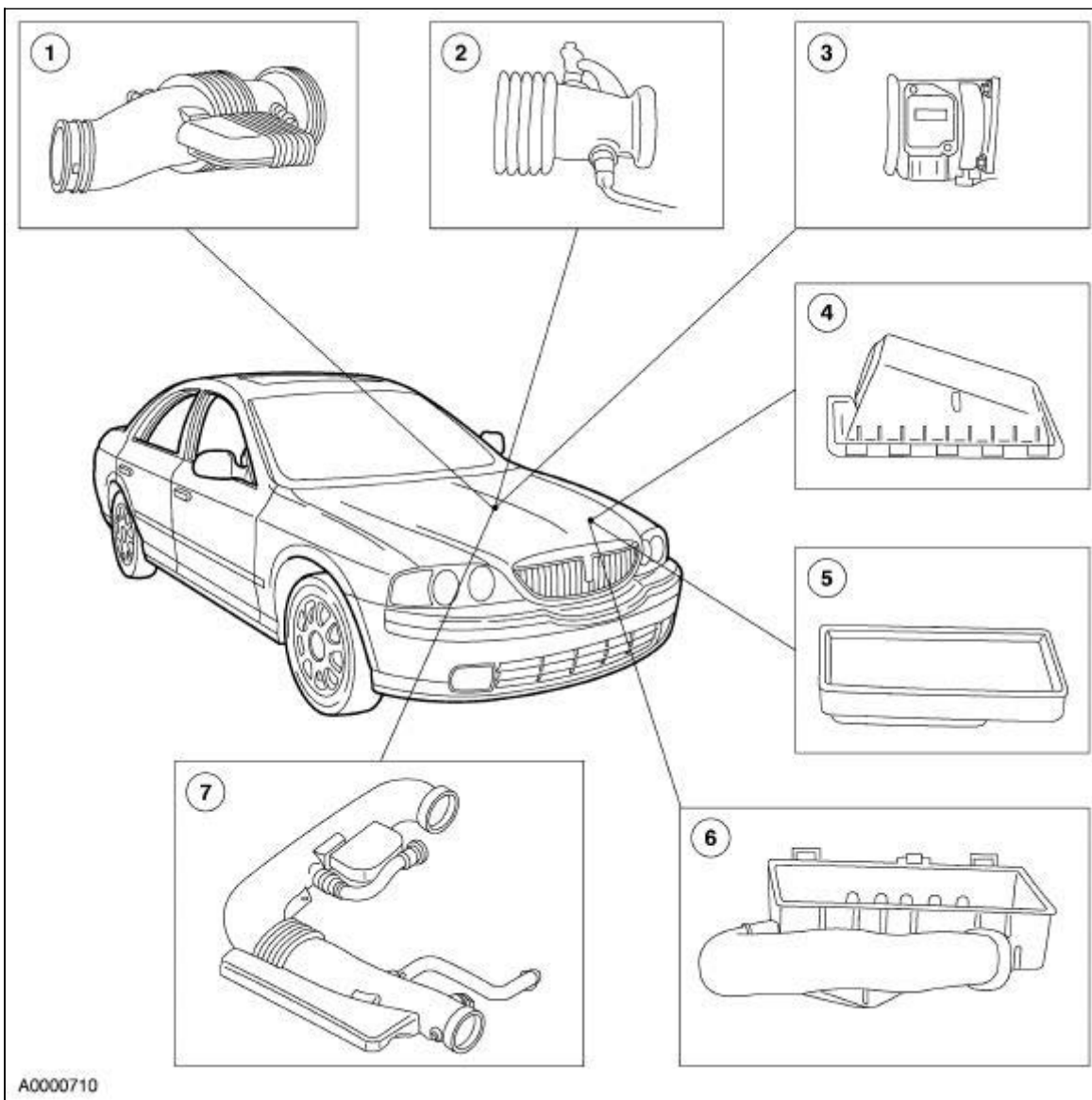
The air intake system consists of the:

- air cleaner (ACL) (inlet and outlet) (9600)
- air cleaner (ACL) element (9601)
- mass airflow (MAF) sensor (12B579)
- intake air temperature (IAT) sensor (12A697)
- air cleaner outlet tube (9F805)

The air intake system:

- cleans intake air with a replaceable air cleaner element.
- measures airflow with the MAF sensor. For additional information, refer to [Section 303-14](#).
- measures air temperature with the IAT.

Component Locations



A0000710

Item	Part Number	Description
1	9B659	Air cleaner outlet tube—3.0L
2	12A697	Intake air temperature sensor
3	12B579	Mass airflow sensor
4	9600	Air cleaner— outlet
5	9601	Air cleaner element
6	9600	Air cleaner— inlet
7	9F805	Air cleaner outlet tube—3.9L

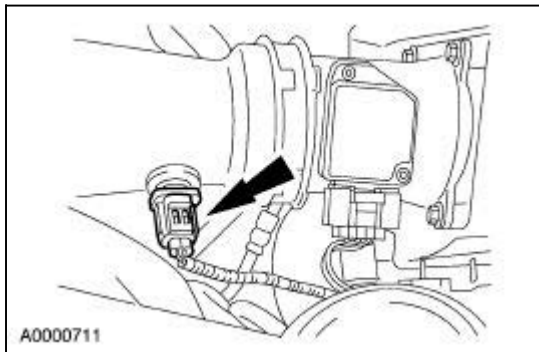
Intake Air Distribution and Filtering

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

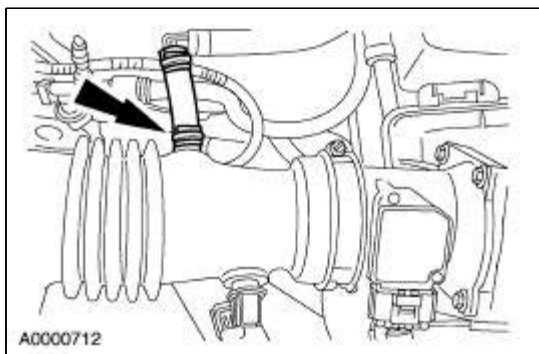
Air Cleaner Outlet Pipe —3.0L

Removal

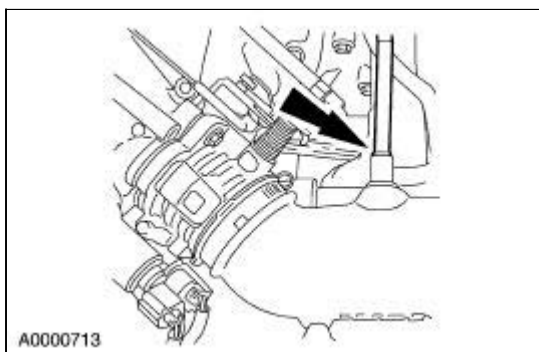
1. Disconnect the intake air temperature (IAT) sensor electrical connector.



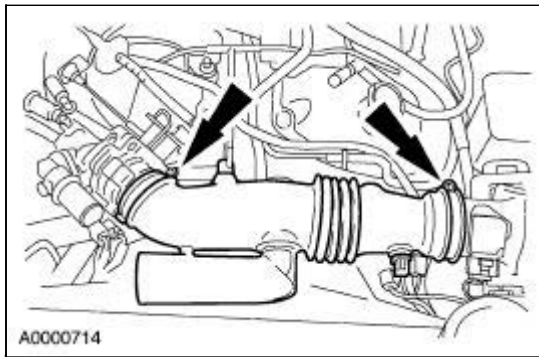
2. Disconnect the aspirator hose from the air cleaner outlet tube (9F805).



3. Disconnect the positive crankcase ventilation hose (6853).



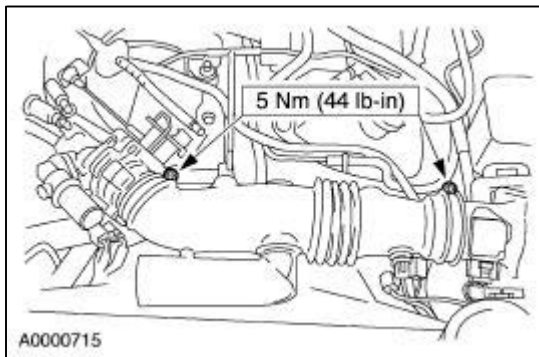
4. Loosen the hose clamp screws and remove the air cleaner outlet tube.



Installation

 **CAUTION:** The air cleaner outlet tube should be securely sealed to prevent unmeasured air from entering the engine.

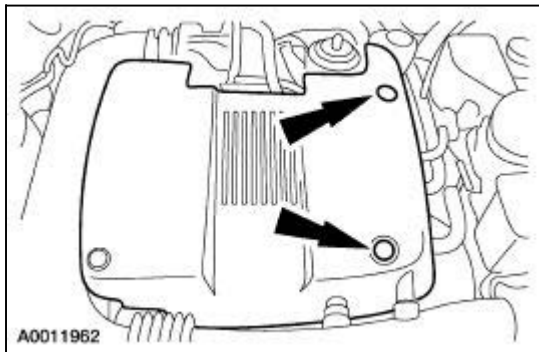
1. To install, reverse the removal procedure.



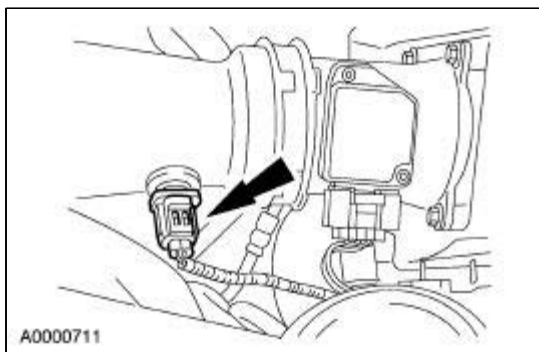
Air Cleaner Outlet Pipe —3.9L

Removal

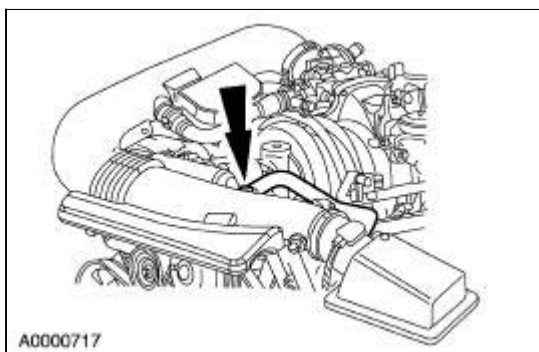
1. Remove the engine appearance cover (6N030).



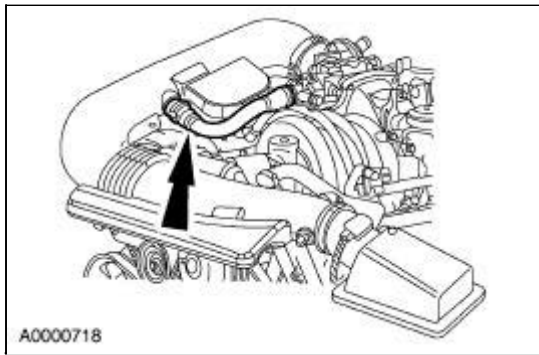
2. Disconnect the intake air temperature (IAT) sensor electrical connector.



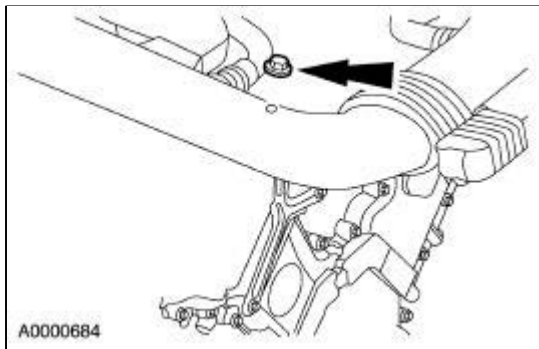
3. Disconnect the full load breather hose (9P903).



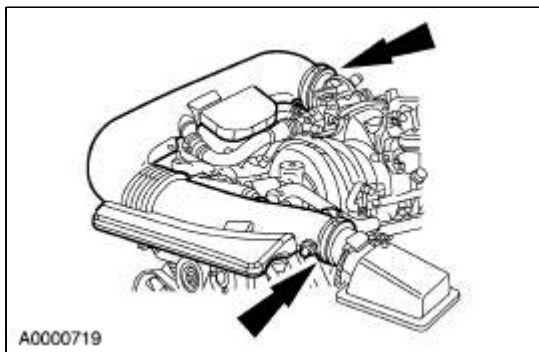
4. Disconnect the idle air control valve inlet tube (9K617).



5. Remove the air cleaner outlet tube support nut and washer.



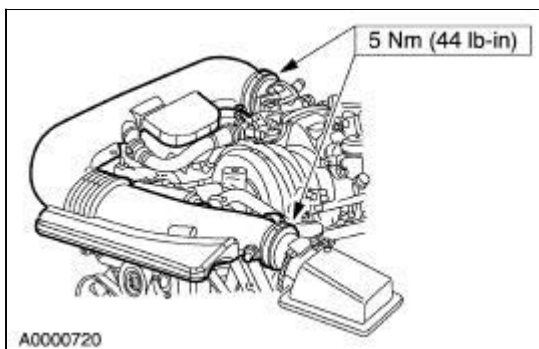
6. Loosen the hose clamp screws and remove the air cleaner outlet tube (9F805).



Installation

 **CAUTION:** The air cleaner outlet tube should be securely sealed to prevent unmeasured air from entering the engine.

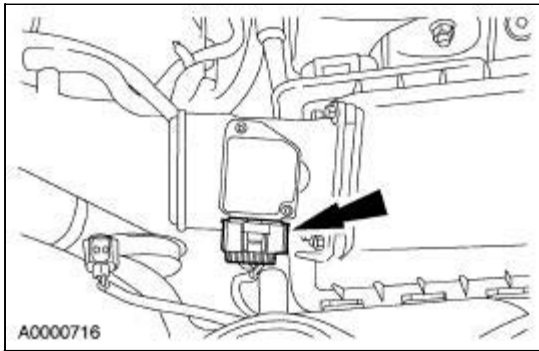
1. To install, reverse the removal procedure.



Air Cleaner —Outlet

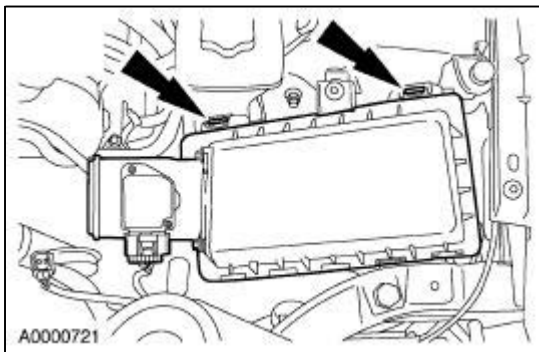
Removal

1. Remove the air cleaner outlet tube (9F805). For additional information, refer to [Air Cleaner Outlet Pipe—3.0L](#) or [Air Cleaner Outlet Pipe—3.9L](#) in this section.
2. Disconnect the electrical connector from the mass airflow (MAF) sensor (12B579).



3. **NOTE:** No tools are needed to remove the air cleaner (ACL) element (9601). The following removal and installation steps should be carried out using hands only.

Open the air cleaner snaps and remove the outlet side of the air cleaner (9600).



4. If necessary, remove the MAF sensor from the outlet side of the air cleaner. For additional information, refer to [Section 303-14](#).

Installation



CAUTION: The grommet used to seal the air cleaner housing must be fully seated. Failure to do so will result in unmetered air entering the engine.

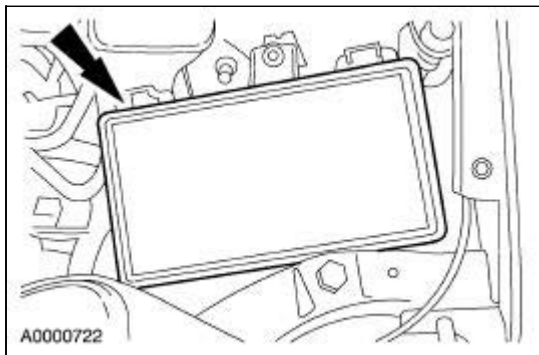
NOTE: Use the alignment notches to correctly align the inlet side and the outlet side of the air cleaner.

1. To install, reverse the removal procedure.

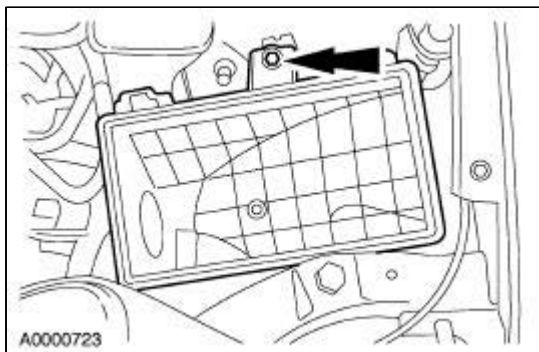
Air Cleaner —Inlet

Removal

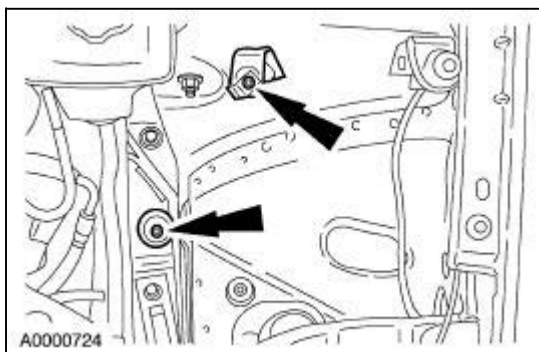
1. Remove the outlet side of the air cleaner (ACL) (9600). For additional information, refer to [Air Cleaner—Outlet](#) in this section.
2. Remove the air cleaner element (9601).



3. Remove the screw and the inlet side of the ACL.



4. If necessary, remove the grommet and bracket.



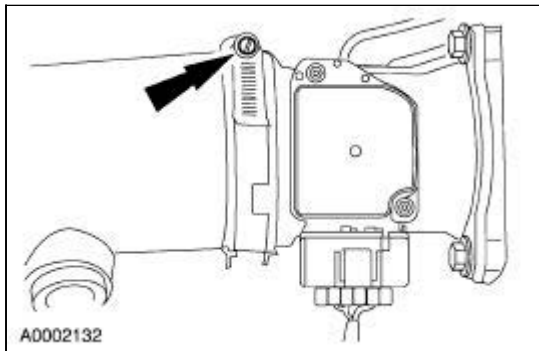
Installation

1. To install, reverse the removal procedure.

Air Cleaner Element

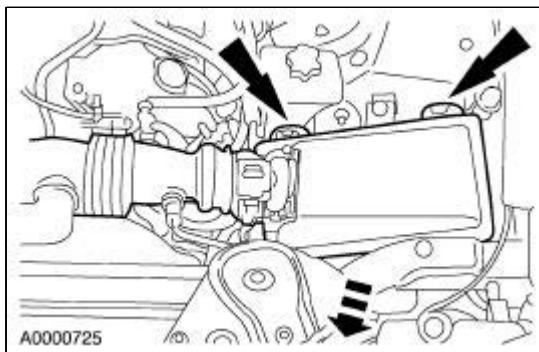
Removal

1. Loosen the clamp on the air cleaner (ACL) outlet tube (9F805) at the mass airflow (MAF) sensor (12B579).

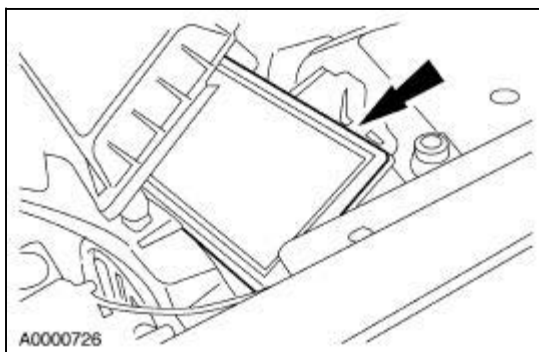


2. **NOTE:** No tools are needed to remove the air cleaner (ACL) element (9601). The following removal and installation steps should be carried out using hands only.

Open the air cleaner snaps and set the outlet side of the air cleaner (ACL) (9600) aside.



3. Remove the air cleaner (ACL) element (9601).



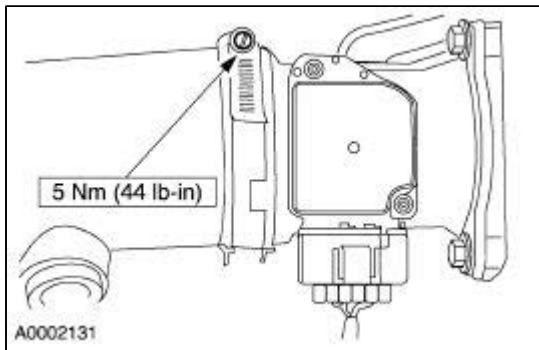
Installation

 **CAUTION:** The grommet used to seal the air cleaner housing must be fully seated. Failure

to do so will result in unmetered air entering the engine.

NOTE: Use the alignment notch to correctly align the inlet side and the outlet side of the air cleaner.

1. To install, reverse the removal procedure.



General Specifications

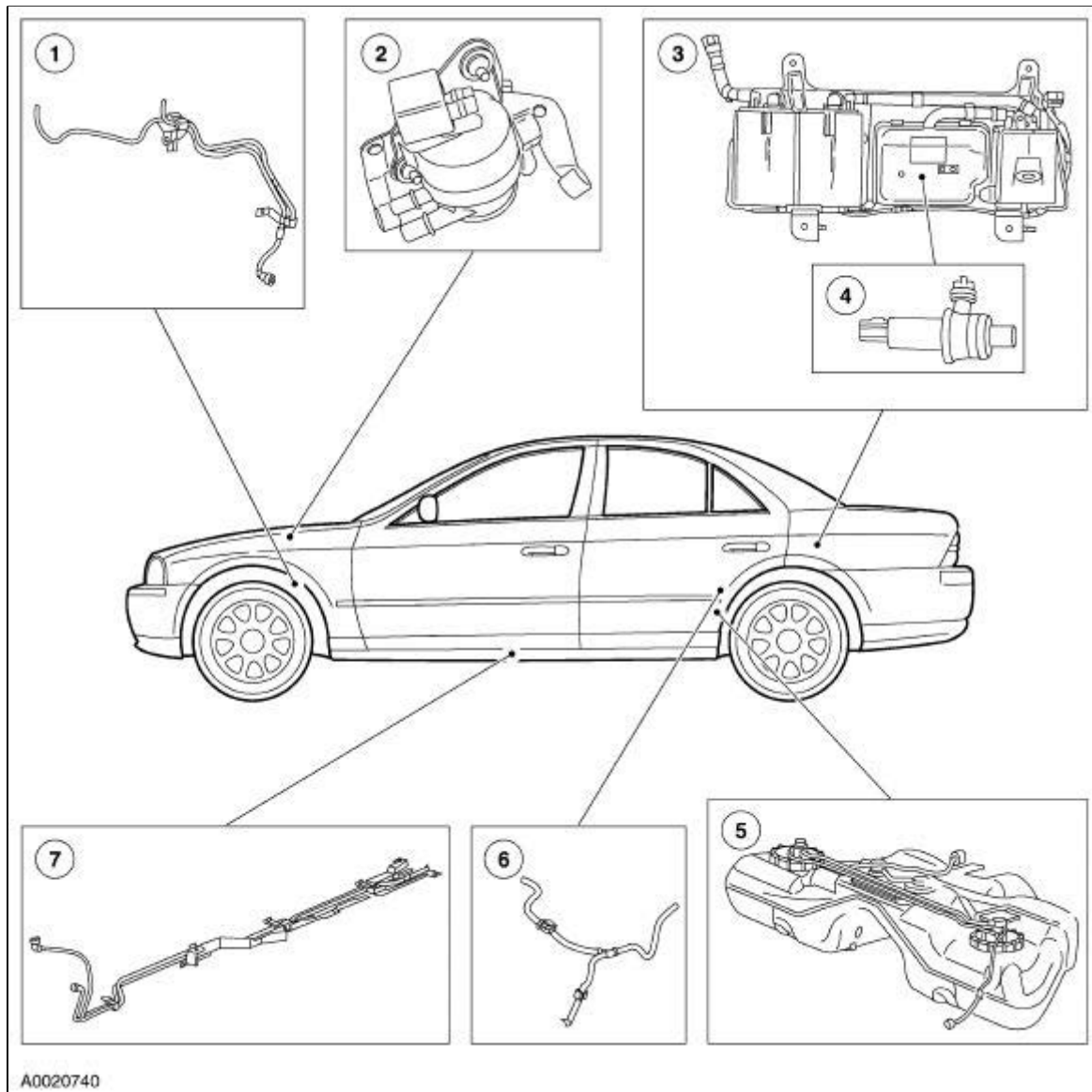
Item	Specification
MERPOL® O-ring Seal Lubricant	ESE-M99B144-B

Torque Specifications

Description	Nm	lb-ft	lb-in
Evaporative emission canister and bracket assembly bolts	10	—	89
Evaporative canister purge valve nuts	8	—	71
Evaporative canister purge valve bracket nuts	10	—	89
Differential bolt	114	84	—

Evaporative Emissions

Component Location



Item	Part Number	Description
1	9J280	Tube assembly —fuel supply and vapor (engine compartment)
2	9C915	EVAP canister purge valve
3	9E857	Evaporative emission (EVAP) canister with bracket assembly
4	9F945	Canister vent solenoid
5	9002	Fuel tank assembly
6	9C047	Fuel vapor control valve tube assembly

7	9S284	Tube assembly—fuel supply and vapor (underbody)
---	-------	---

The evaporative emission (EVAP) system:

- is equipped with an on-board refueling vapor recovery (ORVR) system.
- prevents hydrocarbon emissions from reaching the atmosphere.
- stores fuel vapors in the EVAP canister that are generated during vehicle refueling, vehicle operation or hot soak until they can be consumed by the engine.
- routes the stored fuel vapors to the engine during engine operation.
- is controlled by the powertrain control module (PCM) which uses various sensor inputs to calculate the desired amount of purge flow. The PCM regulates the purge flow, induced by the application of intake manifold vacuum, by varying the duty cycle applied to the EVAP canister purge valve.
- has an EVAP test port for test purposes.

The fuel vapors are routed:

- from the fuel tank through the fuel vapor control valve and fuel vapor vent valve.
- to the EVAP canister through a vapor line.
- to the engine when the EVAP canister purge valve is opened by the PCM.

The fuel tank pressure (FTP) sensor:

- monitors the pressure levels in the fuel tank.
- communicates the pressure reading to the PCM during the OBDII leak test.
- is permanently attached to the fuel vapor control valve tube assembly.

The evaporative emission canister:

- is located above the rear subframe.
- contains activated carbon.
- stores fuel vapors.

The fuel tank filler cap:

- relieves system pressure above 14 kPa (56.21 inches H₂O).
- relieves system vacuum below 3.8 kPa (15.26 inches H₂O).

The canister vent solenoid:

- is normally open.
- seals the EVAP system for the inspection and maintenance (I/M 240) test and OBDII leak and pressure tests.
- is mounted on the EVAP canister bracket assembly.
- is repaired as a separate item.

The evaporative emission (EVAP) canister purge valve:

- is normally closed.
- regulates purging of the EVAP canister.
- is controlled by the PCM.
- is located in the engine compartment near the LH strut tower.

Fuel vapor vent (FVV) valve

- in fuel tank mounted.
- prevents suspended liquid fuel from being drawn into the EVAP canister along with the fuel vapors.

Fuel vapor control valve:

- is fuel tank mounted.
- controls fuel tank refueling fill level.
- prevents suspended liquid fuel from being drawn into the EVAP canister along with the fuel vapors.
- relieves system pressure above 14 kPa (56.21 inches H₂O).

The underbody fuel supply and vapor tube assembly:

- is located under the LH rocker panel.
- includes both the fuel supply line and the EVAP canister purge outlet tube.
- supplies fuel from the fuel pump to the fuel filter.
- routes fuel vapors from the fuel vapor control valve tube assembly to the engine compartment fuel supply and vapor tube.
- is repaired as an assembly.

The engine compartment fuel supply and vapor tube assembly:

- is located on the LH side of the engine compartment.
- supplies fuel from the fuel filter to the fuel injection manifold.
- routes fuel vapors from the underbody fuel supply and vapor tube assembly to the EVAP canister purge valve.
- is repaired as an assembly.

The evaporative emission (EVAP) system monitor:

- is a self-test strategy within the PCM, which tests the integrity of the EVAP system.
- monitors the EVAP system for leaks.
- monitors electronic EVAP components for irrationally high or low voltages.
- monitors for correct EVAP system operation.
- uses negative and positive leak test methods to test and activate the EVAP system.

The evaporative emission (EVAP) test port:



- is used to connect the Evaporative Emission System Leak Tester to the EVAP system.
- is located on the EVAP canister purge valve.

The EVAP Running Loss System Leak Test:

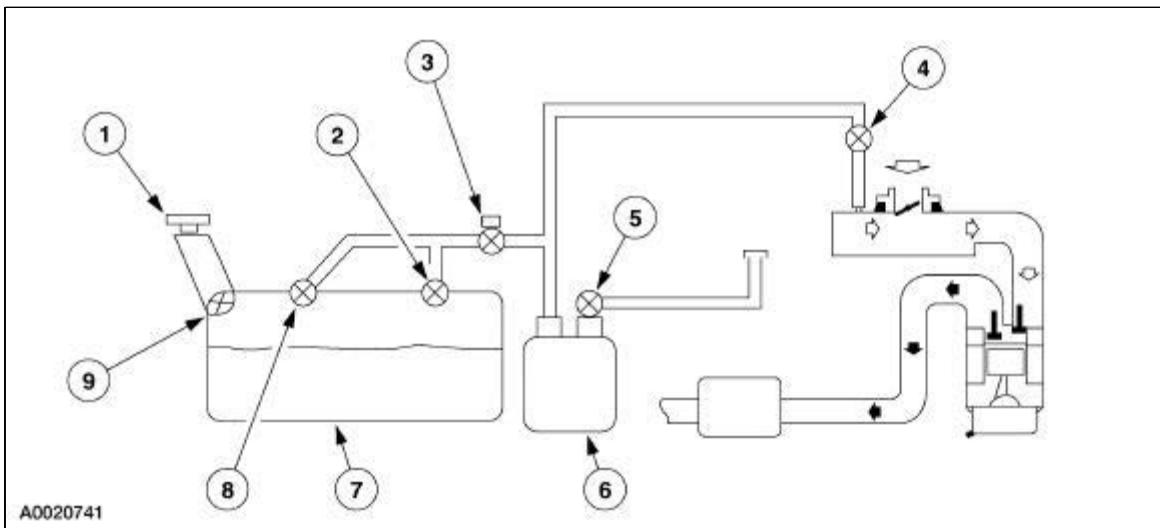
- utilizes intake manifold vacuum to test the EVAP system and involves several stages.
-

Evaporative Emissions

Special Tool(s)

 <p>ST2116-A</p>	<p>Evaporative Emission System Leak Tester 310-F007 (134-00130) or equivalent</p>
 <p>ST2332-A</p>	<p>Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool</p>

Evaporative Emission System



Item	Part Number	Description
1	9030	Fuel filler cap
2	9B190	Fuel vapor control valve
3	9C052	Fuel tank pressure sensor
4	9C915	Evaporative emission canister purge valve
5	9F945	Canister vent solenoid
6	9D653	Evaporative emission canister
7	9002	Fuel tank
8	9B593	Fuel vapor vent valve
9	9189	Fuel filler pipe check valve

Principles of Operation

Fuel Filler Cap

The fuel filler cap is used to prevent fuel spill and to close the EVAP system to the atmosphere.

Fuel Vapor Control Valve

The fuel vapor control valve is normally between the EVAP canister and the fuel vapor vent valve. Its function is to prevent the flow of liquid fuel into the EVAP canister or up to the canister purge valve during refueling, and to prevent the collection of liquid fuel in the fuel vapor hoses by overfilling the fuel tank.

Fuel Tank Pressure (FTP) Sensor

The fuel tank pressure sensor is used to measure the fuel tank pressure during the Evaporative Emissions Monitor Test. It is also used to control excessive fuel tank pressures by forcing the EVAP system to purge. The fuel tank pressure sensor is mounted in the fuel vapor control valve tube assembly as it crosses over the fuel tank.

Evaporative Emission (EVAP) Canister Purge Valve

The EVAP canister purge valve is controlled by the powertrain control module (PCM). The EVAP canister purge valve controls the flow of fuel vapors from the EVAP canister to the engine intake manifold during various engine operating modes. The EVAP canister purge valve is normally closed.

Canister Vent Solenoid

During the Evaporative Emission Running Loss System Test Monitor, Evaporative Emissions Repair Verification Drive Cycle, and the Evaporative Emission System Leak Test, the canister vent solenoid is closed to allow either a vacuum to be drawn on the fuel tank or to hold a specified pressure in the system. The canister vent solenoid is normally open.

Evaporative Emission (EVAP) Canister

Fuel vapors from the fuel tank are stored in the EVAP canister. When the engine is running, the vapors are purged from the EVAP canister for combustion.

Fuel Vapor Vent Valve (FVV) Assembly

The fuel vapor vent (FVV) valve assembly is mounted on the top of the fuel tank. It is used to control the flow of fuel vapors entering the EVAP system. The assembly also has a spring float, which prevents liquid fuel from entering the vapor delivery system under severe handling or vehicle rollover conditions. In the upright position, the open bottom of the float will lift and shut off the orifice. Under severe handling conditions, the spring will push the float closed when angles allow liquid fuel to reach the orifice. In a rollover condition, the weight of the open bottom float and spring pressure will close the orifice. The FVV valve has a pressure relief feature which will vent excessive fuel tank pressure to atmosphere.

Fuel Filler Pipe Check Valve

The fuel filler pipe check valve is an integral part of the fuel filler pipe. It is intended to prevent liquid fuel from re-entering the fuel filler pipe from the fuel tank on refueling or rollover conditions.

Evaporative Emission System Monitor

When a fault occurs, the EVAP system monitor is reset to NO and a diagnostic trouble code (DTC) is set in the PCM memory. After the DTC is repaired, the vehicle drive cycle must be completed to reset the monitor in preparation for inspection and maintenance testing.

EVAP Running Loss System Leak Test

To start the testing, conditions of stable purging and vehicle speed must be satisfied. During the first stage, the canister vent solenoid is closed, while the EVAP canister purge valve remains open, applying and building vacuum in the system as indicated by the FTP sensor. This phase checks for major leaks in the EVAP system.

In the second stage, the EVAP canister purge valve closes and the system looks for minimal decay rate in the EVAP vacuum, indicating the absence of any small EVAP system leaks.

The last stage is entered only if stage two of the leak test has failed and checks whether the failed test was due to excess vapor generation. It monitors fuel vapor generation rate. Initially, the canister vent solenoid is opened to equalize EVAP system pressure to atmosphere. Then the canister vent solenoid is closed, allowing pressure to build if vapor generation is present in sufficient quantity. If the rate of generation is found to be too high, the EVAP running loss system leak test is aborted. If not, then a small leak is diagnosed.

On-Board Refueling Vapor Recovery (ORVR) Evaporative Emission (EVAP) System

The basic elements forming the ORVR system are as follows:

- The fuel filler pipe forms a seal to prevent vapors from escaping the fuel tank while liquid is entering the fuel tank. Liquid in the one inch diameter tube blocks vapors from rushing back up the fuel filler pipe.
- A fuel vapor control valve controls the flow of vapors out of the fuel tank. The valve closes when the liquid level reaches a height associated with fuel tank usable capacity. The valve accomplishes the following:
 - Limits the total amount of fuel that can be dispensed into the fuel tank.
 - Prevents liquid gasoline from exiting the fuel tank when submerged or when tipped well beyond a horizontal plane as part of the vehicle rollover protection in road accidents.
 - Minimizes vapor flow resistance during anticipated refueling conditions.
- Fuel vapor tubing connects the fuel vapor control valve to the EVAP canister. This routes the fuel tank vapors, displaced by the incoming liquid, to the EVAP canister.
- A check valve in the fuel filling system prevents liquid from rushing back up the fuel filler pipe during the liquid flow variations associated with the filler nozzle shut-off.

Between refueling events, the EVAP canister is purged with fresh air so that it may be used again to store vapors accumulated during engine soaks or subsequent refueling events. The vapors drawn off of the carbon in the EVAP canister are consumed by the engine.

Inspection and Verification

1. Verify the customer concern is with the evaporative emission (EVAP) system.
2. Visually inspect the following for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
<ul style="list-style-type: none">● Fuel filler cap● EVAP test port

- EVAP canister or canister vent solenoid
- EVAP lines or hoses
- Vacuum lines or hoses

3. If the concern remains after the inspection, connect the scan tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the scan tool menu. If the scan tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the scan tool still does not communicate with the vehicle, refer to the scan tool manual.
5. Carry out the DATA LINK DIAGNOSTICS test. If the scan tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for PCM, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the PCM KOEO self-test.
6. If the DTCs retrieved are related to the concern, go to the PCM Diagnostic Trouble Code (DTC) Index to continue diagnostics.
7. If the concern remains after the inspection, determine the symptom and proceed to the Symptom Chart.

PCM Diagnostics Trouble Code (DTC) Index

DTC	Description	Source	Action
P0442	Small leak detected in EVAP system (As small as 1.02 mm [0.040 inch])	PCM	GO to Pinpoint Test A .
P0455	Major leak or no flow detected	PCM	GO to Pinpoint Test B .
P1443	Very small or no purge flow detected	PCM	GO to Pinpoint Test B .
P1450	Excessive vacuum detected in the fuel tank	PCM	GO to Pinpoint Test C .
—	Any other PCM DTC	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Hissing Sound When Removing Fuel Cap 	<ul style="list-style-type: none"> ● Canister vent solenoid. ● Evaporative emissions canister. ● Fuel vapor control valve 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D.

	<ul style="list-style-type: none"> ● tube assembly. ● EVAP canister tube. ● EVAP canister purge outlet tube. 	
<ul style="list-style-type: none"> ● Excessive Fuel Odor 	<ul style="list-style-type: none"> ● Canister vent solenoid. ● Evaporative emissions canister. ● Fuel vapor control valve tube assembly. ● Evaporative emissions test port. ● EVAP canister purge outlet tube. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test E.</u>
<ul style="list-style-type: none"> ● Unable to Refuel Vehicle 	<ul style="list-style-type: none"> ● Fuel filler pipe. ● Canister vent solenoid. ● Fuel vapor control valve tube assembly. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test F.</u>

Pinpoint Tests

NOTE: Reinstall or install new evaporative emission hose clamps removed or damaged during testing procedures.

PINPOINT TEST A: DTC P0442 SMALL LEAK IN EVAP SYSTEM

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Condition P0442 DTC set: less than 0.625 kPa (2.5 inches H₂O) bleed-up over 15 seconds at 75% fuel fill. Vapor generation limit: more than 0.625 kPa (2.5 inches H₂O) over 120 seconds.</p>	
<p>A1 VISUALLY INSPECT THE COMPONENTS FOR SMALL LEAKS</p>	
	<ol style="list-style-type: none"> 1 Check for the presence of a fuel filler cap. Do not tighten or check for correct installation at this time. 2 Verify the canister vent solenoid hose is correctly seated on the canister vent solenoid. 3 Check for cut or loose connections to fuel vapor hoses, tubes and connections in the following locations: <ul style="list-style-type: none"> ● EVAP canister to EVAP canister purge valve ● EVAP canister to fuel vapor vent valve assembly ● fuel vapor control valve tube assembly to fuel tank 4 Check the fuel filler pipe for damage. <ul style="list-style-type: none"> ● Is a concern with a hose, tube, connection or valve visually evident?

- **Yes**
REPAIR or INSTALL new components as necessary. GO to A2.
- **No**
GO to A2.

A2 CHECK AT THE EVAP TEST PORT FOR SMALL SYSTEM LEAKS

- 1 Disconnect and plug the evaporative emission return tube at the intake manifold.
 - 2 Complete the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section.
- **Does the system pass the leak test?**
- **Yes**
GO to A3.
 - **No**
GO to A4.

A3 VISUALLY INSPECT THE FUEL FILLER CAP

- 1 Visually inspect the fuel filler cap for damage.
- **Is the fuel filler cap damaged?**
- **Yes**
INSTALL a new fuel filler cap. GO to A4.
 - **No**
GO to A4.

A4 CHECK FOR SMALL LEAKS AT THE FUEL FILLER CAP AND EVAP TEST PORT

2



- 1 Connect the Evaporative Emission System Leak Tester to the fuel filler pipe.
- 3 Close the canister vent solenoid. Refer to Canister Vent Solenoid Closing Procedure in this section.
- 4 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).
- 5 Using the ultrasonic leak detector, check the fuel filler cap and EVAP test port for leaks.

● **Is a leak detected?**

→ **Yes**
REPAIR or INSTALL new components as necessary. GO to [A5](#).

→ **No**
INSTALL the fuel filler cap. CARRY OUT the evaporative emission system leak test. REFER to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emissions repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

A5 CHECK FOR CONCERN OTHER THAN THE FUEL FILLER CAP

1 Refer to previous test results.

● **Did the system pass the evaporative emission system leak test carried out in pinpoint test Step A2?**

→ **Yes**
CARRY OUT the evaporative emission system leak test. REFER to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**
INSTALL the fuel filler cap. GO to [A6](#).

A6 CHECK FOR SMALL LEAK WITH TESTER SET AT FILL POSITION

2



1 Connect the Evaporative Emission System Leak Tester to the EVAP test port.

3 Close the canister vent solenoid. Refer to [Canister Vent Solenoid Closing Procedure](#) in this section.

4 Turn the selector on the Evaporative Emission System Leak Tester to the FILL position.

5 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

● **Does the pressure on the EVAP**

system hold between 3.43 kPa and 3.53 kPa (13.80 inches and 14.20 inches H₂O)?

→ **Yes**
GO to A7.

→ **No**
DISCONTINUE pressurizing the system.
GO to A8.

A7 CHECK FOR LEAKS IN THE COMPLETE EVAP SYSTEM

2



1 Connect the Evaporative Emission System Leak Tester to the EVAP test port.

3 Close the canister vent solenoid. Refer to Canister Vent Solenoid Closing Procedure in this section.

4 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

5 Using the ultrasonic leak detector, check the following EVAP system locations:

- EVAP return tube to EVAP canister purge valve
- EVAP canister purge valve to EVAP canister— canister vent solenoid assembly
- EVAP canister — canister vent solenoid assembly to fuel tank
- fuel filler cap and fuel filler tube

● **Is a leak detected at EVAP return tube, EVAP canister purge outlet tube or EVAP canister tube or associated hose?**

→ **Yes**
REPAIR or INSTALL new components as necessary. CARRY OUT the evaporative emission system leak test. REFER to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emissions repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
DISCONTINUE pressurizing the system.
GO to A8.

A8 CHECK FOR SMALL LEAK FROM THE EVAP RETURN TUBE TO THE FUEL VAPOR

CONTROL VALVE TUBE

1



1 Disconnect the fuel vapor control valve tube assembly from the under vehicle fuel supply and vapor tube assembly. Plug the open end of the under vehicle fuel supply and vapor tube assembly.

2 Connect the Evaporative Emission System Leak Tester to the EVAP test port.

3 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

4 Using the ultrasonic leak detector, check the EVAP system from the intake manifold to the plugged end of the under vehicle fuel supply and vapor tube assembly.

● **Is a leak detected?**

→ **Yes**
REPAIR or INSTALL new components as necessary. REPEAT Step A6 to verify the repair. GO to [A9](#).

→ **No**
GO to [A9](#).

A9 CHECK FOR SMALL LEAK BETWEEN EVAP CANISTER AND FUEL TANK FILLER PIPE

4



1 Connect the Evaporative Emission System Leak Tester to the fuel filler pipe.

2 Transfer the plug from the under-vehicle fuel supply and vapor tube assembly to the fuel vapor control valve tube .

3 Turn the Evaporative Emission System Leak Tester selector to the FILL position.

5 Close the canister vent solenoid. Refer to [Canister Vent Solenoid Closing Procedure](#) in this section.

6 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

7 Using the ultrasonic leak detector, check

the fuel vapor control valve tube to the fuel tank for leaks. Check the fuel tank pressure sensor, fuel vapor control valve tube and the fuel filler pipe. Check tubes from the fuel tank to the EVAP canister and the canister vent solenoid.

● **Is a leak detected?**

→ **Yes**
REPAIR or INSTALL new components as necessary.

GO to A10.

→ **No**
GO to A10.

A10 CHECK EVAP SYSTEM AT FUEL FILLER PIPE

1 Reconnect the fuel vapor control valve tube assembly to the under-vehicle fuel supply and vapor tube assembly.

2 Complete the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section.

● **Does the EVAP system pass the leak test?**

→ **Yes**
RESTORE the system to normal operation. CARRY OUT the evaporative emission system leak test. REFER to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emissions repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
GO to A6.

PINPOINT TEST B: DTC P0455 MAJOR LEAK OR NO FLOW DETECTED OR DTC P1443 VERY SMALL OR NO PURGE FLOW DETECTED IN SYSTEM

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Condition DTC P0455 set: -1.74 kPa (-7.0 inches H ₂ O) over 30 seconds.	
NOTE: Condition DTC P1443 set: -1.74 kPa (-7.0 inches H ₂ O) over 30 seconds with more than 0.02 lb/min vapor flow.	
B1 CHECK FOR DIAGNOSTIC TROUBLE CODE P0455 OR P1443	

1 Use the recorded results from the PCM DTCs.

● **Is DTC P0455 present?**

→ **Yes**
GO to B2.

→ **No**
GO to B3.

B2 VISUALLY CHECK FOR GROSS EVAP SYSTEM LEAKS

1 Check for the presence of a fuel filler cap. Do not tighten or check for correct installation at this time.

2 Check the input port vacuum and EVAP return tube are connected to the EVAP canister purge valve.

3 Check that the canister vent solenoid hose is correctly attached to the canister vent solenoid.

4 Check for disconnected or cracked fuel vapor hoses or tubes between the intake manifold and following components:

- EVAP canister purge valve
- EVAP canister
- fuel vapor vent valve assembly
- fuel vapor control valve tube assembly

5 Check for damaged fuel tank or fuel filler pipe.

● **Is a concern with a hose, tube, connection or valve visually evident?**

→ **Yes**
REPAIR or INSTALL new EVAP components as necessary. GO to B3.

→ **No**
GO to B3.

B3 CHECK FOR EVAP SYSTEM LEAKS

1 Disconnect the EVAP return tube from the intake manifold and plug the EVAP return tube.

2 Connect the Evaporative Emissions System Leak Tester to the EVAP test port.

3 Carry out the evaporative emissions system leak test. Refer to Evaporative Emission System Leak Test in this section.

● **Does the system pressure stay above 1.99 kPa (8 inches H₂O)?**

→ **Yes**
GO to B4.

→ **No**
VERIFY that the fuel filler cap is installed correctly. REPAIR or INSTALL new components as necessary. CARRY OUT the evaporative emission system leak test. REFER to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair

Verification Drive Cycle in this section.

B4 CHECK FOR BLOCKAGE BETWEEN THE EVAP CANISTER PURGE VALVE AND CANISTER VENT SOLENOID

1



2 Close the canister vent solenoid. Refer to Canister Vent Solenoid Closing Procedure in this section.

3 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

4 Open the canister vent solenoid.

● **Does the pressure drop immediately?**

→ **Yes**
GO to B5.

→ **No**
Go to Pinpoint Test D.

B5 CHECK FOR BLOCKAGE BETWEEN FUEL FILLER PIPE AND THE FUEL VAPOR CONTROL VALVE TUBE ASSEMBLY

1 Connect the Evaporative Emissions System Leak Tester to the fuel filler pipe.

2 Pressurize the EVAP system to 6.47 to 6.97 kPa (26 to 28 inches H₂O).

● **Does the pressure drop immediately?**

→ **Yes**
GO to B6.

→ **No**
Go to Pinpoint Test D.

B6 CHECK FOR FAILED EVAP CANISTER PURGE VALVE OR FUEL TANK PRESSURE SENSOR

1 Use the recorded results from the PCM DTCs.

● **Are DTC codes P0455 and P1443 present?**

→ **Yes**
INSTALL a new EVAP canister purge valve. REFER to Evaporative Emission Canister Purge Valve in this section. CARRY OUT the evaporative emission system leak test. REFER to Evaporative Emission System Leak Test in this section. If no leak is detected, CARRY OUT the evaporative emissions repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
INSTALL a new fuel tank. REFER to Section 310-01. CARRY OUT the evaporative emission system leak test. REFER to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY out the evaporative emission repair verification drive cycle. REFER to

PINPOINT TEST C: DTC P1450 EXCESSIVE VACUUM DETECTED IN THE FUEL TANK

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Condition P1450 DTC set: more than -1.79 kPa (-7.2 inches H₂O) over 30 seconds.</p>	
<p>C1 CHECK FOR VISUAL CAUSES OF EXCESSIVE FUEL TANK VACUUM</p>	
	<ol style="list-style-type: none"> 1 Check for kinks or bends in the fuel vapor hoses and tubes. 2 Visually check the canister vent solenoid inlet port for contamination or foreign material. 3 Check the canister vent solenoid for blockage or contamination. <ul style="list-style-type: none"> ● Is a concern with a hose, tube, connection or component visually evident? <p>→ Yes REMOVE any contamination or foreign material around fuel vapor hoses and tubes. REPAIR the hoses, tubes or components as necessary. After all visual concerns are repaired, GO to <u>C2</u>.</p> <p>→ No GO to <u>C2</u>.</p>
<p>C2 CHECK FOR BLOCKAGE BETWEEN EVAP TEST PORT AND CANISTER VENT SOLENOID</p>	
	<ol style="list-style-type: none"> 1 Disconnect and plug the EVAP return tube at the intake manifold. 2 Connect the Evaporative Emissions System Leak Tester to the EVAP test port. 3 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O). <ul style="list-style-type: none"> ● Does the pressure drop immediately? <p>→ Yes GO to <u>C3</u>.</p> <p>→ No GO to <u>Pinpoint Test D</u>.</p>
<p>C3 CHECK FOR BLOCKAGE BETWEEN THE FUEL FILLER PIPE AND THE FUEL VAPOR CONTROL VALVE TUBE ASSEMBLY</p>	

- 1 Connect the Evaporative Emission System Leak Tester to the fuel filler pipe.
- 2 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

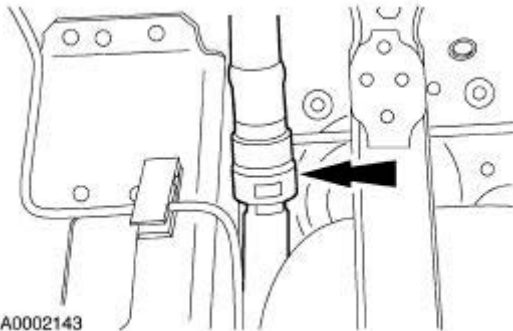
● **Does the pressure drop immediately?**

→ **Yes**
GO to C4.

→ **No**
GO to Pinpoint Test D.

C4 CHECK FOR FUEL TANK PRESSURE SENSOR PID WITHOUT PRESSURE APPLIED

1



2



- 1 Disconnect the EVAP canister outlet tube from the fuel vapor control valve tube assembly.

3 Access PCM PID FTP V.

4 Record the reading.

● **Is PID FTP V reading between 2.40 and 2.80 volts?**

→ **Yes**
GO to C5.

→ **No**
REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue diagnosis.

C5 CHECK FOR STUCK OPEN EVAP CANISTER PURGE VALVE CONDITION AT IDLE

- 1 Reconnect the EVAP canister outlet tube.
- 2 Remove the plug from the EVAP return tube and reconnect the tube to the intake manifold.
- 3 Verify that the fuel filler cap is correctly installed.

4



- 5 Access PCM PIDs FTP V and EVAPPDC.
- 6 Start the engine and allow to idle.
- 7 Monitor the FTP V and EVAPPDC PIDs.

● **When PID EVAPPDC is zero, is PID FTP V reading below 2.40 volts?**


→ **Yes**

INSTALL a new EVAP canister purge valve. REFER to [Evaporative Emission Canister Purge Valve](#) in this section. CARRY OUT an EVAP system leak test. REFER to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT an evaporative emissions repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**

CARRY OUT the EVAP system leak test. REFER to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emissions repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

PINPOINT TEST D: HISS WHEN OPENING FUEL CAP OR UNABLE TO REFUEL VEHICLE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 TEST FOR FUEL TANK PRESSURE SENSOR OPERATION	
<p>2</p> 	<ul style="list-style-type: none"> 1 Connect the Evaporative Emission System Leak Tester to the fuel filler pipe. 3 Close the canister vent solenoid. Refer to Canister Vent Solenoid Closing Procedure in this section. 4 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

- Is the FTP (FTP V) PID reading 3.11 kPa to 3.86 kPa (12.5 to 15.5 inches H₂O) (4.22 to 4.90 volts)?

→ **Yes**
GO to D2.

→ **No**
GO to D3.

D2 TEST FOR BLOCKAGE IN VENTING PORTION OF EVAP SYSTEM

1 Open the canister vent solenoid.

- Does the pressure drop immediately?

→ **Yes**
CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
GO to D5.

D3 TEST FOR BLOCKAGE IN FUEL FILLER PIPE

1 Connect the Evaporative Emission System Leak Tester to the fuel filler pipe.

2 Disconnect the fuel filler pipe from the fuel tank.

3 Pressurize the EVAP system to (3.48 kPa) (14 inches H₂O).

- Does the pressure drop immediately?

→ **Yes**
GO to D4.

→ **No**
INSTALL a new fuel filler pipe assembly. REFER to Section 310-01. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

D4 TEST FOR PINCHED FUEL VAPOR CONTROL VALVE TUBE

- 1 Reconnect the fuel filler pipe to the fuel tank.
- 2 Lower the fuel tank about 19mm (0.75 in).
- 3 Connect the Evaporative Emission System Leak Tester to the fuel filler pipe.
- 4 Close the canister vent solenoid. Refer to [Canister Vent Solenoid Closing Procedure](#) in this section.
- 5 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

- Is the FTP (FTP V) PID reading 3.11 kPa to 3.86 kPa (12.5 to 15.5 inches H₂O)(4.22 to 4.90 volts)?

→ **Yes**

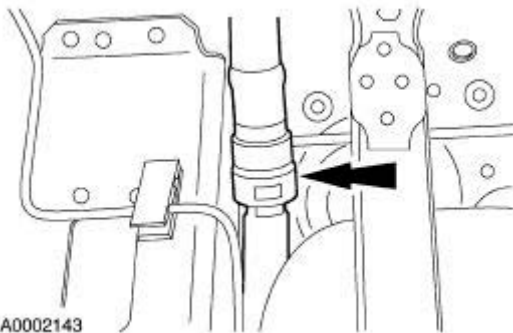
Fuel vapor control valve tube is pinched. INSTALL a new fuel tank assembly. REFER to [Section 310-01](#). CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**

Fuel vapor control valve tube or fuel tank vapor control valve is blocked. INSTALL a new fuel tank assembly. REFER to [Section 310-01](#). CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

D5 ISOLATE LOCATION OF BLOCKAGE

1



A0002143

1

- 1 Disconnect the fuel vapor control valve tube assembly from the EVAP canister purge outlet tube.

2 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

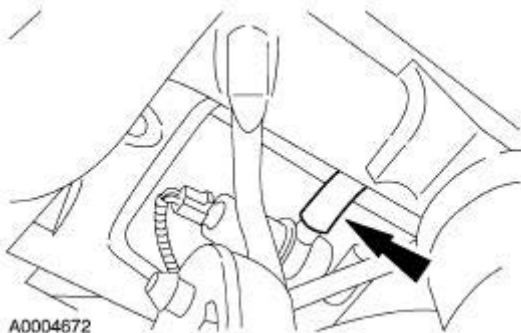
● **Does the pressure drop immediately?**

→ **Yes**
GO to D6.

→ **No**
INSTALL a new fuel tank assembly.
REFER to Section 310-01.
RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

D6 TEST FOR BLOCKAGE IN CANISTER VENT SOLENOID

3



1 Reconnect the fuel vapor control valve tube assembly to the EVAP canister purge outlet tube.

2 Lower the differential to access the canister vent solenoid as necessary. If necessary, refer to Section 205-02.

3 Disconnect the canister vent solenoid from the canister vent solenoid hose.

4 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

● **Does the pressure drop immediately?**

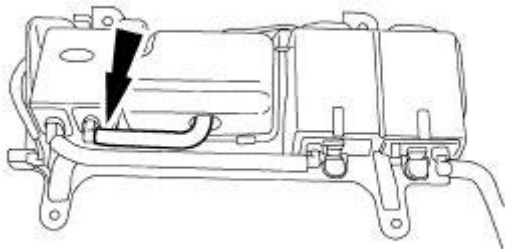
→ **Yes**
INSTALL a new canister vent solenoid.
REFER to Evaporative Emission Canister Vent Solenoid in this section.
RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair

verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**
GO to [D7](#).

D7 TEST FOR BLOCKAGE IN THE CANISTER VENT SOLENOID HOSE

4



A0004673

- 1 Reinstall the differential. If necessary, refer to [Section 205-02](#).
- 2 Lower the rear subframe out of the way to access the EVAP canister with bracket assembly. Refer to [Section 502-00](#).
- 3 Lower the EVAP canister with bracket assembly.
- 4 Disconnect the canister vent solenoid hose from the 1.0L EVAP canister.

- 5 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

- **Does the pressure drop immediately?**

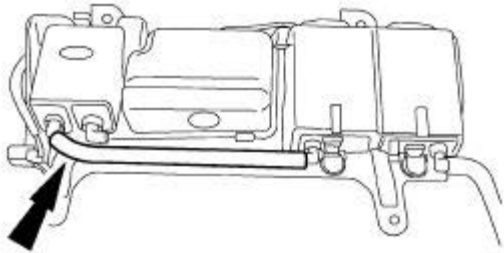
→ **Yes**
INSTALL a new canister vent solenoid hose. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**
GO to [D8](#).

D8 TEST FOR BLOCKAGE IN 1.0L EVAP CANISTER

1

- 1 Disconnect the fuel vapor storage canister inlet tube from the 1.0L EVAP canister.



A0004674

- 2 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

- Does the pressure drop immediately?

→ Yes

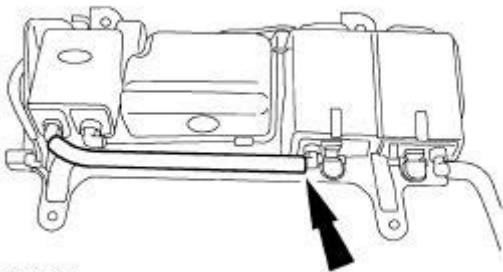
INSTALL a new 1.0L EVAP canister. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ No

GO to [D9](#).

D9 TEST FOR BLOCKAGE IN FUEL VAPOR STORAGE CANISTER INLET TUBE

1



A0004675

- 1 Disconnect the fuel vapor storage canister inlet tube from the 2.0L EVAP canister.

- 2 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

- Does the pressure drop immediately?

→ Yes

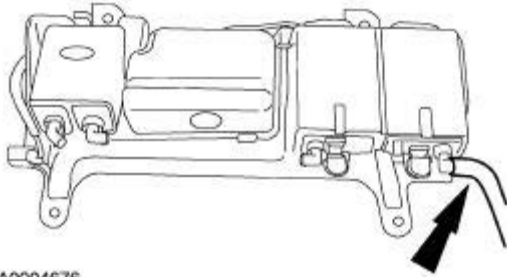
INSTALL a new fuel vapor storage canister inlet tube. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System](#)

Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
GO to D10.

D10 TEST FOR BLOCKAGE IN 2.0L EVAP CANISTER

1



A0004676

1 Disconnect the EVAP canister purge outlet tube from the 2.0L EVAP canister.

2 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

- Does the pressure drop immediately?

→ **Yes**
INSTALL a new 2.0L EVAP canister. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
INSTALL a new EVAP canister purge outlet tube. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

PINPOINT TEST E: EXCESSIVE FUEL ODOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
------------	-------------------------

E1 TEST THE EVAPORATIVE EMISSION (EVAP) RUNNING LOSS SYSTEM MONITOR

1 Carry out the evaporative emission repair verification drive cycle. Refer to Evaporative Emission Repair Verification Drive Cycle in this section.

● **Are PCM DTCs retrieved?**

→ **Yes**
For DTCs P0442, P0455, P1443 and P1450 REFER to the Diagnostic Trouble Code (DTC) Index in this section. For all other DTCs, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

→ **No**
GO to E2.

E2 EVAPORATIVE EMISSION SYSTEM LEAK TEST

1 Carry out the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section.

● **Does the EVAP system pass the leak test?**

→ **Yes**
GO to E3.

→ **No**
GO to E9.

E3 TEST FOR FUEL TANK PRESSURE SENSOR OPERATION

1 Connect the Evaporative Emission System Leak Tester to the fuel filler pipe.

2 Close the canister vent solenoid. Refer to Canister Vent Solenoid Closing Procedure in this section.

3 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

● **Is the FTP (FTP V) PID reading 3.11 kPa to 3.86 kPa (12.5 to 15.5 inches H₂O)(4.22 to 4.90 volts)?**

→ **Yes**
GO to E4.

→ **No**
GO to Pinpoint Test D.

E4 TEST FOR BLOCKAGE IN VENTING PORTION OF THE EVAP SYSTEM

1 Open the canister vent solenoid.

- Does the pressure drop immediately?

→ **Yes**
GO to E5.

→ **No**
GO to Pinpoint Test D.

E5 TEST FOR BLOCKAGE THROUGH EVAPORATIVE EMISSION TEST PORT

- 1 Connect the Evaporative Emission System Leak Tester to the evaporative emission test port.
- 2 Close the canister vent solenoid. Refer to Canister Vent Solenoid Closing Procedure in this section.
- 3 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

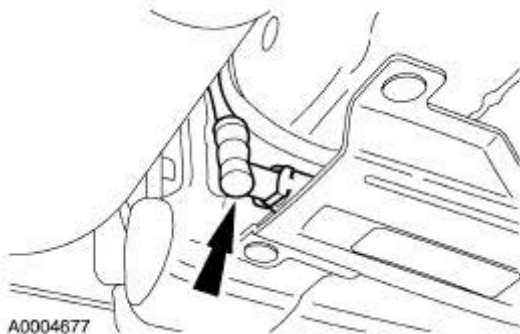
- Is the FTP (FTP V) PID reading 3.11 kPa to 3.86 kPa (12.5 to 15.5 inches H₂O)(4.22 to 4.90 volts)?

→ **Yes**
Evaporative emission system operating correctly. RETURN to Symptom Chart.

→ **No**
GO to E6.

E6 TEST FOR BLOCKAGE IN FUEL VAPOR CONTROL VALVE TUBE ASSEMBLY

1



- 1 Disconnect the fuel vapor control valve tube assembly from the under vehicle fuel supply and vapor tube assembly.

- 2 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

- Does the pressure drop immediately?

→ **Yes**
Blockage located in the fuel vapor control valve tube. INSTALL a new fuel tank assembly. REFER to Section 310-01. CARRY OUT the evaporative emission system leak test. Refer to Evaporative

Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
GO to E7.

E7 TEST FOR BLOCKAGE IN UNDER-VEHICLE FUEL SUPPLY AND VAPOR TUBE ASSEMBLY

1 Disconnect the under-vehicle fuel supply and vapor tube from the engine compartment fuel supply and vapor tube.

2 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

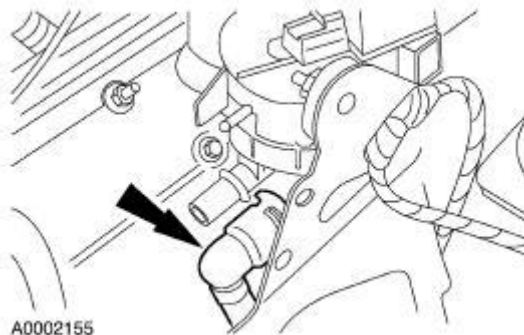
● **Does the pressure drop immediately?**

→ **Yes**
INSTALL a new under-vehicle fuel supply and vapor tube assembly. REFER to Section 310-01. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
GO to E8.

E8 TEST FOR BLOCKAGE IN THE ENGINE COMPARTMENT FUEL SUPPLY AND VAPOR TUBE ASSEMBLY

1



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1 Disconnect the engine compartment fuel supply and vapor tube assembly from the evaporative emission canister purge valve.

2 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

● **Does the pressure drop immediately?**

→ **Yes**

INSTALL a new engine compartment fuel supply and vapor tube assembly. RECONNECT all components. GO to [E7](#). CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**

INSTALL a new evaporative emission canister purge valve. REFER to [Evaporative Emission Canister Purge Valve](#) in this section. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

E9 TEST TO DETERMINE GENERAL LOCATION OF LEAK

2



1 Connect the Evaporative Emission System Leak Tester to the fuel filler pipe.

2 Disconnect the fuel vapor control valve tube from the under-vehicle fuel supply and vapor tube assembly and plug both tubes.

3 Carry out the Evaporative Emission System Leak Test procedure. Refer to [Evaporative Emission System Leak Test](#) in this section.

● **Does the system pass the leak test?**

→ **Yes**

Leak is in the front portion of the EVAP system. GO to [E10](#).

→ **No**

Leak is in the rear portion of the EVAP system. GO to [E14](#).

E10 TEST TO CONFIRM LEAK IS IN THE FRONT PORTION OF THE EVAP SYSTEM

- 1 Connect the Evaporative Emission System Leak Tester to the EVAP system test port.
- 2 Plug the under-vehicle fuel supply and vapor tube assembly.
- 3 Carry out the Evaporative Emission System Leak Test. Refer to Evaporative Emission System Leak Test in this section.

● **Does the EVAP system pass the leak test?**

→ **Yes**
INSTALL new O-ring seals between the evaporative emission fuel vapor control valve tube assembly and the under-vehicle fuel supply and vapor tube assembly. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
GO to E11.

E11 TEST FOR LEAK IN UNDER-VEHICLE FUEL SUPPLY AND VAPOR TUBE ASSEMBLY

- 1 Disconnect the under-vehicle fuel supply and vapor tube assembly from the engine compartment fuel supply and vapor tube assembly.
- 2 Plug the engine compartment fuel supply and vapor tube assembly.
- 3 Carry out the Evaporative Emission System Leak Test procedure. Refer to Evaporative Emission System Leak Test in this section.

● **Does the system pass the leak test?**

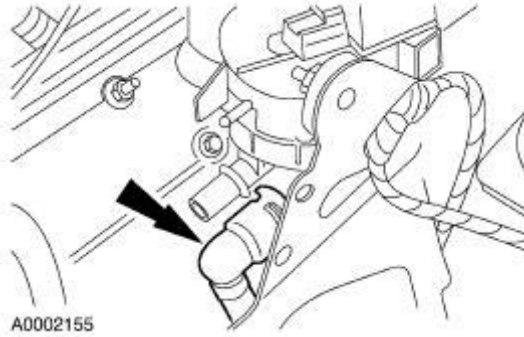
→ **Yes**
INSTALL a new under-vehicle fuel supply and vapor tube assembly. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification

drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
GO to E12.

E12 TEST FOR LEAK IN THE ENGINE COMPARTMENT FUEL SUPPLY AND VAPOR TUBE ASSEMBLY

1



1 Disconnect the engine compartment fuel supply and vapor tube assembly from the evaporative emission canister purge valve.

2 Plug the evaporative emission canister purge valve.

3 Carry out the Evaporative Emission System Leak Test. Refer to Evaporative Emission System Leak Test in this section.

● **Does the EVAP system pass the leak test?**

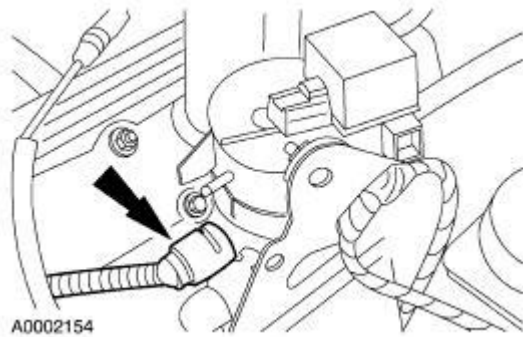
→ **Yes**
INSTALL a new engine compartment fuel supply and vapor tube assembly. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
GO to E13.

E13 TEST FOR LEAK IN EVAP CANISTER PURGE VALVE

1

1 Disconnect the evaporative emission return tube from the EVAP canister purge valve.



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- 2 Plug the EVAP canister purge valve.
- 3 Carry out the Evaporative Emission System Leak Test. Refer to Evaporative Emission System Leak Test in this section.

● **Does the system pass the leak test?**

→ **Yes**

INSTALL a new evaporative emission return tube. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

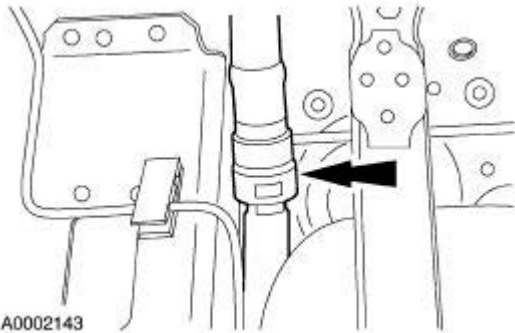
→ **No**

INSTALL a new EVAP canister purge valve assembly. REFER to Evaporative Emission Canister Purge Valve in this section. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

E14 TEST TO DETERMINE IF LEAK IS IN EVAP CANISTER OR FUEL TANK PORTION OF THE SYSTEM

1

- 1 Disconnect the fuel vapor control valve tube from EVAP canister purge outlet tube.



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- 2 Connect evaporative emission system leak tester to the fuel filler pipe.
- 3 Plug open end of the fuel vapor control valve tube.
- 4 Carry out the Evaporative Emission System Leak Test. Refer to Evaporative Emission System Leak Test in this section.

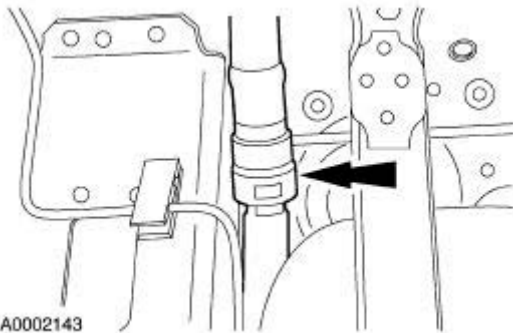
● **Does the EVAP system pass the leak test?**

→ **Yes**
RECONNECT all components. GO to E15.

→ **No**
GO to E20.

E15 TEST FOR LEAK IN CANISTER VENT SOLENOID

1



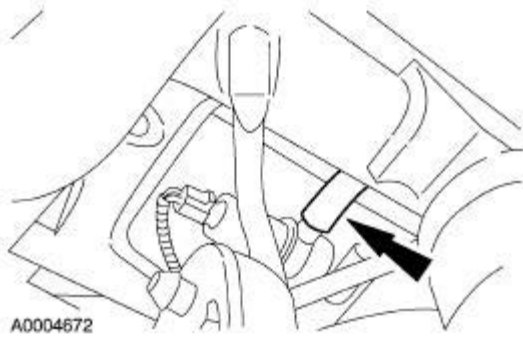
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- 1 Reconnect the fuel vapor control valve tube to the EVAP canister purge outlet tube.

- 2 Lower the differential to access the canister vent solenoid. If necessary, refer to Section 205-02.

3

- 3 Disconnect the canister vent solenoid from the canister vent solenoid hose and plug the hose.



4 Carry out the Evaporative Emission System Leak Test. Refer to Evaporative Emission System Leak Test in this section.

- **Does the EVAP system pass the leak test?**

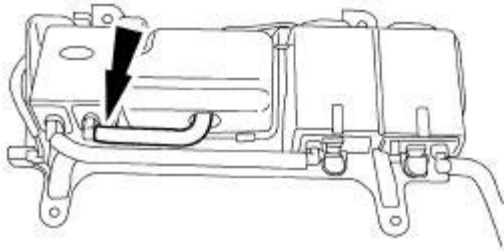
→ **Yes**
 INSTALL a new canister vent solenoid. REFER to Evaporative Emission Canister Vent Solenoid in this section. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
 GO to E16.

E16 TEST THE CANISTER VENT SOLENOID HOSE FOR LEAK

5

- 1 Reinstall the differential. If necessary, refer to Section 205-02.
- 2 Lower the rear subframe out of the way. Refer to Section 502-00.
- 3 Remove the EVAP canister and bracket assembly.
- 4 Connect the Evaporative Emission System Leak Tester to the EVAP canister purge outlet tube.
- 5 Disconnect the canister vent solenoid hose from the 1.0L EVAP canister and plug the EVAP canister.



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- 6 Pressurize the system to 3.48 kPa (14 inches H₂O).

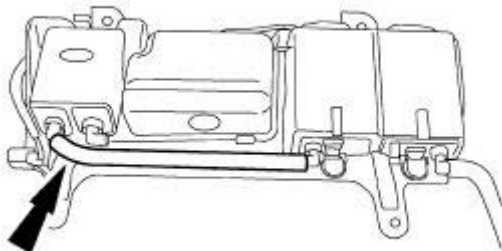
● **Does the pressure hold?**

→ **Yes**
 INSTALL a new canister vent solenoid hose. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **Yes**
 GO to E17.

E17 TEST FOR LEAK IN 1.0L EVAP CANISTER

1



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- 1 Disconnect the fuel vapor storage canister inlet tube from the 1.0L EVAP canister and plug the inlet tube.

- 2 Pressurize the system to 3.48 kPa (14 inches H₂O).

● **Does the pressure hold?**

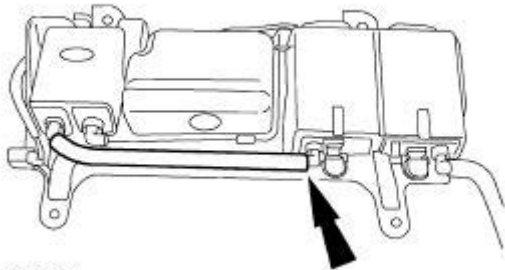
→ **Yes**
 INSTALL a new 1.0L EVAP canister. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to

Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
GO to E18.

E18 TEST FOR LEAK IN FUEL VAPOR STORAGE CANISTER INLET TUBE

1



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1 Disconnect the fuel vapor storage canister inlet tube from the 2.0L EVAP canister and plug the EVAP canister.

2 Pressurize the system to 3.48 kPa (14 inches H₂O).

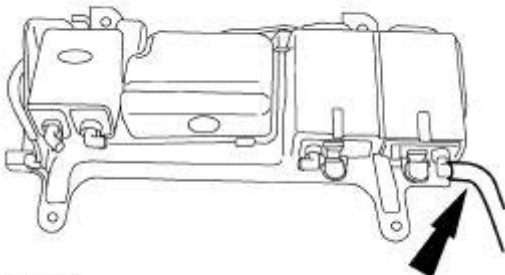
● **Does the pressure hold?**

→ **Yes**
INSTALL a new fuel vapor storage canister inlet tube. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**
GO to E19.

E19 TEST FOR LEAK IN 2.0L EVAP CANISTER

1



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1 Disconnect the EVAP canister purge outlet tube from the 2.0L EVAP canister and plug the outlet tube.

2 Pressurize the system to 3.48 kPa (14 inches H₂O).

● **Does the pressure hold?**

→ **Yes**
INSTALL a new 2.0L EVAP canister. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**
INSTALL a new EVAP canister purge outlet tube. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

E20 TEST FOR LEAK IN FUEL VAPOR CONTROL VALVE TUBE AND FUEL TANK ASSEMBLY

- 1 Disconnect the fuel filler pipe hose at the fuel tank and plug the hose.
 - 2 Carry out the Evaporative Emission System Leak Test. Refer to [Evaporative Emission System Leak Test](#) in this section.
- **Does the EVAP system pass the leak test?**

→ **Yes**
INSTALL a new fuel tank assembly. RECONNECT all components. REFER to [Section 310-01](#). CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**
GO to [E21](#).

E21 TEST FOR LEAK IN FUEL FILLER PIPE HOSE

- 1 Disconnect the fuel filler pipe hose from the fuel filler pipe and plug the fuel filler pipe.
- 2 Carry out the Evaporative Emission System Leak Test. Refer to [Evaporative](#)

Emission System Leak Test in this section.

- **Does the EVAP system pass the leak test?**

→ **Yes**

INSTALL a new fuel filler pipe hose. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**

INSTALL a new fuel filler pipe assembly. REFER to Section 310-01 . RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

PINPOINT TEST F: HISS WHEN OPENING FUEL CAP OR UNABLE TO REFUEL VEHICLE

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 TEST FOR FUEL TANK PRESSURE SENSOR OPERATION	
	<ol style="list-style-type: none"> 1 Connect the Evaporative Emission System Leak Tester to the fuel filler pipe. 2 Close the canister vent solenoid. Refer to <u>Canister Vent Solenoid Closing Procedure</u> in this section. 3 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O). <ul style="list-style-type: none"> ● Is the FTP (FTP V) PID reading 3.11 kPa to 3.86 kPa (12.5 to 15.5 inches H₂O) (4.22 to 4.90 volts)? <p>→ Yes GO to <u>F2</u>.</p> <p>→ No GO to <u>F3</u>.</p>
F2 TEST FOR BLOCKAGE IN VENTING PORTION OF EVAP SYSTEM	

1 Open the canister vent solenoid.

- Does the pressure drop immediately?

→ **Yes**

CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**

GO to [F5](#).

F3 TEST FOR BLOCKAGE IN FUEL FILLER PIPE

1 Connect the Evaporative Emission System Leak Tester to the fuel filler pipe.

2 Disconnect the fuel filler pipe from the fuel tank.

3 Pressurize the EVAP system to (3.48 kPa) (14 inches H₂O).

- Does the pressure drop immediately?

→ **Yes**

GO to [F4](#).

→ **No**

INSTALL a new fuel filler pipe assembly. REFER to [Section 310-01](#). CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

F4 TEST FOR PINCHED FUEL VAPOR CONTROL VALVE TUBE

1 Reconnect the fuel filler pipe to the fuel tank.

2 Lower the fuel tank about 19mm (0.75 in).

3 Connect the Evaporative Emission System Leak Tester to the fuel filler pipe.

4 Close the canister vent solenoid. Refer to [Canister Vent Solenoid Closing Procedure](#) in this section.

5 Pressurize the EVAP system to 3.48 kPa

(14 inches H₂O).

- **Is the FTP (FTP V) PID reading 3.11 kPa to 3.86 kPa (12.5 to 15.5 inches H₂O)(4.22 to 4.90 volts)?**

→ **Yes**

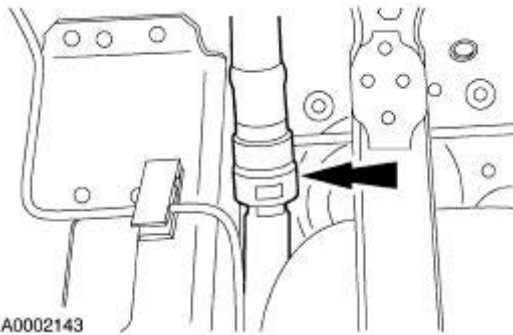
Fuel vapor control valve tube is pinched. INSTALL a new fuel tank assembly. REFER to Section 310-01. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

→ **No**

Fuel vapor control valve tube or fuel tank vapor control valve is blocked. INSTALL a new fuel tank assembly. REFER to Section 310-01. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

F5 ISOLATE LOCATION OF BLOCKAGE

1



1

Disconnect the fuel vapor control valve tube assembly from the EVAP canister purge outlet tube.

2

Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

- **Does the pressure drop immediately?**

→ **Yes**

GO to F6.

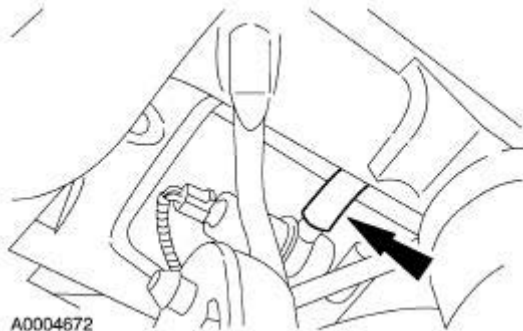
→ **No**

INSTALL a new fuel tank assembly. RECONNECT all components. REFER to

Section 310-01. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

F6 TEST FOR BLOCKAGE IN CANISTER VENT SOLENOID

3



- 1 Reconnect the fuel vapor control valve tube assembly to the EVAP canister purge outlet tube.
- 2 Lower the differential to access the canister vent solenoid as necessary. If necessary, refer to Section 205-02.
- 3 Disconnect the canister vent solenoid from the canister vent solenoid hose.
- 4 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

- **Does the pressure drop immediately?**

→ **Yes**

INSTALL a new canister vent solenoid. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to Evaporative Emission System Leak Test in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to Evaporative Emission Repair Verification Drive Cycle in this section.

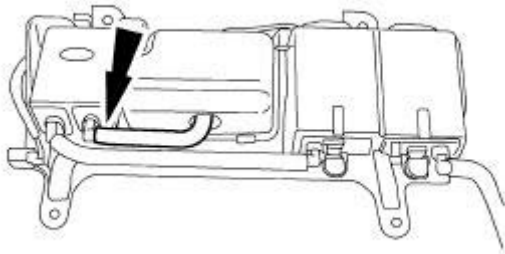
→ **No**

GO to F7.

F7 TEST FOR BLOCKAGE IN THE CANISTER VENT SOLENOID HOSE

- 1 Reinstall the differential. If necessary, refer to Section 205-02.
- 2 Lower the rear subframe out of the way to access the EVAP canister with bracket assembly. Refer to Section 502-00.

4



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3 Lower the EVAP canister with bracket assembly.

4 Disconnect the canister vent solenoid hose from the 1.0L EVAP canister.

5 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

● Does the pressure drop immediately?

→ Yes

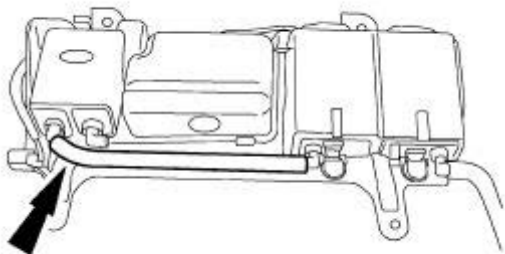
INSTALL a new canister vent solenoid hose. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ No

GO to [F8](#).

F8 TEST FOR BLOCKAGE IN 1.0L EVAP CANISTER

1



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1 Disconnect the fuel vapor storage canister inlet tube from the 1.0L EVAP canister.

2 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

● Does the pressure drop immediately?

→ Yes

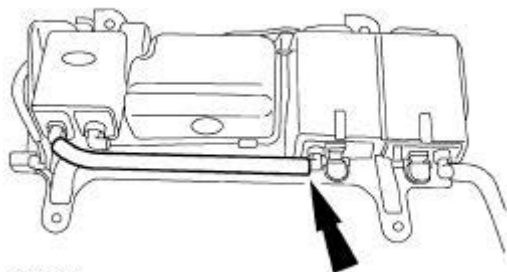
INSTALL a new 1.0L EVAP canister.

RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**
GO to [F9](#).

F9 TEST FOR BLOCKAGE IN FUEL VAPOR STORAGE CANISTER INLET TUBE

1



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1 Disconnect the fuel vapor storage canister inlet tube from the 2.0L EVAP canister.

2 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

- Does the pressure drop immediately?

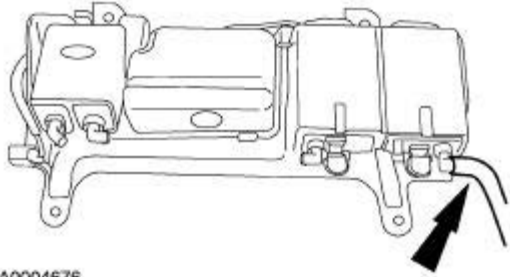
→ **Yes**
INSTALL a new fuel vapor storage canister inlet tube. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**
GO to [F10](#).

F10 TEST FOR BLOCKAGE IN 2.0L EVAP CANISTER

1

1 Disconnect the EVAP canister purge outlet tube from the 2.0L EVAP canister.



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2 Pressurize the EVAP system to 3.48 kPa (14 inches H₂O).

- Does the pressure drop immediately?

→ **Yes**



INSTALL a new 2.0L EVAP canister. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

→ **No**

INSTALL a new EVAP canister purge outlet tube. RECONNECT all components. CARRY OUT the evaporative emission system leak test. Refer to [Evaporative Emission System Leak Test](#) in this section. If the system passes the leak test, CARRY OUT the evaporative emission repair verification drive cycle. REFER to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

Evaporative Emission System Leak Test

Special Tool(s)


 ST2116-A	Evaporative Emission System Leak Tester 310-F007 (134-00056) or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool


 **CAUTION:** The evaporative emission system must not be pressurized to more than 3.48 kPa (14 inches H₂O) or damage to the evaporative emission system may occur.

1. Connect the Evaporative Emission System Leak Tester to the evaporative emission test port.
2. Close the canister vent solenoid. For additional information, refer to [Canister Vent Solenoid Closing Procedure](#) in this section.
3. Pressurize the evaporative emission system to 3.48 kPa (14 inches/H₂O).
4. Monitor the system for two minutes. The system fails the Leak Test if the pressure falls below 2.0 kPa (8 inches/H₂O).
5. Repair any leaks as required.
6. Repeat the Leak Test until the system remains above 2.0 kPa (8 inches/H₂O) after the two-minute test period.

Canister Vent Solenoid Closing Procedure

Special Tool(s)


 <p>ST2332-A</p>	<p>Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool</p>
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 **CAUTION:** The canister vent solenoid must not be energized for more than nine minutes at one time. Once the canister vent solenoid is energized and de-energized, adequate time must be allowed for the component to cool adequately. Failure to allow the component to cool may create a false failure in the diagnostics, causing unnecessary repairs.

1. Connect the scan tool and select the output test mode.
 2. If PID monitors are not active, select PIDs.
 3. Select the fuel tank pressure (FTP) and the volts (V) parameter identification (PID) for monitoring.
 4. Select the ALL OFF mode.
 5. Close the canister vent solenoid by pushing the START button on the scan tool.
-

Evaporative Emission Repair Verification Drive Cycle

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool
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Drive Cycle Recommendations

NOTE: The following procedure is designed to execute and complete the evaporative emission repair verification drive cycle and to clear the Ford P1000, inspection and maintenance (I/M) readiness code. When the ambient air temperature is below 4.4°C (40°F) or above 37.8°C (100°F), or the altitude is above 2,438 meters (8,000 feet), the EVAP monitor will not run. If the P1000 must be cleared in these conditions, the powertrain control module (PCM) must detect them once (twice on some applications) before the EVAP monitor can be bypassed and the P1000 cleared. The EVAP bypassing procedure is described in the following drive cycle.

1. Most OBD II monitors will complete more readily using a steady foot driving style during cruise or acceleration modes. Operating the throttle in a smooth fashion will minimize the time necessary for monitor completion.
2. Fuel tank level should be between one-half and three-quarters full with three-quarters full being the most desirable.
3. The evaporative monitor can only operate during the first 30 minutes of engine operation. When executing the procedure for this monitor, stay in part throttle mode and drive in a smooth fashion to minimize fuel slosh.

Drive Cycle Preparation

NOTE: For best results, follow each of the following steps as accurately as possible.

4. **NOTE:** This step bypasses the engine soak timer and resets OBD II monitor status.

Install the scan tool. Turn the key ON with the engine OFF. Cycle the key off, then on. Select the appropriate vehicle and engine qualifier. Clear all diagnostic trouble codes (DTCs) and carry out a PCM reset.

5. Begin to monitor the following PIDs: ECT, EVAPDC, FLI (if available) and TP MODE. Press Diagnostic Data Link, PCM, PID/Data monitor and record, press trigger to select each PID, then start.
6. Start the engine without returning the key to the OFF position.

Preparation for Monitor Entry



WARNING: Strict observance of posted speed limits and attention to driving conditions

are mandatory when proceeding through the following drive cycle.

7. **NOTE:** This step allows engine warm-up and provides intake air temperature (IAT) input to the PCM.

Idle the vehicle for 15 seconds. Drive at 64 km/h (40 mph) until the ECT is at least 76.7°C (170° F).

8. Is IAT above 4.4°C (40°F) and below 37.8°C (100°F)? If not, continue with the following steps but note that the EVAP Monitor Bypass portion of the drive cycle (Step 13) will be required to bypass the EVAP monitor and clear the P1000.

9. **NOTE:** This step executes the heated oxygen sensor (HO2S) monitor.

Cruise at 64 km/h (40 mph) for 60 seconds.

10. **NOTE:** This executes the EVAP monitor if IAT is above 4.4°C (40°F) and below 37.8°C (100°F).

NOTE: To initiate the monitor, TP MODE should equal PT, EVAPDC must be greater than 75%, and FLI must be between 15 and 85%.

NOTE: Avoid sharp turns and hills.

Cruise at 72 to 104 km/h (45 to 65 mph) for 10 minutes.

11. **NOTE:** This step executes the ISC portion of the Secondary Air/CCM.

Bring the vehicle to a stop. Idle with the transmission in DRIVE (for automatic transmission) or NEUTRAL (for manual transmission) for two minutes.

Pending Code and EVAP Monitor Bypass Check

12. **NOTE:** This determines if a pending code is preventing the clearing of P1000.

NOTE: If the EVAP monitor is not complete and IAT was below 4.4°C (40°F) or above 37.8°C (100°F) temperature range in Step 8, or the altitude is above 2,438 meters (8,000 feet), the EVAP Monitor Bypass (Step 13) must be carried out.

Using the scan tool, check for pending codes. Conduct normal repair procedures for any pending code concerns. Rerun any incomplete monitor.

EVAP Monitor Bypass


13. **NOTE:** This allows the bypass counter to increment to two.


NOTE: Do not repeat Step 4.

Park the vehicle for a minimum of eight hours. Repeat Steps 5 through 12.

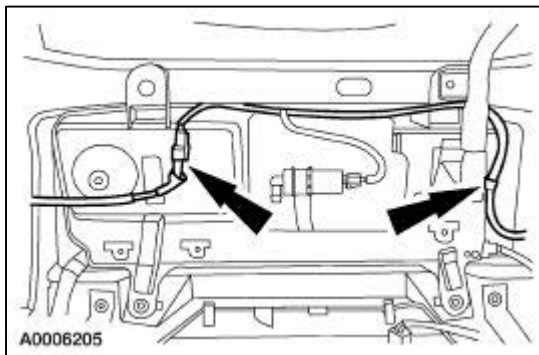
Evaporative Emission Canister

Removal and Installation

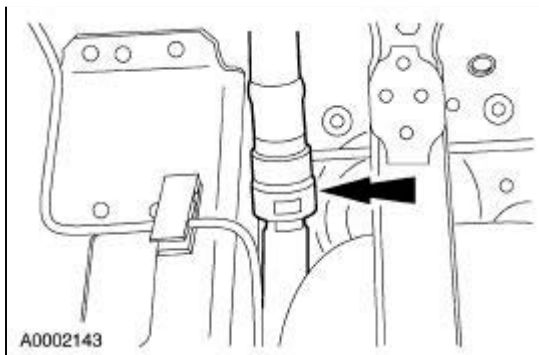
 **WARNING:** The evaporative emission system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions may result in personal injury.

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

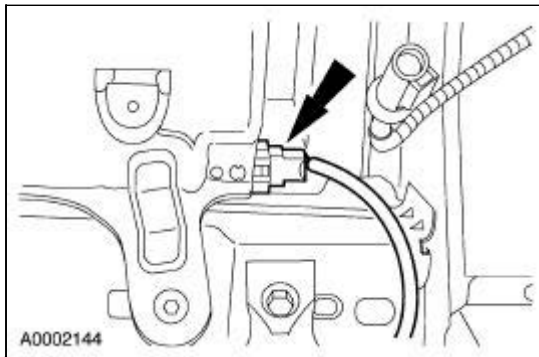
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Lower the rear subframe to access the evaporative emission canister assembly. For additional information, refer to [Section 502-00](#).
4. Disconnect the connectors.



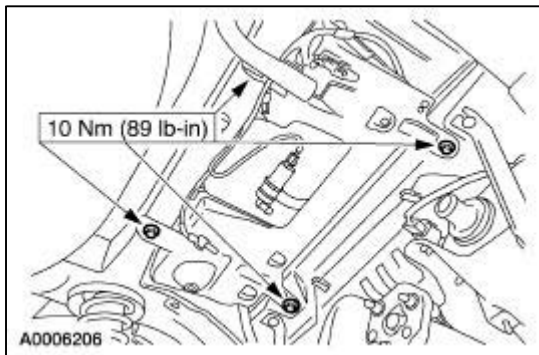
5. Disconnect the hose.



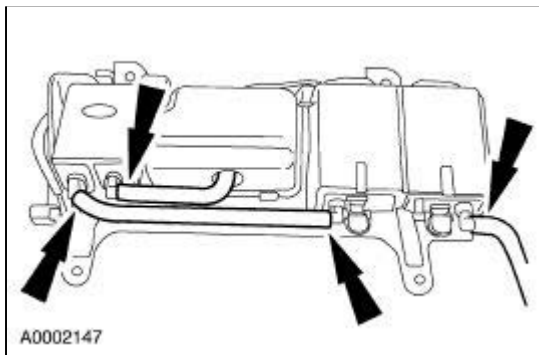
6. Disconnect the connector.



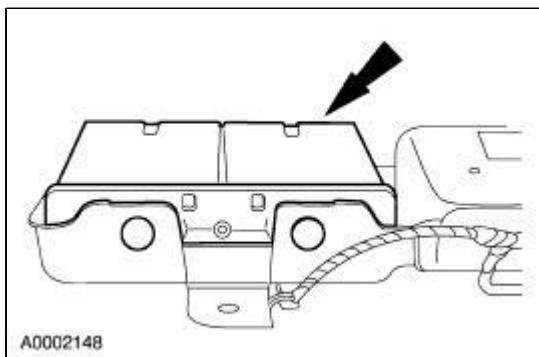
7. Remove the evaporative emission (EVAP) canister and bracket assembly (9E857).
 - Remove the four bolts.



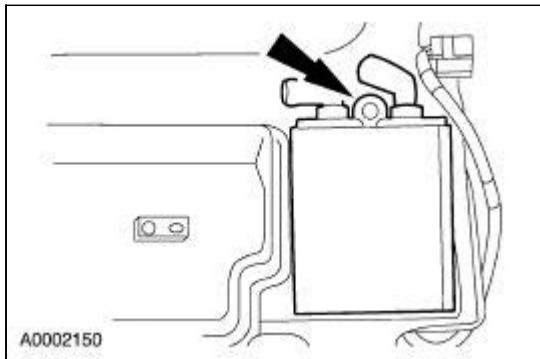
8. Disconnect the hoses.



9. Remove the EVAP canister.



10. Remove the EVAP canister.
 - Remove the rivet.



11. **NOTE:** The evaporative emission canister assembly must be leak-tested prior to installation on the vehicle.


NOTE: Lubricate the O-ring seals with MERPOL® or equivalent meeting Ford specifications ESE-M99B144-B.


To install, reverse the removal procedure.

- Carry out a leak test. For additional information, refer to [Evaporative Emission System Leak Test](#) in this section.
 - Carry out the evaporative emission repair verification drive cycle. For additional information, refer to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.
-

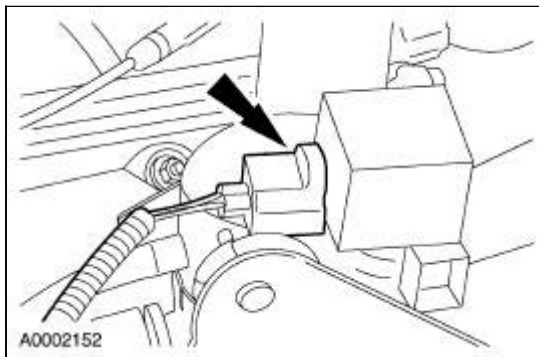
Evaporative Emission Canister Purge Valve

Removal and Installation

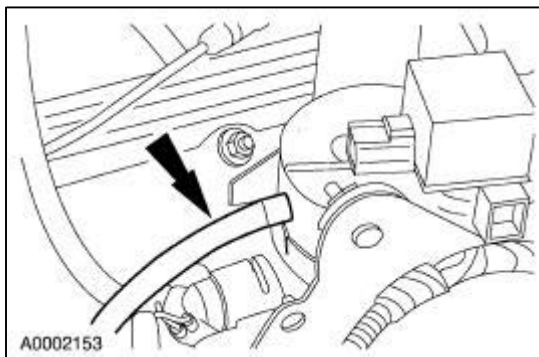
 **WARNING:** The evaporative emission system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions may result in personal injury.

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

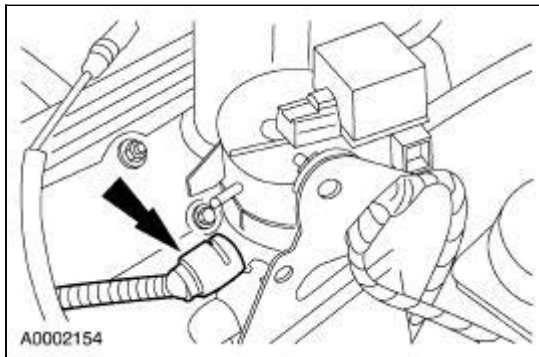
1. Disconnect battery cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the connector.



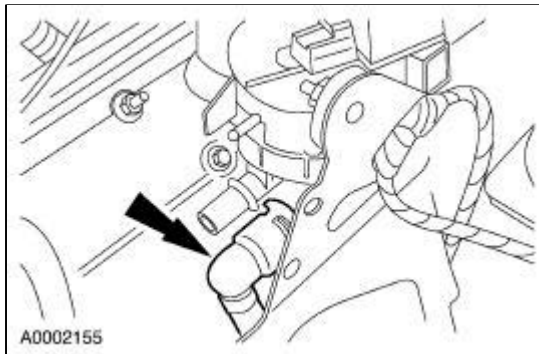
3. Disconnect the vacuum line.



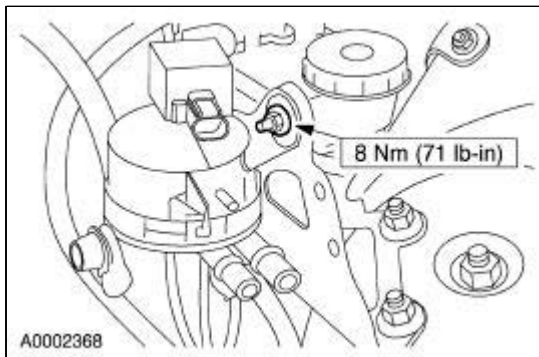
4. Disconnect the evaporative emission (EVAP) return tube.



5. Disconnect the EVAP canister purge outlet tube.



6. Remove the EVAP canister purge valve.



7. **NOTE:** The EVAP canister assembly must be leak-tested prior to installation on the vehicle.


NOTE: Lubricate the O-ring seals with MERPOL® or equivalent meeting Ford specifications ESE-M99B144-B.


To install, reverse the removal procedure.

- Carry out a leak test. For additional information, refer to [Evaporative Emission System Leak Test](#) in this section.
 - Carry out the evaporative emission repair verification drive cycle. For additional information, refer to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.
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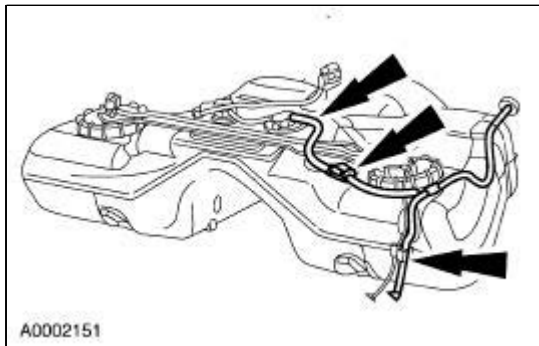
Fuel Vapor Control Tube Assembly Valve

Removal and Installation

 **WARNING:** The evaporative emission system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire. Disconnect the battery ground cable from the battery to minimize the possibility of an electrical spark occurring, possibly causing a fire or explosion if fuel vapor or liquid fuel are present in the area. Failure to follow these instructions may result in personal injury.

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in personal injury.

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the fuel tank. For additional information, refer to [Section 310-01](#).
3. Disconnect and remove the fuel vapor control valve tube assembly.



4. **NOTE:** Lubricate the O-ring seals with MERPOL® or equivalent meeting Ford specifications ESE-M99B144-B.

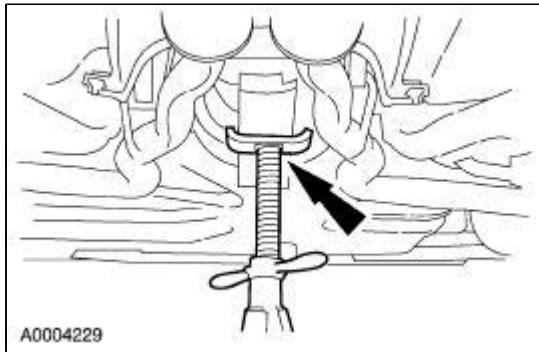
To install, reverse the removal procedure.

- Carry out a leak test. For additional information, refer to [Evaporative Emission System Leak Test](#) in this section.
- Carry out the evaporative emission repair verification drive cycle. For additional information, refer to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.

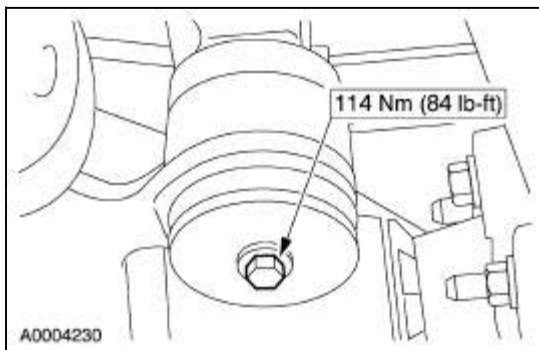
Evaporative Emission Canister Vent Solenoid

Removal and Installation

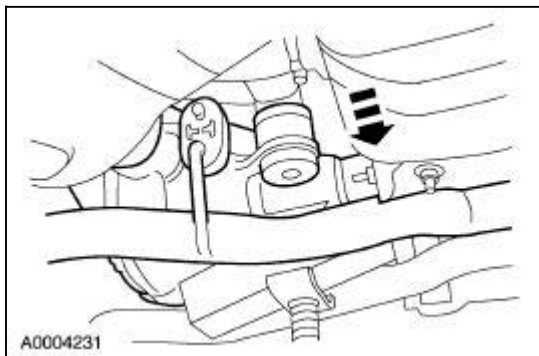
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Position a jack stand under the differential.



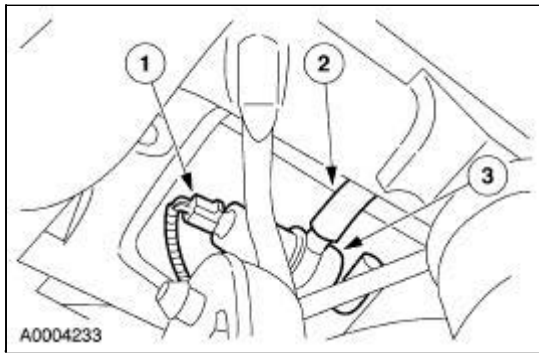
3. Remove the bolt.



4. Lower the differential to access the canister vent solenoid as necessary.



5. Remove the canister vent solenoid.
 1. Disconnect the connector.
 2. Disconnect the hose.
 3. Remove the canister vent solenoid.



6. **NOTE:** Lubricate the O-ring seals with MERPOL® or equivalent meeting Ford specifications ESE-M99B144-B.

To install, reverse the removal procedure.

- Carry out a leak test. For additional information, refer to [Evaporative Emission System Leak Test](#) in this section.
 - Carry out the evaporative emission repair verification drive cycle. For additional information, refer to [Evaporative Emission Repair Verification Drive Cycle](#) in this section.
-

General Specifications

Item	Specification
High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA	ESE-M12A4-A
Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP	WSS-M2C153-G

Torque Specifications

Description	Nm	lb-ft	lb-in
Camshaft position (CMP) sensor bolt	11	8	—
Crankshaft position (CKP) sensor bolt	10	—	89
Cross vehicle support	20	15	—
Cylinder head temperature (CHT) sensor	22	16	—
Differential pressure feedback EGR (DPFE) nuts	6	—	53
Fuel pressure sensor bolts	8	—	71
Fuel pressure sensor shield bolts	10	—	89
Fuel pressure sensor shield nut	6	—	53
Heated oxygen sensor (HO2S)	41	30	—
Idle air control (IAC) valve bolts—3.0L	10	—	89
Intake manifold tuning valve (IMTV) bolts	10	—	89
Intake manifold tuning valve harness bracket nut	7	—	62
Idle air control (IAC) valve—3.9L	12	9	—
Knock sensor (KS) bolt—3.9L	20	15	—
Knock sensor (KS) nut/bolt—3.0L	25	18	—
Mass airflow (MAF) sensor plate nuts	5	—	44
Powertrain control module (PCM) bracket bolts	7	—	62
Powertrain Control module (PCM) harness connector bolts	10	—	89
Power steering pressure (PSP) switch	17	13	—
Throttle position (TP) sensor screws	3	—	27
Wiring harness bracket to cylinder head nuts	10	—	89

Electronic Engine Controls

The electronic engine controls consist of the following:

- powertrain control module (PCM)
- throttle position (TP) sensor
- idle air control (IAC) valve
- camshaft position (CMP) sensor
- crankshaft position (CKP) sensor
- mass air flow (MAF) sensor
- intake air temperature (IAT) sensor
- heated oxygen sensor (HO2S)—front
- heated oxygen sensor (HO2S)—rear
- knock sensor (KS) (12A699)
- cylinder head temperature (CHT) sensor
- power steering pressure (PSP) switch
- fuel pressure sensor
- vehicle speed sensor (VSS)

The powertrain control module needs the following inputs to calibrate the engine correctly:

- camshaft position
- engine rpm
- cylinder head temperature
- clutch pedal position
- amount of engine detonation
- mass air flow (MAF) sensor

The throttle position sensor:

- sends the powertrain control module a signal indicating the throttle plate angle.
- is the main input to the powertrain control module from the driver.

The idle air control valve:

- supplies air to the fuel rail for better atomization of fuel (3.9L only)
- controls bypass air around the throttle plate at low speeds.
- is controlled by the powertrain control module.

The camshaft position sensor:

- sends the powertrain control module a signal indicating camshaft position used for fuel synchronization.

The power steering pressure switch:

- is located on the power steering pump, generates a differential pressure, and is dependent on current input.
- controls the spool valve in the power steering pump.
- regulates the hydraulic flow and, when combined with a current controlling device, yields a variable assist power steering system.
- is controlled by the PCM to increase power steering pump flow and power steering assist at low vehicle speeds and to reduce power steering pump flow and power steering assist at high vehicle speeds.
- is controlled by the PCM to increase the power steering pump flow, thereby increasing power steering assist for evasive maneuvering at high vehicle speeds (steering wheel rotation rate greater than 22 rpm).

The crankshaft position sensor:

- sends the powertrain control module a signal indicating crankshaft position.
- is essential for calculating spark timing.

The mass air flow sensor:

- sends the powertrain control module a signal indicating mass air flow rate of air entering the engine.

The intake air temperature sensor:

- sends the powertrain control module a signal indicating the temperature of the air entering the engine.
- resistance decreases as temperature increases.

The heated oxygen sensors:

- monitor oxygen content before and after the exhaust flows through the catalytic converter.
- provide a voltage to the powertrain control module used to calculate catalytic converter integrity.

The knock sensor:

- is located in the intake valley.
- sends a signal to the powertrain control module indicating engine detonation. (If detonation is occurring, the powertrain control module then changes spark timing.)

The cylinder head temperature sensor:

- is mounted into the wall of the cylinder head and is not connected to any coolant passages.

The knock sensor:

- is located in the intake valley.
- sends a signal to the powertrain control module indicating engine detonation. (If detonation is occurring, the powertrain control module then changes spark timing.)

The fuel pressure sensor:

- sends the powertrain control module a signal indicating fuel pressure.
 - The powertrain control module uses the fuel pressure sensor signal and the fuel temperature sensor signal to maintain the fuel liquid pressure in the fuel line which reduces the fuel vapor pressure in the fuel line.
- sends a signal to the powertrain control module indicating the cylinder head temperature.
 - If the temperature exceeds approximately 121°C (250°F), the powertrain control module disables half the fuel injectors at a time. The powertrain control module will alternate which fuel injectors are disabled every 32 engine cycles. The cylinders that are not being fuel injected act as air pumps to aid in cooling the engine.
 - If the temperature exceeds approximately 166°C (330°F), the powertrain control module disables all of the fuel injectors until the engine temperature drops below approximately 154°C (310°F).
 - The coolant temperature gauge pointer will read fully hot.
 - The check gauge warning indicator will illuminate and DTCs are set.

The vehicle speed sensor:

- sends a frequency signal to the powertrain control module.
 - The powertrain control module uses the vehicle speed sensor signal to calculate vehicle speed and to determine shift scheduling and electronic pressure control.

The intake manifold tuning valve:

- connects the plenums to improve upper rpm power.
-

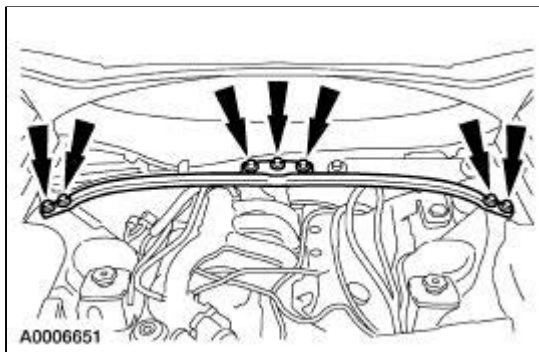
Electronic Engine Controls

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Intake Manifold Tuning (IMT) Valve —3.0L

Removal

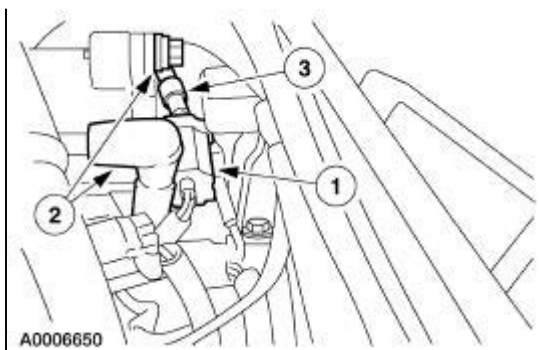
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the cowl vent screen. For additional information, refer to [Section 501-02](#).
3. Remove the bolts and the cross vehicle support.




4. Remove the wiring harness bracket.



5. Remove the intake manifold tuning valve (IMTV).
 1. Disconnect the electrical connector.
 2. Remove the two bolts.
 3. Remove the IMTV.

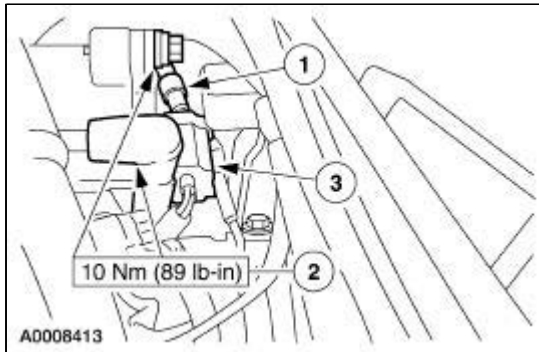


Installation

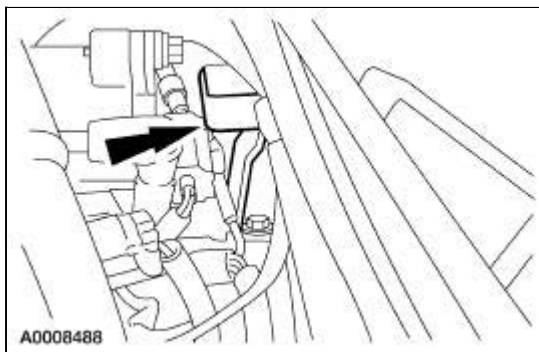
1.  **CAUTION: The IMTV must be fully seated in the intake manifold prior to installing the bolts, or damage to the IMTV may occur.**

Install the intake manifold tuning valve (IMTV).

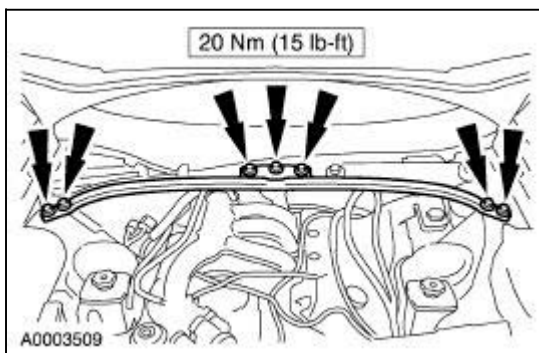
1. Coat the IMTV with Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification WSS-M2C153-G, and install into the intake manifold.
2. Install the two bolts.
3. Connect the electrical connector.



2. Install the wiring harness bracket.



3. Position the cross vehicle support and install the bolts.

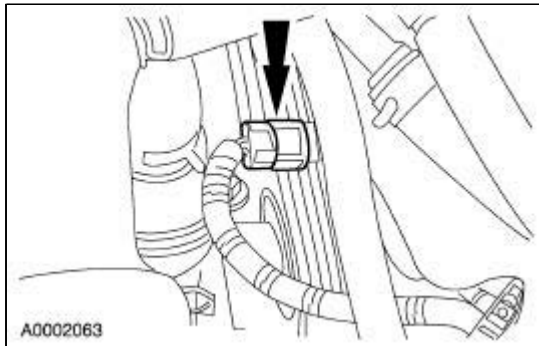


4. Install the cowl vent screen. For additional information, refer to [Section 501-02](#).

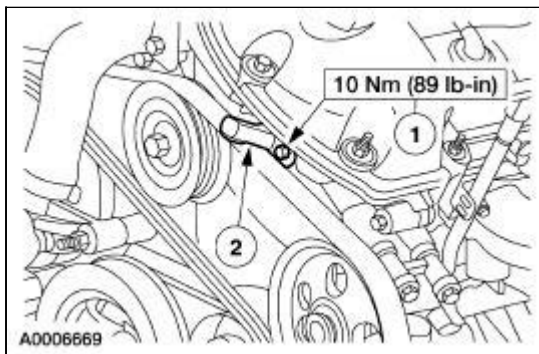
Camshaft Position (CMP) Sensor —3.0L

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the camshaft position (CMP) sensor electrical connector.



3. Remove the CMP sensor.
 1. Remove the bolt from the CMP sensor.
 2. Remove the CMP sensor from the vehicle.



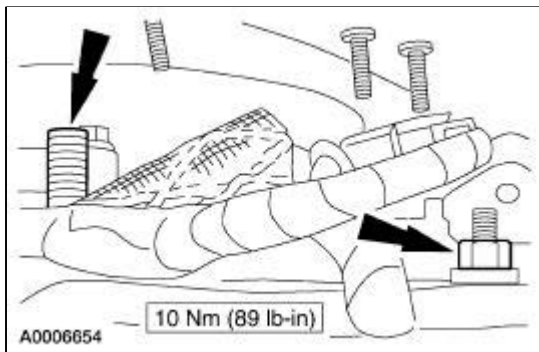
4.  **CAUTION:** Do not overtighten the screw or damage to the CMP sensor may occur.

To install, reverse the removal procedure.

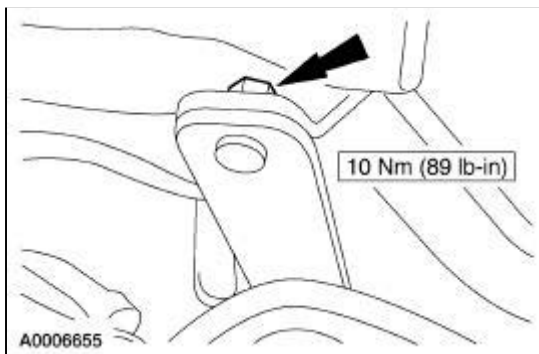
Camshaft Position (CMP) Sensor —3.9L

Removal and Installation

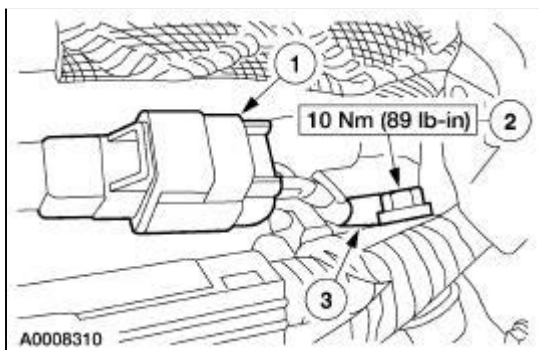
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the wiper motor. Refer to [Section 501-16](#).
3. Remove the harness bracket nut and stud from the rear of the LH cylinder head.



4. Remove the harness bracket nut and position the bracket away from the cylinder head.



5. Remove the camshaft position (CMP) sensor.
 1. Disconnect the electrical connector.
 2. Remove the bolt.
 3. Remove the CMP sensor.



6.  **CAUTION: Do not overtighten the screw or damage to the camshaft position sensor may occur.**

NOTE: When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 miles) or more to relearn the strategy.

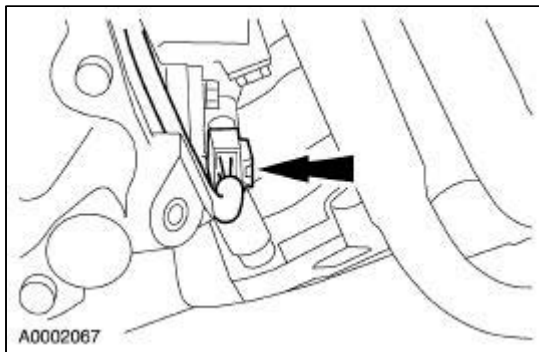
To install, reverse the removal procedure.

Crankshaft Position (CKP) Sensor —3.0L

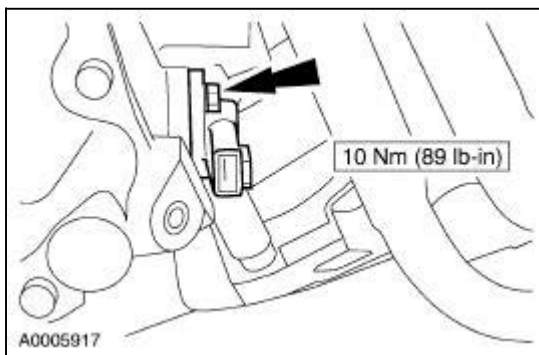
Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. **NOTE:** Generator removed for clarity.

Disconnect the crankshaft position (CKP) sensor electrical connector.



4. Remove the CKP sensor bolt and the CKP sensor.

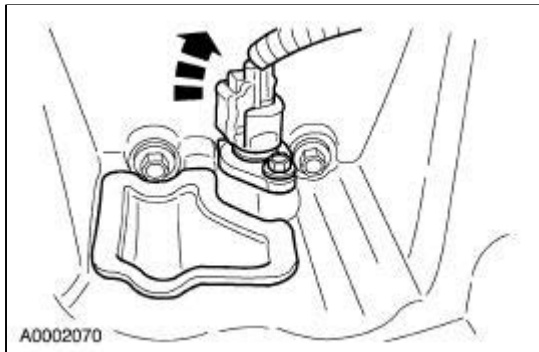


5. To install, reverse the removal procedure.

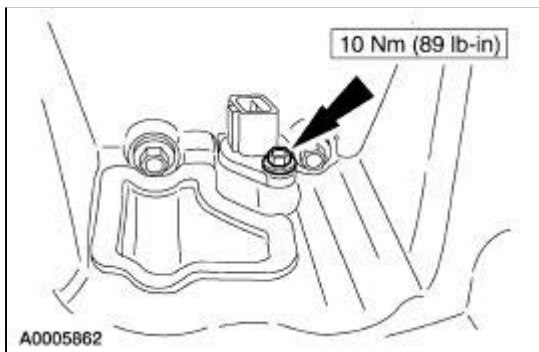
Crankshaft Position (CKP) Sensor —3.9L

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Disconnect the crankshaft position (CKP) sensor electrical connector.



4. Remove the bolt and the CKP sensor.

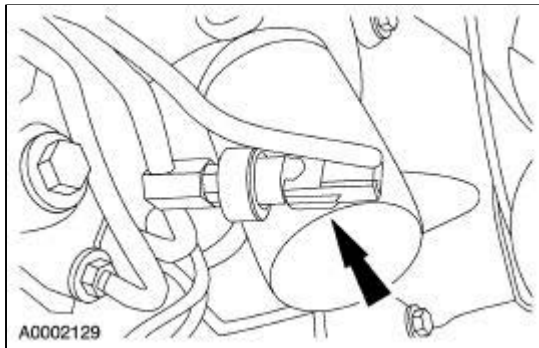


5. To install, reverse the removal procedure.

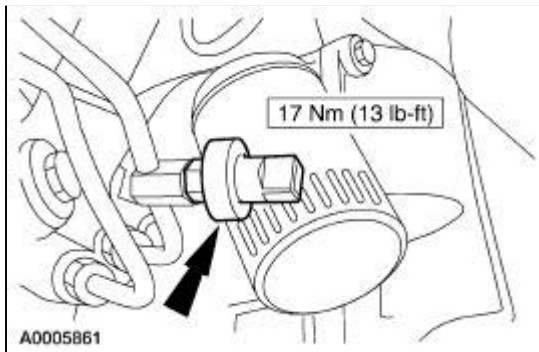
Power Steering Pressure (PSP) Switch —3.0L

Removal

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Disconnect the power steering pressure (PSP) switch electrical connector.



4. Remove the PSP switch.

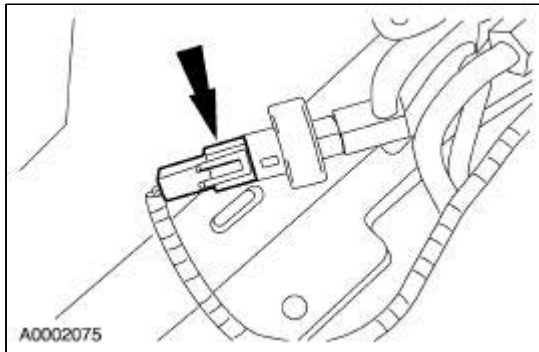


5. To install, reverse the removal procedure.
-

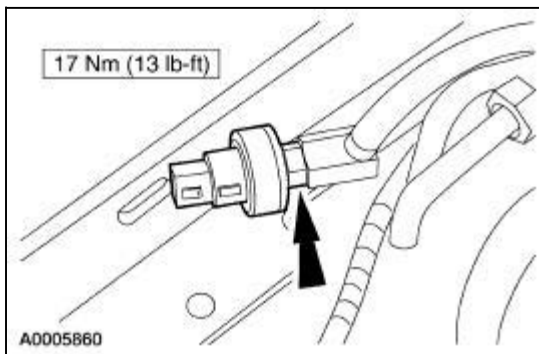
Power Steering Pressure (PSP) Switch —3.9L

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the power steering pressure (PSP) switch electrical connector.




3. Remove the PSP switch.



4. To install, reverse the removal procedure.

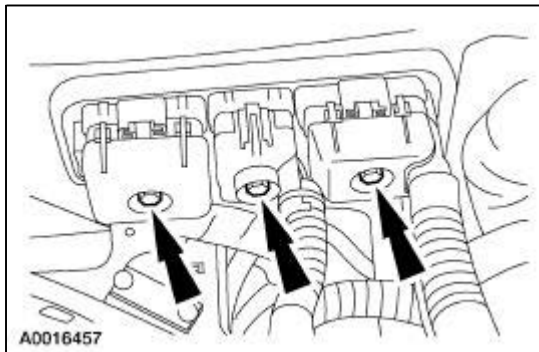
Powertrain Control Module (PCM)

Special Tool(s)

 <p>ST2332-A</p>	<p>Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool</p>
---	--

Removal

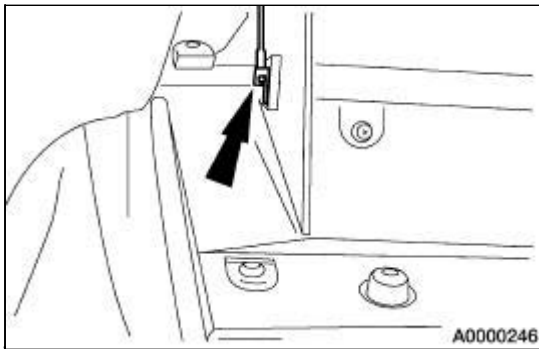
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the cabin air filter and plenum. For additional information, refer to [Section 412-01](#).
3. Loosen the bolts and disconnect the powertrain control module (PCM) harness connectors.



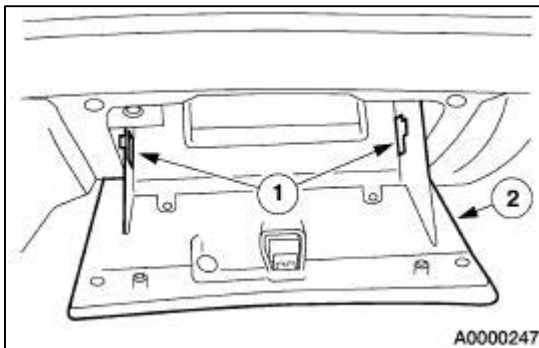
4. Remove the instrument panel finish panel.



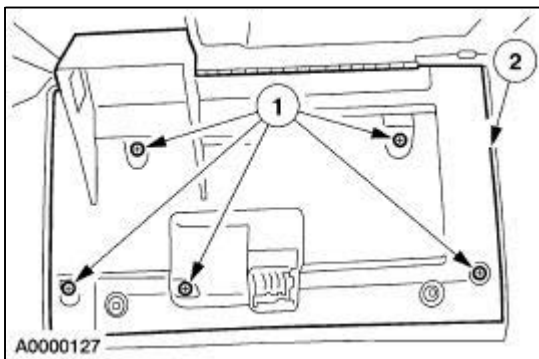
5. Release the assist cable from the glove compartment.



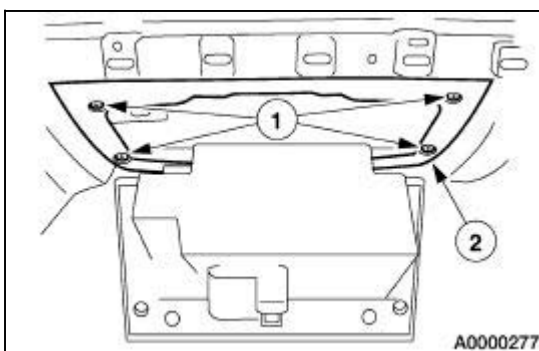
6. Lower the glove compartment.
 1. Release the tabs.
 2. Lower the glove compartment.



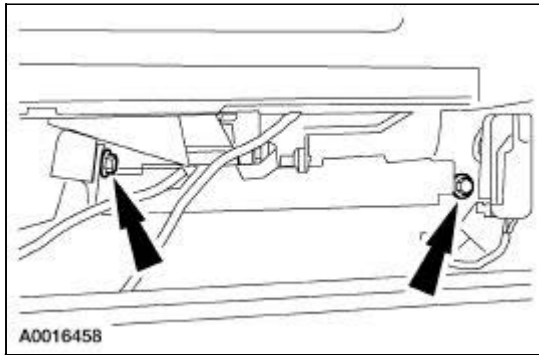
7. If equipped with a compact disc changer, remove the glove compartment inner panel.
 1. Remove the screw.
 2. Remove the panel.



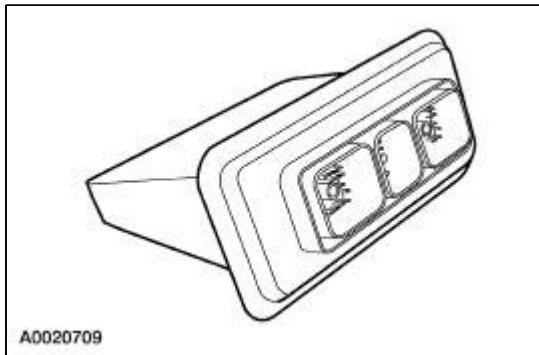
8. Remove the glove compartment instrument panel finish panel.
 1. Remove the screws.
 2. Remove the panel.



9. Remove the PCM bracket bolts and bracket.



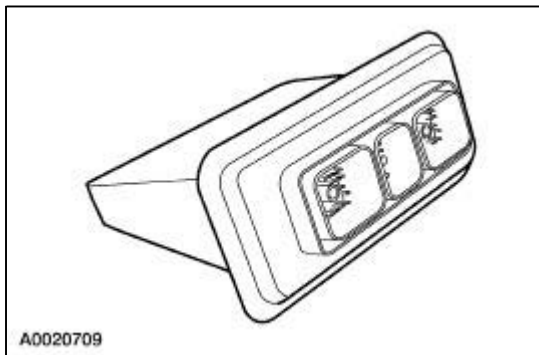
10. Remove the PCM.



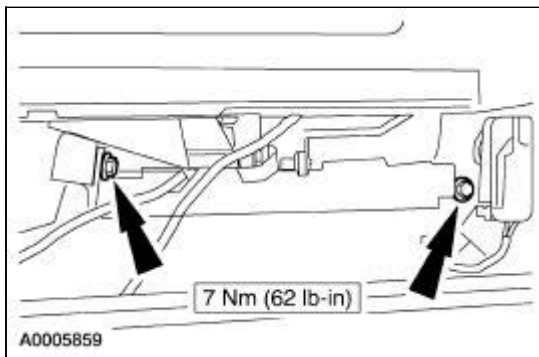
Installation

All Vehicles

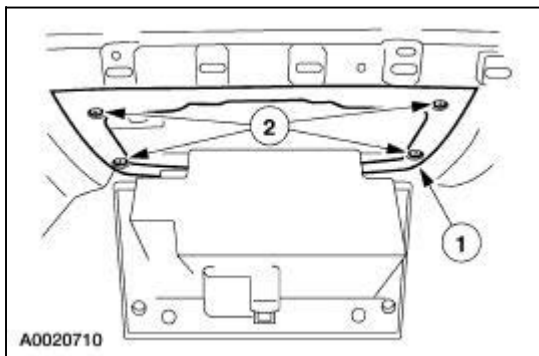
1. Install the PCM into the bracket.



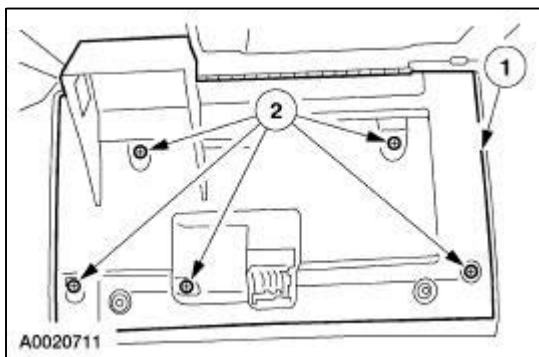
2. Install the PCM into the vehicle through the glove box and install the bolts.



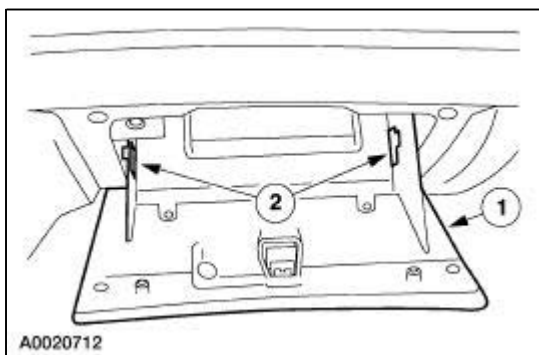
3. Install the glove compartment instrument panel finish panel.
 1. Position the panel.
 2. Install the screws.



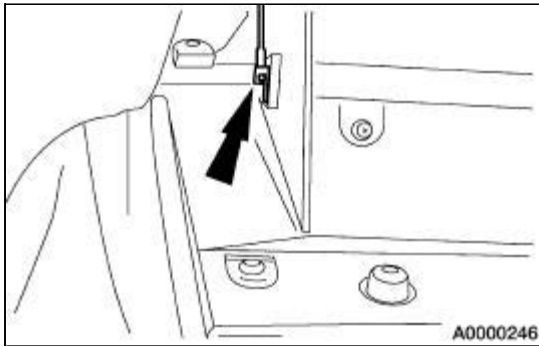
4. If equipped with a compact disc changer, install the glove compartment inner panel.
 1. Position the panel.
 2. Install the screws.



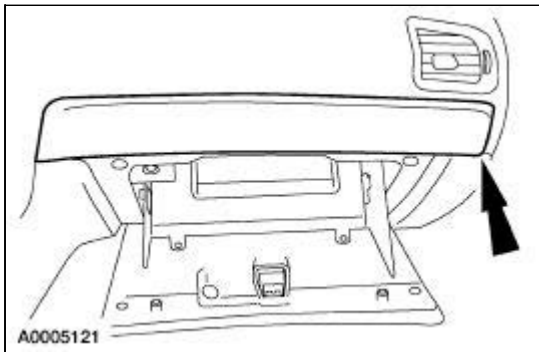
5. Raise the glove compartment.
 1. Raise the glove compartment.
 2. Position the stop tabs.



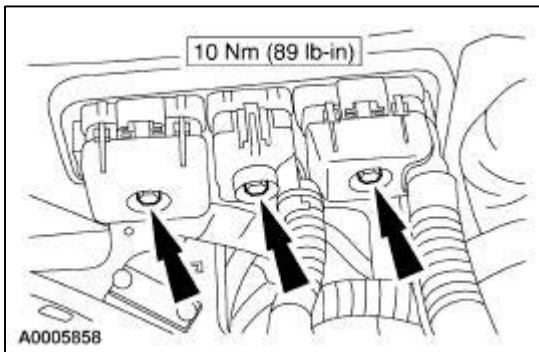
6. Connect the assist cable to the glove compartment.



7. Install the instrument panel finish panel.



8. Connect the PCM harness connectors and tighten the bolts.



9. Install the cabin air filter and plenum. For additional information, refer to [Section 412-01](#).
10. Connect the battery ground cable.

Vehicles With Automatic Transmission

11. Connect the scan tool.
12. Select ICM.
13. Select ENTER SECURITY ACCESS. Wait 10 minutes for security access to be granted.
14. Select PARAMETER RESET.
15. Disconnect the scan tool.

16. Place ignition key in the OFF position.
17. Place ignition key in the RUN position.
18. Remove the ignition key.

Vehicles With Manual Transmission

19. **NOTE:** The steering column lock (SCL) actuator will only allow communication with a tester after the SCL actuator has been activated. To activate the SCL actuator, open the driver door and **do not** put the key in the ignition (or alternatively, you can press one of the buttons on the key fob while there is no key in the ignition.) The SCL actuator will stay activated for 30 minutes after the driver door is opened (or a key fob button is pressed).

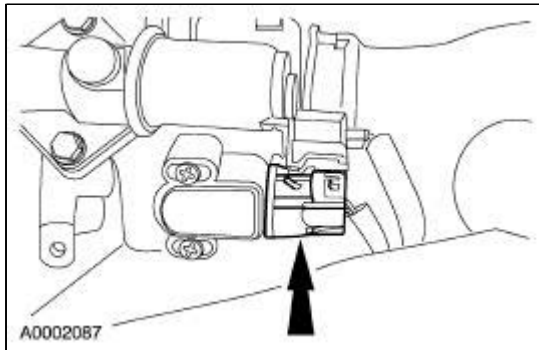
Connect the scan tool.

20. Place the ignition switch in the OFF position.
 21. Select SCLM.
 22. Select ENTER SECURITY ACCESS. Wait 8 minutes for security access to be granted.
 23. Select PARAMETER RESET.
 24. Place the ignition in the RUN position.
 25. Select ICM.
 26. Select ENTER SECURITY ACCESS. Wait 10 minutes for security access to be granted.
 27. Select RESET SCLM PARAMETER.
 28. Select PARAMETER RESET.
 29. Disconnect the scan tool.
 30. Place ignition key in the OFF position.
 31. Place ignition key in the RUN position.
 32. Remove the ignition key.
-

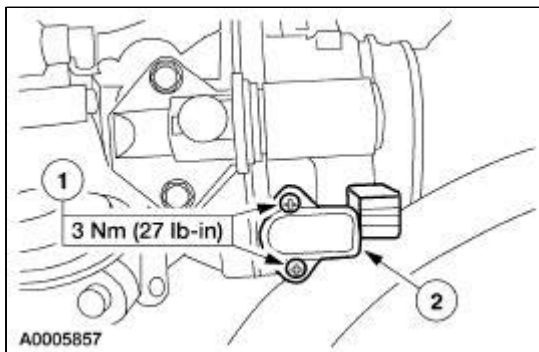
Throttle Position (TP) Sensor —3.0L

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the throttle position (TP) sensor electrical connector.



3. Remove the TP sensor.
 1. Remove the screws from the TP sensor.
 2. Remove the TP sensor from the vehicle.



4. **NOTE:** The TP sensor cannot be adjusted. If necessary, a new sensor must be installed.

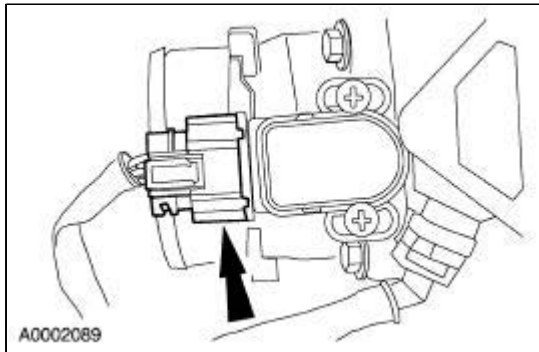
To install, reverse the removal procedure.

- After installation, cycle the throttle lever to wide open throttle (WOT). It should return without interference.

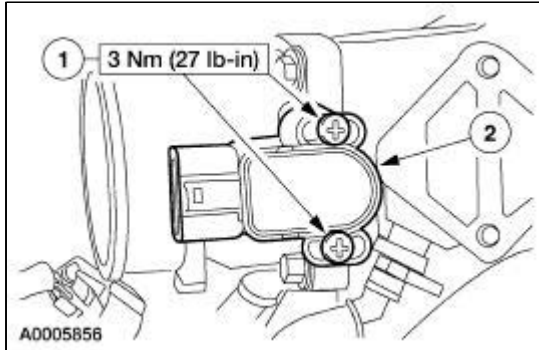
Throttle Position (TP) Sensor —3.9L

Removal and Installation

1. Remove the idler air control (IAC) valve. Refer to [Idle Air Control \(IAC\) Valve—3.9L](#).
2. Disconnect the throttle position (TP) sensor electrical connector.



3. Remove the TP sensor.
 1. Remove the screws from the TP sensor.
 2. Remove the TP sensor from the vehicle.

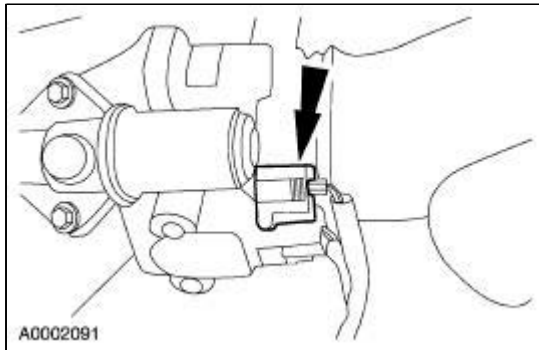


4. To install, reverse the removal procedure.
 - After installation, cycle the throttle lever to wide open throttle (WOT). It should return without interference.

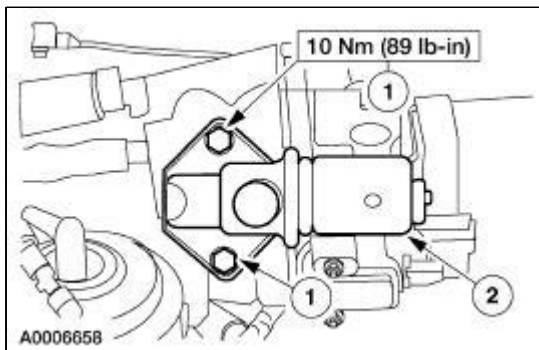
Idle Air Control (IAC) Valve —3.0L


Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the electrical connector from the idle air control (IAC) valve.



3. Remove the IAC valve.
 1. Remove the bolts from the IAC valve.
 2. Lift and remove the IAC valve from the vehicle and discard the gasket.



4.  **CAUTION:** Do not use Carburetor Tune-up Cleaner D9AZ-19579-BA meeting Ford specifications ESR-M14P9-A or any other type of solvent as damage to the valve internal components may result.

NOTE: The engine control sensor wiring (12A581) cannot be cleaned. If necessary, new wiring must be installed.

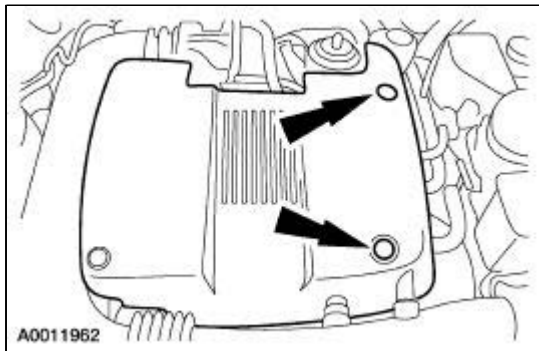
Clean the gasket mating surfaces.

5. To install, reverse the removal procedure.
 - Install a new gasket.

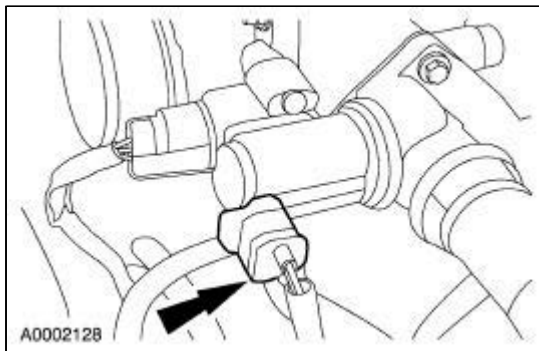
Idle Air Control (IAC) Valve —3.9L

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the engine appearance cover.
 - Remove the pin-type retainers.



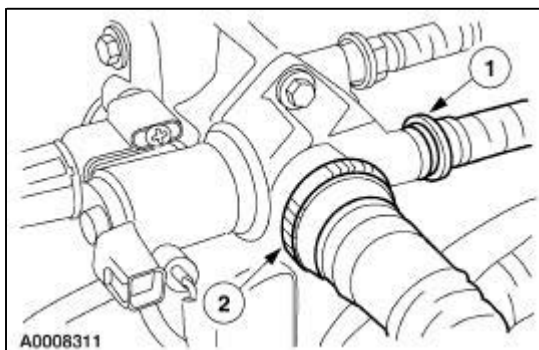
3. Disconnect the electrical connector from the idle air control (IAC) valve (9F715).



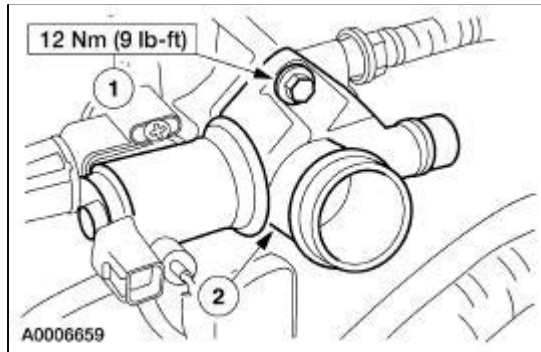
4.  **CAUTION:** In order to disconnect the Noma type hose fittings, squeeze the tabs and pull the hose straight back. Failure to squeeze tabs may result in fitting damage.


Disconnect the hoses.

1. Disconnect the air assist hose.
2. Disconnect the idle air bypass hose.



5. Remove the IAC valve.
 1. Remove the bolts from the IAC valve.
 2. Lift and remove the IAC valve from the vehicle and discard the gasket.



6.  **CAUTION: Do not use Carburetor Tune-up Cleaner D9AZ-19579-BA meeting Ford specification ESR-M14P9-A or any other type of solvent as damage to the valve internal components may result.**

NOTE: The engine control sensor wiring cannot be cleaned. If necessary, new wiring must be installed.

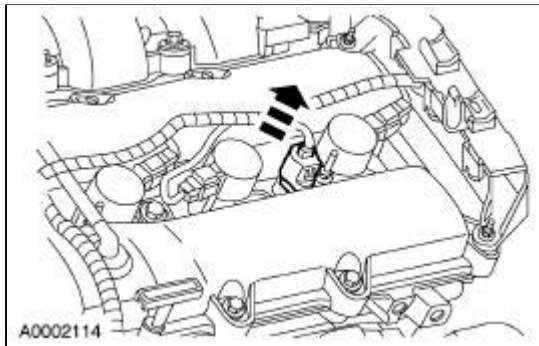
Clean the gasket mating surfaces.

7. To install, reverse the removal procedure.
 - Install a new gasket.

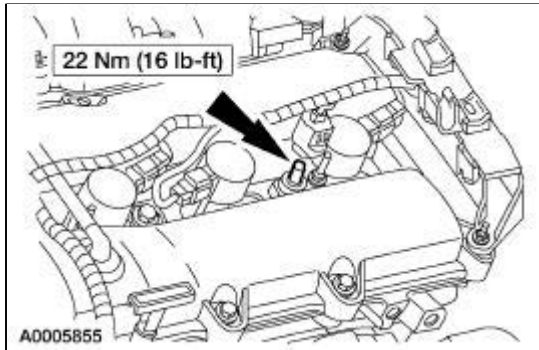
Cylinder Head Temperature (CHT) Sensor —3.0L

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the engine appearance cover.
3. Disconnect the cylinder head temperature (CHT) sensor electrical connector.



4. Remove and discard the CHT sensor.

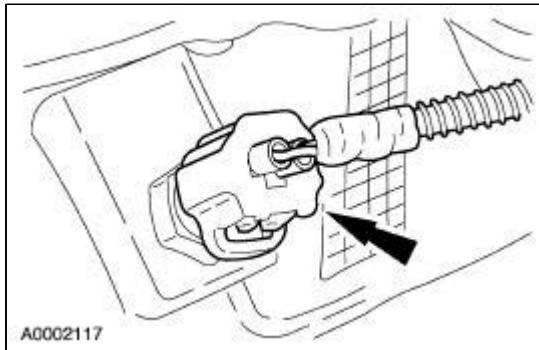


5. To install, reverse the removal procedure.

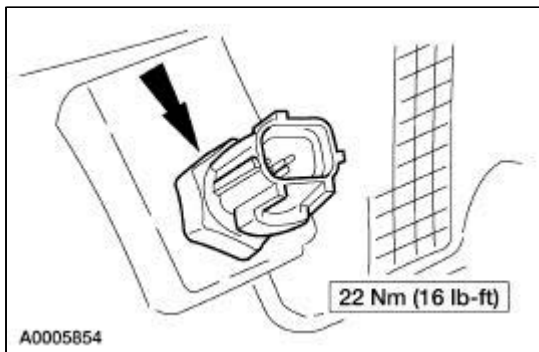
Cylinder Head Temperature (CHT) Sensor —3.9L


Removal and Installation

1. Remove the intake manifold. Refer to [Section 303-01B](#).
2. Disconnect the cylinder head temperature (CHT) sensor electrical connector.



3. Remove and discard the CHT sensor.




4.  **CAUTION:** The tip of the CHT sensor must contact the cylinder head at the bottom of the hole. When removed, it will be slightly crushed. This is a normal condition.

NOTE: 3.9L CHT sensors are not to be reused. Always install a new sensor.

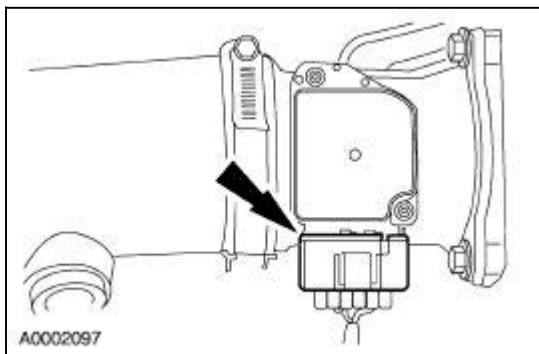
To install, reverse the removal procedure.

Mass Air Flow (MAF) Sensor

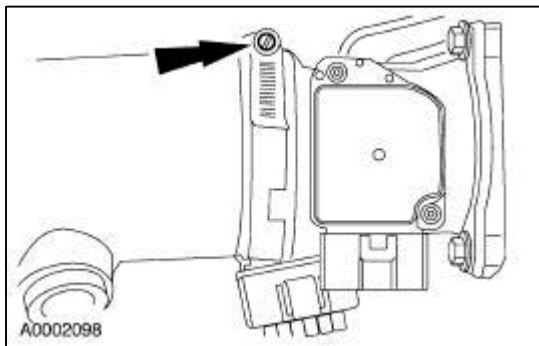
Removal and Installation

 **CAUTION:** The mass airflow sensor hot wire sensing element and housing are calibrated as a unit and must be repaired as a complete assembly. Do not damage the sensing element (internal to housing) or possible failure of the MAF sensor may occur.

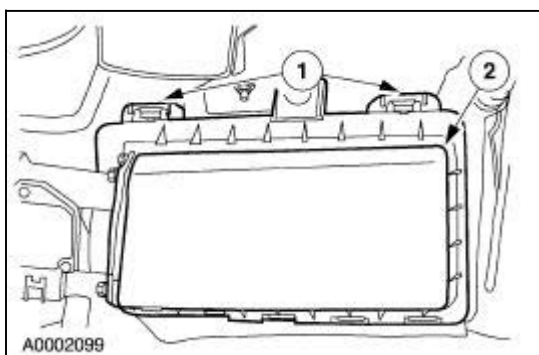
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the mass airflow (MAF) sensor electrical connector.



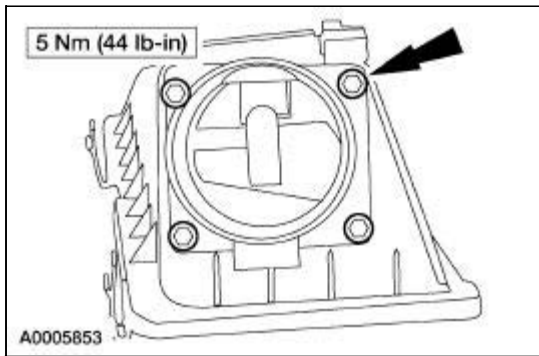
3. Loosen the screws on the air cleaner outlet tube clamp.



4. Remove the air cleaner housing cover.
 1. Release the cover clips.
 2. Remove the cover.



5. Remove the bolts and the MAF sensor.
 - Discard the gasket.

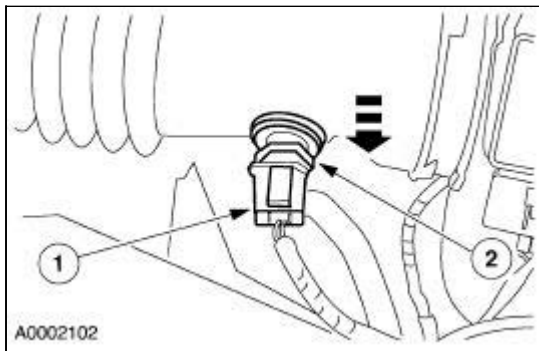


6. **NOTE:** A new gasket must be installed.
To install, reverse the removal procedure.
-

Intake Air Temperature (IAT) Sensor

Removal and Installation

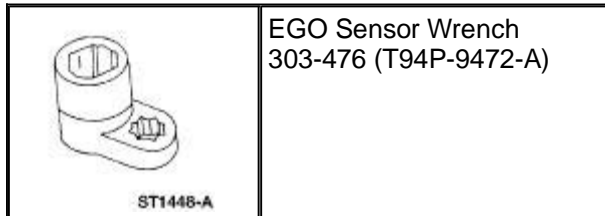
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the intake air temperature (IAT) sensor.
 1. Disconnect the IAT sensor electrical connector.
 2. Remove the IAT sensor.



3. Inspect the IAT sensor O-ring seal for damage or deterioration. Install a new O-ring seal as necessary.
 4. To install, reverse the removal procedure.
-

Heated Oxygen Sensor (HO2S) —3.0L, 3.9L, Front

Special Tool(s)

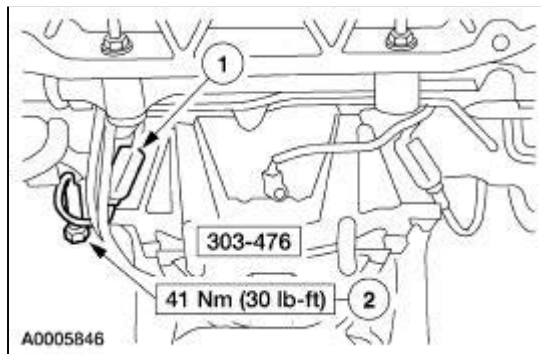


Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. **NOTE:** RH shown, LH similar.

Remove the heated oxygen sensor (HO2S).

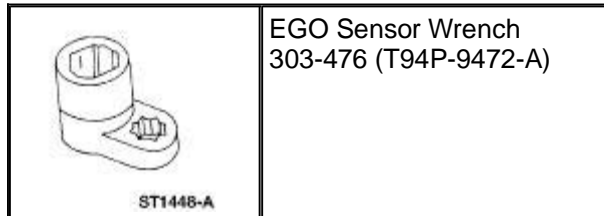
1. Unclip and disconnect the electrical connector.
2. Using the special tool, remove the HO2S.



4. To install, reverse the removal procedure.
 - Apply a light coat of High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA or equivalent meeting Ford specification ESE-M12A4-A to the threads of the heated oxygen sensors.

Heated Oxygen Sensor (HO2S) —3.0L (A/T), 3.9L, Rear

Special Tool(s)

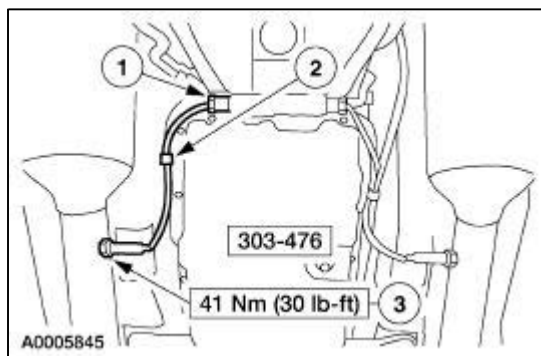


Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. **NOTE:** RH shown, LH similar.

Remove the heated oxygen sensor (HO2S).

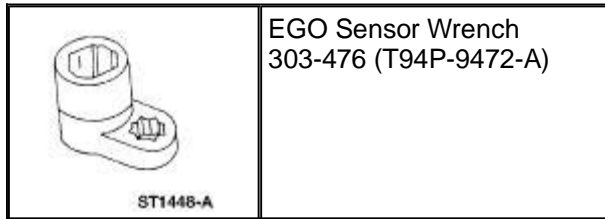
1. Disconnect the electrical connector.
2. Unclip the harness.
3. Using the special tool, remove the sensor.



4. To install, reverse the removal procedure.
 - Apply a light coat of High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA or equivalent meeting Ford specification ESE-M12A4-A to the threads of the heated oxygen sensors.

Heated Oxygen Sensor (HO2S) —3.0L (M/T), Rear

Special Tool(s)

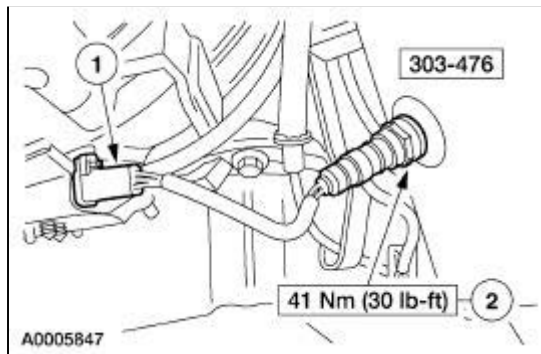


Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. **NOTE:** LH shown, RH similar.

Remove the heated oxygen sensors (HO2S).

1. Disconnect the electrical connector.
2. Using the special tool, remove the HO2S.

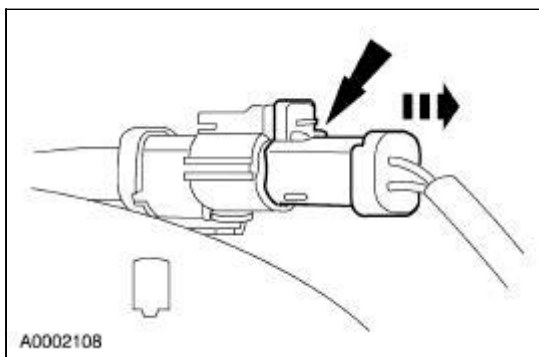


4. To install, reverse the removal procedure.
 - Apply a light coat of High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA or equivalent meeting Ford specification ESE-M12A4-A to the threads of the heated oxygen sensors.

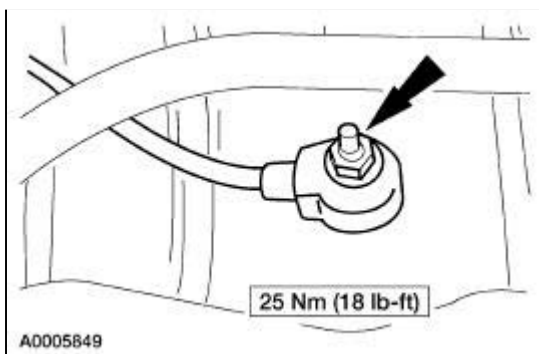
Knock Sensor (KS) —3.0L

Removal and Installation

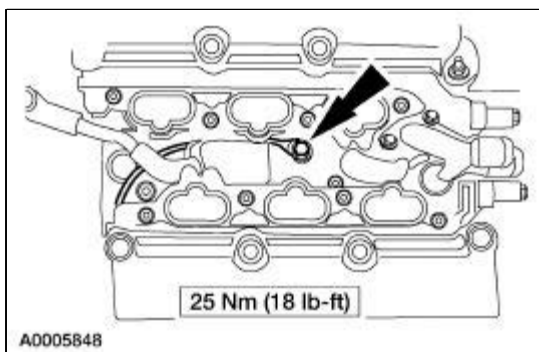
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. If removing the top-mounted knock sensor, remove the lower intake manifold. Refer to [Section 303-01A](#).
3. Disconnect the electrical connectors from the top-mounted and side-mounted knock sensors (KS).



4. Remove the nut and the side-mounted KS.



5. Remove the bolt and the top-mounted KS.

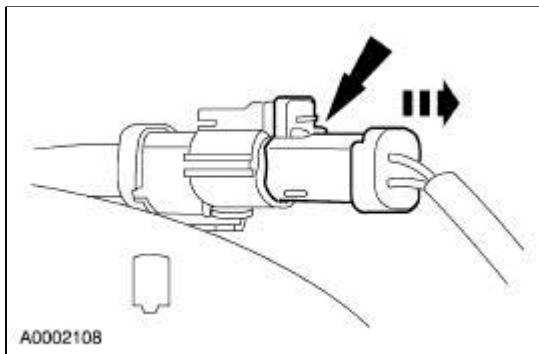


6. To install, reverse the removal procedure.

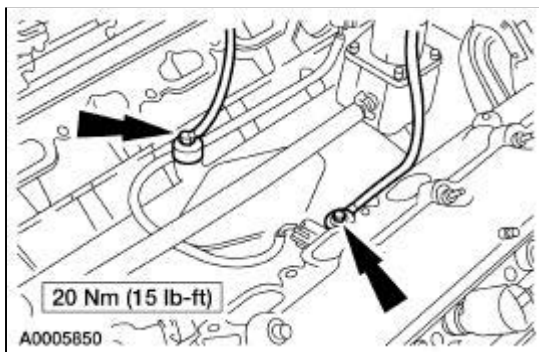
Knock Sensor (KS) —3.9L

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the lower intake manifold. For additional information, refer to [Section 303-01B](#).
3. Disconnect the knock sensor (KS) electrical connectors.



4. Remove the bolts and the knock sensors.

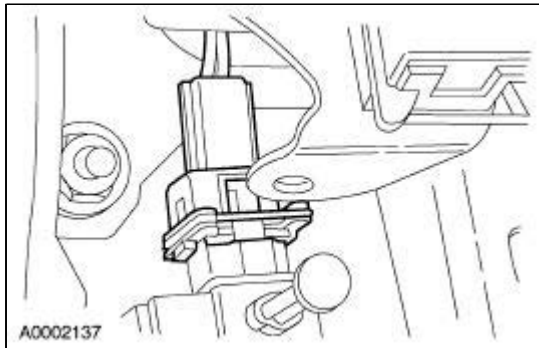


5. To install, reverse the removal procedure.

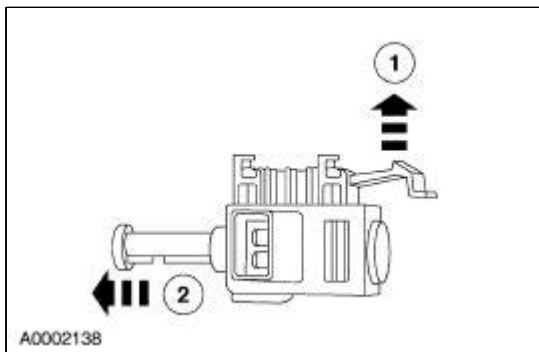
Clutch Pedal Position (CPP) Switch

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Disconnect the clutch pedal position (CPP) switch electrical connector.




3. Remove the CPP switch.
 1. Lift the CPP switch retaining tag.
 2. Remove the CPP switch.




4. To install, reverse the removal procedure.

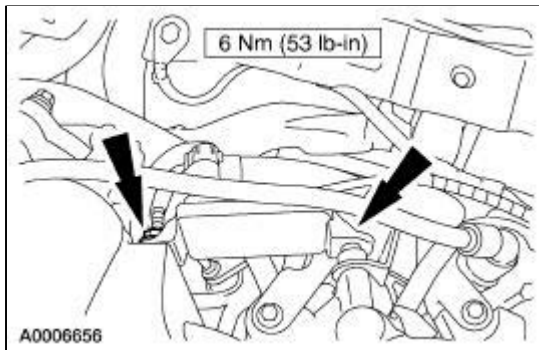
Fuel Pressure Sensor —3.0L

Removal and Installation

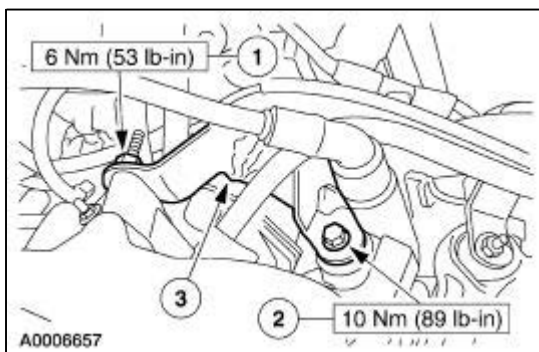
 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Before working on or disconnecting any of the fuel lines or fuel system components the fuel system pressure must be relieved. Failure to do so may result in personal injury.

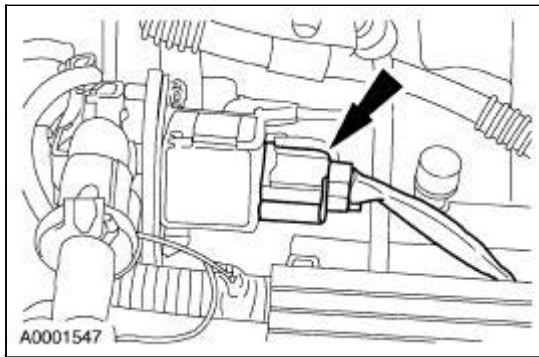
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Relieve the fuel system pressure. For additional information, refer to [Section 310-00](#).
3. Remove the cowl vent screen. For additional information, refer to [Section 501-02](#).
4. Remove the differential pressure feedback EGR (DPFE) nuts.



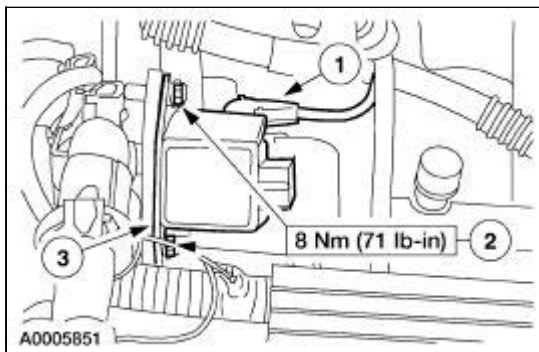
5. Remove the fuel pressure sensor shield.
 1. Remove the nut.
 2. Remove the two bolts.
 3. Remove the shield.




6. Disconnect the fuel pressure sensor electrical connector.



7. Remove the fuel pressure sensor.
 1. Disconnect the fuel pressure sensor vacuum hose.
 2. Remove the bolts.
 3. Remove the fuel pressure sensor.




8.  **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.


NOTE: Lubricate the new seal and O-ring seals with clean Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification ESE-M2C153-G.

To install, reverse the removal procedure.

Fuel Pressure Sensor —3.9L

Removal and Installation

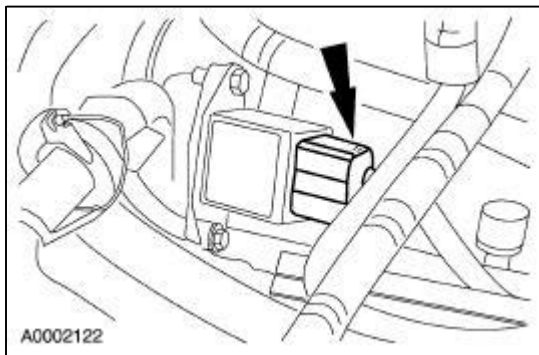
 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Before working on or disconnecting any of the fuel lines or fuel system components the fuel system pressure must be relieved. Failure to do so may result in personal injury.

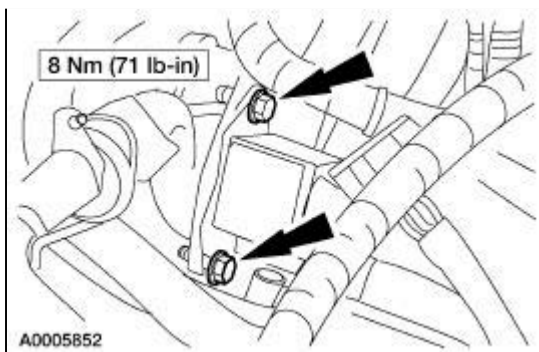
1. **NOTE:** When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven to relearn the strategy.

Disconnect the battery ground cable. For additional information, refer [Section 414-01](#).

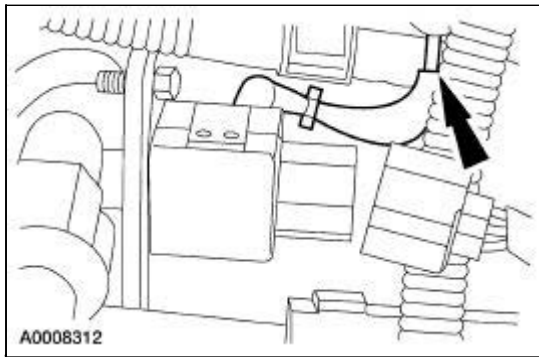
2. Relieve the fuel system pressure. For additional information, refer to [Section 310-00](#).
3. Disconnect the fuel pressure sensor electrical connector.




4. Remove the bolts.



5. Disconnect the fuel pressure sensor vacuum hose and remove the fuel pressure sensor.



6.  **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related components. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.**

NOTE: Lubricate the new seal and O-ring seals with clean Super Premium SAE 5W-30 Motor Oil XO-5W30-QSP or equivalent meeting Ford specification ESE-M2C153-G.

To install, reverse the removal procedure.

Fluid Maintenance



CAUTION: Use only MERCON® V transmission fluid. Use of any other fluids can result in transmission failure.

Intervals	
Normal maintenance	Not necessary. Filled for life.
Severe duty maintenance	Change the fluid at 48,000 km (30,000 miles) intervals. Use MERCON® V.

General Specifications

Vehicle	Engine	Approximate Liters	Refill Capacity ¹ U.S. Quarts	Fluid Type
Lincoln LS— 5R55N	3.0L, 3.9L	11.2	11.9	MERCON® V XT-5-QM

¹ Approximate dry capacity, includes cooler and tubes. Fluid level procedures in this section should be used to determine actual fluid requirements and fluid specification. DO NOT OVERFILL. If it is necessary to add or change fluid, use only fluid that has been certified by the supplier as meeting the Ford Motor Company specification shown.

General Specifications

Item	Specification
Fluid	
Motorcraft MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V
Fluid Filter	
Inline Transmission Fluid Filter Kit	XC3Z-7B155-AA
Inline Transmission Fluid Filter	XC3Z-7B155-BA
Lubricant	
Ford Multi-Purpose Grease D0AZ-19584-AA	ESB-M1C93-B
Premium Long Life Grease XG-1-C	ESA-M1C75-B
Sealant	
Threadlock 262 E2FZ-19554-B	WSK-M2G351-A6

Torque Specifications

Description	Nm	lb-ft	lb-in
Case-to-center support screw	11	8	—

Converter drain plug	10	—	89
Digital transmission range (TR) sensor-to-case screws	10	—	89
Driveshaft bolts and nuts	81	60	—
Extension housing screws and studs	26	19	—
Fill plug to extension housing	20	15	—
Fluid level indicator plug-to-drain pipe assembly	10	—	89
Fluid pan drain plug	26	19	—
Fluid pump housing screws	25	18	—
Heat shield screws	10	—	89
Locknut for band adjustment	54	40	—
Main control-to-case bolts	10	—	89
Manual control valve detent spring-to-case bolt	10	—	89
Manual control lever shaft nut	48	35	—
Output shaft-to-flange nut	131	97	—
Overdrive band adjustment screw	14	10	—
Pressure tap plug to case	13	10	—
Pump assembly-to-case screws	24	18	—
Reverse servo assembly-to-case bolts	10	—	89
Separator to main control bolts	10	—	89
Shift cable bracket bolts	25	18	—
Solenoid body-to-case bolts	8	—	71
Speed sensor-to-case screws	10	—	89
Torque converter adapter plate nuts to converter	44	33	—
Torque converter adapter plate-to-flexplate nut	38	28	—
Transmission cooler fitting to case	47	35	—
Transmission cooler line bracket nut (V6 application)	10	—	89
Transmission cooler line bracket nut (V8 application)	18	13	—
Transmission cooler tube nut to case fitting	40	30	—
Transmission fluid filter-to-case bolts	10	—	89
Transmission fluid pan-to-case screws	11	8	—
Transmission mount-to-extension housing center screw	40	30	—
Transmission mount-to-extension housing screws	50	37	—
Transmission mount-to-floor pan bolts	55	41	—
Transmission-to-engine bolts	47	35	—
Vehicle harness-to-solenoid body screw	5	—	44

End Play Specifications

Transmission Overdrive End Play Dimension D	Select Thrust Washer (No. 1 Nylon)		Identification: Color
	Part Number	Thickness	

38.04-38.28 mm (1.50-1.51 in)	XW4Z-XA	1.70-1.75 mm (0.06 in)	Brown/8
38.29-38.43 mm (1.51 in)	XW4Z-NA	1.85-1.90 mm (0.07 in)	Red/4
38.44-38.63 mm (1.51-1.52 in)	XW4Z-RA	2.05-2.10 mm (0.08 in)	Black/6
38.64-38.78 mm (1.52-1.53 in)	XW4Z-YA	2.20-2.25 mm (0.09 in)	Orange/9
38.79-38.97 mm (1.53 in)	XW4Z-ZA	2.40-2.45 mm (0.10 in)	Purple/10

End Play Specifications

Rear (No. 4) Dimension E	Selective Needle Bearings (No. 4)		Identification: Notches
	Part Number	Thickness	
1.67-1.85 mm (0.066-0.073 in)	XW4Z-7D014-CA	2.65-2.80 mm (0.104-0.110 in)	0
1.86-2.04 mm (0.073-0.080 in)	XW4Z-7D014-DA	2.80-2.95 mm (0.110-0.116 in)	1
2.05-2.23 mm (0.081-0.088 in)	XW4Z-7D014-EA	3.00-3.15 mm (0.118-0.124 in)	2
2.25-2.43 mm (0.089-0.096 in)	XW4Z-7D014-FA	3.20-3.35 mm (0.126-0.132 in)	3

Torque Converter End Play

Transmission Model	Converter End Play			
	New or Rebuilt Converter		Used Converter	
	mm	inch	mm	inch
5R55N	0.44 max.	0.017 max.	0.80 max.	0.031 max.

Band Adjustment And Torque Chart

Description	Number of Turns to Back Off	Locknut		Adjusting Screw	
		Nm	Lb-Ft	Nm	Lb-Ft
Intermediate Band	2.0	54	40	14	10
Overdrive Band	2.0	54	40	14	10

Selective Snap Rings

Coast and Direct Clutch Drum					Forward Clutch Cylinder				
Part Number	Thickness		Diameter		Part Number	Thickness		Diameter	
	mm	inch	mm	inch		mm	inch	mm	inch
E860126-S	1.37	0.0539	130.1	5.122					
E860127-S	1.73	0.0681	130.1	5.122	XW4Z-7D483-AB	1.73	0.0681	141.45	5.56

E860128-S	2.08	0.0819	130.1	5.122	XW4Z-7D483-AC	2.08	0.0819	141.45	5.56
E860129-S	2.44	0.0961	130.1	5.122	XW4Z-7D483-AD	2.44	0.0961	141.45	5.56

Service Identification Model Chart

Vehicle Application			
7000 Prefix and Suffix	C=Column F=Floor	Engine Displacement	Vehicle Application
1W4P-BA, RJL-M	F	3.0L	Lincoln LS
1W4P-AA, RJL-L	F	3.9L	Lincoln LS

Solenoid Operation Chart

Base Gearshift Selector Position	Powertrain Control Module (PCM) Commanded Gear	5R55N Solenoid States						
		SSA	SSB	SSC	SSD	PCA	PCB	PCC
P/N	P	On	Off	Off	On	L ¹	C ²	L
R	R	On	Off	Off	On	L	H ³	H
D5	1	On	Off	Off	On	C	L	L
	2	On	Off	On	On	L	C	L
	3	On	On	Off	On	C	L	L
	4	Off	Off	Off	On	C	L	H
	5	Off	Off	On	On	C	C	H
D4	1	On	Off	Off	On	C	L	L
	2	On	Off	On	On	L	C	L
	3	On	On	Off	ON	C	L	L
	4	Off	Off	Off	Off	C	C	H
3	3	On	On	Off	Off	C	C	L
2	2	On	Off	On	Off	C	C	L
1	1	On	Off	Off	Off	C	C	L

¹ Low line pressure

² Control line pressure

³ High line pressure

Solenoid Operation Chart

Select Shift Gearshift Selector Position	Powertrain Control Module (PCM) Commanded Gear	5R55N Solenoid States						
		SSA	SSB	SSC	SSD	PCA	PCB	PCC
P/N	P	On	Off	Off	On	L ¹	C ²	L
R	R	On	Off	Off	On	L	H ³	H
D5	1	On	Off	Off	On	C	L	L
	2	On	Off	On	On	L	C	L
	3	On	On	Off	On	C	L	L
	4	Off	Off	Off	On	C	L	H
	5	Off	Off	On	On	C	C	H

D4	1	On	Off	Off	On	C	L	L
	2	On	Off	On	On	L	C	L
	3	On	On	Off	On	C	L	L
	4	Off	Off	Off	Off	C	C	H
+/-	1	On	Off	Off	Off	H	H	L
	2	On	Off	On	Off	H	H	L
	3	On	On	Off	Off	H	H	L
	4	Off	Off	Off	Off	H	H	H
	5	Off	Off	On	On	H	H	H

¹ Low line pressure

² Control line pressure

³ High line pressure

Band/Clutch Application Chart A

	Overdrive Band	Intermediate Band	Reverse Band	Intermediate Clutch	Forward Clutch	Direct Clutch	Coast Clutch
PARK							
REVERSE			A ³	A ³		A ³	
NEUTRAL							
1st					A ³		
2nd	A ³				A ³		
3rd		Ac ²		A ³	A ³		
4th				ANE ¹	A ³	A ³	
5th	A ³				ANE ¹	A ³	A ³
1st ^a			Ac ²		A ³		Ac ²
2nd ^a	A ³		Ac ²		A ³		Ac ²
3rd ^a		Ac ²		A ³	A ³		Ac ²
4th ^a				ANE ¹	A ³	A ³	Ac ²
MAN. 3rd		Ac ²		A ³	A ³		Ac ²
MAN. 2nd	A ³		Ac ²		A ³		
MAN. 1st			Ac ²		A ³		Ac ²

³ A = Applied

¹ ANE = Applied but no effect

^a D4 Position (overdrive canceled)

² Ac = Applied to carry coast torque

Band/Clutch Application Chart B

	Direct One-Way Clutch		Low One-Way Clutch		Intermediate One-Way Clutch		Engine Braking
	Drive	Coast	Drive	Coast	Drive	Coast	
PARK							
REVERSE	H ⁵	OR ⁶	NE		ORI ⁷		YES
NEUTRAL							

1st	H ⁵	OR ⁶	H ⁵	OR ⁶	NE ⁴		NO
2nd	OR ⁶	OR ⁶	H ⁵	OR ⁶	NE ⁴		NO
3rd	H ⁵	OR ⁶	OR ⁶	OR ⁶	H ⁵	OR ⁶	NO
4th	H ⁵	OR ⁶	OR ⁶	OR ⁶	OR ⁶	OR ⁶	NO
5th	OR ⁶	OR ⁶	OR ⁶	OR ⁶	OR ⁶	OR ⁶	YES
1st ^a	H ⁵	OR ⁶	H ⁵	OR ⁶	NE ⁴		YES
2nd ^a	OR ⁶	OR ⁶	H ⁵	OR ⁶	NE ⁴		YES
3rd ^a	H ⁵	OR ⁶	OR ⁶	OR ⁶	H ⁵	OR ⁶	YES
4th ^a	H ⁵	OR ⁶	OR ⁶	OR ⁶	OR ⁶	OR ⁶	YES
MAN. 3rd	H ⁵	OR ⁶	OR ⁶	OR ⁶	H ⁵	OR ⁶	YES
MAN. 2ND	OR ⁶	OR ⁶	H ⁵	OR ⁶	NE ⁴		YES
MAN. 1ST	H ⁵	OR ⁶	H ⁵	OR ⁶	NE ⁴		YES

⁵ H = Hold

⁶ OR = Overrunning

⁷ ORI = Overrunning but independent for speed

⁴ NE = No effect

Line Pressure Chart

Range	Idle	WOT Stall	Idle	WOT Stall
	PC C	PC C	Line	Line
P/N	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	862-1,137 kPa (125-165 psi)	2,000-2,482 kPa (290-360 psi)
R	793 kPa (115 psi)	793 kPa (115 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)
D5/D4	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)
M5/M4	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	425-800 kPa (76-116 psi)	1,448-1,793 kPa (210-260 psi)
M3	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)
M2/M1	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	634-910 kPa (92-132 psi)	1,448-1,793 kPa (210-260 psi)
P/N	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	862-1,137 kPa (125-165 psi)	—
R	793 kPa (115 psi)	793 kPa (115 psi)	634-910 kPa (92-132 psi)	2,000-2,482 kPa (290-360 psi)
D5/D4	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)
M5/M4	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)
M3/M2/M1	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)

Stall Speed

--	--	--

Vehicle	Engine	rpm
Lincoln LS	3.0	2,565-3,060
Lincoln LS	3.9	2,491-2,900

Shift Speeds



CAUTION: Always obey local traffic laws. Do not exceed posted limits.

			D5 Position	Speed km/h (mph)
Vehicle Information	Transmission Model	Throttle Position	Shift	Axle Ratio All
Lincoln LS 3.0L/3.9L	RJL-A	Closed	5-4	38-41 (24-26)
	RJL-B		4-3	28-32 (18-20)
			3-2	17-22 (11-14)
			2-1	11-16 (7-10)
		Minimum		
		Monitor PID: TP volt-1.25	1-3	14-25 (9-16)
			3-4	32-41 (20-26)
			4-5	41-48 (26-30)
			5-4	45-48 (28-30)
			4-3	28-32 (18-20)
			3-2	17-22 (11-14)
			2-1	11-16 (7-10)
		Wide Open	1-2	67-72 (42-45)
			2-3	90-96 (56-60)
			3-4	136-159 (85-99)
			4-5	188-236 (117-147)
			5-4	177-201 (110-125)
			4-3	123-125 (77-78)
			3-2	56-67 (35-42)
			2-1	38-41 (24-26)

Transmission Description

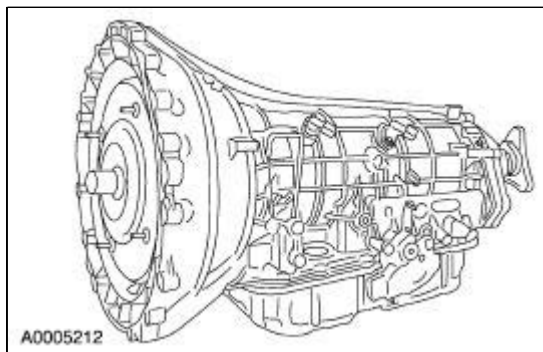
The 5R55N has the following features:

- five forward speeds
- electronic shift, pressure, and torque converter clutch controls
- three compound planetary gearsets
- three bands
- four multi-plate clutches
- three one-way clutches

All hydraulic functions are directed by electronic solenoids to control:

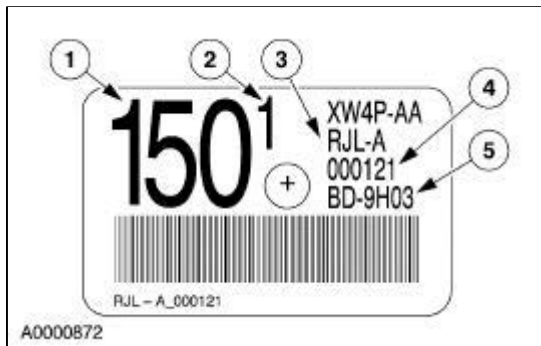
- static engagement feel.
- shift feel.
- shift scheduling.
- modulated torque converter clutch (TCC) applications.
- engine braking utilizing the coast clutch and band.
- manual first and second timing.
- reverse inhibit timing.

Transmission View



Identification Tags

I. D. Tag Located on Transmission Case



Item	Part Number	Description
1	—	Model number
2	—	Assemble level
3	—	Build code
4	—	Serial number
5	—	Build date (YMDD)

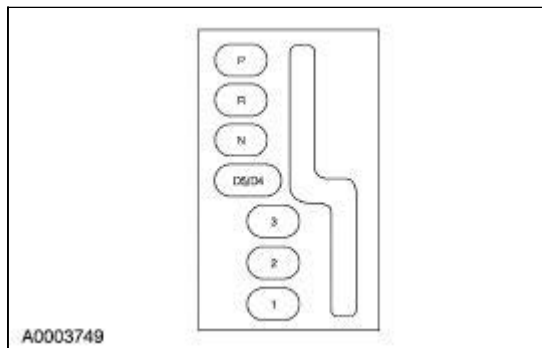
All vehicles are equipped with a Vehicle Certification Label, located on the driver side door lock post. Refer to the code in the space marked TR. For model, service ID level or build date information refer to the transmission service ID tag located on the transmission case.

Range Selection

Depending on the vehicle options selected the transmission range selector may have different range positions.

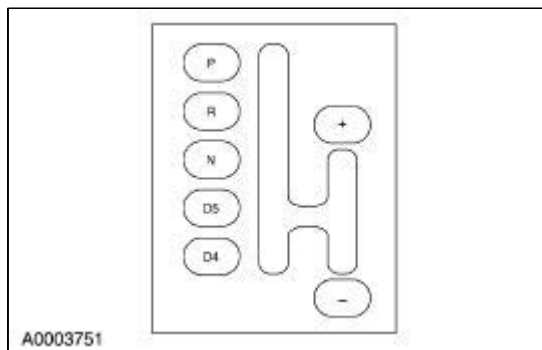
The standard range selector has eight positions: P, R, N, D5, D4, 3, 2, and 1.

Base Range Shifter



The optional Select Shift Transmission (SST) range selector has seven positions P, R, N, D5, or D4, + and -. This option will allow the driver to manually upshift and downshift into any gear range.

Optional Range Shifter



Park

In the PARK position:

- there is no power flow through the transmission.
- the parking pawl locks the output shaft to the case.
- the engine may be started.
- the ignition key may be removed.

Reverse

In the REVERSE position:

- the vehicle may be operated in a rearward direction, at a reduced gear ratio.
- backup lamps are illuminated.

Neutral

In the NEUTRAL position:

- there is no power flow through the transmission.
- the output shaft is not held and is free to turn.
- the engine may be started.

D5 (Overdrive)

D5 (overdrive) is the normal position for most forward driving.

The D5 (overdrive) position provides:

- automatic shift 1-5 and 5-1.
- apply and release of the torque converter clutch.
- maximum fuel economy during normal operation.
- engine braking in 5th gear.

D4 (Overdrive Canceled)

The D4 (overdrive) position provides:

- automatic shift 1-4 and 4-1.
- apply and release of the torque converter clutch.
- engine braking in 4th gear.

Third Position—3rd Gear (Base Shifter)

The 3rd position provides:

- third gear start and hold.
- the torque converter clutch may apply and release.
- improved traction on slippery roads.
- engine braking.

Second Position—2nd Gear (Base Shifter)

The 2nd position provides:

- second gear start and hold.
- the torque converter clutch may apply and release.
- improved traction on slippery roads.
- engine braking.

First Position—1st Gear (Base Shifter)

If this position is selected at normal road speeds, the transmission will downshift into the next lower gear and continue downshifting until the vehicle reaches first gear.

This position provides:

- first gear operation only.
- engine braking for descending steep grades.

+ and - Position Operation (Optional Shifter)

These positions allow the driver to manually select the appropriate upshift (+) or downshift (-) and gear range.

- Can only be entered from the D5 position.
- Gear ranges 1-5 provide the same function and ratio as found in the D5 or D4 automatic mode positions.
- Transmission will not upshift or downshift unless the selector lever is moved forward or rearward.
- One tap forward (+) will command the transmission to upshift one gear range.
- One tap rearward (-) will command the transmission to downshift one gear range.
- Upshifts are allowed at any vehicle speed.
- A second gear start up is normal. A third gear start up will be allowed only if selected. All other selections will revert to second gear.
- If the driver starts in second gear and does not pass 60% throttle, the transmission will remain in second gear. No automatic shift will occur.
- If the driver passes 60% throttle, then a 2-1 automatic kickdown will occur, scheduled by the PCM as used in D5. Once this has occurred, first gear will hold until second gear is selected by the driver moving the shift handle. No automatic upshift is possible under this condition.
- Once a kickdown has occurred, manual shifting in and out of first gear is allowed until the next time the vehicle stops.
- A shift to first gear with the vehicle at rest is never allowed.
- When downshifting at normal road speeds, the transmission will only allow a downshift into the next lower gear.
- If the shifter (-) is tapped more than once in rapid succession, the transmission will downshift only into the next lower gear. Then when the vehicle reaches a speed below a calibrated entry speed, the transmission will allow a downshift into the next lower gear, if again selected by the driver. This is to prevent engine and transmission damage and to keep the engine and transmission within allowable rpm ranges.
- An electronic indicator on the instrument cluster will display the selected gear.

Park Sense Switch

The park sense switch prevents the redundant PRNDL from displaying "P" until the shifter is in the park position.

Electronic Transmission Error Indicator

The vehicle is equipped with a redundant electronic gearshift indicator. This character appears with the key in the run position and displays the same gear selection as shown on the range selector floor console next to the range selector lever. If an "E" character flashes or remains on this indicates a

transmission malfunction.

Shift Patterns

Upshifts

Transmission upshifting is controlled by the powertrain control module. The PCM receives inputs from various engine or vehicle sensors and driver demands to control shift scheduling, shift feel and torque converter clutch (TCC) operation.

The PCM has an adaptive learn strategy to electronically control the transmission which will automatically adjust the shift feel. When the battery has been disconnected, or a new battery installed certain transmission operating parameters may be lost. The Powertrain Control Module (PCM) must re-learn these parameters. During this learning process you may experience slightly firm shifts, delayed, or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Downshifts

Under certain conditions the transmission will downshift automatically to a lower gear range (without moving the gearshift lever). There are three categories of automatic downshifts: coastdown, torque demand and forced or kickdown shifts.

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a stop.

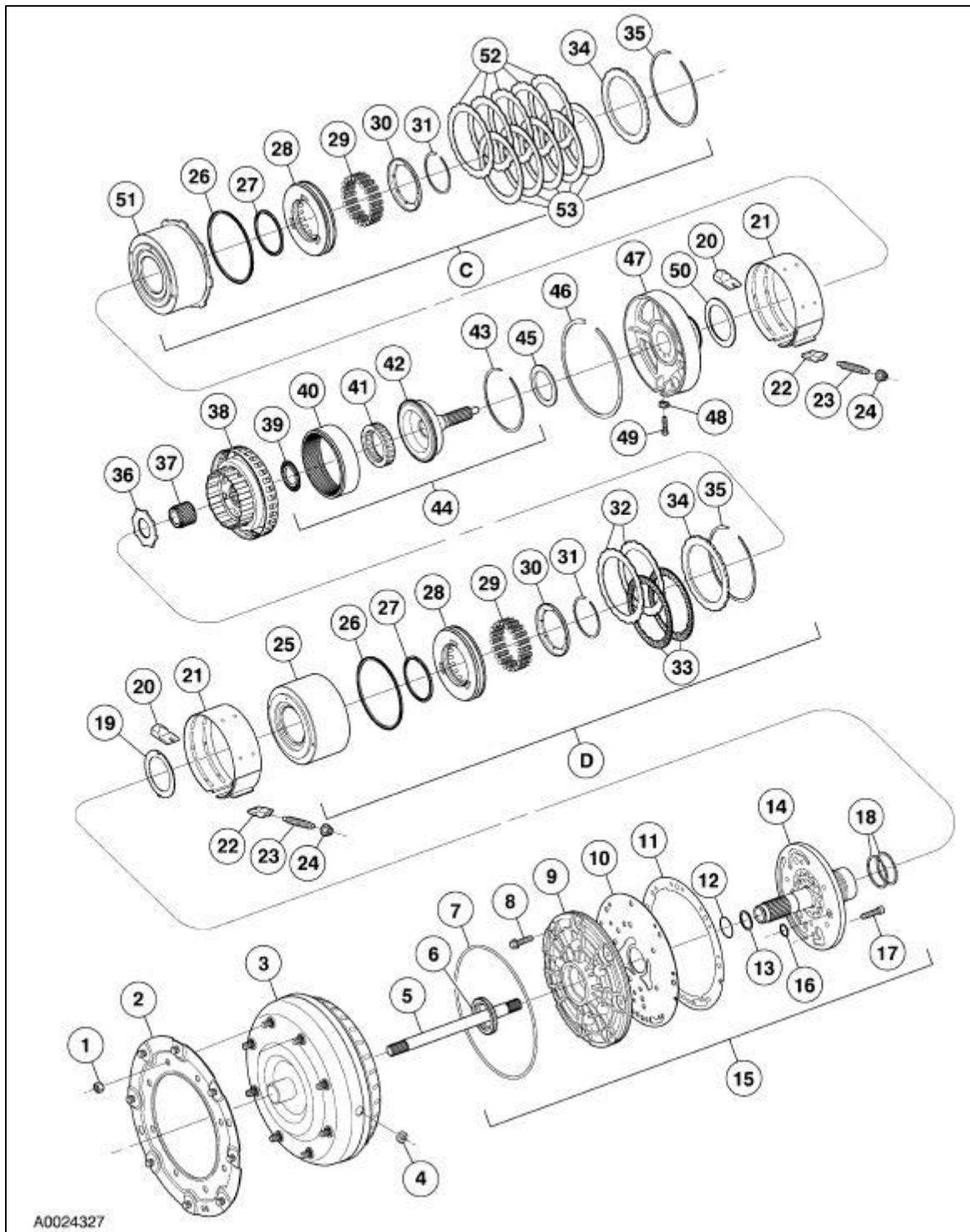
Torque Demand

The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio. If applied, the transmission will disengage the TCC to provide added acceleration.

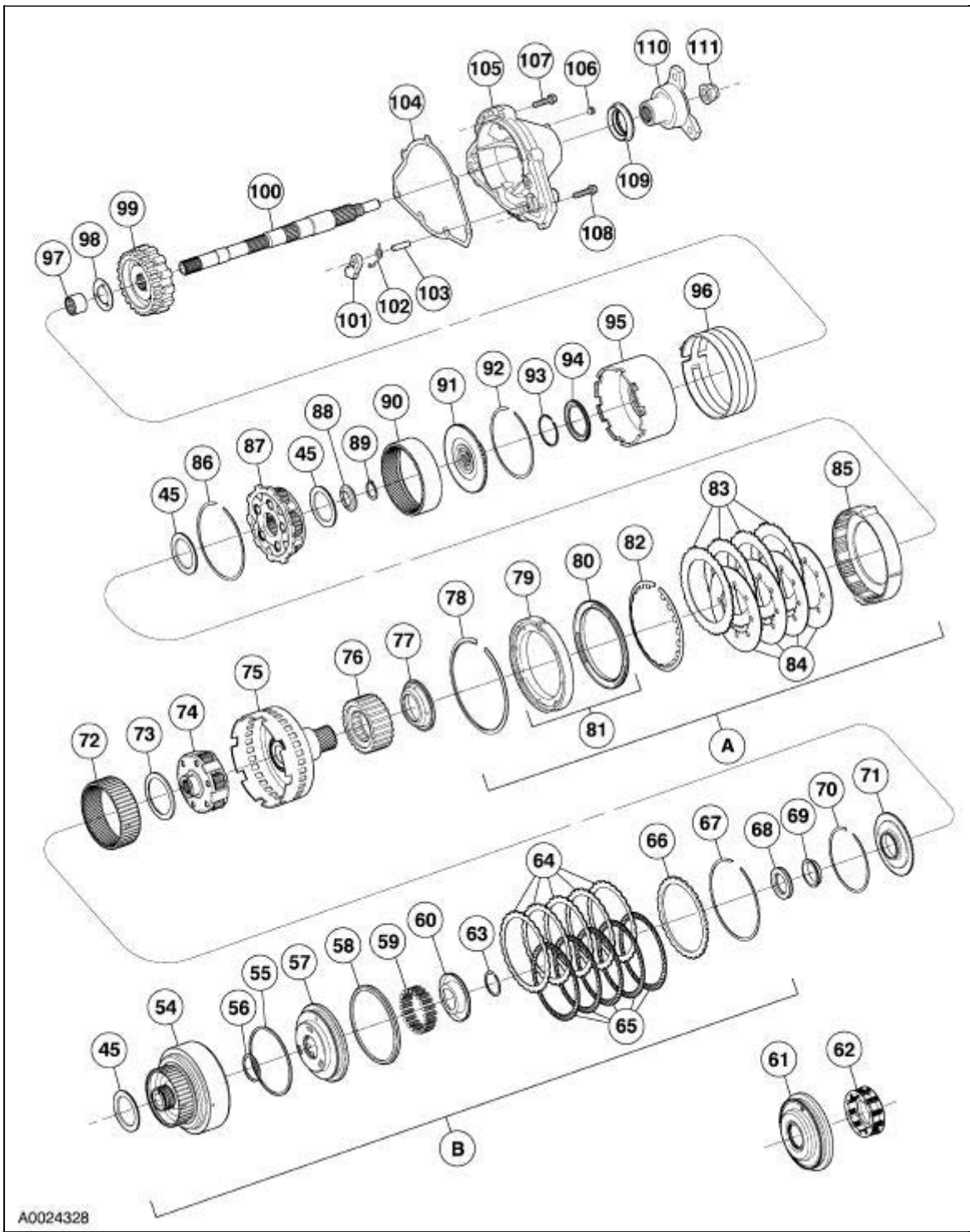
Kickdown

For maximum acceleration, the driver can force a downshift by pressing the accelerator pedal to the floor. A forced downshift into a lower gear is possible below calibrated speeds. Specifications for downshift speeds are subject to variations due to tire size and engine and transmission calibration requirements.

Disassembled Views

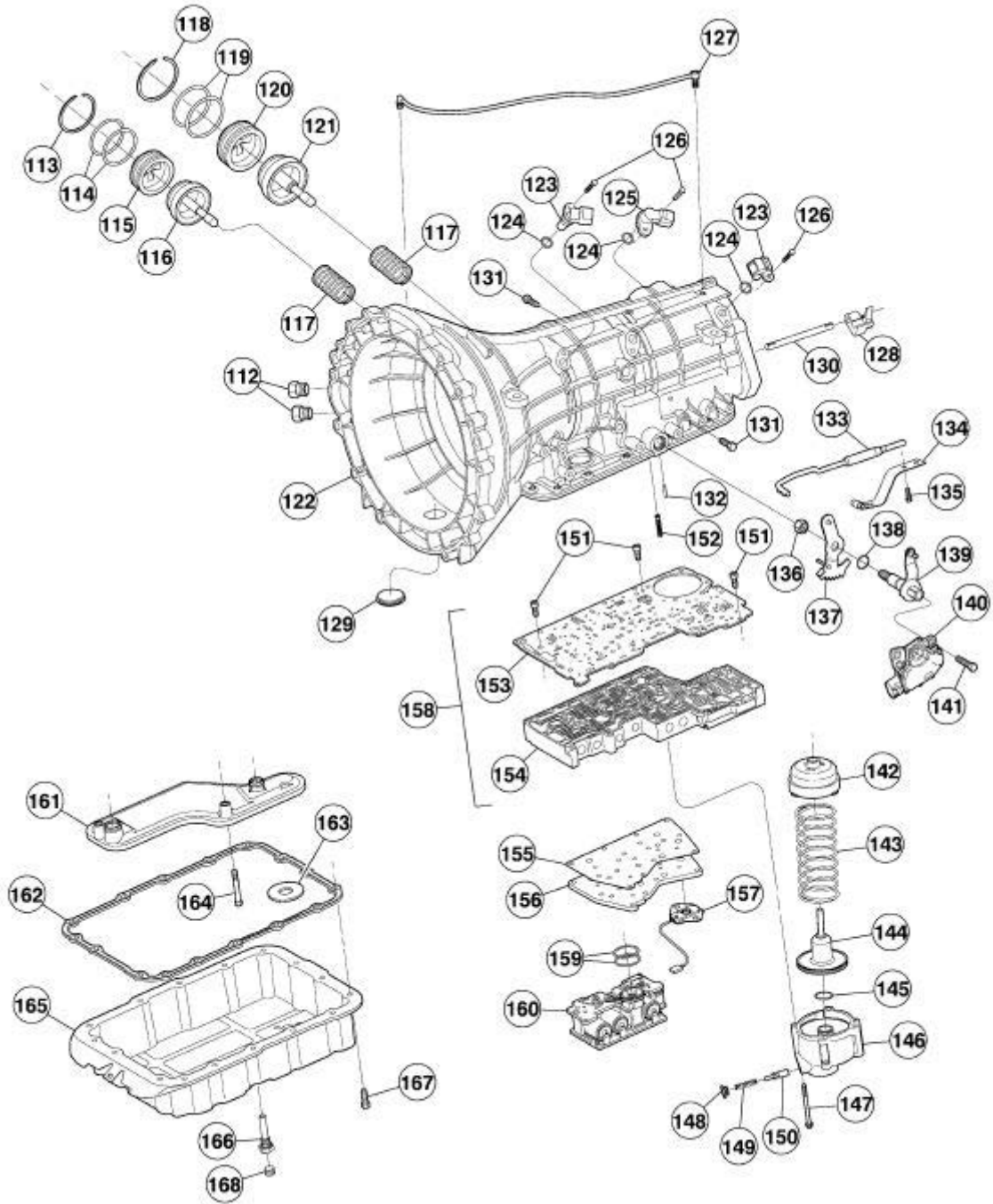


Disassembled Views (Continued)



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Disassembled Views (Continued)



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Item	Part Number	Description
1	6441	Nut — converter to flex plate
2	6K374	Flex plate adapter assembly
3	7902	Converter assembly
4	6730	Torque converter drain plug
5	7017	Input shaft
6	7A248	Front fluid pump seal assembly
7	7A248	Front fluid pump seal
8	W704892-	Screw and washer assembly — M8 x 35

	S1300	(attaches pump to case) (8 req'd)
9	7G178	Fluid pump cover assembly
10	7B472	Fluid pump adapter plate
11	7A136	Front fluid pump gasket
12	W701431-S300	O-ring seal — fluid pump shaft to inner gear (also in pump assembly)
13	7L323	Stator support seal
14	7A108	Front pump support assembly
15	7A103	Fluid pump assembly
16	7H416	Ring
17	W701429-S309M	Bolt — M8 x 1 x 35 int lob (attaches pump support to pump assembly) (6 req'd)
18	7D025	Overdrive brake drum seal
19	7D014	Washer — fluid pump input thrust (select fit) No. 1
20	7D029	Strut — intermediate and overdrive brake band anchor (2 req'd)
21	7D034	Band assembly — intermediate and overdrive brake band (2 req'd)
22	7D029	Strut — intermediate and overdrive brake band apply (2 req'd)
23	7C492	Overdrive/intermediate band adjusting screw
24	71000	Overdrive/intermediate locking nut
25	7L669	Overdrive brake band drum assembly
26	7A548	Seal — direct and overdrive piston — outer
27	7D404	Seal — direct and overdrive piston — inner
28	7A262	Direct and overdrive clutch piston
29	7A480	Spring — direct and overdrive clutch piston
30	7A527	Retainer — clutch piston springs (2 req'd)
31	E860125-S	Retaining ring (retains 7D041 to drum) (2 req'd)
32	7B442	Plate — coast clutch external splined (steel) (2 req'd)
33	7B164	Plate — coast clutch internal splined (friction) (2 req'd)
34	7B066	Plate — coast and direct clutch pressure (2 req'd)
35	E860126-S	Retaining ring — coast and direct clutch plates (select fit) (2 req'd)
36	7660	Adapter — coast clutch to overdrive carrier
37	7D063	Gear — sun overdrive
38	7B446	Carrier — planetary gear overdrive (with trigger wheel)
39	7L495	Bearing — overdrive planet thrust No. 2
40	7A153	Gear — overdrive ring
41	7A089	Overdrive one-way clutch assembly (part of 7L678)

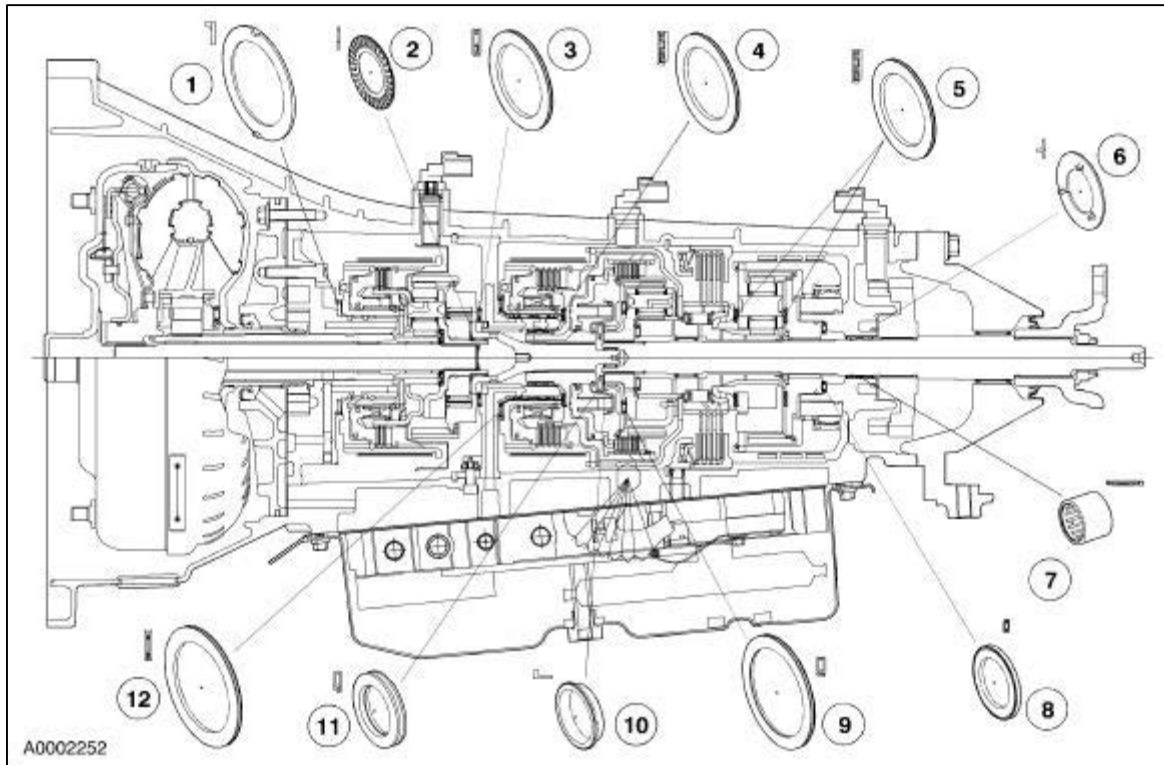
42	7A658	Overdrive center shaft assembly
43	W702037-S300	Retaining ring (retains 7A658 to 7A153)
44	7L678	Hub and ring gear assembly (includes 7A089, 7A153, 7A658, and W702037-S300)
45	7M153	Bearing assembly— center shaft and forward clutch cylinder No. 3, No. 5, No. 8 and No. 9 (4 req'd)
46	W702465-S300	Retaining ring
47	7A130	Support — center
48	E826160-S76	Nut and cage assembly — (attaches center support to case)
49	W705407-S300	Screw
50	7D014	Bearing assembly — intermediate clutch drum (select fit) No. 4
51	7D044	Drum assembly — intermediate brake
52	7B442	Plate assembly — direct clutch external splined steel (5 req'd)
53	7B164	Plate assembly — direct clutch internal splined friction (5 req'd)
54	7A360	Cylinder assembly — forward clutch
55	7A548	Seal — forward clutch piston — outer
56	7A548	Seal — forward clutch piston — inner
57	7A262	Piston assembly — forward clutch
58	7B070	Spring — forward clutch couison
59	7C151	Spring — forward clutch couison (15 req'd)
60	7A527	Retainer — forward clutch piston spring
61	7A262	Piston assembly — forward clutch
62	7G299	Support and spring assembly — forward clutch
63	E860109-S	Retaining ring — external spline
64	7B442	Plate — forward clutch external spline (steel) (5 req'd)
65	7B164	Plate — forward clutch internally spline (friction) (5 req'd)
66	7B066	Plate — forward clutch pressure
67	7D483	Retaining ring 141.45 x 1.37 internal (select fit)
68	7D234	Bearing — forward ring gear hub thrust No. 6A
69	7D090	Washer — forward clutch thrust No. 6B
70	7G375	Ring — forward clutch hub retainer
71	7B067	Hub — forward ring gear
72	7D392	Gear — forward ring
73	7G433	Bearing — forward planet thrust No. 7
74	7A398	Planet assembly — forward

75	7A019	Shell and sun gear assembly
76	7A089	Sprag clutch and race assembly
77	7C167	Spacer — low and reverse gear
78	7D483	Ring — bevel retaining
79	7G384	Housing assembly — intermediate clutch (part of 7N060)
80	7E005	Piston — intermediate clutch (part of 7N060)
81	7N060	Intermediate clutch assembly
82	7B070	Spring — intermediate clutch piston
83	7B442	Plate — intermediate clutch external spline (steel) (4 req'd)
84	7B164	Plate — intermediate clutch internal spline (friction) (4 req'd)
85	7F340	Cylinder — intermediate clutch
86	W702775-S300	Snap ring — reverse carrier drum
87	7D006	Planet assembly — reverse
88	7B167	Sleeve — output shaft
89	E860527-S	Retainer — ring external
90	7A153	Gear — output shaft ring
91	7D164	Hub — output shaft
92	7C122	Ring — output shaft ring gear retaining
93	7D019	Seal — output shaft hub
94	7H027	Bearing assembly — low/intermediate sun gear No. 10
95	7C498	Drum and clutch assembly — reverse brake (includes OWC)
96	7D095	Band assembly — reverse
97	7R205	Bearing — output shaft to case
98	7B368	Washer — output shaft thrust No. 11
99	7A233	Gear assembly— transmission parking
100	7060	Shaft assembly — output
101	7A441	Pawl — parking
102	7D070	Spring — parking pawl return
103	7D071	Shaft — parking pawl
104	7086	Gasket — extension housing
105	7A039	Extension housing
106	6026	Plug — fluid fill access
107	W500312-S1309	Bolt — M8 x 45 extension housing to case (2 req'd)
108	W500311-S1427	Bolt — M8 x 1.2 extension housing to case (5 req'd)
109	7052	Seal — extension housing
110	7089	Flange — output shaft

111	W701357-S309	Nut — M20 x 1.5 retains flange to output shaft
112	7D273	Connector assembly — fluid tube (2 req'd)
113	7H074	Ring — overdrive servo retainer
114	W703119-S300	Seal — overdrive servo cover (quantity model-dependent)
115	7D027	Cover — overdrive servo
116	7D021	Piston and rod — overdrive servo
117	7D028	Spring — intermediate/overdrive servo piston (2 req'd)
118	W702777-S300	Ring intermediate servo retainer
119	W702969-S300	Seal — intermediate servo cover (quantity model-dependent)
120	7D027	Cover — intermediate servo
121	7D021	Piston and rod — intermediate servo
122	7005	Case assembly
123	7H103	Sensor — output shaft speed and turbine shaft speed
124	W702981-S300	O-ring seal — speed sensor to case (3 req'd)
125	7M183	Sensor assembly— intermediate shaft speed (ISS)
126	W702769-S300	Screw — M6 x 19 (sensor to case)
127	7034	Vent assembly — case
128	7A179	Lever assembly — reverse brake drum
129	7N171	Converter housing access plug
130	7D433	Shaft — reverse band actuating lever
131	390318-S2	Pipe plug
132	7B210	Pin retainer — manual lever shaft
133	7A232	Rod — parking pawl actuating
134	7E332	Spring assembly — manual valve detent
135	E800185-S	Bolt detent spring
136	W703001-S309	Nut — manual lever shaft
137	7C494	Lever — manual valve inner
138	7B498	Seal — manual control lever
139	7A256	Lever — manual control
140	7F293	Sensor assembly — digital transmission range (TR)
141	N806933-S100	Bolt and washer assembly — digital transmission range (TR) sensor (2 req'd)
142	7D372	Plate — servo reverse
143	7D466	Spring — reverse servo accumulator

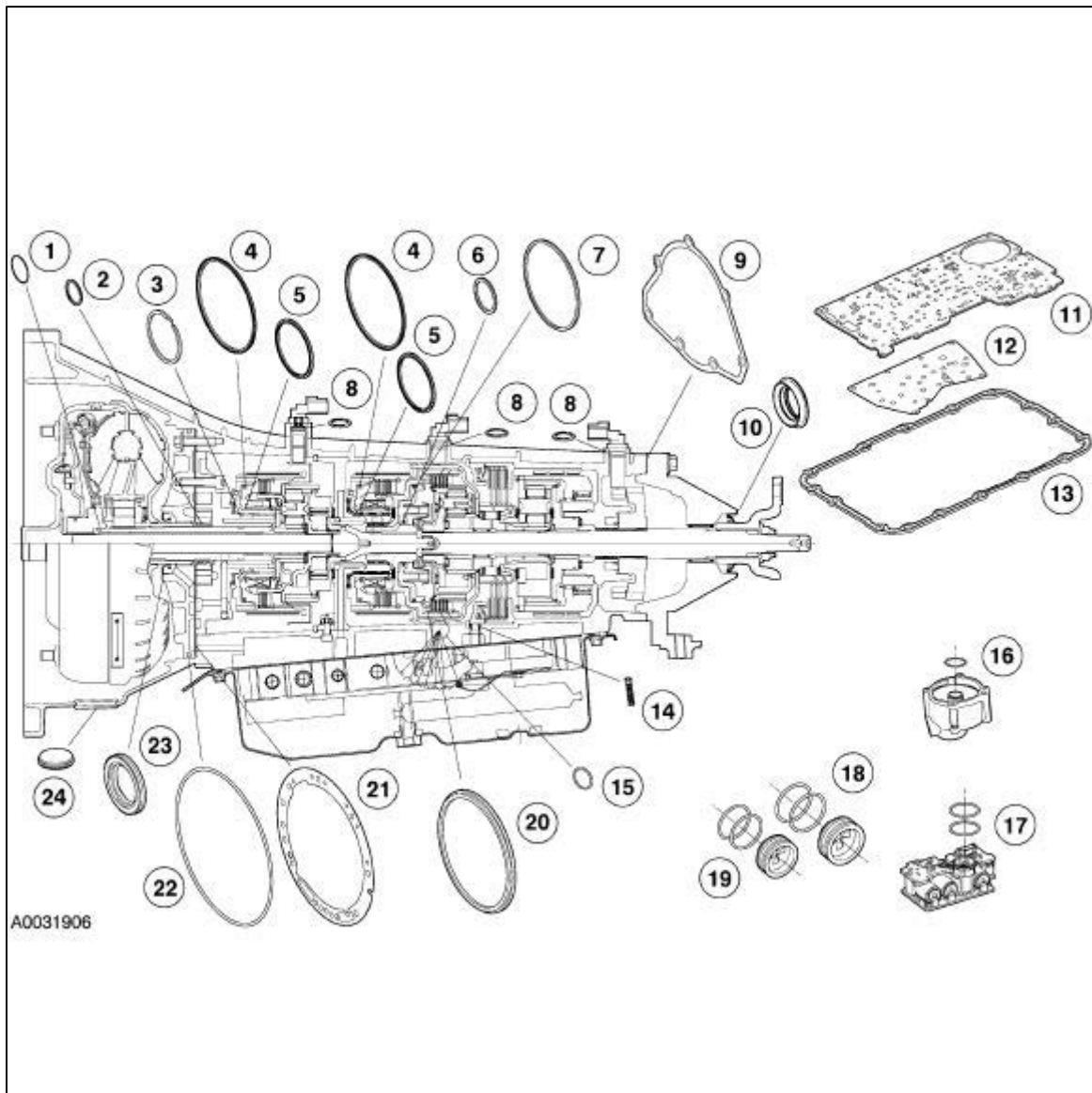
144	7D189	Piston and seal assembly — reverse servo
145	7423	O-ring seal — reverse servo piston
146	7D036	Cover — reverse servo
147	W703135-S1300	Bolt — (attaches reverse servo piston to case) (4 req'd)
148	7D321	Retainer — control valve spring
149	7A270	Spring — main fluid pressure regulator valve
150	7D488	Valve — reverse servo check
151	W701099-S1430	Screw — attaches separating plate to main control
152	7H003	Tube — intermediate clutch fluid inlet
153	7Z490	Plate assembly — valve body separator plate with bonded gasket
154	7A101	Control assembly — lower main
155	7H173	Gasket — valve body cover plate
156	7A008	Plate — valve body cover
157	7E440	Switch assembly — pressure
158	7A100	Control valve body — main (includes 7Z490 and 7A101)
159	W705928	O-ring seal — solenoid body connector
160	7G391	Body assembly — transmission control solenoid
161	7A098	Filter — transmission fluid pan
162	7A191	Gasket — fluid pan
163	7L027	Magnet — fluid pan
164	W705559-S300	Bolt — (attaches filter to main control) (2 req'd)
165	7A194	Pan — transmission fluid
166	7A010	Tube — fluid drain
167	W500213-S1309	Fluid pan bolt
168	W704999-S309	Plug — short hex
A	—	Intermediate clutch assembly
B	—	Forward clutch assembly
C	—	Direct clutch assembly
D	—	Coast clutch assembly

Bushings, Bearing and Thrust Washer Locator



Item	Part Number	Description
1	7D014	Front pump support thrust washer No. 1
2	7L495	Overdrive planetary thrust bearing No. 2
3	7M153	Center shaft and forward clutch cylinder bearing No. 3
4	7M153	Center shaft and forward clutch cylinder bearing No. 5
5	7M153	Center shaft and forward clutch cylinder No. 8, 9
6	7B368	Output shaft thrust washer No. 11
7	7R205	Output shaft to case bearing
8	7H027	Low/intermediate sun gear bearing No. 10
9	7G433	Forward planetary thrust bearing No. 7
10	7D090	Forward clutch hub thrust washer No. 6B
11	7D234	Forward ring gear hub thrust bearing No. 6A
12	7D014	Intermediate clutch drum bearing No. 4

Seals, Rings and Gaskets Locator



Item	Part Number	Description
1	7L323	Stator support seal
2	W701431-S300	Seal ring
3	7D025	Overdrive brake drum seal
4	7A548	Direct and overdrive piston outer seal
5	7D404	Direct and overdrive piston inner seal
6	—	Forward clutch piston inner seal
7	—	Forward clutch piston outer seal (part of 7A262)
8	W702981-S300	O-ring seal (OSS)
9	7086	Extension housing gasket

10	7052	Extension housing seal
11	7Z490	Valve body separator plate
12	7H173	Valve body cover plate gasket
13	7A191	Gasket (fluid pan)
14	7H003	Intermediate clutch fluid inlet tube
15	7B498	Manual control lever seal
16	7423	Reverse servo piston O-ring seal
17	W705928	Solenoid body connector O-ring seal (2 req'd)
18	W702969- S300	Intermediate servo cover seal
19	W703119- S300	Overdrive servo cover seal
20	7B070	Forward clutch piston cushion spring (part of 7A262)
21	7A136	Front fluid pump gasket
22	7A248	Front fluid pump seal
23	7A248	Front fluid pump seal assembly
24	7N171	Converter housing access plug

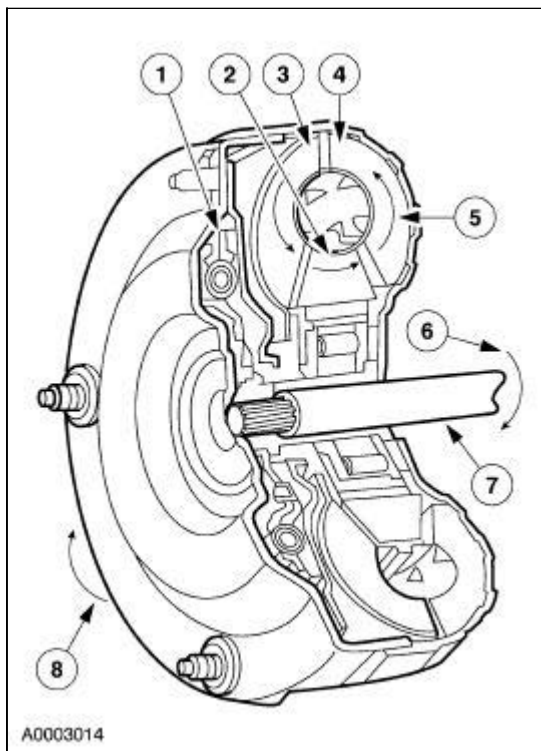
Torque Converter

The torque converter transmits and multiplies torque. The torque converter is a four-element device:

- impeller assembly
- turbine and damper assembly
- reactor assembly
- clutch

The standard torque converter components operate as follows:

- Rotation of the converter housing and impeller set the fluid in motion.
- The turbine reacts to the fluid motion from the impeller, transferring rotation to the geartrain through the input shaft.
- The reactor redirects fluid going back into the impeller, allowing for torque multiplication.
- The clutch and damper assembly dampens powertrain torsional vibration and provides a direct mechanical connection for improved efficiency.
- Power is transmitted from the torque converter to the planetary gearsets and other components through the input shaft.



Item	Part Number	Description
1	—	Converter clutch and damper (part of 7902)
2	—	Reactor (part of 7902)
3	—	Turbine damper (part of 7902)

4	—	Impeller (part of 7902)
5	—	Fluid motion
6	—	Transmission input rotation
7	—	Input shaft
8	—	Engine rotation

Geartrain

Power is transmitted from the torque converter to the planetary gearsets through the input shaft. Bands and clutches are used to hold and drive certain combinations of gearsets. This results in five forward ratios and one reverse ratio, which are transmitted to the output shaft and differential.

Gear Ratio	
1st	3.25 to 1
2nd Early Production Vehicles	2.44 to 1
2nd Late Production Vehicles	2.29 to 1
3rd	1.55 to 1
4th	1.00 to 1
5th Early Production Vehicles	0.75 to 1
5th Late Production Vehicles	0.71 to 1
Reverse	3.07 to 1

Planetary Gearset — Overdrive

For component location, refer to [Disassembled Views](#) in this section.

The planetary gear overdrive carrier is driven by the input shaft.

- The overdrive planetary gearset carrier drives the center shaft via the overdrive one-way clutch in 1st, 3rd, 4th, and reverse gears.
- In 2nd, and 5th, the overdrive sun gear is held causing the pinion gears to rotate around the overdrive sun gear.
- The pinion gears in turn drive the overdrive ring gear resulting in the 5th (overdrive) gear ratio.
- The overdrive planetary gearset is internally splined to the coast clutch for engine braking.

Planetary Gearset — Forward

For component location, refer to [Disassembled Views](#) in this section.

The forward planetary gearset is splined to the output shaft.

- The forward planetary gearset is driven by the forward ring gear when the forward clutch is applied.
- The forward planetary gearset pinions drive the forward sun gear.
- The forward sun gear is splined to the input shell.
- The forward carrier is splined to the output shaft.

Planetary Gearset — Low/Reverse

For component location, refer to [Disassembled Views](#) in this section.

The low/reverse planetary gearset is connected to the reverse brake drum by lugs from the low/reverse brake drum to the lugs of the low/reverse planetary gearset.

- The low/reverse planetary gearset is driven by the forward sun gear which is splined to the input shell.
- The forward sun gear drives the pinions in the low/reverse planetary gearset.
- The pinions of the low/reverse planetary gearset drive the output shaft ring gear and output shaft hub which is splined to the output shaft.
- The low/reverse planetary gearset can be held by the low one-way clutch in the low/reverse brake drum, or by the low/reverse band.

Input Shaft

For component location, refer to [Disassembled Views](#) in this section.

- The radial positioning of the input shaft is controlled by two bushings in the stator support.
- Axial positioning of the input shaft is controlled by the splines in the converter turbine and the retaining ring in the overdrive planetary carrier.

Output Shaft

For component location, refer to [Disassembled Views](#) in this section.

The output shaft is supported by a bearing in the case and by a bearing in the extension housing. End positioning is controlled by the parking pawl gear and by the reverse ring gear hub and snap ring.

Apply Components

Band — Overdrive

For component location, refer to [Disassembled Views](#) in this section.

During 2nd and 5th gear operation, hydraulic pressure is applied to the overdrive servo.

- This pressure causes the piston to move and apply force to the band.
- This action causes the overdrive band to hold the overdrive drum.
- This causes the overdrive sun gear to be held stationary through the adapter plate and the overdrive drum.

Band — Low/Reverse

For component location, refer to [Disassembled Views](#) in this section.

During 2nd gear operation, 1st gear operation and reverse, hydraulic pressure is applied to the low/reverse servo.

- This pressure causes the servo to move and apply force to the low/reverse band.
- This action causes the low/reverse brake drum to be held.
- This action causes the low/reverse planetary assembly to be held stationary.

Band — Intermediate

For component location, refer to [Disassembled Views](#) in this section.

During 3rd gear operation, hydraulic pressure is applied to the intermediate servo.

- This pressure causes the servo to move and apply force to the intermediate band.
- This action causes the direct clutch drum to be held.
- The intermediate band holds the intermediate brake and direct clutch drum to the case in 3rd gear.
- This causes the input shell and forward sun gear to be held stationary.

Clutches — Direct

For component location, refer to [Disassembled Views](#) in this section.

The direct clutch is a multi-disc clutch made up of steel and friction plates.

- The direct clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- It is housed in the direct clutch drum.
- During 4th, 5th, and reverse gear application, the direct clutch is applied transferring torque from the forward clutch cylinder to the direct clutch drum.

- This action causes the forward sun gear to drive the pinions of the low/reverse planetary carrier.

Clutches — Forward

For component location, refer to [Disassembled Views](#) in this section.

The forward clutch is a multi-disc clutch made up of steel and friction plates.

- The forward clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- The forward clutch is applied in all forward gears.
- When applied, the forward clutch provides a direct mechanical coupling between the center shaft and the forward ring gear and hub.

Clutches — Coast

For component location, refer to [Disassembled Views](#) in this section.

The coast clutch is a multi-disc clutch made up of steel and friction plates.

- The coast clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- The coast clutch is housed in the overdrive drum.
- The coast clutch is applied when in 1st, 3rd, D4, and reverse positions.
- When applied, the coast clutch locks the overdrive sun gear to the overdrive planetary carrier, thus preventing the one-way clutch from overrunning when the vehicle is coasting.
 - This allows the use of engine compression to help slow the vehicle and provide engine braking.

Clutches — Intermediate

For component location, refer to [Disassembled Views](#) in this section.

The intermediate clutch is a multi-disc stationary clutch made up of steel and friction plates which are in a module assembly that includes the cylinder and frictions.

- Applied with hydraulic pressure.
- Disengaged by a return spring and releasing of hydraulic pressure.
- Hydraulic pressure is feed through a feed tube in the case worm trail.
- Uses a bonded piston in an aluminum housing.
- Applied in during a 2-3 shift event.
- Transfers torque from the sun gear to the planetary carrier.
- Torque transfer causes the one way clutch to engage and holds the sun gear from turning, delivering 3rd gear.

One-Way Clutch — Direct

For component location, refer to [Disassembled Views](#) in this section.

The direct one-way clutch is a sprag-type one-way clutch that is pressed into the center shaft.

- The direct one-way clutch is driven by the ring gear of the overdrive planetary carrier.
- The direct one-way clutch holds and drives the outer splines of the center shaft in 1st, 3rd, 4th and reverse gears.
- The direct one-way clutch overruns during all coast operations and at all times in 2nd and 5th gear.

One-Way Clutch — Intermediate

For component location, refer to [Disassembled Views](#) in this section.

The Intermediate One-Way Clutch is a sprag type one-way clutch.

- The Intermediate One-Way Clutch connects the intermediate assembly to the input shell and sun gear assembly in third gear.

One-Way Clutch — Low/Reverse

For component location, refer to [Disassembled Views](#) in this section.

The low/reverse one-way clutch is a sprag type one-way clutch.

- The low/reverse one-way clutch holds the low/reverse drum and low/reverse planetary assembly to the case in 1st and 2nd gear.
 - In all other gears the low/reverse one-way clutch overruns.
-

Hydraulic System

Fluid Pump

For component location, refer to [Disassembled Views](#) in this section.

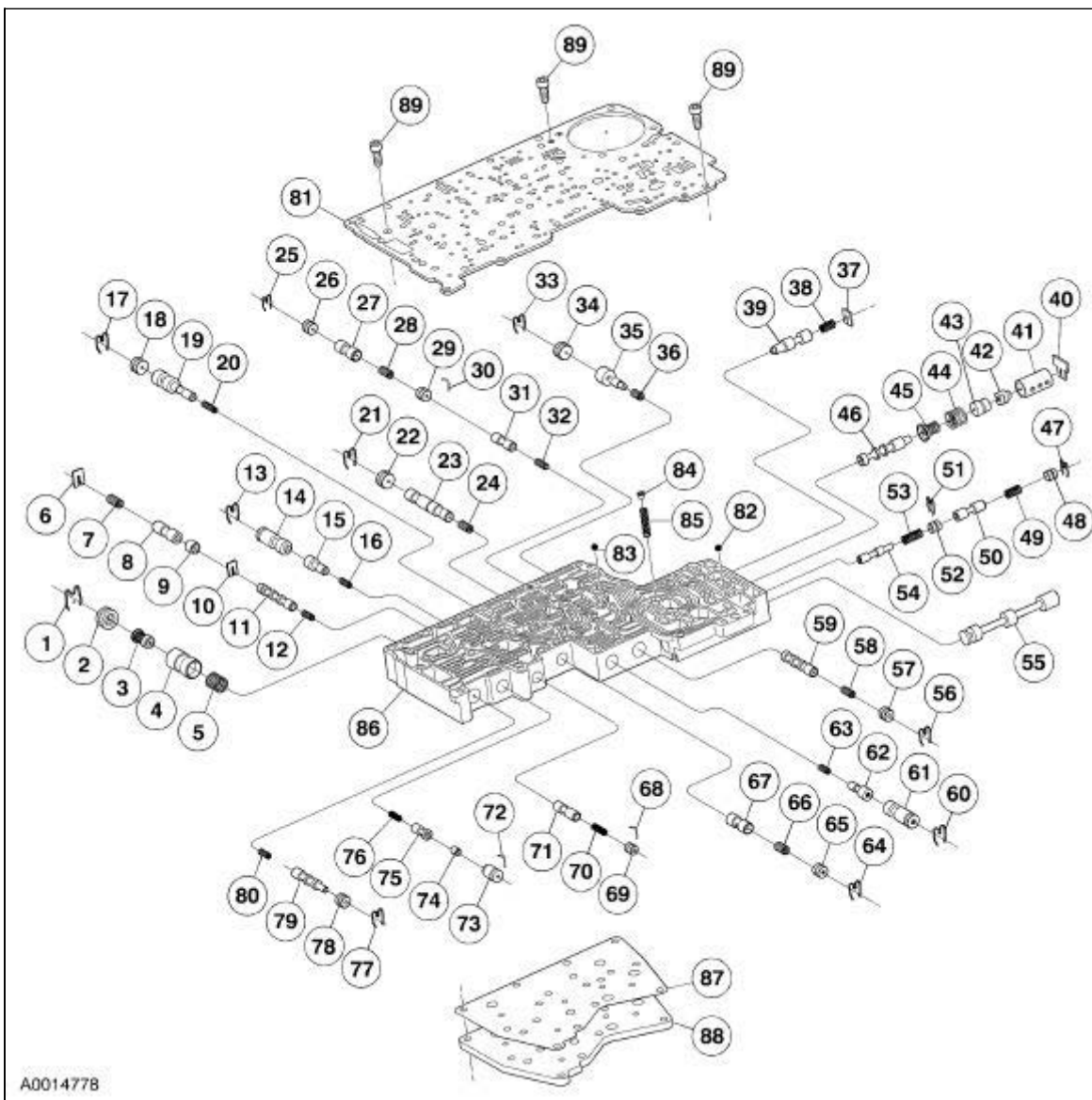
- The fluid pump provides the fluid pressure necessary to charge the torque converter, main control assembly, transmission cooling system, lubrication system and apply devices.
- The fluid pump is a positive displacement, gear type pump.
 - The fluid pump is driven by the torque converter impeller hub.

Filter

For component location, refer to [Disassembled Views](#) in this section.

- All fluid drawn from the transmission fluid pan by the fluid pump passes through the fluid filter.
- The transmission fluid filter and its accompanying seals are part of the fluid path from the sump (pan) to the fluid pump.
 - The transmission fluid filter has a bypass section which allows fluid vented at the main regulator valve to be recirculated to the fluid pump, without passing through the transmission fluid filter.

Main Control



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Item	Part Number	Description
1	7F445	Clip — retainer
2	7D374	Plug — retainer
3	7M094	Valve assembly — thermo
4	7L367	Valve — fluid cooler bypass
5	7M116	Spring — fluid cooler bypass
6	7E336	Plate
7	7G489	Spring — coast clutch control
8	7G490	Valve — coast clutch control
9	7G490	Valve — coast clutch control
10	7E336	Plate
11	7M189	Valve — overdrive servo control
12	7M193	Spring — overdrive servo control valve
13	7M445	Clip — retainer
14	7D374	Plug — retainer
15	7M095	Valve — modulator

16	7M104	Spring — modulator valve
17	7F445	Plug — retainer
18	7D374	Clip — retainer
19	7F259	Valve — 4-3 ISR downshift control
20	7F260	Spring — 4-3 ISR control valve
21	7F445	Plug — retainer
22	7D374	Clip — retainer
23	7M188	Valve — 4-3 pre-stroke intermediate band control
24	7G289	Spring — 4-3 pre-stroke intermediate band control valve
25	7F445	Clip — retainer
26	7D374	Plug — retainer
27	7G317	Valve — reverse engagement
28	7D312	Spring — reverse engagement valve
29	7D374	Plug — retainer
30	7D335	Retainer — wire
31	7M187	Valve — high clutch control
32	7M192	Spring — high clutch control valve
33	7F445	Clip — retainer
34	7D374	Plug — retainer
35	7M095	Valve — reverse modulator
36	7M104	Spring — reverse modulator valve
37	7E336	Plate
38	7M191	Spring — rear servo control valve
39	7M098	Valve — rear servo control
40	7E336	Plate
41	7D002	Sleeve
42	7D003	Valve — booster
43	7D003	Valve — booster
44	7A270	Spring — outer
45	7H149	Spring and retainer assembly
46	7C388	Valve — main regulator
47	7F445	Retainer — clip
48	7D374	Retainer — plug
49	7L317	Spring — reverse inhibition valve
50	7L316	Valve — reverse inhibition
51	7E445	Retainer — clip
52	7D374	Retainer — plug
53	7G411	Spring — solenoid regulator valve
54	7G473	Valve — solenoid regulator
55	7340	Valve — manual

56	7F445	Retainer — clip
57	7D374	Retainer — plug
58	7M009	Spring — select valve
59	7M186	Spring — select
60	7F445	Retainer — clip
61	7D374	Retainer — plug
62	7M095	Valve — modulator
63	7M104	Spring — modulator valve
64	7A445	Retainer — clip
65	7D374	Retainer — plug
66	7G312	Spring — forward engagement control valve
67	7D317	Valve — forward engagement control
68	7E335	Retainer — wire
69	7D374	Retainer — plug
70	7M190	Spring — back pressure
71	7M185	Valve — converter clutch back pressure
72	7E335	Retainer — wire
73	7D002	Sleeve — converter clutch modulator control
74	7M184	Valve — converter clutch modulator control
75	7G307	Valve — converter clutch modulator
76	7G316	Spring — converter clutch modulator control
77	7F445	Retainer — clip
78	7D374	Retainer — plug
79	7L318	Valve — converter clutch control
80	7L490	Spring — converter clutch control valve
81	7Z490	Plate assembly — main control valve body separator
82	7E195	Ball — lubrication check
83	7E195	Ball — shuttle valve
84	7E368	Valve — limit
85	7E340	Spring — limit valve
86	7A101	Body — control valve lower
87	7H173	Gasket — valve body cover plate
88	7C034	Plate — valve body cover
89	W701099-S1430	Screw — separator plate

- The main control assembly and related components are part of the pressure side of the hydraulic system.
- The main control assembly consists of the solenoids, the valve body assembly and the separator plate.
- These components combine to convert electrical signals into hydraulic actions.
 - All valves in the main control assembly are anodized aluminum and cannot be sanded,

filed, or dressed in any other way. If there is any damage to the valves that prevents or restricts their movement, install a new main control assembly.

Transmission Electronic Control System

Electronic System Description

The powertrain control module and its input/output network control the following transmission operations:

- shift timing.
- line pressure (shift feel).
- torque converter clutch.

The transmission control strategy combined with the engine control provides optimum powertrain operation under all conditions. When determining the best operating strategy for transmission operation, the PCM uses input information from certain engine-related and driver-demand related sensors and switches.

In addition, the PCM receives input signals from certain transmission-related sensors and switches. The PCM also uses these signals when determining transmission operating strategy.

Using all of these input signals, the PCM can determine when the time and conditions are right for a shift, or when to apply or release the torque converter clutch. It will also determine the pressure needed to optimize shift feel. To accomplish this the PCM uses three pressure controls, one torque converter clutch and four shift solenoids to control transmission operation.

The following provides a brief description of each of the sensors and actuators used to control transmission operation.

Powertrain Control Module

The operation of the transmission is controlled by the powertrain control module. Many input sensors provide information to the powertrain control module. The powertrain control module then controls the actuators which determine transmission operation.

Air Conditioning (A/C) Clutch

An electromagnetic clutch is energized when the clutch cycling pressure switch closes. The switch is located on the suction accumulator/drier. The closing of the switch completes the circuit to the clutch and draws it into engagement with the compressor driveshaft. When the A/C is engaged, operating pressures are adjusted to compensate for additional load on the engine.

Brake Pedal Position (BPP) Switch

The brake pedal position (BPP) switch tells the powertrain control module (PCM) when the brakes are applied. The torque converter clutch disengages when the brakes are applied. The BPP switch closes when the brakes are applied and opens when they are released. The BPP is also used to disengage the brake shift interlock.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor detects engine coolant temperature and supplies the information to the PCM. The ECT sensor is used to control torque converter clutch (TCC) operation.

Electronic Ignition (EI) System

The electronic ignition consists of a crankshaft position sensor, two four-tower ignition coils and the powertrain control module. The ignition control module operates by sending crankshaft position information from the crankshaft position sensor to the ignition control module. The ignition control module generates a profile ignition pickup (PIP) signal (engine rpm) and sends it to the PCM. The PCM uses PIP signal in the transmission strategy, wide-open throttle (WOT) shift control, torque converter clutch control and operating pressures.

Intake Air Temperature (IAT) Sensor

The intake air temperature (IAT) sensor provides the sequential fuel injection (SFI) system mixture temperature information. The IAT sensor is used both as a density corrector for air flow calculation and to proportion cold enrichment fuel flow. The IAT sensor is installed in the air cleaner outlet tube. The IAT sensor is also used in determining control pressures.

Mass Air Flow (MAF) Sensor

The mass air flow sensor measures the mass of air flowing into the engine. The MAF sensor output signal is used by the powertrain control module (PCM) to calculate injector pulse width. For transmission strategies, the MAF sensor is used to regulate electronic pressure control, shift and torque converter clutch scheduling.

Transmission Control Switch (TCS)

The transmission control switch (TCS) sends a signal to the powertrain control module (PCM) when the driver selects the D4 position, canceling operation of 5th (overdrive) gear.

The TCS is located within the range selector assembly (base shifter only).

The PCM uses this signal to control the shift solenoids to disengage/disable 5th gear operation and activates coast clutch. At the same time, the PCM changes the instrument panel indicator to display D4.

When the driver moves the range selector lever back to the D5 position, 5th gear operation is enabled, the coast clutch is released and the instrument panel indicator changes to display D5.

Throttle Position (TP) Sensor

The throttle position (TP) sensor is a potentiometer mounted on the throttle body. The TP sensor detects the position of the throttle plate and sends this information to the powertrain control module. The TP sensor is used for shift scheduling, electronic pressure control and torque converter clutch (TCC) control.

Digital Transmission Range (TR) Sensor

The digital transmission range (TR) sensor is located on the outside of the transmission at the manual lever. The digital TR sensor completes the start circuit in PARK, NEUTRAL, and the back-up lamp circuit in REVERSE. The digital TR sensor also opens and closes a set of four switches that are monitored by the powertrain control module to determine the position of the manual lever (P, R, N, D5, 3, 2, 1).

Turbine Shaft Speed (TSS) Sensor

The turbine shaft speed (TSS) sensor is a magnetic pickup that sends the powertrain control module torque converter turbine speed information.

The TSS sensor is mounted externally on the case.

The PCM uses TSS information to help determine appropriate operating pressures and torque converter clutch (TCC) operation.

Output Shaft Speed (OSS) Sensor

The output shaft speed (OSS) sensor is a magnetic pickup, located at the park gear, that sends a signal to the powertrain control module to indicate transmission output shaft speed. The OSS sensor is mounted externally on the case. The OSS is used for torque converter clutch control, speed scheduling and to determine electronic pressure control.

Intermediate Shaft Speed (ISS) Sensor

The intermediate shaft speed (ISS) sensor is a magnetic pickup that sends planetary sun gear speed information to the PCM. The ISS is mounted externally on the center of the case.

The PCM uses the ISS information to aid in determining pressure requirements.

Pressure Control Solenoids (PCA, PCB, PCC)

The pressure control (PC) solenoids are a variable-force style (VFS) solenoid. The VFS-type solenoid is an electrohydraulic actuator combining a solenoid and a regulating valve.

The line pressure tap is used to verify output pressure from PC A or PC B by turning either one off while verifying the output from the other solenoid. The second pressure tap is used to verify the output from the PC C solenoid.

There are three PC solenoids located in the solenoid body assembly used to control line pressure, band and clutch application pressure within the transmission.

The powertrain control module varies the current to the PC solenoid.

The PCM has an adaptive learn strategy to electronically control the transmission which will automatically adjust the shift feel. When the battery is disconnected or a new battery installed, certain transmission operating parameters can be lost. The Powertrain Control Module (PCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed, or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Torque Converter Clutch (TCC) Solenoid

The torque converter clutch (TCC) solenoid is a pulse-width-modulating type solenoid that is used to control the apply and release of the TCC.

Shift Solenoids — (SSA, SSB, SSC, SSD)

Four On/Off shift solenoids allow the powertrain control module to control shift scheduling.

- The solenoids are three-way, normally open style.
- The shift solenoids SSA, SSB, SSC and SSD provide gear selection of 1st through 5th and reverse gears by directing PC pressures to the appropriate elements.

Coast braking and manual gears are also controlled by the shift solenoids.

Transmission Fluid Temperature (TFT) Sensor

- The transmission fluid temperature (TFT) sensor is a thermistor-type sensor that varies a reference voltage signal. The resistance in the TFT varies with temperature. The powertrain control module (PCM) monitors the voltage signal across the TFT, and uses this information to determine the transmission fluid temperature.
- The TFT is located on the solenoid body.

- The PCM uses the TFT signal to help determine shift scheduling, torque converter clutch operation and pressure control requirements.

It sends a voltage signal to the powertrain control module. The voltage signal varies with transmission fluid temperature. The PCM uses this signal to determine whether a cold start shift schedule is necessary. The shift schedule is compensated when the transmission fluid temperature is cold. The PCM also inhibits torque converter clutch (TCC) operation at low transmission fluid temperatures and determines pressure control (PC) solenoid operations.

Reverse Pressure (RP) Switch

The reverse pressure (RP) switch is a simple open or closed switch that is used to detect the presence of pressure in the main control valve body. The switch is mounted on the main control valve body. When pressure is not present, the switch is opened and the voltage reading is high. When pressure is present, the switch is closed and the voltage reading will be near zero.

Instrument Panel Range Selector Indicator

This indicator is an electronic readout in the instrument cluster which will match the position of the range selector (P, R, N, D4, D5, 3, 2, 1). If an error in the range selector assembly occurs, an "E" (error) will be displayed on the instrument panel.

Select Shift Transmission (SST) Switches (+ and -)

The positions indicated by a (+) or a (-) allow the driver to manually select the appropriate upshift (+) or downshift (-) and gear range.

The SST switches are located within the transmission range selector assembly and are momentary contact switches that send a signal to the PCM each time the driver moves the selector lever into the upshift or downshift gear range.

The PCM uses the input signals from the SST+ and the SST- switches, along with other vehicle inputs to determine which gear should be commanded.

Diagnostic Strategy

Troubleshooting an electronically controlled automatic transmission is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow.

NOTE: Do not take any shortcuts or assume that critical checks or adjustments have already been made.

Follow the procedures as written to avoid missing critical components or steps.

To correctly diagnose a concern, have the following publications available:

- Powertrain Control/Emissions Diagnosis (PC/ED) manual
- TSBs and OASIS messages.
- Wiring Diagram.

These publications provide the necessary information when diagnosing transmission concerns.

Use the Diagnostic Flow Chart as a guide and follow the steps as indicated.

Preliminary Inspection

- Know and understand the customer's concern.
- Verify the concern by operating the vehicle.
- Check the fluid levels and condition.
- Check for non-factory add-on items.
- Check shift linkages for correct adjustment.
- Check TSBs and OASIS messages regarding the concern.

Diagnostics

- Carry out on-board diagnostic procedures key on engine off (KOEO) and key on engine running (KOER).
- Record all diagnostic trouble codes (DTCs).
- Repair all non-transmission codes first.
- Repair all transmission codes second.
- Erase all continuous codes and attempt to repeat them.
- Repair all continuous codes.
- If only pass codes are obtained, proceed to Diagnosis by Symptom Index for further information and diagnosis.

Follow the diagnostic sequence to diagnose and repair the concern the first time.

Diagnostic Flow Chart

Diagnostic Flow Chart		
<ul style="list-style-type: none"> ● Know and understand the customer concerns ● Check the fluid level and condition ● Verify the concern by operating the vehicle ● Check for non-factory-installed items and verify correct installation ● Check the shift linkage adjustments ● Check TSBs and OASIS messages for vehicle concerns ● Carry out quick test both KOER and KOEO ● Record all codes <p>1) Did you record any Diagnostic Trouble Codes?</p>	Yes	<ul style="list-style-type: none"> • REPAIR all hard Diagnostic Trouble Codes. FOLLOW the pinpoint tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first, then this workshop manual.
	No	<ul style="list-style-type: none"> • REFER to <u>Diagnosis By Symptom</u> in this section, then GO to Step 5.
2) Are any continuous test memory codes present?	Yes	<ul style="list-style-type: none"> • CLEAR codes and CARRY OUT drive cycle test.
	No	<ul style="list-style-type: none"> • GO to Step 4.
3) Did the continuous test memory codes reappear?	Yes	<ul style="list-style-type: none"> • REPAIR all continuous test memory codes. FOLLOW the pinpoint tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual then the transmission reference manual, then this workshop manual, then GO to Step 4.
	No	<ul style="list-style-type: none"> • GO to Step 4.
4) Is the concern repaired?	Yes	<ul style="list-style-type: none"> • CARRY OUT the final quick test to verify that no Diagnostic Trouble Codes are present. CLEAR memory codes.
	No	<ul style="list-style-type: none"> • REFER to <u>Diagnosis By Symptom</u> in this section.
5) Are there any electrical concerns?	Yes	<ul style="list-style-type: none"> • INSTALL the NGS and CARRY OUT output state control test, then GO to Step 6.
	No	<ul style="list-style-type: none"> • REFER to the hydraulic and mechanical routine to diagnose and repair the concern, then GO to Step 7.
6) Was the transmission concern corrected when the NGS was installed?	Yes	<ul style="list-style-type: none"> • REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual, intermittent fault diagnosis section and use the NGS or WDS to diagnose cause of concern in the processor, vehicle harness or external inputs (sensors or

		switches).
	No	• REFER to the hydraulic and mechanical routine to diagnose the concern, then GO to Step 7.
7) Is the concern repaired?	Yes	• CARRY OUT the final quick test to verify that no diagnostic trouble codes are present. CLEAR memory codes.
	No	• GET assistance from Technical Hotline.

Preliminary Inspection

The following items must be checked prior to beginning the diagnostic procedures:

Know and Understand the Concern

In order to correctly diagnose a concern, first understand the customer complaint or condition. Customer contact may be necessary in order to begin to verify the concern. Understand the condition as to when the concern occurs, for example:

- hot or cold vehicle temperature.
- hot or cold ambient temperature.
- vehicle driving conditions.
- vehicle loaded/unloaded.

After understanding when and how the concern occurs, proceed to verify the concern.

Verification of Condition

This section provides information that must be used in both determining the actual cause of customer concerns and executing the appropriate procedures.

The following procedures must be used when verifying customer concerns for the engine.

Determine Customer Concern

NOTE: Some transmission conditions can cause engine concerns. An electronic pressure control short circuit can cause engine misfiring. The torque converter clutch not disengaging will stall the engine.

Determine customer concerns relative to vehicle use and dependent driving conditions, paying attention to the following items:

- hot or cold vehicle operating temperature
- hot or cold ambient temperatures
- type of terrain
- vehicle loaded/unloaded
- city/highway driving
- upshift
- downshift
- coasting
- engagement
- noise/vibration — check for dependencies, either rpm dependent, vehicle speed dependent, shift dependent, gear dependent, range dependent, or temperature dependent.

Check Fluid Level and Condition



CAUTION: The vehicle should not be driven if the fluid level is low or internal failure could result.

NOTE: If the vehicle has been operated for an extended period of time at highway speeds, in city traffic, in hot weather, or pulling a trailer, the fluid must cool down 30 minutes to obtain an accurate reading.

This vehicle is not equipped with a fluid level indicator. An incorrect level may affect the transmission operation and can result in transmission damage. To correctly check and add fluid to the transmission, refer to [Transmission Fluid Drain and Refill—Automated Equipment](#), [Transmission Fluid Drain and Refill—Vehicles With Torque Converter Drain Plug](#) or [Transmission Fluid Drain and Refill—Vehicles Without Torque Converter Drain Plug](#) in this section.

High Fluid Level

A fluid level that is too high can cause the fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of fluid from the vent tube and possible transmission damage. If an overfill reading is indicated, refer to [Transmission Fluid Drain and Refill—Automated Equipment](#), [Transmission Fluid Drain and Refill—Vehicles With Torque Converter Drain Plug](#) or [Transmission Fluid Drain and Refill—Vehicles Without Torque Converter Drain Plug](#) in this section.

Low Fluid Level

A low fluid level can result in poor transmission engagement, slipping or damage. It can also indicate a leak in one of the transmission seals or gaskets.

Adding Fluid



CAUTION: The use of any type of transmission fluid other than specified can result in transmission damage.

If fluid must be added, add fluid in 0.25L (0.5 pint) increments through the fill hole opening. Do not overfill the fluid. For fluid type, refer to the General Specification chart in this section.

Fluid Condition Check

1. Check the fluid level. For additional information, refer to [Transmission Fluid Drain and Refill—Automated Equipment](#), [Transmission Fluid Drain and Refill—Vehicles With Torque Converter Drain Plug](#) or [Transmission Fluid Drain and Refill—Vehicles Without Torque Converter Drain Plug](#) in this section.
2. Observe the color and the odor of the fluid. Under normal circumstances, the color should be dark reddish, not brown or black.
3. Allow the fluid to drip onto a facial tissue and examine the stain.
4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.
5. If fluid contamination or transmission failure is confirmed by the sediment in the bottom of the transmission fluid pan, the transmission must be disassembled and completely cleaned.
6. Carry out diagnostic checks and adjustments. For additional information, refer to [Diagnosis By Symptom](#) in this section.

Road Testing Vehicle

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: When the battery is disconnected or a new battery installed, certain transmission operating parameters may be lost. The powertrain control module (PCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed, or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

The Shift Point Road Test and Torque Converter Clutch Operation Test provide diagnostic information on transmission shift controls and torque converter operation.

Shift Point Road Test

This test verifies that the shift control system is operating correctly.

1. Bring engine and transmission up to normal operating temperature.
2. Operate the vehicle with the selector lever in the D5 position.
3. Apply minimum throttle and observe the speeds at which upshift occurs and torque converter engages. Refer to the following Shift Speeds chart. (Also refer to the Automatic Transmission Specifications Issue.)
4. Stop the vehicle. Select the D4 position. Repeat Step 3. The transmission will make all upshifts except 4-5 and torque converter clutch should apply above 46 km/h (27 mph).
5. Press the accelerator pedal to the floor, wide open throttle (WOT). The transmission should shift from third to second, or third to first, depending on vehicle speed, and torque converter clutch should release.
6. With vehicle speed above 48 km/h (30 mph), move the transmission range selector lever from D4 position to first position and release the accelerator pedal. The transmission should immediately downshift to third gear. When vehicle speed drops below 32 km/h (20 mph), the transmission should downshift into first gear.
7. If transmission fails to upshift/downshift or torque converter clutch does not apply/release, refer to [Diagnosis By Symptom](#) for possible causes.

Shift Speeds



CAUTION: Always obey local traffic laws. Do not exceed posted limits.

			D5 Position	Speed km/h (mph)
Vehicle Information	Transmission Model	Throttle Position	Shift	Axle Ratio All
Lincoln LS 3.0L/3.9L	RJL-A	Closed	5-4	38-41 (24-26)
	RJL-B		4-3	28-32 (18-20)
			3-2	17-22 (11-14)
			2-1	11-16 (7-10)
		Minimum		
		Monitor PID: TP volt-	1-3	14-25 (9-16)

		1.25		
			3-4	32-41 (20-26)
			4-5	41-48 (26-30)
			5-4	45-48 (28-30)
			4-3	28-32 (18-20)
			3-2	17-22 (11-14)
			2-1	11-16 (7-10)
		Wide Open	1-2	67-72 (42-45)
			2-3	90-96 (56-60)
			3-4	136-159 (85-99)
			4-5	188-236 (117-147)
			5-4	177-201 (110-125)
			4-3	123-125 (77-78)
			3-2	56-67 (35-42)
			2-1	38-41 (24-46)

Torque Converter Diagnosis

Prior to installing a new torque converter, all diagnostic procedures must be followed. This is to prevent the unnecessary replacement of good torque converters. Only after a complete diagnostic evaluation can the decision be made to install a new torque converter.

Begin with the normal diagnostic procedures as follows:

1. Preliminary Inspection.
2. Know and Understand the Customer Concern.
3. Verify the Concern — Carry out the Torque Converter Clutch Operation Test. Refer to Torque Converter Operation Test in this section.
4. Carry out Diagnostic Procedures.
 - Run on-board diagnostics; see On-Board Diagnostics With NGS, refer to Diagnosics in this section.
 - Repair all non-transmission related DTCs first.
 - Repair all transmission DTCs.
 - Rerun on-board diagnostic to verify repair.
 - Carry out the Line Pressure Test. Refer to Special Testing Procedures in this section.
 - Carry out the Stall Speed Test. Refer to Special Testing Procedures in this section.
 - Carry out the Diagnosis by Symptom Routine for torque converter diagnosis. Refer to Diagnosis By Symptom in this section.
 - Use the index to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed; diagnose and service as necessary before servicing the torque converter.

Torque Converter Operation Test

This test verifies that the torque converter clutch control system and the torque converter are operating correctly.

5. Carry out the Quick Test; see On-Board Diagnostics With NGS, refer to Diagnosics in this section. Check for DTCs. Refer to the Diagnostic Trouble Code Charts.
6. Connect a tachometer to the engine.
7. Bring the engine to normal operating temperature by driving the vehicle at highway speeds for approximately 15 minutes in D5 position.
8. After normal operating temperature is reached, maintain a constant vehicle speed of about 80 km/h (50 mph) and tap brake pedal with the left foot.
9. The engine rpm should increase when brake pedal is tapped, and decrease about five seconds after pedal is released. If this does not occur, see Torque Converter Operation Concerns, Diagnosis By Symptom.

10. If the vehicle stalls in D5 or manual 2 at idle with vehicle at a stop, move the transmission range selector lever to manual 1 position. If the vehicle stalls, see Torque Converter Operation Concerns, Diagnosis By Symptom in this section. Repair as necessary. If the vehicle does not stall in D5, refer to Diagnosis By Symptom in this section.
-

Visual Inspection

This inspection will identify modifications or additions to the vehicle operating system that may affect diagnosis. Inspect the vehicle for non-Ford factory add-on devices such as:

- electronic add-on items:
 - air conditioning
 - generator (alternator)
 - engine turbo
 - cellular telephone
 - cruise control
 - CB radio
 - linear booster
 - backup alarm signal
 - computer
- Vehicle modification:

These items, if not installed correctly, will affect the powertrain control module, or transmission function. Pay particular attention to add-on wiring splices in the PCM harness or transmission wiring harness, abnormal tire size, or axle ratio changes.

- leaks. Refer to [Leakage Inspection](#) in this section.
- correct linkage adjustments. Refer to [Section 307-05](#).

Shift Linkage Check

Check for a misadjustment in shift linkage by matching the detents in the transmission range selector lever with those in the transmission. If they match, the misadjustment is in the indicator. Do not adjust the shift linkage.

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the linkage is not correctly adjusted. Refer to [Section 307-05](#) for shift linkage adjustment.

Check TSBs and OASIS



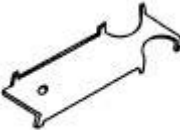
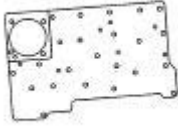



Refer to all Technical Service Bulletins and OASIS messages which pertain to the transmission concern and follow the procedure as outlined.



Carry Out On-Board Diagnostics (KOEO, KOER)

After a road test, with the vehicle warm and before disconnecting any connectors, carry out the Quick Test using New Generation Star (NGS) Tester. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the powertrain control system.

Diagnosics

Special Tool(s)

 <p>ST1300-A</p>	<p>UV Leak Detector 164-R0756 or equivalent</p>
 <p>ST1565-A</p>	<p>Pressure Gauge, Transmission Fluid 307-004 (T57L-77820-A)</p>
 <p>ST1633-A</p>	<p>Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)</p>
 <p>ST2408-A</p>	<p>Air Test Plate, Transmission 307-405</p>
 <p>ST1137-A</p>	<p>73 III Automotive Meter 105-R0057 or equivalent</p>
	<p>Trans Tester TR/MLP Overlay and Manual 007-00131 or equivalent</p>
 <p>ST2332-A</p>	<p>Worldwide Diagnostic System (WDS) 418-F224</p> <p>New Generation Star (NGS) Tester 418-F052 or equivalent</p>
	<p>MLP-TR Cable 418-F107 (007-00111) or</p>

 <p>ST1632-A</p>	<p>equivalent</p>
 <p>ST1389-A</p>	<p>Transmission Tester 307-F016 (007-00130) or equivalent</p>

Diagnosing electronically controlled automatic transmissions is simplified using the following procedures. It is important to remember that there is a definite procedure to follow. **DO NOT TAKE SHORTCUTS OR ASSUME THAT CRITICAL CHECKS OR ADJUSTMENTS HAVE ALREADY BEEN MADE.** Follow the procedures as written to avoid missing critical components or steps. By following the diagnostic sequence, the technician will be able to diagnose and repair the concern the first time.

On-Board Diagnostics with NGS

NOTE: For detailed instruction and other diagnostic methods using the NGS, refer to the NGS tester and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

These quick tests should be used to diagnose the powertrain control module and should be carried out in order.

- Quick Test 1.0 — Visual Inspection
- Quick Test 2.0 — Set Up
- Quick Test 3.0 — Key On, Engine Off
- Quick Test 4.0 — Continuous Memory
- Quick Test 5.0 — Key On, Engine Running
- Special Test Mode
 - Wiggle Test Mode
 - Output Test Mode
- PCM Reset Mode
- Clearing DTCs
- OBD II Drive Cycle
- Other NGS Features

For further information on other diagnostic testing features using the NGS or generic scan tool, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Other diagnostic methods include the following:

- Parameter Identification (PID) Access Mode
- Freeze Frame Data Access Mode
- Oxygen Sensor Monitor Mode

Output State Control (OSC) Mode

Output state control (OSC) allows the technician to control certain transmission function parameters. For example, OSC allows the technician to shift the transmission only when commanding a gear change. If the technician commands 1st gear in OSC, the transmission will remain in 1st gear until the technician commands the next gear. For another example, the technician can command a shift solenoid to turn on or off when carrying out an electrical circuit check. The OSC has two modes of operation for transmission: the BENCH MODE and the DRIVE MODE. Each mode/parameter has a unique set of vehicle operating requirements that the technician must meet before being allowed to operate OSC.

NOTE: To operate OSC, the digital transmission range (TR) sensor and the vehicle speed sensor (VSS) must be operational. No diagnostic trouble codes (DTCs) related to the digital TR sensor or the VSS can be present.

- The vehicle requirements **MUST BE MET** when **SENDING** the OSC value. Refer to vehicle requirements for each individual test.
- If the vehicle requirements are **NOT MET** when **SENDING** the OSC value, an **ERROR MESSAGE** will appear. When the **ERROR MESSAGE** is received, OSC is aborted and must be restarted.
- If, after a sent value is substituted, the vehicle requirements are no longer met, the PCM will cancel the OSC value and resume normal operation. No error message will be sent.
- The OSC value [XXX] may be sent anytime to cancel OSC.

Output State Control (OSC) Procedures

- Carry out visual inspection and vehicle preparation as necessary.
- Select "Vehicle and Engine Selection" menu.
- Select appropriate vehicle and engine.
- Select "Diagnostic Data Link."
- Select "Powertrain Control Module."
- Select "Diagnostic Test Mode."
- Select "KOEO On-Demand Self Test and KOER On-Demand Self Tests."
- Carry out test and record DTCs.
- Repair all NON-Transmission DTCs.
- Repair all VSS and digital TR sensor DTCs.
- Make sure that VSS/digital TR sensors are functional.
- Select "Active Command Modes."
- Select "Output State Control."
- Select "Trans — Bench Mode" or "Trans — Drive Mode."

OSC — Transmission Bench Modes

The following Transmission Bench Modes may be used as necessary during diagnostics.

SSA, SSB, SSC, SSD and TCC in BENCH MODE



CAUTION: The parking brake must be set prior to carrying out this procedure.

The BENCH MODE allows the technician to carry out electrical circuit checks on the following components:

- SSA — Activates SS A OFF or ON.
- SSB — Activates SS B OFF or ON.
- SSC — Activates SS C OFF or ON.
- SSD — Activates SS D OFF or ON.
- TCC — Activates TCC OFF or ON.

OSC "SSA, SSB, SSC, SSD, TCC" BENCH MODE Operates ONLY when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Transmission range selector lever in P or N.
- Key ON.
- Engine OFF.

OSC Command Values

- [OFF] — turns solenoid OFF.
- [ON] — turns solenoid ON.
- [XXX] — cancels OSC value sent.
- [SEND] — sends the values to PCM.

BENCH MODE Procedure for SSA, SSB, SSC, SSD and TCC

Follow operating instructions from the NGS menu screen:

- Select "Output State Control."
- Select "Trans - Bench Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - SSA, SSB, SSC, SSD or TCC."
- Select "ON" to turn solenoid ON.
- Press "SEND" to send command ON.
- Select "OFF" to turn solenoid OFF.
- Press "SEND" to send command OFF.
- Select "XXX" to cancel at any time.
- Press "SEND."

PC A, PC B, PC C in BENCH MODE



CAUTION: The parking brake must be set prior to carrying out this procedure.

The BENCH MODE is also used to test the functionality of the transmission electronic pressure control. During BENCH MODE, the PCx solenoids can be commanded in increments of 15 psi from zero to 90 psi and 90 to zero psi.

The line pressure tap is used to verify output pressure from PC A or PC B by turning either one off while verifying the output from the other solenoid. The second pressure tap is used to verify the output from the PC C solenoid.

The OSC functions for the parameter PCx allows the technician to choose the following options:

- PCx — Activates PCx to selected values.
- [00] — sets PCx pressure to 00 psi.
- [15] — sets PCx pressure to 15 psi.
- [30] — sets PCx pressure to 30 psi.
- [45] — sets PCx pressure to 45 psi.
- [60] — sets PCx pressure to 60 psi.
- [75] — sets PCx pressure to 75 psi.
- [90] — sets PCx pressure to 90 psi.

The OSC PCx Bench Mode should ONLY be operated to check PRESSURE FUNCTIONALITY using an installed pressure gauge (300 psi) when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Transmission range selector lever in P or N.
- Pressure gauge installed.
- Key ON.
- Engine ON.
- Engine rpm at least 1,500.

The OSC PCx Bench Mode should ONLY be operated to complete PCx SOLENOID CIRCUIT PINPOINT TESTS when:

- VSS and Digital TR Sensor are operational.
- No VSS and Digital TR Sensor DTCs are present.
- Transmission range selector lever is in "P" or "N".
- Key "ON".
- Engine "OFF".

OSC Command Values

- [00] — sets PCx pressure to 00 psi.
- [15] — sets PCx pressure to 15 psi.
- [30] — sets PCx pressure to 30 psi.

- [45] — sets PCx pressure to 45 psi.
- [60] — sets PCx pressure to 60 psi.
- [75] — sets PCx pressure to 75 psi.
- [90] — sets PCx pressure to 90 psi.
- [XXX] — cancels OSC value sent.
- [SEND] — sends the values to PCM.

BENCH MODE Procedure for PCx

Following operating instructions from the NGS menu screen:

- Select "Output State Control."
- Select "Trans — Bench Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters — PCx."
- Select Value "0 - 90 psi."
- Press "SEND" to send command.
- Select "XXX" to cancel at any time.
- Press "SEND."

OSC — Transmission DRIVE MODES

The DRIVE MODE allows control of three transmission parameters. Each mode/parameter has a unique set of vehicle operating requirements that the technician must meet before being allowed to operate OSC. When using the DRIVE MODE, the recommended procedure is to control one parameter at a time.

The DRIVE MODE allows the technician to carry out the following functions on the transmission:

- GEAR — allows upshifts or downshifts.
- TCC — engages or disengages the torque converter clutch.
- FIRM_SFT — commands a higher control pressure during upshift.

The pressure control (PCx) solenoids for this transmission are not directly controlled during DRIVE MODE testing. Pressures may be raised during an upshift via the harsh shift control channel (FIRM_SFT)

GEAR in DRIVE MODE

This OSC function is used to test the transmission shift functions.

The OSC functions for the GEAR parameter allow the technician to choose the following options:

- [1] — PCM selects 1st gear.
- [2] — PCM selects 2nd gear.
- [3] — PCM selects 3rd gear.
- [4] — PCM selects 4th gear.

- [5] — PCM selects 5th gear.

The OSC GEAR Mode operates ONLY when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Engine ON.
- TCC "OFF" (TCC cannot be engaged)
- Transmission range selector lever in D5.
- Vehicle speed is greater than 3 km/h (2 mph).

OSC Command Values

- [1] — PCM selects 1st gear.
- [2] — PCM selects 2nd gear.
- [3] — PCM selects 3rd gear.
- [4] — PCM selects 4th gear.
- [5] — PCM selects 5th gear.
- [XXX] — cancels OSC value sent.
- [SEND] — sends the values to PCM.

DRIVE MODE Procedure for GEAR

Follow operating instructions from the NGS menu screen.

- Select "Output State Control."
- Select "Trans — DRIVE MODE."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters — GEAR."
- Select Value "1-5."
- Press "SEND" to send command.
- Re-Select Value "1-5."
- Press "SEND" to send command.
- Select "XXX" to cancel at any time.
- Press "SEND."

TCC in DRIVE MODE

This OSC function is used to test whether the torque converter clutch is engaging and disengaging correctly.

The OSC functions for the TCC parameter allows the technician to choose the following:

- TCC — activates TCC OFF and ON.

- [ON] — turns TCC solenoid ON.
- [OFF] — turns TCC solenoid OFF.

OSC "TCC OFF" DRIVE MODE operates ONLY when:

- VSS and digital TR sensors are operational.
- No VSS and digital TR sensor DTCs present.
- Engine ON.
- Transmission range selector lever in D5.
- Vehicle speed is greater than 3 km/h (2 mph).

OSC "TCC ON" DRIVE MODE operates ONLY when:

- VSS and digital TR sensors are operational.
- No VSS and digital TR sensor DTCs present.
- Engine ON.
- Transmission range selector lever in D5.
- Vehicle speed is greater than 3 km/h (2 mph).
- Transmission in 2nd gear or higher.
- TFT is between 33-153°C (60-275° F).
- Brake not applied "OFF" below 32 km/h (20 mph).
- Maintain steady speed.

OSC Command Values

- [OFF] — turns TCC OFF.
- [ON] — turns TCC ON.
- [XXX] — cancels OSC value sent.
- [SEND] — sends the values to PCM.

Drive Mode Procedures for TCC

Follow operating instructions from the NGS menu screen.

- Select "Output State Control."
- Select "Trans — Drive Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters — TCC."
- Select "ON" to turn solenoid ON.
- Press "SEND" to send command ON.
- Select "OFF" to turn solenoid OFF.
- Press "SEND" to send command OFF.

- Select "XXX" to cancel at any time.
- Press "SEND."

FIRM_SFT in DRIVE MODE

This OSC function is used to raise pressure during an upshift to determine whether the pressure control system is functioning correctly. Harsher shifts indicate that the pressure control system works at higher pressure. The best test for isolating pressure control system problems is to carry out the PC A, PC B, PC C in BENCH MODE, using a hydraulic pressure gauge.

The OSC functions for the parameter FIRM_SFT allows the technician to choose the following options:

- FIRM_SFT — activates the harsh shift channel.
 - [ON] — sets control pressure higher for all upshifts (determined by the PCM)
 - [OFF]— sets control pressure to normal for all upshifts (determined by the PCM)
 - [XXX] — cancel OSC for FIRM_SFT

OSC "FIRM_SFT" DRIVE MODE operates ONLY when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Transmission range selector lever in O/D.
- Pressure gauge installed (optional).
- Key ON.
- Engine ON.
- Vehicle speed greater than 3 km/h (2 mph).
- TCC is OFF (TCC is not engaged).

OSC Command Values

- [ON] — sets control pressure high for all upshifts (determined by the PCM)
- [OFF] — sets control pressure to normal for all upshifts (determined by the PCM)
- [XXX] — cancel OSC for FIRM_SFT
- [SEND] — sends the values to the PCM

DRIVE MODE Procedure for FIRM_SFT.

Follow operating instructions from the NGS menu screen.

- Select "Output State Control."
- Select "Trans — Drive Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters — FIRM_SFT."
- Press "SEND" to send command.
- Select "XXX" to cancel at any time.

- Press "SEND."

Using Output State Control (OSC) and Accessing PIDs

To confirm that the OSC value was sent by the NGS and the PCM has accepted the OSC substitution, a corresponding PID for each OSC parameter must be monitored. Additional PIDs should be monitored to help the technician adequately diagnose the transmission.

The following is a list of OSC parameters and their corresponding PIDs:

Corresponding PID	PID Description
BPP	Brake Pedal Position Switch On/Off
PCA	Pressure Control Solenoid A — Commanded Pressure
PCB	Pressure Control Solenoid B — Commanded Pressure
PCC	Pressure Control Solenoid C — Commanded Pressure
FIRMST	Firm Shift Control (FMC) status requested by OSC; 0 = FSC not commanded by OSC, NGS PID output = OFF; 1 = FSC commanded by OSC, NGS PID output = ON
GEAR	Commanded Transmission Gear (use in drive only)
RPS	Pinpoint test for reverse pressure switch; 0 = closed, 1 = open
FFG RPS	Instantaneous Failure Flag for reverse pressure switch; Failure = 1
RPM	Engine Revolutions Per Minute
SSA	Shift solenoid A Commanded ON
SSB	Shift solenoid B Commanded ON
SSC	Shift solenoid C Commanded ON
SSD	Shift solenoid D Commanded ON
TCC	Torque converter commanded duty cycles (%)
TCCRAT	Torque converter speed ratio (RPM and/or TSS)
TFT	Transmission Fluid Temperature (degrees F)
VSS	Vehicle Speed (mph)

To confirm that the OSC substitution occurred, SEND the OSC value and monitor the corresponding PID value. If no ERROR MESSAGE was received and the value of the corresponding PID is the same as the value sent from OSC, the OSC substitution was successful.

Transmission Drive Cycle Test

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: The Transmission Drive Cycle Test must be followed exactly. Transmission failure must occur four times consecutively for shift error DTC code to be set, and five times consecutively for continuous torque converter clutch code to set.

NOTE: When carrying out the Transmission Drive Cycle Test, use the Solenoid Operation Chart for correct solenoid operation. Refer to [Pinpoint Tests — OSC Equipped Vehicles](#).

After carrying out the Quick Test, use the Transmission Drive Cycle Test for checking continuous codes.

1. Record and then erase Quick Test codes.
2. Warm engine to normal operating temperature.
3. Make sure transmission fluid level is correct.
4. With transmission in D5 position, moderately accelerate from stop to 80 km/h (50 mph). This allows the transmission to shift into fifth gear. Hold speed and throttle open steady for a minimum of 15 seconds.
5. With transmission in fifth gear and maintaining steady speed and throttle opening, lightly apply and release brake to operate stoplamps. Then hold speed and throttle steady for a minimum of five seconds.
6. Brake to a stop and remain stopped for a minimum of 20 seconds.
7. Repeat steps 4 through 6 at least five times.
8. Carry out Quick Test and record continuous DTCs.

After On-Board Diagnostics

NOTE: The vehicle wiring harness, powertrain control module and non-transmission sensors may affect transmission operations. Repair these concerns first.

After the on-board diagnostic procedures are completed, repair all DTCs.

Begin with non-transmission related DTCs, then repair any transmission related DTCs. Refer to the [Diagnostic Trouble Code Charts](#) for information on condition and symptoms. This chart will be helpful in referring to the correct manual(s) and aids in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing transmission electrical concerns. Make sure that the vehicle wiring harness and the PCM are diagnosed as well. The Powertrain Control/Emissions Diagnosis (PC/ED) manual will aid in diagnosing non-transmission electronic components.

Before Pinpoint Tests

NOTE: Prior to entering pinpoint tests, check the powertrain control module wiring harness for correct connections, bent or broken pins, corrosion, loose wires, correct routing, correct seals and their condition. Check the PCM, sensors and actuators for damage. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

NOTE: If a concern still exists after electrical diagnosis, refer to [Diagnosis By Symptom](#) in this section.

If DTCs appear while carrying out the on-board diagnostics, refer to the [Diagnostic Trouble Code Charts](#) for the appropriate repair procedure. Prior to entering pinpoint tests, refer to any TSBs and OASIS messages for transmission concerns.

Diagnostic Trouble Code Charts

Diagnostic Trouble Code Chart

**May also be generated by some other non-electric transmission hardware system.					
*Output circuit check, generated only by electrical symptoms.					
Five Digit DTC	Component	Description	Condition	Symptom	Action
P0102, P0103, P1100, P1101	MAF	MAF concerns	MAF system inoperative which may cause a transmission concern.	High/low EPC pressure, incorrect shift schedule. Incorrect torque converter clutch engagement scheduling. Symptoms similar to a TP failure.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0112	IAT	IAT indicates 125°C (254°F) (grounded)	Voltage drop across IAT exceeds scale set for temperature 125°C (254°F).	Incorrect EPC pressure. Either high or low which will result in harsh or soft shifts.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0113	IAT	IAT indicates -40°C (-40°F) (open circuit)	Voltage drop across IAT exceeds scale set for temperature -40°C (-40°F).	Incorrect EPC pressure. Either high or low which will result in harsh or soft shifts.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0114	IAT	IAT out of on-board diagnostic range	IAT temperature higher or lower than expected during KOEO and KOER.	Rerun on-board diagnostic at normal operating temperature.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1116	ECT	ECT out of on-board diagnostic range	ECT temperature higher or lower than expected during KOEO and KOER.	Rerun on-board diagnostic at normal operating temperature.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0117	ECT	ECT indicates 125°C (254°F)	Voltage drop across ECT exceeds scale set for temperature 125°C (254°F) (grounded).	Torque converter clutch will always be off, resulting in reduced fuel economy.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0118	ECT	ECT indicates -40°C (-40°F)	Voltage drop across ECT exceeds scale set for temperature -40°C (-40°F) (open circuit).	Torque converter clutch will always be off, resulting in reduced fuel economy.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

P0121, P0122, P0123, P1120, P1121, P1125, P1124	TP	TP concern	PCM has detected an error. This error may cause a transmission concern.	Harsh engagements, firm shift feel, abnormal shift schedule, torque converter clutch does not engage. Torque converter clutch cycling.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0300- P0308, P0320, P0340, P1351- P1364	EI	EI concerns	EI system is inoperative which may cause a transmission concern.	Harsh engagements and shifts, late WOT shifts, no torque converter clutch engagement.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0503, P0500,	ABS	Insufficient VSS input from ABS through SCP link.	PCM detected a loss of vehicle speed signal through SCP link from ABS.	No transmission symptom. I.P. speedometer may be affected.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0705	Digital TR sensor	Digital TR circuit failure	Digital TR circuits, indicating an invalid pattern in TR_D. Condition caused by a short to ground or an open in TR4, TR3A, TR2, and or TR1 circuits. This DTC cannot be set by an incorrectly adjusted digital TR sensor.	Increase in control pressure (harsh shifts). Defaults to D5 or invalid position.	<u>Go To Pinpoint Test C.</u>
P0708	Digital TR sensor	Digital TR sensor circuit TR3A open	Digital TR sensor circuit TR3A reading 2.6v - 5.0v (open circuit). This DTC cannot be set by an incorrectly adjusted digital TR sensor.	Increase in PC pressure. Defaults to D5 for all gear positions.	<u>Go To Pinpoint Test C.</u>
P0712	TFT	157°C (315°F) indicated TFT sensor circuit grounded	Voltage drop across TFT sensor exceeds scale set for temperature of 157°C (315°F).	Firm shift feel.	<u>Go To Pinpoint Test B.</u>
P0713	TFT	-40°C (-40°F) indicated TFT sensor circuit open	Voltage drop across TFT sensor exceeds scale set for temperature -40°C (-40°F).	Firm shift feel.	<u>Go To Pinpoint Test B.</u>
P0715	TSS	Insufficient input from	PCM detected a loss of TSS	Harsh shifts, harsh torque converter	<u>Go To Pinpoint Test E.</u>

		turbine shaft speed sensor	signal during operation.	clutch activation, and harsh engagement.	
P0717	TSS	Turbine shaft speed sensor signal intermittent.	PCM has detected an intermittent TSS signal.	Harsh shifts, harsh torque converter clutch activation, and harsh engagement.	Go To Pinpoint Test E.
P0718	TSS	Turbine shaft speed sensor signal noisy.	PCM has detected a noisy TSS signal.	Harsh shifts, harsh torque converter clutch activation, and harsh engagement.	Go To Pinpoint Test E.
P0720	OSS	Insufficient input from OSS sensor	PCM detected a loss of OSS signal during operation.	Possible abnormal shift schedule.	Go To Pinpoint Test E.
P0721	OSS	Output shaft speed sensor signal noisy	PCM has detected an erratic OSS signal.	Abnormal shift schedule.	Go To Pinpoint Test E.
P0722	OSS	Output shaft speed sensor signal intermittent	PCM has detected an intermittent OSS signal.	Abnormal shift schedule.	Go To Pinpoint Test E.
P0731**	SSA, SSB, SSC or internal parts	1st gear error	No 1st gear.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected.	REFER to the Solenoid On/Off Charts. Go To Pinpoint Test A.
P0732**	SSA, SSB, SSC or internal parts	2nd gear error	No 2nd gear.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected.	REFER to the Solenoid On/Off Charts. Go To Pinpoint Test A.
P0733**	SSA, SSB, SSC or internal parts	3rd gear error	No 3rd gear.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to	REFER to the Solenoid On/Off Charts. Go To Pinpoint Test A.

				other internal transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected.	
P0734**	SSA, SSB, SSC or internal parts	4th gear error	No 4th gear.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected.	REFER to the Solenoid On/Off Charts. Go To Pinpoint Test A .
P0735	SSA, SSB, SSC, SSD or internal parts	5th gear error	No 5th gear.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material etc.). Engine rpm could be higher or lower than expected.	REFER to the Solenoid On/Off Chart. Go To Pinpoint Test A .
P0741**	TCC	TCC slippage detected	The PCM picked up an excessive amount of TCC slippage during normal vehicle operation.	TCC slippage/erratic or no torque converter clutch operation.	REFER to the Diagnosis by Symptom Index in Diagnosis By Symptom .
P0743*	TCC	TCC solenoid circuit failure during on-board diagnostic	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostics.	Short circuit — converter clutch always engage. Open circuit — torque converter clutch never engages.	Go To Pinpoint Test A .
P0745, P1747**	PCA	PCA solenoid circuit failure, shorted circuit	Voltage through PCA solenoid is checked. An error will be noted if tolerance is exceeded.	Short circuit — causes minimum PCA pressure (minimum capacity) and limits engine torque (alternate firm). Slips in gear	Go To Pinpoint Test D .

				and third gear incorrect.	
P0750*	SSA	SSA solenoid circuit failure	SSA circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	No fourth or fifth gear (short) or no first gear (open). Will flash MIL.	Go To Pinpoint Test A.
P0753*	SSA	SSA solenoid circuit failure	SSA circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	No fourth or fifth gear (short) or no first gear (open). Will flash TCIL.	Go To Pinpoint Test A.
P0755*	SSB	SSB solenoid circuit failure	SSB circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	No first gear (short) or no third gear (open). Will flash MIL.	Go To Pinpoint Test A.
P0758*	SSB	SSB solenoid circuit failure	SSB circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	No first gear (short) or no third gear (open). Will flash TCIL.	Go To Pinpoint Test A.
P0760*	SSC	SSC solenoid circuit failure	SSC circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Incorrect gear selection depending on condition mode and manual lever position. See Solenoid On/Off chart. Will flash MIL.	Go To Pinpoint Test A.
P0763*	SSC	SSC solenoid circuit failure	SSC circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Incorrect gear selection depending on condition mode and manual lever position. See Solenoid On/Off chart. Will flash TCIL.	Go To Pinpoint Test A.
P0765	SSD	SSD solenoid circuit failure	SSD circuit failed to provide voltage drop	No engine braking in manual gears. Will flash MIL.	Go To Pinpoint Test A.

			across solenoid. Circuit open, shorted or PCM driver circuit failure during on-board diagnostics.		
P0768	SSD	SSD solenoid circuit failure	SSD circuit failed to provide voltage drop across solenoid. Circuit open, shorted or PCM driver circuit failure during on-board diagnostics.	No engine braking in manual gears. Will flash TCIL.	Go To Pinpoint Test A.
P0775, P1789**	PCB	PCB solenoid circuit failure, shorted circuit	Voltage through PCB solenoid is checked. An error will be noted if tolerance is exceeded.	Short circuit — causes minimum PCB pressure (minimum capacity) and limits engine torque (alternate firm). Zero PCB — no second and fifth gear.	Go To Pinpoint Test D.
P0779	PCB	PCB solenoid Intermittent short to ground	Voltage through PCB solenoid is checked. An error will be noted if tolerance is exceeded.	Short circuit — causes minimum PCB pressure (minimum capacity) and limits engine torque (alternate firm). Zero PCB — no second and fifth gear.	Go To Pinpoint Test D.
P0791	ISS	Intermediate shaft speed sensor signal failure.	PCM has detected a loss of the ISS signal.	Harsh shifts (2-3).	Go To Pinpoint Test E.
P0794	ISS	Intermediate shaft speed sensor signal intermittent	PCM has detected an intermittent ISS signal.	Harsh shifts (2-3).	Go To Pinpoint Test E.
P0795, P0797**	PCC	PCC solenoid circuit failure, shorted circuit	Voltage through PCC solenoid is checked. An error will be noted if tolerance is exceeded.	Incorrect gear ratio in fourth and fifth gear.	Go To Pinpoint Test D.
P0796**	PCC	PCC solenoid circuit open	Voltage through PCC solenoid is checked. Error is noted if tolerance is exceeded.	Open circuit — causes maximum PCC pressure, harsh engagements and shifts.	Go To Pinpoint Test D.
P0799	PCC	PCC solenoid intermittent short to ground	Voltage through PCC solenoid is checked. An error will be noted if tolerance	Short circuit — causes minimum PCC pressure (minimum capacity) and limits engine	Go To Pinpoint Test D.

			is exceeded.	torque (alternate firm). Incorrect gear ratio in fourth and fifth gear.	
P0814	J-GATE	J-GATE circuit input signal failed.	PCM has detected incorrect J gate voltage.	No or improper illumination of the J-gate position.	REFER to Section 307-05 .
P0815	SST +/-	SST +/- circuit input signal failed.	PCM has detected an incorrect voltage SST input.	May not be able to shift in manual mode.	REFER to Section 307-05 .
P0840	REV	Reverse pressure switch circuit input signal failed.	PCM has detected incorrect voltage at the reverse pressure switch input.	No engine braking in manual third or fourth gear.	Go To Pinpoint Test G .
P1124	TP	TP voltage high/low for on-board diagnostic.	TP was not in the correct position for on-board diagnostic.	Rerun at appropriate throttle position per application.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1460	A/C	A/C clutch cycling pressure switch error	A/C or defrost ON condition may result from A/C clutch being ON during on-board diagnostic.	DTC set during on-board diagnostic — rerun with A/C OFF. Failed ON — EPC pressure slightly low with A/C OFF.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1636	SSx	SSx ISIG communication error	PCM has detected an error with the ISIG chip.	—	INSTALL a new PCM.
P1700	TRANS	Transmission indeterminate failure	Internal component failure. Direct one-way clutch failure.	Failed a neutral condition. FMEM becomes active — engine rpm limited to 4000 rpms. No 1st, 3rd, or 4th gear in automatic mode. Other DTCs that may set P1700: P0745, P1747, P1760, P1714, P1715, P0750, P0755.	If other solenoid DTCs are present, diagnose and repair them first. CLEAR DTCs and drive vehicle. If P1700 returns, disassemble transmission and inspect the direct one-way clutch. Repair as required. CLEAR DTC. Drive vehicle and verify repair.
P1702	Digital TR	Digital TR signal intermittent, code P0705, P0708 are set.	See P0705, P0708 conditions.	See P0705, P0708 symptoms.	Go To Pinpoint Test C .
P1703	BPP	Brake not actuated during on-board diagnostic KOER	Brake not cycled during KOER.	Failed ON or not connected — torque converter clutch will not engage at less than 1/3 throttle. Failed OFF or not	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

				connected — torque converter clutch will not disengage when brake is applied.	
P1703	BPP	BPP switch circuit failed	Brake ON circuit failure during KOEO.	Failed ON or not connected — torque converter clutch will not engage at less than 1/3 throttle. Failed OFF or not connected — torque converter clutch will not disengage when brake is applied.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1704	Digital TR	Digital TR not in P or N positions during KOEO/KOER.	Digital TR sensor or shift cable incorrectly adjusted or digital TR circuit failure.	Wrong commanded PC pressure. Digital TR reading the wrong gear position. (i.e., in overdrive position, transmission stuck in manual three for base shifter and four for SST shifter).	<u>Go To Pinpoint Test C.</u>
P1705	Digital TR	Digital TR not in PARK or NEUTRAL during KOEO/KOER.	KOEO/KOER not run in PARK or NEUTRAL, or digital TR circuit failure.	DTC is set.	RERUN KOEO/KOER in PARK or NEUTRAL or <u>Go To Pinpoint Test C.</u>
P1711	TFT	TFT out of on-board diagnostic range	Transmission not at operating temperature during on-board diagnostic.	DTC set — vehicle cold or overheated.	Warm or cool vehicle to normal operating temperature. <u>Go To Pinpoint Test B.</u>
P1713	TFT	No change in TFT - low range	PCM has detected no TFT change at low range during operation.	Increase EPC, incorrect TCC engagement schedule, harsh engagement, harsh shifts.	<u>Go To Pinpoint Test B.</u>
P1714	SSA	SSA inoperative	Mechanical failure of the solenoid detected.	No fourth or fifth gear (short) or no first gear (open).	<u>Go To Pinpoint Test F.</u>
P1715	SSB	SSB inoperative	Mechanical failure of the solenoid detected.	No first gear (short) or no third gear (open)	<u>Go To Pinpoint Test F.</u>
P1716	SSC	SSC inoperative	Mechanical failure of the solenoid detected.	Incorrect gear selection depending on condition mode and manual lever position. See Solenoid On/Off Chart.	<u>Go To Pinpoint Test F.</u>

P1717	SSD	SSD inoperative	Mechanical failure of the solenoid detected.	Incorrect gear selection depending on condition, mode and manual lever position. See the Solenoid On/Off Chart.	Go To Pinpoint Test F.
P1718	TFT	No change in TFT - high range	PCM has detected no TFT change at high range during operation.	Increase EPC, incorrect TCC engagement schedule, harsh engagement, harsh shifts.	Go To Pinpoint Test B.
P1740	TCC	TCC inoperative	Mechanical failure of the solenoid detected.	Failed ON — Converter clutch always on. Failed OFF — torque converter never applies.	Go To Pinpoint Test F.
P1746**	PCA	PCA solenoid circuit open	Voltage through PCA solenoid is checked. Error is noted if tolerance is exceeded.	Open circuit — causes maximum PCA pressure, harsh engagements and shifts.	Go To Pinpoint Test D.
P1760	PCA	PCA solenoid Intermittent short to ground	Voltage through PCA solenoid is checked. An error will be noted if tolerance is exceeded.	Short circuit — causes minimum PCA pressure (minimum capacity) and limits engine torque (alternate firm). Slips in gear, third incorrect.	Go To Pinpoint Test D.
P1780	TCS	TCS input incorrect per selected position	TCS voltage incorrect.	No overdrive cancel when range selector is moved	RERUN on-board diagnostic and cycle switch. REFER to Section 307-05.
P1783	TFT	Transmission overtemp condition indicated	Transmission fluid temperature exceeded 127°C (270°F).	Increase in control pressure.	Go To Pinpoint Test B.
P1788**	PCB	PCB solenoid circuit open	Voltage through PCB solenoid is checked. Error is noted if tolerance is exceeded.	Open circuit — causes maximum PCB pressure, harsh engagements and shifts.	Go To Pinpoint Test D.

Rotunda Transmission Tester

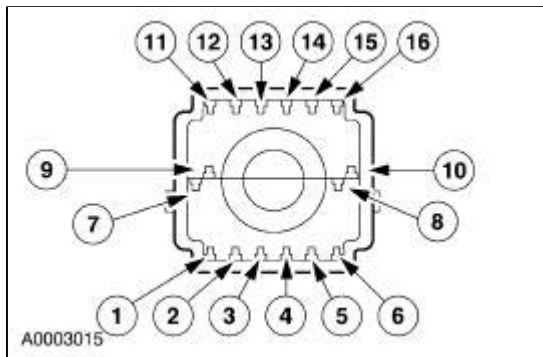
The Rotunda Transmission Tester is used to diagnose electronically controlled transmissions and is used in conjunction with the pinpoint tests. The tests should be carried out in order. Installing the Rotunda Transmission Tester allows separation of the vehicle electronics from transmission electronics. Refer to the Rotunda Transmission Tester manual for these tests.

- Digital Transmission Range (TR) Sensor Testing
- Resistance/Continuity Test

- Switch Test - Park/Neutral, Backup Lamp, and Optional Circuits
-

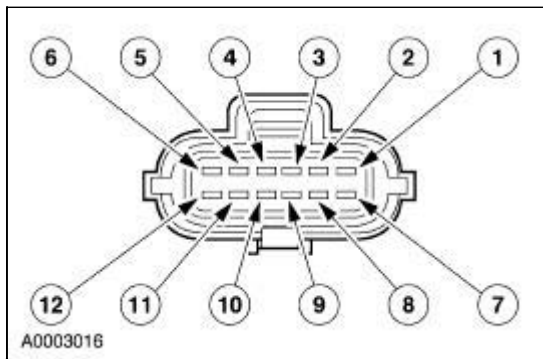
Transmission Connector Layouts

Transmission Vehicle Harness Connector



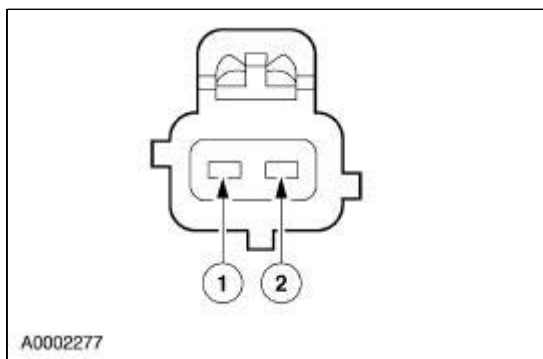
Pin Number	PTEC-B Pin number	Circuit Function
1	B7	PCA
2	B23	Transmission fluid temperature (TFT) sensor
3	—	Shift solenoid power
4	B13	PCB
5	B4	SSD
6	B3	SSC
7	—	NOT USED
8	—	NOT USED
9	—	NOT USED
10	—	NOT USED
11	B12	PCC
12	B17	Signal return
13	B30	Reverse pressure switch
14	B5	Torque converter clutch (TCC) solenoid
15	B2	SSB
16	B1	SSA

Digital Transmission Range (TR) Sensor Vehicle Harness Connector



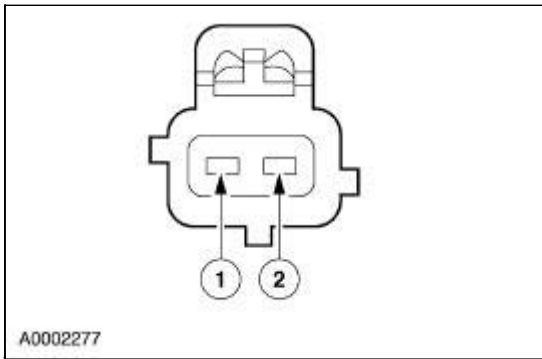
Pin Number	PTEC-B Pin Number	Circuit Function
1	—	NOT USED
2	B17	Signal return
3	B9	TR3A
4	B22	TR1
5	B18	TR2
6	B10	TR4
7	—	Ground
8	—	Neutral sense
9	—	Fused power feed
10	—	Starter control
11	—	Back up
12	—	Starter to starter interrupt relay

Turbine Shaft Speed (TSS) Sensor Harness Connector



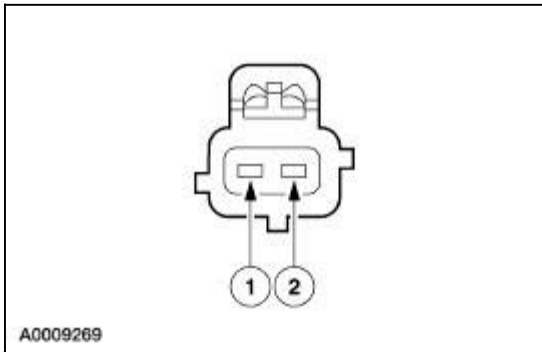
Pin Number	PTEC-B Pin Number	Circuit Function
1	B27	Turbine Shaft Speed Sensor (TSS)
2	B17	Signal Return

Output Shaft Speed (OSS) Sensor Harness Connector



Pin Number	PTEC-B Pin Number	Circuit Function
1	B26	Output shaft speed sensor (OSS)
2	B17	Signal return

Intermediate Shaft Speed (ISS) Sensor Harness Connector



Pin Number	PTEC-B Pin Number	Circuit Function
1	B21	Intermediate shaft speed sensor (ISS)
2	B17	Signal return

Digital Transmission Range (TR) Sensor Diagnosis Chart

Selector Position	Base Shift Lever Indicator	Select Shift Lever Indicator	PID: TR_D				PID: TR_V (volts)
			TR4	TR3A	TR2	TR1	TR3A (PCM pin 64 to sigtrn)
PARK	P	P	0	0	0	0	0.0 Volts
In Between	R	R	0	1	0	0	1.3 - 1.8 Volts
REVERSE	R	R	1	1	0	0	1.3 - 1.8 Volts
In Between	R	R	0	1	0	0	1.3 - 1.8 Volts
NEUTRAL	N	N	0	1	1	0	1.3 - 1.8 Volts
In Between	D5/D4	D5	1	1	1	0	1.3 - 1.8 Volts
OVERDRIVE	D5/D4	D5	1	1	1	1	1.3 - 1.8 Volts
In Between	D5/D4	D5	1	1	1	0	1.3 - 1.8 Volts

Manual 3	3	D4	1	0	1	0	0.0 Volts
In-Between	2	—	1	0	1	1	0.0 Volts
Manual 2	2	—	1	0	0	1	0.0 Volts
In Between	2	—	1	0	1	1	0.0 Volts
Manual 1	Man 1	—	0	0	1	1	0.0 Volts

- A. TR_V is the voltage at the PCM pin 64 (TR3A Circuit) to signal return.
- B. "In Between" reading could be caused by a shift cable or digital TR sensor misaligned or a digital TR sensor circuit failure of TR1, TR2, TR3A, or TR4.
- C. TR_D: 1= Open digital TR switch, 0= Closed digital TR switch.
- D. EEC-V Control System Breakout Box Readings: Taken from PCM signal pins for TR1, TR2, TR3A, TR4 to signal return.

- **Voltages for TR1, TR2, TR4:**

- 0 = 0.0 volts.
- 1 = 9.0 - 14.0 volts.

- **Voltage for TR3A:**

- 0 = 0.0 volts.
- 1 = 1.3 - 1.8 volts.

Wiggle Test Information for Open/Shorts

- A. TR4, TR3A, TR2, and TR1 are all closed in PARK, PARK is a good position to check for intermittent open circuits (with scan tool monitoring TR_D).
- B. TR4, TR3A, TR2, and TR1 are all open in D5, so D5 is a good position to check for shorts to ground. To determine the shorted components while observing TR_D, unplug the TR and see if the short goes away. If the short is still present unplug the transmission harness and see if the short goes away. If the short is still present, then the short is in the PCM or vehicle harness. Remove the suspect circuit(s) wire terminal from the PCM connector. If the short is still present, then the PCM has an internal failure, otherwise the failure is in the vehicle harness.

Reverse Pressure (RP) Switch Diagnosis Chart

Selector Lever Position	Actual Gear	PID RPS
P,R,N	—	1
D5	1	0/1 ^a
	2	0/1 ^a
	3	1
	4	1
	5	1
D4	1	0/1 ^a
	2	0/1 ^a
	3	1
	4	1
3	3	1
2	2	0/1 ^a

1	1	0/1 ^a
---	---	------------------







^a RPS will read "0" when pressure is above 23 psi and "1" when PC A pressure is below 8 psi. This reading should show "0" for a calibrated time then go to "1".

RP Switch Symptoms

Conditions	Actions	Results
FFG_RPS = 1 FFG = Failure Flag	RPS does not match RPS diagnosis chart	No manual third gear and fourth gear
P0840 set	RPS reads zero (0) in first, third, fourth, and fifth or one (1) in first, third, fourth, and fifth (PCM sees this condition three times in first)	"E" symbol will appear on the instrument panel. If equipped with the message center, a message to "Check Transmission" will be transmitted. No manual third and fourth gears.

Pinpoint Tests — OSC Equipped Vehicles

Special Tool(s)

 ST1565-A	Transmission Fluid Pressure Gauge 307-004 (T57L-77820-A)
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
	Trans Tester TR/MLP Overlay and Manual 007-00131 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224 New Generation Star (NGS) Tester 418-F205 or equivalent
 ST1632-A	MLP-TR Cable 418-F107 (007-00111) or equivalent
 ST1389-A	Transmission Tester 307-F016 (007-00130) or equivalent

Shift Solenoid Pre-Diagnosis

Any time an electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install new as necessary.

Use the following shift solenoid operation information when carrying out Pinpoint Test A.

Solenoid Operation Chart

Base Gearshift Selector Position	Powertrain Control Module (PCM) Commanded Gear	5R55N Solenoid States						
		SSA	SSB	SSC	SSD	PCA	PCB	PCC
P/N	P	On	Off	Off	On	L ¹	C ²	L
R	R	On	Off	Off	On	L	H ³	H
D5	1	On	Off	Off	On	C	L	L
	2	On	Off	On	On	L	C	L
	3	On	On	Off	On	C	L	L
	4	Off	Off	Off	On	C	L	H
	5	Off	Off	On	On	C	C	H
D4	1	On	Off	Off	On	C	L	L
	2	On	Off	On	On	L	C	L
	3	On	On	Off	On	C	L	L
	4	Off	Off	Off	Off	C	C	H
3	3	On	On	Off	Off	C	C	L
2	2	On	Off	On	Off	C	C	L
1	1	On	Off	Off	Off	C	C	L

¹ Low line pressure

² Control line pressure

³ High line pressure

Solenoid Operation Chart

Select Shift (optional) Gearshift Selector Position	Powertrain Control Module (PCM) Commanded Gear	5R55N Solenoid States						
		SSA	SSB	SSC	SSD	PCA	PCB	PCC
P/N	P	On	Off	Off	On	L ¹	C ²	L
R	R	On	Off	Off	On	L	H ³	H
D5	1	On	Off	Off	On	C	L	L
	2	On	Off	On	On	L	C	L
	3	On	On	Off	On	C	L	L
	4	Off	Off	Off	On	C	L	H
	5	Off	Off	On	On	C	C	H
D4	1	On	Off	Off	On	C	L	L
	2	On	Off	On	On	L	C	L
	3	On	On	Off	On	C	L	L
	4	Off	Off	Off	Off	C	C	H
+/-	1	On	Off	Off	Off	H	H	L
	2	On	Off	On	Off	H	H	L
	3	On	On	Off	Off	H	H	L
	4	Off	Off	Off	Off	H	H	H
	5	Off	Off	On	On	H	H	H

¹ Low line pressure

² Control line pressure

³ High line pressure

Shift Solenoid Failure Mode Chart "Always Off"

Failed OFF due to powertrain control module and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck OFF.

SSA Always "OFF":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear	
1	3	3
2	2	2
3	3	3
4	4	4M ^a
5	5	

^a Manual

SSB Always "OFF":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	1	1
2	2	2
3	1	1
4	4	4M ¹
5	5	

¹ Manual

SSC Always "OFF":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	1	1
2	1	1
3	3	3
4	4	4M ¹
5	4	

¹ Manual

SSD Always "OFF":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	1/1M ¹	1/1M ¹

2	2M ¹	2M ¹
3	3/3M ¹	3M ¹
4	4/4M ¹	4M ¹
5	5	

¹ Manual

Shift Solenoid Failure Mode Chart "Always On"

Failed OFF due to powertrain control module and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck ON.

SSA Always "ON":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	1	1
2	2	2
3	3	3
4	1	1M ¹
5	2	

¹ Manual

SSB Always "ON":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	3	3
2	2	2
3	3	3
4	4	4M ¹
5	5	

¹ Manual

SSC Always "ON":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	1/2	1/2
2	2	2
3	3/Ratio 1.16	3/Ratio 1.16
4	4/5	4/5
5	5	

	Transmission Range Selector Lever Position	
	D5	D4

SSD Always "ON":	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	1	1
2	2	2
3	3	3
4	4	4
5	5	

Pressure Control Solenoid Failure Mode Chart "Always Low"

PC A "Low":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	S ² /1	1
2	2	2
3	S ² /1	1
4	S ² /4	4M
5	5	

²Slips

PC B "Low":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	1	1
2	1	1
3	3	3
4	4	4
5	4	

PC C "Low":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	1	1
2	2	2
3	3	3
4	3	3
5	1.1	

Pressure Control Solenoid Failure Mode Chart "Always High"

PC A "High":	Transmission Range Selector Lever Position	
	D5	D4

PCM Gear Commanded	Actual Gear Obtained	
1	1	1
2	2	2
3	3	3
4	4	4M ¹
5	5	

¹ Manual

PC B "High":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	1	1
2	2	2
3	3	3
4	4	4M ¹
5	5	

¹ Manual

PC C "High":	Transmission Range Selector Lever Position	
	D5	D4
PCM Gear Commanded	Actual Gear Obtained	
1	1	1
2	2	2
3	3	3
4	4	4M ¹
5	5	

¹ Manual

Pinpoint Tests

PINPOINT TEST A: SHIFT AND TORQUE CONVERTER CLUTCH SOLENOIDS

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.</p> <p>NOTE: Refer to the Internal Harness Diagram illustration preceding these pinpoint tests.</p> <p>NOTE: Read and record all DTCs. All Digital TR Sensor and VSS DTCs must be repaired before entering Output State Control (OSC).</p>	
<p>A1 ELECTRONIC DIAGNOSTICS</p>	
<p>1</p>	



2



4



NGS Tester

5



6



Diagnostic Data Link

7



PCM

8



Active Command Modes

9



Output State Control (OSC)

10



Trans-Bench Mode

3 Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding.

● Does vehicle enter Trans-Bench Mode?

- **Yes**
REMAIN in Trans-Bench Mode. GO to A2.
- **No**
REPEAT procedure to enter Trans-Bench Mode. If vehicle did not enter Trans-Bench Mode, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM or NGS.

A2 WIGGLE TEST

- 1 Remain in Trans-Bench Mode.
 - 2 Select PIDs to be monitored.
- | PID Command | PID Actual |
|-------------|------------|
| SSA | SSA |
| SSB | SSB |
| SSC | SSC |
| SSD | SSD |
| TCC | TCC |
- 3 Select "ON" to turn suspect solenoid on.
 - 4 Press "SEND".
 - 5 Wiggle all wiring and connectors to the transmission. Monitor the solenoid state for changes.
 - 6 Select "OFF" to turn solenoid off.
 - 7 Press "SEND".
- **Does the suspect solenoid(s) fault state change?**
- **Yes**
REPAIR the circuit. TEST the system for normal operation.
 - **No**
GO to A3.

A3 SOLENOID FUNCTIONAL CHECK

- 1 Monitor each solenoid state.
 - 2 Turn each solenoid ON and OFF.
- **Does the solenoid turn ON and OFF when commanded and can solenoid activation be heard?**
- **Yes**
GO to A4.

→ **No**
GO to A5.

A4 OSC TRANS-DRIVE MODE (GEAR OR TCC)

- 1 Carry out OSC Trans-Drive Mode.
- 2 Select GEAR for shift solenoids or follow procedures for GEAR as listed in this section.
- 3 Select TCC for Torque Converter Clutch Solenoid. Follow procedures of TCC in Drive Mode as listed in this section.

- **Does the transmission upshift and downshift or torque converter engage/disengage when commanded?**

→ **Yes**
CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom to diagnose shift or torque converter concern.

→ **No**
GO to A5.

A5 CHECK FOR BATTERY VOLTAGE

1

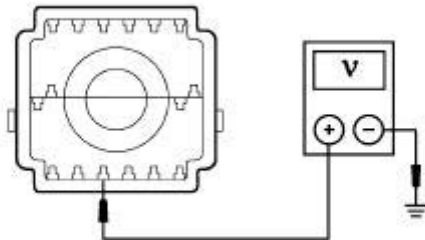


Transmission Vehicle Harness Connector

3



4



A0005135

- 2 Visually inspect all wires and connectors for damage.

- 4 Measure the voltage on pin 3 harness side and ground.

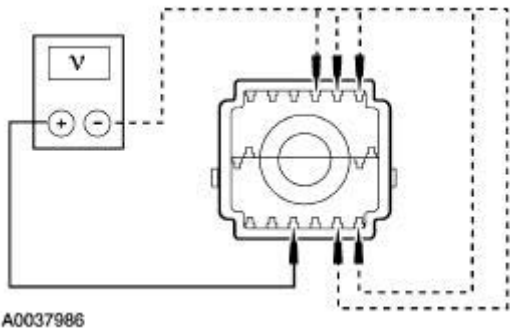
- **Is the voltage greater than 10 volts?**

→ **Yes**
GO to A6.

→ **No**
REPAIR the circuit. TEST for normal operation.

A6 ELECTRICAL SIGNAL CHECK

1



2



Trans-Bench Mode

1 Leave positive lead connected to pin 3 and connect negative lead to pin 5, 6, 14, 15 and 16.

3 Select Parameter SSA, SSB, SSC, SSD or TCC.

4 Select "ON".

5 Press "SEND".

6 Measure the voltage while cycling the solenoids ON and OFF.

7 Select "OFF", press "SEND".

● **Does the voltage change?**

→ **Yes**
GO to A7.

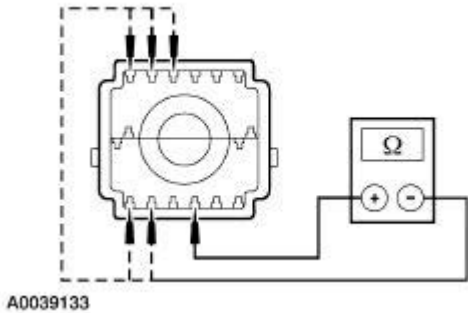
→ **No**
REPAIR the circuit. TEST the system for normal operation.

A7 CHECK SOLENOID RESISTANCE AT SOLENOID

1

1 Measure the resistance between pin 3 and pin 5, 6, 14, 15, and 16 solenoid side.

Solenoid	Resistance (ohms)
SSA	16-45
SSB	16-45
SSC	16-45
SSD	16-45



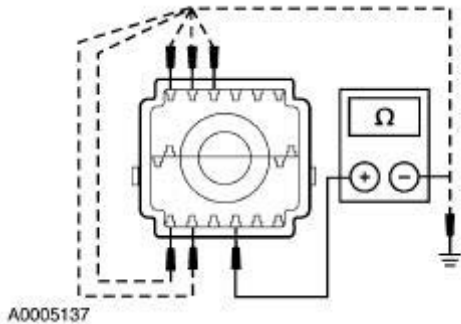
● Is the resistance within specification?

→ **Yes**
GO to A8.

→ **No**
INSTALL a new solenoid body assembly.
TEST the system for normal operation.

A8 CHECK SOLENOID FOR SHORT TO GROUND

1



1

Measure the resistance between pin 3 and pin 5, 6, 14, 15, and 16 solenoid side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new solenoid body assembly.

→ **No**
REFER to Diagnosis By Symptom in this section for diagnosis of shift or torque converter concerns.

PINPOINT TEST B: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.	
B1 ELECTRONIC DIAGNOSTICS	
1	



2



4



NGS Tester

5



9



PIDs; TFT, TFTV

3 Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding.

6 Select Diagnostic Data Link.

7 Select PCM.

8 Select PID/Data Monitor and Record.

● Does the vehicle enter PID/Data Monitor and Record?

→ Yes
REMAIN in PID/Data Control.GO to B2.

→ No
REPEAT procedure to enter PID. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM and NGS.

B2 WARM-UP/COOL-DOWN CYCLE

1 While monitoring the TFT PIDs, carry out the following test: If transmission is cold, run transmission to warm it up. If transmission is warm, allow transmission to cool down.

● Do the TFT PIDs increase as the transmission is warmed up or

decrease as the transmission is cooled or does the TFT or TFTV drop in and out of range?

→ **Yes**

If the TFT PIDs increase as the transmission is warmed or decrease as the transmission is cooled, CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section to diagnose transmission overheating.

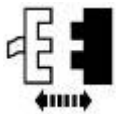
If the TFT or TFTV drop in and out of range, INSPECT for intermittent concern in the internal/external harness, sensor or connector.

→ **No**

GO to B3.

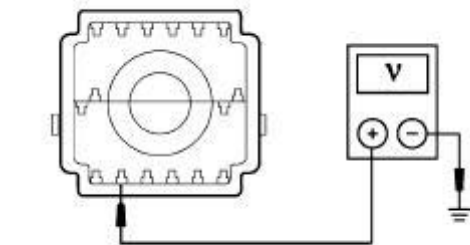
B3 ELECTRICAL SIGNAL CHECK

1



Transmission Harness Connector

3



A0005138

2

Visually inspect all wires and connectors for damage.

3

Measure the voltage between pin 2 harness side and ground.

● Is the voltage between 4.5 and 5.0 volts?

→ **Yes**

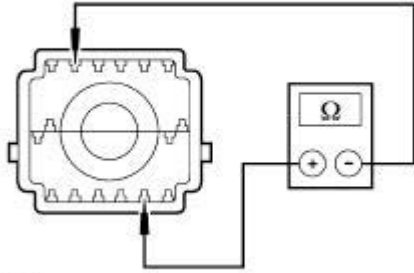
GO to B4.

→ **No**

REPAIR the circuit. TEST the system for normal operation.

B4 CHECK RESISTANCE OF TFT SENSOR

1



A0038288

- 2 Measure the resistance between pin 2 and 12 at the solenoid body connector.
- 3 Record the resistance.
- 4 Resistance should be approximately in the following ranges:






Transmission Fluid Temperature

°C	°F	Resistance (Ohms)
-40 to -20	-40 to 4	967K - 284K
-19 to -1	-3 - 31	284K - 100K
0 - 20	32 - 68	100K - 37K
21 - 40	69 - 104	37K - 16K
41 - 70	105 - 158	16K - 5K
71 - 90	159 - 194	5K - 2.7K
91 - 110	195 - 230	2.7K - 1.5K
111 - 130	231 - 266	1.5K - 0.8K
131 - 150	267 - 302	0.8K - 0.54K

● **Is the resistance in the range?**

- **Yes**
REFER to [Diagnosis By Symptom](#) in this section to diagnose an overheating concern.
- **No**
INSTALL a new solenoid body assembly.

PINPOINT TEST C: DIGITAL TRANSMISSION RANGE (TR) SENSOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Refer to the Digital Transmission Range (TR) Sensor Connector illustration and Digital Transmission Range (TR) Sensor Diagnosis Chart preceding these pinpoint tests.</p>	
<p>C1 VERIFY DIAGNOSTIC TROUBLE CODES</p>	
<p>1 </p> <p>2 </p>	<p>3 Carry out on-board diagnostic test.</p> <ul style="list-style-type: none"> ● Are only DTC codes P0705, P0708 present? <p>→ Yes GO to <u>C4</u>.</p> <p>→ No GO to <u>C2</u>.</p>
<p>C2 VERIFY DIGITAL TRANSMISSION RANGE SENSOR ALIGNMENT</p>	
<p>1 </p> <p>2 </p> <p>5 </p>	<p>3 Check to make sure the digital TR sensor harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding.</p> <p>4 Apply the parking brake.</p> <p>6 Disconnect the shift cable/linkage from the manual lever.</p> <p>7 Verify that the TR Sensor Alignment Gauge fits in the appropriate slots.</p> <ul style="list-style-type: none"> ● Is the digital TR sensor correctly adjusted?

- **Yes**
GO to C3.
- **No**
ADJUST the digital TR sensor; REFER to Digital Transmission Range (TR) Sensor in this section. PLACE transmission range selector lever into PARK and CLEAR DTCs. RERUN OBD Tests.GO to C3.

C3 VERIFY SHIFT CABLE/LINKAGE ADJUSTMENT

1



D5

- 2 Connect the shift cable/linkage.
- 3 Verify that the shift cable/linkage is correctly adjusted. Refer to Section 307-05.

- **Is the shift cable/linkage is correctly adjusted?**

- **Yes**
GO to C4.
- **No**
ADJUST the shift cable/linkage. REFER to Section 307-05.GO to C4.

C4 CHECK ELECTRICAL SIGNAL OPERATION


1



2



Digital TR Sensor

- 2  **CAUTION: Do not pry on connector. This will damage the connector and result in a transmission concern.**

Press button and pull out on the digital TR harness connector.

- 3 Inspect both ends of the connector for damage or pushed out pins, corrosion, loose wires and missing or damaged seals.

- **Is there damage to the connector, pins or harness?**

- **Yes**
REPAIR as necessary. CLEAR DTCs and RERUN OBD Tests.

→ **No**
If diagnosing a DTC, GO to C5.

If diagnosing a starting concern or a backup lamp concern, GO to C10.

C5 CHECK ELECTRICAL SYSTEM OPERATION (DTR AND PCM)

1



2



NGS Tester

3



Digital TR Sensor

4



5



TR PIDS TR_D, TR_V

6 Move transmission range selector lever into each gear and stop.

7 Observe the PIDs, TR_D, and TR_V (vehicle-dependent) while wiggling harness, tapping on sensor, or driving the vehicle. Use PIDs TR_D for DTCs P0705, P1704, and P1705. Use PIDs TR_V for DTC P0708.

8 Compare the PIDs to the Digital Transmission Range (TR) Sensor Diagnosis Chart.

- Do the PIDs TR_D and TR_V match the Digital Transmission Range (TR) Sensor Diagnosis chart, and does the TR_D PID remain steady when the harness is wiggled, the sensor is tapped on, or the vehicle driven?

→ **Yes**
The problem is not in the digital TR

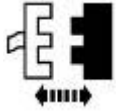
sensor system. REFER to [Diagnosis By Symptom](#) in this section for further diagnosis.

→ **No**
If TR_D changes when wiggling harness, tapping on the sensor or driving the vehicle, the problem may be intermittent.

GO to [C6](#).

C6 CHECK DIGITAL TRANSMISSION RANGE SENSOR OPERATION

1



Digital TR Sensor

2



TR-E Cable to Transmission Tester

3



TR-E Cable to Digital TR Sensor

4 Place the DIGITAL TR Overlay onto Transmission Tester.

5 Carry out SENSOR Test as instructed on the digital TR Overlay.

- Does the status lamp on the tester TRS-E cable match the selected gear positions?

→ **Yes**
Concern is not in the digital TR sensor. GO to [C7](#).

→ **No**
INSTALL a new digital TR sensor and ADJUST. REFER to [Digital Transmission Range \(TR\) Sensor](#) in this section. CLEAR DTCs and RERUN OBD Tests.

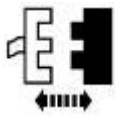
C7 CHECK PCM HARNESS CIRCUITS FOR OPENS

1



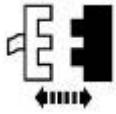
2

2 Inspect for damaged or pushed out pins, corrosion or loose wires.



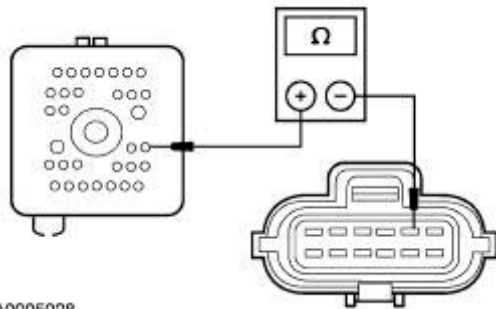
150 Pin PTEC Module Connector "B"

3



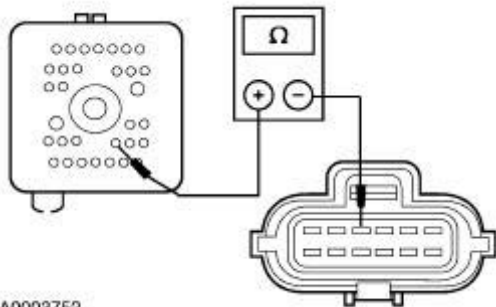
Digital TR Sensor

4



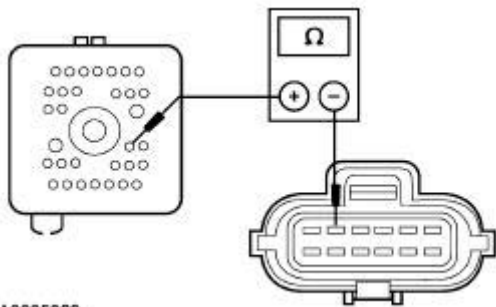
A0005028

5



A0003752

6



A0005029

7

3



CAUTION: Do not pry the connector. This will damage the connector and result in a transmission concern.

Disconnect the digital TR sensor connector.

4

Measure the resistance between pin 2 harness side and signal return pin 17 harness side.

5

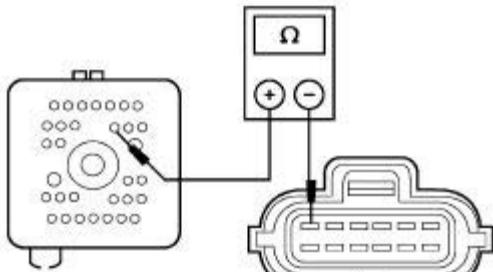
Measure the resistance between pin 22 and pin 4 harness side.

6

Measure the resistance between pin 18 and pin 5 harness side.

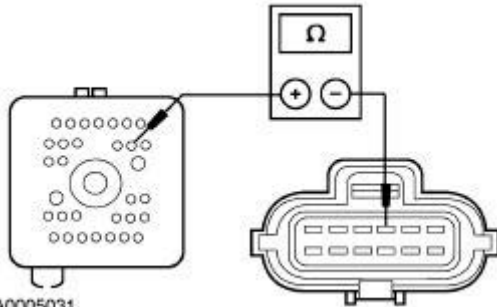
7

Measure the resistance between pin 10 and pin 6 harness side.



A0005030

8



A0005031

8 Measure the resistance between pin 9 and pin 3 harness side.

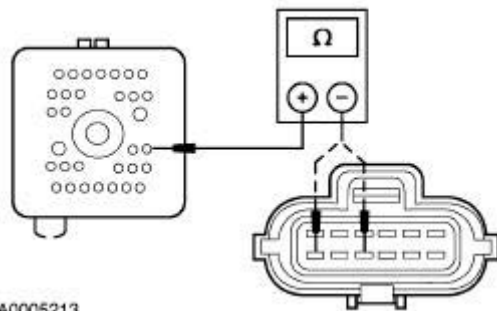
• Are the resistances less than 5 ohms?

→ **Yes**
GO to C8.

→ **No**
REPAIR the circuits. TEST the system for normal operation.

C8 CHECK PCM HARNESS CIRCUITS FOR SHORT TO GROUND OR POWER

1

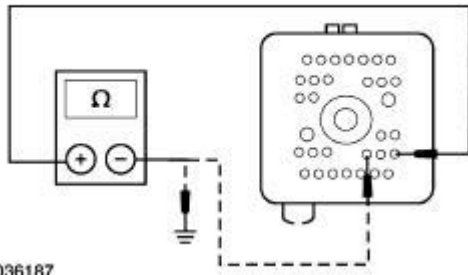


A0005213

2

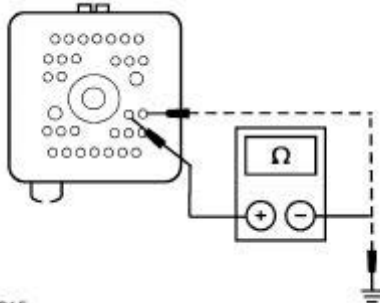
1 Measure the resistance between pin 17 and pin 10 harness side and ground; and pin 12 harness side.

2 Measure the resistance between pin 22 harness side and ground; and pin 17 harness side and ground.



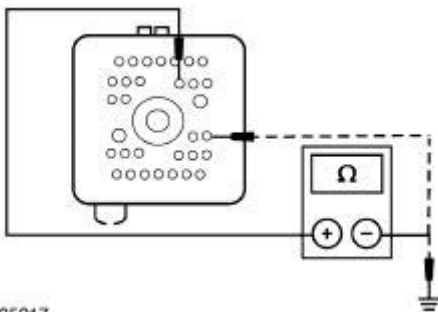
A0036187

3



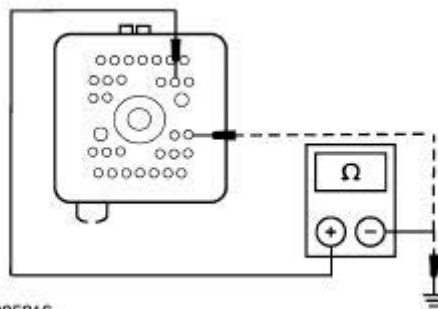
A0005215

4



A0005217

5



A0005216

3 Measure the resistance between pin 18 harness side and ground; and pin 17 harness side and ground.

4 Measure the resistance between pin 10 harness side and ground; and pin 17 harness side and ground.

5 Measure the resistance between pin 9 harness side and ground; and pin 17 harness side and ground.

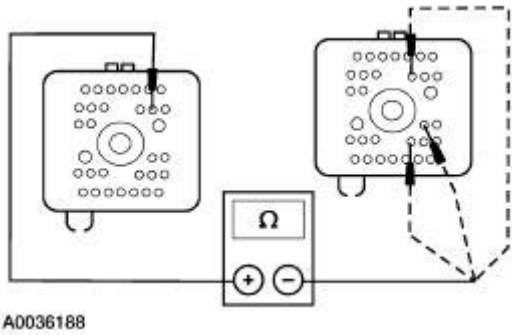
• Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to C9.

→ **No**
REPAIR the circuits. TEST the system for normal operation. CLEAR DTCs. RERUN OBD Tests.

C9 CHECK FOR SHORT BETWEEN TR/PCM INPUT SIGNAL CIRCUITS

1

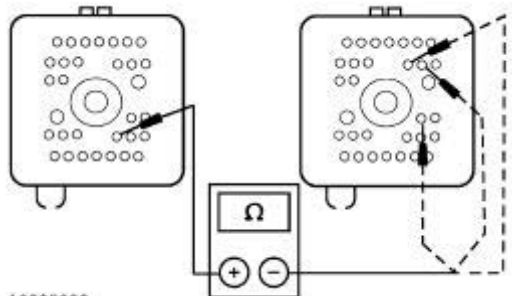


A0036188

1

Measure the resistance between pin 9 harness side and pin 22; pin 18; pin 10 harness side.

2

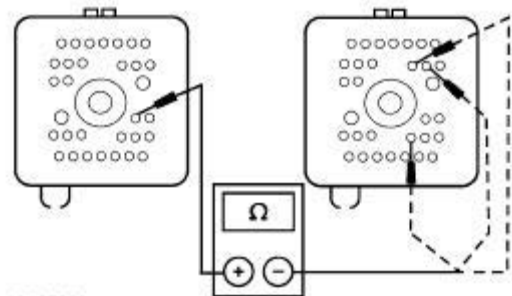


A0005032

2

Measure the resistance between pin 22 harness side and pin 9; pin 18; pin 10 harness side.

3

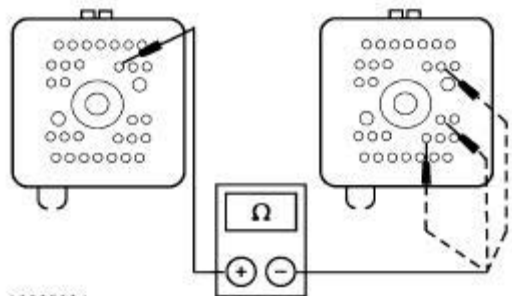


A0005033

3

Measure the resistance between pin 18 harness side and pin 22; pin 9; pin 10 harness side.

4



A0005034



4

Measure the resistance between pin 10 harness side and pin 22; pin 18; pin 9 harness side.


- Are the resistances greater than 10,000 ohms?

→ Yes

INSTALL a new PCM. TEST the system for normal operation.

	→ No REPAIR the circuit. TEST the system for normal operation.
C10 CHECK THE NON-PCM INTERNAL CIRCUITS OF SENSOR	
<p>1 </p> <p>TRS-E Cable to Transmission</p> <p>2 </p> <p>TRS-E Cable to Digital TR Sensor</p>	<p>3 Place the Digital TR Overlay onto Transmission Tester.</p> <p>4 Carry out Switch Test as instructed on the digital TR Overlay.</p> <ul style="list-style-type: none"> ● Does the status lamp on the tester indicate RED for the correct gear position? <p>→ Yes Concern is not in the digital TR sensor. For start system concerns, REFER to <u>Section 303-06</u> . For backup lamp concerns, REFER to <u>Section 417-01</u> .</p> <p>→ No INSTALL a new digital TR sensor and ADJUST; REFER to <u>Digital Transmission Range (TR) Sensor</u> in this section. CLEAR DTCs and RERUN OBD Tests.</p>

PINPOINT TEST D: PRESSURE CONTROL (PC) SOLENOIDS (PCA, PCB, PCC)

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.</p> <p>NOTE: Read and record all DTCs. All digital TR Sensor and VSS DTCs must be repaired before entering Output State Control (OSC).</p>	
D1 ELECTRONIC DIAGNOSTICS	
<p>1 </p> <p>2</p>	

PRND
↑

5



NGS Tester

6



7



Diagnostic Data Link

8



PCM

9



Active Command Modes

10



Output State Control (OSC)

11



Trans-Bench Mode

3 Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in the connector and in good condition before proceeding.

4 Install 300 psi pressure gauges into Line and PC C tap.

● Does the vehicle enter the Trans-Bench Mode?

→ Yes

REMAIN in Trans-Bench Mode. GO to D2.

→ **No**
REPEAT procedure to enter Trans-Bench Mode. If vehicle did not enter OSC, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM or NGS.

D2 SOLENOID FUNCTIONAL TEST

2



Parameter; PCx

8



XXX

1 Monitor pressure gauges.

3 **NOTE:** Make sure that the solenoids not being tested are off or at zero.

Select PC A, PC B, or PC C.

4 Select value - 15, 30, 45, 60, 70 or 90 psi.

5 Press "SEND".

6 Select another value "0-90 psi".

7 Press "SEND".

9 Press "SEND".

- For PC A and PC B: Does the pressure reading for A or B follow the commanded pressure, (actual A and B pressure will be higher than the commanded pressure)?

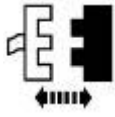
For PC C: Does the pressure reading match the commanded pressure?

→ **Yes**
CLEAR DTCs.

→ **No**
GO to D3.

D3 CHECK FOR BATTERY VOLTAGE

1

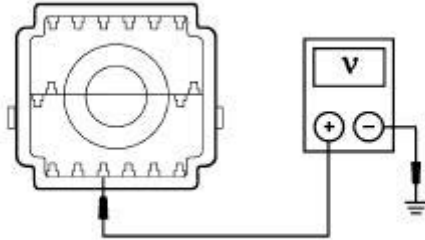


Transmission Harness Connector

3



4



A0005135

2 Visually inspect all wires and connectors for damage.

4 Measure the voltage between pin 3 harness side and ground.

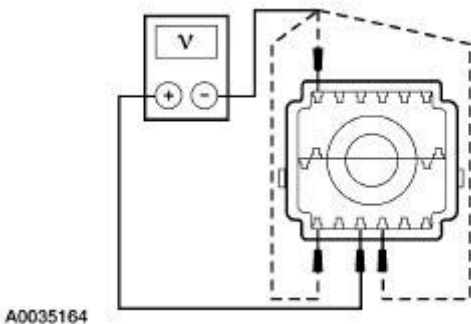
• Is the voltage greater than 10 volts?

→ Yes
GO to D4.

→ No
REPAIR the circuit. TEST the system for normal operation.

D4 ELECTRICAL SIGNAL CHECK

1



A0035164

1 Leave positive lead connected pin 3 and connect negative lead to pins 1, 4 and 11 harness side.

3



Trans-Bench Mode

4

2 Activate solenoids (ON and OFF) while monitoring the voltage reading.



Parameter; PCx

9



XXX

- 5 Select a value "0-90 psi".
- 6 Press "SEND".
- 7 Select another value "0-90 psi".
- 8 Press "SEND".

10 Press "SEND".

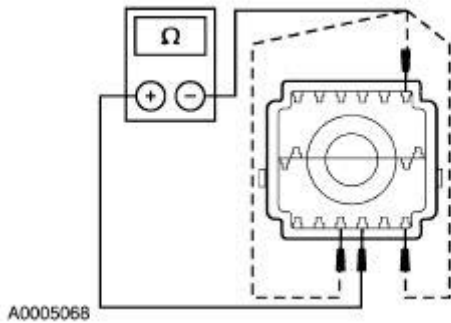
● Does the voltage and solenoid state change?

→ Yes
GO to D5.

→ No
CHECK for open or short circuit in harness or PCM.

D5 CHECK SOLENOID RESISTANCE AT SOLENOID

1



1 Measure and record the resistance between PC solenoid pin 3 and pins 1, 4, and 11. Resistance should be between 3.3 and 7.5 ohms.

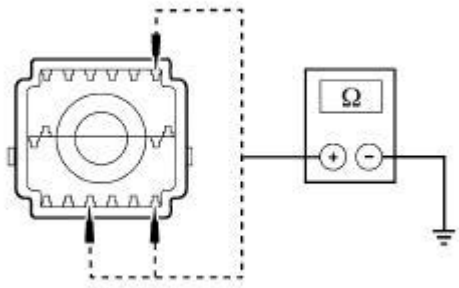
● Is the resistance within specifications?

→ Yes
GO to D6.

→ No
INSTALL a new solenoid body assembly.

D6 CHECK SOLENOID FOR SHORT TO GROUND

1



A0037992



2 Measure and record the resistance between the PC solenoid pins 1, 4, 11, and ground solenoid side.

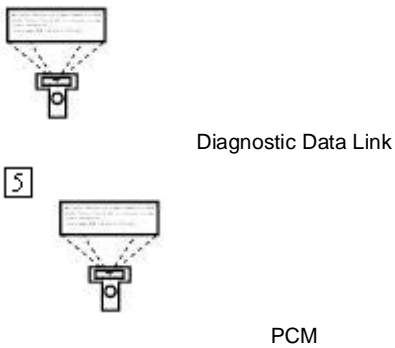
• Is the resistance less than 10,000 ohms?

→ **Yes**
INSTALL a new solenoid body assembly.
TEST the system for normal operation.

→ **No**
REFER to [Diagnosis By Symptom](#) in this section for diagnosis of pressure concerns. TEST the system for normal operation.

PINPOINT TEST E: TURBINE SHAFT SPEED (TSS), INTERMEDIATE SHAFT SPEED (ISS), AND OUTPUT SHAFT SPEED (OSS) SENSORS

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Refer to the turbine shaft speed (TSS), intermediate shaft speed (ISS), and output shaft speed (OSS) sensor connector illustrations preceding these pinpoint tests.</p>	
<p>E1 ELECTRONIC DIAGNOSTICS</p>	
<p>2</p>  <p>NGS Tester</p> <p>3</p>  <p>4</p>	<p>1 Check to make sure the transmission harness connectors are fully seated, terminals are fully engaged in connector and in good condition before proceeding.</p>



- 6 Select PID/Data Monitor and Record.
- 7 Select the following PIDs: TSS, ISS, or OSS.
- **Does vehicle enter PID/Data Monitor and Record?**
- **Yes**
REMAIN in PID/Data.GO to E2.
- **No**
REPEAT procedure to ENTER PID. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM or NGS.

E2 DRIVE CYCLE TEST

- 1 While monitoring the appropriate sensor PID, drive the vehicle so that the transmission upshifts and downshifts through all gears.
- **Does the TSS, ISS, or OSS Speed PID increase and decrease with engine and vehicle speed?**
- **Yes**
GO to E3.
- **No**
If the TSS, ISS, or OSS Speed PID does not increase and decrease with engine and vehicle speed, INSPECT for open or short in vehicle harness, sensor, a PCM concern, or internal hardware concern.GO to E4.

E3 DRIVE CYCLE TEST ERRATIC

- 1 While monitoring the appropriate sensor PID, drive the vehicle so that the transmission upshifts and downshifts through all gears.
- **Is the TSS, ISS, or OSS Speed PID signal erratic (drop to zero or near**

zero and return to normal operation)?

→ **Yes**

If the sensor signal is erratic, INSPECT for intermittent concern in the harness, sensor, or connector. GO to E4.

→ **No**

CLEAR all DTCs. Rerun OBD.

E4 CHECK PCM HARNESS CIRCUITS FOR OPENS

1

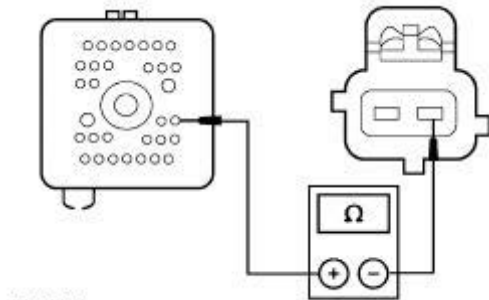


2



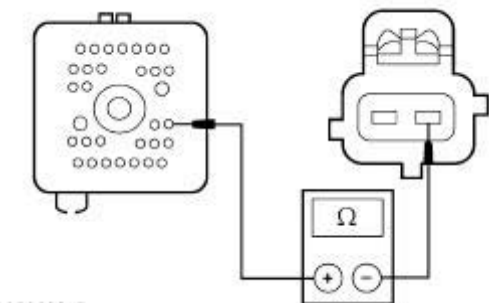
150 Pin PTEC Module Connector "B"

3



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4



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5

2

Inspect for damaged or pushed out pins, corrosion or loose wires.

3

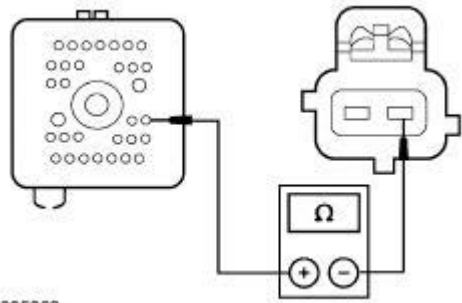
For OSS, measure the resistance between pin 17 and the appropriate sensor connector pin 2 harness side.

4

For ISS, measure the resistance between pin 17 and the appropriate sensor connector pin 2 harness side.

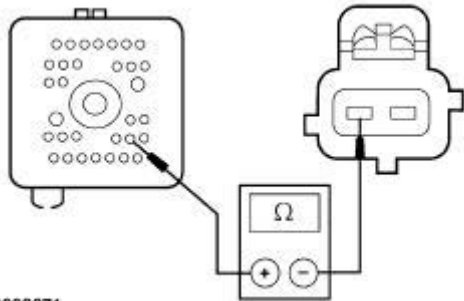
5

For TSS, measure the resistance between pin 17 and the appropriate sensor connector pin 2 harness side.



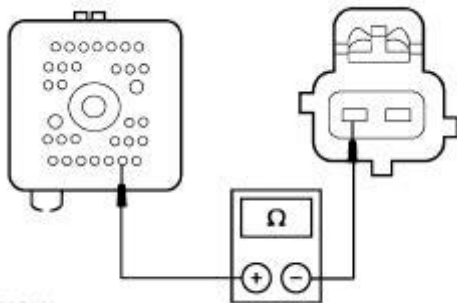
A0005069

6



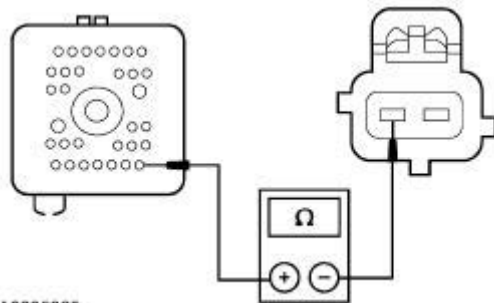
A0009271

7



A0005141

8



A0005035

6 For ISS, measure the resistance between pin 21 and the appropriate sensor connector pin 1 harness side.

7 For TSS, measure the resistance between pin 27 and the appropriate sensor connector pin 1 harness side.

8 For OSS, measure the resistance between pin 26 and the appropriate sensor connector pin 1 harness side.

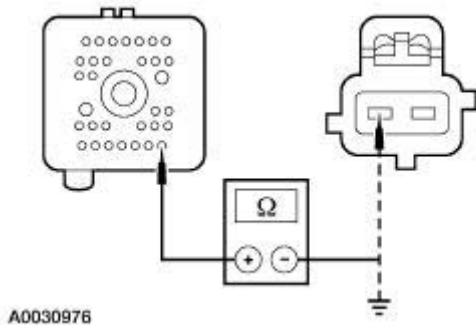
• Are all resistances less than 5 ohms?

→ **Yes**
GO to E5.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

E5 CHECK PCM HARNESS CIRCUITS FOR SHORT TO GROUND

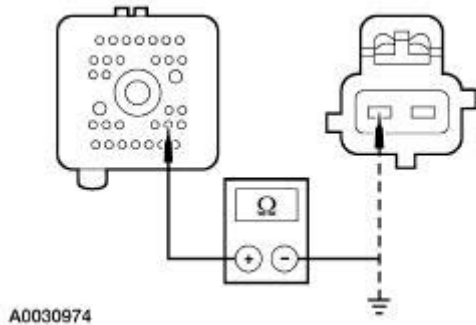
1



1

For OSS, measure the resistance between pin 26 and sensor connector pin 1 harness side and ground.

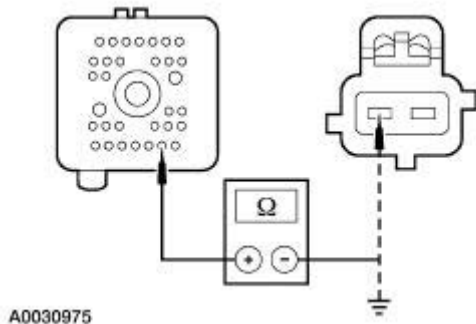
2



2

For ISS, measure the resistance between PCM pin 21 and sensor connector pin 1 harness side and ground.

3



3

For TSS, measure the resistance between PCM pin 27 and sensor connector pin 1 harness side and ground.

- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to E6.

→ **No**
REPAIR the circuits. TEST the system for normal operation. CLEAR DTCs. RERUN OBD Tests.

E6 CHECK RESISTANCE OF TSS, ISS or OSS SENSOR

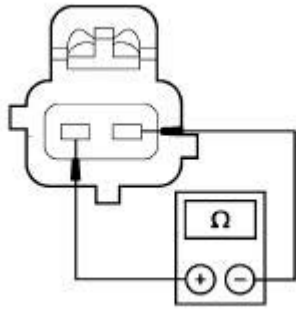
2

1

Disconnect the appropriate vehicle harness connector from the TSS, ISS or OSS sensor.

2

Connect ohmmeter negative lead to one pin of the sensor and the positive lead to the other pin on the sensor.



A0005211

- 3 Record the resistance. Resistance should be as follows:

Resistance (ohms)	Temperature C° (F°)
266-390	-20° (4°)
325-485	21° (70°)
492-738	150° (302°)

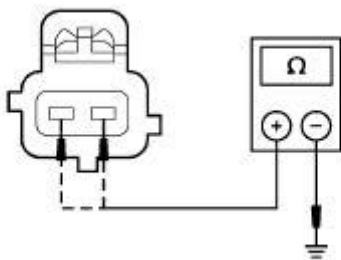
- Is the resistance within specification for the appropriate sensor?

→ **Yes**
GO to E7.

→ **No**
INSTALL a new sensor.

E7 CHECK SENSORS FOR SHORT TO GROUND

1



A0005501





- 1 Measure the resistance between pin 1 and 2 of each sensor and ground.

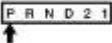

- Is the resistance less than 10,000 ohms?

→ **Yes**
INSTALL a new sensor.


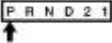


→ **No**
REFER to Diagnosis By Symptom for diagnosis of shift or torque converter concerns in this section.

PINPOINT TEST F: SOLENOID MECHANICAL FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Repair all other DTCs before repairing the following DTCs: P1714, P1715, P1716, P1717, P1740.</p>	
<p>F1 ELECTRONIC DIAGNOSIS</p>	
<p>1 </p> <p>NGS Tester</p> <p>2 </p> <p>3 </p>	<p>4 Carry out KOEO test until continuous DTCs have been displayed.</p> <p>5 If any of the following DTCs are present, continue with this test: P1714, P1715, P1716, P1717, P1740.</p> <ul style="list-style-type: none"> ● Are other DTCs present for TFT or shift solenoids? <p>→ Yes REPAIR the DTCs for TFT or shift solenoids first. CLEAR DTCs and CARRY OUT transmission Drive Cycle test. RERUN Quick Test.</p> <p>→ No INSTALL a new solenoid and/or body. REFER to the <u>Diagnostic Trouble Code Charts</u> for code description. GO to <u>F2</u>.</p>
<p>F2 TRANSMISSION DRIVE CYCLE TEST</p>	
	<p>1 Carry out transmission drive cycle test. Refer to <u>Transmission Drive Cycle Test</u> in this section.</p> <ul style="list-style-type: none"> ● Does the vehicle upshift and downshift OK? <p>→ Yes GO to <u>F3</u>.</p> <p>→ No REFER to <u>Diagnosis By Symptom</u> in this section to diagnose shift concerns.</p>
<p>F3 RETRIEVE DTCS</p>	
<p>1 </p> <p>NGS Tester</p>	

<p>2</p> 	
<p>3</p> 	
	<p>4 Carry out KOEO test until continuous DTCs have been displayed.</p> <ul style="list-style-type: none"> ● Are DTCs P1714, P1715, P1716, P1717, P1740 still present? <p>→ Yes INSTALL a new PCM. ROAD TEST and RERUN Quick Test.</p> <p>→ No Testing completed. If a concern still exists, REFER to Diagnosis By Symptom in this section for concern diagnosis.</p>

PINPOINT TEST G: REVERSE PRESSURE SWITCH

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Refer to the Reverse Pressure (RP) Switch Diagnosis Chart preceding these pinpoint tests.</p>	
<p>G1 ELECTRONIC DIAGNOSIS</p>	
<p>1</p> 	
<p>2</p> 	
<p>4</p> 	
<p>5</p> 	
	<p>3 Check to make sure that the transmission harnesses is fully seated, the terminals are fully engaged in the connector, and the terminals are in good condition.</p>
	<p>6 Select Diagnostic Data Link.</p>

9



PIDs: RPS, FFG RPS

- 7 Select PCM.
- 8 Select PID DATA Monitor and record.

● **Does the vehicle enter PID/DATA Monitor and record?**

- **Yes**
REMAIN in PID/DATA control. GO to G2.
- **No**
REPEAT the procedure. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for PCM and NGS.

G2 ELECTRICAL SIGNAL CHECK

- 1 Carry out Transmission Drive Cycle Test and monitor line pressure and PIDs: RPS, FFG RPS.

● **Do the PIDs: RPS, FFG RPS match the chart for a given gear?**

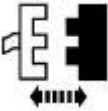
- **Yes**
RP switch is OK. REFER to Diagnosis By Symptom in this section.
- **No**
GO to G3.

G3 CHECK HARNESS FOR OPENS

1

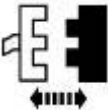


2



150 Pin PTEC Module Connector "B"

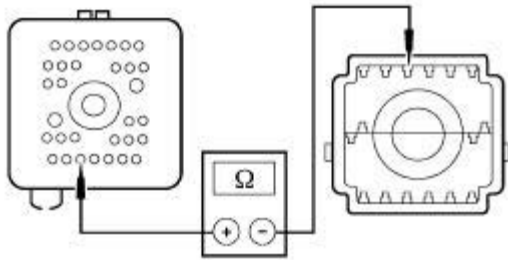
3



Transmission Connector

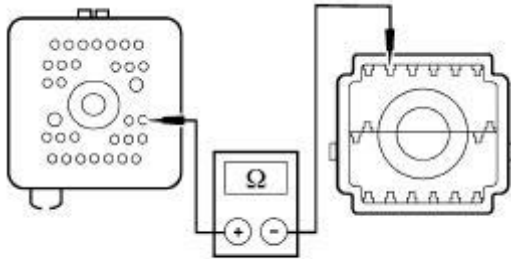
4

- 4 Measure the resistance between PCM pin 30 and pin 13 harness side.



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5



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5 Measure the resistance between PCM pin 17 and pin 12 harness side.

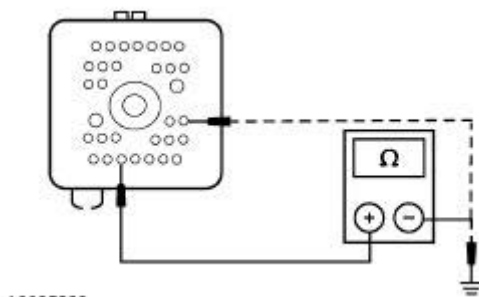
- Are the resistances less than 5 ohms?

→ **Yes**
GO to G4.

→ **No**
REPAIR the circuit. CLEAR DTCs.
RERUN OBD tests.

G4 CHECK CIRCUIT FOR SHORT TO GROUND OR POWER

1



A0005220

1 Measure the resistance between PCM pin 30 and pin 17 harness side and ground.

- Is the resistance less than 10,000 ohms?

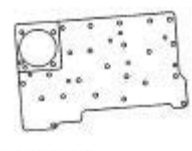

→ **Yes**
INSTALL a new reverse pressure switch.
TEST the system for normal operation.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
RERUN OBD test. TEST the system for

normal operation.

Special Testing Procedures

Special Tool(s)

 ST2408-A	Air Test Plate, Transmission 307-405
 ST1565-A	Transmission Fluid Pressure Gauge 307-004 (T57L-77820-A)

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portion of the transmission.

Engine Idle Speed Check

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the engine idle speed.

Line Pressure Test



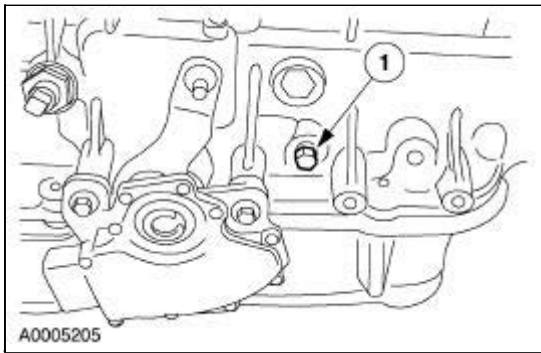
CAUTION: Carry out Line Pressure Test prior to carrying out Stall Speed Test. If line pressure is low at stall, do not carry out the Stall Speed Test or further transmission damage will occur. Do not maintain wide open throttle in any gear range for more than five seconds.

NOTE: Certain sensor failures may cause high PC, FMEM (Failure Mode Effect Management) actions. Be sure that self test and electrical repairs have been carried out, or test results may be incorrect.

NOTE: The line pressure tap is used to verify output pressure from PC A or PC B by turning either one off while verifying the output from the other solenoid. The second pressure tap is used to verify the output from the PC C solenoid.

This test verifies that the line pressure is within specifications.

1. Connect pressure gauge to the line pressure tap.



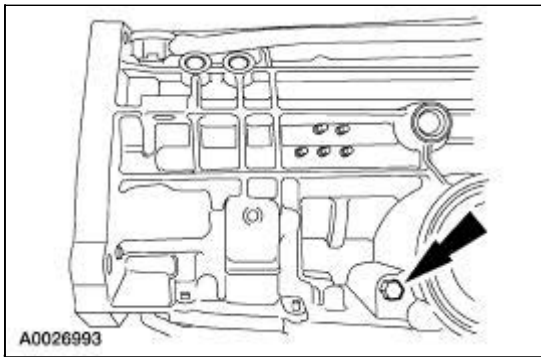
Item	Part Number	Description
1	—	Line Pressure Tap

2. Start engine and check line pressures. Refer to the following Line Pressure Chart to determine if line pressure is within specifications.

Line Pressure Chart

Range	Idle	WOT Stall	Idle	WOT Stall
	PC C	PC C	Line	Line
P/N	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	862-1,137 kPa (125-165 psi)	2,000-2,482 kPa (290-360 psi)
R	793 kPa (115 psi)	793 kPa (115 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)
D5/D4	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)
M5/M4	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	425-800 kPa (76-116 psi)	1,448-1,793 kPa (210-260 psi)
M3	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)
M2/M1	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	634-910 kPa (92-132 psi)	1,448-1,793 kPa (210-260 psi)
P/N	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	862-1,137 kPa (125-165 psi)	—
R	793 kPa (115 psi)	793 kPa (115 psi)	634-910 kPa (92-132 psi)	2,000-2,482 kPa (290-360 psi)
D5/D4	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)
M5/M4	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)
M3/M2/M1	0-103 kPa (0-15 psi)	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	1,448-1,793 kPa (210-260 psi)

3. If line pressure is not within specifications, check PC C pressure.
4. Connect Pressure Gauge to PC C pressure tap.



Item	Part Number	Description
1	—	Pressure Control (PC C) Tap

5. Start engine and check PC C pressure. Refer to Line Pressure Diagnosis Chart in this section for specification.
6. If PC C pressure is not within specification, [Go To Pinpoint Test D](#) to diagnose PC C operation. If PC C operation is OK, refer to Line Pressure Diagnosis Chart in this section for line pressure concern causes.

Line Pressure Diagnosis Chart

Test Results	Possible Source
High at Idle — All Ranges	<ul style="list-style-type: none"> ● Wiring Harnesses ● EPC Boost Valve ● EPC Solenoid ● Main Regulator Valve
Low at Idle — All Ranges	<ul style="list-style-type: none"> ● Low Fluid Level ● Fluid Inlet Filter/Seal ● Main Control Body ● Cross Leaks ● Gaskets ● Pump ● Separator Plate
Low — All Forward Ranges	<ul style="list-style-type: none"> ● Forward Clutch ● Main Control ● Overdrive Servo ● Intermediate Servo
Low in Park Only	<ul style="list-style-type: none"> ● Valve Body
Low in Reverse Only	<ul style="list-style-type: none"> ● Separator Plate ● Rear Servo Piston, Cover Seal ● Reverse Clutch ● Overdrive Servo ● Intermediate Servo ● Valve Body ● Forward Clutch
Low in Neutral Only	<ul style="list-style-type: none"> ● Valve Body ● Overdrive Servo ● Intermediate Servo
Low in Overdrive Only	<ul style="list-style-type: none"> ● Forward Clutch ● Overdrive Servo ● Intermediate Servo ● Valve Body
Low in Drive Only (O/D Cancelled)	<ul style="list-style-type: none"> ● Forward Clutch ● Overdrive Servo ● Intermediate Servo

	<ul style="list-style-type: none"> ● Valve Body
Low in 1st Position	<ul style="list-style-type: none"> ● Forward Clutch ● Valve Body
Low in 2nd Position	<ul style="list-style-type: none"> ● Intermediate Servo ● Overdrive Servo ● Intermediate Servo ● Forward Clutch

Stall Speed Test

This test checks operation of the following items:

- torque converter clutch
- forward clutch
- low-one way clutch (OWC) assembly
- engine performance
- overdrive one-way clutch assembly



WARNING: Apply the parking brake firmly while carrying out each stall test.



CAUTION: Always carry out the Line Pressure Test procedures prior to carrying out the Stall Speed Test. If line pressure is low at stall, do not carry out the Stall Speed Test or further transmission damage will occur.

NOTE: The Stall Speed Test should be carried out with the engine and transmission at normal operating temperatures.

1. Connect tachometer to the engine.

2.  **CAUTION:** After testing each of the following ranges D5, D4, 3, 2, 1, and R, move the transmission range selector lever to N (NEUTRAL) and run the engine at 1,000 rpm for about 15 seconds to allow the torque converter to cool before testing the next range.



CAUTION: Do not maintain wide open throttle in any range for more than five (5) seconds.



CAUTION: If the engine rpm recorded by the tachometer exceeds maximum specified rpm, release the accelerator pedal immediately. Clutch or band slippage is indicated.

NOTE: Prolonged use of this procedure may set Diagnostic Trouble Code P0712, P1783. After Carrying out Stall Speed Test run OBD Test and clear DTCs from memory.

Press accelerator pedal to floor (WOT) in each range. Record rpm reached in each range. Stall speeds should be as follows:

Stall Speed Chart

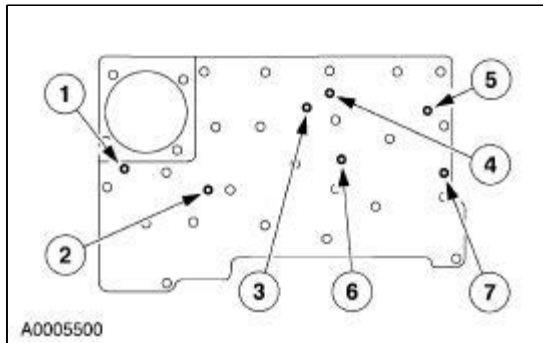
Vehicle	Engine	RPM
Lincoln LS	3.0	2,565-3,060
Lincoln LS	3.9	2,491-2,900

If stall speeds were too high, refer to the following Stall Speed Diagnosis Chart. If stall speeds were too low, first check the engine idle speed. If engine idle is OK, remove torque converter and check the torque converter one-way clutch for slippage.

Stall Speed Diagnosis Chart

Transmission Range Selector Lever Position	Stall Speeds High	Stall Speeds Low
D5, D4, and 1	Overdrive One-Way Clutch, Rear One-Way Clutch	—
D4, 2 and 1	Forward Clutch, Overdrive One-Way Clutch	—
D5	Forward Clutch, Overdrive One-Way Clutch	—
D5, D4, 2, 1 and R	General Pressure Concerns, Forward Clutch, Overdrive One-Way Clutch	Converter One-Way Clutch or Engine Driveability Concerns
R Only	High/Reverse, High Clutch, Low and Reverse Band/Servo	—
2 Only	Intermediate Band/Servo	—
1 Only	Low/Reverse Band/Servo	—

Air Pressure Tests



Item	Part Number	Description
1	—	Reverse servo
2	—	Intermediate clutch apply
3	—	Intermediate servo apply
4	—	Direct clutch
5	—	Overdrive servo apply
6	—	Forward clutch
7	—	Coast clutch

A no-drive condition can exist even with correct transmission fluid pressure because of inoperative clutches or bands. An erratic shift can be located through a series of checks by substituting air pressure for fluid pressure to determine the location of the failure.

Follow the procedure to determine the location of the inoperative clutch or band by introducing air pressure into the various test plate passages.

NOTE: Use only dry, regulated (276 kPa [40 psi] maximum) air pressure.

Apply air to the appropriate passage(s). A dull thud should be felt or heard or movement could be observed when the component applies. There should be no hissing sound when the component is fully applied.

NOTE: Cover the vent hole in the test plate with a clean, lint-free shop towel to prevent spray when the air is applied. Plugging the vent hole during testing will result in inaccurate results.

1. Drain transmission fluid and remove the transmission fluid pan.
2. Remove the main control valve body.
3. Install the Transmission Test Plate and gasket. Tighten bolts to 10 Nm (89 lb-in).
4. **NOTE:** Do not apply air to the test plate vent hole.

Apply air to the appropriate clutch port (refer to diagram). A dull thud may be heard or movement felt when the component is applied or released. If clutch seals or check balls are leaking a hissing sound may be heard.

If test results find that the servos do not operate, disassemble, clean and inspect them to locate the source of the concern.

If air pressure applied to the clutch passages fails to operate a clutch, or operates another clutch simultaneously, disassemble and use air pressure to check the fluid passages in the center support and clutches to detect obstructions.

Leakage Inspection



CAUTION: Do not try to stop the fluid leak by increasing the torque beyond specifications. This may cause damage to the case threads.

Leakage at the transmission fluid pan to case gasket often can be stopped by tightening the attaching bolts to 14 Nm (10 lb-ft). If necessary, install a new oil pan case gasket.

Check the fluid filler plug at the transmission case. If leakage is found here, install a new plug.

Check fluid tubes and fittings between the transmission and the cooler for looseness, wear, or damage. If leakage cannot be stopped by tightening a fluid tube nut, install new parts. When fluid is found leaking between the case and cooler line fitting, check for missing or damaged O-ring seal, then tighten the fitting to maximum specification.

If the leak continues, install a new cooler line fitting and tighten to specification. The same procedure should be followed for fluid leaks between the cooler and the cooler line fittings in this section. For additional information, refer to [Section 307-02](#).

The cooler can be further checked for leaks. For additional information, refer to [Section 307-02](#).

If leakage is found at the transmission range selector lever, install a new seal.

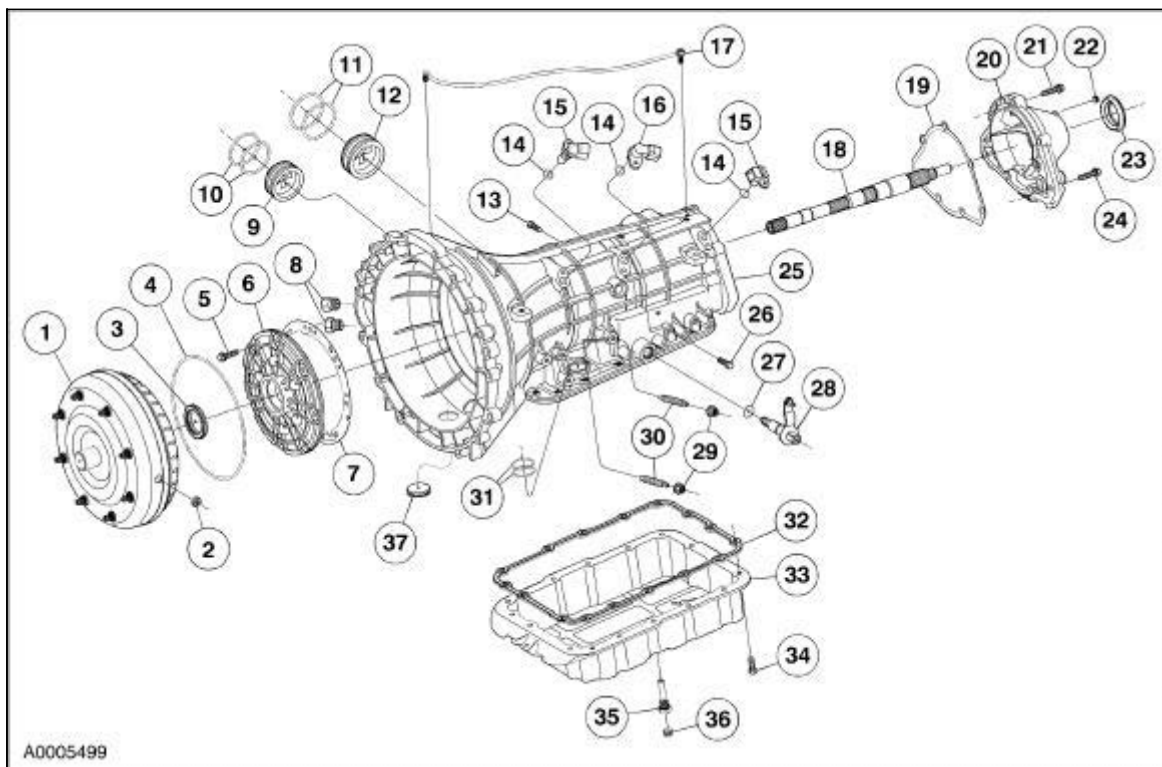
If leakage is found at the transmission harness connector, install a new O-ring seal.

External Sealing

The transmission has the following parts to prevent external fluid leakage:

- gaskets
- lip-type seals
- O-ring seals
- seal rings
- seal grommets
- thread sealant

External Sealing



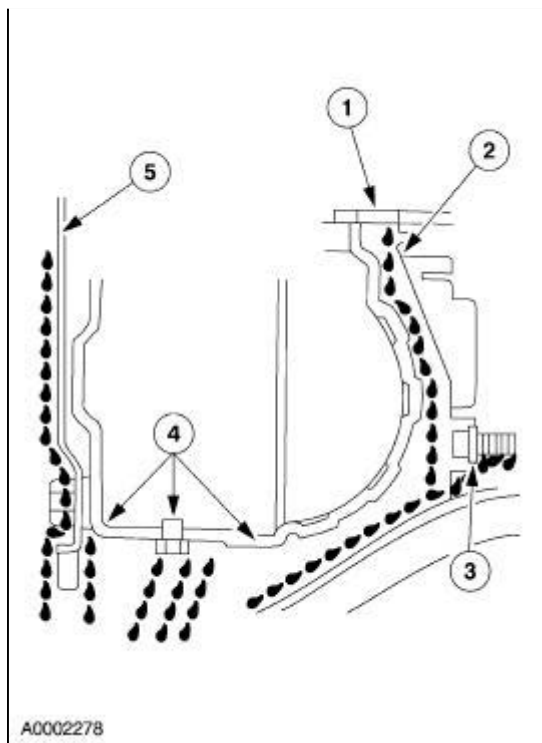
A0005499

Item	Part Number	Description
1	7902	Torque converter assembly
2	6730	Torque converter drain plug
3	7A248	Front pump fluid seal assembly
4	7A248	Seal— front fluid pump
5	W704892-S1300	Screw and washer assembly
6	7G187	Cover assembly fluid pump
7	7A136	Gasket front fluid pump
8	7D273	Fluid tube connector assembly
9	7D027	Overdrive servo cover
10	W703119-S300	Overdrive servo cover seal
11	W702969-S300	Intermediate servo cover seal
12	7D027	Intermediate servo cover
13	390318-S2	Pipe plug
14	W702981-S300	O-ring seal — speed sensor
15	7H103	Turbine shaft speed and output shaft speed sensors
16	7M183	Intermediate shaft speed sensor
17	7034	Vent assembly
18	7060	Output shaft
19	7086	Gasket — extension housing
20	7A039	Housing assembly — extension
22	W500312-S1309	Screw — extension housing to case (2 req'd)
22	W701516-S304	Fluid fill access plug

23	7052	Seal assembly — extension housing
24	W500311-S1427	Screw — extension housing to case (5 Req'd)
25	7005	Case
26	3930318-S2	Pipe plug
27	7B498	Seal assembly — main control lever
28	7A256	Manual control lever
29	W705582-S430	Overdrive intermediate lock nut
30	7C492	Screw — intermediate band adjuster/lock
31	W705928	Solenoid body connector O-ring seal
32	7A191	Gasket — fluid pan
33	7A194	Pan — fluid
34	W500213-S1309	Screw — fluid pan to case
35	7A010	Fluid fill drain tube
36	W704999-S309	Short hex plug
37	7N171	Converter housing access plug

Fluid Leakage in Torque Converter Area

In diagnosing and correcting fluid leaks in the front pump support and gear and torque converter area, use the following procedures to locate the exact cause of the leakage. Leakage at the front of transmission, as evidenced by fluid around the torque converter housing, may have several sources. By careful observation it is possible, in many instances, to pinpoint the source of leak before removing the transmission from the vehicle. The paths which the fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The five steps following correspond with the numbers in the illustration.



1. Fluid leaking by the pump seal lip will tend to move along the impeller hub and onto the back of the impeller housing. Except in the case of a total seal failure, fluid leakage by the lip of the seal will be deposited on the inside of the torque converter housing only, near the outside diameter of the housing. Fluid from the vent assembly may move along the impeller hub and onto the back of the impeller housing. Fluid from a converter hub weld leak will move along a path on the inside of the converter housing.
2. Fluid leakage by the outside diameter of the pump seal and pump body will follow the same path that leaks by the inside diameter of the pump seal follow. Fluid from a converter hub weld leak will move along a path on the inside of the converter housing.
3. Fluid that leaks by a pump to case screw or pump gasket will be deposited on the inside of the torque converter housing only. Fluid will not be deposited on the back of the torque converter.
4. Fluid leakage from the converter drain plug, (vehicle-dependent) converter seal weld or converter to flexplate stud weld will appear at the outside diameter of the torque converter on the back face of the flexplate, and in the converter housing only near the flexplate. Fluid leaks from the torque converter will leave a ring of fluid around the inside of the torque converter housing.
5. **NOTE:** White facial tissue paper may aid in determining the color (red is transmission fluid) and source of the leaking fluid.

Engine oil leaks are sometimes incorrectly diagnosed as transmission pump gasket leaks. The following areas of possible leakage should also be checked to determine if engine oil leakage is causing the concern.

- a. Leakage at the valve cover gasket may allow oil to flow over the torque converter housing or seep down between the torque converter housing and cylinder block causing oil to be present in or at the bottom of the torque converter housing.
- b. Oil galley plug leaks will allow oil to flow down the rear face of the cylinder block to the bottom of the torque converter housing.
- c. Leakage at the crankshaft rear oil seal will work back to the flexplate, and then into the torque converter housing.
- d. Leakage at the oil pressure sensor.

Leak Check Test

1. Remove the fluid drain tube and note the color of the fluid. Original factory fill fluid is dyed red to aid in determining if leakage is from the engine or transmission. The red color should assist in pinpointing the leak.
2. Clean off any fluid from the top and bottom of the torque converter housing, of the case, and the rear face of the engine and oil pan. Clean the torque converter area by washing with a suitable nonflammable solvent and blow dry with compressed air.
3. Wash out the torque converter housing, and the front of the flexplate. The torque converter housing may be washed out using cleaning solvent and a squirt-type oil can. Blow all washed areas dry with compressed air.
4. Start and run the engine until the transmission reaches its normal operating temperature. Observe the back of the cylinder block and the top of the torque converter housing for evidence of fluid leakage. Raise the vehicle on a hoist. Refer to [Section 100-02](#) and run the engine at fast idle, then at engine idle, occasionally shifting to the D5 and REVERSE positions to increase pressure within the transmission. Observe the front of the flexplate, back of the cylinder block (in as far as possible), and inside the torque converter housing and front of the case. Run the engine until fluid leakage is evident and the probable source of leakage can be determined.

Leak Check Test With Black Light

Fluid soluble aniline or fluorescent dyes premixed at the rate of 2.5ml (1/2 teaspoon) of dye powder to 0.24L (1/2 pint) of automatic transmission fluid have proven helpful in locating the source of fluid leakage. Such dyes may be used to determine whether an engine fluid or transmission fluid leak is present. An ultraviolet light must be used to detect the fluorescent dye solution.

Transmission Fluid Cooler



CAUTION: Whenever a transmission has been disassembled to install new parts, the transmission fluid cooler must be replaced and the transmission fluid cooler tubes must be cleaned and backflushed.

NOTE: Cleaning and backflushing the transmission fluid cooling system along with normal cleaning and inspection procedures as outlined in this section during disassembly and reassembly will keep contamination from reentering the transmission and causing a repeat repair.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material, or band material may have been carried into the torque converter and transmission fluid cooler. These contaminants are a major cause of recurring transmission troubles and must be removed from the system before the transmission is put back in use.

If the vehicle was not equipped with a fluid filter, install a fluid filter kit follow the instructions supplied in the kit. If the vehicle was equipped with a filter install a new filter.

Transmission Fluid Cooler Flow Test

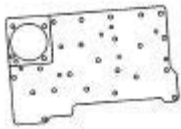







Prior to carrying out the Transmission Fluid Cooler Flow Test check to see if the vehicle is equipped with a fluid filter. If the vehicle was not equipped with a in-line fluid filter, install a fluid filter kit follow the instructions supplied in the kit. If the vehicle was equipped with a filter install a new filter. For additional information, refer to [Section 307-02](#).

Transmission Fluid Cooler Tube Replacement

Prior to carrying out the Transmission Fluid Cooler Tube Replacement check to see if the vehicle is equipped with a in-line fluid filter. If the vehicle was not equipped with a fluid filter, install a fluid filter kit follow the instructions supplied in the kit. If the vehicle was equipped with a filter install a new filter. For additional information, refer to [Section 307-02](#).

Diagnosis By Symptom

Special Tool(s)

 ST2408-A	Air Test Plate, Transmission 307-405
 ST1137-A	73 III Automotive Meter 105-R0057 or equivalent
	Trans Tester TR/MLP Overlay and Manual 007-00131 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224
 ST1632-A	New Generation Star (NGS) Tester 418-F052 or equivalent
 ST1632-A	MLP-TR Cable 418-F107 (007-00111) or equivalent
 ST1389-A	Transmission Tester 307-F016 (007-00130) or equivalent
 ST1565-A	Pressure Gauge, Transmission Fluid 307-004 (T57L-77820-A)
	UV Leak Detector Kit 164-R0756 or equivalent



The Diagnosis by Symptom Index gives the technician diagnostic information and direction, and suggests possible components, using a symptom as a starting point.

The Diagnosis by Symptom Index is divided into two categories: Electrical Routines (indicated by 200 series numbers) and Hydraulic/Mechanical Routines (indicated by 300 series numbers). The Electrical Routines list the possible electrical components that can cause or contribute to the symptom described. The Hydraulic/Mechanical Routines list the possible hydraulic or mechanical components that can cause or contribute to the symptom described.

Diagnosis by Symptom Index — Directions

1. Using the Symptom Index, select the Concern/Symptom that best describes the condition.
2. Refer to the routine indicated in the Diagnosis by Symptom Index.
3. Always begin diagnosis of a symptom with:
 - a. Preliminary inspections.
 - b. Verifications of condition.
 - c. Checking the fluid levels.
 - d. Carrying out other test procedures as directed.
4. **NOTE:** Not all concerns and conditions with electrical components will set a diagnostic trouble code (DTC). Be aware that the components listed may still be the cause. Verify correct function of these components prior to proceeding to the Hydraulic/Mechanical Routine listed.

NOTE: When the battery is disconnected or a new battery installed, certain transmission operating parameters can be lost. The powertrain control module (PCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed, or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Begin with the Electrical Routine, if indicated. Follow the reference or action statements. Always carry out the on-board diagnostic tests as necessary. Never skip steps. Repair as necessary. If the concern is still present after electrical diagnosis, then proceed to the Hydraulic/Mechanical Routine listed.

5. The Hydraulic/Mechanical Routines list possible hydraulic or mechanical components that can cause the concern. These components are listed in the removal sequence and by most probable cause. All components listed must be inspected to ensure correct repair.

Diagnosis by Symptom Index

Diagnosis by Symptom Index

5R55N	Routines	
	Electrical ¹	Mechanical/ Hydraulic
Engagement Concerns:		
● No Forward in D5 or D4 Only	201A	301A
● No Forward Only (All Positions)	201B	301B

● No Reverse Only	202	302
● Harsh Reverse Only	203	303
● Harsh Forward Only	204A	304A
● Harsh Manual 1st Gear Only	204B	304B
● Delayed/Soft Reverse Only	205	305
● Delayed/Soft Forward Only	206	306
● No Forward and No Reverse	207	307
● Harsh Forward and Harsh Reverse	208	308
● Delayed Forward and Delayed Reverse	209	309
Shift Concerns:		
● Some/All Shifts Missing (Automatic Mode Only)	210	310
● Timing Concern		
Early/Late (Some/All)	211	311
Erratic/Hunting (Some/All)	212	312
● Feel Concerns		
Soft/Slipping (Some/All)	213	313
Harsh (Some/All)	214	314
● No First Gear in Drive, Engages in a Higher Gear	215	315
● No First Gear in Manual 1st	216	316
● No Manual 2nd Gear	217	317
Torque Converter Clutch Operation Concerns:		
● Does Not Apply	240	340
● Always Applied/Stalls Vehicle	241	341
● Cycling/Shudder/Chatter	242	342
Other Concerns:		
● Shift Lever Efforts High	251	351
● External Leaks	252	352
● Poor Vehicle Performance	253	353
● Noise/Vibration — Forward or Reverse	254	354
● Engine Will Not Crank	255	355
● No Park Range	256	356
● Transmission Overheating	257	357
● No Engine Braking in Manual 2nd Position	258	358
● No Engine Braking in Manual 1st Position	259	359
● Fluid Venting or Foaming	261	361
● Vehicle Movement with Gear Selector in "N"	262	362
● Slips/Chatters in Manual 1st Gear	263	363
● Slips/Chatters in Manual 2nd Gear	264	364
● No Engine Braking in Manual 3rd Position	280	380
● No Engine Braking in Manual 4th (D4) Position	281	381
● Slips/Chatters in Manual 3rd Gear	282	382
● Engine Braking in ALL Gears	283	383
● No 2nd and 5th Gears	284	384
● No 3rd, 4th and 5th gears		

¹ Carry out electrical routine first.

Diagnostic Routines

Engagement Concern: No Forward in D5 or D4 Only

Possible Component	Reference/Action
201A — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Pressure Control Solenoid B 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test D .
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
301A — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
<ul style="list-style-type: none"> Incorrect level 	<ul style="list-style-type: none"> Adjust fluid to the correct level. Refer to <u>Transmission Fluid Level Check</u> in this section.
<ul style="list-style-type: none"> Condition 	<ul style="list-style-type: none"> Carry out the Fluid Condition Check in this section.
Forward Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
OD Servo	
<ul style="list-style-type: none"> Servo retaining ring damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Seals (piston and cover) damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none"> Band damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Servo worn or damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Not adjusted correctly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Case	
<ul style="list-style-type: none"> Damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Engagement Concern: No Forward

Possible Component	Reference/Action
201B — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain

harnesses, Pressure Control Solenoid B	Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> • <u>Go To Pinpoint Test D.</u>
	<ul style="list-style-type: none"> • Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
301B — HYDRAULIC/MECHANICAL ROUTINE	
Main Control	
<ul style="list-style-type: none"> • Bolt not tightened to specification. 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damage. 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install a new main control assembly. If misassembled, assemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Center Support	
<ul style="list-style-type: none"> • Screw not tightened to specification. 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Seal rings or bearing damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Outside diameter of case bore damage 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Support damaged or leaking 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
<ul style="list-style-type: none"> • Seals, piston damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> • Friction elements damaged or worn 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Return springs damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Forward Planetary Assembly	
<ul style="list-style-type: none"> • Planetary damage 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> • Seals, piston damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> • Feed tube or seal damaged 	<ul style="list-style-type: none"> • Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> • Friction elements damaged or worn 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Return springs damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Low One-Way Clutch	
<ul style="list-style-type: none"> • Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.

Engagement Concern: No Reverse

Possible Component	Reference/Action
202 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Pressure Control Solenoid C (PC C), Shift Solenoid B (SSB) 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test A and Go To Pinpoint Test D .
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
302 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specifications 	<ul style="list-style-type: none"> Tighten to specifications.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damage 	<ul style="list-style-type: none"> If damaged or parts are missing, install a new main control assembly. If misassembled, assemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Direct Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect or damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Feed tube or seal damaged 	<ul style="list-style-type: none"> Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Reverse Servo	
<ul style="list-style-type: none"> Servo retaining ring damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Seals (piston and cover) 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

damaged	
Reverse Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
Reverse Drum Assembly	
· One-way clutch damaged	· Inspect for damage. Install a new drum assembly.
· Bearing damaged	· Inspect for damage. Install a new drum assembly.

Engagement Concern: Harsh Reverse ONLY

Possible Component	Reference/Action
203 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Pressure Control Solenoid C (PC C)	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	· <u>Go To Pinpoint Test D.</u>
	· Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
303 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· High pressures	· Check pressure at Line and PC C taps.
	· Carry out Line Pressure Test, refer to procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
· Bolts not tightened to specification	· Tighten to specification.
· Separator plate damaged	· Inspect for damage. If damaged, install a new separator plate.
· Contamination	· Disassemble and clean.
· Valves and springs damaged, misassembled, missing, stuck or bore damaged	· If damaged or parts are missing, install a new main control assembly. If misassembled, assemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Direct Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.

· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Feed tube or seal damaged	· Inspect for damage. Install a new feed tube.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Reverse Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
Reverse Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
Reverse Drum Assembly	
· One-way clutch damaged	· Inspect for damage. Install a new drum assembly.
· Bearing damaged	· Inspect for damage. Install a new drum assembly.

Engagement Concern: Harsh Forward ONLY

Possible Component	Reference/Action
204A — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Pressure Control Solenoid A (PC A), Pressure Control Solenoid C (PC C)	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	· <u>Go To Pinpoint Test D</u> .
	· Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
304A — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· High Pressures	· Check pressure at line and PC C taps
	· Carry out Line Pressure Test. Follow pressure diagnosis and repair as required.
Main Control	
· Bolts not tightened to specification	· Tighten to specification.
· Separator plate damaged	· Inspect for damage. If damaged, install a new separator plate.

<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install a new main control assembly. If misassembled, assemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
OD Servo	
<ul style="list-style-type: none"> Servo retaining ring damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Seals (piston and cover) damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none"> Band damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Servo worn or damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Not adjusted correctly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Center Support	
<ul style="list-style-type: none"> Screw not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Seal rings or bearing damage 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Outside diameter of case bore damage 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Support damaged or leaking 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Feed tube or seal damaged 	<ul style="list-style-type: none"> Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Engagement Concern: Harsh Manual 1st Gear ONLY

Possible Component	Reference/Action
204B — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Pressure Control Solenoid B (PC B), Turbine Shaft Speed (TSS) sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> <u>Go To Pinpoint Test D</u> and <u>Go To Pinpoint Test E</u> .

	<ul style="list-style-type: none"> Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
304B — HYDRAULIC/MECHANICAL ROUTINE	
	<ul style="list-style-type: none"> No hydraulic or mechanical concerns

Engagement Concern: Delayed or Soft Reverse ONLY

Possible Component	Reference/Action
205 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Pressure Control Solenoid C (PC C) 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> <u>Go To Pinpoint Test D.</u>
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
305 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect pressures	
<ul style="list-style-type: none"> Low pressure 	<ul style="list-style-type: none"> Check pressure at line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test, refer to the procedure in this section. Follow pressure diagnosis and repair as necessary.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install a new main control assembly. If misassembled, assemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Direct Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Reverse Servo	
<ul style="list-style-type: none"> Servo retaining ring damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Seals (piston and cover) damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Reverse Band	
<ul style="list-style-type: none"> Band damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Servo worn or damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Engagement Concern: Delayed/Soft Forward ONLY

Possible Component	Reference/Action
206 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Pressure Control Solenoid B (PC B) 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test D .
	<ul style="list-style-type: none"> Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
306 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> Low pressures 	<ul style="list-style-type: none"> Check pressure at line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test, refer to procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install a new main control assembly. If misassembled, assemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Servo	
<ul style="list-style-type: none"> Servo retaining ring damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Seals (piston and cover) damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none"> Band damaged. 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Servo worn or damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Not adjusted correctly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Center Support	
<ul style="list-style-type: none"> Screw not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Seal rings or bearing damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Outside diameter of case bore damage 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Support damaged or leaking 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new

missing, not seating, off location	cylinder.
• Friction element damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: No Forward and No Reverse

Possible Component	Reference/Action
207 — ELECTRICAL ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid B (PC B)	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• <u>Go To Pinpoint Test D.</u>
	• Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
307 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
• Incorrect level	• Adjust to the correct level. Refer to <u>Transmission Fluid Level Check</u> in this section.
• Condition	• Carry out Fluid Condition Check. Refer to <u>Preliminary Inspection</u> in this section.
Shift Cable/Digital TR Sensor	
• Cable system or digital TR sensor damaged, misaligned	• Inspect and repair as necessary. Refer to <u>Digital Transmission Range (TR) Sensor</u> or <u>Section 307-05</u> .
Main Control	
• Bolts not tightened to specification	• Tighten bolts to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves and springs damaged, misassembled, missing, stuck, or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Input Shaft	
• Damaged	• Inspect for damage. Repair as necessary.
Fluid Pump Assembly	
• Bolts not tightened to specification	• Tighten bolts to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or siezed	• Inspect for damage. Install a new pump.
• Flow control valves, springs, or seal damaged,	• Inspect for damage. Install a new seal or flow control valve.

stuck or not assembled correctly	
OD Planetary Assembly	
· Planetary damaged	· Inspect for damage. Repair as necessary.
Center Shaft Assembly	
· Damaged. One-way clutch damaged	· Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Forward Planetary Assembly	
· Planetary damaged	· Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Reverse Planetary Assembly	
· Planetary damaged	· Inspect for damage. Repair as necessary.
Output Shaft	
· Damage	· Inspect for damage. Repair as necessary.
Torque Converter	
· Damaged flexplate or adapter plate	· Inspect for damage. Carry out the Torque Converter checks, refer to the procedure in this section. Repair as necessary.
· Damaged impeller hub	
· Damaged turbine hub	
Direct One-way Clutch	
· Worn, damaged or assembled incorrectly	· Inspect for damage. Repair as necessary.

Engagement Concern: Harsh Forward and Harsh Reverse

Possible Component	Reference/Action
208 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, digital TR	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and

sensor, Transmission Fluid (TFT) sensor	testing of the PCM.
	<ul style="list-style-type: none"> • Go To Pinpoint Test B and Go To Pinpoint Test C.
	<ul style="list-style-type: none"> • Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
308 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
<ul style="list-style-type: none"> • Incorrect level 	<ul style="list-style-type: none"> • Adjust to the correct level. Refer to Transmission Fluid Level Check
<ul style="list-style-type: none"> • Condition 	<ul style="list-style-type: none"> • Carry out Fluid Condition Check. Refer to Preliminary Inspection.
Incorrect Pressures	
<ul style="list-style-type: none"> • High pressures. 	<ul style="list-style-type: none"> • Check line pressure at line and PC C taps.
	<ul style="list-style-type: none"> • Carry out Line Pressure Test. Refer to procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Forward Clutch Assembly	
<ul style="list-style-type: none"> • Seals, piston damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> • Friction elements damaged or worn 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Return springs damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> • Seals, piston damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> • Feed tube or seal damaged 	<ul style="list-style-type: none"> • Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> • Friction elements damaged or worn 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Return springs damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.

Engagement Concern: Delayed Forward and Delayed Reverse

Possible Component	Reference/Action
209 — ELECTRICAL ROUTINE	
Powertrain Control System	

<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test B.
	<ul style="list-style-type: none"> Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
309 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
<ul style="list-style-type: none"> Incorrect level 	<ul style="list-style-type: none"> Adjust to the correct level. Refer to Transmission Fluid Level Check.
<ul style="list-style-type: none"> Condition 	<ul style="list-style-type: none"> Carry out Fluid Condition Check. Refer to Preliminary Inspection.
Incorrect Pressures	
<ul style="list-style-type: none"> High pressures 	<ul style="list-style-type: none"> Check line pressure at line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file, or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Fluid Pump Assembly	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Gasket damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new gasket.
<ul style="list-style-type: none"> Porosity, cross leaks, ball missing, plugged hole 	<ul style="list-style-type: none"> Inspect for damage. If damaged, repair as necessary.
<ul style="list-style-type: none"> Pump gears cracked and/or siezed 	<ul style="list-style-type: none"> Inspect for damage. Install a new pump.
<ul style="list-style-type: none"> Flow control valves, springs, or seal damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> Inspect for damage. Install a new seal or flow control valve.

Shift Concern: Some/All Shifts Missing (Automatic Mode Only)

Possible Component	Reference/Action
210 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoids A, B, C, Torque Converter Clutch (TCC) solenoid, Pressure Control Solenoids A, B, C, Output Shaft Speed (OSS) sensor, digital TR sensor, IAT sensor, VSS input 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM, IAT, and VSS.

	<ul style="list-style-type: none"> • <u>Go To Pinpoint Test A</u> , <u>Go To Pinpoint Test C</u> , <u>Go To Pinpoint Test D</u> and <u>Go To Pinpoint Test E</u>.
	<ul style="list-style-type: none"> • Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
310 — HYDRAULIC/MECHANICAL ROUTINE	
Some Shifts Missing ONLY	
	<ul style="list-style-type: none"> • If only some shifts are missing, determine which shift(s) is missing.
	<ul style="list-style-type: none"> • Refer to the following routine(s) for further No Shift concerns: <ul style="list-style-type: none"> ■ No 1-2 Shift, Routine 220/320 ■ No 2-3 Shift, Routine 221/321 ■ No 3-4 Shift, Routine 222/322 ■ No 4-5 Shift, Routine 270/370 ■ No 5-4 Shift, Routine 271/371 ■ No 4-3 Shift, Routine 223/323 ■ No 3-2 Shift, Routine 224/324 ■ No 2-1 Shift, Routine 225/325
Fluid	
<ul style="list-style-type: none"> • Incorrect level 	<ul style="list-style-type: none"> • Adjust to correct level. Refer to the procedure in this section.
<ul style="list-style-type: none"> • Condition 	<ul style="list-style-type: none"> • Carry out Fluid Condition Check. Refer to the procedure in this section.
Shift Cable/Digital TR Sensor	
<ul style="list-style-type: none"> • Cable system or digital TR sensor damaged, misaligned 	<ul style="list-style-type: none"> • Inspect and repair as necessary. Refer to <u>Digital Transmission Range (TR) Sensor</u> or <u>Section 307-05</u>.
Incorrect Pressures	
<ul style="list-style-type: none"> • High/Low pressures 	<ul style="list-style-type: none"> • Check pressure at line and PC C taps.
	<ul style="list-style-type: none"> • Carry out Line Pressure Test. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Fluid Pump Assembly	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Gasket damaged 	<ul style="list-style-type: none"> • If damaged, install a new gasket.
<ul style="list-style-type: none"> • Porosity, cross leaks, ball missing, plugged hole 	<ul style="list-style-type: none"> • If damaged, repair as necessary.
<ul style="list-style-type: none"> • Pump gears cracked and/or siezed 	<ul style="list-style-type: none"> • Inspect for damage. Install a new pump.
<ul style="list-style-type: none"> • Flow control valves, springs, or seal damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> • Inspect for damage. Install a new seal or flow control valve.

OD Planetary Assembly	
· Planetary damaged	· Inspect for damage. Repair as necessary.
Center Support	
· Screw not tightened to specification	· Tighten to specification.
· Seal rings or bearing damaged	· Inspect for damage. Repair as necessary.
· Outside diameter of case bore damaged	· Inspect for damage. Repair as necessary.
· Support damaged or leaking	· Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Feed tube or seal damaged	· Inspect for damage. Install a new feed tube.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Intermediate One-Way Clutch	
· Worn, damaged, or assembled incorrectly	· Inspect for damage. Repair as necessary.

Shift Concern: Timing Concerns—Early/Late

Possible Component	Reference/Action
211— ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Output Shaft Speed (OSS) sensor, IAT sensor	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM and IAT.
	· Go To Pinpoint Test E .
	· Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
311 — HYDRAULIC/MECHANICAL ROUTINE	
Only some Shifts Early/Late	
	· If only some shifts are early/late, determine which shift(s) is missing.
	· Refer to the following routine(s) for further No Shift concerns: <ul style="list-style-type: none"> ■ Soft/Slipping 1-2 Shift, Routine 226/326 ■ Soft/Slipping 2-3 Shift, Routine 227/327 ■ Soft/Slipping 3-4 Shift, Routine 228/328 ■ Soft/Slipping 4-5 Shift, Routine 272/372 ■ Soft/Slipping 5-4 Shift, Routine 273/373

	<ul style="list-style-type: none"> ■ Soft/Slipping 4-3 Shift, Routine 229/329 ■ Soft/Slipping 3-2 Shift, Routine 230/330 ■ Soft/Slipping 2-1 Shift, Routine 221/321
Fluid	
· Incorrect level	· Adjust to the correct level. Refer to Transmission Fluid Level Check .
· Condition	· Carry out Fluid Condition Check. Refer to Preliminary Inspection .
Main Control	
· Bolts not tightened to specification	· Tighten to specification.
· Separator plate damaged	· Inspect for damage. If damaged, install a new separator plate.
· Contamination	· Disassemble and clean.
· Valves and springs damaged, misassembled, missing, stuck, or bore damaged	· If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
OD Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
· Not adjusted correctly	· Inspect for damage. Repair as necessary.

Shift Concern: Timing Concerns—Erratic/Hunting (Some/All)

Possible Component	Reference/Action
212 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Output Shaft Speed (OSS) sensor, IAT sensor	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM and IAT.
	· Go To Pinpoint Test E .
	· Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
312 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust to the correct level. Refer to Transmission Fluid Level Check .
· Condition	· Carry out Fluid Condition Check. Refer to procedure in this section.
Main Control	
· Bolts not tightened to specification	· Tighten to specification.

<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
<p>Further Diagnosis</p> <ul style="list-style-type: none"> • For further diagnosis for timing issues, refer to Reference/Actions 	<ul style="list-style-type: none"> • Refer to the following routine(s) for specific diagnosis: <ul style="list-style-type: none"> ● No 1-2 shift see Routine 220/320 ● No 2-3 shift see Routine 221/321 ● No 3-4 shift see Routine 222/323 ● No 4-5 shift see Routine 270/370 ● No 5-4 shift see Routine 271/371 ● No 4-3 shift see Routine 223/323 ● No 3-2 shift see Routine 224/324 ● No 2-1 shift see Routine 225/325 ● Soft/Slip 1-2 shift see Routine 226/326 ● Soft/Slip 2-3 shift see Routine 227/327 ● Soft/Slip 3-4 shift see Routine 228/328 ● Soft/Slip 4-5 shift see Routine 272/372 ● Soft/Slip 5-4 shift see Routine 273/373 ● Soft/Slip 4-3 shift see Routine 229/329 ● Soft/Slip 3-2 shift see Routine 230/330 ● Soft/Slip 2-1 shift see Routine 231/331 ● Harsh 1-2 shift see Routine 232/332 ● Harsh 2-3 shift see Routine 234/334 ● Harsh 3-4 shift see Routine 234/334 ● Harsh 4-5 shift see Routine 274/374 ● Harsh 5-4 shift see Routine 275/375 ● Harsh 4-3 shift see Routine 235/335 ● Harsh 3-2 shift see Routine 236/336 ● Harsh 2-1 shift see Routine 237/337

Engagement Concern: Feel—Soft/Slipping (Some/All)

Possible Component	Reference/Action
213 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> • PCM, vehicle wiring harnesses, Shift Solenoids A, B, C, Pressure Control Solenoids A, B, C, D, Intermediate Shaft Speed (ISS) sensor, Transmission Fluid Temperature (TFT) sensor, IAT Sensor, VSS input 	<ul style="list-style-type: none"> • Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM, IAT, and VSS.
	<ul style="list-style-type: none"> • <u>Go To Pinpoint Test A</u>, <u>Go To Pinpoint Test B</u>, <u>Go To Pinpoint Test D</u> and <u>Go To Pinpoint Test E</u>.
	<ul style="list-style-type: none"> • Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
313 — HYDRAULIC/MECHANICAL ROUTINE	
Only some Shifts Soft/Slipping	
	<ul style="list-style-type: none"> • If only some of the shifts are soft/slipping, determine which shift(s) is missing.
	<ul style="list-style-type: none"> • Refer to the following routine(s) for further

	<p>Soft/Slipping concerns:</p> <ul style="list-style-type: none"> ■ Soft/Slipping 1-2 Shift, Routine 226/326 ■ Soft/Slipping 2-3 Shift, Routine 227/327 ■ Soft/Slipping 3-4 Shift, Routine 228/328 ■ Soft/Slipping 4-5 Shift, Routine 272/372 ■ Soft/Slipping 5-4 Shift, Routine 273/373 ■ Soft/Slipping 4-3 Shift, Routine 229/329 ■ Soft/Slipping 3-2 Shift, Routine 230/330 ■ Soft/Slipping 2-1 Shift, Routine 231/331
Fluid	
· Incorrect level	· Adjust to the correct level. Refer to Transmission Fluid Level Check in this section.
· Condition	· Carry out Fluid Condition Check. Refer to the procedure in this section.
Incorrect Pressures	
· High/Low pressures	· Check pressure at line and PC C taps.
	· Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as necessary.
Main Control	
· Bolts not tightened to specification	· Tighten to specification.
· Separator plate damaged	· Inspect for damage. If damaged, install a new separator plate.
· Contamination	· Disassemble and clean.
· Valves and springs damaged, misassembled, missing, stuck, or bore damaged	· If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Fluid Pump Assembly	
· Bolts not tightened to specification	· Tighten to specification.
· Gasket damaged	· Inspect for damage. If damaged, install a new gasket.
· Porosity, cross leaks, misassembled, ball missing, plugged hole	· Inspect for damage. If damaged, repair as necessary.
· Pump gears cracked and/or siezed	· Inspect for damage. Install a new pump.
· Flow control valves, springs, or seal damaged, stuck or not assembled correctly	· Inspect for damage. Install a new seal or flow control valve.
Coast Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Center Support	
· Screw not tightened to specification	· Tighten to specification.
· Seal rings or bearings damaged	· Inspect for damage. Repair as necessary.
· Outside diameter of case bore damage	· Inspect for damage. Repair as necessary.

· Support damaged or leaking	· Inspect for damage. Repair as necessary.
Intermediate Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
Intermediate Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
· Not adjusted correctly	· Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Feed tube or seal damaged	· Inspect for damage. Install a new feed tube.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Reverse Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
Reverse Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
Case	
· Damaged	· Inspect for damage. Repair as necessary.

Shift Concern: Feel—Harsh (Some/All)

Possible Component	Reference/Action
214— ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Shift Solenoids A, B, C, Pressure Control	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis

Solenoids A, B, C, D, Intermediate Shaft Speed (ISS) sensor, digital TR sensor, Transmission Fluid Temperature (TFT) sensor, IAT sensor, VSS input	(PC/ED) manual for diagnosis and testing of the PCM, IAT, and VSS.
	<ul style="list-style-type: none"> • Go To Pinpoint Test A, Go To Pinpoint Test B, Go To Pinpoint Test D and Go To Pinpoint Test E.
	<ul style="list-style-type: none"> • Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
314 — HYDRAULIC/MECHANICAL ROUTINE	
Only some Shifts Harsh	
	<ul style="list-style-type: none"> • If only some of the shifts are harsh, determine which shift(s) is missing.
	<ul style="list-style-type: none"> • Refer to the following routine(s) for further No Shift concerns: <ul style="list-style-type: none"> ■ Harsh 1-2 Shift, Routine 232/332 ■ Harsh 2-3 Shift, Routine 233/333 ■ Harsh 3-4 Shift, Routine 234/334 ■ Harsh 4-5 Shift, Routine 274/374 ■ Harsh 5-4 Shift, Routine 275/375 ■ Harsh 4-3 Shift, Routine 235/335 ■ Harsh 3-2 Shift, Routine 236/336 ■ Harsh 2-1 Shift, Routine 237/337
Incorrect Pressures	
<ul style="list-style-type: none"> • High/Low pressures 	<ul style="list-style-type: none"> • Check pressure at line and PC C taps.
	<ul style="list-style-type: none"> • Carry out Line Pressure Test, refer to procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Input Shaft	
<ul style="list-style-type: none"> • Damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
OD Servo	
<ul style="list-style-type: none"> • Servo retaining ring damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Seals (piston and cover) damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none"> • Band damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Servo worn or damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Not adjusted correctly 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Anchor pins worn or damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Center Shaft Assembly	

· Center shaft assembly damaged	· Inspect for damage. Repair as necessary.
· One-way clutch damaged	· Inspect for damage. Repair as necessary.
Intermediate Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
Intermediate Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
· Not adjusted correctly	· Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Feed tube or seals damaged	· Inspect for damage. Install a new feed tube.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Reverse Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
Reverse Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
Output Shaft	
· Damaged	· Inspect for damage. Repair as necessary.
Case	
· Damaged	· Inspect for damage. Repair as necessary.

Shift Concern: No 1st and 2nd Gear in Drive, Engages in a Higher Gear

Possible Component	Reference/Action
215 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Shift Solenoids A, B, C, digital TR sensor	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	· <u>Go To Pinpoint Test A</u> and <u>Go To Pinpoint Test C</u> .

	<ul style="list-style-type: none"> Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
315 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Check which pressures are on at Line and PC C taps. Refer to the Band/Clutch Chart in this section to determine which gears are on. Follow the diagnostic routines to repair the missing gears.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file, or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Feed tube or seal damaged 	<ul style="list-style-type: none"> Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Direct One-way Clutch	
<ul style="list-style-type: none"> Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Low One-Way Clutch	
<ul style="list-style-type: none"> Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Engagement Concern: No 1st Gear in Manual 1 Position

Possible Component	Reference/Action
216 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoids A, B, Pressure Control Solenoids B, C 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> <u>Go To Pinpoint Test A</u> and <u>Go To Pinpoint Test D</u>.
	<ul style="list-style-type: none"> Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
316 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	

<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Planetary Assembly	
<ul style="list-style-type: none"> Planetary damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Direct One-Way Clutch	
<ul style="list-style-type: none"> Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Low One-Way Clutch	
<ul style="list-style-type: none"> Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Shift Concern: No 2nd Gear in Manual 2 Position

Possible Component	Reference/Action
217 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoids A, B, C, Pressure Control Solenoid B 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test A and Go To Pinpoint Test D.
	<ul style="list-style-type: none"> Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
317 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification. 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Servo	

<ul style="list-style-type: none"> • Servo retaining ring damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Seals (piston and cover) damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none"> • Band damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Servo worn or damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Not adjusted correctly 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Direct One-Way Clutch	
<ul style="list-style-type: none"> • Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Low One-Way Clutch	
<ul style="list-style-type: none"> • Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.

Torque Converter Operation Concerns: Does Not Apply

Possible Component	Reference/Action
240 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> • PCM, vehicle wiring harnesses, Torque Converter Clutch (TCC) solenoid, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> • Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> • Go To Pinpoint Test A and Go To Pinpoint Test B.
	<ul style="list-style-type: none"> • Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
340 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> • High/Low pressures 	<ul style="list-style-type: none"> • Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> • Carry out Line Pressure Test. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Fluid Pump Assembly	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten bolts to specification.
<ul style="list-style-type: none"> • Gasket damaged 	<ul style="list-style-type: none"> • Inspect or damage. If damaged, install a new fluid pump assembly.

<ul style="list-style-type: none"> • Porosity, cross leaks, ball missing, plugged hole 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new fluid pump assembly.
<ul style="list-style-type: none"> • Pump gears cracked and/or siezed 	<ul style="list-style-type: none"> • Inspect for damage. Install a new pump.
<ul style="list-style-type: none"> • Flow control valves, springs, or seal damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> • Inspect for damage. Install a new seal or flow control valve.
Torque Converter Assembly	
<ul style="list-style-type: none"> • Torque Converter internal failure preventing engagement, piston application 	<ul style="list-style-type: none"> • Remove transmission. Inspect for damage. Carry out Torque Converter checks. If the torque converter fails to pass the checks or is damaged, install a new or remanufactured torque converter.

Torque Converter Operation Concern: Always Applied/Stalls Vehicle

Possible Component	Reference/Action
241 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> • PCM, vehicle wiring harnesses, Torque Converter Clutch (TCC) solenoid 	<ul style="list-style-type: none"> • Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> • <u>Go To Pinpoint Test A.</u>
	<ul style="list-style-type: none"> • Repair as necessary. Clear DTCs, road test and carry out on-board diagnostic test again.
341 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valve and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
<ul style="list-style-type: none"> • Low one-way clutch 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Torque Converter Assembly	
<ul style="list-style-type: none"> • Torque Converter internal failure preventing engagement, piston release 	<ul style="list-style-type: none"> • Remove transmission. Inspect for damage. Carry out Torque Converter checks. If the torque converter fails to pass the checks or is damaged, install a new or remanufactured torque converter.
Low One-Way Clutch	
<ul style="list-style-type: none"> • Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.

Torque Converter Operation Concern: Cycling/Shudder/Chatter

Possible Component	Reference/Action

242 — ELECTRICAL ROUTINE

Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Torque Converter Clutch (TCC) solenoid 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> <u>Go To Pinpoint Test A.</u>
	<ul style="list-style-type: none"> Repair as necessary. Clear DTCs, road test and carry out on-board diagnosis test again.

342 — HYDRAULIC/MECHANICAL ROUTINE

Fluid	
<ul style="list-style-type: none"> Condition—contaminated, degraded 	<ul style="list-style-type: none"> Carry out Fluid Condition Check. Refer to the procedure in this section. If contaminated, locate source of contamination. If burnt, inspect mechanical bands, clutches. Repair as necessary. Change fluid. Carry out drain and refill procedure. Refer to <u>Transmission Fluid Drain and Refill—Automated Equipment</u>, <u>Transmission Fluid Drain and Refill—Vehicles With Torque Converter Drain Plug</u> or <u>Transmission Fluid Drain and Refill—Vehicles Without Torque Converter Drain Plug</u> in this section. Carry out fluid cooler and torque converter cleaning procedure. Refer to <u>Section 307-02</u>.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valve and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Torque Converter Assembly	
<ul style="list-style-type: none"> Torque converter internal leakage, clutch material damaged 	<ul style="list-style-type: none"> Remove transmission. Inspect for damage. Carry out torque converter checks, refer to procedures in this section. If torque converter fails to pass the checks or is damaged, install a new or remanufactured converter.

Other Concerns: Shift Lever Efforts High

Possible Component	Reference/Action
251 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, digital TR sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> <u>Go To Pinpoint Test C.</u>
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
351 — HYDRAULIC/MECHANICAL ROUTINE	

Shift Cable, Digital TR sensor	
<ul style="list-style-type: none"> • Cable system or digital TR sensor damaged, misaligned 	<ul style="list-style-type: none"> • Inspect and repair as required. For shift cable information, refer to Section 307-05. For digital TR information, refer to this section.
Main Control	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valve and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Case	
<ul style="list-style-type: none"> • Manual control lever assembly damage, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new part.
<ul style="list-style-type: none"> • Manual valve lever shaft retaining pin damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, repair as necessary.

Other Concerns: External Leaks

Possible Component	Reference/Action
252 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> • Output Shaft Speed (OSS) sensor, Intermediate Shaft Speed (ISS) sensor, Turbine Shaft Speed (TSS) sensor, digital TR sensor 	<ul style="list-style-type: none"> • Inspect for leakage. If areas around sensor show signs of leakage, install a new sensor O-ring seal. If area behind digital TR sensor shows signs of a leak, a new manual lever shaft seal may need to be installed.
352 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
<ul style="list-style-type: none"> • Incorrect level 	<ul style="list-style-type: none"> • Adjust to correct level. Refer to the procedure in this section.
Case	
<ul style="list-style-type: none"> • Case vent damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, repair as necessary.
Seals/Gaskets	
<ul style="list-style-type: none"> • Leakage at gaskets, seals, etc. 	<ul style="list-style-type: none"> • Refer to Leakage Inspection and Fluid Leakage in the Torque Converter Area diagrams in this section for potential leak locations.
	<ul style="list-style-type: none"> • Remove all traces of lubricant on exposed surfaces of the transmission. Check vent for free breathing. Operate the vehicle at normal temperatures and carry out Leak Check Test procedures in this section. Repair as necessary.

Other Concern: Poor Vehicle Performance

Possible Component	Reference/Action

253 — ELECTRICAL ROUTINE

Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoids A, B, C, Pressure Control Solenoids A, B, C, Output Shaft Speed (OSS) sensor, Turbine Shaft Speed (TSS) sensor, Transmission Fluid Temperature (TFT) sensor, digital TR sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test A, Go To Pinpoint Test B, Go To Pinpoint Test C, Go To Pinpoint Test D and Go To Pinpoint Test E.
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.

353 — HYDRAULIC/MECHANICAL ROUTINE

Fluid	
<ul style="list-style-type: none"> Incorrect level 	<ul style="list-style-type: none"> Adjust to correct level. Refer to the procedure in this section.
Input Shaft	
<ul style="list-style-type: none"> Damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Center Shaft Assembly	
<ul style="list-style-type: none"> Center shaft assembly or one-way clutch damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Piston check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Feed tube or seal damaged 	<ul style="list-style-type: none"> Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Torque Converter Assembly	
<ul style="list-style-type: none"> Torque Converter one-way clutch slipping 	<ul style="list-style-type: none"> Carry out torque converter one-way clutch check as listed in this section. If one-way clutch fails the check, install a new or remanufactured torque converter.
<ul style="list-style-type: none"> Incorrect torque converter used in rebuild 	<ul style="list-style-type: none"> Inspect for correct torque converter assembly. If not correct, install the correct torque converter for this application.

Other Concern: Noise/Vibration—Forward or Reverse

Possible Component	Reference/Action

254 — ELECTRICAL ROUTINE

Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Torque Converter Clutch (TCC) solenoid, Pressure Control Solenoids A, B, C 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> <u>Go To Pinpoint Test A</u> and <u>Go To Pinpoint Test D</u>.
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.

354 — HYDRAULIC/MECHANICAL ROUTINE

Fluid Pump Assembly	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Gasket damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new gasket.
<ul style="list-style-type: none"> Porosity, cross leaks, ball missing, plugged hole 	<ul style="list-style-type: none"> Inspect for damage. If damaged, repair as necessary.
<ul style="list-style-type: none"> Pump gears cracked and/or siezed 	<ul style="list-style-type: none"> Inspect for damage. Install a new pump.
<ul style="list-style-type: none"> Flow control valves, springs, or seal damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> Inspect for damage. Install a new seal or flow control valve.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Feed tube or seal damaged 	<ul style="list-style-type: none"> Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Low One-Way Clutch	
<ul style="list-style-type: none"> Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Flexplate or Adapter Plate	
<ul style="list-style-type: none"> Damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Adapter Plate not aligned correctly 	<ul style="list-style-type: none"> Remove transmission and using special service tool and procedure in this section, align adapter plate.

Other Concern: Engine Will Not Crank

Possible Component	Reference/Action
255 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, digital TR sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> <u>Go To Pinpoint Test C</u>.
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
355 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Cable/ Digital TR	

Sensor	
<ul style="list-style-type: none"> · Cable system or digital TR Sensor damaged, misaligned 	<ul style="list-style-type: none"> · Inspect and repair as required. For shift cable information, refer to Section 307-05. For digital TR information, refer to this section.
Fluid Pump Assembly	
<ul style="list-style-type: none"> · Seized 	<ul style="list-style-type: none"> · Inspect for damage. If damaged, install a new fluid pump assembly.
Flexplate or Adapter Plate	
<ul style="list-style-type: none"> · Damaged 	<ul style="list-style-type: none"> · Inspect for damage. Repair as necessary.

Other Concern: No Park Range

Possible Component	Reference/Action
256 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> · No electrical concerns 	
356 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Cable/Digital TR sensor	
<ul style="list-style-type: none"> · Cable system or digital TR sensor damaged, misaligned 	<ul style="list-style-type: none"> · Inspect and repair as required. For shift cable information, refer to Section 307-05. For digital TR information, refer to this section.
Case	
<ul style="list-style-type: none"> · Manual control lever assembly damage, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged 	<ul style="list-style-type: none"> · Inspect for damage. If damaged, repair as necessary.
<ul style="list-style-type: none"> · Manual valve lever shaft retaining pin damaged 	<ul style="list-style-type: none"> · Inspect for damage. If damaged, repair as necessary.
Park System	
<ul style="list-style-type: none"> · Park gear, parking pawl, parking pawl return spring, park or guide plate, parking actuating rod, parking pawl shaft, manual lever, manual lever detent spring damaged or misassembled 	<ul style="list-style-type: none"> · Inspect for damage. If damaged, repair as necessary.
<ul style="list-style-type: none"> · External linkages/brackets damaged 	<ul style="list-style-type: none"> · Inspect for damage. If damaged, repair as necessary.

Other Concern: Transmission Overheating

Possible Component	Reference/Action
257 ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> · PCM, vehicle wiring harnesses, Torque Converter Clutch (TCC) solenoid, Pressure Control Solenoids A, B, C, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> · Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> · Go To Pinpoint Test A, Go To Pinpoint Test B and Go To Pinpoint Test D.

	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
357 HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
<ul style="list-style-type: none"> Incorrect level 	<ul style="list-style-type: none"> Adjust to correct level. Refer to the procedure in this section.
Incorrect Pressures	
<ul style="list-style-type: none"> High/low pressures 	<ul style="list-style-type: none"> Check pressure at line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Fluid Pump Assembly	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Gasket damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new gasket.
<ul style="list-style-type: none"> Porosity, cross leaks, ball missing, plugged hole 	<ul style="list-style-type: none"> Inspect for damage. If damaged, repair as necessary.
<ul style="list-style-type: none"> Pump gears cracked and/or siezed 	<ul style="list-style-type: none"> Inspect for damage. Install a new pump.
<ul style="list-style-type: none"> Flow control valves, springs, or seal damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> Inspect for damage. Install a new seal or flow control valve.
Case	
<ul style="list-style-type: none"> Case vent damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, repair as necessary.
Torque Converter Assembly	
<ul style="list-style-type: none"> Sized torque converter one-way clutch 	<ul style="list-style-type: none"> Remove transmission. Inspect for damage. Carry out torque converter checks. Refer to the procedures in this section. If torque converter fails to pass the checks or is damaged, install a new or remanufactured converter.
<ul style="list-style-type: none"> Excessive slip detected 	
Other	
<ul style="list-style-type: none"> Restriction in the transmission cooling system 	<ul style="list-style-type: none"> Refer to Section 307-02, Transmission Cooling for information and diagnosis of cooling issues.
<ul style="list-style-type: none"> Excessive trailer tow load 	<ul style="list-style-type: none"> Refer to owners guide for specifications on trailer towing.
<ul style="list-style-type: none"> Poor engine driveability concerns 	<ul style="list-style-type: none"> Check engine driveability concerns. Refer to Section 303-08.

Other Concern: No Engine Braking in Manual 3rd Position

Possible Component	Reference/Action
280 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, shift solenoids A, B, C, Reverse Pressure (RP) switch, pressure control solenoids A, B 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test A , Go To Pinpoint Test D and Go To Pinpoint Test G .
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
380 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
<ul style="list-style-type: none"> Incorrect level 	<ul style="list-style-type: none"> Adjust to correct level. Refer to the procedure in this section.
Incorrect Pressures	
<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Fluid Pump Assembly	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Gasket damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new gasket.
<ul style="list-style-type: none"> Porosity, cross leaks, ball missing, plugged hole 	<ul style="list-style-type: none"> Inspect for damage. If damaged, repair as necessary.
<ul style="list-style-type: none"> Pump gears cracked and/or siezed 	<ul style="list-style-type: none"> Inspect for damage. Install a new pump.
<ul style="list-style-type: none"> Flow control valves, springs, or seal damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> Inspect for damage. Install a new seal or flow control valve.
Coast Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

· Return springs damaged	· Inspect for damage. Repair as necessary.
Center Support	
· Screw not tightened to specification	· Tighten to specification.
· Seals rings or bearing damaged	· Inspect for damage. Repair as necessary.
· Outside diameter of case bore damage	· Inspect for damage. Repair as necessary.
· Support damaged or leaking	· Inspect for damage. Repair as necessary.
Intermediate Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
Intermediate Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
· Not adjusted correctly	· Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Feed tube or seal damaged	· Inspect for damage. Install a new feed tube.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Low One-Way Clutch	
· Worn, damaged, or assembled incorrectly	· Inspect for damage. Repair as necessary.

Other Concern: No Engine Braking in Manual 4th (D4) Position

Possible Component	Reference/Action
281 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Shift Solenoid D, Reverse Pressure (RP) switch, Pressure Control Solenoid B	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	· Go To Pinpoint Test A , Go To Pinpoint Test D and Go To Pinpoint Test G .
	· Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
381 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Improper level	· Adjust to correct level. Refer to the procedure in this section.
Main Control	

• Bolts not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves and springs damaged, misassembled, missing, stuck, or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Fluid Pump Assembly	
• Bolts not tightened to specification	• Tighten bolts to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or siezed	• Inspect for damage. Install a new pump.
• Flow control valves, springs, or seal damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Coast Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.

Other Concerns: No Engine Braking in Manual 2nd Position

Possible Component	Reference/Action
258 — ELECTRICAL ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoids A, C, D, Pressure Control Solenoid A	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• Go To Pinpoint Test A and Go To Pinpoint Test D .
	• Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
358 — HYDRAULIC/MECHANICAL ROUTINE	

Fluid	
· Incorrect level	· Adjust to correct level. Refer to the procedure in this section.
Incorrect Pressures	
· High/low pressures	· Check pressure at line and PC C taps.
	· Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Reverse Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
Reverse Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.

Other Concern: No Engine Braking in Manual 1st Position

Possible Component	Reference/Action
259 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Shift Solenoids A, C, D, Pressure Control Solenoids A, B	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	· Carry out Pinpoints Tests A and D.
	· Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
359 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust to correct level. Refer to procedure in this section.
Incorrect pressures	
· High/low pressures	· Check pressure at Line and PC C taps.
	· Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Fluid Pump Assembly	
· Bolts not tightened to specification	· Tighten to specification.
· Gasket damaged	· Inspect for damage. If damaged, install a new gasket.
· Porosity, cross leaks, ball missing, plugged hole	· Inspect for damage. If damaged, repair as necessary.
· Pump gears cracked and/or siezed	· Inspect for damage. Install a new pump.
· Flow control valves, springs, or seal damaged, stuck or not assembled correctly	· Inspect for damage. Install a new seal or flow control valve.
Coast Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not	· Inspect for mislocation, poor seating, damage. Install a

seating, off location	new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Reverse Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
Reverse Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.

Other Concerns: Fluid Venting/Foaming

Possible Component	Reference/Action
261 — ELECTRICAL ROUTINE	
Powertrain Control System	
· No Electrical concerns	
361 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust to correct level. Refer to the procedure in this section.
· Condition	· Carry out Fluid Condition Check. Refer to the procedure in this section.
Fluid Pump Assembly	
· Bolts not tightened to specification	· Tighten bolts to specification.
· Gasket damaged	· Inspect for damage. If damaged, install a new gasket.
· Porosity, cross leaks, ball missing, plugged hole	· Inspect for damage. If damaged, repair as necessary.
· Pump gears cracked and/or siezed	· Inspect for damage. Install a new pump.
· Flow control valves, springs, or seal damaged, stuck or not assembled correctly	· Inspect for damage. Install a new seal or flow control valve.
Intermediate Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
Intermediate Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
· Not adjusted correctly	· Inspect for damage. Repair as necessary.
Case	
· Case vent damaged	· Inspect for damage. If damaged, repair as necessary.
Other	
· Transmission overheating	· Refer to routine 257/357 in this section.

Other Concern: Vehicle Movement with Gear Selector in "N" Position

Possible Component	Reference/Action
262 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> No Electrical concerns 	
362 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
<ul style="list-style-type: none"> Incorrect level 	<ul style="list-style-type: none"> Adjust to correct level. Refer to the procedure in this section.
Incorrect pressures	
<ul style="list-style-type: none"> High/low pressures 	<ul style="list-style-type: none"> Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.

Other Concern: Slips/Chatters in Manual 1st Position

Possible Component	Reference/Action
263 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Pressure Control Solenoids A, B 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test D.
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
363 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
<ul style="list-style-type: none"> Incorrect level 	<ul style="list-style-type: none"> Adjust to the correct level. Refer to the procedure in this section.
<ul style="list-style-type: none"> Condition 	<ul style="list-style-type: none"> Carry out Fluid Condition Test. Refer to the procedure in this section.
Incorrect Pressures	
<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.

Fluid Pump Assembly	
• Bolts not tightened to specification	• Tighten bolts to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or siezed	• Inspect for damage. Install a new pump.
• Flow control valves, springs, or seal damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Reverse Servo	
• Servo retaining ring damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
Direct One-way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Low One-way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Other Concern: Slips/Chatters in Manual 2nd Position

Possible Component	Reference/Action
264 — ELECTRICAL ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoids A, B	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• Go To Pinpoint Test D.
	• Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
364 — HYDRAULIC/MECHANICAL ROUTINE	

Fluid	
· Incorrect level	· Adjust to the correct level. Refer to the procedure in this section.
· Condition	· Carry out Fluid Condition Check. Refer to the procedure in this section.
Incorrect Pressures	
· High/low pressures	· Check pressure at Line and PC C taps.
	· Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Fluid Pump Assembly	
· Bolts not tightened to specification	· Tighten to specification.
· Gasket damaged	· Inspect for damage. If damaged, install a new gasket.
· Porosity, cross leaks, ball missing, plugged hole	· Inspect for damage. If damaged, repair as necessary.
· Pump gears cracked and/or siezed	· Inspect for damage. Install a new pump.
· Flow control valves, springs, or seal damaged, stuck or not assembled correctly	· Inspect for damage. Install a new seal or flow control valve.
OD Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
OD Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
· Not adjusted correctly	· Inspect for damage. Repair as necessary.
OD Planetary Assembly	
· Planetary damaged	· Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Reverse Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
Reverse Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
Low One-way Clutch	
· Worn, damaged or assembled	· Inspect for damage. Repair as necessary.

incorrectly

Other Concern: Slip/Chatters in Manual 3rd Position

Possible Component	Reference/Action
282 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none">PCM, vehicle wiring harnesses, Pressure Control Solenoids A, B	<ul style="list-style-type: none">Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"><u>Go To Pinpoint Test D</u>.
	<ul style="list-style-type: none">Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
382 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
<ul style="list-style-type: none">Incorrect level	<ul style="list-style-type: none">Adjust to the correct level. Refer to the procedure in this section.
<ul style="list-style-type: none">Condition	<ul style="list-style-type: none">Carry out Fluid Condition Check. Refer to the procedure in this section.
Incorrect Pressures	
<ul style="list-style-type: none">High/Low pressures	<ul style="list-style-type: none">Check pressure at Line and PC C taps.
	<ul style="list-style-type: none">Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Fluid Pump Assembly	
<ul style="list-style-type: none">Bolts not tightened to specification	<ul style="list-style-type: none">Tighten bolts to specification.
<ul style="list-style-type: none">Gasket damaged	<ul style="list-style-type: none">Inspect for damage. If damaged, install a new gasket.
<ul style="list-style-type: none">Porosity, cross leaks, ball missing, plugged hole	<ul style="list-style-type: none">Inspect for damage. If damaged, repair as necessary.
<ul style="list-style-type: none">Pump gears cracked and/or siezed	<ul style="list-style-type: none">Inspect for damage. Install a new pump.
<ul style="list-style-type: none">Flow control valves, springs, or seal damaged, stuck or not assembled correctly	<ul style="list-style-type: none">Inspect for damage. Install a new seal or flow control valve.
OD Servo	
<ul style="list-style-type: none">Servo retaining ring damaged	<ul style="list-style-type: none">Inspect for damaged. Repair as necessary.
<ul style="list-style-type: none">Seals (piston and cover) damaged	<ul style="list-style-type: none">Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none">Band damaged	<ul style="list-style-type: none">Inspect for damage. Repair as necessary.
<ul style="list-style-type: none">Servo worn or damaged	<ul style="list-style-type: none">Inspect for damage. Repair as necessary.
<ul style="list-style-type: none">Not adjusted correctly	<ul style="list-style-type: none">Inspect for damage. Repair as necessary.
Intermediate Servo	
<ul style="list-style-type: none">Servo retaining ring damaged	<ul style="list-style-type: none">Inspect for damage. Repair as necessary.
<ul style="list-style-type: none">Seals (piston and cover) damaged	<ul style="list-style-type: none">Inspect for damage. Repair as necessary.

Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Feed tube or seal damaged	• Inspect for damage. Install a new feed tube.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Direct One-way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Low One-way Clutch	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Other Concern: Engine Braking in ALL Gears

Possible Component	Reference/Action
283 — ELECTRICAL ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid D	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• Go To Pinpoint Test A .
	• Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
383 — HYDRAULIC/MECHANICAL ROUTINE	
No Hydraulic/Mechanical Concerns	

Other Concern: No 2nd and 5th Gears

Possible Component	Reference/Action
284 — ELECTRICAL ROUTINE	

Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Pressure Control Solenoids A, B 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test D .
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
384 — HYDRAULIC/MECHANICAL ROUTINE	
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Feed tube or seal damaged 	<ul style="list-style-type: none"> Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Other Concern: No 3rd, 4th and 5th Gears

Possible Component	Reference/Action
285 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Pressure Control Solenoids A, B 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test D .
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
385 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid Pump Assembly	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Gasket damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new gasket.
<ul style="list-style-type: none"> Porosity, cross leaks, ball missing, plugged hole 	<ul style="list-style-type: none"> Inspect for damage. If damaged, repair as necessary.
<ul style="list-style-type: none"> Pump gears cracked and/or siezed 	<ul style="list-style-type: none"> Inspect for damage. Install a new pump.
<ul style="list-style-type: none"> Flow control valves, springs, or seal damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> Inspect for damage. Install a new seal or flow control valve.
OD Band	
<ul style="list-style-type: none"> Band damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Servo worn or damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Not adjusted correctly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
OD Planetary Assembly	
<ul style="list-style-type: none"> Planetary damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Shift Concern: Harsh 1-2 Shift

Possible Component	Reference/Action
232 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Control Solenoid C, Pressure Control Solenoids B, Turbine Shaft Speed (TSS) sensor, Digital TR sensor, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test A, Go To Pinpoint Test B, Go To Pinpoint Test C, Go To Pinpoint Test D and Go To Pinpoint Test E.
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
332 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Servo	
<ul style="list-style-type: none"> Servo retaining ring damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Seals (piston and cover) damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none"> Band damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Servo worn or damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Not adjusted correctly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> • Feed tube or seal damaged 	<ul style="list-style-type: none"> • Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> • Friction elements damaged or worn 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Return springs damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.

Shift Concern: Harsh 2-3 Shift

Possible Component	Reference/Action
233 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> • PCM, vehicle wiring harnesses, Shift Control Solenoid B, Pressure Control Solenoids A, Turbine Shaft Speed (TSS) sensor, Intermediate Shaft Speed (ISS) sensor, Digital TR sensor, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> • Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> • <u>Go To Pinpoint Test A</u>, <u>Go To Pinpoint Test B</u>, <u>Go To Pinpoint Test C</u>, <u>Go To Pinpoint Test D</u> and <u>Go To Pinpoint Test E</u>.
	<ul style="list-style-type: none"> • Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
333 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> • High/Low pressures 	<ul style="list-style-type: none"> • Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> • Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Direct Clutch Assembly	
<ul style="list-style-type: none"> • Seals, piston damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> • Friction elements damaged or worn 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Return springs damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> • Seals, piston damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating, damage.

off location	Install a new cylinder.
· Feed tube or seal damaged	· Inspect for damage. Install a new feed tube.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Direct One-way Clutch	
· Worn, damaged or assembled incorrectly	· Inspect for damage. Repair as necessary.

Shift Concern: Harsh 3-4 Shift

Possible Component	Reference/Action
234 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Shift Control Solenoid A, Pressure Control Solenoids C, Digital TR sensor, Transmission Fluid Temperature (TFT) sensor	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	· <u>Go To Pinpoint Test A</u> , <u>Go To Pinpoint Test B</u> , <u>Go To Pinpoint Test C</u> and <u>Go To Pinpoint Test D</u> .
	· Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
334 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· High/low pressures	· Check pressure at Line and PC C taps.
	· Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as necessary.
Main Control	
· Bolts not tightened to specification	· Tighten to specification.
· Separator plate damaged	· Inspect for damage. If damaged, install a new separator.
· Contamination	· Disassemble and clean.
· Valves and springs damaged, misassembled, missing, stuck, or bore damaged	· If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Center Support	
· Screws not tightened to specification	· Tighten to specification.
· Seal rings or bearing damaged	· Inspect for damage. Repair as necessary.
· Outside diameter of case bore damage	· Inspect for damage. Repair as necessary.
· Support damaged or leaking	· Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.

· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Feed tube or seal damaged	· Inspect for damage. Install a new feed tube.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.

Shift Concerns: Harsh 4-5 Shift

Possible Component	Reference/Action
274 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Shift Solenoid C, Pressure Control Solenoid B, Turbine Shaft Speed (TSS) sensor, Digital TR sensor, Transmission Fluid Temperature (TFT) sensor	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	· Go To Pinpoint Test A , Go To Pinpoint Test B , Go To Pinpoint Test C , Go To Pinpoint Test D and Go To Pinpoint Test E .
	· Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
374 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· High/Low pressures	· Check pressure at Line and PC C taps.
	· Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
· Bolts not tightened to specification	· Tighten to specification.
· Separator plate damaged	· Inspect for damage. If damaged, install a new separator.
· Contamination	· Disassemble and clean.
· Valves and springs damaged, misassembled, missing, stuck, or bore damaged	· If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seal (piston and cover) damaged	· Inspect for damage. Repair as necessary.
OD Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.

· Not adjusted correctly

· Inspect for damage. Repair as necessary.

Shift Concern: Harsh 5-4 Shift

Possible Component	Reference/Action
275 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> · PCM, vehicle wiring harnesses, Shift Control Solenoid C, Pressure Control Solenoid C, Turbine Shaft Speed (TSS) sensor, Digital TR sensor, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> · Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> · Go To Pinpoint Test A, Go To Pinpoint Test B, Go To Pinpoint Test C, Go To Pinpoint Test D and Go To Pinpoint Test E.
	<ul style="list-style-type: none"> · Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
375 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> · High/low pressures 	<ul style="list-style-type: none"> · Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> · Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> · Bolts not tightened to specification 	<ul style="list-style-type: none"> · Tighten to specification.
<ul style="list-style-type: none"> · Separator plate damaged 	<ul style="list-style-type: none"> · Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> · Contamination 	<ul style="list-style-type: none"> · Disassemble and clean.
<ul style="list-style-type: none"> · Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> · If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Direct Clutch Assembly	
<ul style="list-style-type: none"> · Seals, piston damaged 	<ul style="list-style-type: none"> · Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> · Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> · Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> · Friction elements damaged or worn 	<ul style="list-style-type: none"> · Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> · Return springs damaged 	<ul style="list-style-type: none"> · Inspect for damage. Repair as necessary.
Direct One-way Clutch	
<ul style="list-style-type: none"> · Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> · Inspect for damage. Repair as necessary.

Shift Concern: Harsh 4-3 Shift

Possible Component	Reference/Action
235 — ELECTRICAL ROUTINE	
Powertrain Control System	

<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoid A, Pressure Control Solenoid A, Digital TR sensor, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test A, Go To Pinpoint Test B, Go To Pinpoint Test C and Go To Pinpoint Test D.
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
335 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Direct Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Feed tube or seal damaged 	<ul style="list-style-type: none"> Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Shift Concern: Harsh 3-2 Shift

Possible Component	Reference/Action
236 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Control Solenoid C, Pressure Control Solenoid B, Turbine Shaft Speed (TSS) sensor, Intermediate Shaft Speed (ISS) sensor, 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.

Digital TR sensor, Transmission Fluid Temperature (TFT) sensor	
	<ul style="list-style-type: none"> • Go To Pinpoint Test A , Go To Pinpoint Test B , Go To Pinpoint Test C , Go To Pinpoint Test D and Go To Pinpoint Test E .
	<ul style="list-style-type: none"> • Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
336 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> • High/Low pressures 	<ul style="list-style-type: none"> • Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> • Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Servo	
<ul style="list-style-type: none"> • Servo retaining ring damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Seals (piston and cover) damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none"> • Band damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Servo worn or damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Not adjusted correctly 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
<ul style="list-style-type: none"> • Seals, piston damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> • Friction elements damaged or worn 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Return springs damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> • Seals, piston damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> • Feed tube or seal damaged 	<ul style="list-style-type: none"> • Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> • Friction elements damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Return springs damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.

Shift Concern: Harsh 2-1 Shift

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Possible Component	Reference/Action
237 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> • PCM, vehicle wiring harnesses, Shift Control Solenoid C, Pressure Control Solenoid B, Turbine Shaft Speed (TSS) sensor, Digital TR sensor, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> • Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> • Go To Pinpoint Test A, Go To Pinpoint Test B, Go To Pinpoint Test C, Go To Pinpoint Test D and Go To Pinpoint Test E.
	<ul style="list-style-type: none"> • Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
337 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> • High/Low pressures 	<ul style="list-style-type: none"> • Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> • Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Direct Clutch Assembly	
<ul style="list-style-type: none"> • Seals, piston damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating damage. Install a new cylinder.
<ul style="list-style-type: none"> • Friction elements damaged or worn 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Return springs damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> • Seals, piston damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating damage. Install a new cylinder.
<ul style="list-style-type: none"> • Feed tube or seal damaged 	<ul style="list-style-type: none"> • Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> • Friction elements damaged or worn 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Return springs damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Direct Clutch One-way Clutch	
<ul style="list-style-type: none"> • Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.

Shift Concern: No 1-2 Shift

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Possible Component	Reference/Action
220 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoid C, Pressure Control Solenoid B, Output Shaft Speed (OSS) sensor, Digital TR sensor, IAT sensor, VSS input 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM, IAT and VSS.
	<ul style="list-style-type: none"> Go To Pinpoint Test A, Go To Pinpoint Test C, Go To Pinpoint Test D and Go To Pinpoint Test E.
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
320 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
<ul style="list-style-type: none"> Incorrect level 	<ul style="list-style-type: none"> Adjust to correct level. Refer to the procedure in this section.
Incorrect Pressures	
<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Check pressure at line and PC C taps. Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Servo	
<ul style="list-style-type: none"> Servo retaining ring damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Seals (piston and cover) damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none"> Band damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Servo worn or damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Not adjusted correctly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
OD Planetary Assembly	
<ul style="list-style-type: none"> Planetary damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

· Seals, piston damaged	
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating damage. Install a new cylinder.
· Feed tube or seal damaged	· Inspect for damage. Install a new feed tube.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.

Shift Concern: No 2-3 Shift

Possible Component	Reference/Action
221 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Shift Solenoid B, Torque Converter Clutch (TCC) solenoid, Pressure Control Solenoid A, Output Shaft Speed (OSS) sensor, Digital TR sensor	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	· <u>Go To Pinpoint Test A</u> , <u>Go To Pinpoint Test C</u> , <u>Go To Pinpoint Test D</u> and <u>Go To Pinpoint Test E</u> .
	· Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
321 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· High/low pressures	· Check pressure at Line and PC C taps.
	· Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
· Bolts not tightened to specification	· Tighten to specification.
· Separator plate damaged	· Inspect for damage. If damaged, install a new separator plate.
· Contamination	· Disassemble and clean.
· Valves and springs damaged, misassembled, missing, stuck, or bore damaged	· If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Forward Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball, damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball, damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.

· Feed tube or seal damaged	· Inspect for damage. Install a new feed tube.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Intermediate One-way Clutch	
· Worn, damaged or assembled incorrectly	· Inspect for damage. Repair as necessary.

Shift Concern: No 3-4 Shift

Possible Component	Reference/Action
222 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Shift Solenoid A, Pressure Control Solenoid C, Output Shaft Speed (OSS) sensor, Digital TR sensor	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
· Transmission Control Switch (TCS)	· <u>Go To Pinpoint Test A</u> , <u>Go To Pinpoint Test C</u> , <u>Go To Pinpoint Test D</u> and <u>Go To Pinpoint Test E</u> .
	· Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
	· For TSC diagnosis, refer to External Controls in <u>Section 307-05</u> .
322 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· High/Low pressures	· Check pressure at Line and PC C taps.
	· Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as necessary.
Main Control	
· Bolts not tightened to specification	· Tighten to specification.
· Separator plate damaged	· Inspect for damage. If damaged, install a new separator plate.
· Contamination	· Disassemble and clean.
· Valves and springs damaged, misassembled, missing, stuck, or bore damaged	· If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Center Support	
· Screws not tightened to specification	· Tighten to specification.
· Seal rings or bearing damaged	· Inspect for damage. Repair as necessary.
· Outside diameter of case bore damaged	· Inspect for damage. Repair as necessary.
· Support damaged or leaking	· Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.

• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Feed tube or seal damaged	• Inspect for damage. Install a new feed tube.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.

Shift Concern: No 4-5 Shift

Possible Component	Reference/Action
270 — ELECTRICAL ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C, Pressure Control Solenoid B, Output Shaft Speed (OSS) sensor, Digital TR sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
• Transmission Control Switch (TCS)	• <u>Go To Pinpoint Test A</u> , <u>Go To Pinpoint Test C</u> , <u>Go To Pinpoint Test D</u> and <u>Go To Pinpoint Test E</u> .
	• Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
	• For TSC diagnosis, refer to <u>Section 307-05</u> .
370 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
• High/Low pressures	• Check pressure at Line and PC C taps.
	• Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
• Bolts not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves and springs damaged, misassembled, missing, stuck, or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or

	transmission damage.
OD Servo	
· Servo retaining ring damaged	· Inspect for damage. Repair as necessary.
· Seals (piston and cover) damaged	· Inspect for damage. Repair as necessary.
OD Band	
· Band damaged	· Inspect for damage. Repair as necessary.
· Servo worn or damaged	· Inspect for damage. Repair as necessary.
· Not adjusted correctly	· Inspect for damage. Repair as necessary.

Shift Concern: No 5-4 Shift

Possible Component	Reference/Action
271 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Shift Solenoid C, Pressure Control Solenoid C, Output Shaft Speed (OSS) sensor, Digital TR sensor	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
· Transmission Control Switch (TCS)	· Go To Pinpoint Test A , Go To Pinpoint Test C , Go To Pinpoint Test D and Go To Pinpoint Test E .
	· Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
	· For TCS diagnosis, refer to Section 307-05 .
371 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· High/Low pressures	· Check pressure at Line and PC C taps.
	· Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
· Bolts not tightened to specification	· Tighten to specification.
· Separator plate damaged	· Inspect for damage. If damaged, install a new separator plate.
· Contamination	· Disassemble and clean.
· Valves and springs damaged, misassembled, missing, stuck, or bore damaged	· If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Direct Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.

Shift Concern: No 4-3 Shift

Possible Component	Reference/Action
223 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoid A, Pressure Control Solenoid A, Output Shaft Speed (OSS) sensor, Digital TR sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
<ul style="list-style-type: none"> Transmission Control Switch (TCS) 	<ul style="list-style-type: none"> <u>Go To Pinpoint Test A</u> , <u>Go To Pinpoint Test C</u> , <u>Go To Pinpoint Test D</u> and <u>Go To Pinpoint Test E</u> .
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
	<ul style="list-style-type: none"> For TCS diagnosis, refer to <u>Section 307-05</u> .
323 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as necessary.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Forward Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Feed tube or seal damaged 	<ul style="list-style-type: none"> Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Shift Concern: No 3-2 Shift

Possible Component	Reference/Action

224 — ELECTRICAL ROUTINE

Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoid C, Pressure Control Solenoid B, Output Shaft Speed (OSS) sensor, Digital TR sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> <u>Go To Pinpoint Test A</u>, <u>Go To Pinpoint Test C</u>, <u>Go To Pinpoint Test D</u> and <u>Go To Pinpoint Test E</u>.
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.

324 — HYDRAULIC/MECHANICAL ROUTINE

Incorrect Pressures	
<ul style="list-style-type: none"> High/low pressures 	<ul style="list-style-type: none"> Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as necessary.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Servo	
<ul style="list-style-type: none"> Servo retaining ring damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Seals (piston and cover) damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none"> Band damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Servo worn or damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Not adjusted correctly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Feed tube or seal damaged 	<ul style="list-style-type: none"> Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Shift Concern: No 2-1 Shift

Possible Component	Reference/Action
225 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoid C, Pressure Control Solenoid B, Output Shaft Speed (OSS) sensor, Digital TR sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> <u>Go To Pinpoint Test A</u>, <u>Go To Pinpoint Test C</u>, <u>Go To Pinpoint Test D</u> and <u>Go To Pinpoint Test E</u>.
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
325 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Forward Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Feed tube or seal damaged 	<ul style="list-style-type: none"> Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 1-2 Shift

Possible Component	Reference/Action

226 — ELECTRICAL ROUTINE

Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoid C, Pressure Control Solenoid B, Transmission Fluid Temperature (TFT) sensor, IAT sensor, VSS input 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> <u>Go To Pinpoint Test A</u>, <u>Go To Pinpoint Test B</u> and <u>Go To Pinpoint Test D</u>.
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.

326 — HYDRAULIC/MECHANICAL ROUTINE

Fluid	
<ul style="list-style-type: none"> Incorrect level 	<ul style="list-style-type: none"> Adjust to correct level. Refer to the procedure in this section.
<ul style="list-style-type: none"> Condition 	<ul style="list-style-type: none"> Carry out Fluid Condition Check. Refer to the procedure in this section.
Incorrect Pressures	
<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as necessary.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valve and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Servo	
<ul style="list-style-type: none"> Servo retaining ring damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Seals (piston and cover) damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none"> Band damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Servo worn or damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Not adjusted correctly 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 2-3 Shift

Possible Component	Reference/Action
227 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoid A, Pressure Control Solenoid A, Intermediate Shaft Speed (ISS) 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.

sensor, Transmission Fluid Temperature (TFT) sensor	
	<ul style="list-style-type: none"> • Go To Pinpoint Test A , Go To Pinpoint Test B , Go To Pinpoint Test D and Go To Pinpoint Test E .
	<ul style="list-style-type: none"> • Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
327 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> • High/Low pressures 	<ul style="list-style-type: none"> • Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> • Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Intermediate Servo	
<ul style="list-style-type: none"> • Servo retaining ring damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Seals (piston and cover) damaged 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating, damage. Install a new cylinder.
Intermediate Band	
<ul style="list-style-type: none"> • Band damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Servo worn or damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Not adjusted correctly 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
<ul style="list-style-type: none"> • Seals, piston damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> • Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> • Feed tube or seal damaged 	<ul style="list-style-type: none"> • Inspect for damage. Install a new feed tube.
<ul style="list-style-type: none"> • Friction elements damaged or worn 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Return springs damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
Direct One-Way Clutch	
<ul style="list-style-type: none"> • Worn, damaged or assembled incorrectly 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 3-4 Shift

Possible Component	Reference/Action
228 — ELECTRICAL ROUTINE	
Powertrain Control System	

<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoid A, Pressure Control Solenoid C, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> Go To Pinpoint Test A, Go To Pinpoint Test B and Go To Pinpoint Test E.
	<ul style="list-style-type: none"> Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
328 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> High/Low pressures 	<ul style="list-style-type: none"> Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> Bolts not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Separator plate damaged 	<ul style="list-style-type: none"> Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> Contamination 	<ul style="list-style-type: none"> Disassemble and clean.
<ul style="list-style-type: none"> Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Center Support	
<ul style="list-style-type: none"> Screw not tightened to specification 	<ul style="list-style-type: none"> Tighten to specification.
<ul style="list-style-type: none"> Seal rings or bearing damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Outside diameter of case bore damage 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Support damaged or leaking 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
<ul style="list-style-type: none"> Seals, piston damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Check ball damaged, missing, not seating, off location 	<ul style="list-style-type: none"> Inspect for mislocation, poor seating, damage. Install a new cylinder.
<ul style="list-style-type: none"> Friction elements damaged or worn 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> Return springs damaged 	<ul style="list-style-type: none"> Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 4-5 Shift

Possible Component	Reference/Action
272 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> PCM, vehicle wiring harnesses, Shift Solenoid C, Pressure Control Solenoid B, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.

	<ul style="list-style-type: none"> • Go To Pinpoint Test A , Go To Pinpoint Test B and Go To Pinpoint Test D .
	<ul style="list-style-type: none"> • Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
372 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> • High/Low pressures 	<ul style="list-style-type: none"> • Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> • Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> • Bolts not tightened to specification 	<ul style="list-style-type: none"> • Tighten to specification.
<ul style="list-style-type: none"> • Separator plate damaged 	<ul style="list-style-type: none"> • Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> • Contamination 	<ul style="list-style-type: none"> • Disassemble and clean.
<ul style="list-style-type: none"> • Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> • If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Servo	
<ul style="list-style-type: none"> • Servo retaining ring damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Seals (piston and cover) damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
OD Band	
<ul style="list-style-type: none"> • Band damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Servo worn or damaged 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.
<ul style="list-style-type: none"> • Not adjusted correctly 	<ul style="list-style-type: none"> • Inspect for damage. Repair as necessary.

Shift Concern: Feel — Soft/Slipping 5-4 Shift

Possible Component	Reference/Action
273 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> • PCM, vehicle wiring harnesses, Shift Solenoid C, Pressure Control Solenoid C, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> • Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> • Go To Pinpoint Test A , Go To Pinpoint Test B and Go To Pinpoint Test D .
	<ul style="list-style-type: none"> • Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
373 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> • High/Low pressures 	<ul style="list-style-type: none"> • Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> • Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	

· Bolts not tightened to specification	· Tighten to specification.
· Separator plate damaged	· Inspect for damage. If damaged, install a new separator plate.
· Contamination	· Disassemble and clean.
· Valves and springs damaged, misassembled, missing, stuck, or bore damaged	· If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
Direct Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as necessary.
· Check ball damaged, missing, not seating, off location	· Inspect for mislocation, poor seating, damage. Install a new cylinder.
· Friction elements damaged or worn	· Inspect for damage. Repair as necessary.
· Return springs damaged	· Inspect for damage. Repair as necessary.
Direct One-Way Clutch	
· Worn, damaged or assembled incorrectly	· Inspect for damage. Repair as necessary.

Shift Concern: Feel — Soft/Slipping 4-3 Shift

Possible Component	Reference/Action
229 — ELECTRICAL ROUTINE	
Powertrain Control System	
· PCM, vehicle wiring harnesses, Shift Solenoid A, Pressure Control Solenoid A, Transmission Fluid Temperature (TFT) sensor	· Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	· <u>Go To Pinpoint Test A</u> , <u>Go To Pinpoint Test B</u> and <u>Go To Pinpoint Test D</u> .
	· Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
329 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· High/Low pressures	· Check pressure at Line and PC C taps.
	· Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
· Bolts not tightened to specification	· Tighten to specification.
· Separator plate damaged	· Inspect for damage. If damaged, install a new separator plate.
· Contamination	· Disassemble and clean.
· Valves and springs damaged, misassembled, missing, stuck, or bore damaged	· If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.

Intermediate Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Feed tube or seal damaged	• Inspect for damage. Install a new feed tube.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 3-2 Shift

Possible Component	Reference/Action
230 — ELECTRICAL ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C, Pressure Control Solenoid B, Intermediate Shaft Speed (ISS) sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• Go To Pinpoint Test A , Go To Pinpoint Test B , Go To Pinpoint Test D and Go To Pinpoint Test E .
	• Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
330 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
• High/Low pressures	• Check pressure at Line and PC C taps.
	• Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
• Bolts not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves and springs damaged, misassembled, missing, stuck, or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.
OD Servo	
• Servo retaining ring damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
OD Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch	

· Worn, damaged or assembled incorrectly

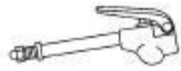



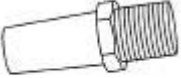
· Inspect for damage. Repair as necessary.

Shift Concern: Feel — Soft/Slipping 2-1 Shift

Possible Component	Reference/Action
231 — ELECTRICAL ROUTINE	
Powertrain Control System	
<ul style="list-style-type: none"> · PCM, vehicle wiring harnesses, Shift Solenoid C, Pressure Control Solenoid B, Transmission Fluid Temperature (TFT) sensor 	<ul style="list-style-type: none"> · Carry out on-board diagnostic tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	<ul style="list-style-type: none"> · <u>Go To Pinpoint Test A</u> , <u>Go To Pinpoint Test B</u> and <u>Go To Pinpoint Test D</u> .
	<ul style="list-style-type: none"> · Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
331 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
<ul style="list-style-type: none"> · High/Low pressures 	<ul style="list-style-type: none"> · Check pressure at Line and PC C taps.
	<ul style="list-style-type: none"> · Carry out Line Pressure Test. Refer to the procedure in this section. Follow pressure diagnosis and repair as required.
Main Control	
<ul style="list-style-type: none"> · Bolts not tightened to specification 	<ul style="list-style-type: none"> · Tighten to specification.
<ul style="list-style-type: none"> · Separator plate damaged 	<ul style="list-style-type: none"> · Inspect for damage. If damaged, install a new separator plate.
<ul style="list-style-type: none"> · Contamination 	<ul style="list-style-type: none"> · Disassemble and clean.
<ul style="list-style-type: none"> · Valves and springs damaged, misassembled, missing, stuck, or bore damaged 	<ul style="list-style-type: none"> · If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This removes the anodized finish and can result in further main control or transmission damage.

Transmission Fluid Level Check

Special Tool(s)

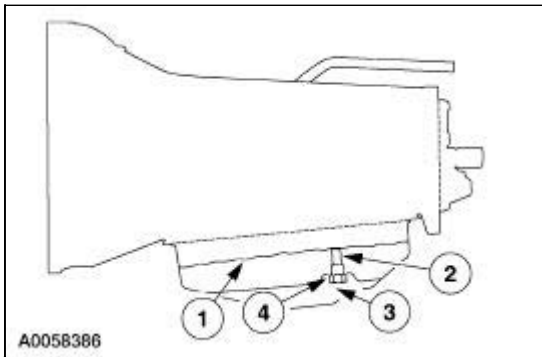
 ST2467-A	Rubber Tip Air Nozzle 100-D009 (D93L-7000-A)
 ST1269-A	Vacuum Pump Kit 416-D002 (D95L-7559-A)
 ST2715-A	Fluid Transporter / Evacuator / Injector 307-D465
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224 New Generation Star (NGS) Tester 418-F205 or equivalent scan tool
 ST2581-A	Adapter, Fluid Level and Fill Plug 307-437

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

Fluid Fill Reference

NOTE: Left side of case is shown.

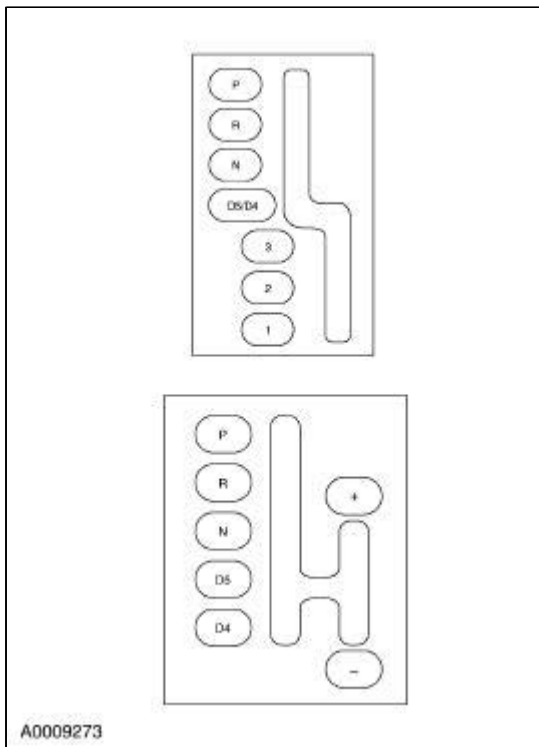


Item	Part Number	Description
1	—	Fluid level
2	7A010	Fluid level tube
3	W704999-S309	Fluid level and fill plug (small) (in-vehicle)
4	7A010	Fluid drain plug (large)

1. Using the scan tool (WDS), monitor the transmission fluid temperature (TFT) using PID: TFT.
2. Start the vehicle.
3. **NOTE:** Engine idle speed is approximately 650 rpm.

While proceeding with this procedure, run the engine until the transmission fluid temperature is between 27°C - 49°C (80°F - 120°F).

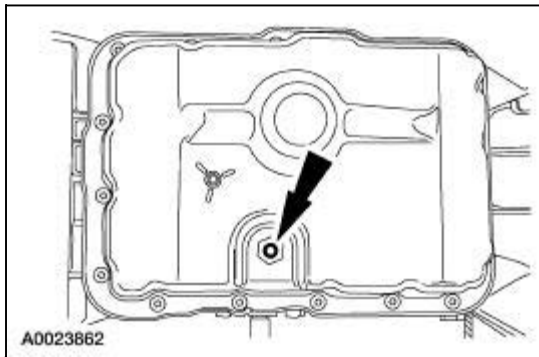
4. Move the range selector lever slowly through each gear, stopping in each position and allowing the transmission to engage.



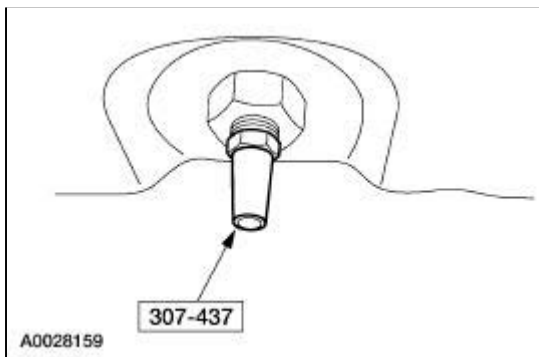
5. Place the range selector lever in the PARK position.
6. With the engine running, position the vehicle on a hoist and set it as close to level as possible.

For additional information, refer to [Section 100-02](#) .

7. Hold the larger drain plug with a wrench and remove the small (center) fluid level indicating plug using a 3/16-inch Allen key.

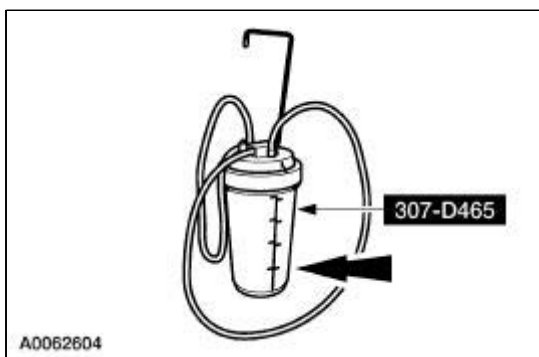


8. Install the special tool into the pan.

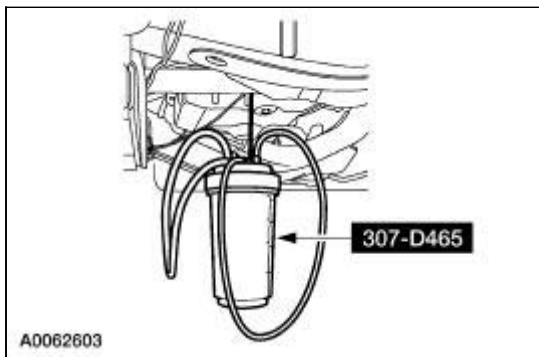


9. **NOTE:** Prior to filling the special tool with clean transmission fluid, make sure that the canister is clean.

Fill the special tool with clean automatic transmission fluid.

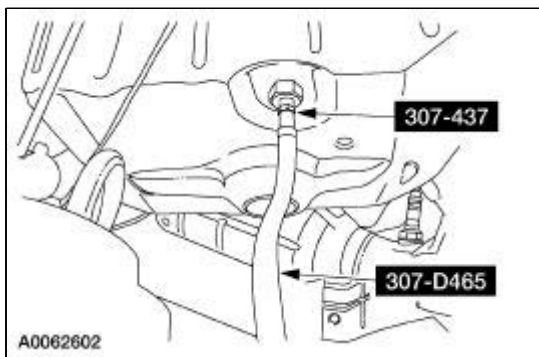


10. Hang the special tool under the vehicle. Position it upright and close to the transmission.

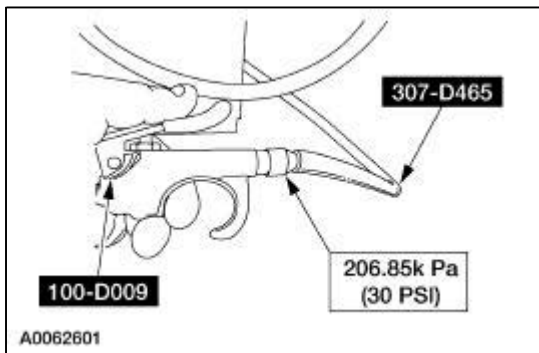


11. Connect the special tools.

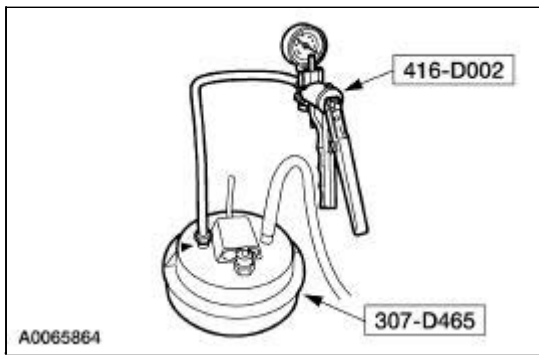
- Connect the open end of the fluid hose from the Fluid Transporter/Evacuator/Injector to the Fluid Level and Fill Plug Adapter at the bottom of the transmission fluid pan.



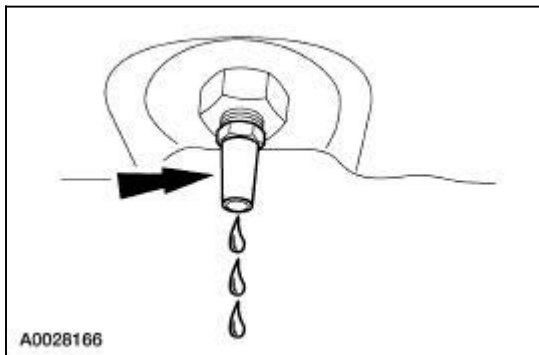
12. Apply a maximum of 206.85 kPa (30 psi) to the open end of the vacuum/pressure hose from the special tool. Fluid will immediately start flowing out of the special tool into the transmission fluid pan.



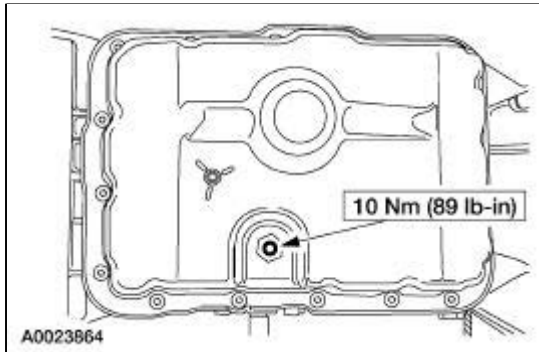
13. Add one pint of transmission fluid into the fluid pan. Stop the process by releasing the air pressure and removing the air nozzle from the end of the hose.
14. Inspect the fluid level in the special tool. If the fluid drains back into the canister, the transmission is full. If no fluid drains back, more fluid will need to be added. Repeat steps 12 and 13.
15. Once the transmission is full, place a hand vacuum pump on the open end of the vacuum/pressure hose of the special tool and apply vacuum to the system. This will pull out any extra fluid trapped in the system and direct it into the container.



16. Allow the fluid to drain. Make sure that the fluid temperature is between 27°C - 49°C (80°F - 120°F). When the fluid comes out as a thin stream or drip, the fluid is at the correct level.



17. Reinstall the small (center) fluid level indicating plug using a 3/16-inch Allen key.




18. Check the operation of the transmission by moving the range selector lever slowly through each gear, stopping in each position and allowing the transmission to engage.
-

Transmission Fluid Cooler — Backflushing and Cleaning

For additional information, refer to [Section 307-02](#).

Transmission Fluid Drain and Refill —Automated Equipment

Special Tool(s)

 ST2654-A	Automatic Transmission Flush and Fill Machine 211-00018
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Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON®V

Draining



CAUTION: Use only clean automatic transmission fluid. Do not use any supplemental transmission fluid additives, treatments or cleaning agents. The use of these materials can affect the operation of the transmission, resulting in internal component failure.



CAUTION: Always refer to the instructions supplied with the flush and fill machine.

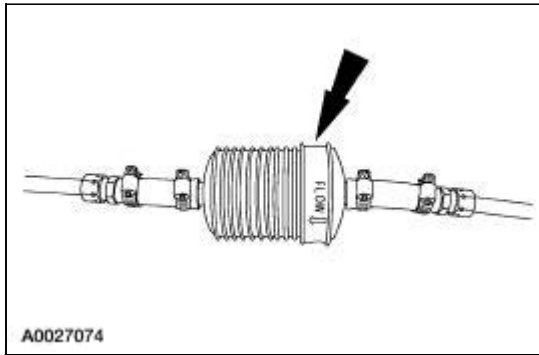
NOTE: This is a new procedure for draining and adding transmission fluid using a suitable transmission flush and fill machine.

1. Position the vehicle on a hoist. Place in PARK. For additional information, refer to [Section 100-02](#).
2. Use a suitable flush and fill machine to change the fluid.
3. When connecting the flush and fill machine, connect the machine to the fluid cooler tube after the fluid cooler on the cooler return tube. This will help remove any foreign material trapped in the fluid coolers.
4. Carry out the fluid exchange process.

Refill

1. Use only clean automatic transmission fluid.
2. Once the fluid exchange has been completed, disconnect the flush and fill machine. Reconnect any disconnected fluid cooler tubes.
3. **NOTE:** If the vehicle is equipped with an in-line fluid filter, install a new in-line fluid filter (XC3Z-7B155-BA).




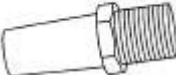
Install a new in-line transmission fluid filter.



4. Lower the vehicle. For additional information, refer to [Section 100-02](#).
 5. With the engine running and the transmission at normal operating temperature 66-77°C (150-170°F), check and adjust the transmission fluid level and check for any leaks. If fluid is needed, add fluid in increments of 0.24 liter (0.5 pint) until the correct level is achieved (fluid should be in the cross-hatched area of the fluid level indicator).
 6. Carry out the fluid level check. For additional information, refer to [Transmission Fluid Level Check](#) in this section.
-

Transmission Fluid Drain and Refill — Vehicles With Torque Converter Drain Plug

Special Tool(s)

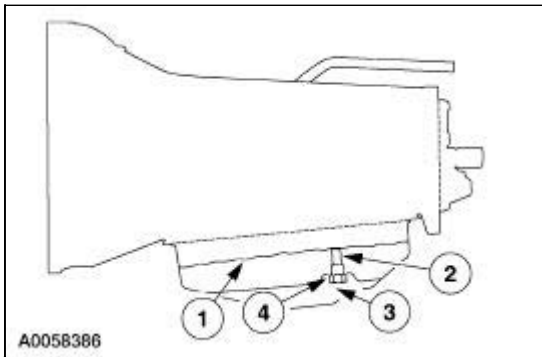
 ST2467-A	Rubber Tip Air Nozzle 100-D009 (D93L-7000-A)
 ST1269-A	Vacuum Pump Kit 416-D002 (D95L-7559-A)
 ST2715-A	Fluid Transporter / Evacuator / Injector 307-D465
 ST2581-A	Adapter, Fluid Level and Fill Plug 307-437

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

Fluid Fill Reference

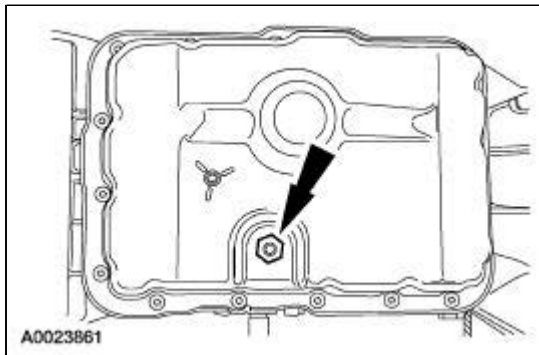
NOTE: Left side of case is shown.



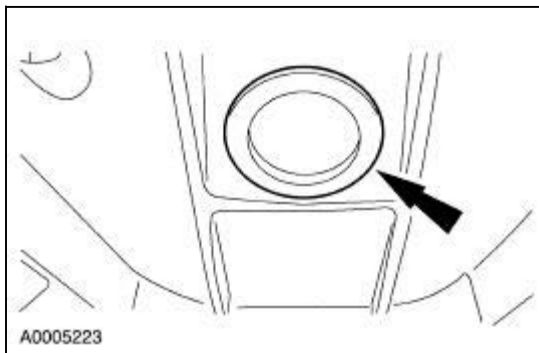
Item	Part Number	Description
1	—	Fluid level
2	7A010	Fluid level tube
3	W704999-S309	Fluid level and fill plug (small) (in-vehicle)
4	7A010	Fluid drain plug (large)

Draining

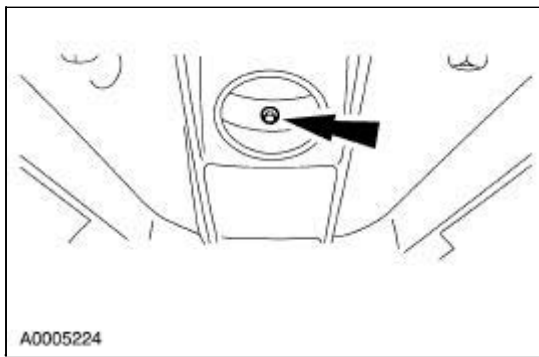
1. With the vehicle in PARK, position it on a hoist. Set the vehicle as close to level as possible. For additional information, refer to [Section 100-02](#).
2. Remove the drain plug (large plug) and allow the fluid to drain.



3. Remove the converter housing plug.

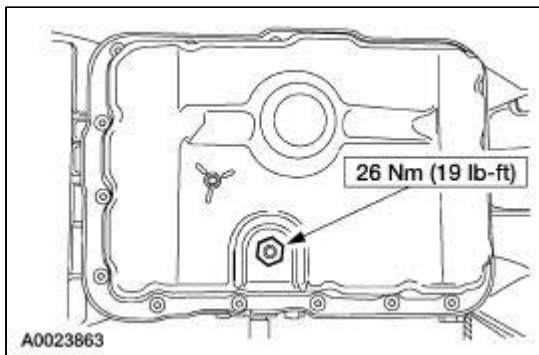


4. Remove and discard the drain plug.

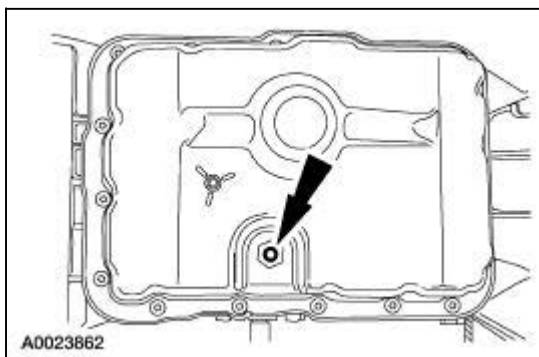


Refill

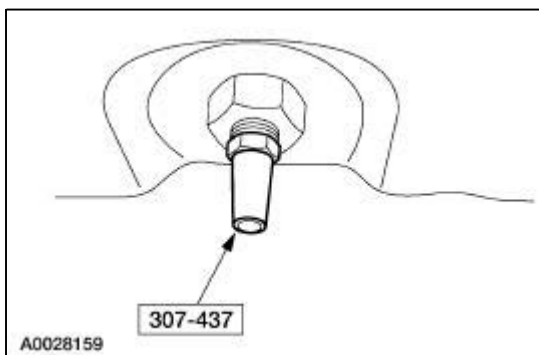
1. Install the fluid drain plug.



2. Hold the larger drain plug with a wrench and remove the small (center) fluid level indicating plug using a 3/16-inch Allen key.



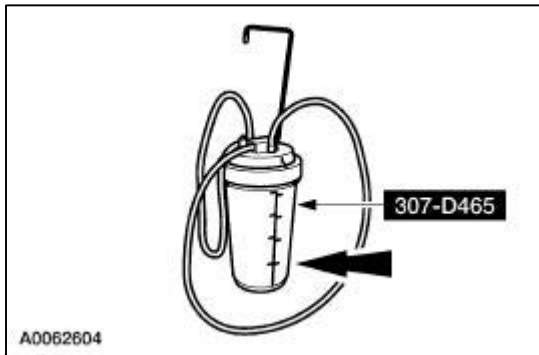
3. Install the special tool into the pan.



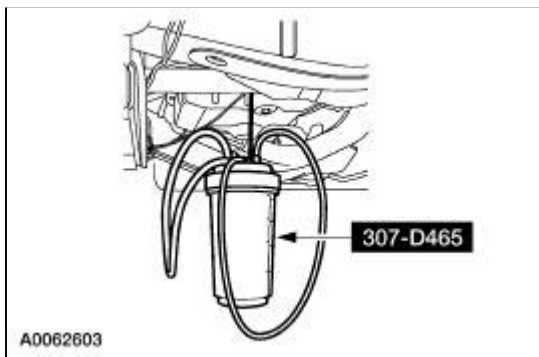
4. **NOTE:** Prior to filling the special tool with clean transmission fluid, make sure that the canister is

clean.

Fill the special tool with clean automatic transmission fluid.

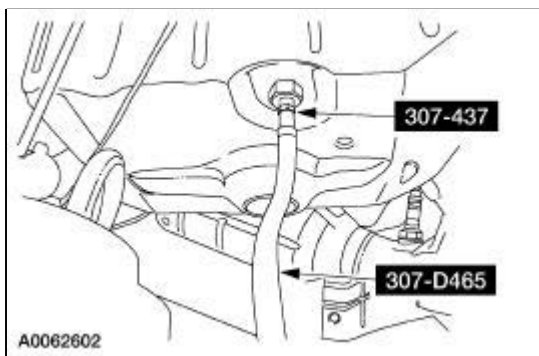


5. Hang the special tool under the vehicle, upright and close to the transmission.

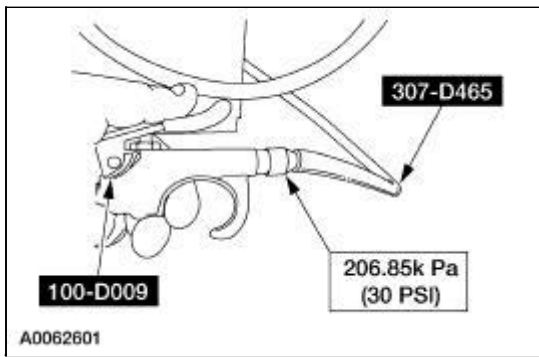


6. Connect the special tools.

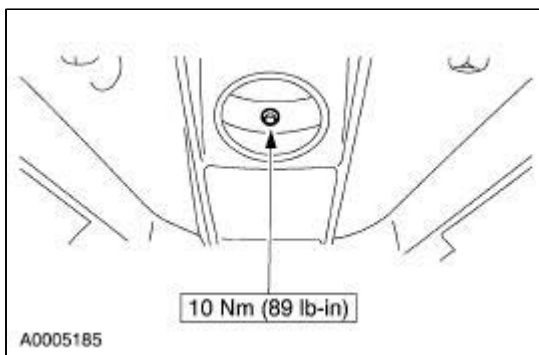
- Connect the open end of the fluid hose from the Fluid Transporter/Evacuator/Injector to the Fluid Level and Fill Plug Adapter at the bottom of the transmission fluid pan.



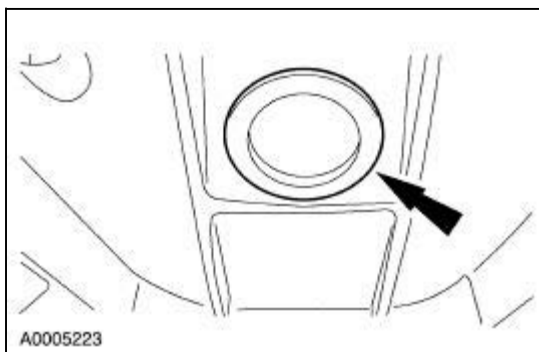
7. Apply a maximum of 206.85 kPa (30 psi) to the open end of the vacuum/pressure hose from the special tool. Fluid will immediately start flowing out of the special tool into the transmission fluid pan.



8. Add two or three quarts of transmission fluid into the fluid pan. Stop the process by releasing the air pressure and removing the air nozzle from the end of the hose.
9. Install a new torque converter drain plug to prevent any leakage.



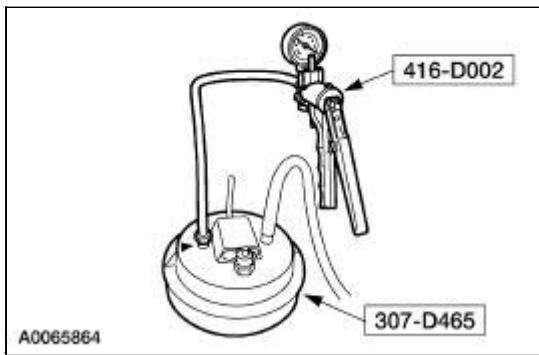
10. Install the converter housing access plug.



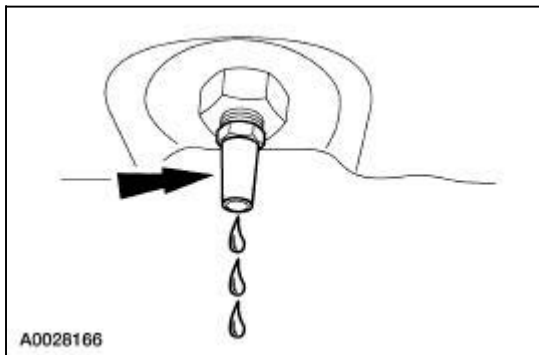
11. **NOTE:** Engine idle speed is approximately 650 rpm.

Start and run the engine until the transmission fluid temperature is between 27°C - 49°C (80°F - 120°F).

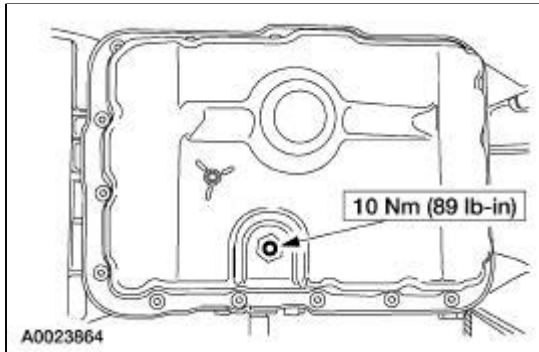
12. Inspect the fluid level in the special tool. If the fluid drains back into the canister, the transmission is full. If no fluid drains back, more fluid will need to be added. Repeat steps 11 and 12.
13. Once the transmission is full, place a hand vacuum pump on the open end of the hose of the special tool and apply vacuum to the system. This will pull any extra fluid trapped in the system and direct it into the container.



14. Allow the fluid to drain. When the fluid comes out as a thin stream or drip, the fluid is at the correct level.




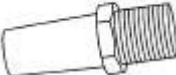


15. Reinstall the small (center) fluid level indicating plug using a 3/16-inch Allen key.



Transmission Fluid Drain and Refill — Vehicles Without Torque Converter Drain Plug

Special Tool(s)

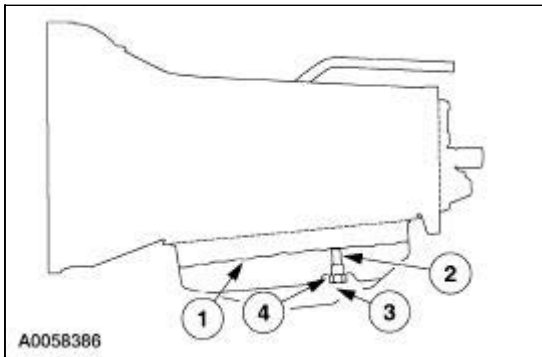
 ST2467-A	Rubber Tip Air Nozzle 100-D009 (D93L-7000-A)
 ST1269-A	Vacuum Pump Kit 416-D002 (D95L-7559-A)
 ST2715-A	Fluid Transporter / Evacuator / Injector 307-D465
 ST2581-A	Adapter, Fluid Level and Fill Plug 307-437

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

Fluid Fill Reference

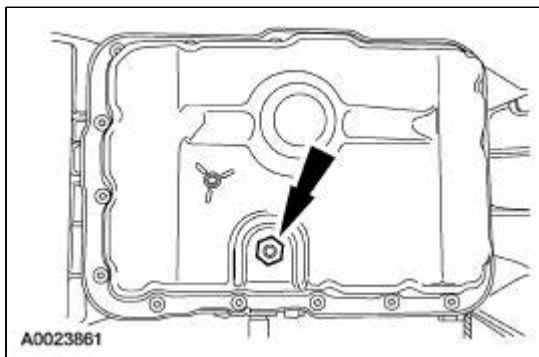
NOTE: Left side of case is shown.



Item	Part Number	Description
1	—	Fluid level
2	7A010	Fluid level tube
3	W704999-S309	Fluid level and fill plug (small) (in-vehicle)
4	7A010	Fluid drain plug (large)

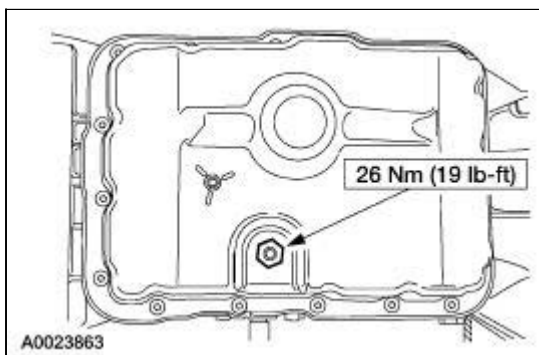
Draining

1. With the vehicle in PARK, position it on a hoist. Set the vehicle as close to level as possible. For additional information, refer to [Section 100-02](#).
2. Remove the drain plug (large plug) and allow the fluid to drain.

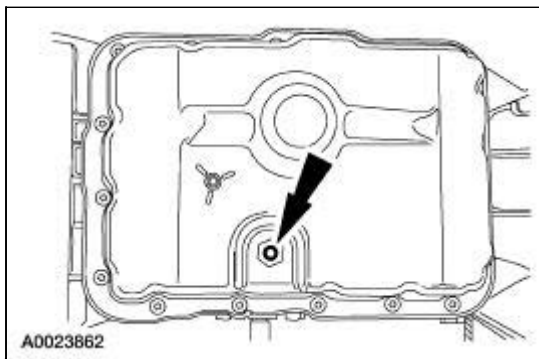


Refill

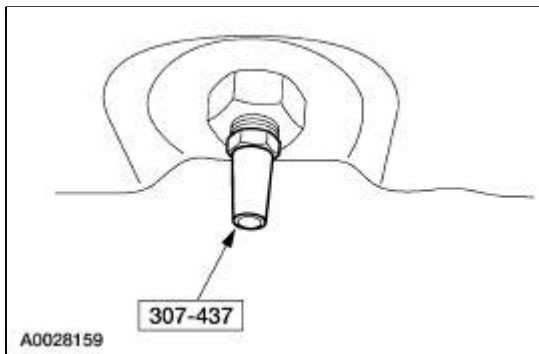
1. Install the fluid drain plug.



2. Hold the larger drain plug with a wrench and remove the small (center) fluid level indicating plug using a 3/16-inch Allen key.

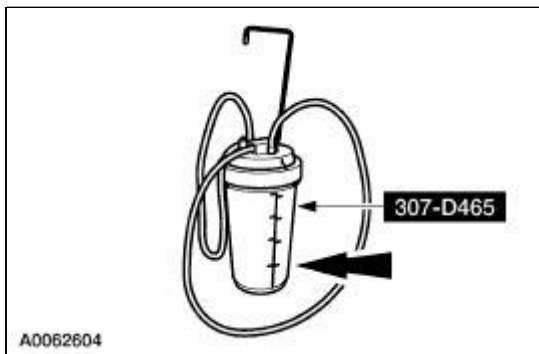


3. Install the special tool into the pan.

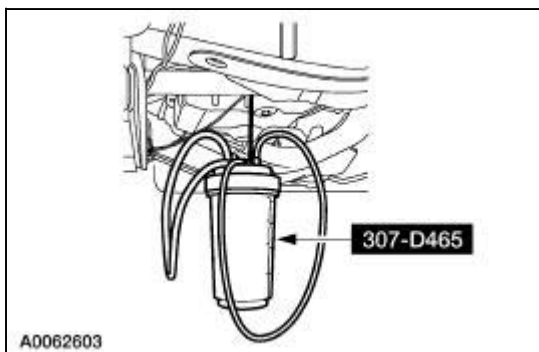


4. **NOTE:** Prior to filling the special tool with clean transmission fluid, make sure that the canister is clean.

Fill the special tool with clean automatic transmission fluid.

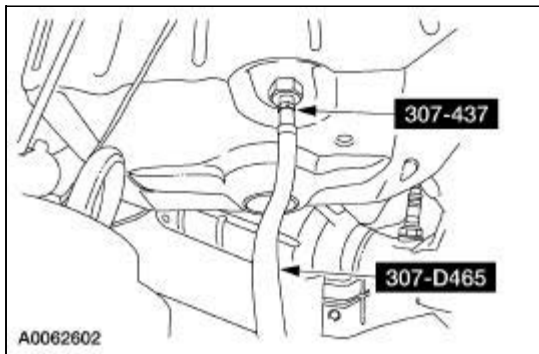


5. Hang the special tool under the vehicle, upright and close to the transmission.

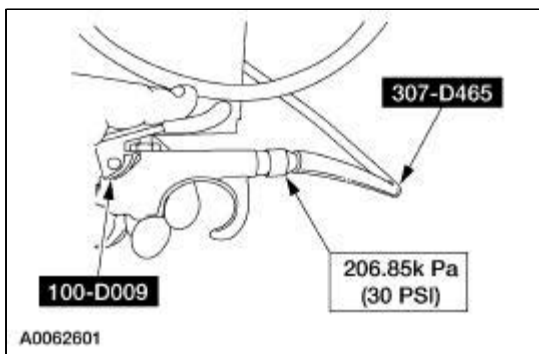


6. Connect the special tools.

- Connect the open end of the fluid hose from the Fluid Transporter/Evacuator/Injector to the Fluid Level and Fill Plug Adapter at the bottom of the transmission fluid pan.



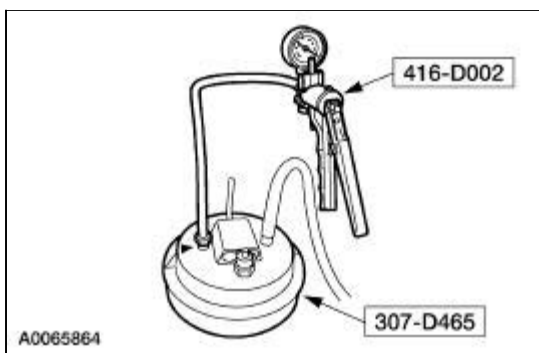
7. Apply a maximum of 206.85 kPa (30 psi) to the open end of the vacuum/pressure hose from the special tool. Fluid will immediately start flowing out of the special tool into the transmission fluid pan.



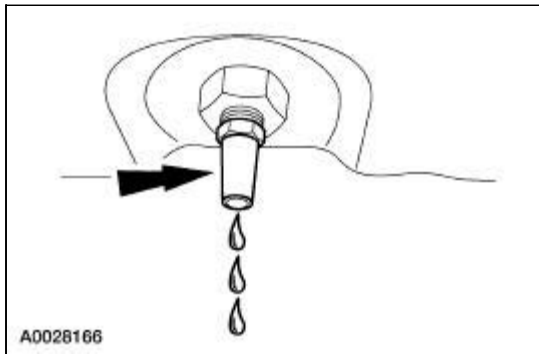
8. Add two or three quarts of transmission fluid into the fluid pan. Stop the process by releasing the air pressure and removing the air nozzle from the end of the hose.
9. **NOTE:** Engine idle speed is approximately 650 rpm.

Start and run the engine until the transmission fluid temperature is between 27°C - 49°C (80°F - 120°F).

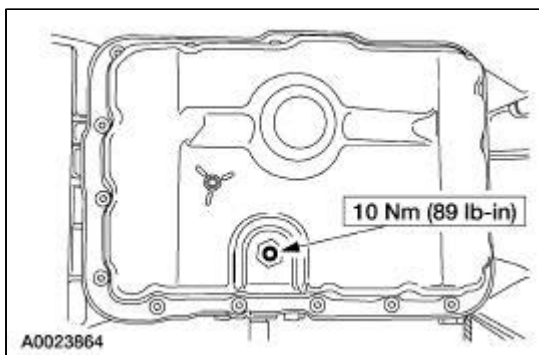
10. Inspect the fluid level in the special tool. If the fluid drains back into the canister, the transmission is full. If no fluid drains back, more fluid will need to be added. Repeat steps 9 and 10.
11. Once the transmission is full, place a hand vacuum pump on the open end of the hose of the special tool and apply vacuum to the system. This will pull any extra fluid trapped in the system and direct it into the container.



12. Allow the fluid to drain. When the fluid comes out as a thin stream or drip, the fluid is at the correct level.




13. Reinstall the small (center) fluid level indicating plug using a 3/16-inch Allen key.




Transmission Range (TR) Sensor Adjustment

Special Tool(s)

 ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)
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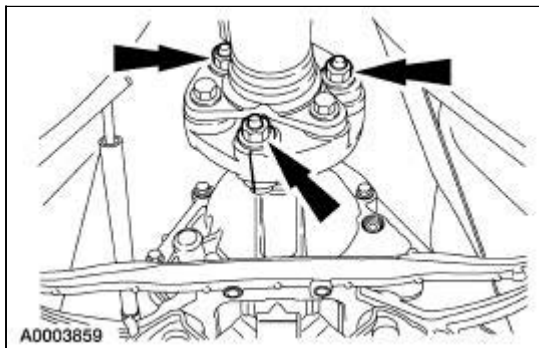
Material

Item	Specification
Threadlock 262 E2FZ-19554-B	WSK-M2G351-A6

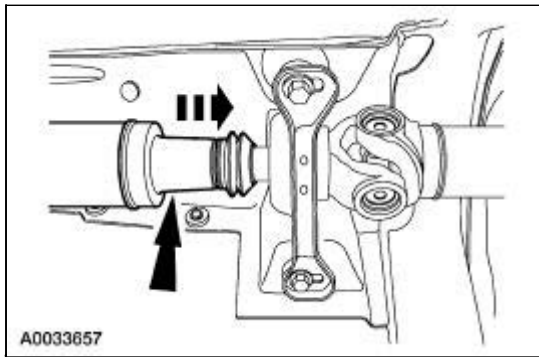
1. Position the vehicle on a hoist. Place in NEUTRAL. For additional information, refer to [Section 100-02](#).
2. Remove the exhaust heat shield. For additional information, refer to [Section 309-00](#).
3.  **CAUTION: Index-mark (color paint) the bolts, washers, nuts, and the flex coupling to the transmission flange and the pinion flange to assure assembly in the exact location from which they were removed. Components not assembled in their original locations can cause driveshaft imbalance.**


 **CAUTION: Do not remove the bolts retaining the flex coupling to the driveshaft.**

Index-mark the front driveshaft pinion flange. Remove the three nuts, washers and bolts.



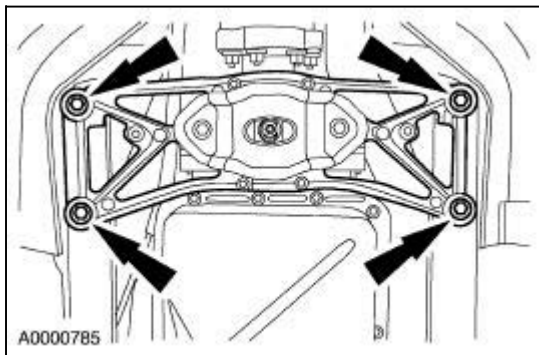
4. Slide the front shaft assembly rearward and support.



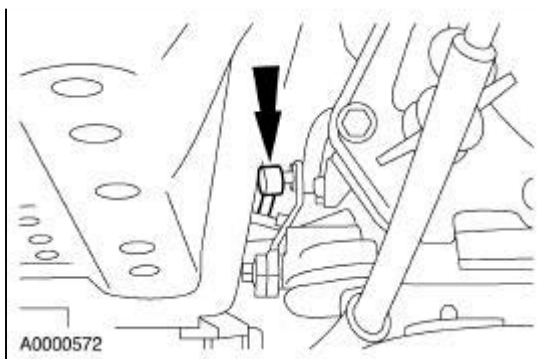
5.  **WARNING: Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions can result in personal injury.**

Support the transmission with a transmission jack.

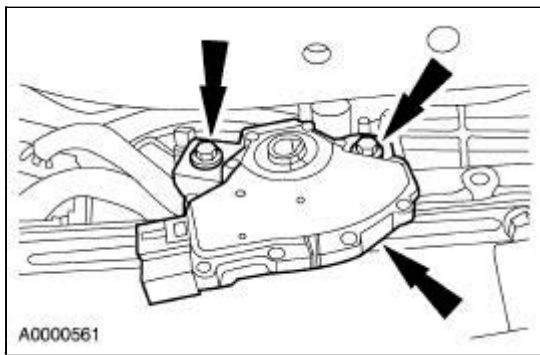
6. Remove the transmission mount and lower the transmission enough to gain access to the digital TR sensor.



7. Disconnect the shift cable.



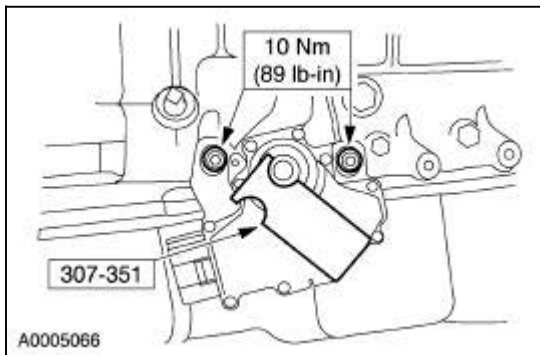
8. Loosen the digital TR sensor screws.



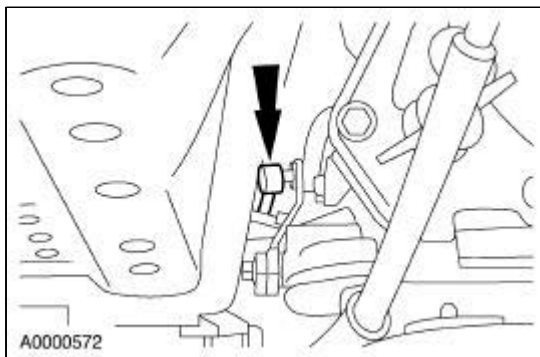
9.  **CAUTION:** Tightening one screw before tightening the other can cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the NEUTRAL position.

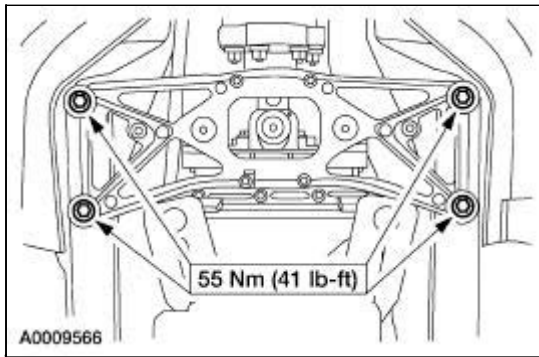
Using the special tool, align the digital TR sensor and tighten the screws in an alternating sequence.



10. Connect the shift cable.

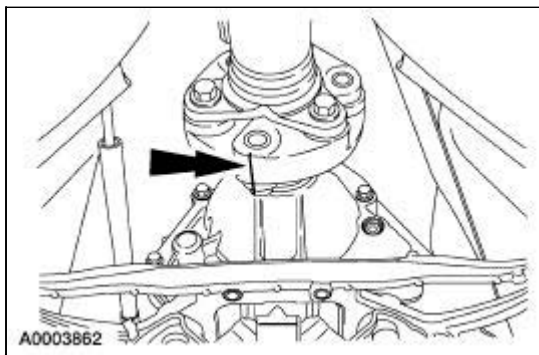



11. Install the rear transmission support and remove the transmission jack.



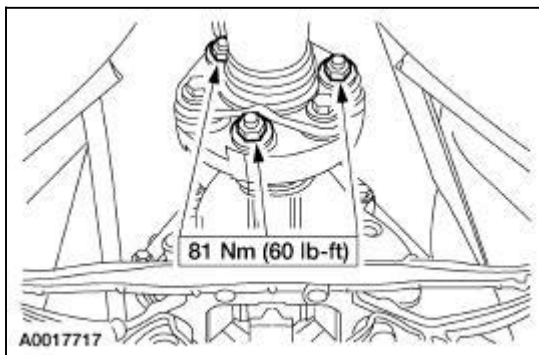
12.  **CAUTION: Align the index marks or driveshaft imbalance can occur.**

Align the index marks made during removal and position the driveshaft on the transmission flange.



13.  **CAUTION: Install the bolts, washers and nuts in their original positions or driveshaft imbalance can occur. Install the driveshaft flex coupling bolts with the head of the bolt seated against the flange, and the nuts seated against the flex coupling.**

Install the bolts, washers and nuts. Coat the nut and bolt threads with threadlock sealer.



14. Install the exhaust heat shield. For additional information, refer to [Section 309-00](#).
15. Lower the vehicle.
-

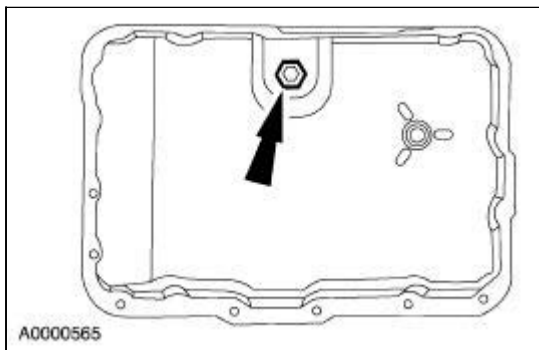
Fluid Pan, Gasket and Filter

Material

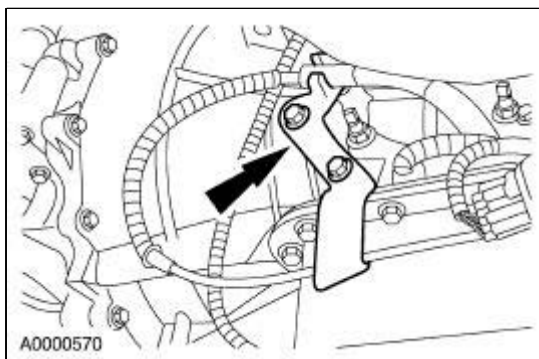
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

Removal

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Place a drain pan under the transmission fluid pan.
3. Remove the drain plug and drain the fluid.

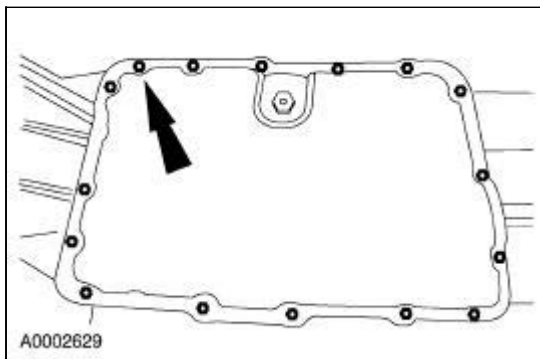


4. Remove the bracket.

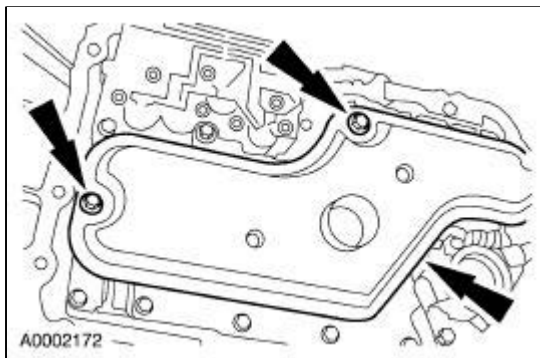


5. **NOTE:** The transmission fluid pan gasket is reusable, clean and inspect for damage; if not damaged, the gasket should be reused.

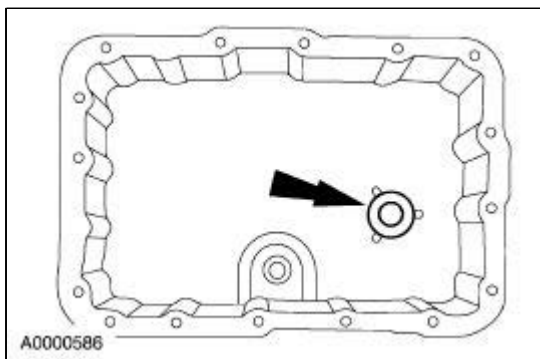
Remove the fluid pan and gasket.



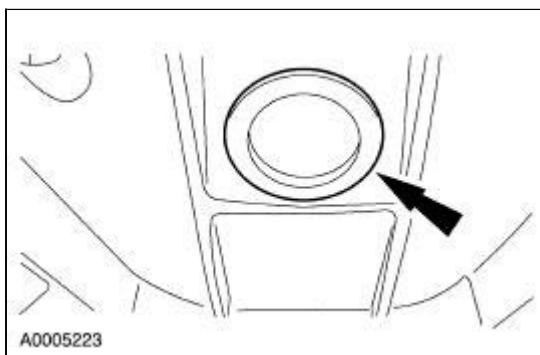
6. Remove and discard the transmission fluid filter.



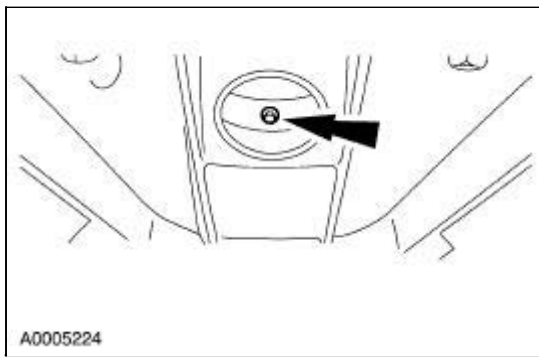
7. Clean and inspect the transmission fluid pan and magnet.



8. Remove the converter housing plug.



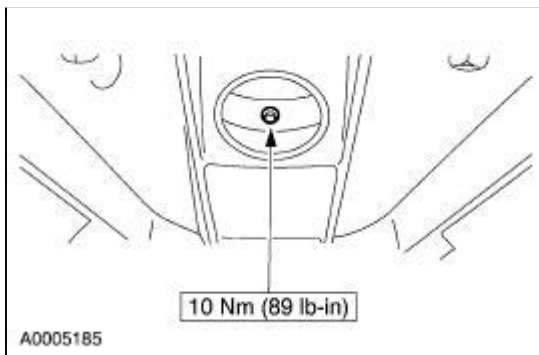
9. Remove the drain plug.



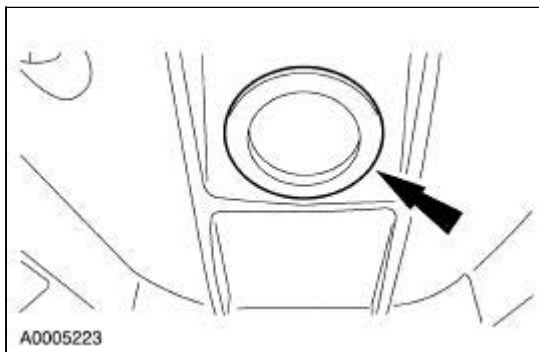
Installation

1. **NOTE:** A new converter drain plug must be used to prevent leakage.

Install the drain plug.



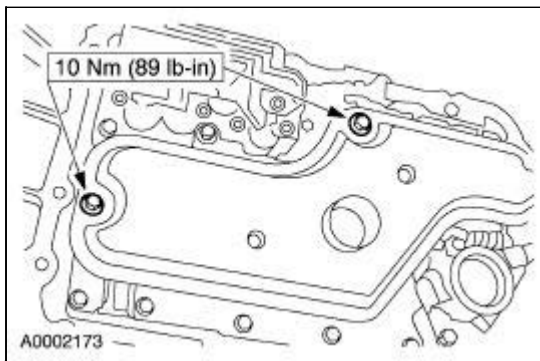
2. Install the converter housing access plug.



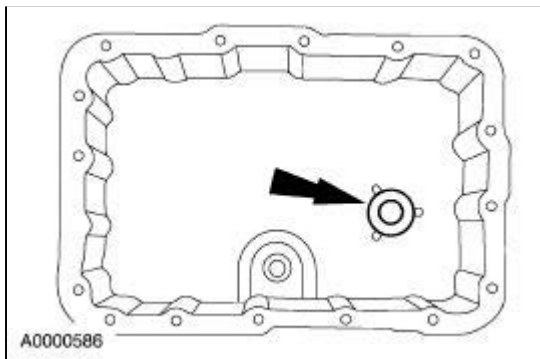
3.  **CAUTION:** Lubricate the fluid filter O-ring seals with clean automatic transmission fluid or seals may be damaged.

NOTE: Make sure that the fluid filter O-ring seals are correctly seated on the filter.

Lubricate the seals and install the transmission fluid filter.

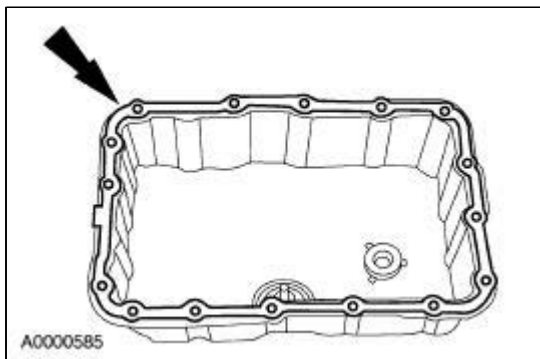


4. Install the oil pan magnet in the transmission fluid pan.

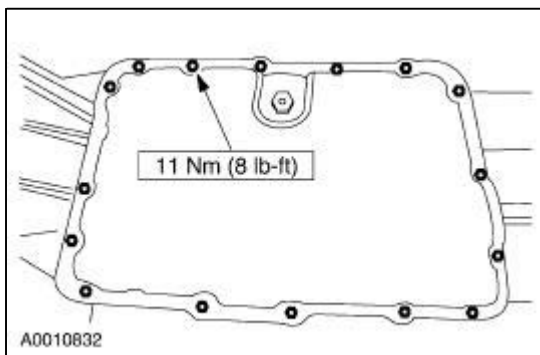


5. **NOTE:** The transmission fluid pan gasket is reusable, clean and inspect for damage; if not damaged, the gasket should be reused.

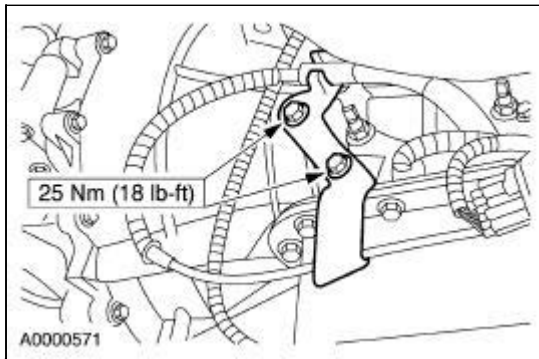
Install the transmission fluid pan and gasket and loosely install the screws.



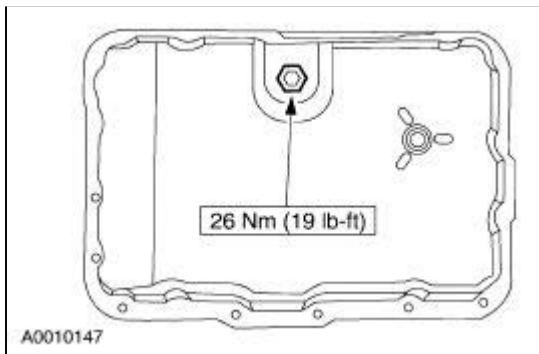
6. Using a crisscross sequence, tighten the screws.



7. Install the shifter cable bracket.



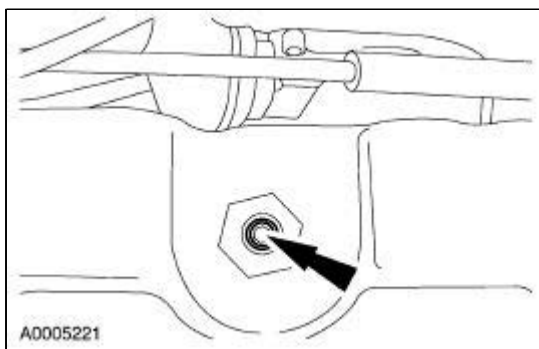
8. Install the drain plug.



9. **NOTE:** It will be necessary to hold the drain plug (larger plug) with a wrench when removing the fluid level indicator plug.

NOTE: Use 3/16 inch Allen key to remove the fluid level indicator plug.


Remove the fluid level indicator plug.



10. Carry out fluid level check. For additional information, refer to [Transmission Fluid Level Check](#) in this section.
-

Main Control —Valve Body

Special Tool(s)

 ST1639-A	Aligner, Valve Body 307-334 (T95L-70010-C) (2 req'd)
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Material

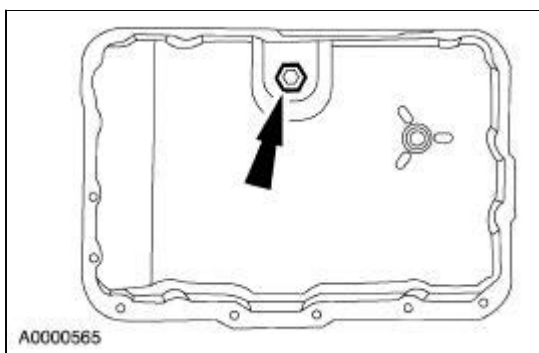
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

Removal

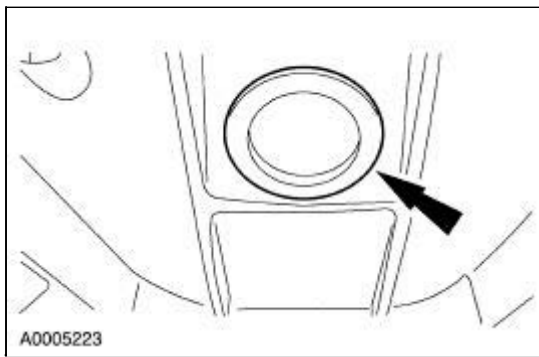
1. **NOTE:** When the battery is disconnected or a new battery installed, certain transmission operating parameters can be lost. The powertrain control module (PCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed, or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).

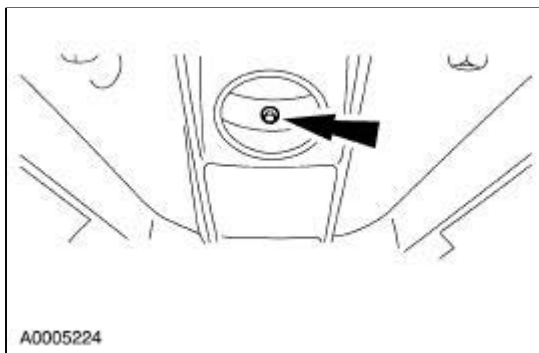
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Drain the transmission fluid.



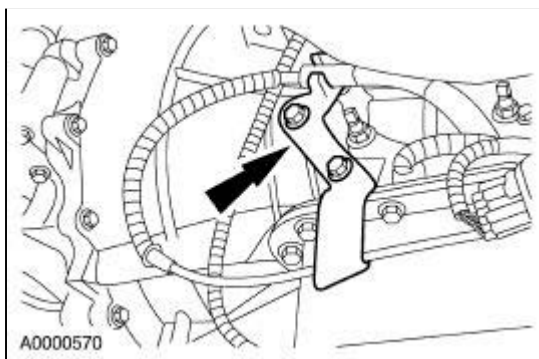
4. Remove the converter housing plug.



5. Remove the drain plug.

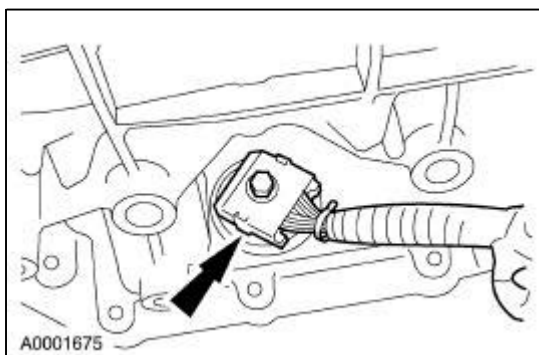


6. Remove the shifter cable bracket.

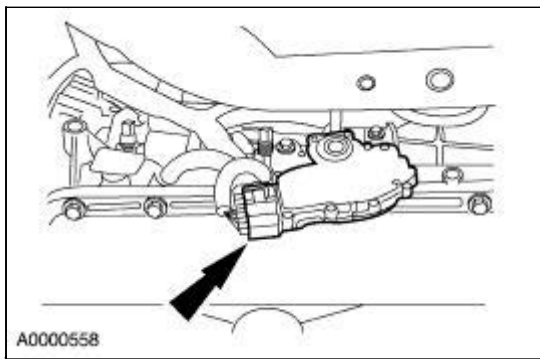


7. **NOTE:** Clean the area around connector to prevent contamination of the solenoid body connector.

Disconnect the transmission connector.

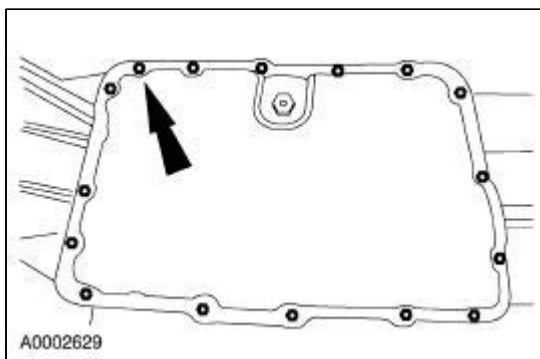


8. Disconnect the digital transmission range (TR) sensor connector.

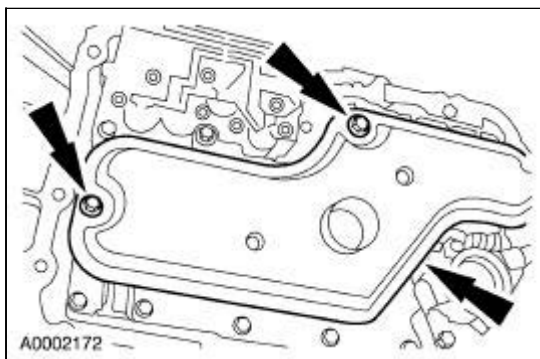


9. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect for damage. If not damaged, the gasket should be reused.

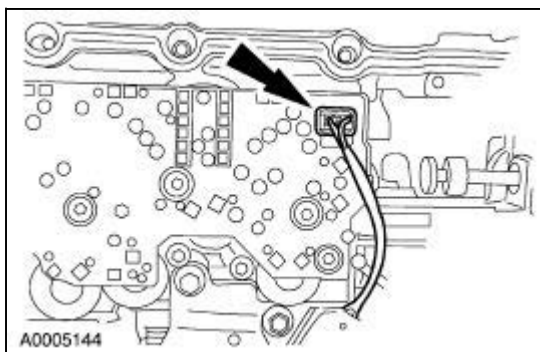
Remove the transmission fluid pan and gasket.



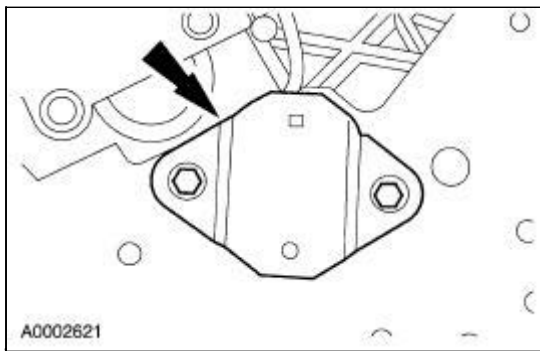
10. Remove the transmission fluid filter.



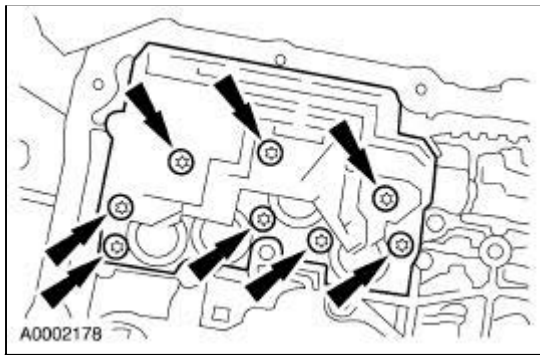
11. Disconnect the reverse pressure switch connector.



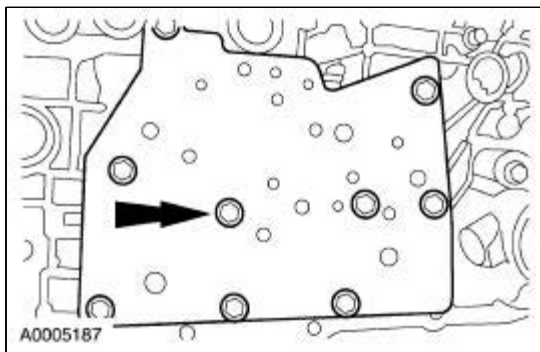
12. Remove the reverse pressure switch and discard.



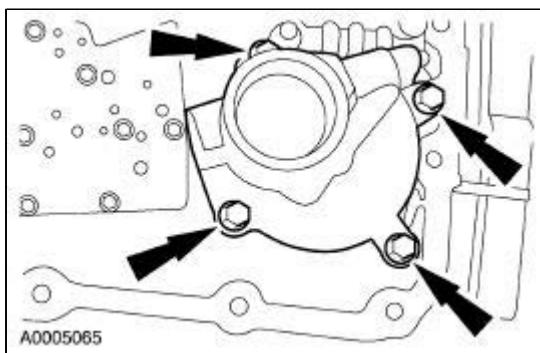
13. Remove the solenoid body.



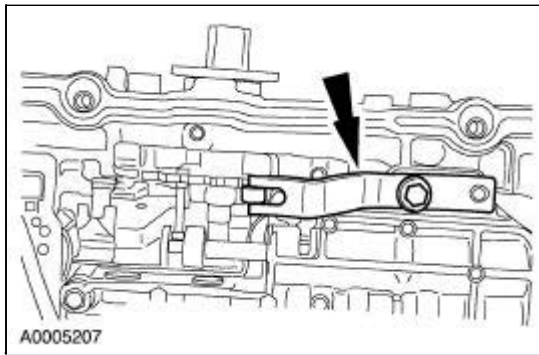
14. Remove the valve body cover plate and gasket.



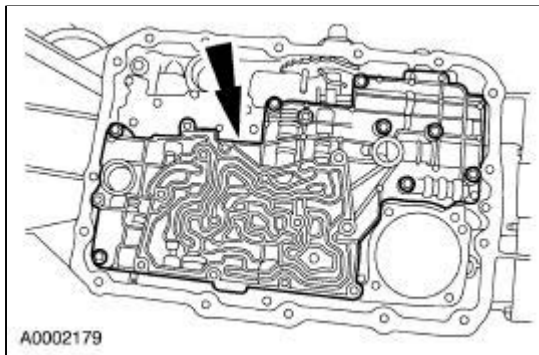
15. Remove the reverse servo.



16. Remove the manual control valve detent spring.

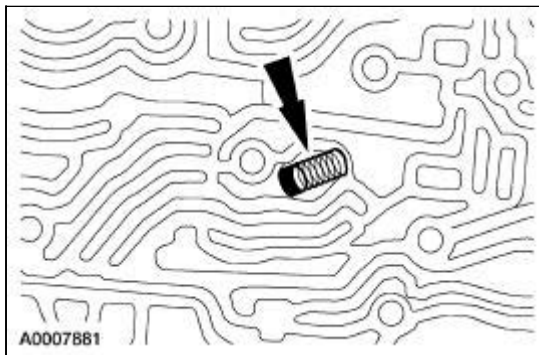


17. Remove the main control valve body, separator plate and gasket.




18. **NOTE:** The intermediate clutch spring and seal will fall out of the case.

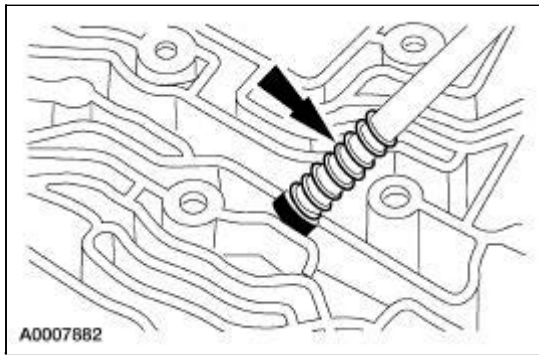
Remove the intermediate clutch spring and seal.



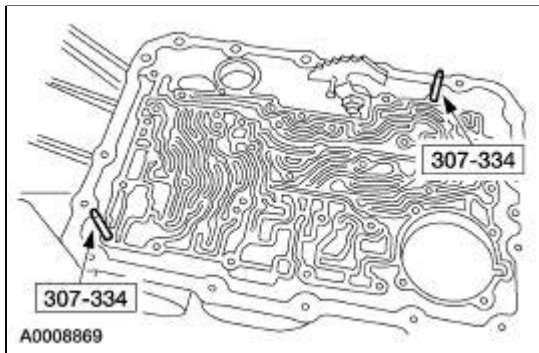
Installation

1.  **CAUTION:** The intermediate clutch fluid inlet tube seal and spring must be correctly seated in the case. Failure to correctly seat the inlet tube seal and spring will cause an internal fluid leak and transmission damage.

Using a drift punch, correctly install and seat the intermediate clutch fluid inlet tube seal and spring into the case.

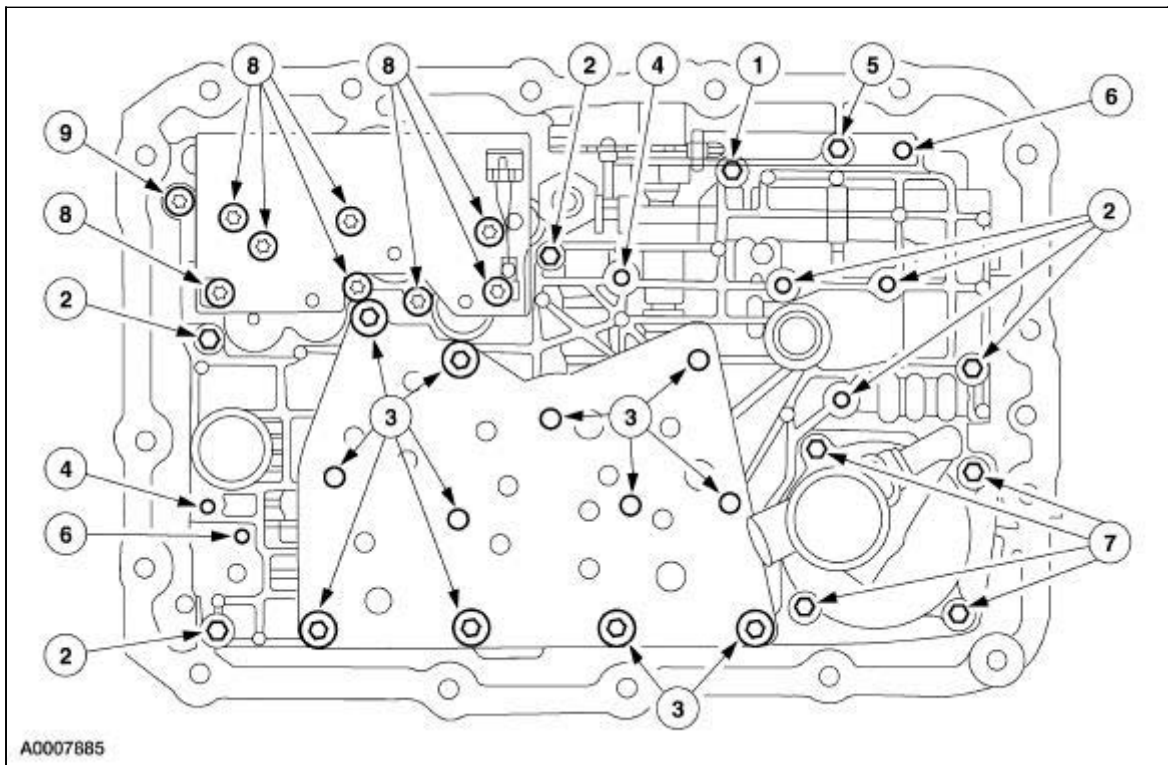


2. Install the special tools into the transmission case.

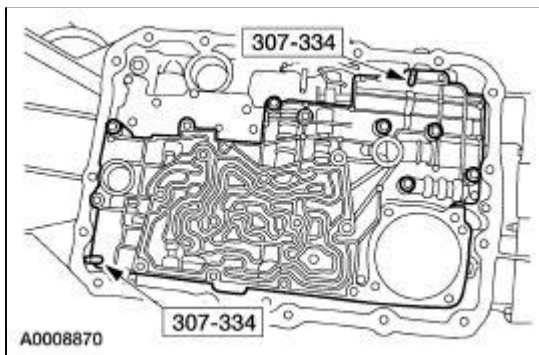


3. Refer to the following chart for bolt locations:

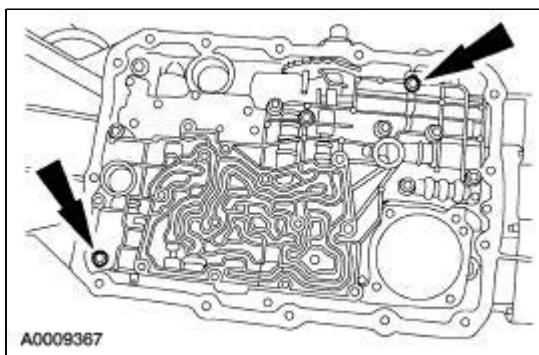
Item	Part Number	Part Name	Size
1	W702791-S300	Hex bolt	M6 X 27
2	W500103-S1300	Hex bolt	M6 X 45
3	W703133-S1300	Hex bolt	M6 X 52
4	W705559-S300	Hex bolt	M6 X 82.2
5	W500100-S300	Hex bolt	M6 X 30
6	W701099-S1430	Cap int lob screw	M6 X 20
7	W703135-S1300	Hex bolt	M6 X 70
8	W703189-S1430	Cap int lob 8	M6 X 63
9	W702921-S430	Cap int lob 8	M6 X 25



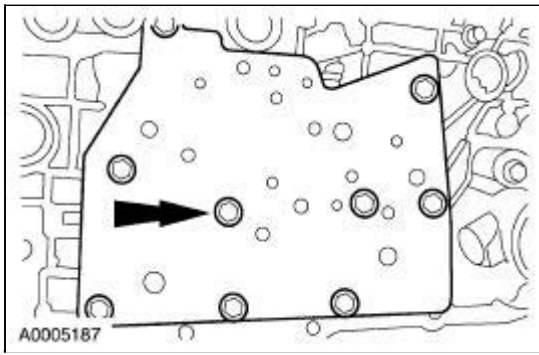
4. Install the main control valve body and loosely install the screws.



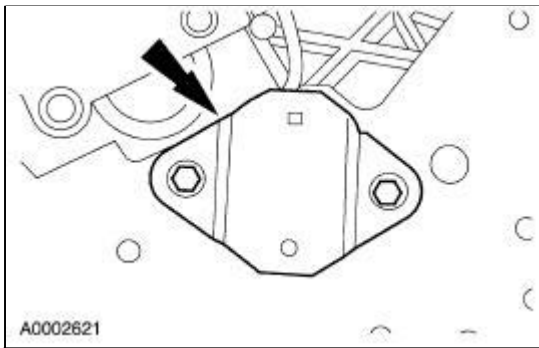
5. Remove the special tools and loosely install the screws.



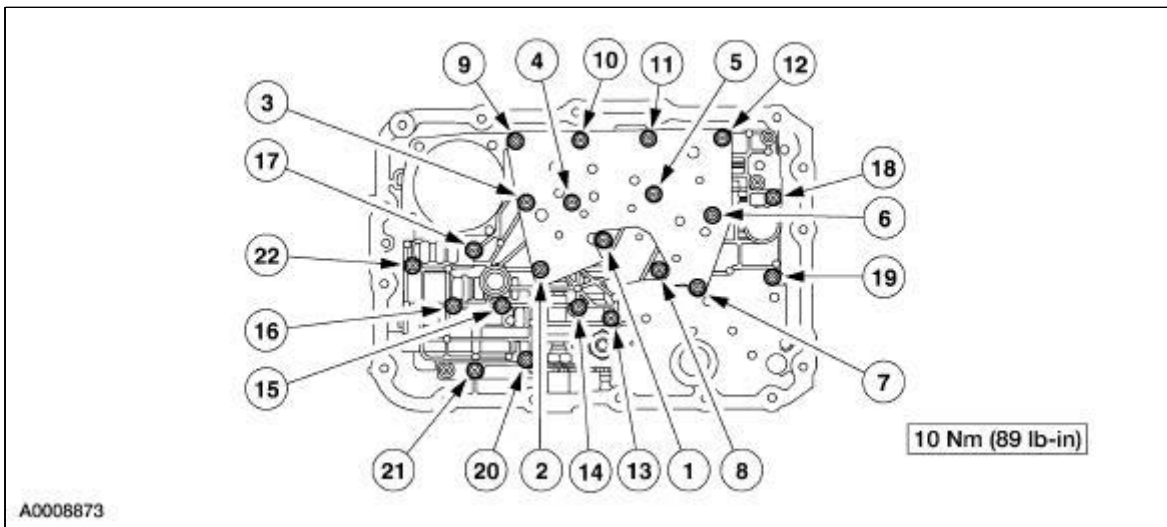
6. Install the valve body cover plate and gasket and loosely install the screws.



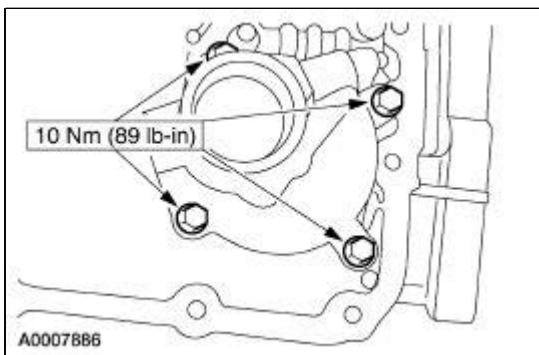
7. Install the reverse pressure switch and loosely install the screws.



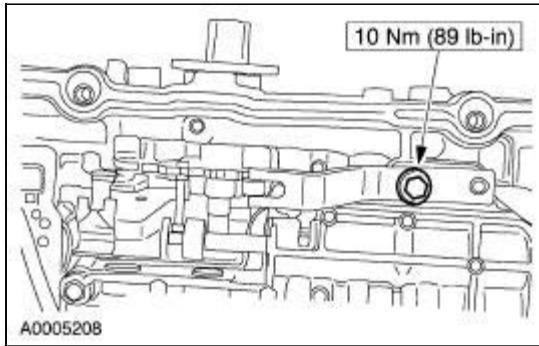
8. Tighten the screws in the sequence shown.



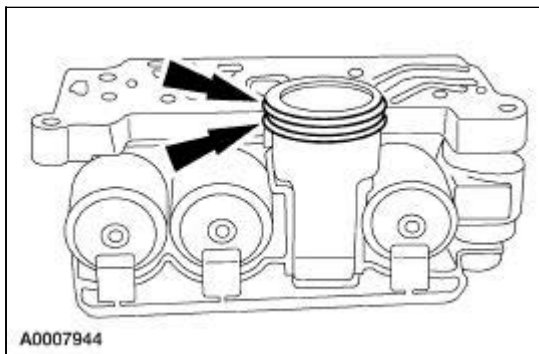
9. Install the reverse servo, using a crisscross pattern to tighten the bolts.



10. Install the manual control valve detent spring.

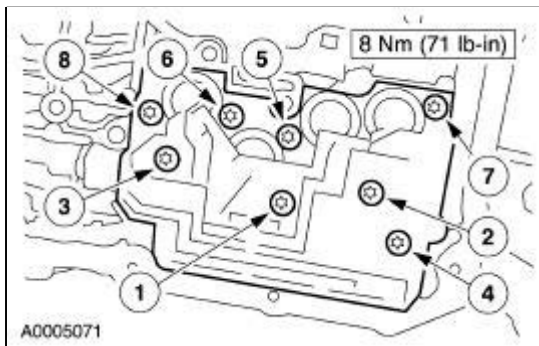


11. Install new O-ring seals on the solenoid body connector. Lubricate the O-ring seals with clean automatic transmission fluid.

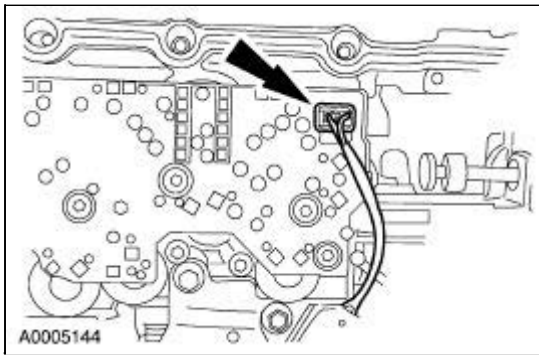


12.  **CAUTION:** Inspect the transmission case bore to make sure it is free of foreign material and not damaged. If it is damaged, transmission leak may occur.

Install the solenoid body. Tighten the bolts in sequence shown.



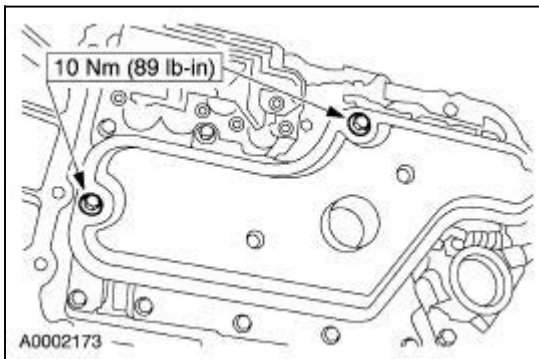
13. Connect the reverse pressure switch connector.



14.  **CAUTION:** Lubricate the fluid filter O-ring seals with clean automatic transmission fluid or seals can be damaged.

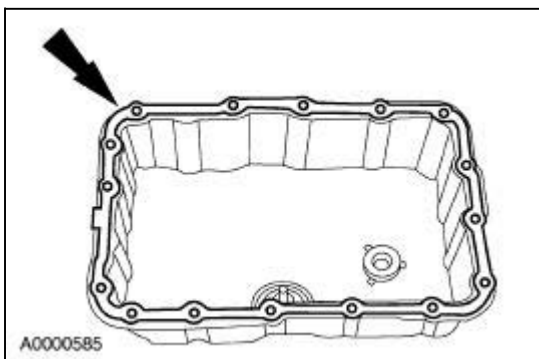
NOTE: Make sure that the fluid filter O-ring seals are correctly seated on the filter.

Lubricate the seals and install the transmission fluid filter.

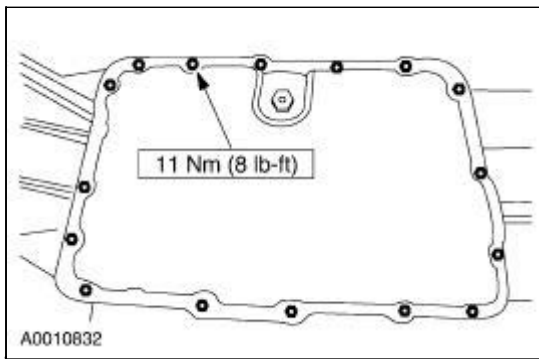


15. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect for damage. If not damaged, the gasket should be reused.

Install the transmission fluid pan and gasket and loosely install the screws.

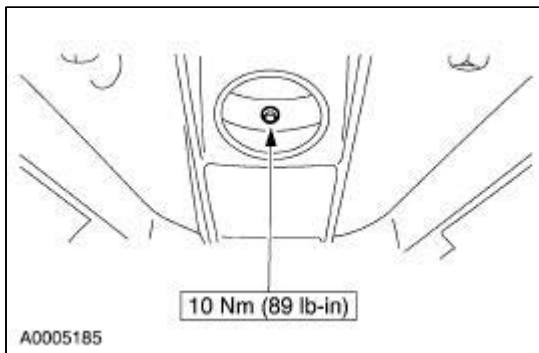


16. Using a crisscross sequence, tighten the screws.

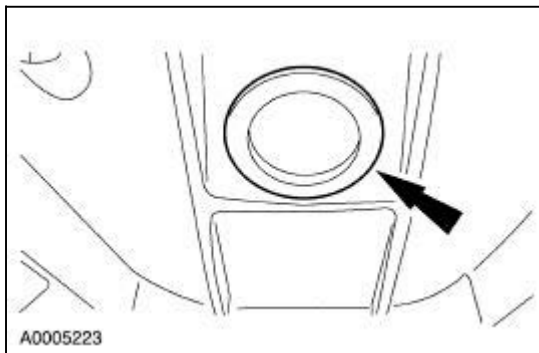


17. **NOTE:** A new converter drain plug must be used to prevent leakage.

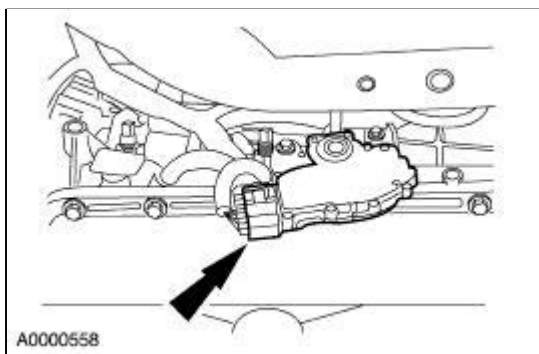
Install the drain plug.




18. Install the converter housing access plug.



19. Reconnect the digital TR sensor connector.



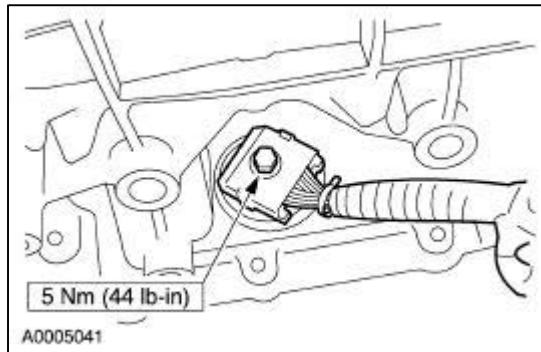
20.  **CAUTION:** Damage to the solenoid body assembly can result if the screw is tightened above specification.

NOTE: Always install new O-ring seals on vehicle harness connector.

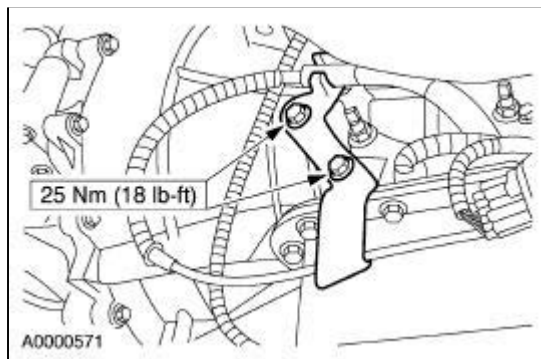
NOTE: Clean the area around connector to prevent contamination of the solenoid body connector.

NOTE: Use petroleum jelly to lubricate the O-ring seals to aid in the installation process.

Install and lubricate new O-ring seals on the transmission connector and connect the connector.



21. Install the shift cable bracket.



22. Lower the vehicle.

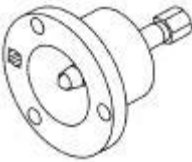
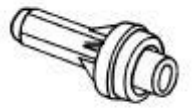

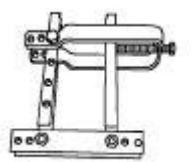

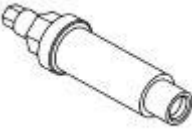
23. **NOTE:** When the battery is disconnected or a new battery installed, certain transmission operating parameters can be lost. The powertrain control module (PCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed, or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Connect the battery ground cable. For additional information, refer to [Section 414-01](#).

24. Fill the transmission to the correct fluid level and check for correct transmission operation. For additional information, refer to [Transmission Fluid Level Check](#) in this section.
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Extension Housing Seal

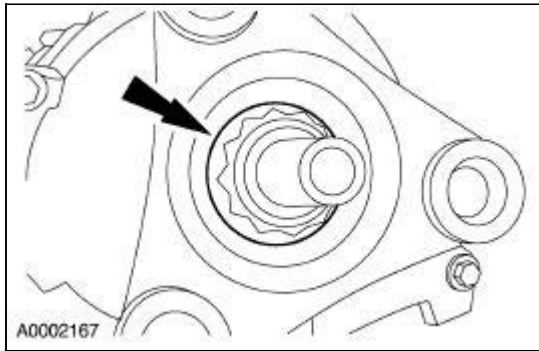
Special Tool(s)

 ST2415-A	Remover, Output Flange 307-408
 ST1791-A	Installer, Transmission Extension Housing Fluid Seal 307-038 (T74P-77052-A)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1758-A	Remover, Torque Converter Fluid Seal 307-309 (T94P-77001-BH)
 ST2416-A	Installer, Output Shaft Flange 307-404
 ST2440-A	Installer, Drive Pinion Flange 205-479

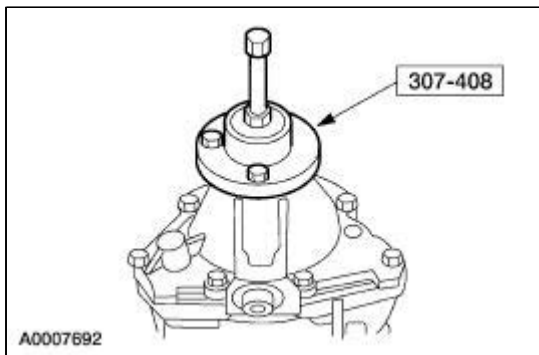
Removal

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the exhaust. For additional information, refer to [Section 309-00](#).
3. Remove the driveshaft. For additional information, refer to [Section 205-01](#).

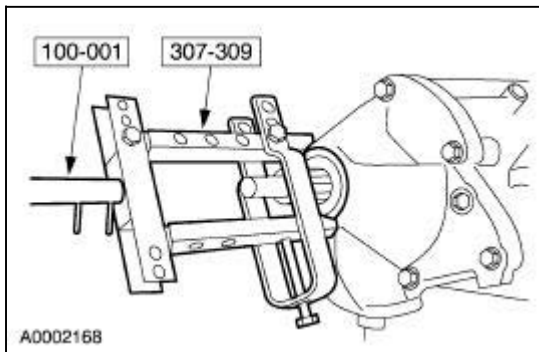
4. Remove the nut and discard.



5. Using the special tool, remove the output flange.

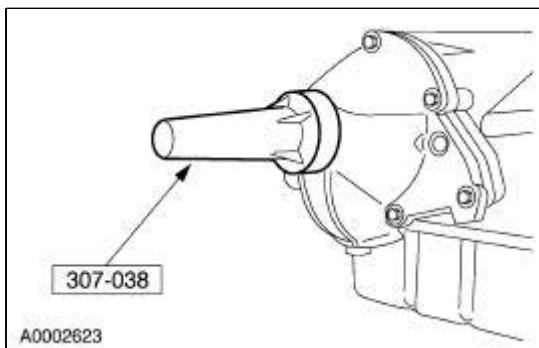


6. Using the special tools, remove the extension housing seal.

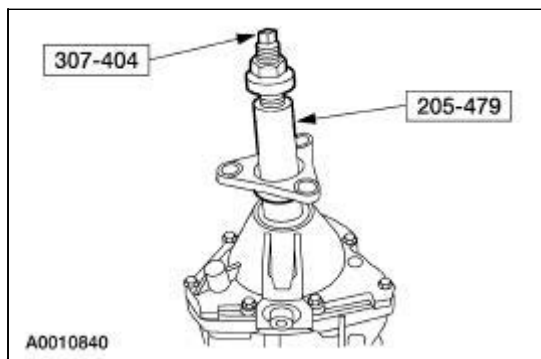


Installation

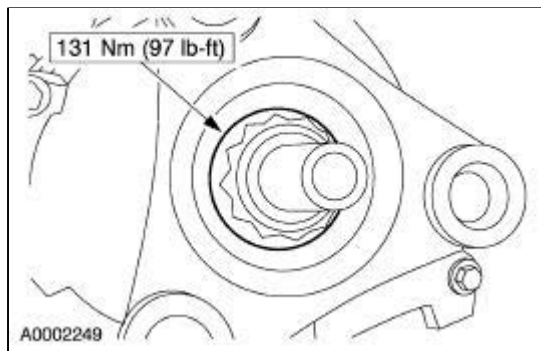
1. Using the special tool, install the extension housing seal.



2. Using the special tools, install the output flange.



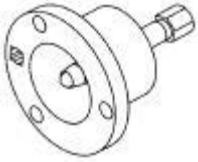

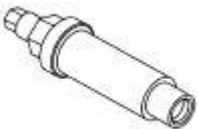
3. Install a new nut.




4. Install the driveshaft. For additional information, refer to [Section 205-01](#).
 5. Install the exhaust. For additional information, refer to [Section 309-00](#).
 6. Fill the transmission to the correct fluid level and check for correct transmission operation. For additional information, refer to [Transmission Fluid Level Check](#) in this section.
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Extension Housing Gasket

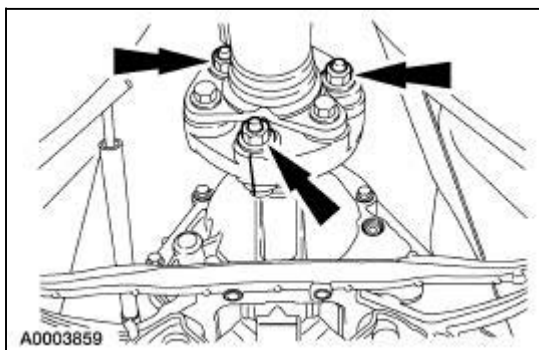
Special Tool(s)

 ST2415-A	Remover, Output Flange 307-408
 ST2416-A	Installer, Output Shaft Flange 307-404
 ST2440-A	Installer, Drive Pinion Flange 205-479

Removal

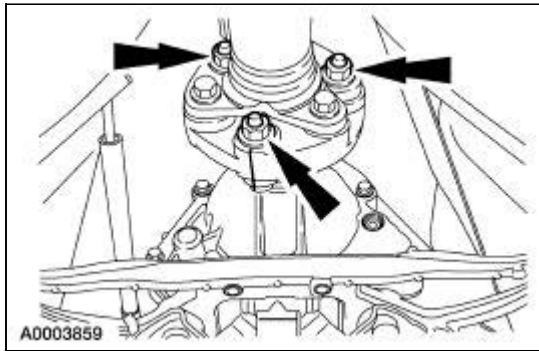
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the exhaust heat shield. For additional information, refer to [Section 309-00](#).
3.  **CAUTION:** Index-mark (color paint) the bolts, washers, nuts, and the flex coupling to the transmission flange and the pinion flange to make sure they are installed in the same location. Components not assembled in their original locations can cause driveshaft imbalance.

Index-mark the front driveshaft pinion flange.

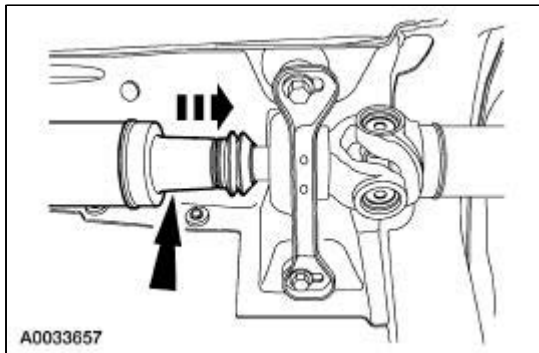


4.  **CAUTION:** Do not remove the bolts retaining the flex coupling to the driveshaft.

Remove the three nuts, washers and bolts.

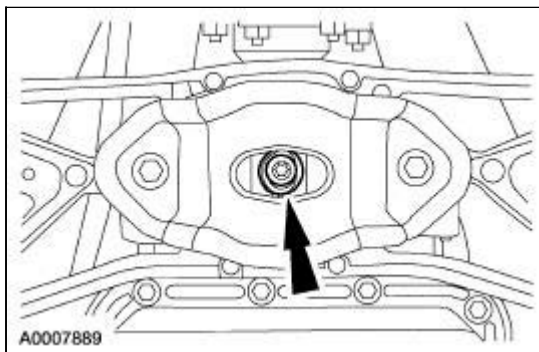


5. Slide the front portion of the driveshaft toward the rear of the vehicle.

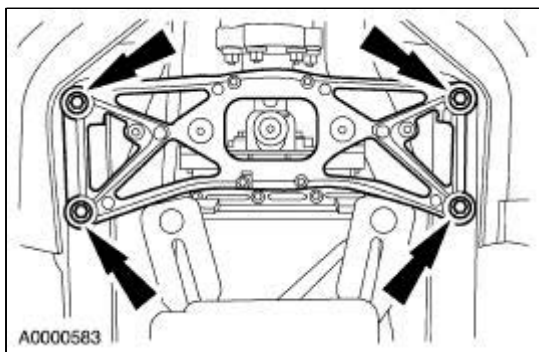


6. Support the transmission with a transmission jack.

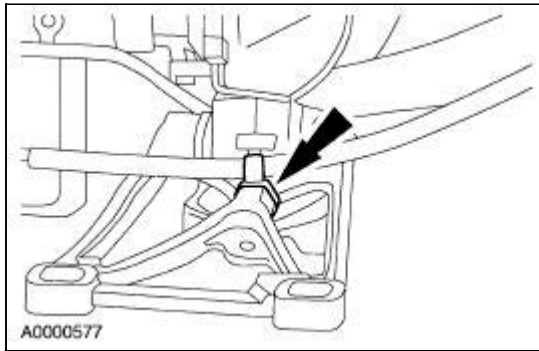
7. Remove the bolt.



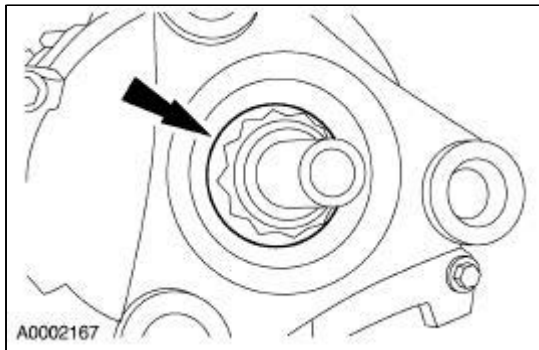
8. Remove the bolts.



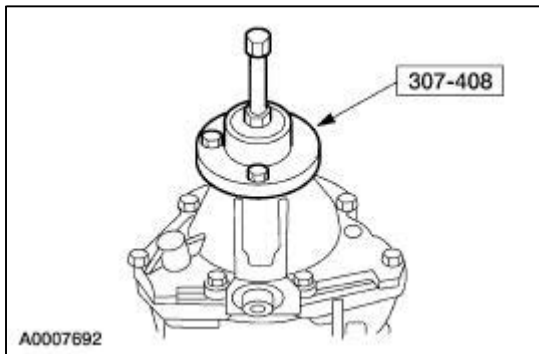
9. Disconnect the shift cable.



10. Remove the nut and discard.

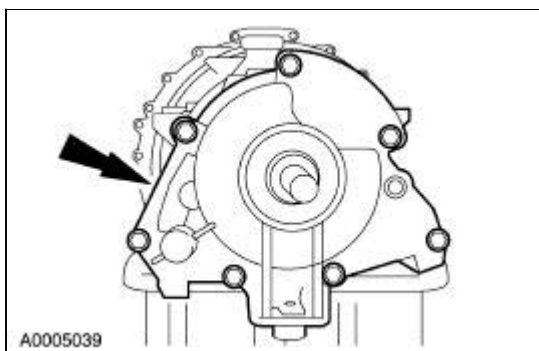


11. Using the special tool, remove the output flange.

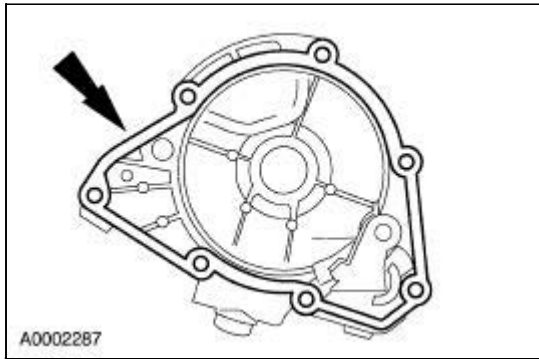


12.  **CAUTION:** The parking pawl, parking pawl return spring and parking pawl shaft could fall out during removal of the extension housing.

Remove the extension housing.

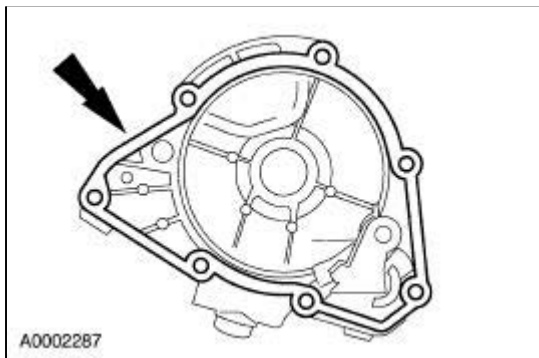


13. Remove and discard the extension housing gasket.



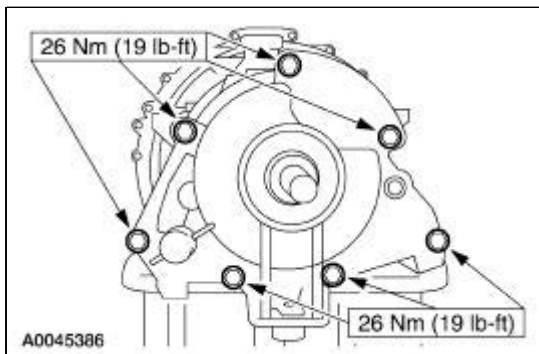
Installation

1. Clean the extension housing and install new extension housing gasket. Make sure that the park pawl is installed correctly.

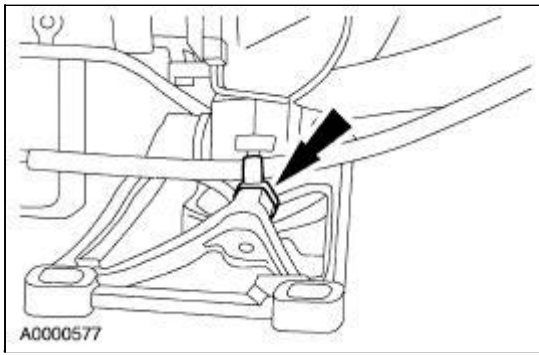


2.  **CAUTION: Make sure the parking lever actuating rod is correctly seated into the case parking rod guide cup.**

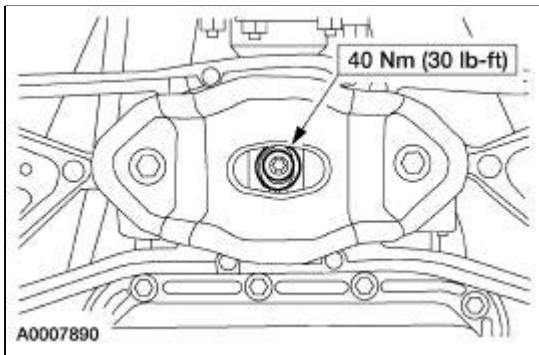
Install the extension housing.



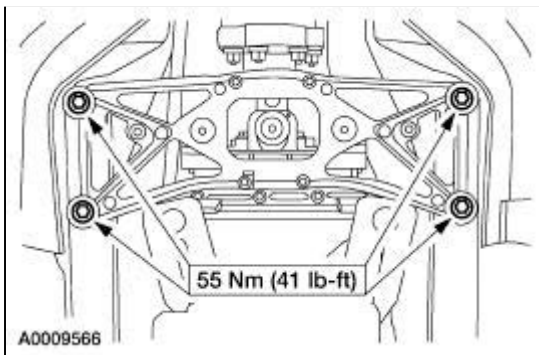
3. Install the shift cable.



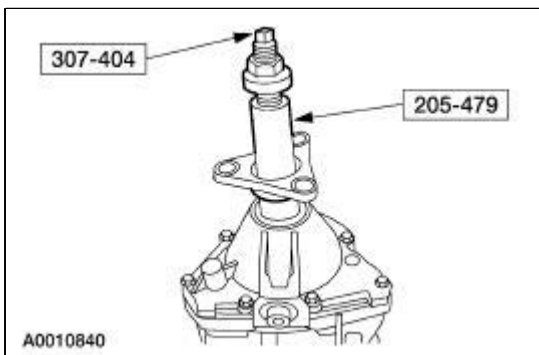
4. Install the rear mount.



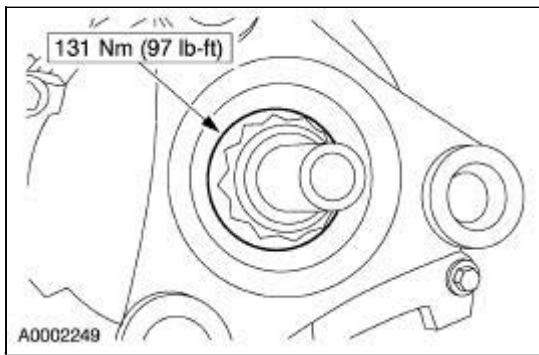
5. Install the rear mount.



6. Using the special tools, install the output flange.

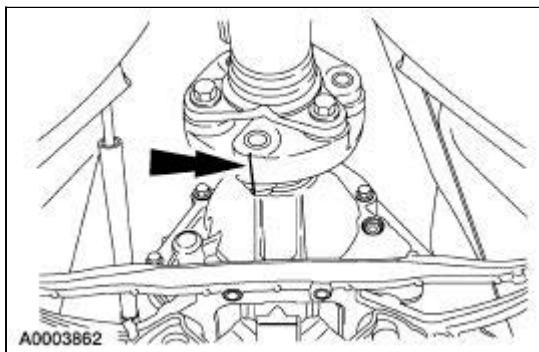



7. Install a new nut.



8.  **CAUTION: Align the index marks or driveshaft imbalance can occur.**

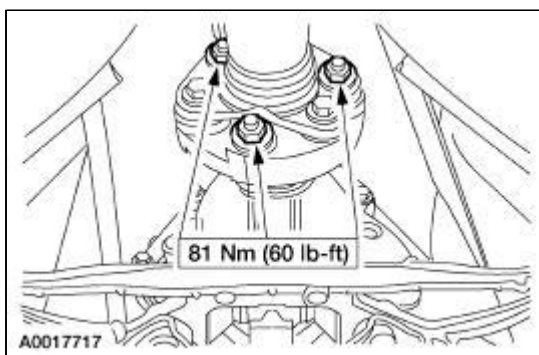
Align the index marks on the pinion flange made during removal and position the driveshaft in place.



9.  **CAUTION: Install the bolts, washers and nuts in their original positions or driveshaft imbalance can occur. Install the driveshaft flex coupling bolts with the head of the bolt seated against the flange, and the nuts seated against the flex coupling. Install the short bolts in the front and the long bolts in the rear.**

Install the bolts, washers and nuts.

- Coat the nut and bolt threads with threadlock sealer.



10. Install the exhaust heat shield. For additional information, refer to [Section 309-00](#).
11. Fill the transmission to the correct fluid level and check for correct transmission operation. For additional information, refer to [Transmission Fluid Level Check](#) in this section.
-

Solenoid Body Assembly

Material

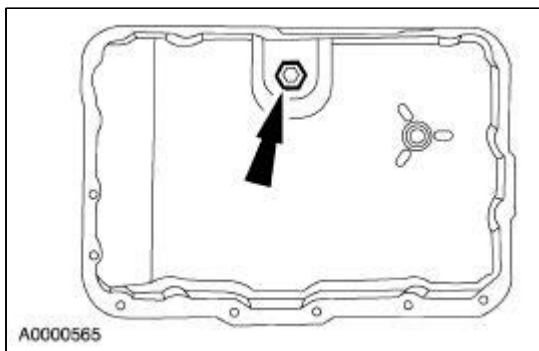
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

Removal

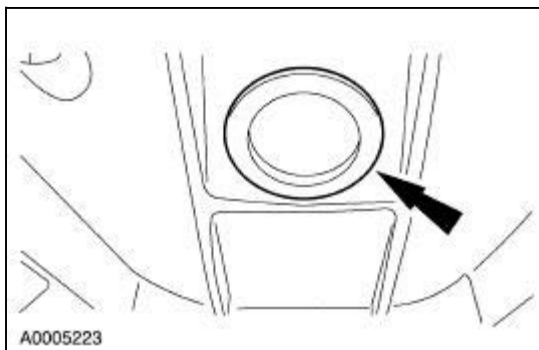
1. **NOTE:** When the battery is disconnected or a new battery installed, certain transmission operating parameters can be lost. The powertrain control module (PCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed, or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).

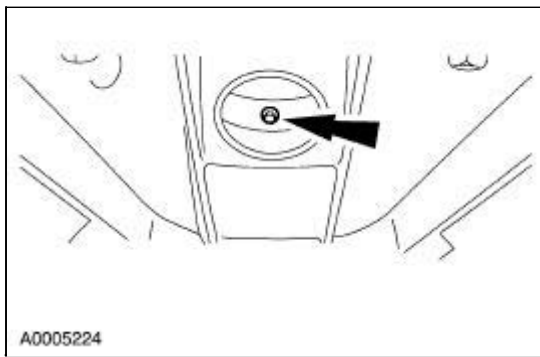
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Drain the transmission fluid.



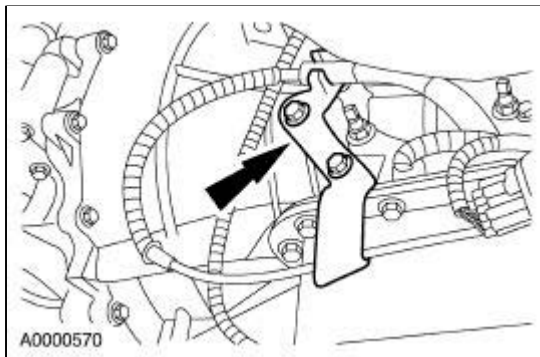
4. Remove the converter housing plug.



5. Remove the drain plug.

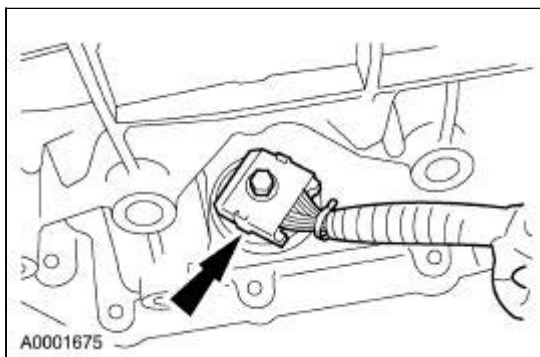


6. Remove the shift cable bracket.

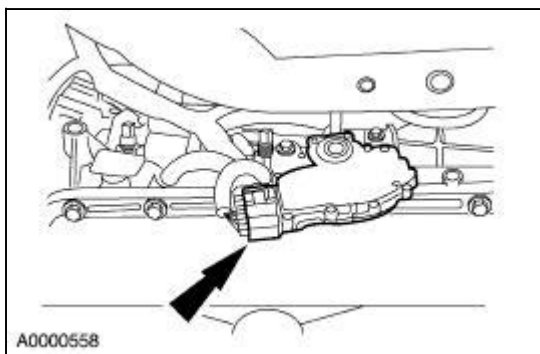


7. **NOTE:** Clean the area around connector to prevent contamination of the solenoid body connector.

Disconnect the transmission connector.



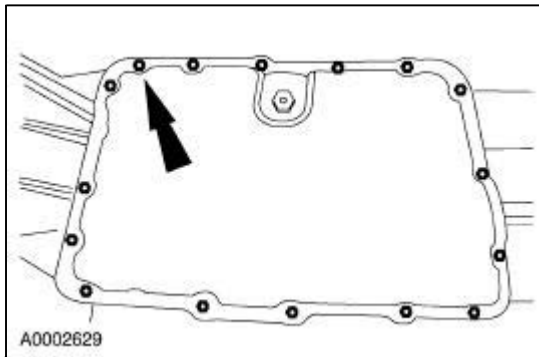
8. Disconnect the digital transmission range (TR) sensor connector.



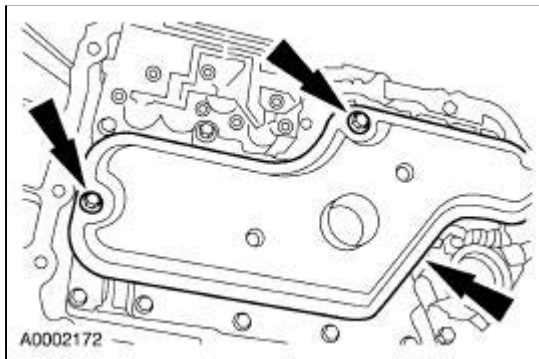
9. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect for damage. If not

damaged, the gasket should be reused.

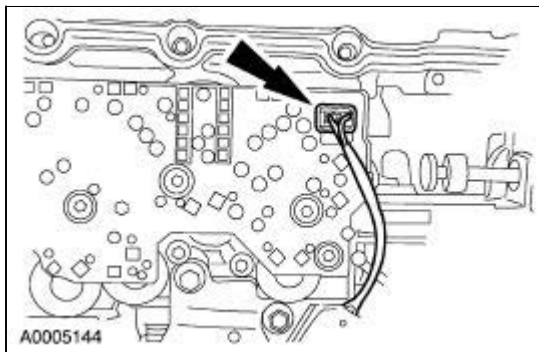
Remove the transmission fluid pan and gasket.



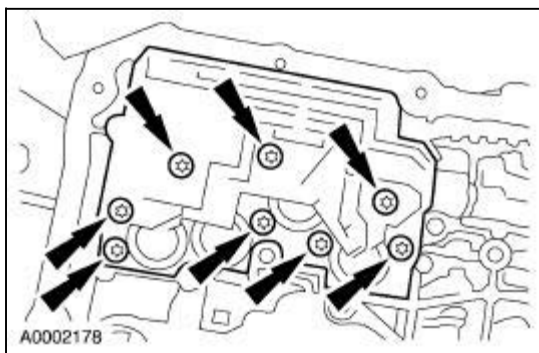
10. Remove the transmission fluid filter.



11. Disconnect the reverse pressure switch connector.

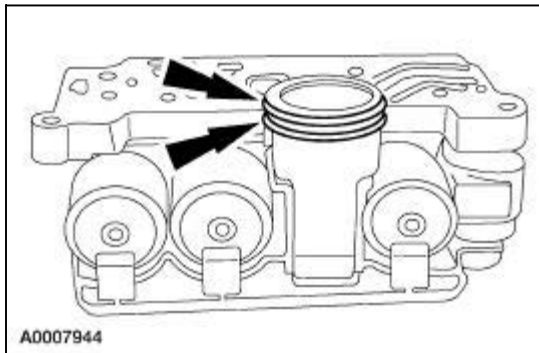



12. Remove the solenoid body.



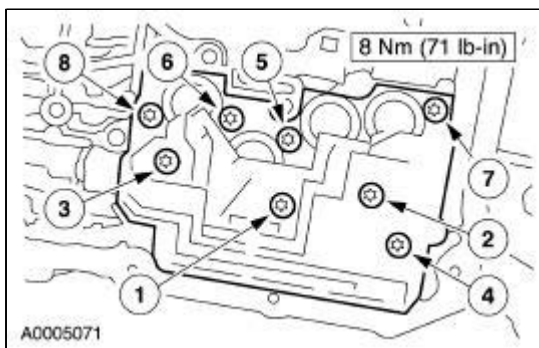
Installation

1. Install new O-ring seals on the solenoid body connector. Lubricate the O-ring seals with clean automatic transmission fluid.

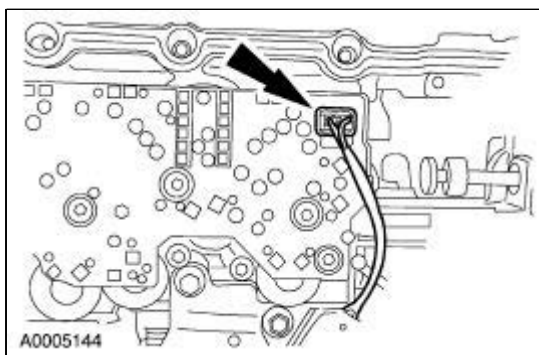


2.  **CAUTION:** Inspect the transmission case bore to make sure it is free of foreign material and not damaged. If damaged, a transmission leak can result.

Install the solenoid body. Tighten the bolts in sequence shown.



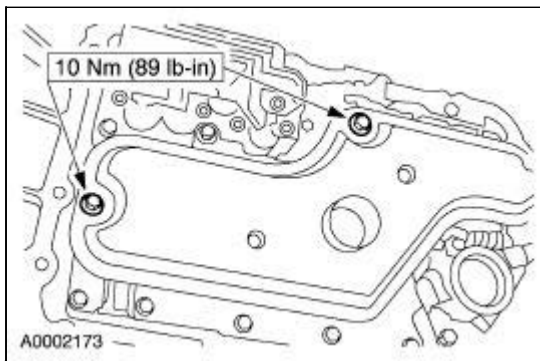
3. Connect the reverse pressure switch connector.



4.  **CAUTION:** Lubricate the fluid filter O-ring seals with clean automatic transmission fluid or seals may be damaged.

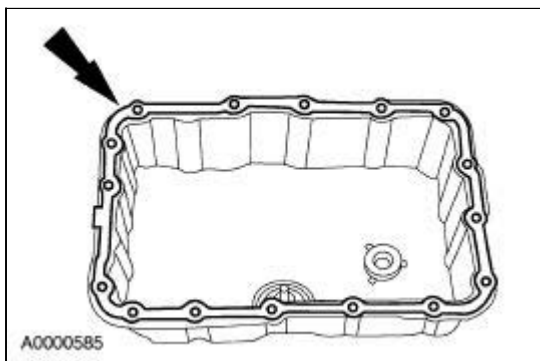
NOTE: Make sure that the fluid filter O-ring seals are correctly seated on the filter.

Lubricate the seals and install the transmission fluid filter.

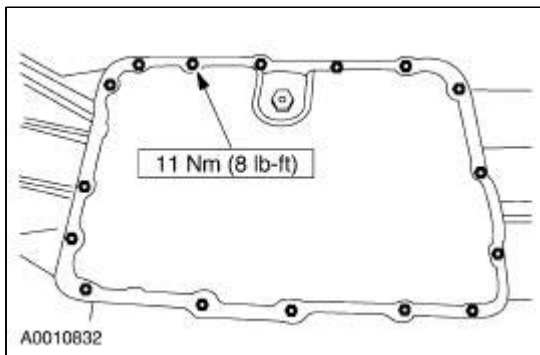


5. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect for damage. If not damaged, the gasket should be reused.

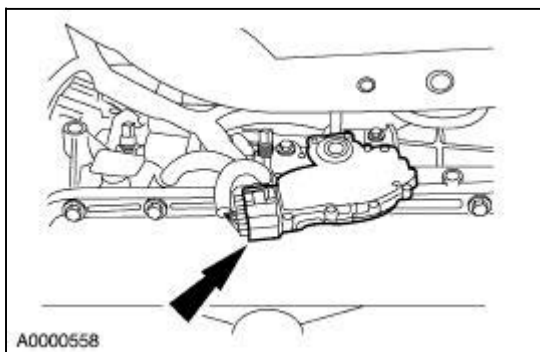
Install the transmission fluid pan and gasket and loosely install the screws.



6. Using a crisscross sequence, tighten the screws.

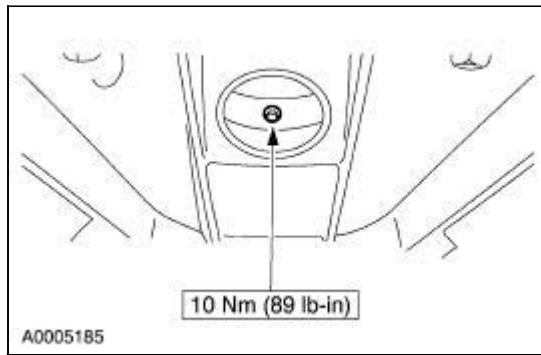


7. Reconnect the digital TR sensor connector.

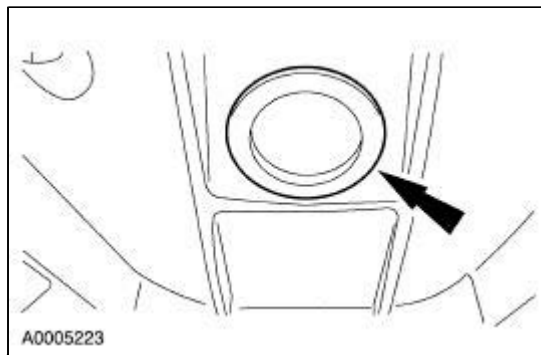



8. **NOTE:** A new converter drain plug must be used to prevent leakage.

Install the drain plug.



9. Install the converter housing access plug.



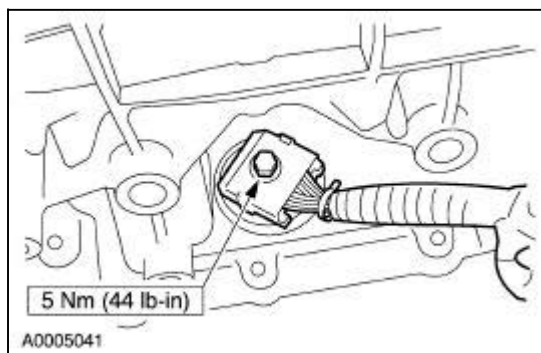
10.  **CAUTION:** Damage to the solenoid body assembly can result if the screw is tightened above the specification.

NOTE: Always install new O-ring seals on vehicle harness connector.

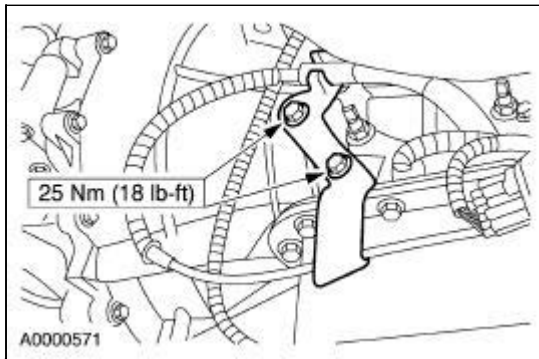
NOTE: Clean the area around connector to prevent contamination of the solenoid body connector.

NOTE: Use petroleum jelly to lubricate the O-ring seals to aid in the installation process.

Install and lubricate new O-ring seals on the transmission connector and connect the connector.



11. Install the shift cable bracket.



12. **NOTE:** When the battery is disconnected or a new battery installed, certain transmission operating parameters can be lost. The powertrain control module (PCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed, or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Connect the battery ground cable. For additional information, refer to [Section 414-01](#).

13. Fill the transmission to the correct fluid level and check for correct transmission operation. For additional information, refer to [Transmission Fluid Level Check](#) in this section.
-

Digital Transmission Range (TR) Sensor

Special Tool(s)

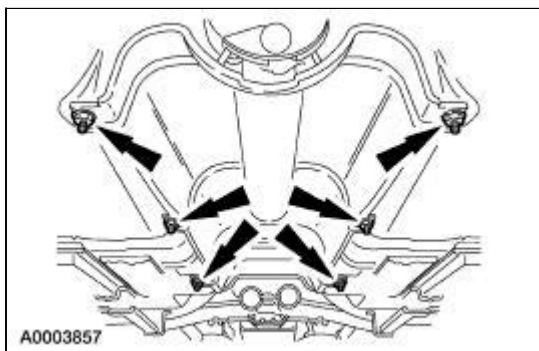
 ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)
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Material

Item	Specification
Premium Long Life Grease XG-1-C	ESA-M1C75-B
Threadlock and Sealer E2FZ-19554-B	WSK-M2G351-A6

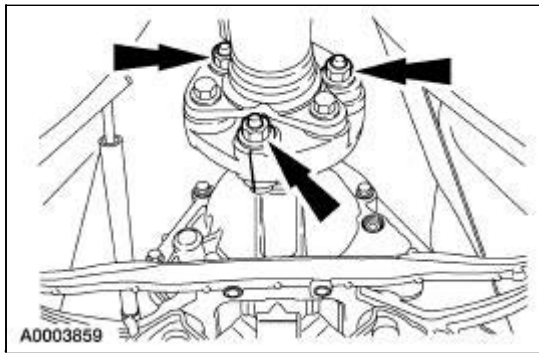
Removal

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the three-way catalytic converter. For additional information, refer to [Section 309-00](#).
3. Remove the eight retainers and the heat shield.

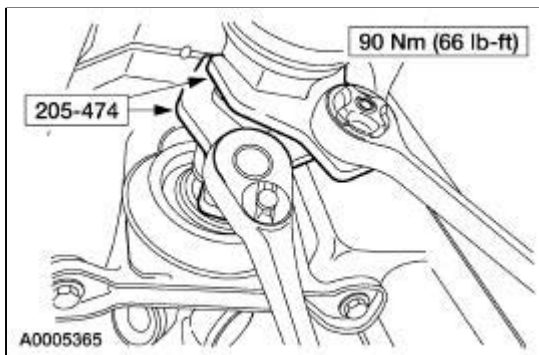


4.  **CAUTION:** Index-mark (color paint) the bolts, washers, nuts, and the flex coupling to the transmission flange and the pinion flange to assure assembly in the exact same location. Components not assembled in their original locations can cause driveshaft imbalance.

Index-mark the components.



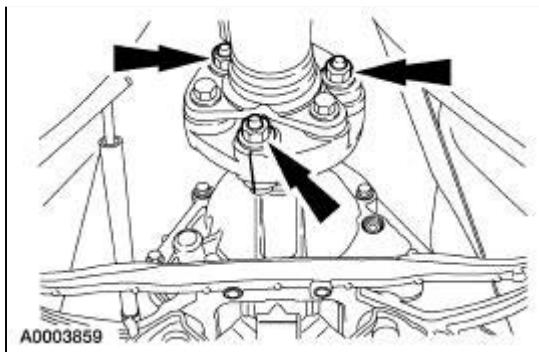
5. Using the special tools, loosen the nut.



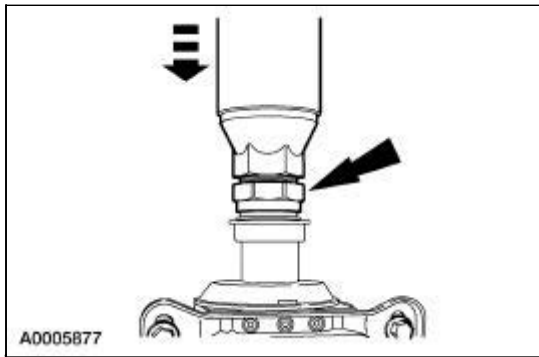
6.  **CAUTION: Do not remove the bolts retaining the flex coupling to the driveshaft.**


NOTE: The bolt heads are serrated. Hold the bolt and loosen the nut.

Remove the three nuts, washers and bolts.



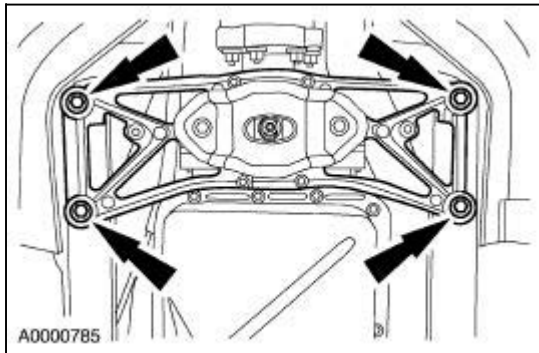
7. Slide the front shaft assembly rearward and support.
 - Tighten the nut to prevent separation of the front and rear shaft assemblies.



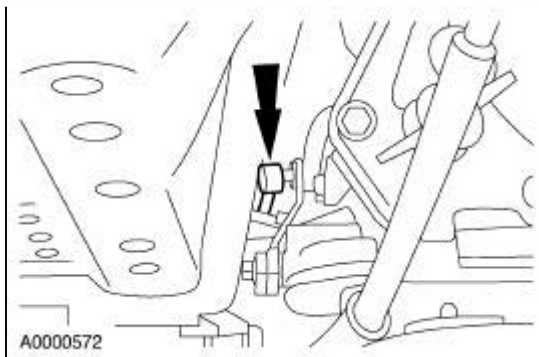
8.  **WARNING: Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions may result in personal injury.**

Support the transmission with a transmission jack.

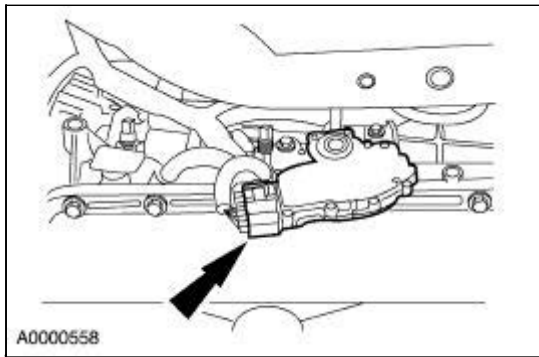
9. Remove the transmission mount and lower the transmission enough to gain access to the digital transmission range (TR) sensor.



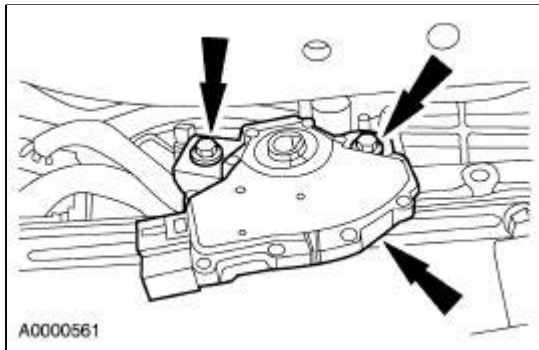
10. Disconnect the shift cable.



11. Disconnect the digital TR sensor connector.



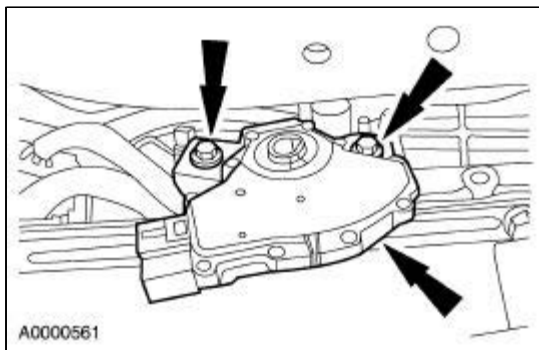
12. Remove the digital TR sensor.



Installation

1.  **CAUTION:** The digital transmission range sensor must fit flush against the boss on the case to prevent damage to the sensor.

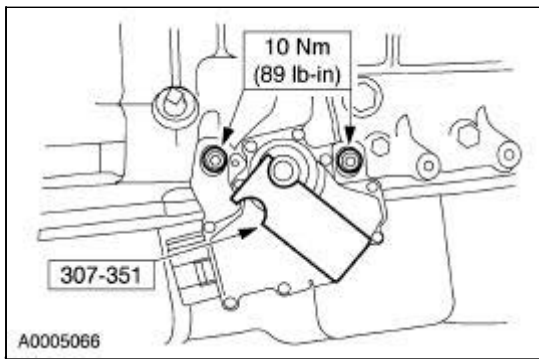
Install the digital TR sensor and loosely install the screws.



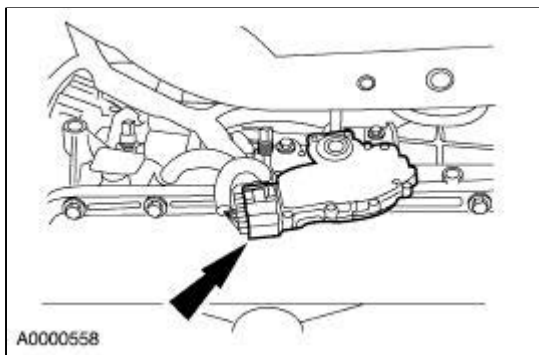
2.  **CAUTION:** Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the Neutral position.

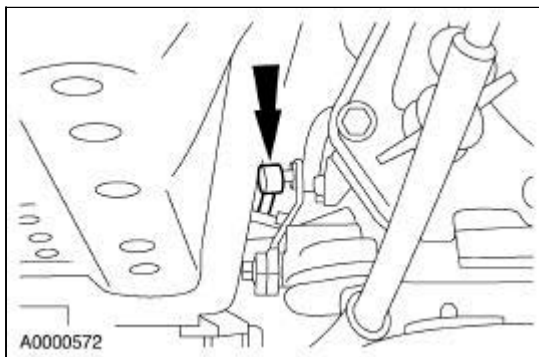
Using the special tool, align the digital TR sensor and tighten the screws in an alternating sequence.



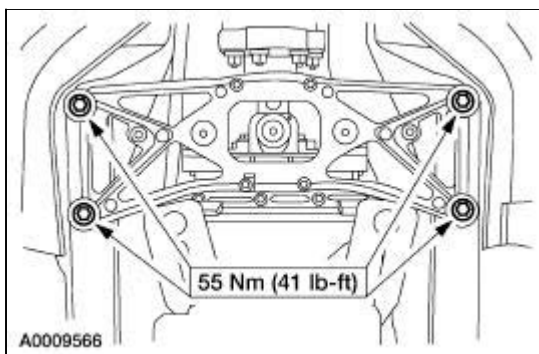
3. Reconnect the digital TR sensor connector.



4. Connect the shift cable.

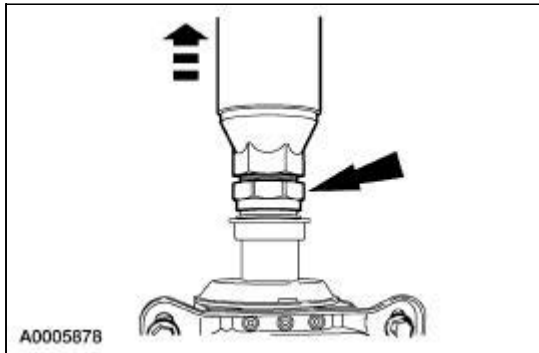


5. Install the rear mount.



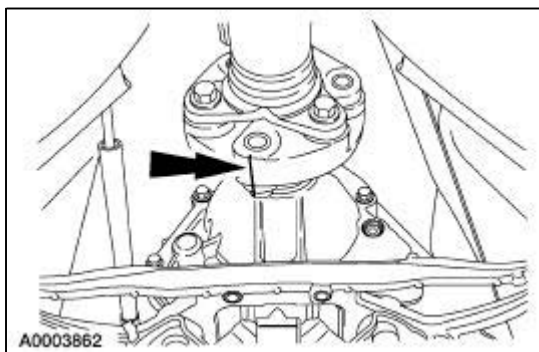
6. Verify that the shift cable is adjusted. For additional information, refer to [Section 307-05](#).
7. Add one gram of grease to both alignment bushing cavities.


8. Loosen the nut and slide the front shaft assembly forward.



9.  **CAUTION: Align the index marks or driveshaft imbalance can occur.**

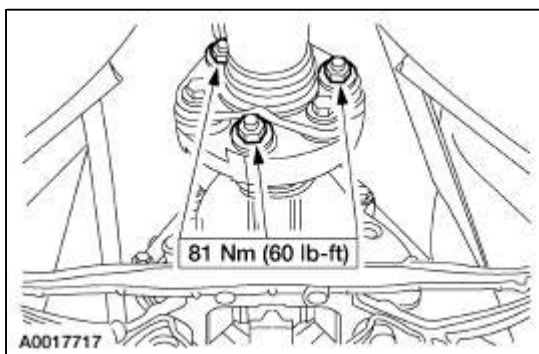
Align index marks and position the alignment bushing on the transmission flange piloting system.



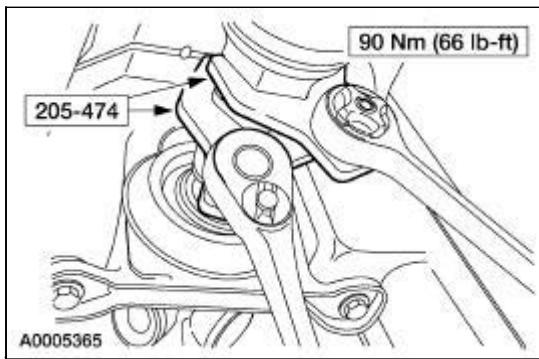
10.  **CAUTION: Install the bolts, washers and nuts in their original positions or driveshaft imbalance can occur. Install the driveshaft flex coupling bolts with the head of the bolt seated against the flange, and the nuts seated against the flex coupling. Install the short bolts in the front and the long bolts in the rear.**

NOTE: The bolt heads are serrated. Hold the bolt and tighten the nut.

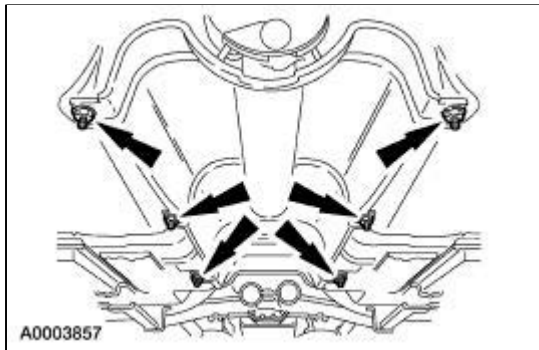
Install the bolts, washers and nuts. Coat the nut and bolt threads with threadlock sealer.



11. Using the special tools, tighten the nut.



12. Install the heat shield.



13. Install the three-way catalytic converter. For additional information, refer to [Section 309-00](#).

14. Lower the vehicle.
-

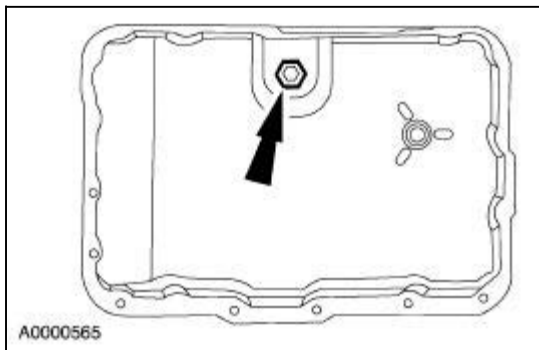
Reverse Servo Assembly

Material

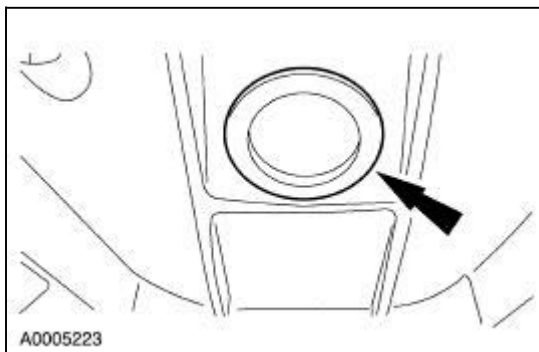
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

Removal

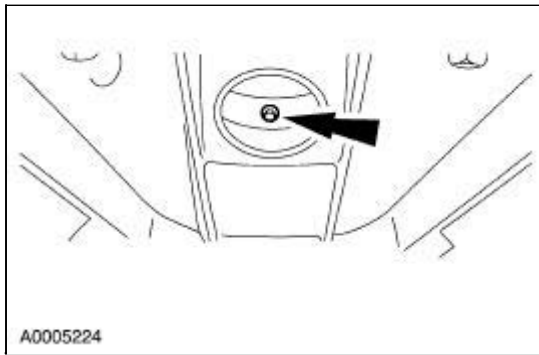
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Drain the transmission fluid.



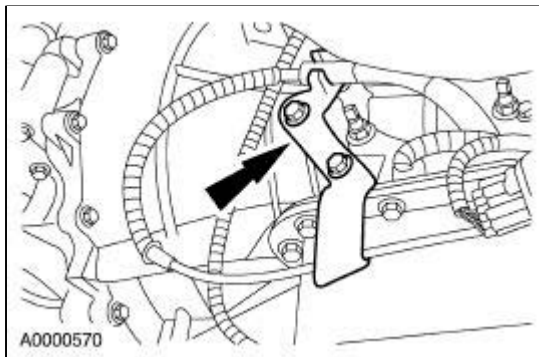
3. Remove the converter housing plug.



4. Remove the drain plug.

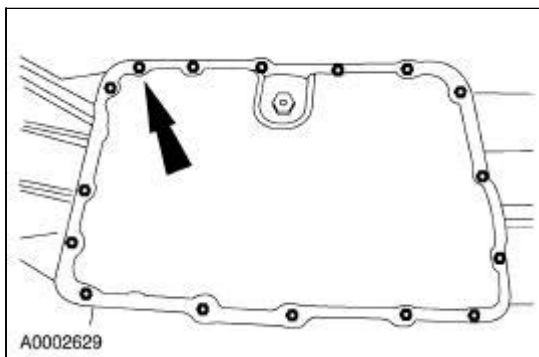


5. Remove the shift cable bracket.

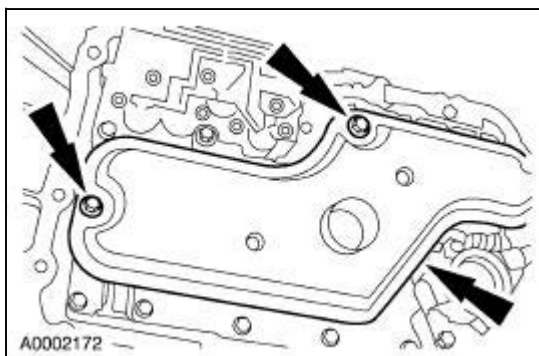


6. **NOTE:** The transmission fluid pan gasket is reusable, clean and inspect for damage; if not damaged, the gasket should be reused.

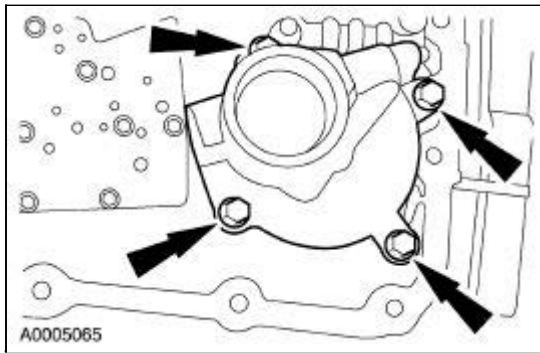
Remove the transmission fluid pan and gasket.



7. Remove the transmission fluid filter.

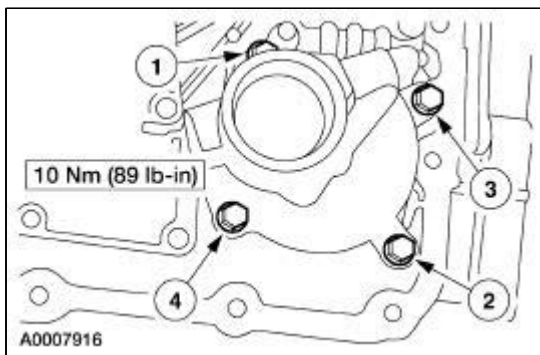


8. Remove the reverse servo.



Installation

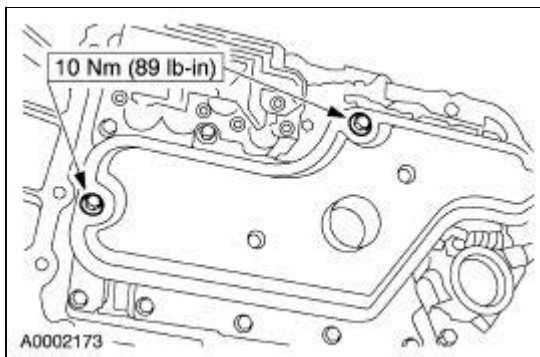
1. Install the reverse servo.
 - Install the bolts in the sequence shown.



2.  **CAUTION:** Lubricate the fluid filter O-ring seals with clean automatic transmission fluid or seals may be damaged.

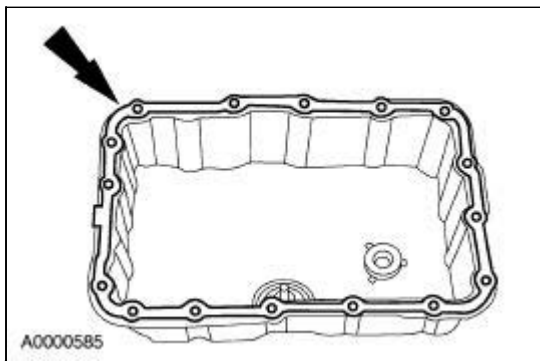
NOTE: Make sure that the fluid filter O-ring seals are correctly seated on the filter.

Lubricate the seals and install the transmission fluid filter.

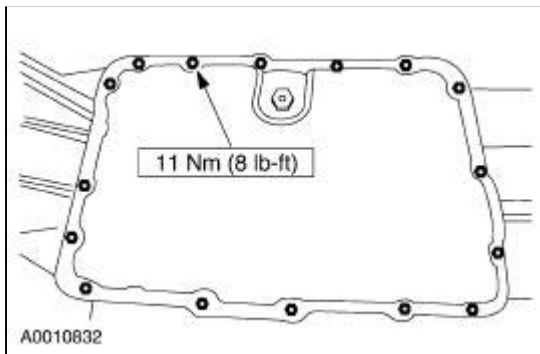


3. **NOTE:** The transmission fluid pan gasket is reusable, clean and inspect for damage; if not damaged, the gasket should be reused.

Install the transmission fluid pan and gasket and loosely install the screws.

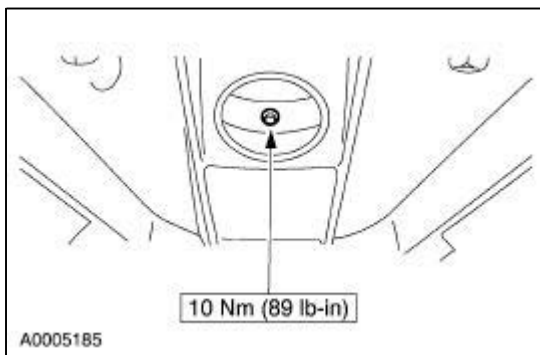


4. Using a crisscross sequence, tighten the screws.

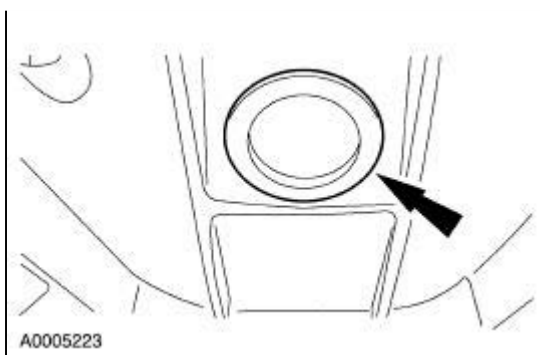


5. **NOTE:** A new converter drain plug must be used to prevent leakage.

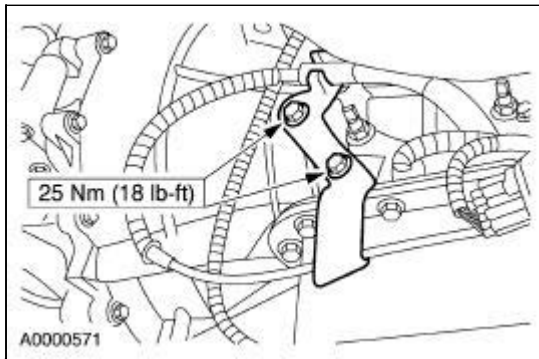
Install the drain plug.



6. Install the converter housing access plug.






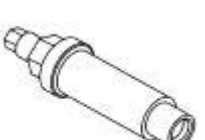
7. Install the shift cable bracket.



8. Lower the vehicle.
 9. Fill the transmission to the correct fluid level and check for correct transmission operation. For additional information, refer to [Transmission Fluid Level Check](#) in this section.
-

Park System

Special Tool(s)

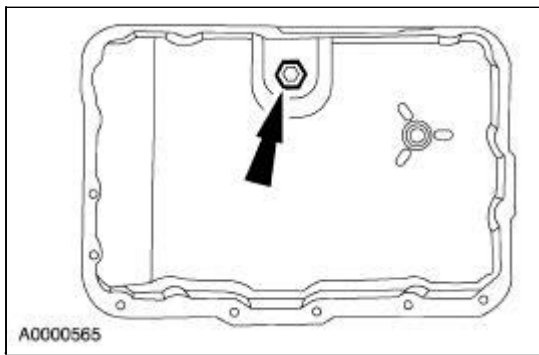
 <p>ST2415-A</p>	<p>Remover, Output Flange 307-408</p>
 <p>ST2416-A</p>	<p>Installer, Output Shaft Flange 307-404</p>
 <p>ST1633-A</p>	<p>Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)</p>
 <p>ST2440-A</p>	<p>Installer, Drive Pinion Flange 205-479</p>

Material

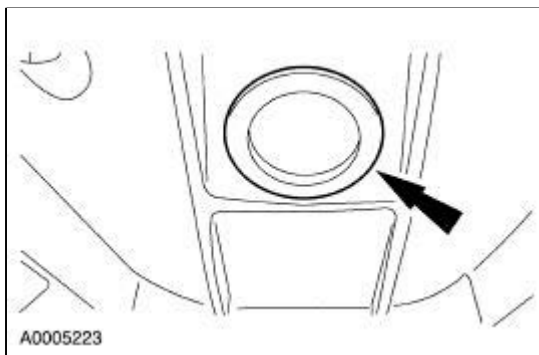
Item	Specification
<p>MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM</p>	<p>MERCON® V</p>

Removal

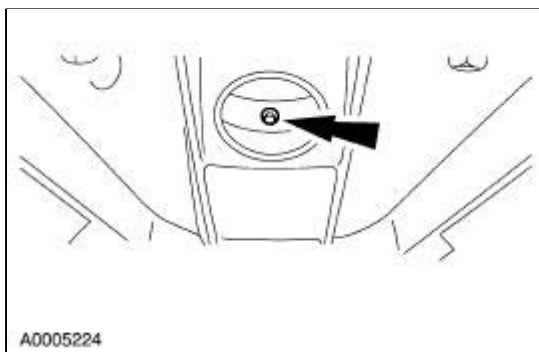
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Drain the transmission fluid.




3. Remove the converter housing plug.



4. Remove the drain plug.

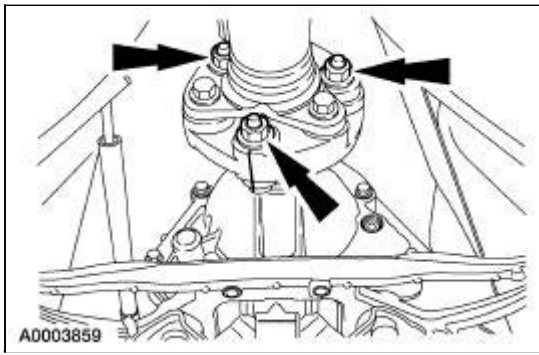


5. Remove the exhaust heat shield. For additional information, refer to [Section 309-00](#).

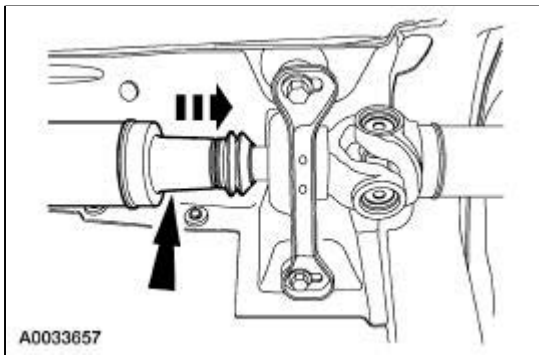
6.  **CAUTION:** Index-mark (color paint) the bolts, washers, nuts, and the flex coupling to the transmission flange and the pinion flange to make sure they are installed in the same location. Components not assembled in their original locations can cause driveshaft imbalance.


 **CAUTION:** Do not remove the bolts retaining the flex coupling to the driveshaft.

Index-mark the front driveshaft pinion flange. Remove the three nuts, washers and bolts.



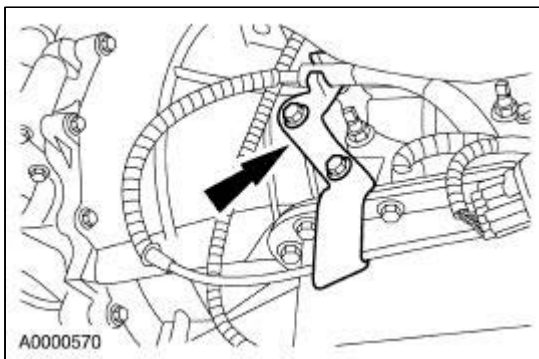
7. Slide the front portion of the driveshaft toward the rear of the vehicle.



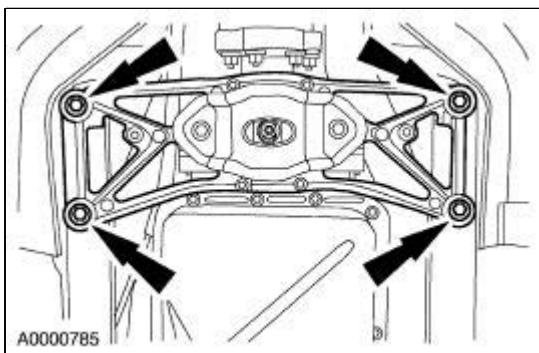
8.  **WARNING:** Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions may result in personal injury.

Support the transmission with a transmission jack.

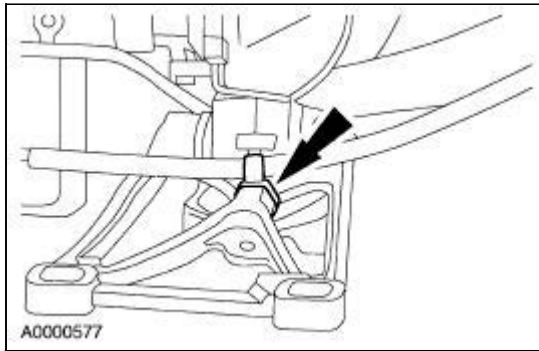
9. Remove the shift cable bracket.



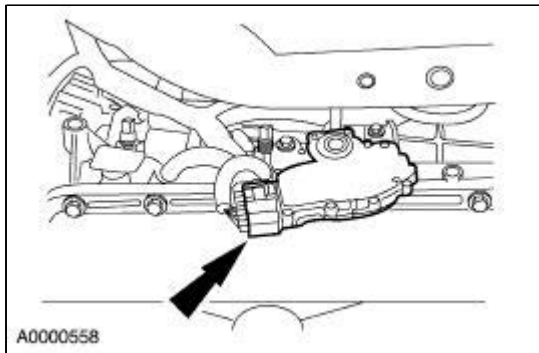
10. Remove the transmission mount.



11. Disconnect the shift cable.

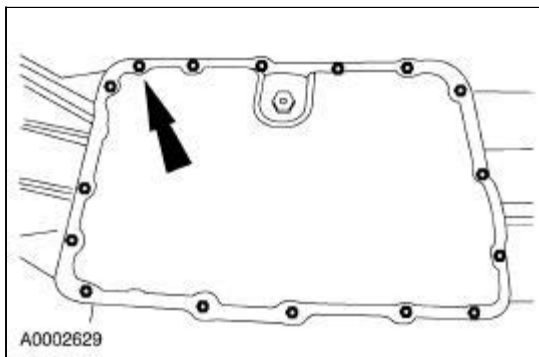


12. Disconnect the digital transmission range (TR) sensor connector.

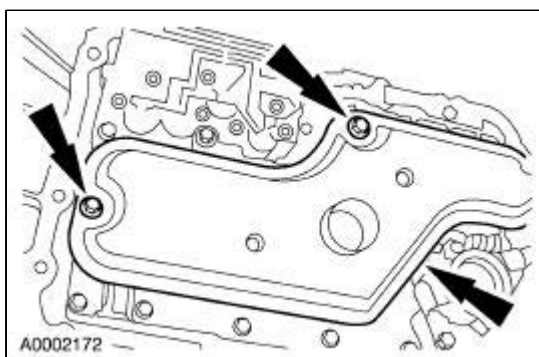


13. **NOTE:** The transmission fluid pan gasket is reusable, clean and inspect for damage; if not damaged, the gasket should be reused.

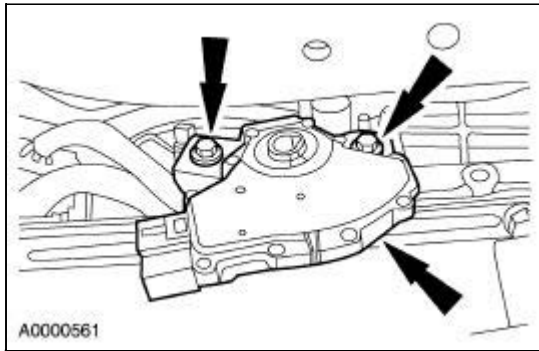
Remove the transmission fluid pan and gasket.



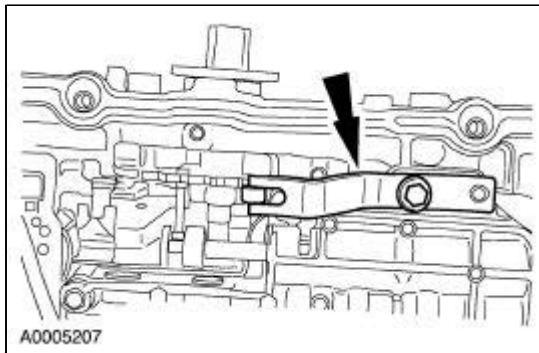
14. Remove the transmission fluid filter.



15. Remove the digital TR sensor.

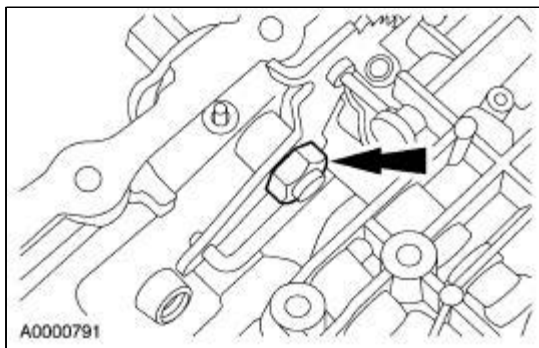


16. Remove the manual control valve detent spring.

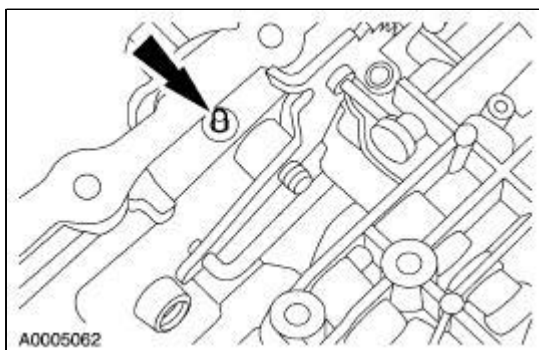


17.  **CAUTION:** To avoid damage, make sure the wrench does not strike the manual valve inner lever pin.

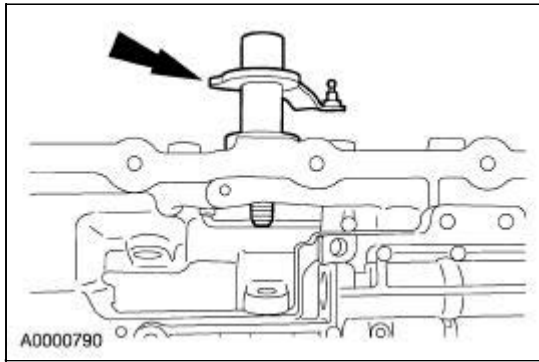
Remove the nut.



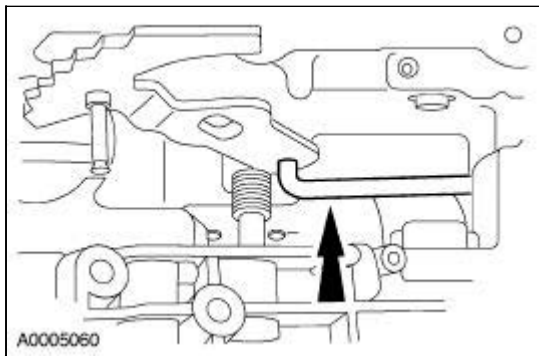
18. Remove the manual lever shaft retaining pin.



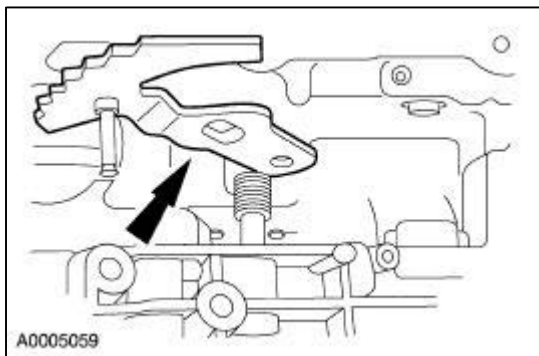
19. Partially remove the manual control lever shaft.



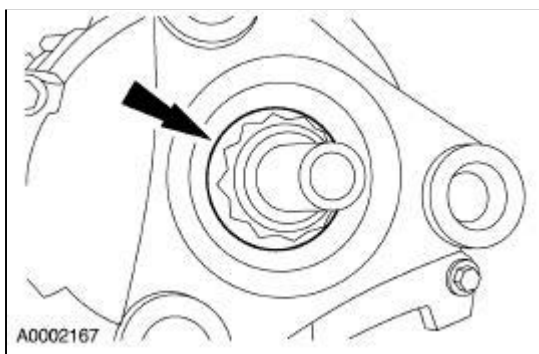
20. Disconnect the manual valve inner lever from the parking lever actuating rod.



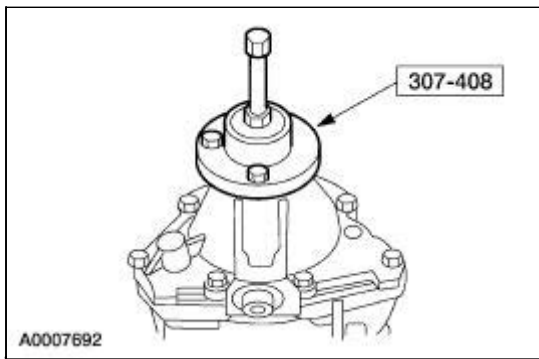
21. Remove the manual valve inner lever.



22. Remove the nut and discard.



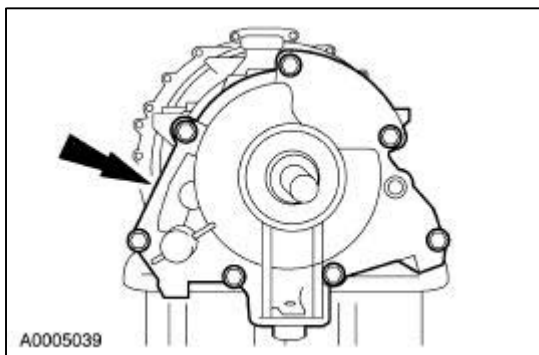
23. Using the special tool, remove the output shaft flange.



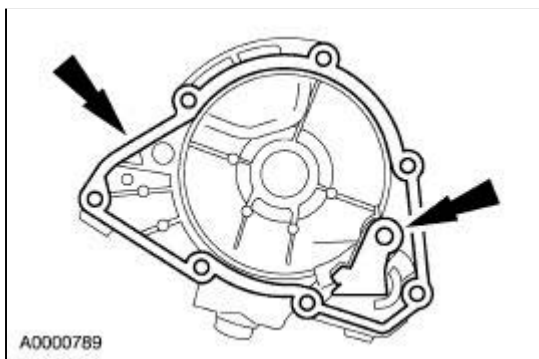
24. **NOTE:** If damage is found to the parking gear, the transmission must be removed and disassembled.

NOTE: The parking pawl, parking pawl return spring and parking pawl shaft may fall out during removal of the extension housing.

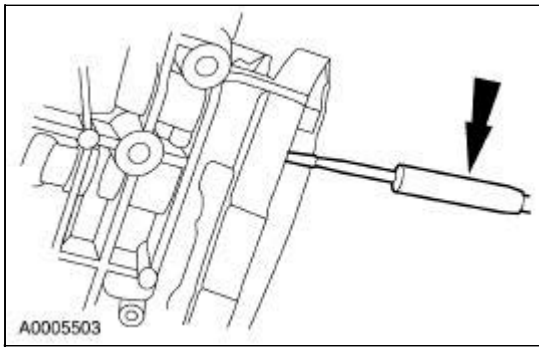
Remove the extension housing.



25. Remove and discard the gasket. Inspect the parking pawl, parking pawl return spring, and the parking pawl shaft. Discard components if damaged or worn.

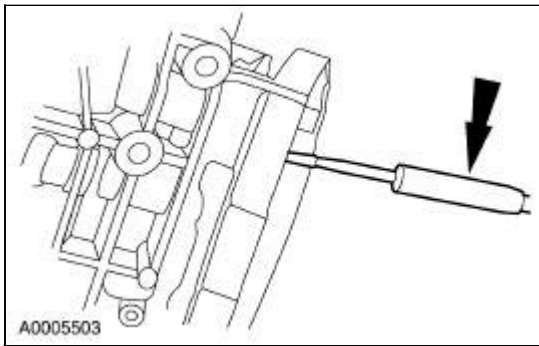


26. Remove the parking lever actuating rod.

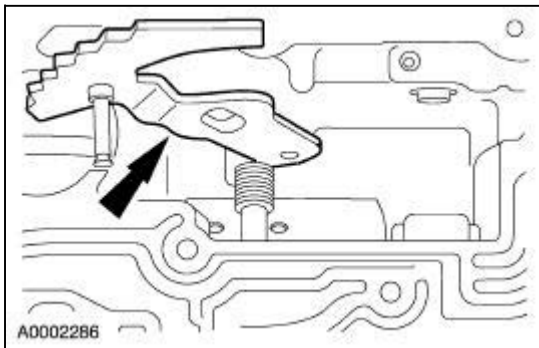


Installation

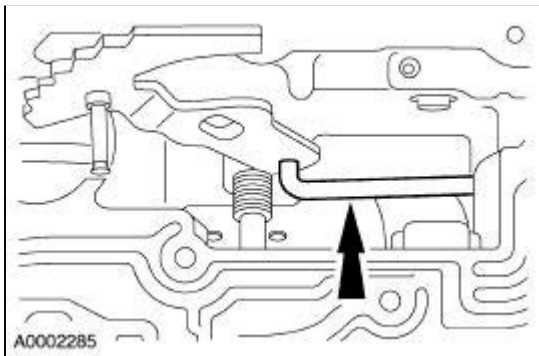
1. Install the parking lever actuating rod.



2. Install the manual control lever.

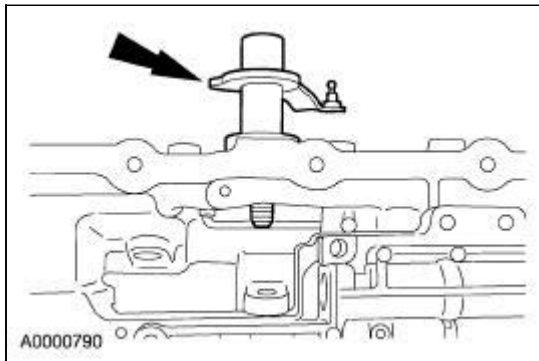


3. Assemble the manual valve inner lever and parking lever actuating rod as shown.

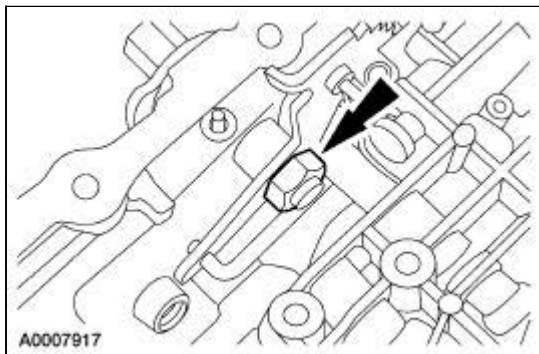


4.  **CAUTION:** Align the flats on the manual valve inner lever with the flats on the manual control lever shaft.

Align the flats of the manual inner lever with the flats on the manual control lever shaft. Install the manual valve inner lever and parking lever actuating rod onto the manual control lever shaft.



5. Install the manual valve inner lever onto the manual shaft and loosely install the nut.

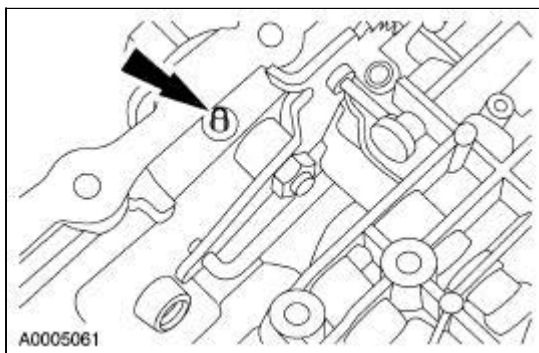


6.  **CAUTION:** Use care not to damage the fluid pan rail surface when installing the retaining pin.

NOTE: Align the manual control lever shaft alignment groove with the manual control lever shaft spring pin bore in the transmission case.

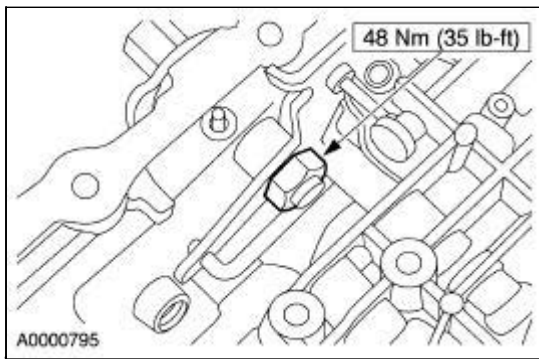
Install the manual control lever shaft spring pin.

- Tap the manual control lever shaft spring pin into the transmission case.

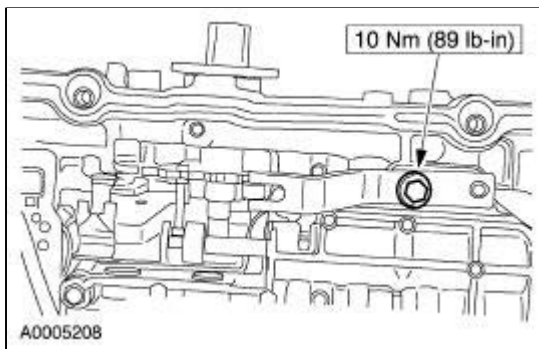


7.  **CAUTION:** To avoid damage, do not allow the wrench to strike the manual valve inner lever pin.

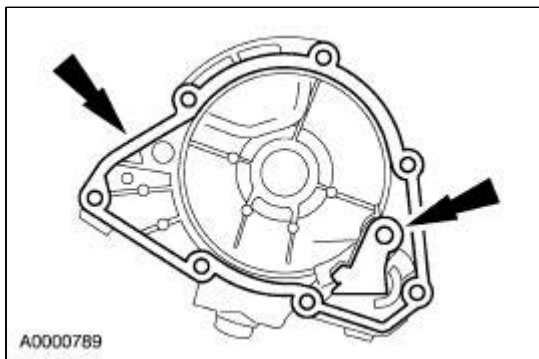
Tighten the nut.



8. Install the manual valve detent spring.

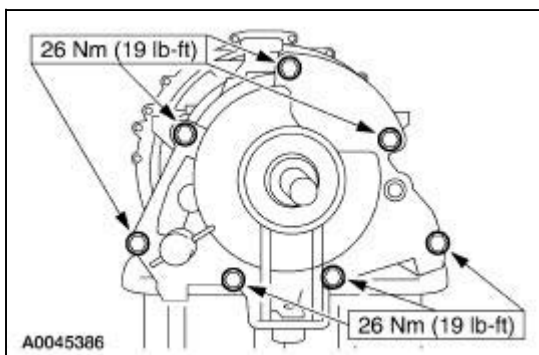


9. Clean the extension housing and install a new extension housing gasket. Make sure that the parking pawl is correctly installed.



10.  **CAUTION:** Make sure the parking lever actuating rod is correctly seated into the case parking rod guide cup.

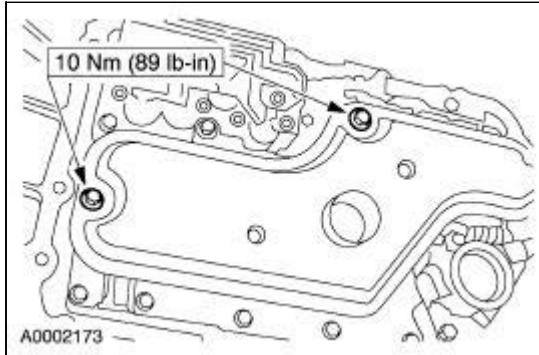
Install the extension housing.



11.  **CAUTION:** Lubricate the fluid filter O-ring seals with clean automatic transmission fluid or seals may be damaged.

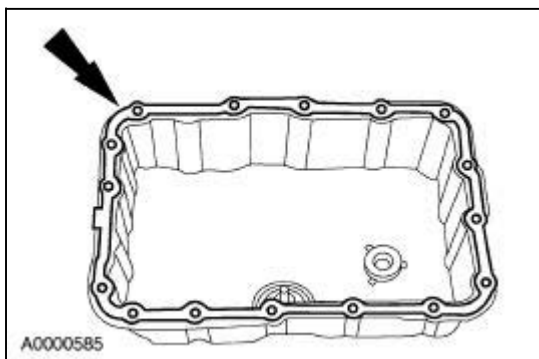
NOTE: Make sure that the fluid filter O-ring seals are correctly seated on the filter.

Lubricate the seals and install the transmission fluid filter.

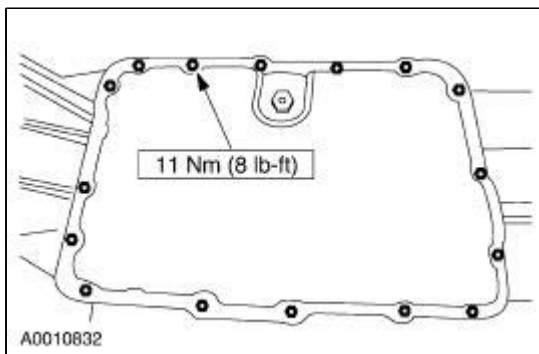



12. **NOTE:** The transmission fluid pan gasket is reusable, clean and inspect for damage; if not damaged, the gasket should be reused.

Install the transmission fluid pan and gasket and loosely install the screws.

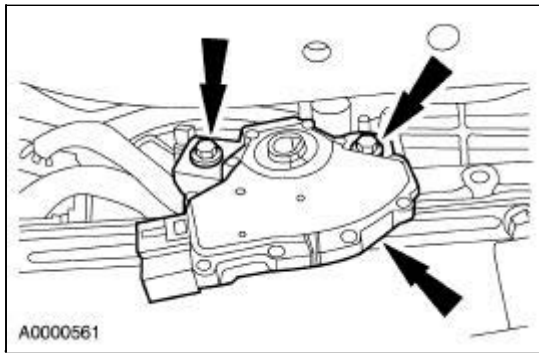


13. Using a crisscross sequence, tighten the screws.



14.  **CAUTION:** The digital transmission range sensor must fit flush against the boss on the case to prevent damage to the sensor.

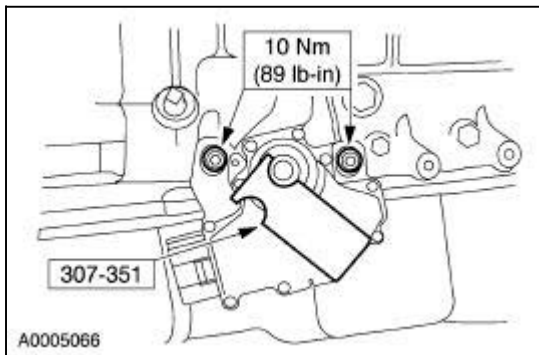
Install the digital TR sensor and loosely install the screws.



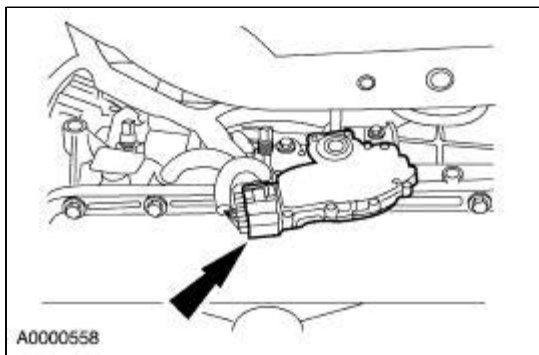
15.  **CAUTION:** Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the Neutral position.

Using the special tool, align the digital TR sensor and tighten the screws in an alternating sequence.

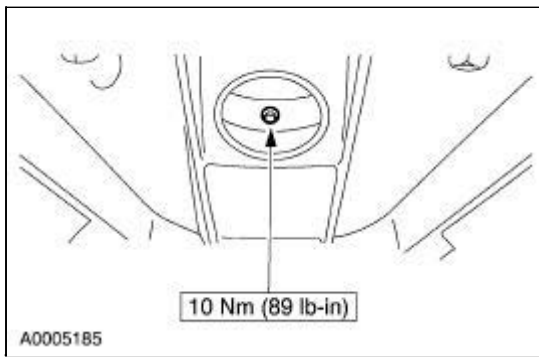


16. Reconnect the digital TR sensor connector.

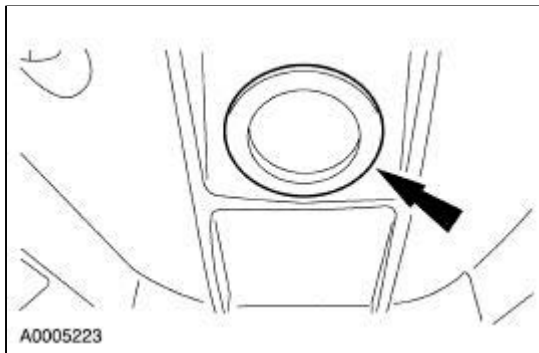


17. **NOTE:** A new converter drain plug must be used to prevent leakage.

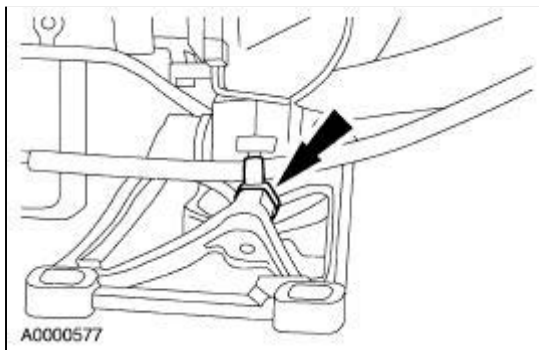
Install the drain plug.



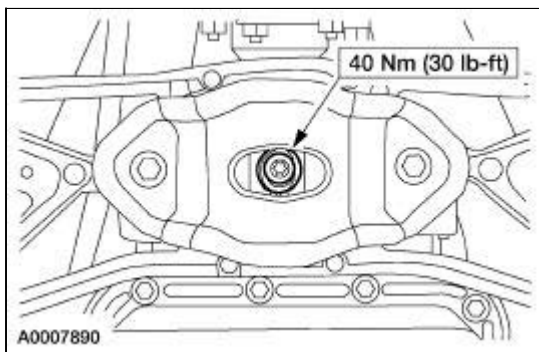
18. Install the converter housing access plug.



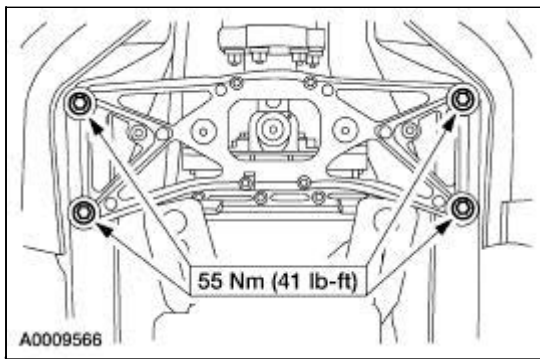
19. Install the shift cable.



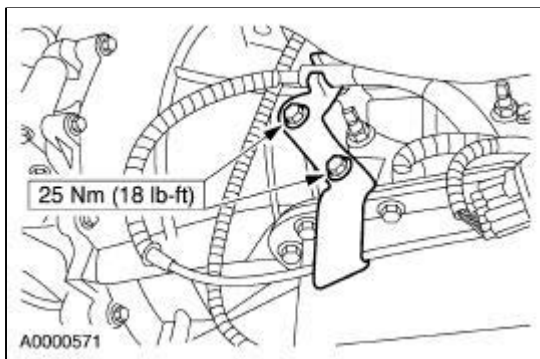
20. Install the rear mount.



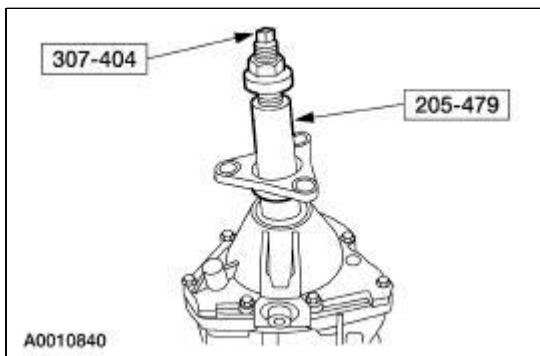
21. Install the rear mount.



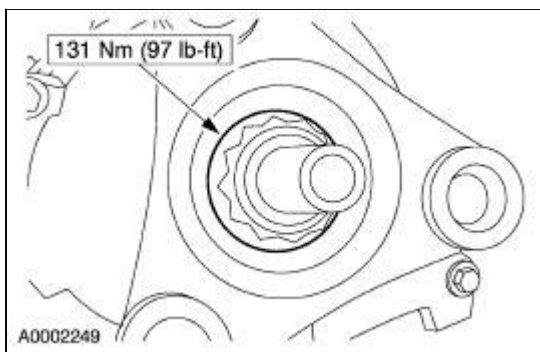
22. Install the shift cable bracket.



23. Using the special tools, install the output flange.

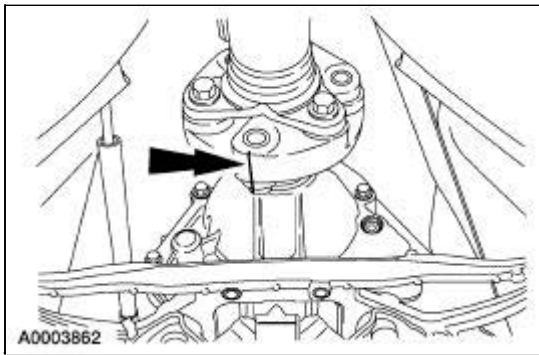



24. Install a new nut.



25.  **CAUTION: Align the index marks or driveshaft imbalance can occur.**

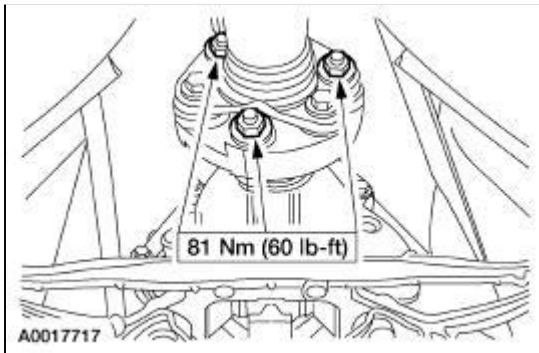
Align the index marks on the pinion flange made during removal and position the driveshaft in place.



26.  **CAUTION:** Install the bolts, washers and nuts in their original positions or driveshaft imbalance can occur. Install the driveshaft flex coupling bolts with the head of the bolt seated against the flange, and the nuts seated against the flex coupling. Install the short bolts in the front and the long bolts in the rear.

Install the bolts, washers and nuts.

- Coat the nut and bolt threads with threadlock sealer.

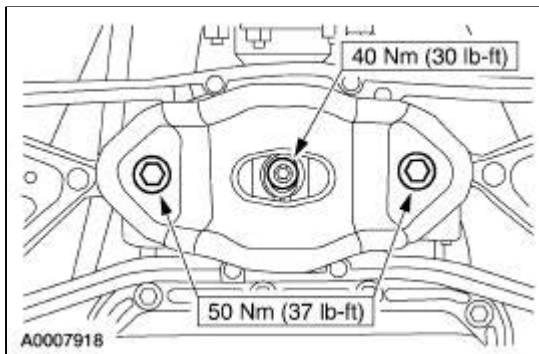


27. Install the exhaust heat shield. For additional information, refer to [Section 309-00](#) .
28. Fill the transmission to the correct fluid level and check for correct transmission operation. For additional information, refer to [Transmission Fluid Level Check](#) in this section.
-

Transmission Support Insulator

Removal and Installation

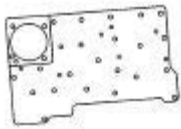

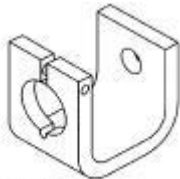


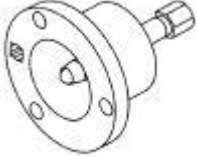

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Support the transmission with a transmission jack.
3. Remove the bolts.


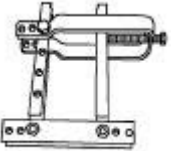
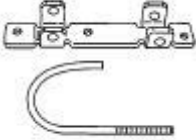

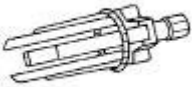


4. To install, reverse the removal procedure.
-

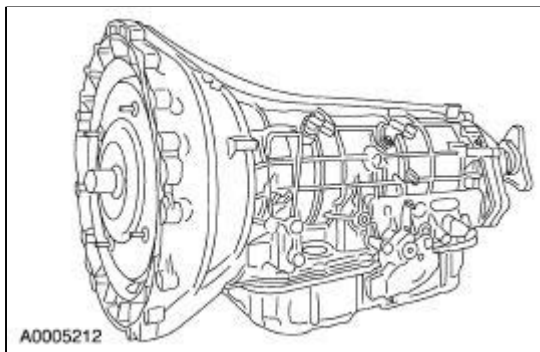
Transmission

Special Tool(s)

 <p>ST2408-A</p>	<p>Air Test Plate, Transmission 307-405</p>
 <p>ST2417-A</p>	<p>Remover, Input Shaft Oil Seal 308-375</p>
 <p>ST2418-A</p>	<p>Remover, Transmission Fluid Pump 307-397</p>
 <p>ST2424-A</p>	<p>Compressor, Cushion Spring 307-401</p>
 <p>ST1104-B</p>	<p>Retaining Ring Pliers 307-343 (T95P-77001-AHR)</p>
 <p>ST2415-A</p>	<p>Remover, Output Flange 307-408</p>
 <p>ST1186-A</p>	<p>Holding Fixture, Transmission 307-003 (T57L-500-B)</p>
	<p>Slide Hammer 100-001 (T50T-100-A)</p>

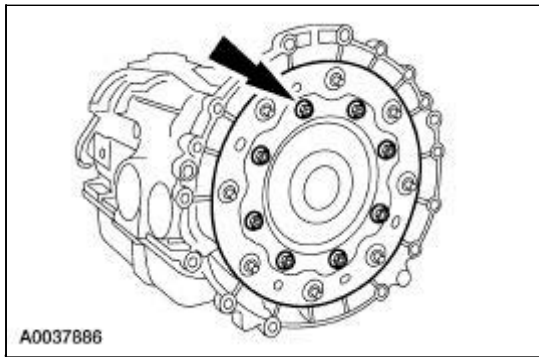
 <p>ST1185-A</p>	
 <p>ST1758-A</p>	<p>Remover, Torque Converter Fluid Seal 307-309 (T94P-77001-BH)</p>
 <p>ST2393-A</p>	<p>Compressor, Servo Cover 307-402</p>
 <p>ST1631-A</p>	<p>Handle, Torque Converter 307-091 (T81P-7902-C)</p>
 <p>ST1213-A</p>	<p>Remover, Bushing 307-001 (TOOL-1175-AC) or equivalent</p>

1. Place the transmission on a workbench.



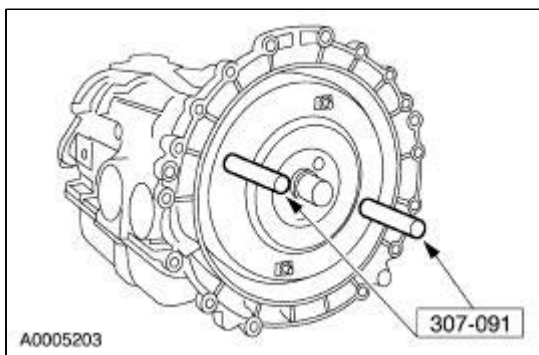
2. If vehicle is equipped, remove the torque converter adapter plate assembly.
3. **NOTE:** Make an identifying mark on the nut, stud, and adapter plate to allow for correct installation.

If the vehicle is equipped and installation of a new or remanufactured torque converter is necessary, remove the torque converter adapter plate.



4.  **WARNING: The torque converter is heavy, especially when full of fluid.**

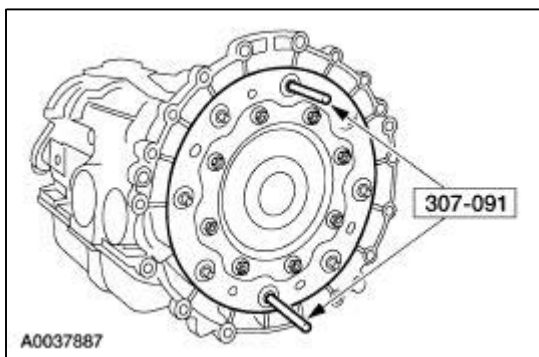
Using the special tools, remove the torque converter.



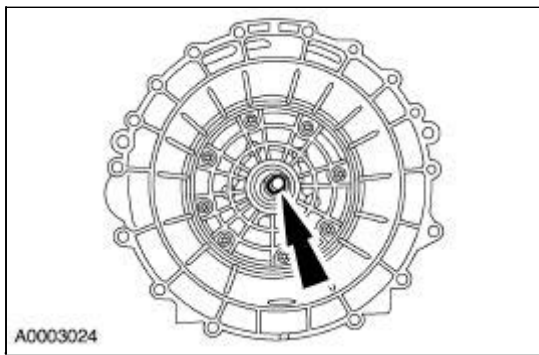
5.  **WARNING: The torque converter is heavy, especially when full of fluid.**

NOTE: If not installing a new torque converter leave the adapter bolted to the torque.

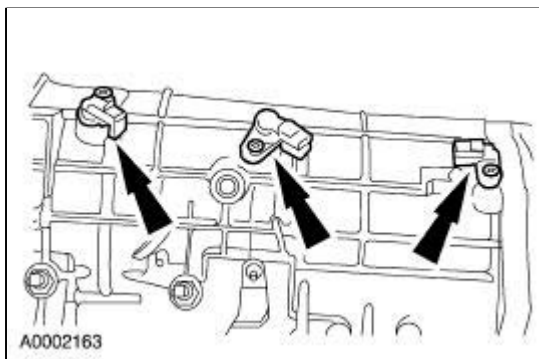
Using the special tools, remove the torque converter and adapter plate as an assembly.



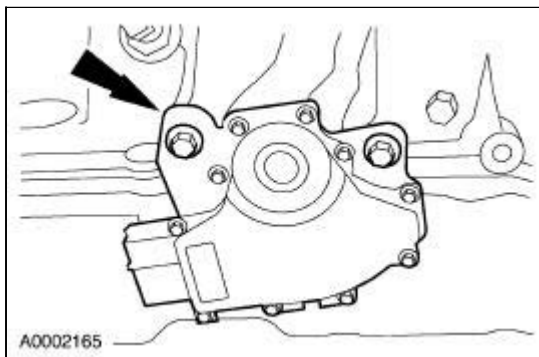
6. Remove the input shaft.



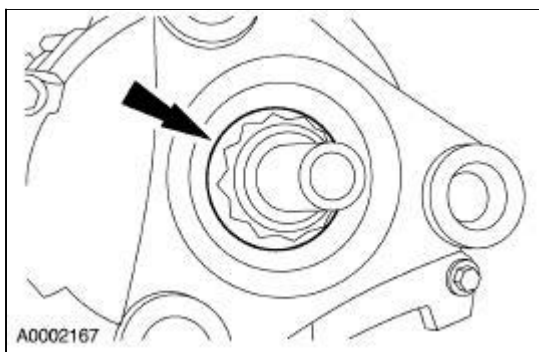
7. Remove the sensors.



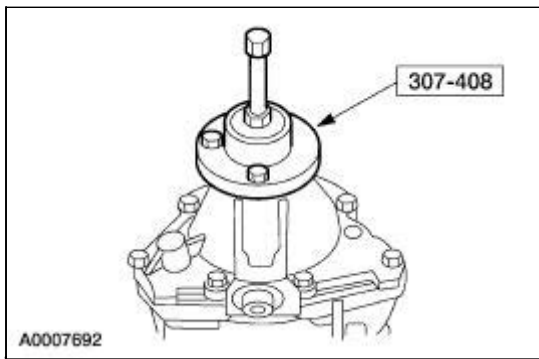
8. Remove the digital transmission range (TR) sensor.



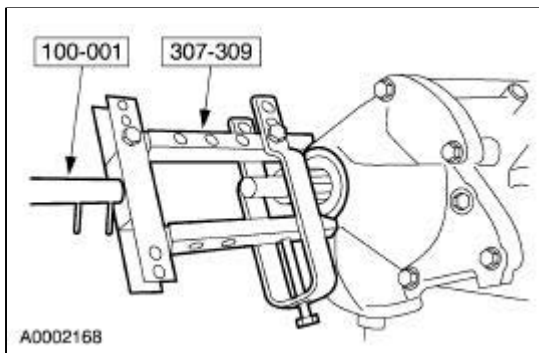
9. Remove and discard the nut.



10. Using the special tool, remove the output shaft flange.

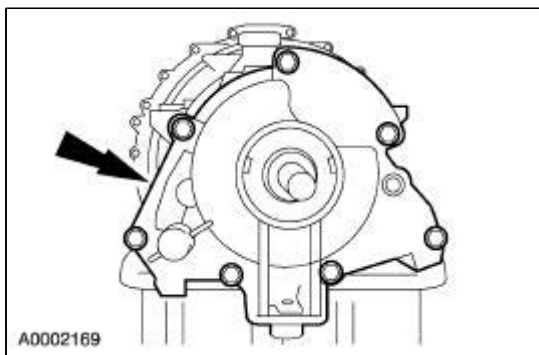


11. Using the special tools, remove the extension housing seal.

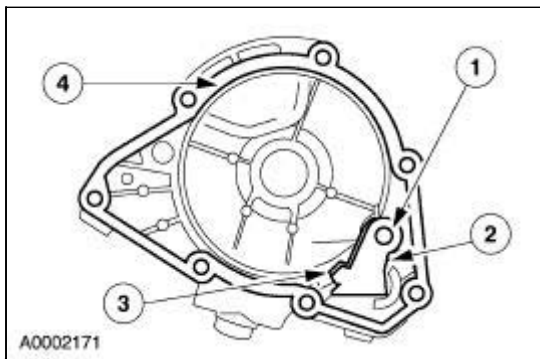


12.  **CAUTION:** The parking pawl, parking pawl return spring and parking pawl shaft could fall out during removal of the extension housing.

Remove the extension housing.

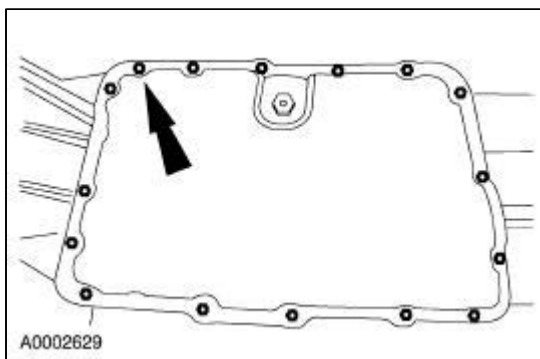


13. Remove the parking pawl assembly and discard the gasket.
 1. Remove the parking pawl shaft.
 2. Remove the parking pawl.
 3. Remove the parking pawl return spring.
 4. Remove and discard the gasket.

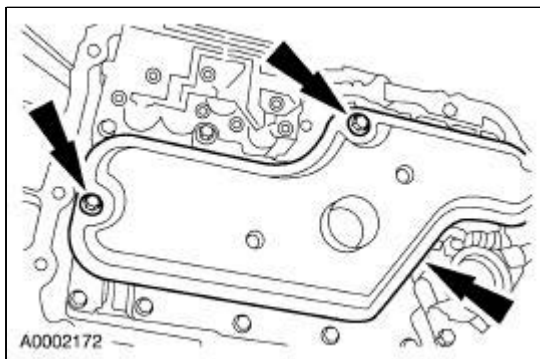


14. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect the gasket for damage. If not damaged, the gasket should be reused.

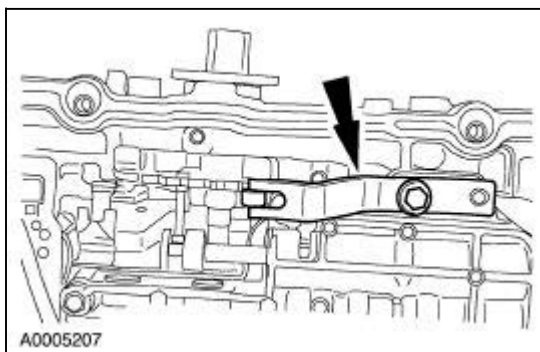
Remove the transmission fluid pan and gasket.



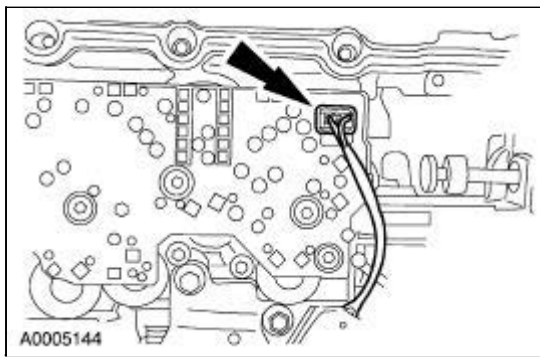
15. Remove the transmission fluid filter and discard.



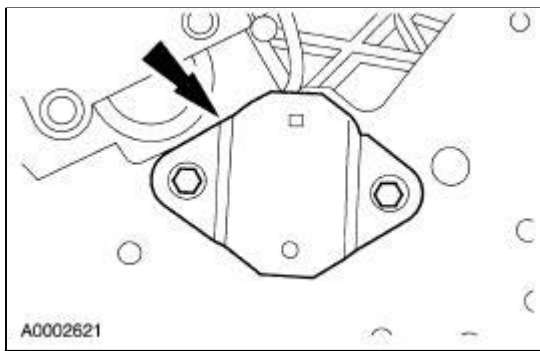
16. Remove the manual control valve detent spring.



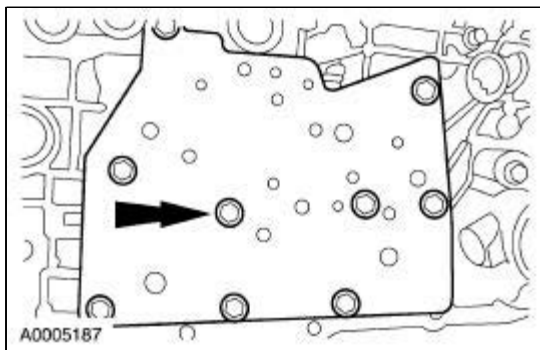
17. Disconnect the reverse pressure switch connector.



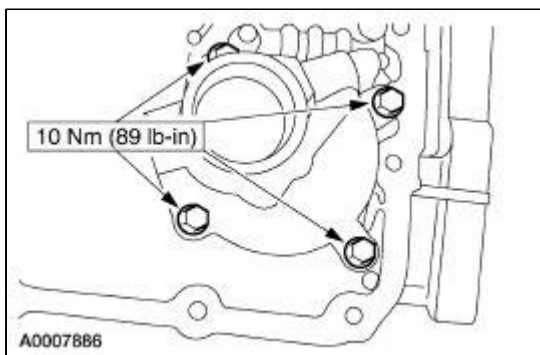
18. Remove the reverse pressure switch and discard.



19. Remove the valve body cover plate and gasket. Discard the gasket.

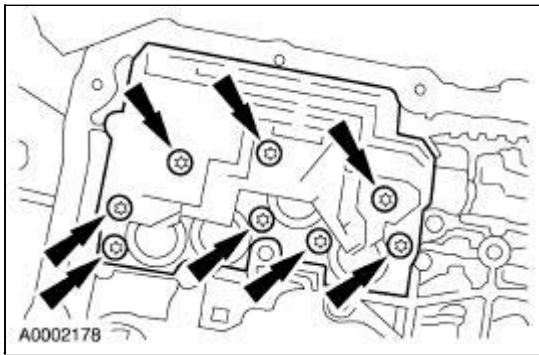


20. Remove the reverse servo assembly.

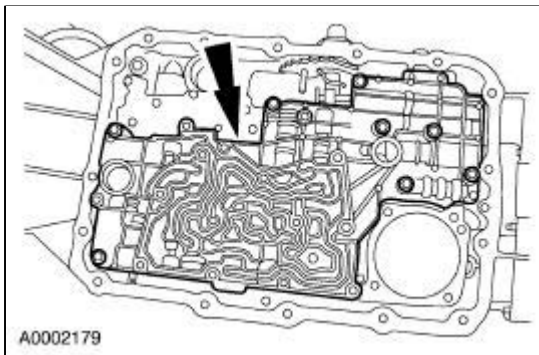


21.  **CAUTION: Do not damage solenoid body connector pins.**

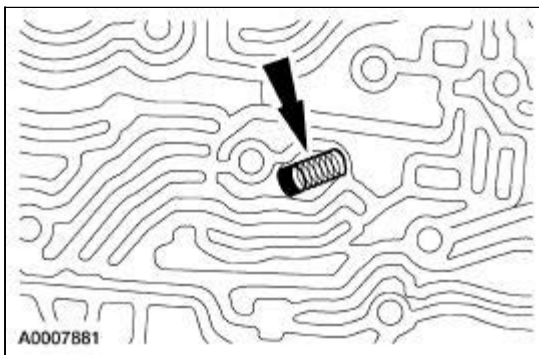
Remove the solenoid body assembly by lifting on the body and pushing the connector from the other side of the case.



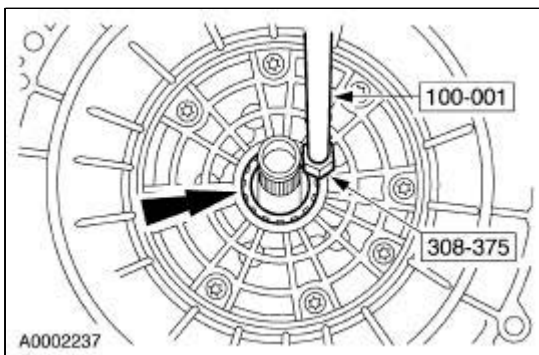
22. Remove the main control valve body, separator plate, and gasket.



23. Remove the intermediate clutch spring and seal.



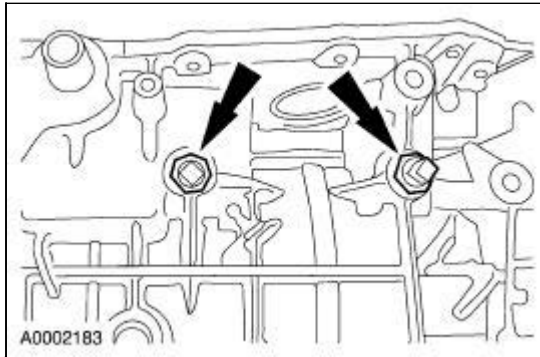
24. Using the special tools, remove the converter hub seal.



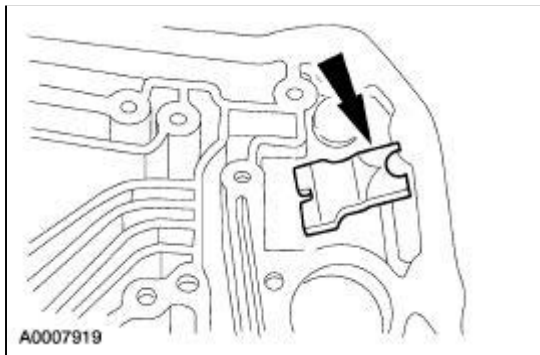
25.  **CAUTION:** Failure to loosen the OD band adjusting screw prior to pump removal may cause damage to the pump and OD band.

 **CAUTION: Throw the locknuts away. The locknuts are not reusable for assembly.**

Remove the locknuts, and loosen the OD band adjusting screw.

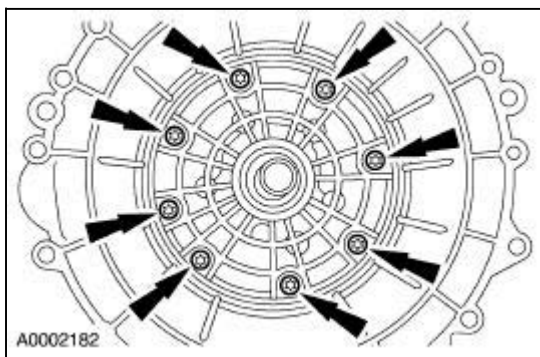


26. Remove the OD anchor strut.

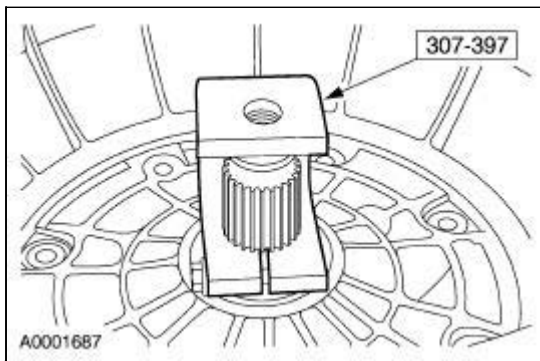


27.  **CAUTION: The screws are not reusable for assembly. Discard the screws. If the screws are reused the housing may become separated from the transmission.**

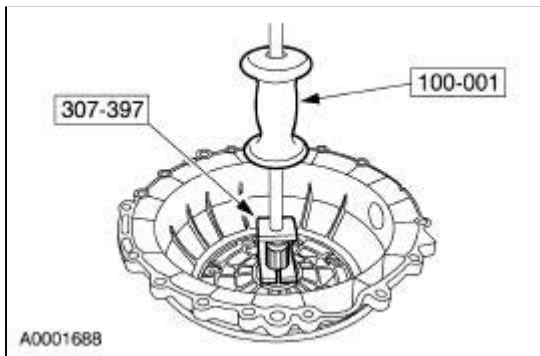
Remove and discard the screws.



28. Install the special tool.

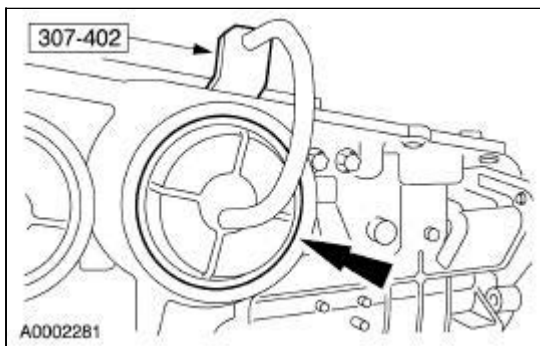


29. Using the special tools, remove the pump.

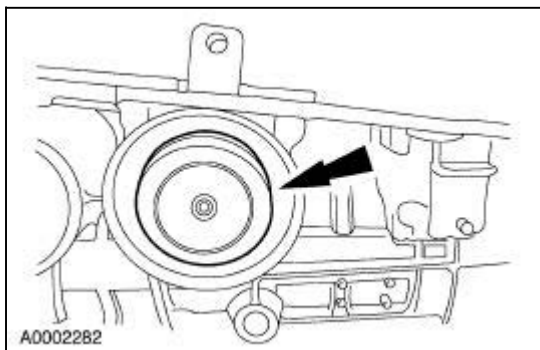


30.  **CAUTION: Servo cover is under spring tension.**

Using the special tool, remove the intermediate servo cover retaining ring and cover.

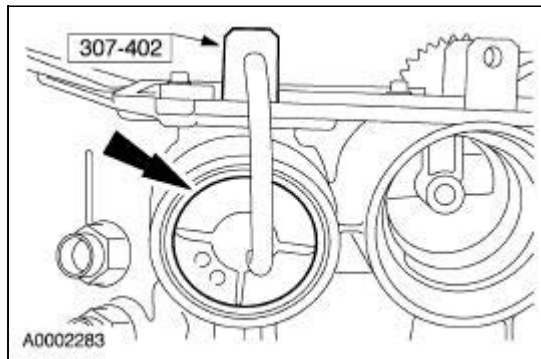


31. Remove the intermediate band servo piston and spring.

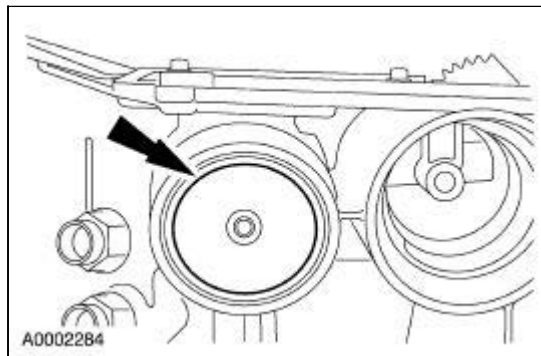


32.  **CAUTION: Servo cover is under spring tension.**

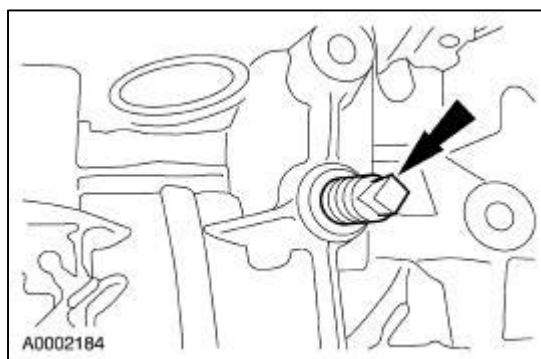
Using the special tool, remove the overdrive servo cover retaining ring and cover.



33. Remove the front band servo piston and spring.

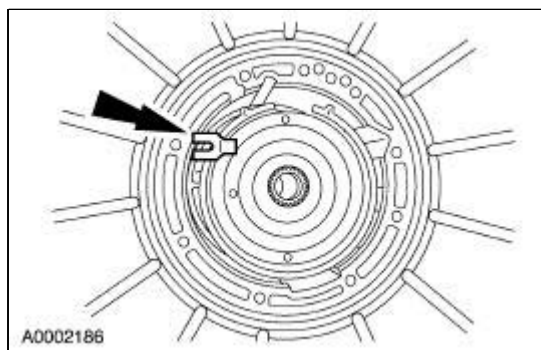


34. Remove the screw.

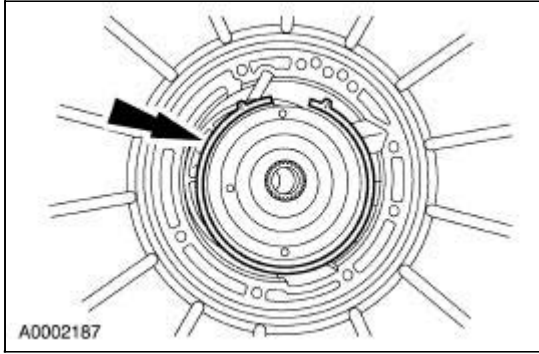


35. **NOTE:** Tag and identify parts for reassembly.

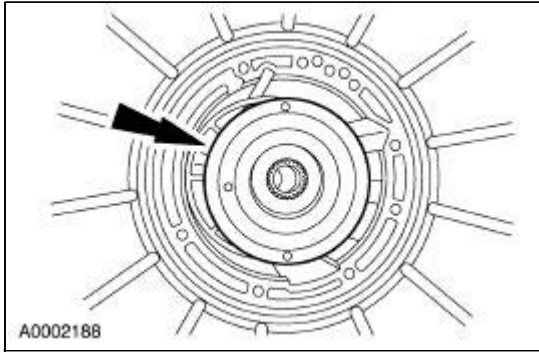
Compress the overdrive band and remove the apply strut.




36. Remove the overdrive band.



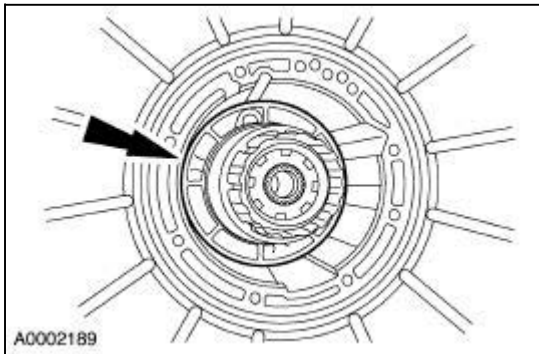
37. Remove the overdrive brake and coast clutch drum.



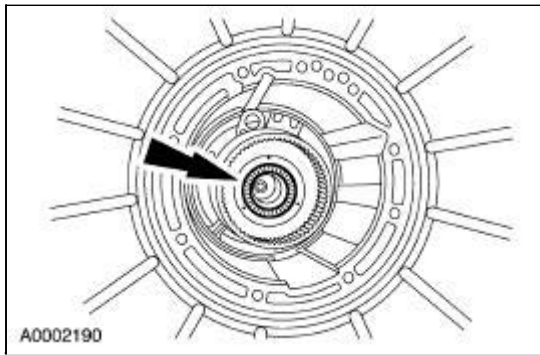
38.  **CAUTION: Do not bend trigger wheel.**

NOTE: The No. 2 thrust bearing is in this assembly.

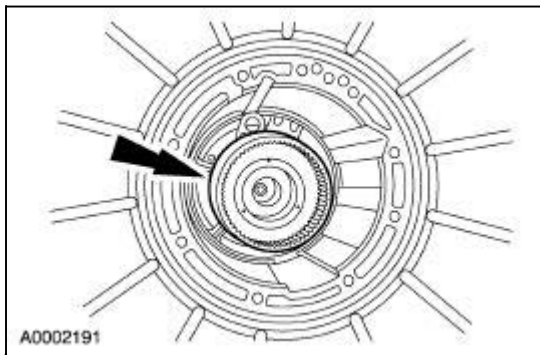
Remove the planetary gear overdrive carrier.



39. Remove the overdrive planet thrust bearing (No. 2).

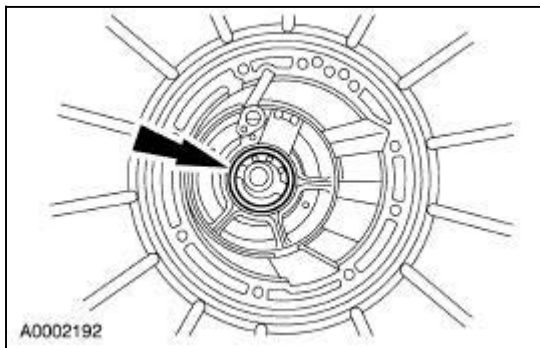


40. Remove the overdrive ring gear, overdrive one-way clutch assembly, and center shaft as an assembly.



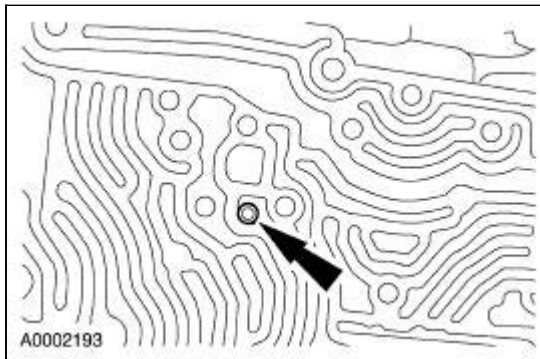
41. **NOTE:** Tag and identify the center shaft thrust bearing (No. 3) for assembly.

Remove the No. 3 center shaft thrust bearing.

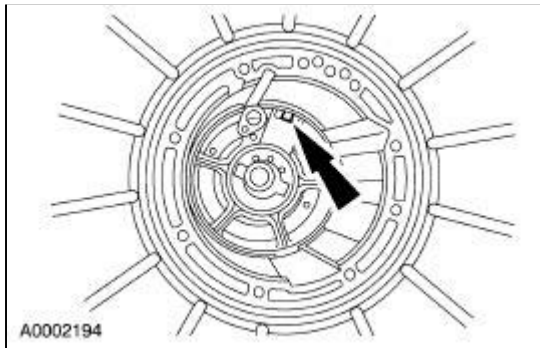


42.  **CAUTION:** The center support locknut could fall into the remaining assembly if not removed.

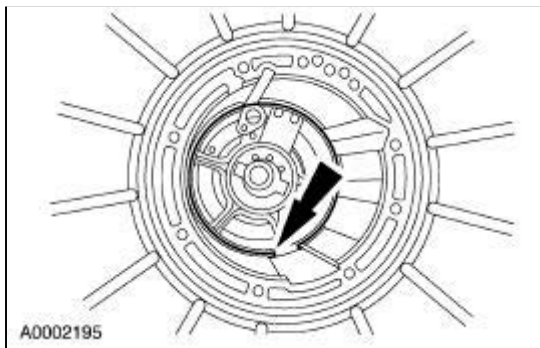
Remove the screw.



43. Remove the locknut and cage.

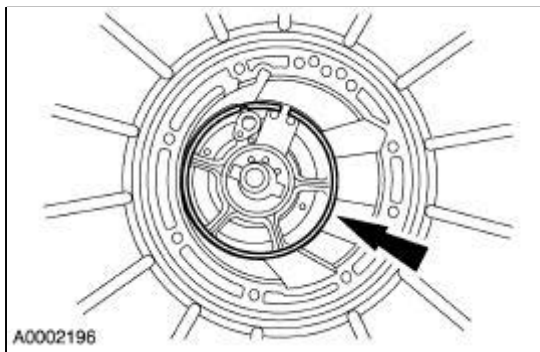


44. Remove the center support retaining ring.



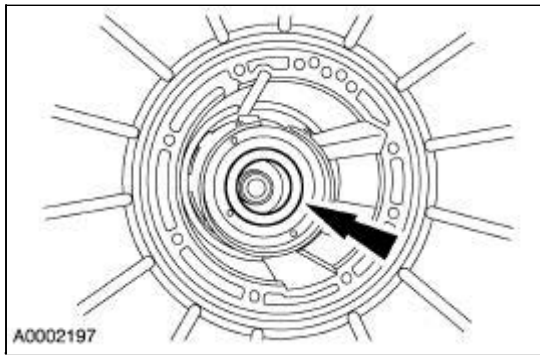
45. **NOTE:** When removing the center support, pull evenly around the center support web.

Remove the center support.

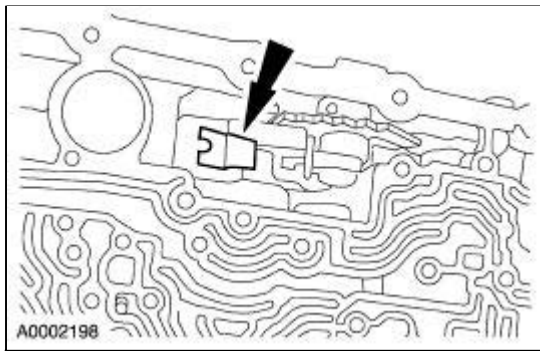



46. **NOTE:** Tag and identify the No. 4 intermediate brake drum thrust bearing.

Remove the intermediate brake drum thrust bearing (No. 4).

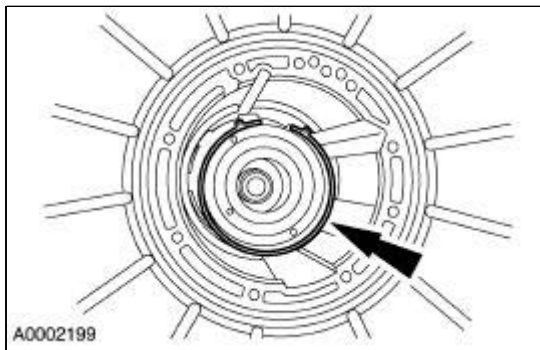


47. Remove the intermediate band anchor strut.

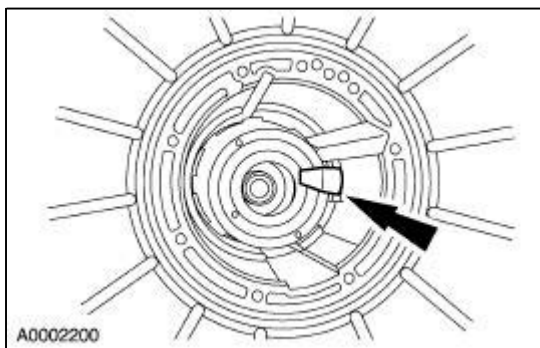


48.  **CAUTION:** Identify the anchor and apply ends of the intermediate band.

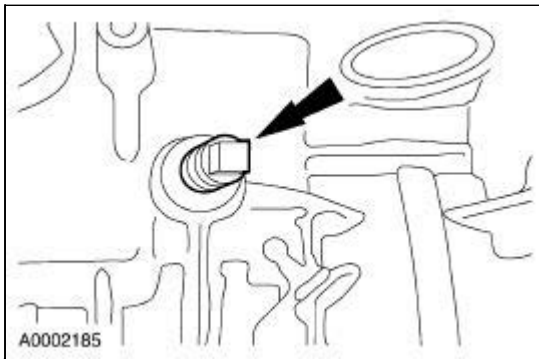
Remove the intermediate band.



49. Remove the intermediate band apply strut.

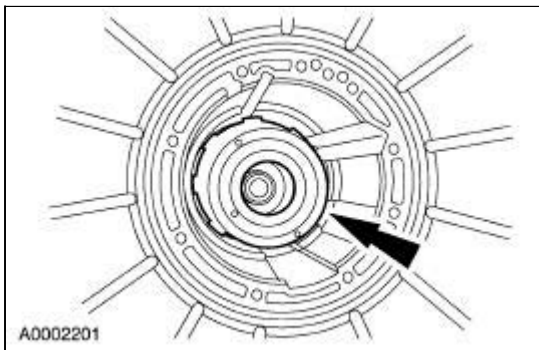


50. Remove the screw.

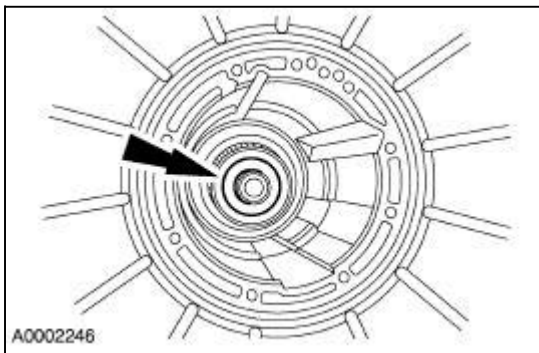


51. **NOTE:** The No. 5 forward clutch cylinder thrust bearing may come out with the intermediate brake and direct clutch drum.

Remove the direct clutch drum.

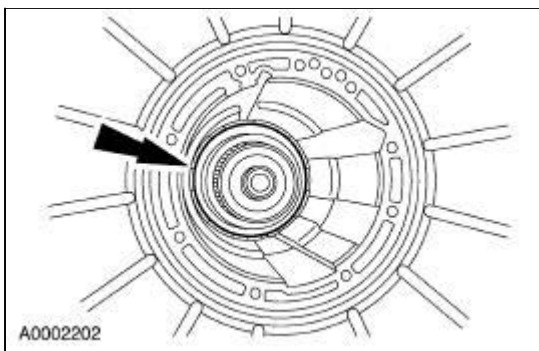


52. Remove the No. 5 forward clutch cylinder thrust bearing, tag and identify.



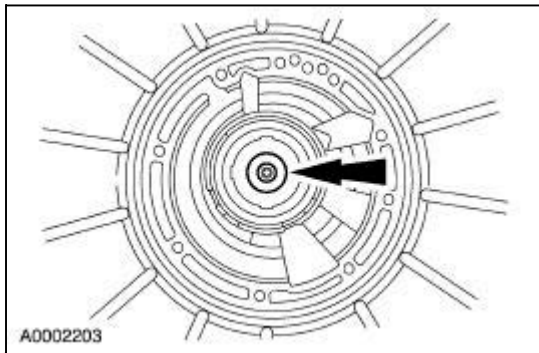
53. **NOTE:** The No. 6A thrust bearing may come out with the cylinder. Tag for reassembly.

Remove the forward clutch cylinder.



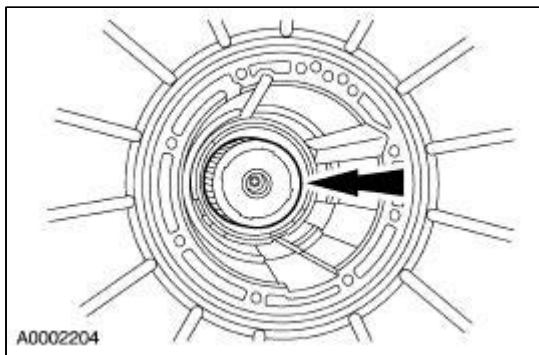
54. **NOTE:** The No. 6A forward ring gear hub thrust bearing may have come out with the forward clutch cylinder.

Remove the No. 6A forward ring gear hub thrust bearing.

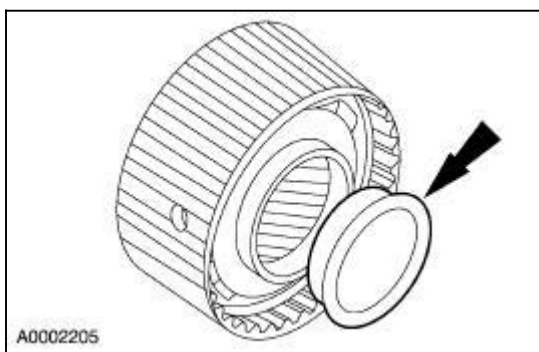


55. **NOTE:** The No. 7 forward planet thrust bearing may come out with the forward ring gear and hub assembly.

Remove the forward ring gear and hub as an assembly.

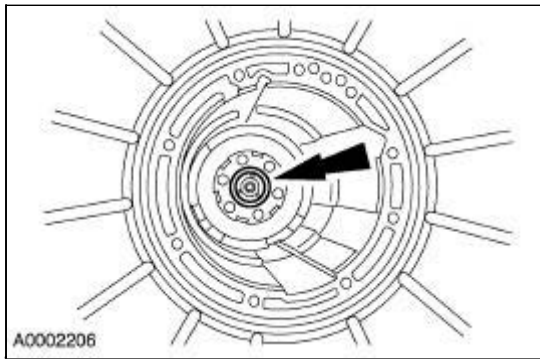


56. Remove the No. 6B forward clutch thrust washer from the forward ring gear hub.

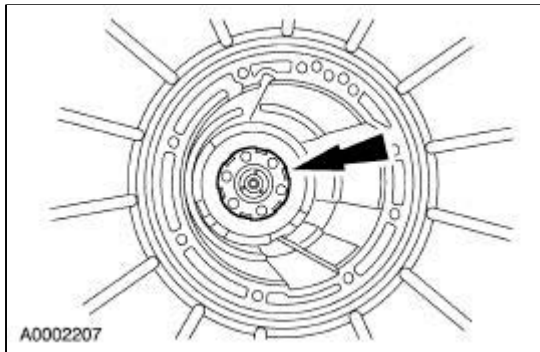


57. **NOTE:** The No. 7 forward planet thrust bearing may come out with the forward ring gear and hub assembly.

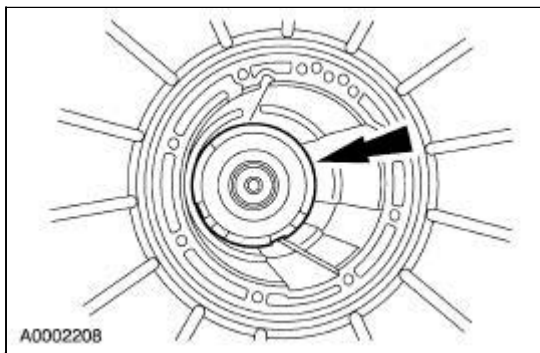
Remove the No. 7 forward planet thrust bearing.



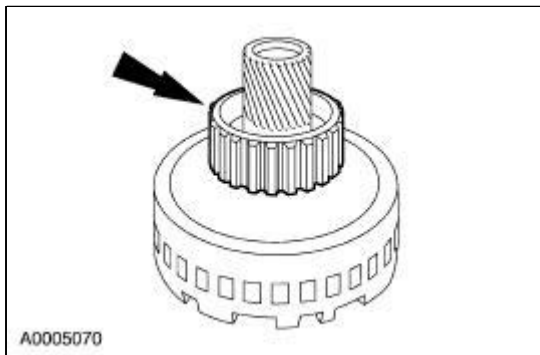
58. Remove the forward planetary assembly.



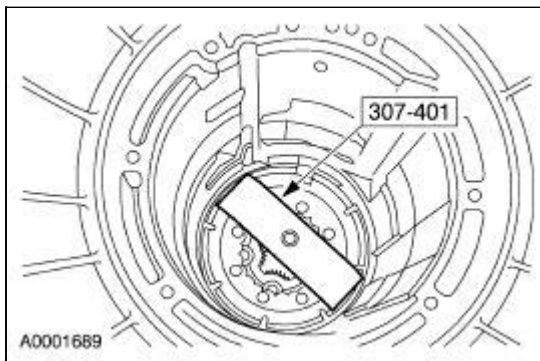
59. Remove the input shell and sun gear assembly.



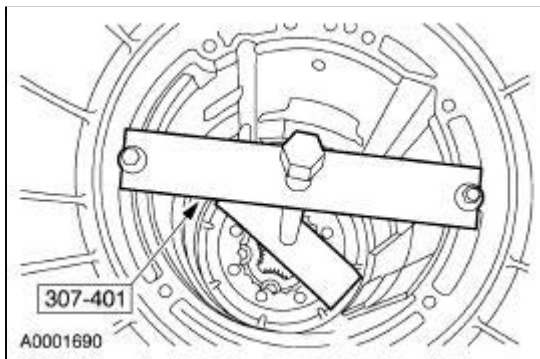
60. Rotate the intermediate one-way clutch sprag and race to disassemble.



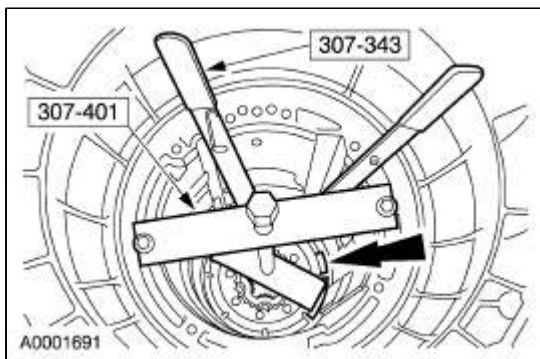
61. Install the special tool.



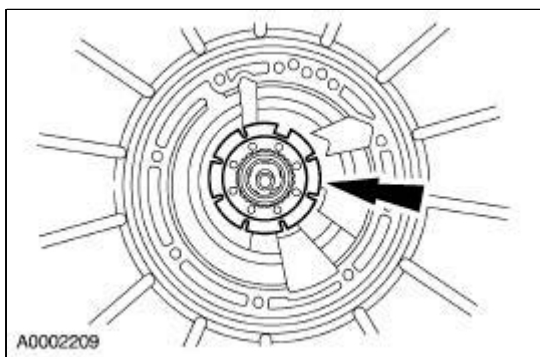
62. Install the special tool.



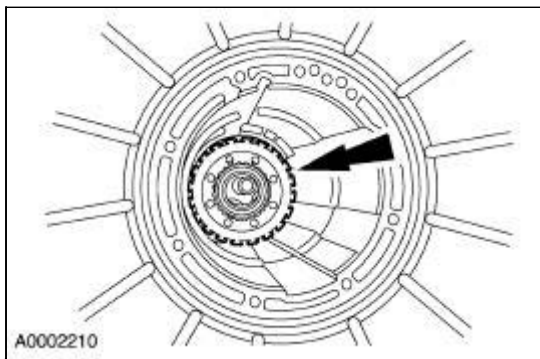
63. Using the special tools, remove the intermediate clutch retaining ring.



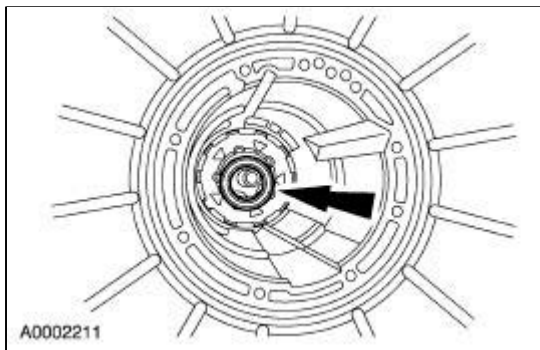
64. Remove the intermediate clutch housing and piston assembly.



65. Remove the intermediate clutch piston spring, clutch plates, and cylinder as an assembly.

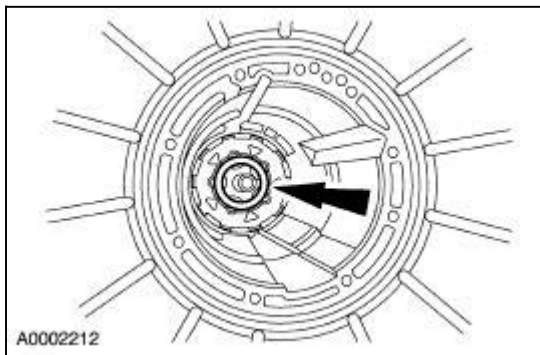


66. Remove the low and reverse gear spacer.

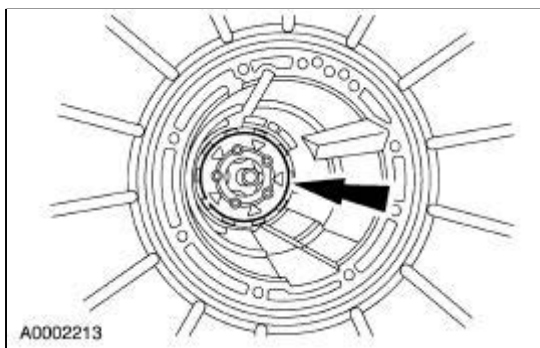


67. **NOTE:** Tag and identify the No. 8 low/reverse planetary carrier thrust bearing.

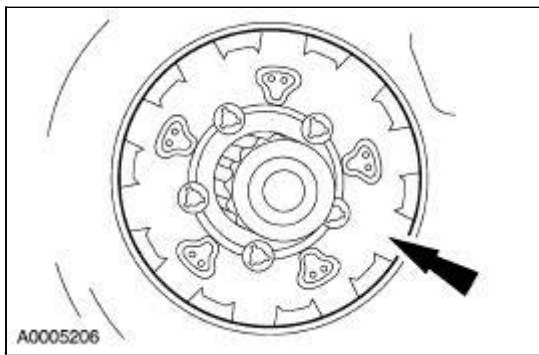
Remove the thrust bearing.



68. Remove the retaining ring.

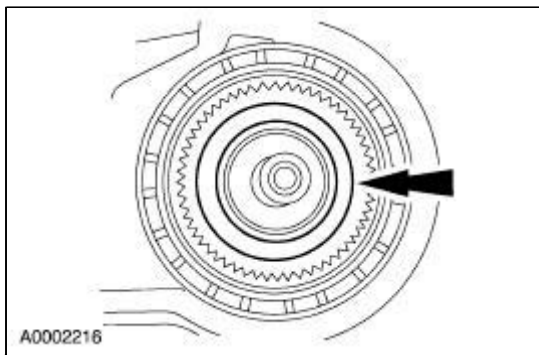


69. Remove low/reverse planetary assembly.



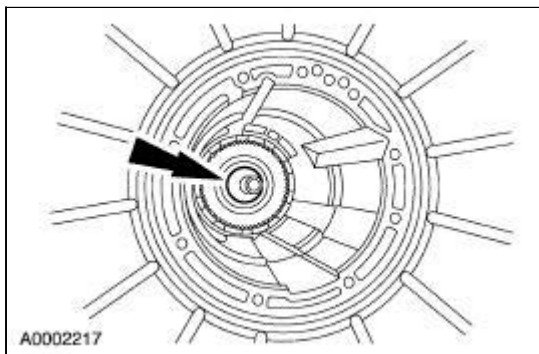
70. **NOTE:** Tag and identify the No. 9 low/reverse planetary carrier thrust bearing.

Remove the thrust bearing.



71. **NOTE:** Use slots located around the outside of the sleeve.

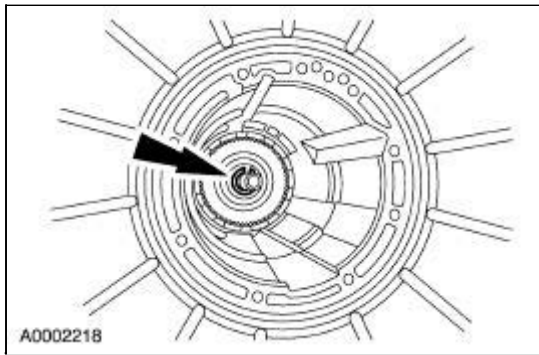
Using a small pick, remove the output shaft sleeve.



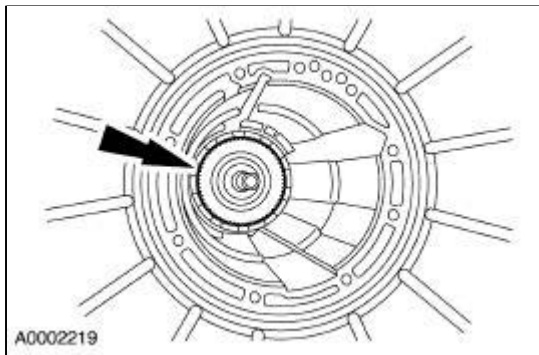
72. **⚠ WARNING:** The output shaft may fall out after removing the snap ring. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Discard the output shaft retaining ring. A new retaining ring must be used for assembly.

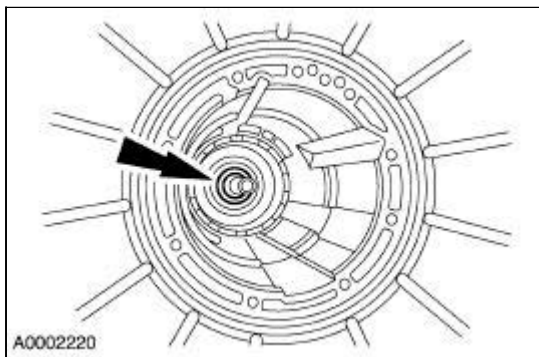
While holding the output shaft remove and discard the output shaft retaining ring.



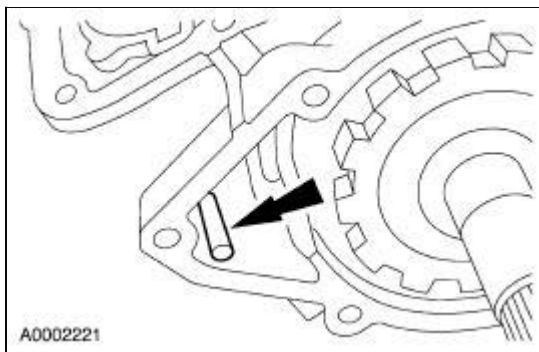
73. Remove the output shaft ring gear and hub.



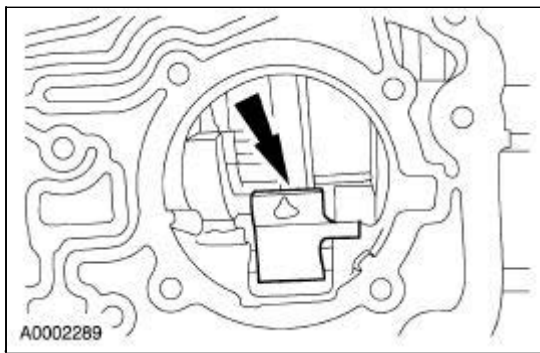
74. Remove the No. 10 low intermediate sun gear bearing.



75. Remove the reverse band actuating lever shaft.

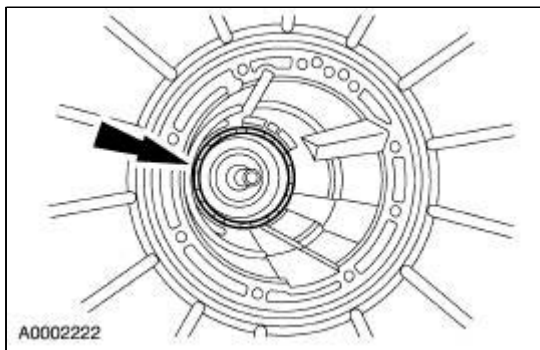


76. Remove the reverse band actuating lever assembly.

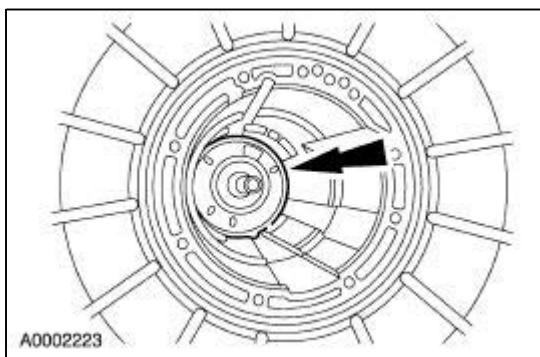


77. **NOTE:** The inner race of the rear one-way clutch is not removable. It is repaired in the case.

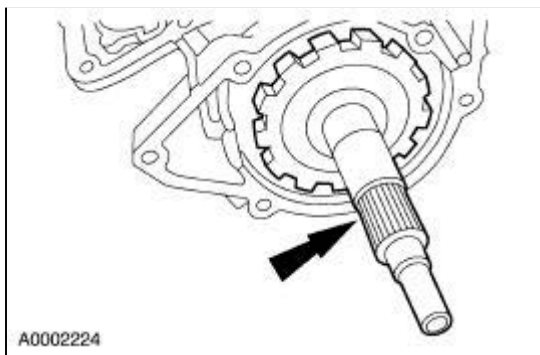
Remove the low/reverse brake drum and one-way clutch assembly by rotating it clockwise.



78. Remove the reverse band.

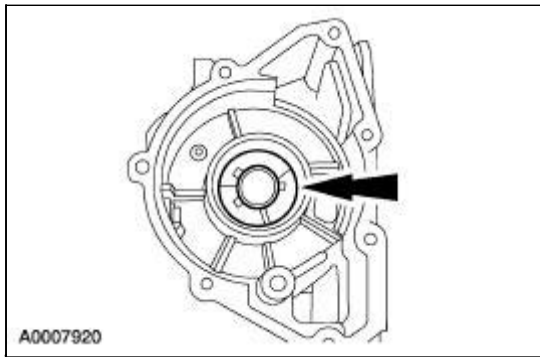


79. Remove the output shaft and park gear.



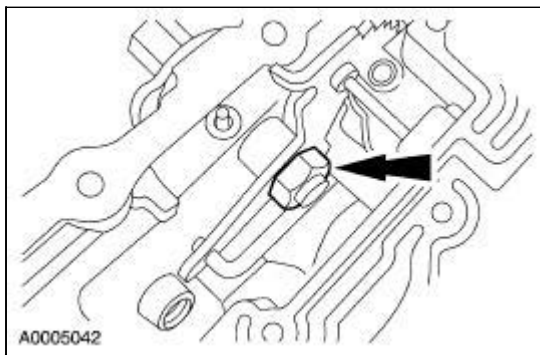
80. **NOTE:** Tag and identify the No. 11 output shaft thrust washer.

Remove the output shaft thrust washer.

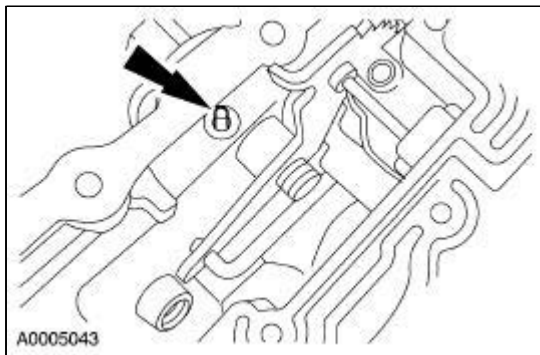


81.  **CAUTION:** To avoid damage, make sure the wrench does not strike the manual valve inner lever pin.

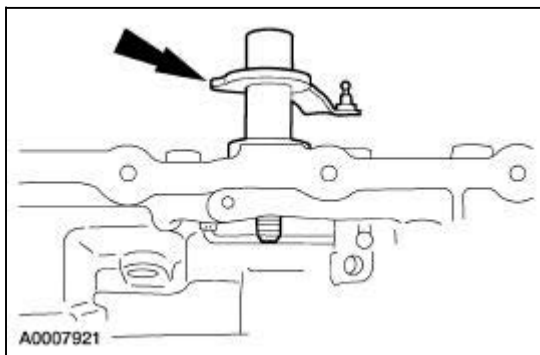
Remove the nut.



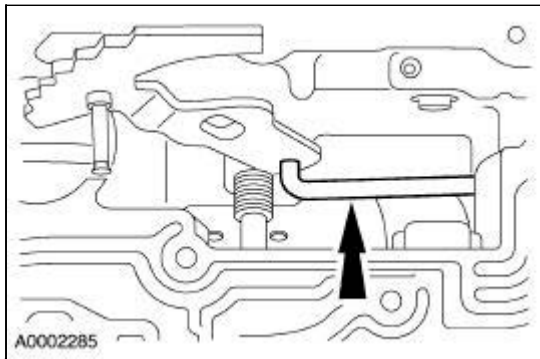
82. Remove the manual lever shaft retaining pin.



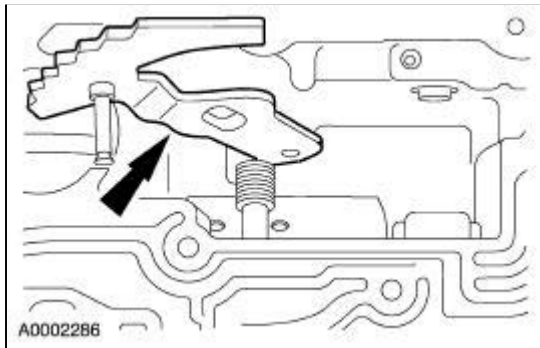
83. Remove the manual control lever shaft.



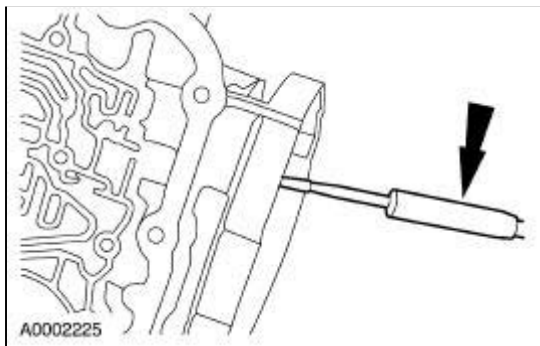
84. Disconnect the manual valve inner lever from the parking lever actuating rod.




85. Remove the manual valve inner lever.

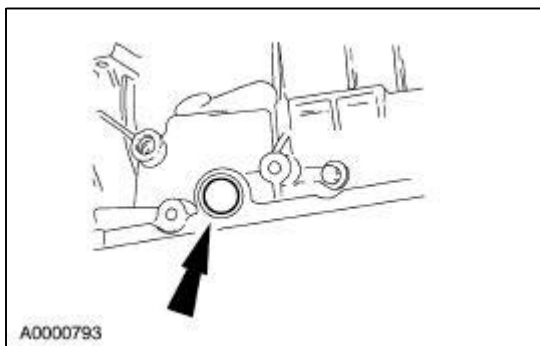


86. Remove the parking lever actuating rod.



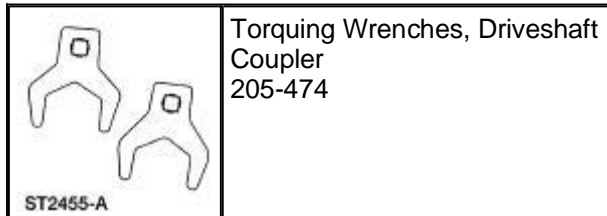
87.  **CAUTION: Do not damage the bore.**

Remove the manual control lever seal.



Transmission

Special Tool(s)

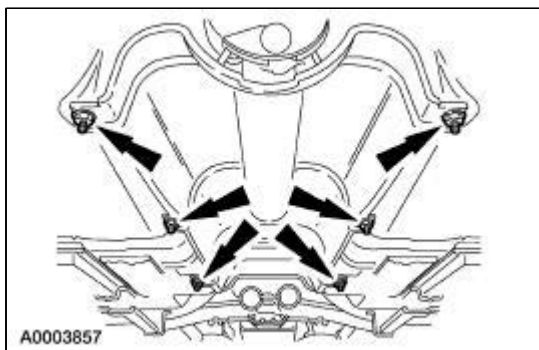



NOTE: If the transmission is to be removed for a period of time, support the engine with a safety stand and a wood block.

1. **NOTE:** When the battery is disconnected or a new battery installed, certain transmission operating parameters can be lost. The powertrain control module (PCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed, or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

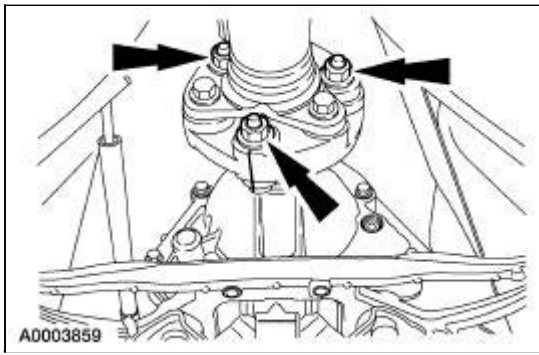
Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).

2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Remove the three-way catalytic converter. For additional information, refer to [Section 309-00](#).
4. Remove the eight retainers and the heat shield.

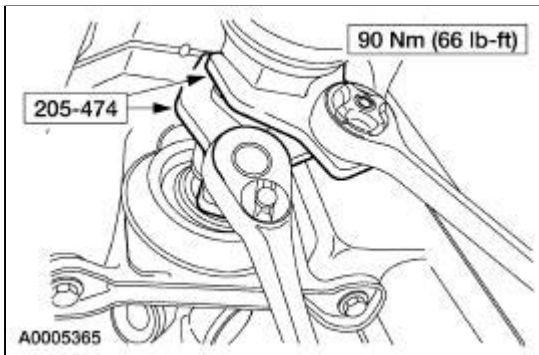


5.  **CAUTION:** Index-mark (color paint) the bolts, washers, nuts, and the flex coupling to the transmission flange and the pinion flange to make sure they are installed in the same location. Components not assembled in their original locations can cause driveshaft imbalance.

Index-mark the components.



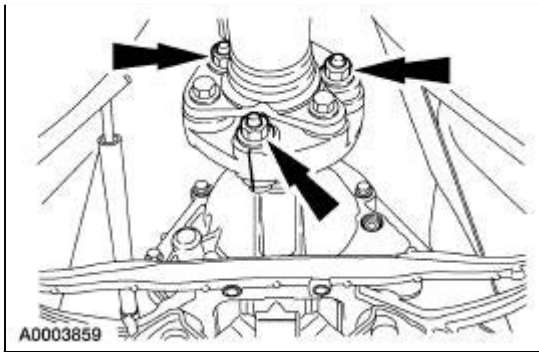
- Using the special tools, loosen the nut.



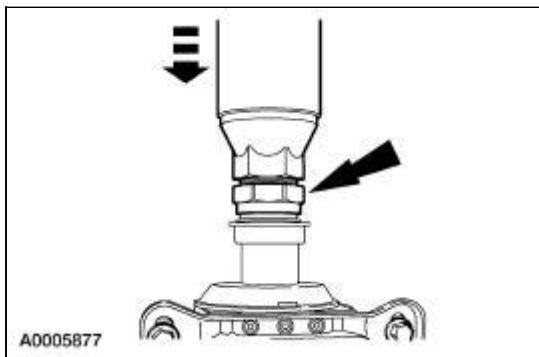
-  **CAUTION:** Do not remove the bolts retaining the flex coupling to the driveshaft.

NOTE: The bolt heads are serrated. Hold the bolt and loosen the nut.


Remove the three nuts, washers and bolts.



- Slide the front shaft assembly rearward and support.
 - Tighten the nut to prevent separation of the front and rear shaft assemblies.

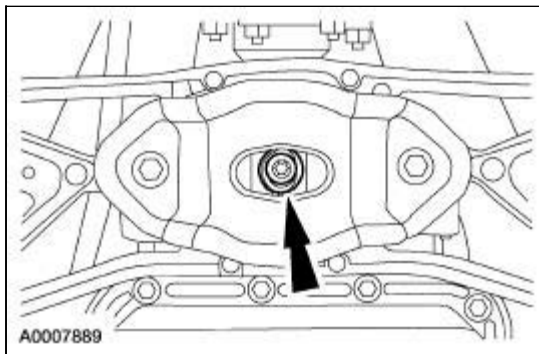


9. If transmission disassembly is necessary, drain the transmission fluid. For additional information, refer to [Transmission Fluid Drain and Refill—Automated Equipment](#), [Transmission Fluid Drain and Refill—Vehicles With Torque Converter Drain Plug](#) or [Transmission Fluid Drain and Refill—Vehicles Without Torque Converter Drain Plug](#) in this section.

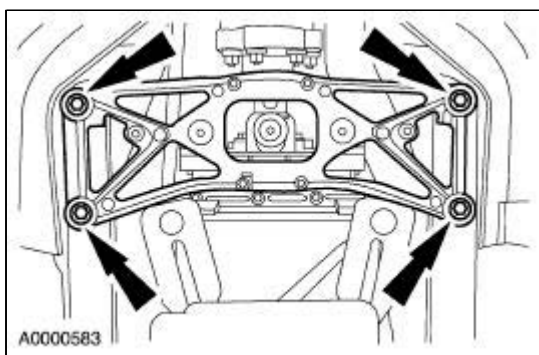
10.  **WARNING:** Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions can result in personal injury.

Support the transmission with a transmission jack.

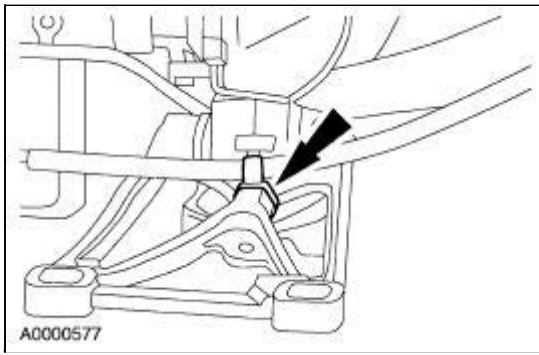
11. Remove the transmission mount.



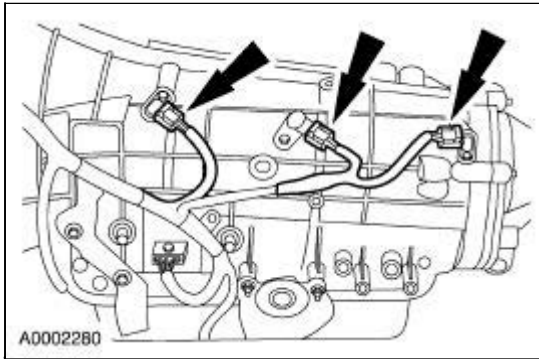
12. Remove the transmission mount.



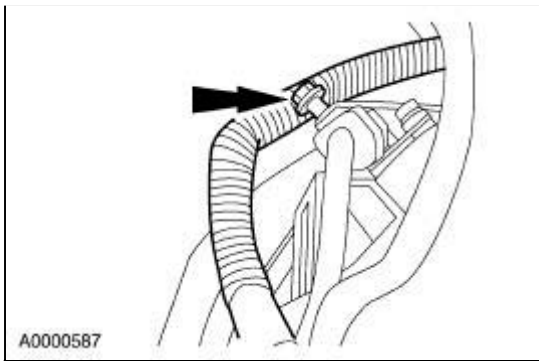
13. Disconnect the shift cable.



14. Lower the transmission enough to gain access to the sensors. Disconnect the turbine shaft speed (TSS) sensor, output shaft speed (OSS) sensor and intermediate shaft speed (ISS) sensor electrical connectors.

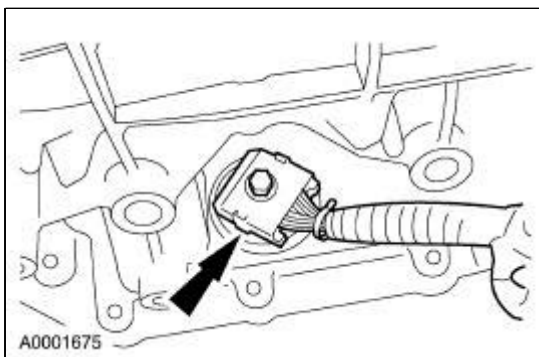


15. Remove the screw from the harness.

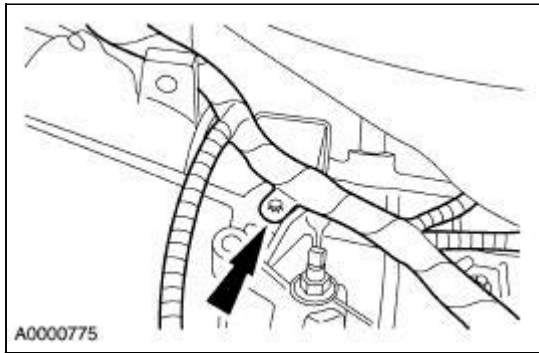


16. **NOTE:** Clean the area around connector to prevent contamination of the solenoid body connector.

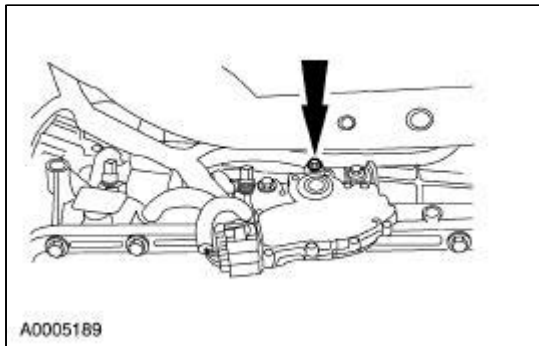
Disconnect the transmission connector.



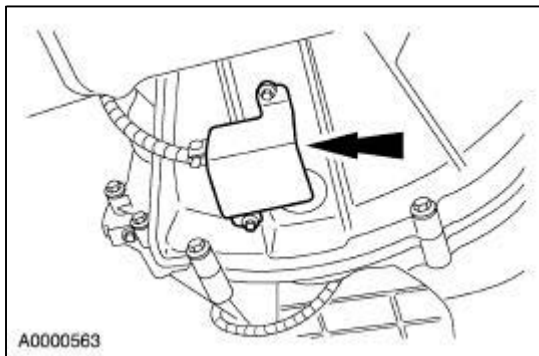
17. Disconnect the harness retainer.



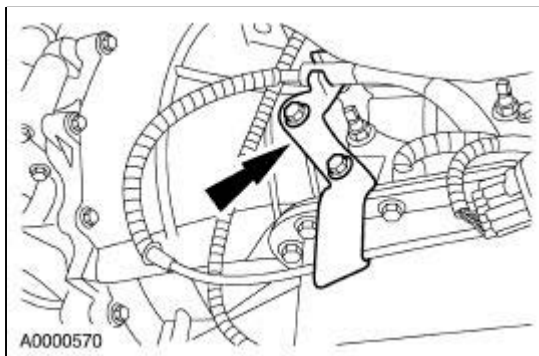
18. Disconnect the harness retainer.



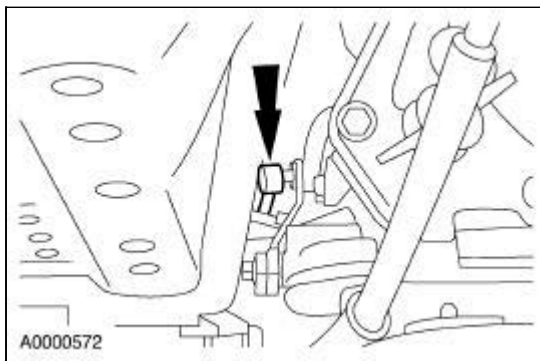
19. Remove the heated oxygen sensor (HO2S) connector.



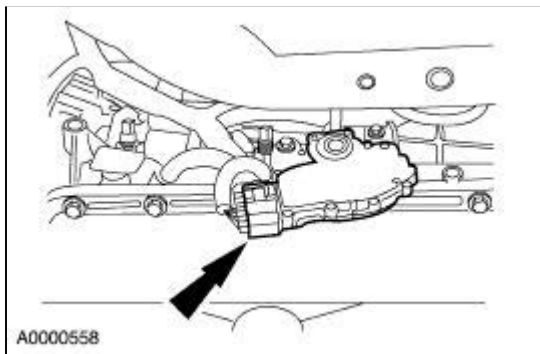
20. Remove the shifter cable bracket.



21. Disconnect the shifter cable from the manual lever.

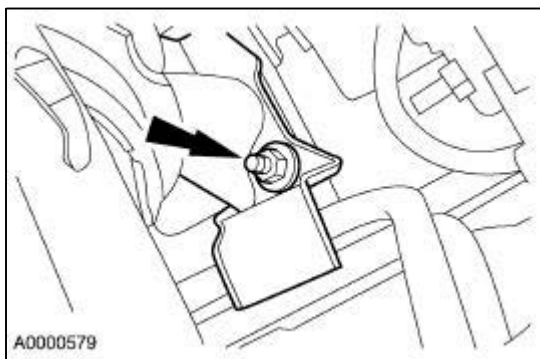


22. Disconnect the digital transmission range (TR) sensor connector.



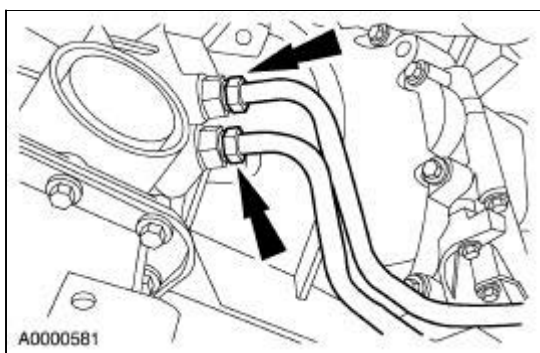
23. **NOTE:** V8 application shown; V6 application similar.

Disconnect the transmission cooler line bracket.

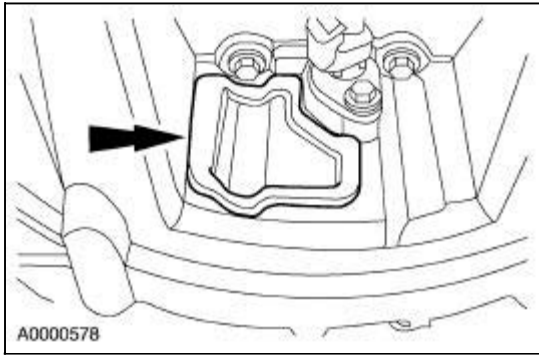


24.  **CAUTION: Do not damage the cooler tubes.**

Disconnect the transmission cooler tubes.

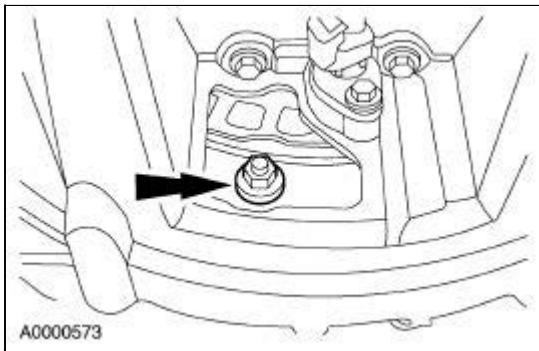


25. On 3.0L engines only, remove the starter motor. For additional information, refer to [Section 303-06](#).
26. Remove the access cover.

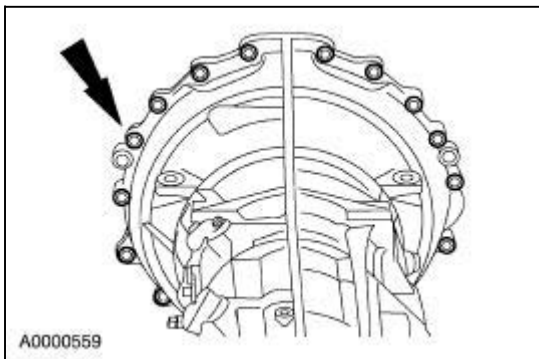


27. **NOTE:** Make an identifying mark on the nut, stud and adapter plate to allow for correct installation.

Remove the nuts.




28. Remove the bolts.

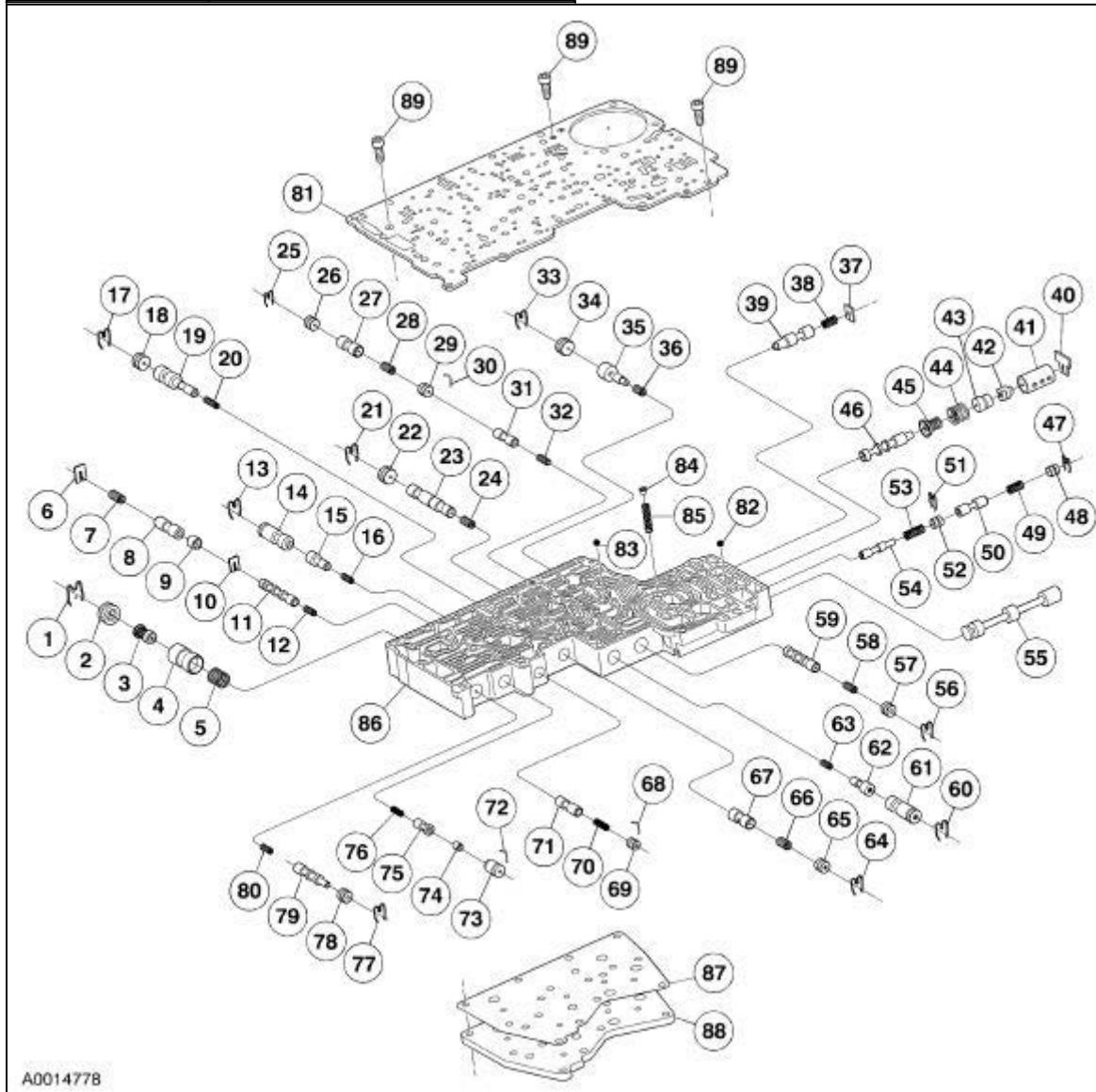


29. Lower the transmission from the vehicle.
 30. Backflush and clean the transmission fluid cooler. For additional information, refer to [Section 307-02](#).
-

Main Control Valve Body

Special Tool(s)

 <p>ST1639-A</p>	<p>Aligner, Valve Body 307-334 (T95L-70010-C) (2 req'd.)</p>
---	--



A001477B

Item	Part Number	Description
1	7F445	Clip — retainer
2	7D374	Plug — retainer
3	7M094	Valve assembly— thermo

4	7L367	Valve — fluid cooler bypass
5	7M116	Spring — fluid cooler bypass
6	7E336	Plate
7	7G489	Spring — coast clutch control
8	7G490	Valve — coast clutch control
9	7G490	Valve — coast clutch control
10	7E336	Plate
11	7M189	Valve — overdrive servo control
12	7M193	Spring — overdrive servo control valve
13	7M445	Clip — retainer
14	7D374	Plug — retainer
15	7M095	Valve — modulator
16	7M104	Spring — modulator valve
17	7F445	Plug — retainer
18	7D374	Clip — retainer
19	7F259	Valve — 4-3 ISR downshift control
20	7F260	Spring — 4-3 ISR control valve
21	7F445	Plug — retainer
22	7D374	Clip — retainer
23	7M188	Valve — 4-3 pre-stroke intermediate band control
24	7G289	Spring — 4-3 pre-stroke intermediate band control valve
25	7F445	Clip — retainer
26	7D374	Plug — retainer
27	7G317	Valve — reverse engagement
28	7D312	Spring — reverse engagement valve
29	7D374	Plug — retainer
30	7D335	Retainer — wire
31	7M187	Valve — high clutch control
32	7M192	Spring — high clutch control valve
33	7F445	Clip — retainer
34	7D374	Plug — retainer
35	7M095	Valve — reverse modulator
36	7M104	Spring — reverse modulator valve
37	7E336	Plate
38	7M191	Spring — rear servo control valve
39	7M098	Valve — rear servo control
40	7E336	Plate
41	7D002	Sleeve
42	7D003	Valve — booster
43	7D003	Valve — booster

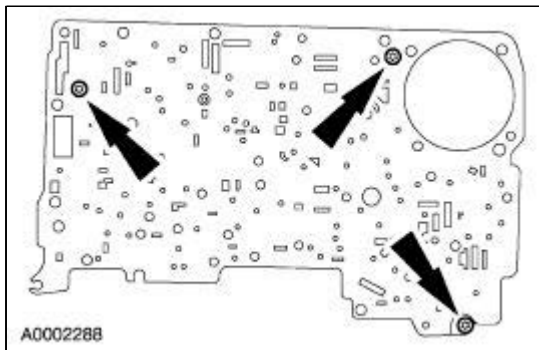
44	7A270	Spring — outer
45	7H149	Spring and retainer assembly
46	7C388	Valve — main regulator
47	7F445	Retainer — clip
48	7D374	Retainer — plug
49	7L317	Spring — reverse inhibition valve
50	7L316	Valve — reverse inhibition
51	7E445	Retainer — clip
52	7D374	Retainer — plug
53	7G411	Spring — solenoid regulator valve
54	7G473	Valve — solenoid regulator
55	7340	Valve — manual
56	7F445	Retainer — clip
57	7D374	Retainer — plug
58	7M099	Spring — select valve
59	7M186	Spring — select
60	7F445	Retainer — clip
61	7D374	Retainer — plug
62	7M095	Valve — modulator
63	7M104	Spring — modulator valve
64	7F445	Retainer — clip
65	7D374	Retainer — plug
66	7G312	Spring — forward engagement control valve
67	7D317	Valve — forward engagement control
68	7E335	Retainer — wire
69	7D374	Retainer — plug
70	7M190	Spring — back pressure
71	7M185	Valve — converter clutch back pressure
72	7E335	Retainer — wire
73	7D002	Sleeve — converter clutch modulator control
74	7M184	Valve — converter clutch modulator control
75	7G307	Valve — converter clutch modulator
76	7G316	Spring — converter clutch modulator control
77	7F445	Retainer — clip
78	7D374	Retainer — plug
79	7L318	Valve — converter clutch control
80	7L490	Spring — converter clutch control valve
81	7Z490	Plate assembly — main control valve body separator
82	7E195	Ball — lubrication check
83	7E195	Ball — shuttle valve
84	7E368	Valve — limit

85	7E340	Spring — limit valve
86	7A101	Body — control valve lower
87	7H173	Gasket — valve body cover plate
88	7C034	Plate — valve body cover
89	W701099-S1430	Screw — separator plate

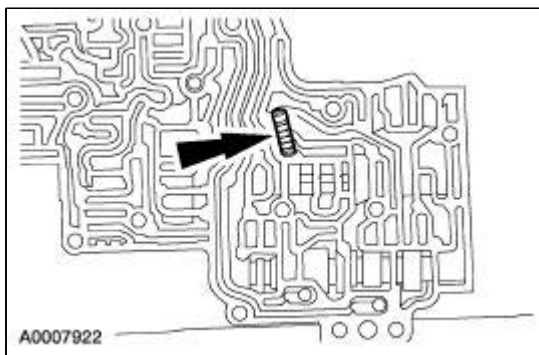
Disassembly

1. **NOTE:** The valve body separator plate has a bonded gasket.

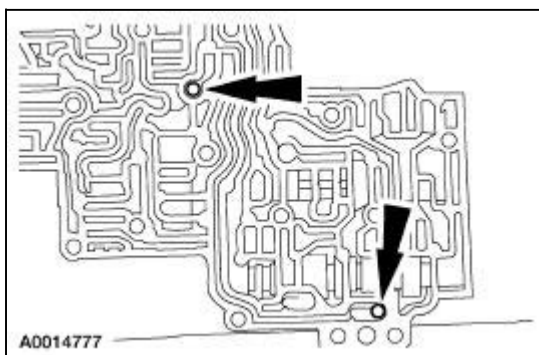
Remove the valve body separator plate.



2. Remove the pressure control limit relief valve and spring.




3. Remove the check balls.



4. **NOTE:** Refer to the disassembled view.

Disassemble the main control valve body.

Assembly

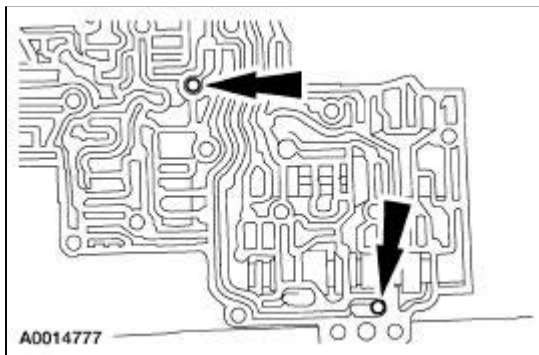
1.  **CAUTION: Do not lose parts when cleaning or repairing.**

Thoroughly clean all parts in solvent and blow dry with moisture-free compressed air.

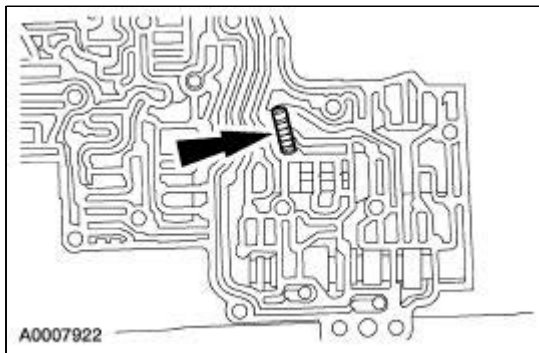
2.  **CAUTION: Do not stone, file, or sand the valves. This will remove the anodized finish and may result in further main control or transmission damage.**

After cleaning the main control valve body, carry out the following.

- Inspect all valve and plug bores for scoring or burrs.
 - Check all fluid passages for obstructions.
 - Inspect all valves and plugs for burrs.
 - Inspect all mating surfaces for burrs or distortion.
 - Inspect all springs for distortion.
 - Check all valves and plugs for free movement in their respective bores.
 - Valves and plugs, when dry, must fall from their own weight into their respective bores.
 - Roll the manual valve on a flat surface to check for a bent condition.
3. Assemble the main control valve body.
 4. Install the main control valve body check balls.

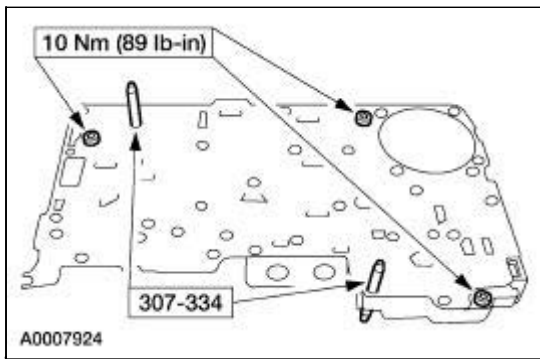


5. Install the pressure control limit relief valve and spring.



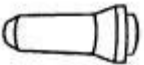



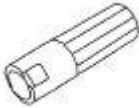

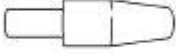
6. **NOTE:** Use a new valve body separator plate for main control valve body installation.

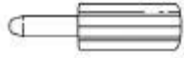
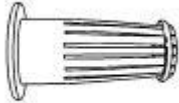
Using the special tools, install the main control valve body separator plate.



Fluid Pump

Special Tool(s)

 <p>ST1833-A</p>	<p>Installer, Torque Converter Fluid Seal 307-349 (T97T-77000-A)</p>
 <p>ST1817-A</p>	<p>Alignment Set, Fluid Pump 307-S039 (T74P-77103-X)</p>
 <p>ST2532-A</p>	<p>Alignment Gauge, Transmission Fluid Pump 307-431</p>
 <p>ST2533-A</p>	<p>Alignment Gauge, Transmission Fluid Pump 307-432</p>
 <p>ST1826-A</p>	<p>Sizer, Piston Seal 307-338 (T95L-70010-G)</p>
 <p>ST2419-A</p>	<p>Alignment Pins, Transmission Fluid Pump 307-398</p>
 <p>ST2684-A</p>	<p>Transmission Fluid Pump Seal Aligner 307-451/1</p>
	<p>Transmission Fluid Pump Seal Sizer 307-451/2</p>

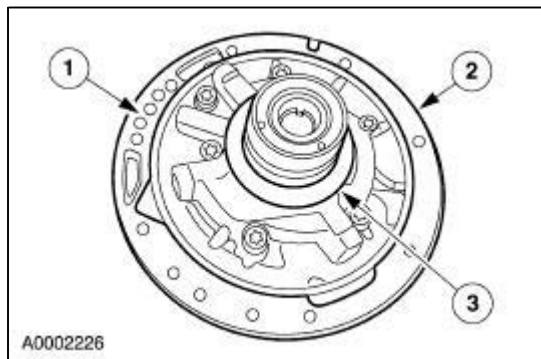
 ST2685-A	
 ST2686-A	Transmission Fluid Pump Seal Installer 307-451/3

Material

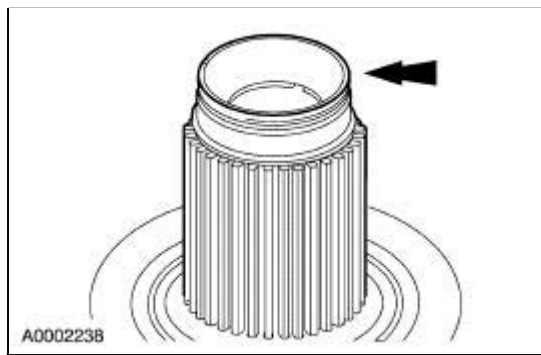
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V

Disassembly

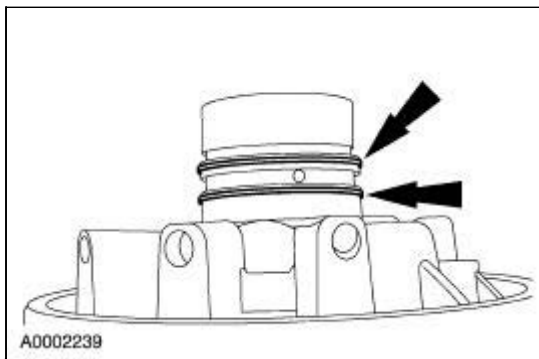
1. Remove the fluid pump gasket, fluid pump seal ring, and the No.1 thrust washer.
 1. Remove and discard the fluid pump gasket.
 2. Remove and discard the fluid pump seal ring (square cut).
 3. Remove and tag the No.1 thrust washer.



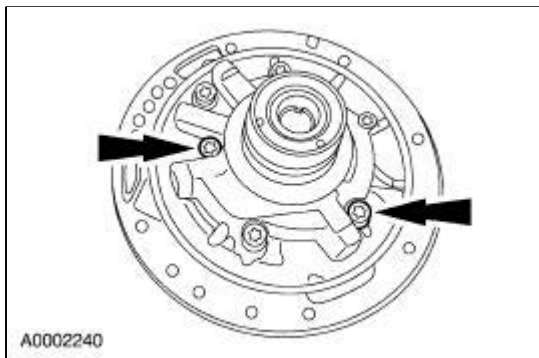
2. Remove the fluid pump support seal ring.



3. Remove the seal rings.



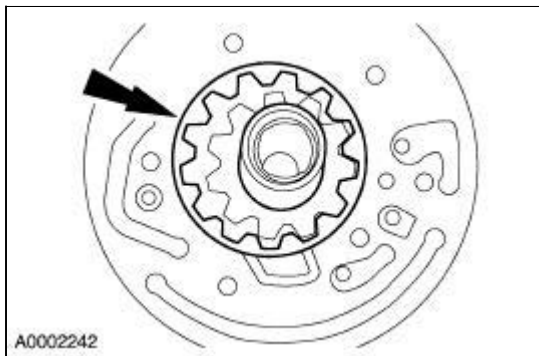
4. Remove the fluid pump housing.



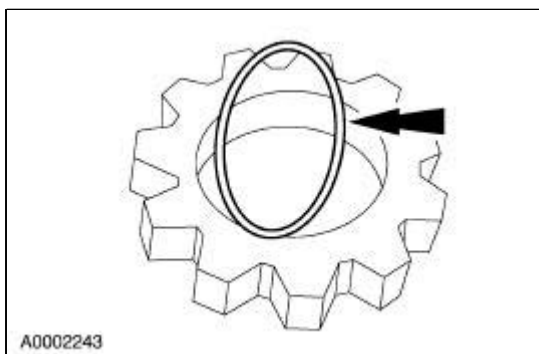
5. **NOTE:** A rough casting on the pump surface crescent is not a flaw.

NOTE: The fluid pump gears are part of the pump assembly and are not repaired separately.

Remove the fluid pump gears.

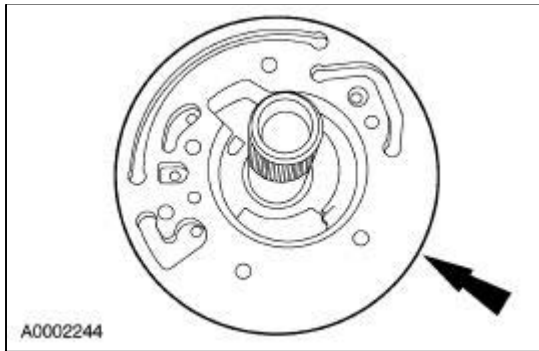


6. Remove the drive gear O-ring seal and discard. Inspect the fluid pump gears for cracks and scoring.

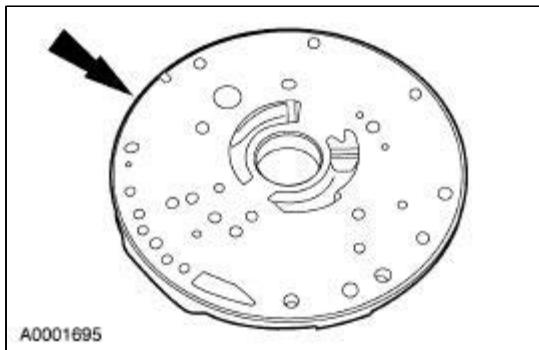


7. Inspect the overdrive pump.

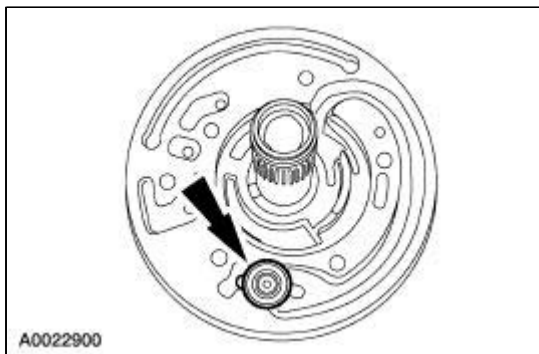
- Inspect the overdrive pump support gear pockets for scoring and wear.
- Clean and inspect the overdrive and rear input shaft bushings.



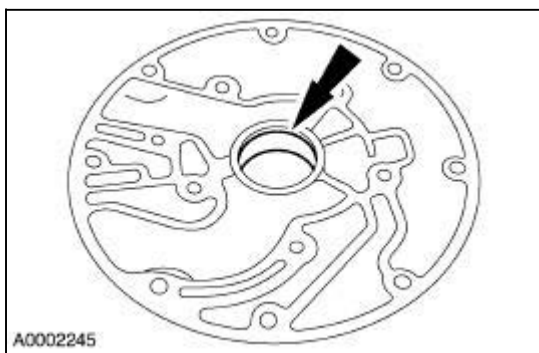
8. Inspect the fluid pump adapter plate for scoring and wear.



9. Remove the valve.



10. Inspect the fluid pump to converter housing bushing.



Assembly

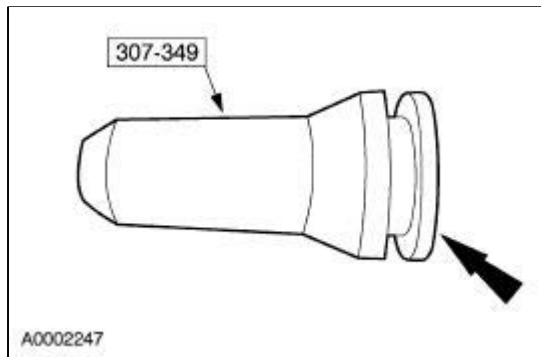
1. **NOTE:** Minor burrs and scoring may be removed with crocus cloth. If damage is found, install a new assembly.

Inspect the fluid pump components for the following:

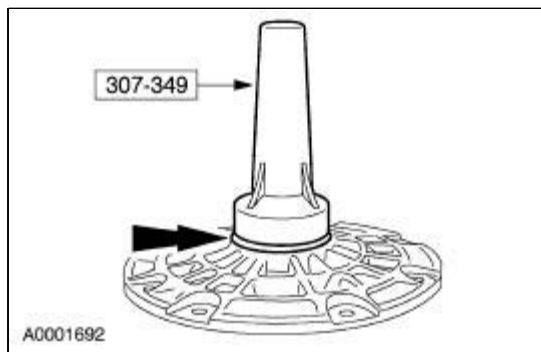
- Pump body and case for burrs.
- Fluid passages for obstructions.

2. **NOTE:** Check and make sure that the garter spring in the seal has not popped off of the converter hub seal.

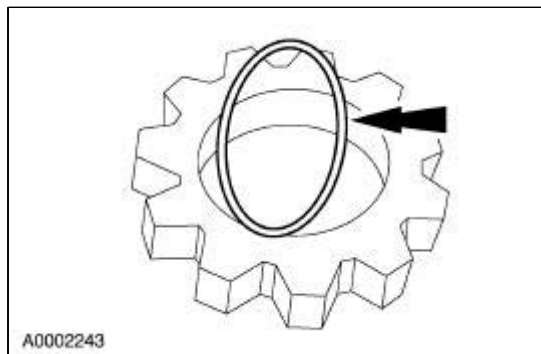
Install a new seal onto the special tool.



3. Using the special tool, install the converter hub seal.

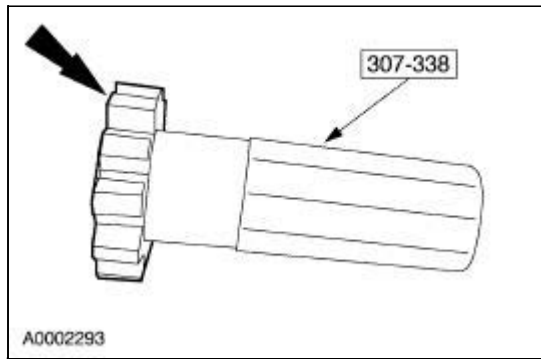


4. Install a new O-ring seal in fluid pump drive gear.



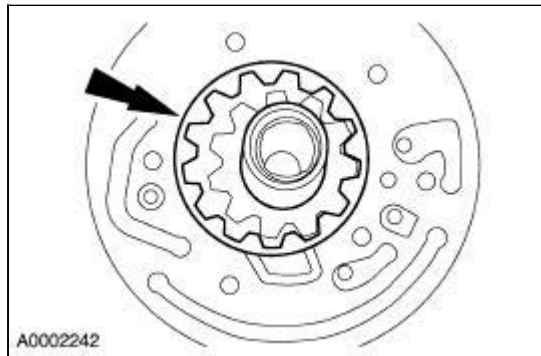
5.  **CAUTION:** Lubricate the special tool with multi-purpose grease.

Using the special tool, seat the O-ring seal in the pump gear.

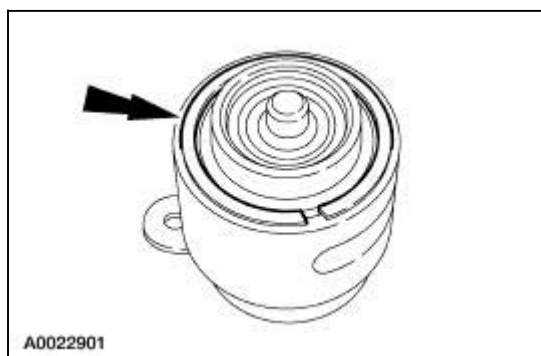


6.  **CAUTION:** The chamber on the inside edge of the small gear must be up when in the pump housing gear pocket. The dimple on the larger gear must be down when in the pump housing gear pocket.

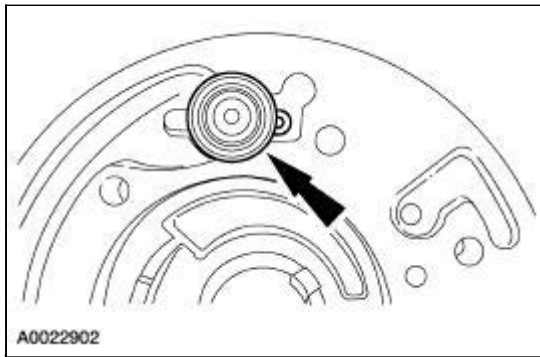
Install the pump gears into the fluid pump housing. Apply multi-purpose grease to pump gear to prevent scoring at start-up.



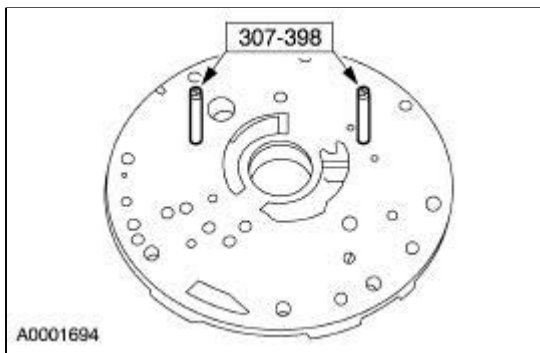
7. Install a new seal on the valve.




8. Install the valve.

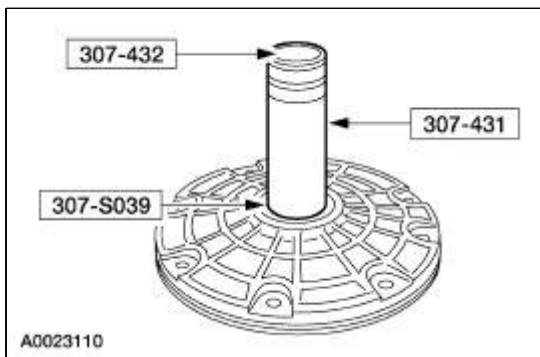


9. First install the fluid pump adapter plate and then the alignment pins in their correct locations.

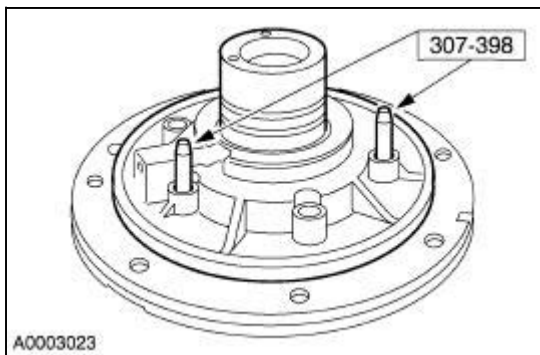


10.  **CAUTION: The special tools must be used to correctly align the pump with the adapter plate to reduce gear noise, bushing failure and leakage.**

Using the special tool, align the fluid pump to the adapter plate.

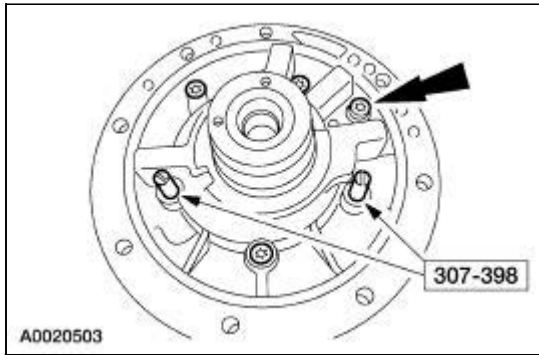


11. Using the special tools, assemble the pump.

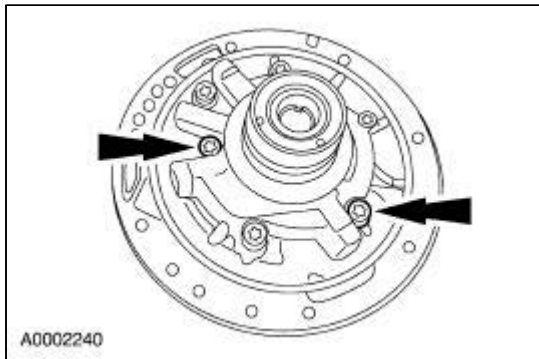


12. Loosely install the fluid pump housing screws in their correct locations and remove the special

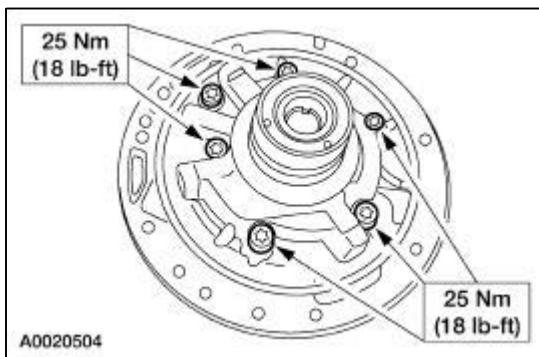
tools.



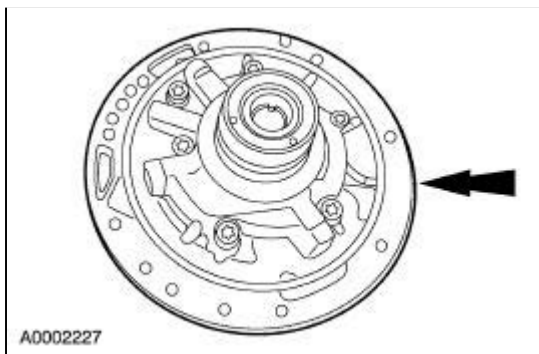
13. Install the two remaining screws.



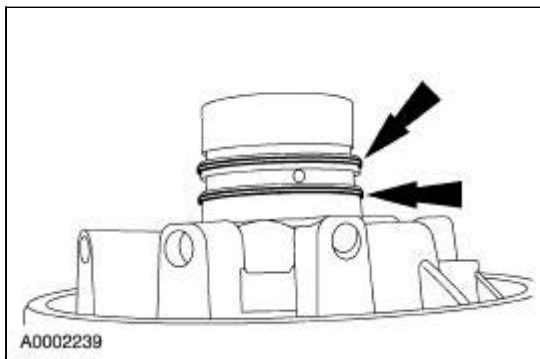
14. Tighten all of the fluid pump screws in a star pattern.



15. Install a new fluid pump seal ring.

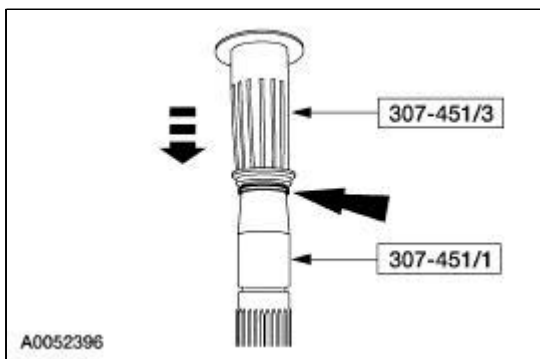



16. Install new seal rings.



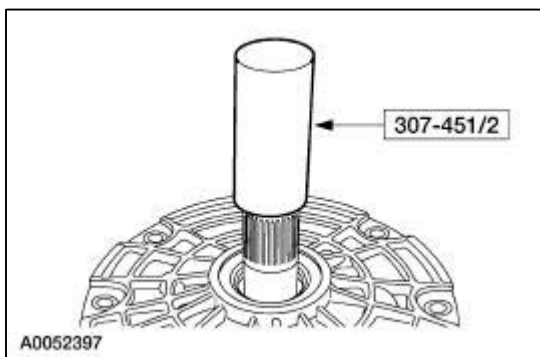
17.  **CAUTION: Be careful not to overstretch the seal ring past the seal ring groove. Damage to the seal will occur.**

Using the special tools, install the fluid pump seal ring.



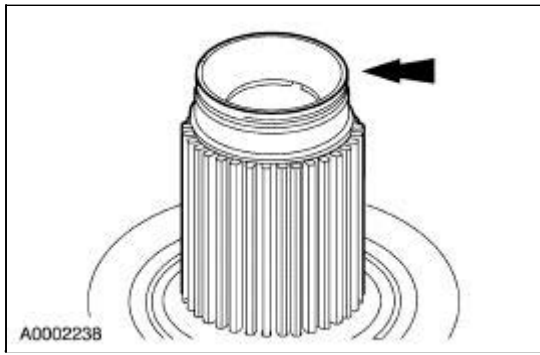
18.  **CAUTION: Failure to correctly size the seal will damage the seal when the torque converter is installed.**

Using the special tool, size the seal to the correct size. Leave the special tool on the seal for two minutes to obtain the correct seal size.





19.  **CAUTION: Verify correct seal installation. Make sure seal grooves are clean and free of burrs.**

Install the seal.



Overdrive Brake and Coast Clutch Drum Assembly

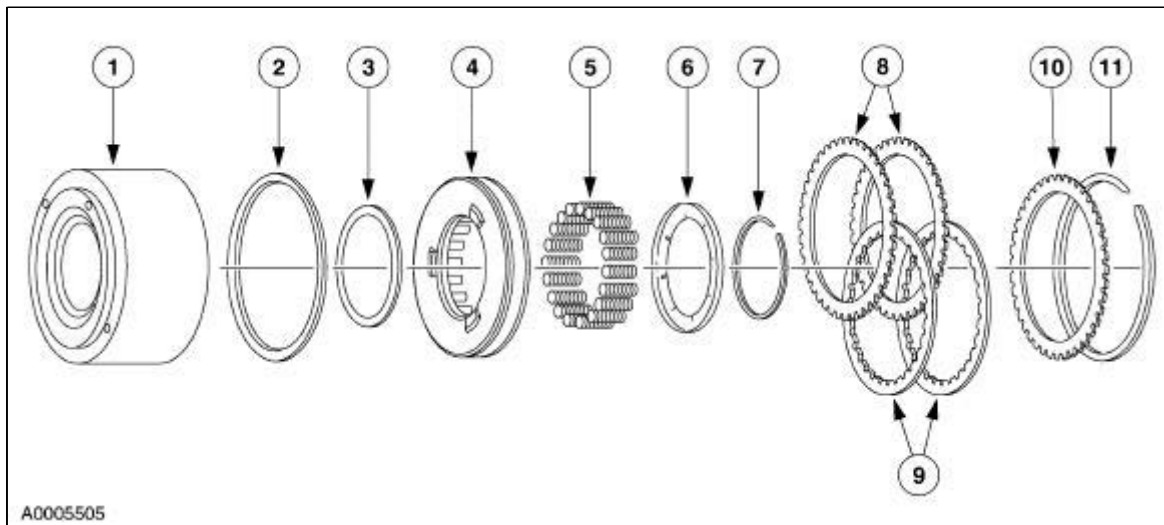
Special Tool(s)

 <p>ST1190-A</p>	Compressor, Clutch Spring 307-015 (T65L-77515-A)
 <p>ST2431-A</p>	Protector, Piston Seal 307-049 (T74P-77404-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

Overdrive Brake and Coast Clutch Drum Assembly

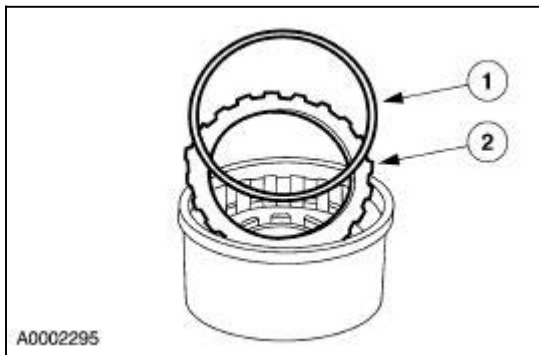


Item	Part Number	Description
1	7L669	Overdrive brake and coast clutch drum
2	7A548	Direct and overdrive piston outer seal ring
3	7D404	Direct and overdrive piston inner seal ring
4	7A262	Direct and overdrive clutch piston
5	7A480	Direct and overdrive piston spring (20 req'd)

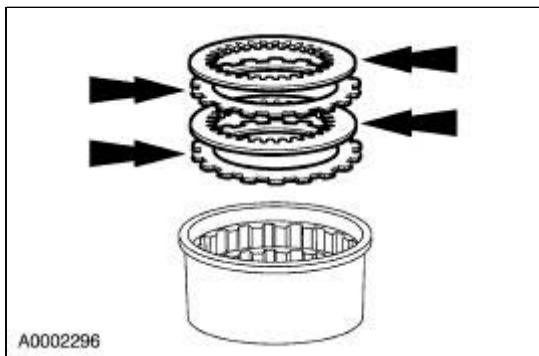
6	7A527	Direct/coast clutch piston spring retainer
7	E860125-S	Retaining ring
8	7B442	Coast clutch external plate — steel (2 Req'd)
9	7B164	Coast clutch internal plate — friction (2 Req'd)
10	7B066	Direct/coast clutch pressure plate
11	E860126S/129S	Retaining ring (select fit)

Disassembly


1. Remove the coast clutch pressure plate.
 1. Remove the coast clutch retaining ring.
 2. Remove the coast clutch pressure plate.



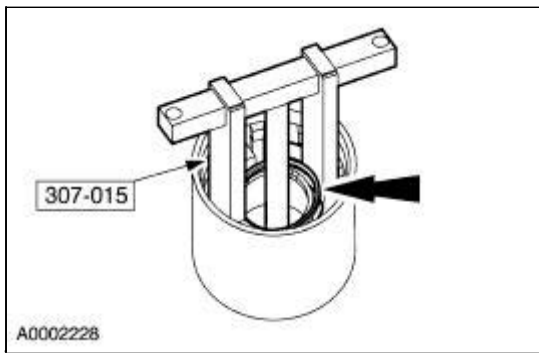
2. Remove the coast clutch disc pack.
 - Inspect for wear, install a new pack as necessary.



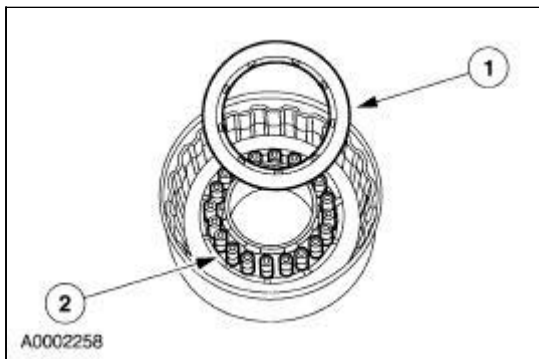
3.  **WARNING:** Use caution when releasing tool pressure on the rear clutch piston spring. Failure to follow these instructions may result in personal injury.

 **CAUTION:** Do not fully compress the special tool or damage to the spring retainer may occur.

Using the special tool, remove the coast clutch piston retaining ring.



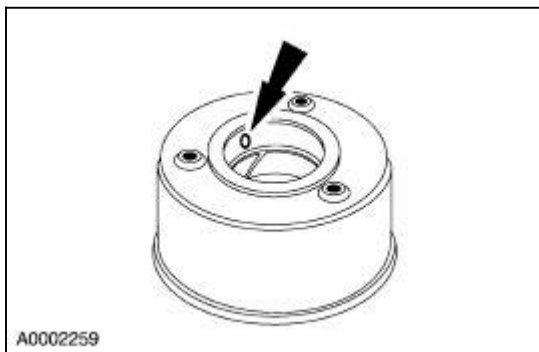
4. Relieve the coast clutch spring tension and remove the special tool.
5. Remove the coast clutch piston springs.
 1. Remove the coast clutch piston retainer.
 2. Remove the clutch piston springs.



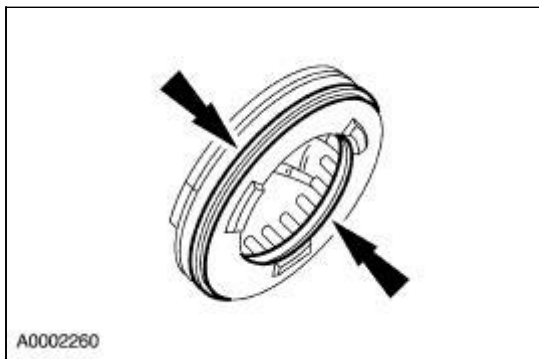
6. **⚠ WARNING: Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air, and make sure the drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

Remove the coast clutch piston.

- Apply air pressure to the hole in the drum to remove the coast clutch piston while blocking the other hole with a finger.



7. Remove the coast clutch piston inner seal and the coast clutch piston outer seal.
 - Clean and install a new seal as necessary.

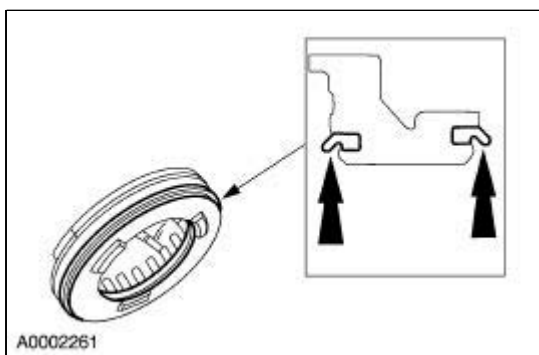


Assembly

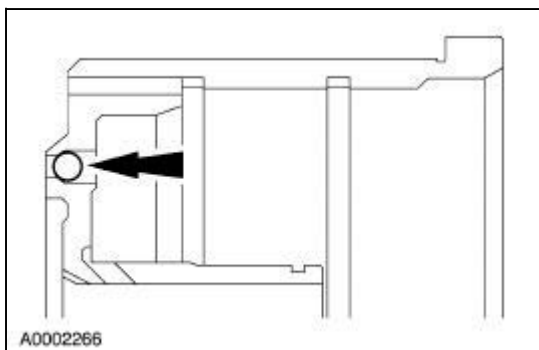
1. Inspect the coast clutch components for damage or wear. Install new components as necessary.
 - Inspect the drum band surface, bushing, and thrust surfaces for damage.
 - Inspect the clutch piston bore, and piston.
 - Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.
 - Inspect the clutch plates for damage.
 - Inspect the clutch springs.

2.  **CAUTION: The lip seals must be positioned as shown. Care must be taken to prevent rollover of the lip seal.**

Install the new coast clutch piston inner and outer seal.

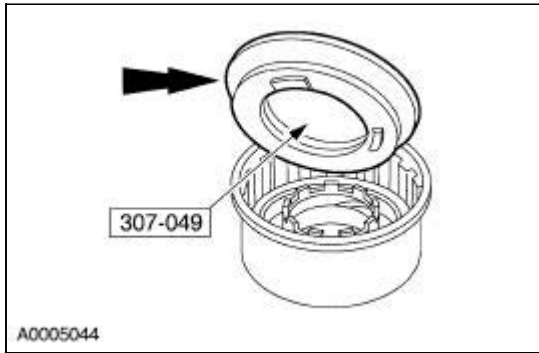


3. Verify the check ball is free to move.

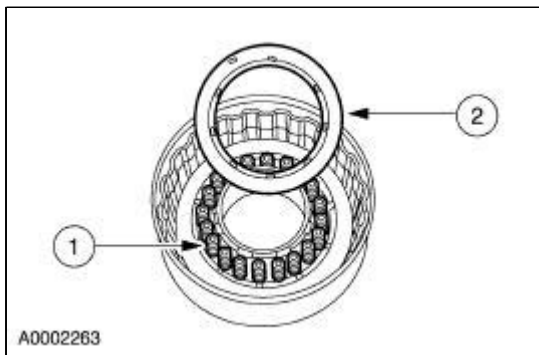



4.  **CAUTION: Care must be taken to prevent damage to the seals during installation.**

Using the special tool, install the coast clutch piston.

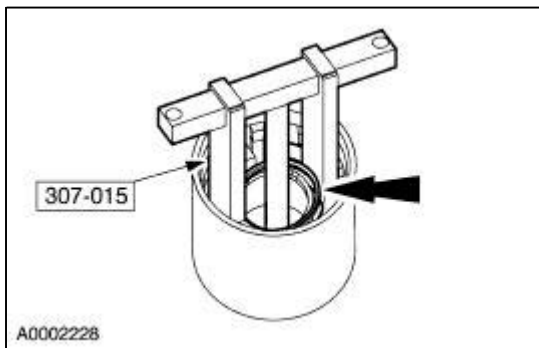


5. Install the coast clutch piston springs.
 1. Install the coast clutch piston springs.
 2. Install the coast clutch spring retainer.



6.  **CAUTION: Do not fully compress the special tool or damage to the coast clutch piston spring retainer may occur.**

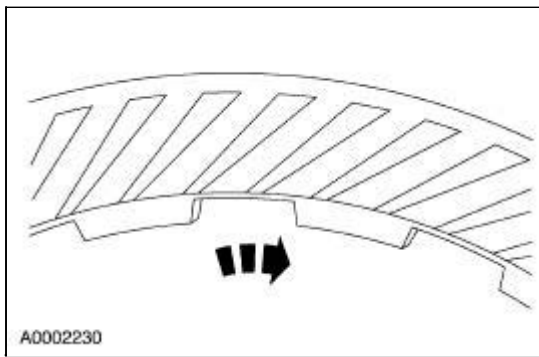
Using the special tool, install the coast clutch piston spring retainer ring.



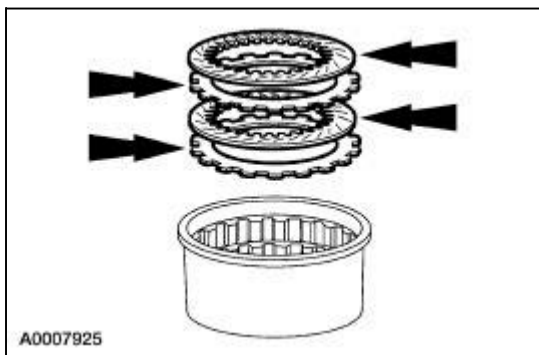
7.  **CAUTION: Coast clutch friction plates are directional and must be installed with grooves clockwise (I.D. to O.D.). The word "TOP" should face up.**

 **CAUTION: If new clutch plates are being used, they should be soaked in clean automatic transmission fluid for at least 30 minutes before assembly.**

When installing friction plates, the word "TOP" should face up. If reusing plates, grooves must be installed clockwise. Install the coast clutch disc pack.



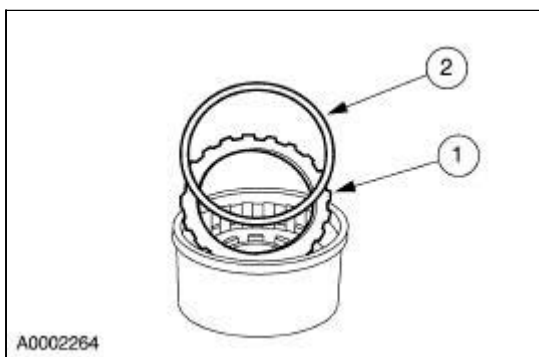
8. Install the two steel clutch plates and two friction clutch plates in alternating order starting with a steel clutch plate.




9.  **CAUTION: The retaining ring is select fit.**

Install the coast clutch pressure plate.

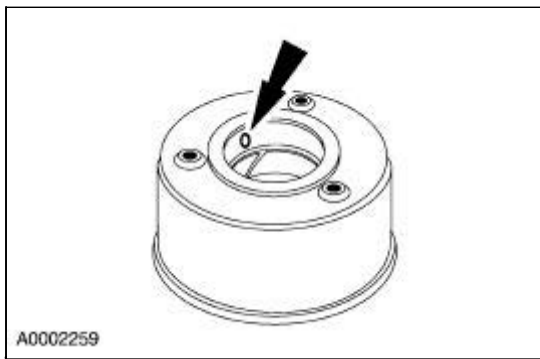
1. Install the coast clutch pressure plate.
2. Install the original coast clutch retaining ring.



10.  **WARNING: Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air, and make sure drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

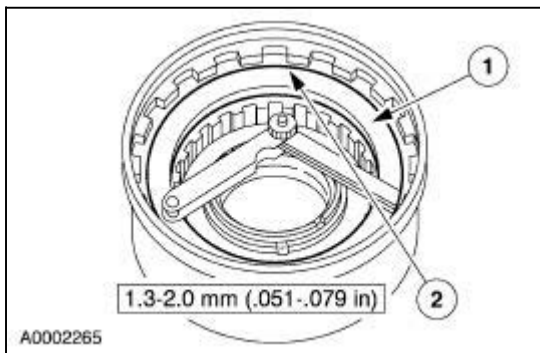
Air check the assembly.

- Apply air pressure to the hole in the drum while blocking the other hole with a finger.





11. Check the coast clutch disc pack free play.
 1. Push down on the coast pressure plate.
 2. Check clearance between the coast clutch retaining ring and coast pressure plate. Clearance should be 1.3-2.0 mm (.051-.079 in). If clearance is not within the specification, install a correct coast clutch retaining ring that will provide the correct free play adjustment.

Part Number	Thickness		Diameter	
	mm	In	mm	In
E860126-S	1.37	.0539	130.1	5.122
E860127-S	1.73	.0681	130.1	5.122
E860128-S	2.08	.0819	130.1	5.122
E860129-S	2.44	.0961	130.1	5.122



Direct Clutch Drum Assembly

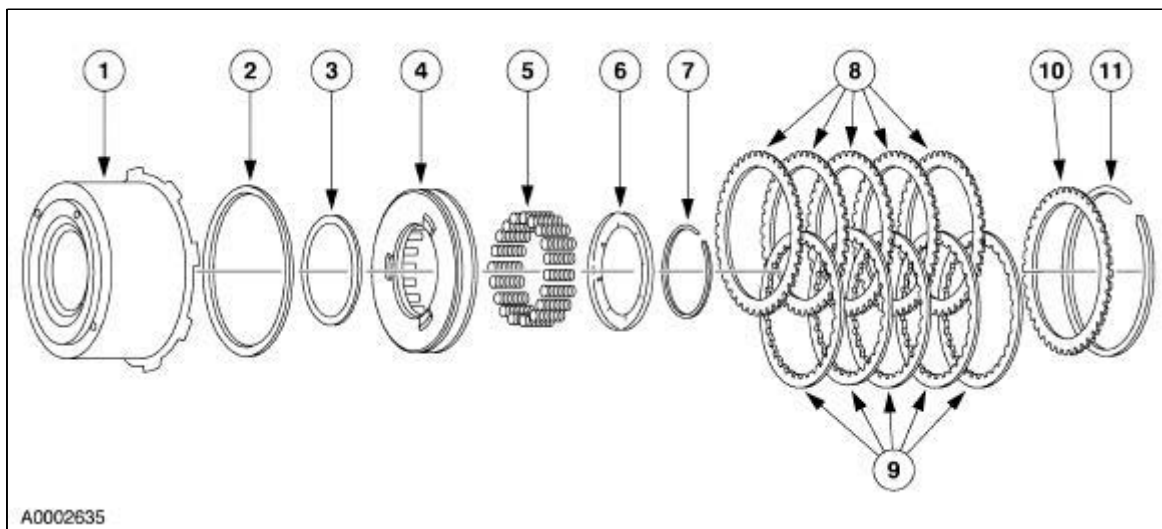
Special Tool(s)

 <p>ST1190-A</p>	Compressor, Clutch Spring 307-015 (T65L-77515-A)
 <p>ST2431-A</p>	Protector, Piston Seal 307-049 (T74P-77404-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

Direct Clutch Drum Assembly

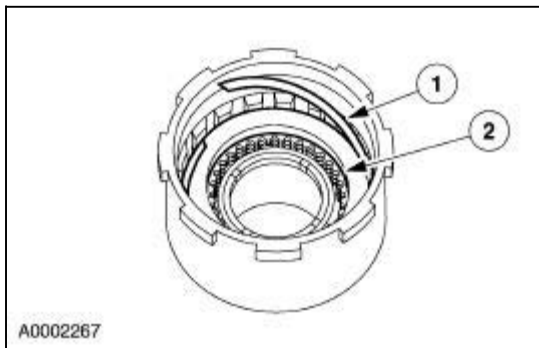


Item	Part Number	Description
1	7D044	Intermediate brake drum assembly
2	7A548	Direct and overdrive piston outer seal ring
3	7D404	Direct and overdrive piston inner seal ring
4	7A262	Direct and overdrive clutch piston
5	7A480	Direct and overdrive piston spring (20 req'd)

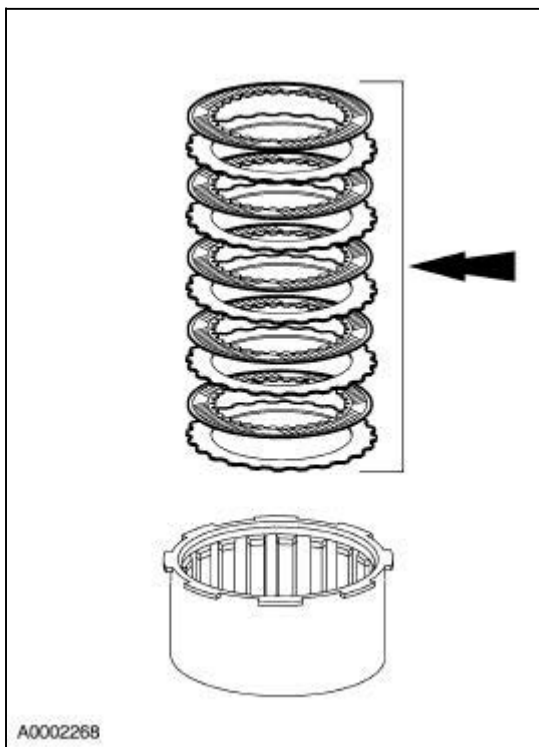
6	7A527	Direct/coast clutch piston spring retainer
7	E860125-S	Retaining ring
8	7B442	Direct clutch external spline plate
9	7B164	Direct clutch internal spline plate
10	7B066	Direct/coast clutch pressure plate
11	E860126S/129S	Retaining ring (select fit)

Disassembly

1. Remove the direct clutch retaining ring and the direct clutch pressure plate.
 1. Remove the direct clutch retaining ring.
 2. Remove the direct clutch pressure plate.



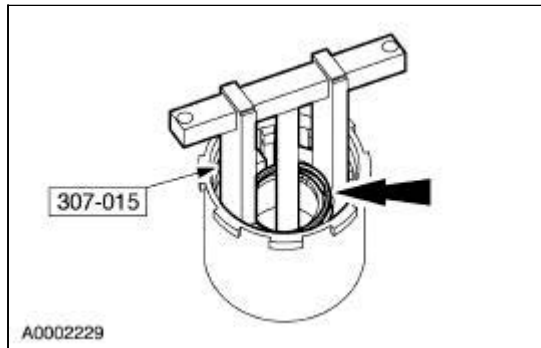
2. Remove the direct clutch disc pack.
 - Inspect and install new friction plates if worn, damaged, or overheated.



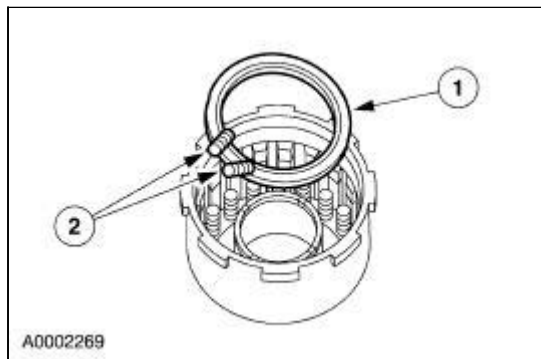
3.  **WARNING:** After removing the retaining ring, use care when releasing the pressure on the springs. Failure to follow these instructions may result in personal injury.

⚠ CAUTION: Do not fully compress the special tool or damage to the spring retainer may occur.

Using the special tool, remove the direct clutch piston retaining ring.



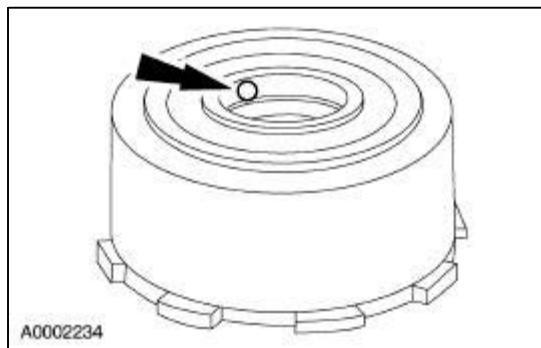
4. Relieve the direct clutch spring tension and remove the special tool.
5. Remove the direct clutch piston spring retainer and the direct clutch piston springs.
 1. Remove the direct clutch piston spring retainer.
 2. Remove the direct clutch piston springs.



6. **⚠ WARNING: Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air, and make sure the drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

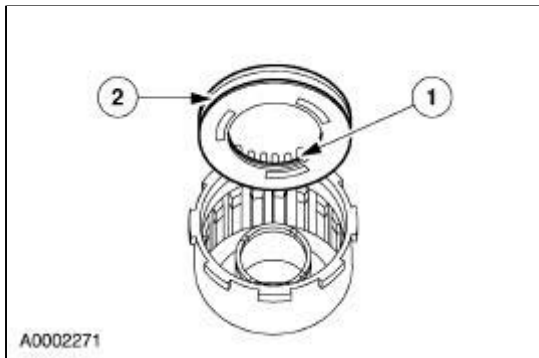
Using compressed air, remove the direct clutch piston from the direct clutch drum.

- Apply air pressure to the hole in the drum while blocking the other hole with a finger.



7. Remove the direct clutch piston inner and outer seal.
 1. Remove the direct clutch piston inner seal.
 2. Remove the direct clutch piston outer seal.

- Clean and install new components as necessary.



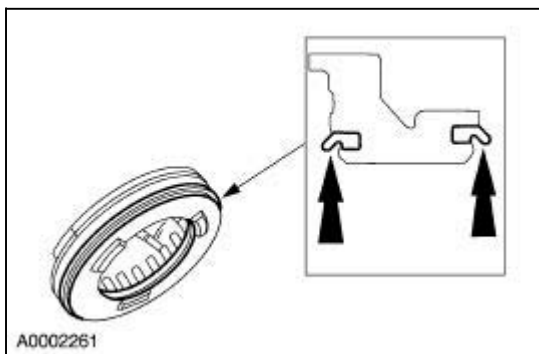
Assembly

1. Inspect the clutch components for damage or wear. Install new components as necessary.
 - Inspect the drum surface for damage.
 - Inspect the clutch piston bore, and piston.
 - Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.
 - Inspect the clutch plates for damage.
 - Inspect the clutch springs.

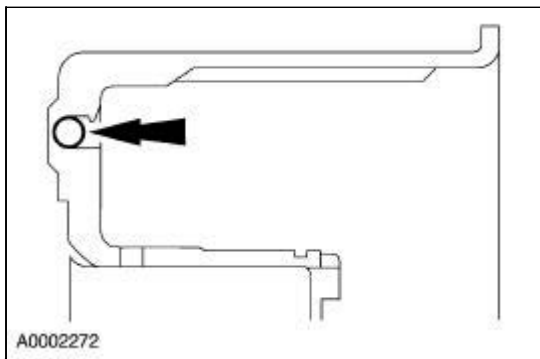
2.  **CAUTION: The lip seals must be positioned as shown. Care must be taken to prevent rollover of the lip seal.**

NOTE: Use new seals to help prevent seal failures.

Install the new direct clutch piston inner seal and the direct clutch piston outer seal.

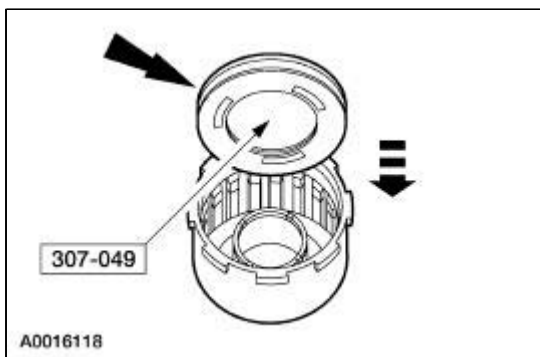


3. Verify the check ball is free to move.

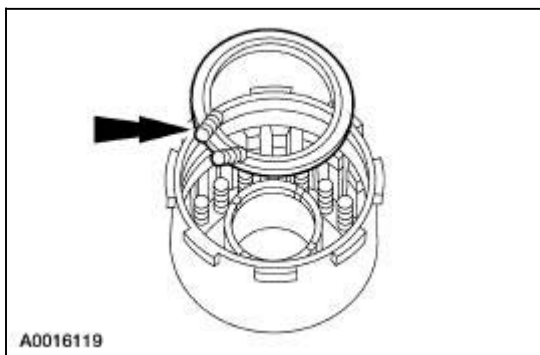


4.  **CAUTION:** Care must be taken to prevent damage to the seals during installation.

Using the special tool, install the direct clutch piston.




5. Install the direct clutch piston springs and the retainer.

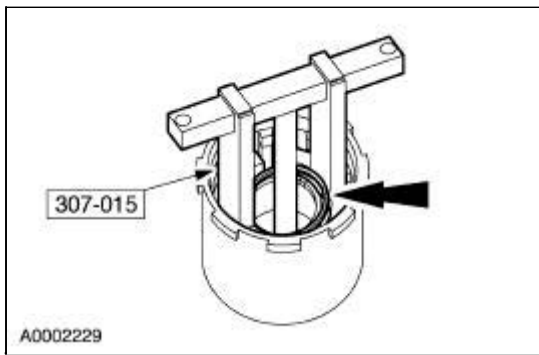


6. Relieve the direct clutch spring tension and remove the special tool.


7.  **WARNING:** After removing the retaining ring, use care when releasing the pressure on the springs. Failure to follow these instructions may result in personal injury.

 **CAUTION:** Do not fully compress the special tool or damage to the spring retainer may occur.

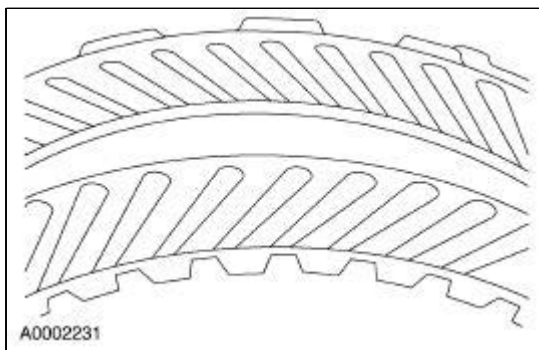
Using the special tool, install the direct clutch piston retaining ring.



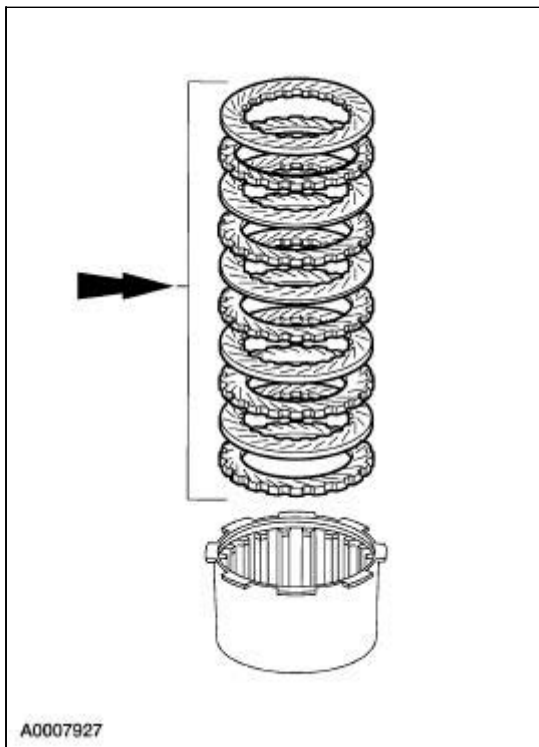
8.  **CAUTION:** The direct clutch friction plates are directional and must be installed correctly. Alternate the internally splined (clockwise) and the externally splined (counterclockwise) clutch plates.

 **CAUTION:** If new plates are used, they should be soaked in clean automatic transmission fluid for at least 30 minutes before assembly.

When installing friction plates, alternate the internally splined (clockwise) and the externally splined (counterclockwise) clutch plates. Install the direct clutch disc pack.

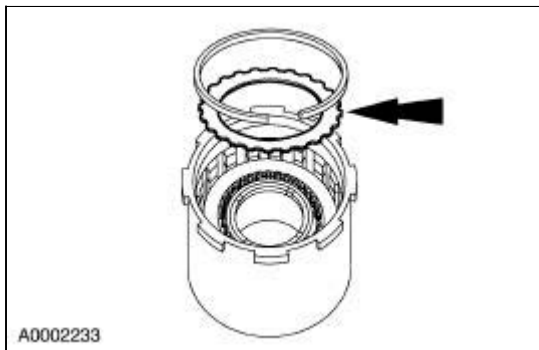



9. Install the friction plates alternating the internally splined (clockwise) and the externally splined (counterclockwise) clutch plates starting with an externally splined (counterclockwise) clutch plate.



10.  **CAUTION: The retaining ring is a select fit.**

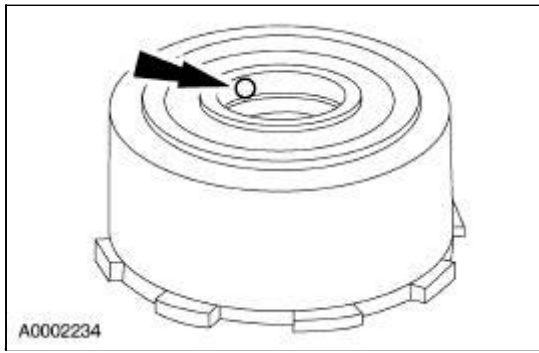
Install the direct clutch pressure plate using the original direct clutch retaining ring.



11.  **WARNING: Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air, and make sure drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

Air check the assembly.

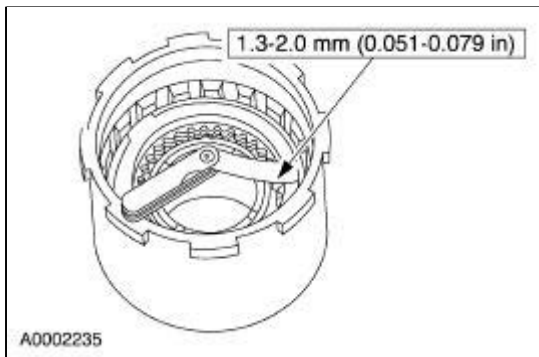
- Apply air pressure to the hole in the drum while blocking the other hole with a finger.



12. Push down on direct clutch disc pack and check gap between the direct clutch retaining ring and the direct clutch pressure plate with a feeler gauge.
 - If specifications do not match use a select fit direct clutch retaining ring to match specifications and verify with a feeler gauge.

Direct Clutch

Part Number	Thickness		Diameter	
	mm	In	mm	In
E860126-S	1.37	0.0539	130.1	5.122
E860127-S	1.73	0.0681	130.1	5.122
E860128-S	2.08	0.0819	130.1	5.122
E860129-S	2.44	0.0961	130.1	5.122



Forward Clutch

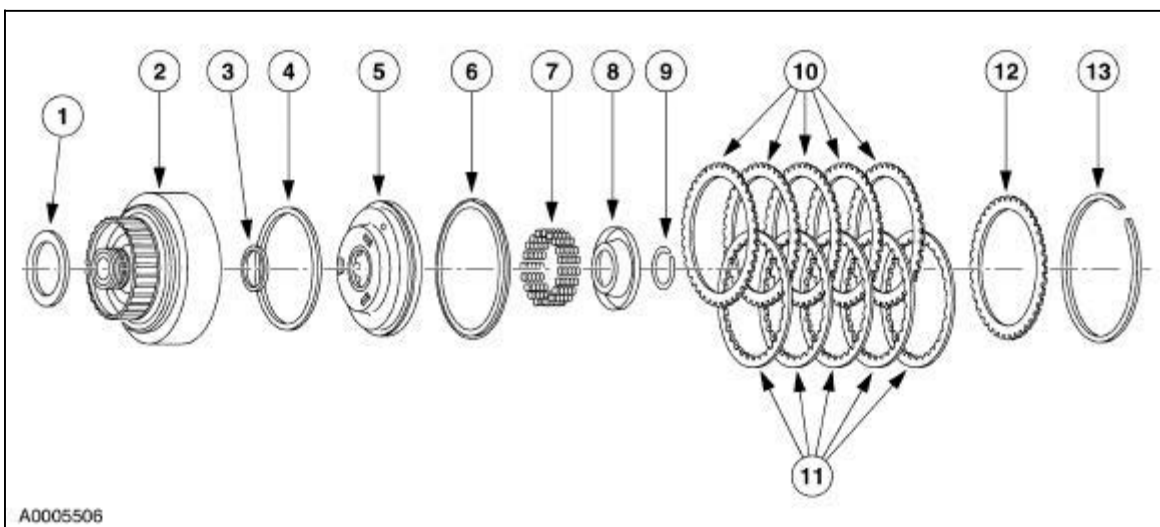
Special Tool(s)

<p>ST1190-A</p>	Spring Compressor, Clutch 307-015 (T65L-77515-A)
<p>ST1813-A</p>	Protector, Piston Seal 307-051 (T74P-77548-A)
<p>ST1812-A</p>	Protector, Piston Seal 307-052 (T74P-77548-B)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON®

Forward Clutch Assembly



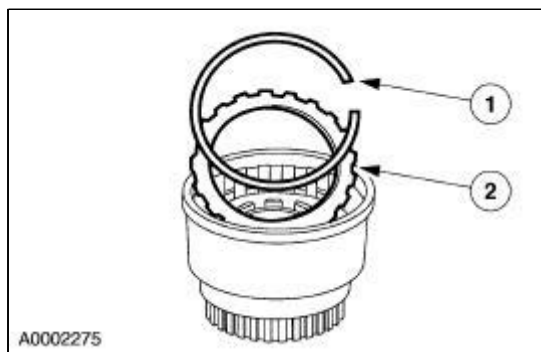
A0005506

Part

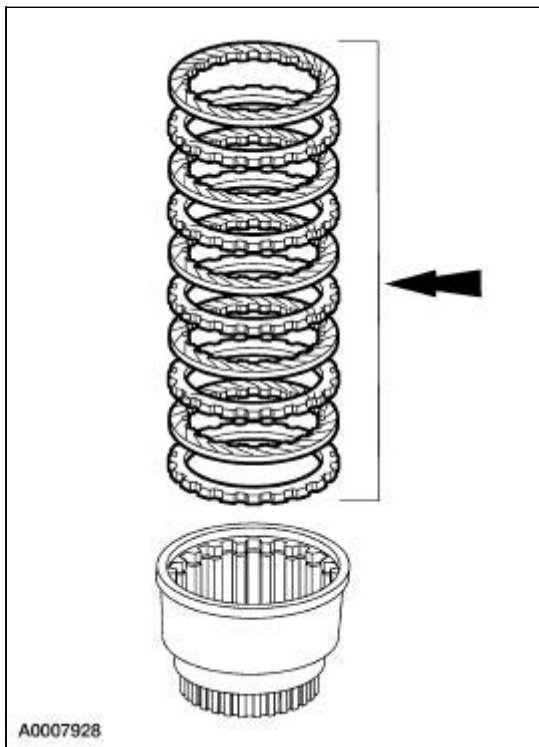
Item	Number	Description
1	7M153	Forward clutch cylinder thrust bearing (no. 5)
2	7A360	Forward clutch cylinder assembly
3	7A548	Forward clutch piston inner seal ring
4	7A548	Forward clutch piston outer seal ring
5	7A262	Forward clutch piston
6	7B070	Forward clutch cushion spring
7	7C151	Forward clutch piston spring (15 req'd)
8	7A527	Forward clutch piston spring retainer
9	E860109-S	Forward clutch retaining ring
10	7B442	Forward clutch external plate-steel (vehicle-dependent)
11	7B164	Forward clutch internal plate- friction (vehicle-dependent)
12	7B066	Forward clutch pressure plate
13	7D483	Forward clutch retaining ring (select fit)


Disassembly

1. Remove the pressure plate.
 1. Remove the forward clutch retaining ring.
 2. Remove the pressure plate.



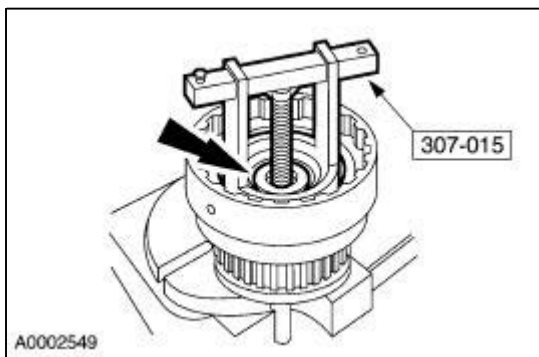
2. Remove the forward clutch disc pack.
 - Inspect the forward clutch plates for wear, damage or overheating.



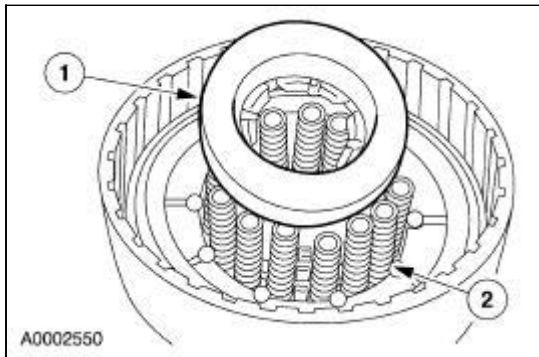
3.  **WARNING:** Use caution when releasing tool pressure on the clutch piston springs. Failure to follow these instructions may result in personal injury.


 **CAUTION:** Do not fully depress the special tool or damage to the spring retainer may occur.

Using the special tool, remove the forward clutch piston retaining ring.



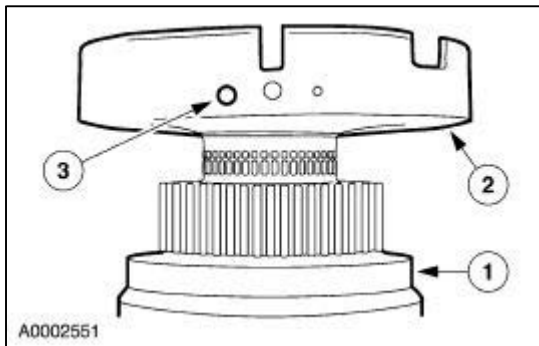
4. Relieve the forward clutch spring tension and remove the tool.
5. Remove the forward clutch piston spring retainer, springs, and cushion spring.
1. Remove the forward clutch piston spring retainer.
 2. Remove the forward clutch piston springs.
 - Inspect the forward clutch piston springs for distortion.



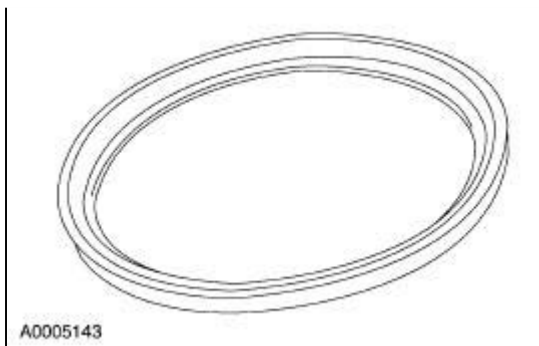
6.  **WARNING:** Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air. Make sure the cylinder is facing down as shown. Failure to follow these instructions may result in personal injury.

Remove the forward clutch piston.

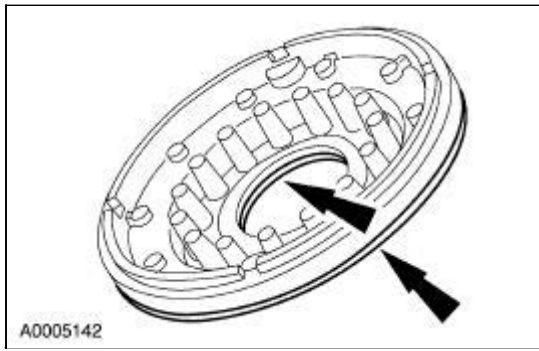
1. Place the forward clutch cylinder with forward clutch piston facing down.
2. Install the center support on the forward clutch cylinder.
3. Apply air pressure to the left port of the center support.



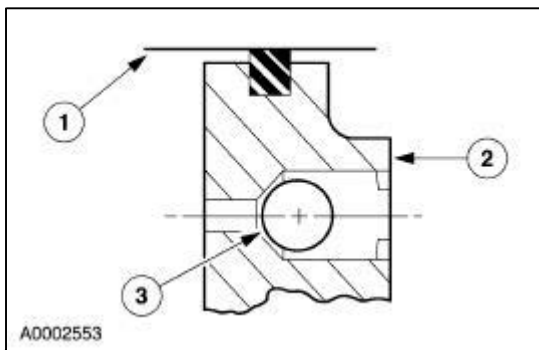
7. Remove the cushion spring.



8. Remove and discard the forward clutch piston seals.
- Inspect the forward clutch piston for cracks.

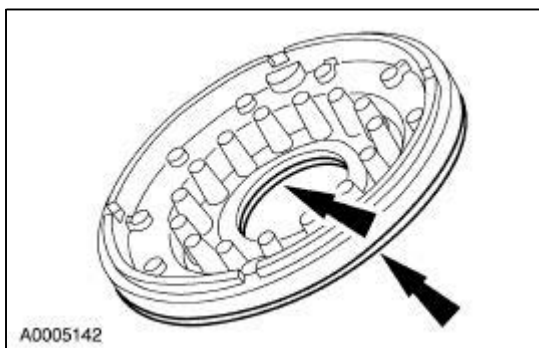


9. Inspect the forward clutch drum assembly.
 1. Inspect the forward clutch cylinder surfaces for scores or burrs.
 2. Inspect forward clutch piston for scores or burrs.
 3. Verify the check ball is free to move in the piston.



Assembly

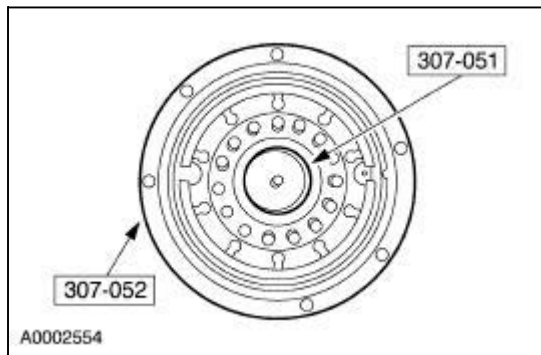
1. Inspect the clutch components for damage or wear. Install new components as necessary.
 - Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.
 - Inspect the clutch plates for damage.
 - Inspect the clutch springs.
 - Inspect the needle bearing and seal rings for damage.
 - Check clutch hub thrust surfaces for damage.
 - Check clutch plates for flatness and fit on the clutch hub serrations.
2. Install new forward clutch piston seals.



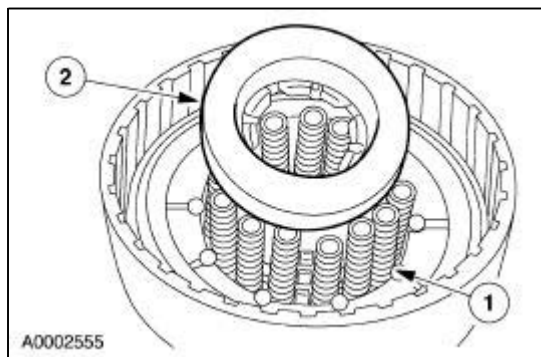
3.  **CAUTION: Care must be taken to prevent damage to the seals.**

NOTE: Lubricate the forward clutch piston inner and outer seal with clean automatic transmission fluid.

Using the special tool, install the forward clutch piston into the forward clutch cylinder.

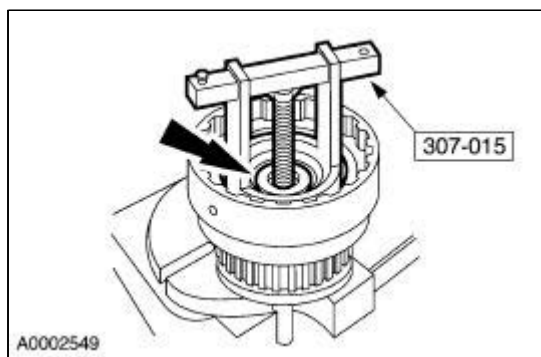


4. Install the forward clutch piston spring retainer.
 1. Install the forward clutch piston spring.
 2. Install the forward clutch piston spring retainer.



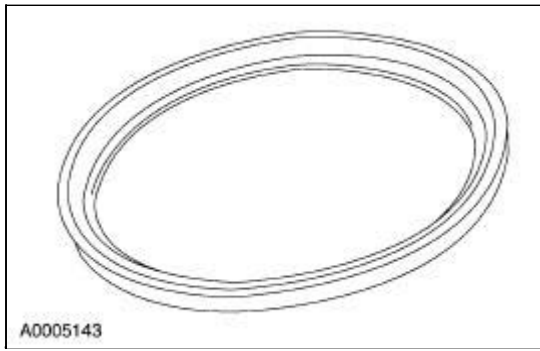
5.  **CAUTION:** Do not fully depress the clutch spring compressor or damage to the spring retainer may occur.


Using the special tool, install the forward clutch piston spring retaining ring.




6.  **CAUTION:** If there is evidence of clutch plate burning, install a new forward clutch cushion.

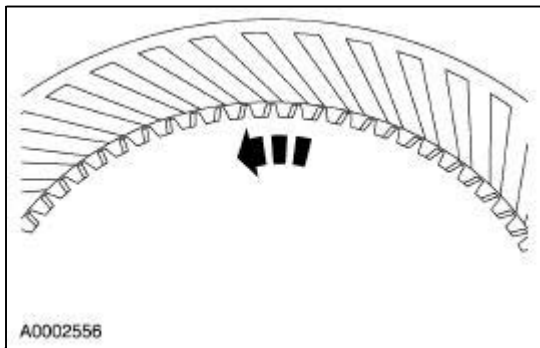
Install the forward clutch cushion spring.



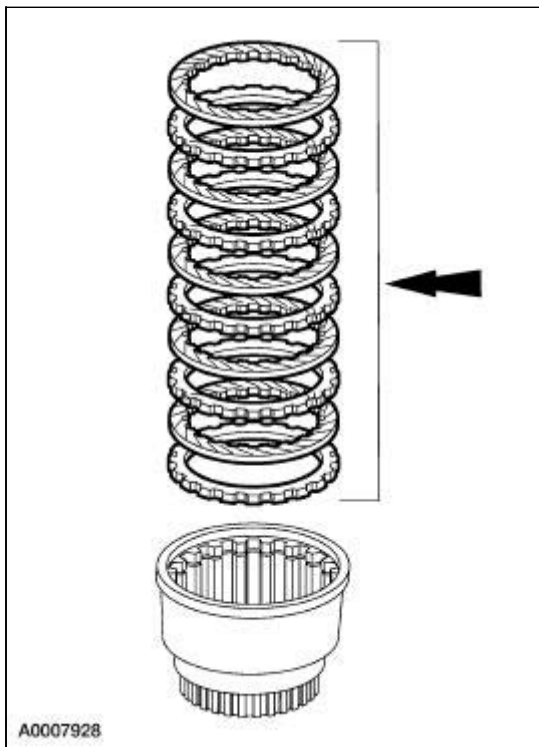
7.  **CAUTION:** The forward clutch friction plates are directional and must be installed with grooves pointing counterclockwise.

 **CAUTION:** If new plates are used, they should be soaked in clean automatic transmission fluid for at least 30 minutes before assembly.

If reusing plates, grooves must be installed counterclockwise. Install the direct clutch disc pack.



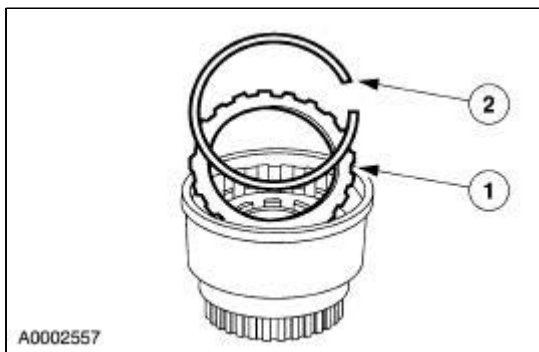
8. Install the steel clutch plates and friction clutch plates in alternating order starting with a steel clutch plate.




9.  **CAUTION: The retaining ring is a select fit.**

Install the original selective retaining ring.

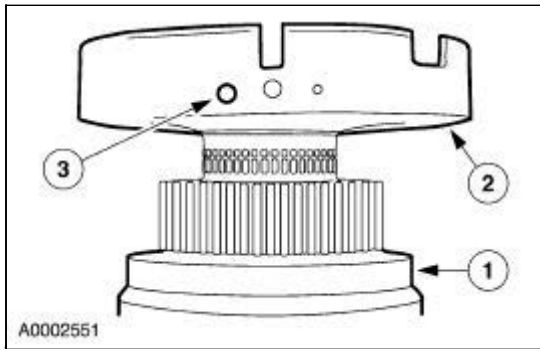
1. Install the forward clutch pressure plate.
2. Install the original selective retaining ring.



10.  **WARNING: Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air. Make sure the cylinder is facing down as shown. Failure to follow these instructions may result in personal injury.**

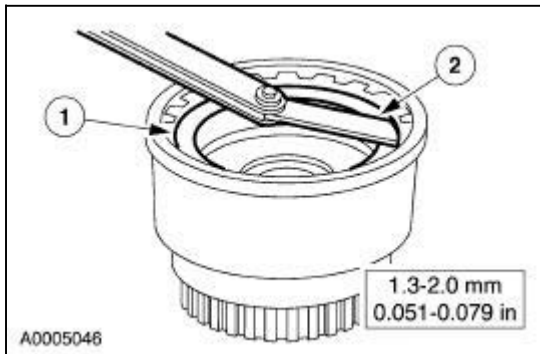
Air check the forward clutch piston.

1. Place the forward clutch cylinder with forward clutch piston facing down.
2. Install the transmission center support on the forward clutch cylinder.
3. Apply air pressure to the left port of the center support.




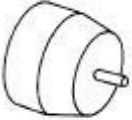

11. Check forward clutch disc pack free play.
1. Press down on forward clutch disc pack.
 2. Using a feeler gauge, check the gap between the forward clutch retaining ring and the forward clutch pressure plate.
- If the clearance is not within specifications, install the correct size retaining ring.

Part Number	Thickness		Diameter	
	mm	In	mm	In
XW4Z-7D483-AB	1.73	0.0681	141.45	5.65 in
XW4Z-7D483-AC	2.08	0.0819	141.45	5.65 in
XW4Z-7D483-AD	2.44	0.0961	141.45	5.65 in



Forward Clutch — Bonded Piston

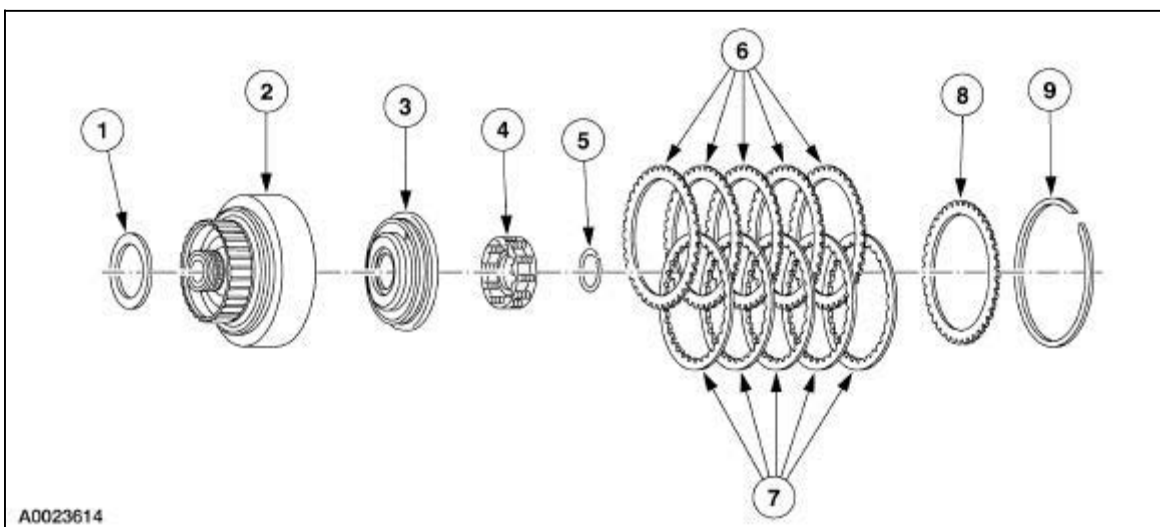
Special Tool(s)

 <p>ST1190-A</p>	Compressor, Clutch Spring 307-015 (T65L-77515-A)
 <p>ST1813-A</p>	Protector, Piston Seal 307-051 (T74P-77548-A)
 <p>ST2534-A</p>	Gauge, Forward Clutch Seal 307-434

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON®

Forward Clutch Assembly

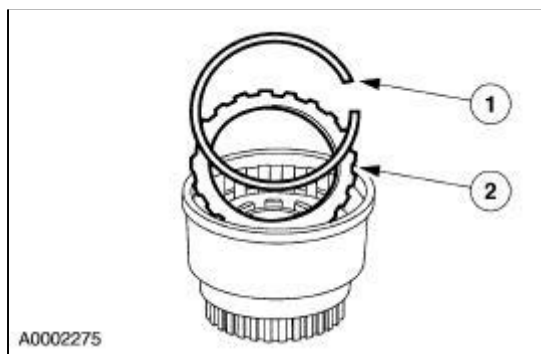


	Part	
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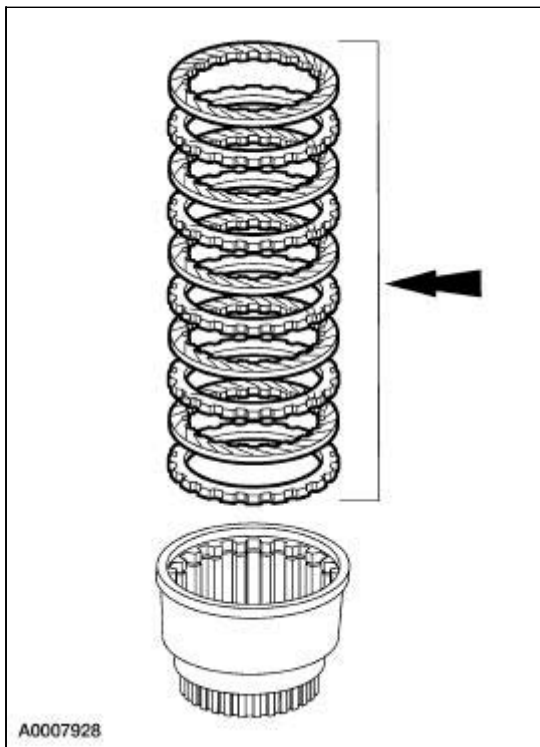
Item	Number	Description
1	7M153	Forward clutch cylinder thrust bearing (No. 5)
2	7A360	Forward clutch cylinder assembly
3	7A262	Forward clutch piston
4	7G229	Forward clutch cushion spring
5	E860109-S	Forward clutch retaining ring
6	7B442	Forward clutch external plate-steel (vehicle-dependent)
7	7B164	Forward clutch internal plate-friction (vehicle-dependent)
8	7B066	Forward clutch pressure plate
9	7D483	Forward clutch retaining ring (select fit)


Disassembly


1. Remove the pressure plate.
 1. Remove the forward clutch retaining ring.
 2. Remove the pressure plate.



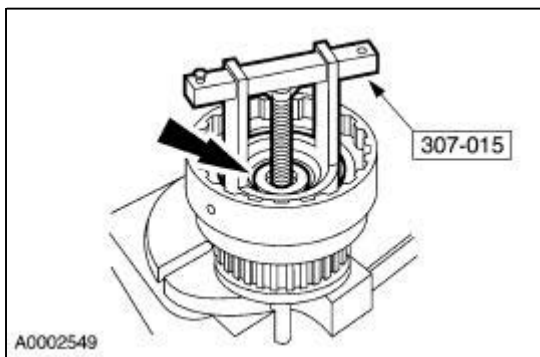
2. Remove the forward clutch disc pack.
 - Inspect the forward clutch plates for wear, damage or overheating.



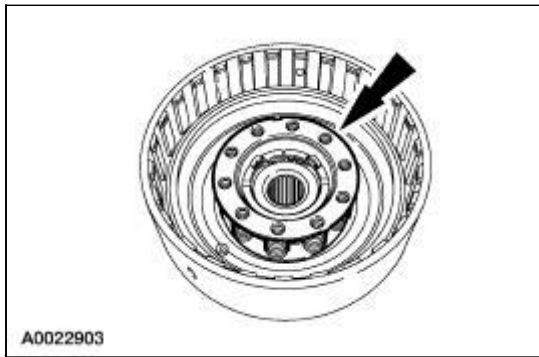
3.  **WARNING:** Use caution when releasing tool pressure on the clutch piston springs. Failure to follow these instructions may result in personal injury.


 **CAUTION:** Do not fully depress the special tool or damage to the spring retainer may occur.

Using the special tool, remove the forward clutch piston retaining ring.



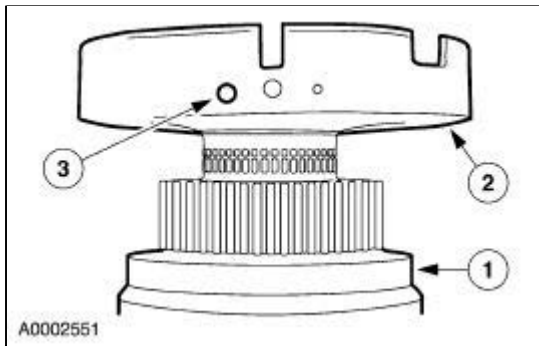
4. Relieve the forward clutch spring tension and remove the tool.
5. Remove the forward clutch piston spring assembly.



6.  **WARNING:** Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air. Make sure the cylinder is facing down as shown. Failure to follow these instructions may result in personal injury.

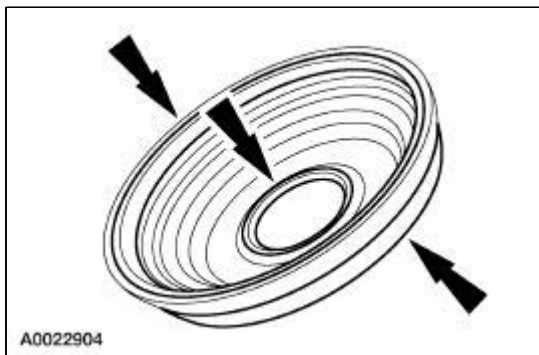
Remove the forward clutch piston.

1. Place the forward clutch cylinder with forward clutch piston facing down.
2. Install the center support on the forward clutch cylinder.
3. Apply air pressure to the left port of the center support.

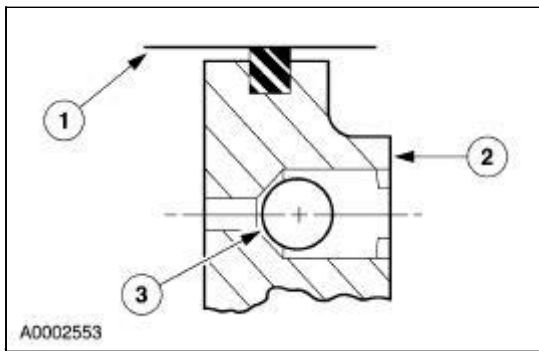


7. **NOTE:** If the seals on the forward clutch piston show any signs of damage the forward clutch piston will need to be replaced.

Inspect the forward clutch piston, and seals.



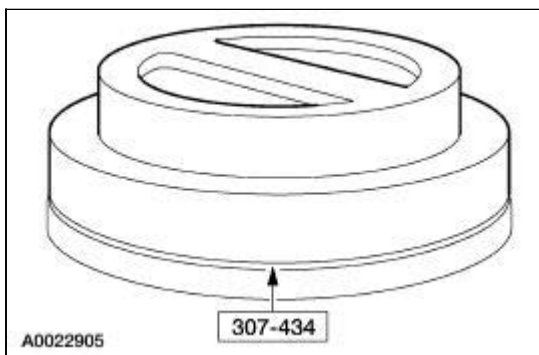
8. Inspect the forward clutch drum assembly.
1. Inspect the forward clutch cylinder surfaces for scores or burrs.
 2. Inspect forward clutch piston for scores or burrs.
 3. Verify the check ball is free to move in the piston.



Assembly

1. Inspect the clutch components for damage or wear. Install new components as necessary.
 - Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.
 - Inspect the clutch plates for damage.
 - Inspect the clutch springs.
 - Inspect the needle bearing and seal rings for damage.
 - Check clutch hub thrust surfaces for damage.
 - Check clutch plates for flatness and fit on the clutch hub serrations.
2. **NOTE:** The special tool needs to be installed on the forward clutch piston for a couple of minutes prior to installing it into the forward clutch cylinder.

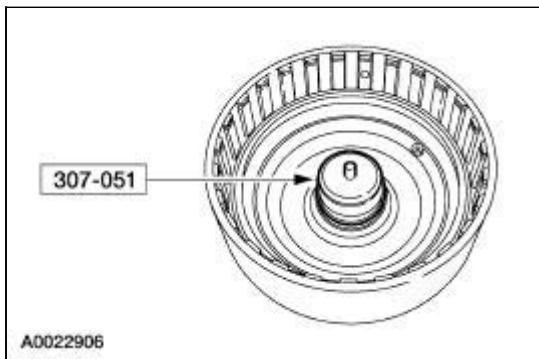
Install the special tool on the forward clutch piston.



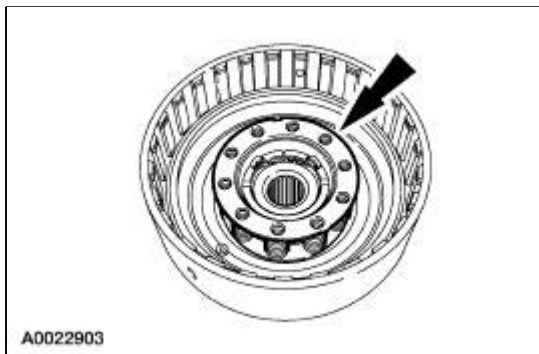
3.  **CAUTION: Care must be taken to prevent damage to the seals.**

NOTE: Lubricate the forward clutch piston inner and outer seal with clean automatic transmission fluid.

Using the special tool, install the forward clutch piston assembly into the forward clutch cylinder.

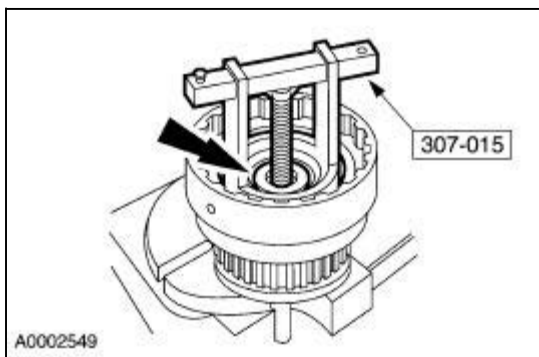



4. Install the forward clutch piston spring assembly.




5.  **CAUTION: Do not fully depress the clutch spring compressor or damage to the spring retainer may occur.**

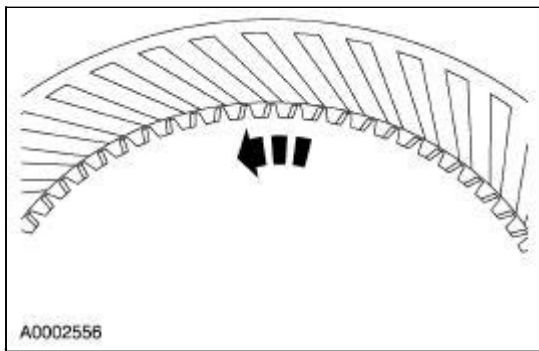
Using the special tool, install the forward clutch piston spring retaining ring.



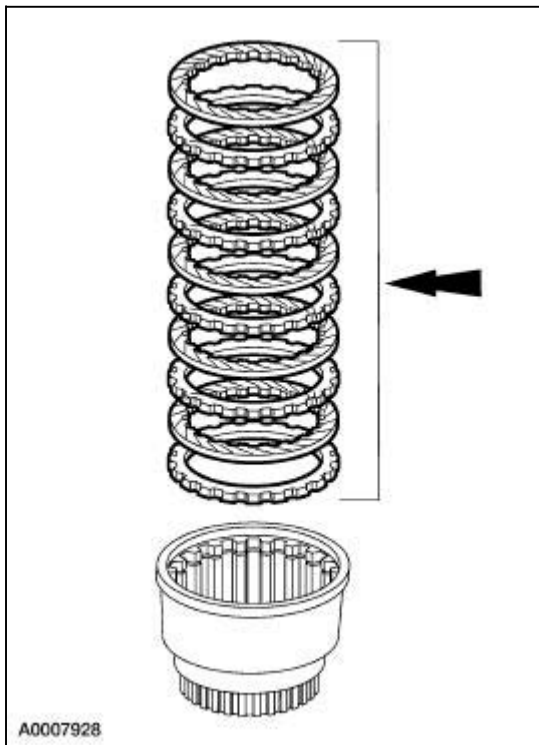
6.  **CAUTION: The forward clutch friction plates are directional and must be installed with grooves pointing counterclockwise.**

 **CAUTION: If new plates are used, they should be soaked in clean automatic transmission fluid for at least 30 minutes before assembly.**

If reusing plates, grooves must be installed counterclockwise. Install the direct clutch disc pack.



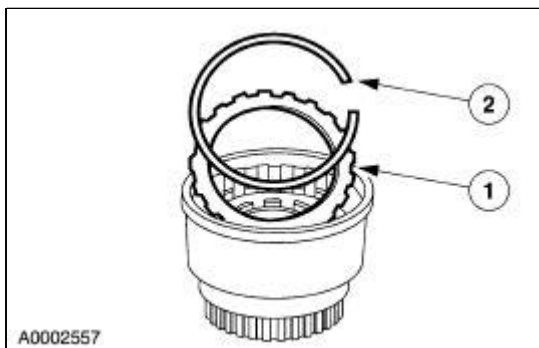
7. Install the steel clutch plates and friction clutch plates in alternating order starting with a steel clutch plate.




8.  **CAUTION: The retaining ring is a select fit.**

Install the original selective retaining ring.

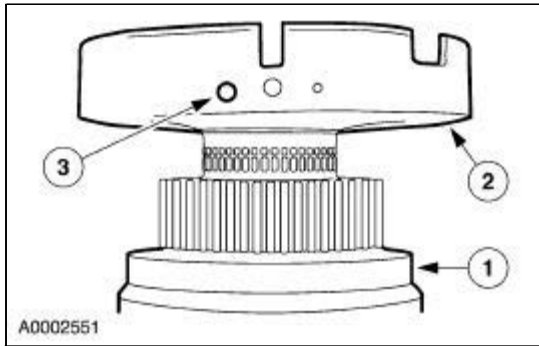
1. Install the forward clutch pressure plate.
2. Install the original selective retaining ring.



9.  **WARNING: Air pressure must not exceed 138 kPa (20 psi). Wear safety glasses when using compressed air. Make sure the cylinder is facing down as shown. Failure to follow these instructions may result in personal injury.**

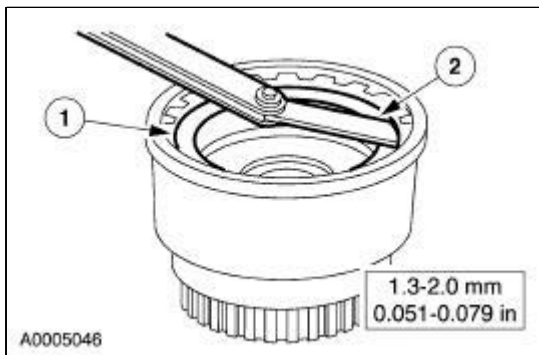
Air check the forward clutch piston.

1. Place the forward clutch cylinder with forward clutch piston facing down.
2. Install the transmission center support on the forward clutch cylinder.
3. Apply air pressure to the left port of the center support.

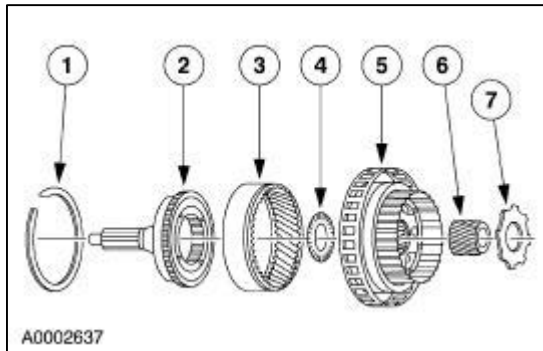


10. Check forward clutch disc pack free play.
1. Press down on forward clutch disc pack.
 2. Using a feeler gauge, check the gap between the forward clutch retaining ring and the forward clutch pressure plate.
- If the clearance is not within specifications, install the correct size retaining ring.

Part Number	Thickness		Diameter	
	mm	In	mm	In
XW4Z-7D483-AB	1.73	0.0681	141.45	5.65 in
XW4Z-7D483-AC	2.08	0.0819	141.45	5.65 in
XW4Z-7D483-AD	2.44	0.0961	141.45	5.65 in



Overdrive Planetary and One-Way Clutch Assembly



A0002637

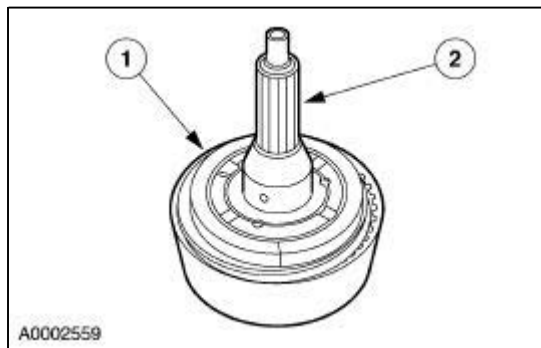
Item	Part Number	Description
1	W702037-S300	Retaining ring
2	7A658	Center shaft
3	7653	Overdrive ring gear
4	7L495	No. 2 overdrive planetary thrust bearing
5	7B446	Overdrive planetary gear carrier assembly
6	7D063	Overdrive sun gear
7	7660	Coast clutch adapter

Disassembly

- NOTE:** The overdrive one-way clutch is serviced with the center shaft assembly.

Remove the center shaft from the overdrive ring gear.

- Remove the overdrive center shaft retaining ring.
- While rotating counterclockwise remove the center shaft from the ring gear.

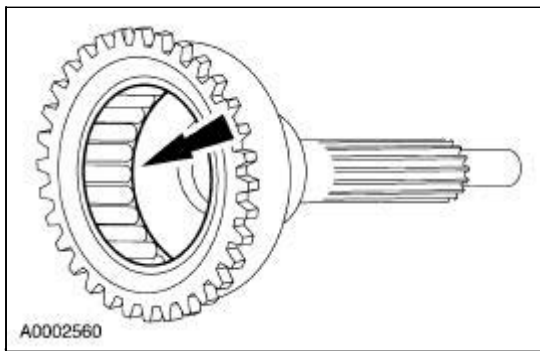


A0002559

- CAUTION:** Do not remove the overdrive one-way clutch. Damage to the clutch may occur if it is removed.

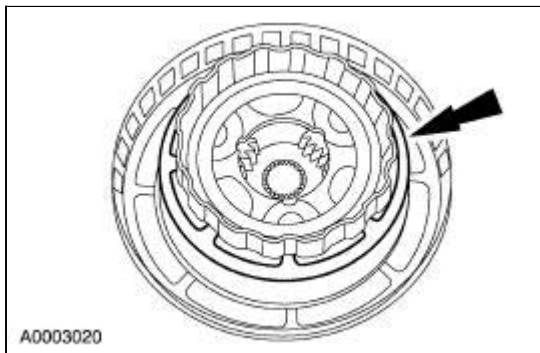
Clean and inspect the overdrive one-way clutch and center shaft.

- Inspect for cracks in the roller cage and wear on the roller clutch, and the press fit of the one-way clutch to the center shaft.



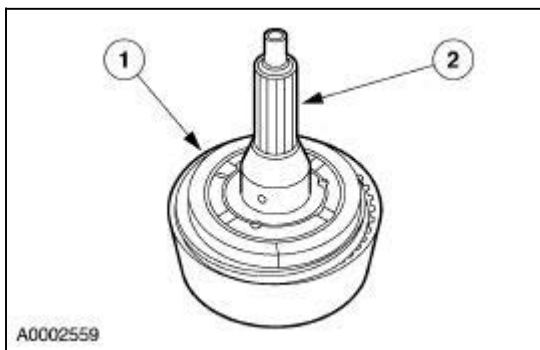
3. Inspect the one-way clutch.

- Temporarily insert the overdrive planetary gear carrier assembly into the one-way clutch rollers for verification of the one-way clutch.
- The planetary gear must rotate counterclockwise and hold when rotated clockwise.
- Remove the planetary gear carrier assembly.



Assembly

1. Install the center shaft and one-way clutch.
 1. Install the center shaft and one-way clutch.
 2. Install the center shaft retaining ring.



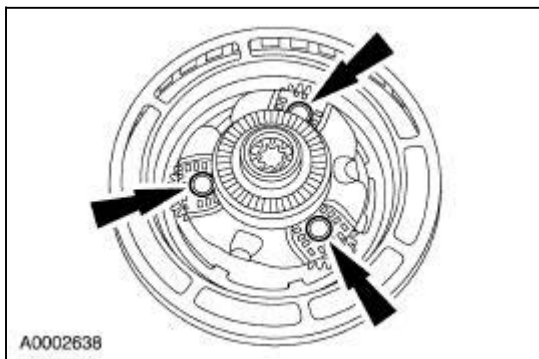
Overdrive Planetary Gears

Disassembly

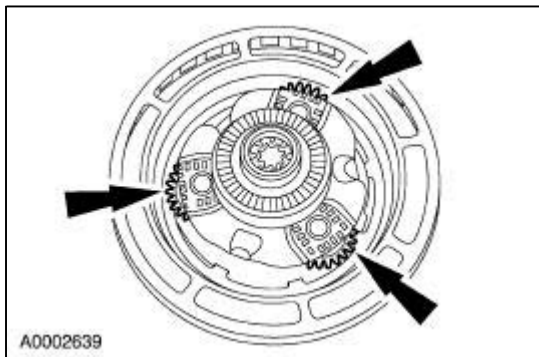
1.  **CAUTION: New planetary gears must be installed. Do not restake the originals.**

NOTE: Individual parts of the planetary carriers are not serviceable.

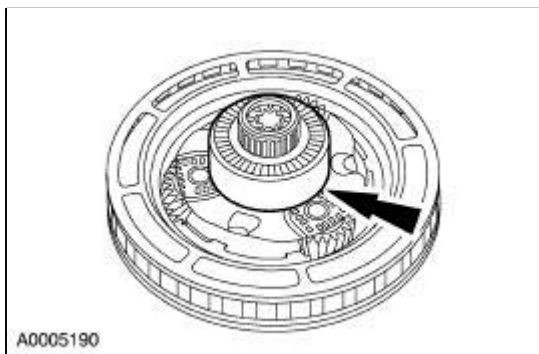
Before installing a planetary assembly, the shaft retaining pins should be checked for adequate staking. Check the pins and shafts in the planetary assemblies for loose fit and/or complete disengagement. Install a new planetary assembly if necessary.



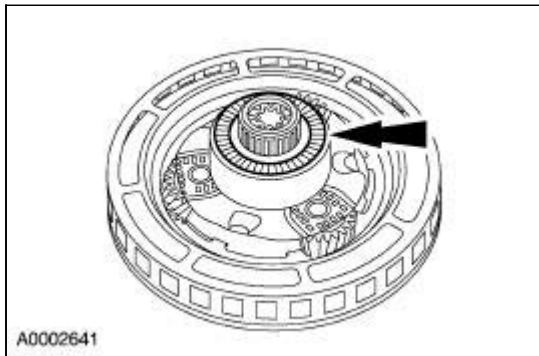
2. Inspect the pinion gears for damaged or excessively worn teeth, and for free rotation.



3. Inspect the overdrive one-way clutch inner race, and the inner and outer races for scored or damaged surface areas where the rollers contact the races.

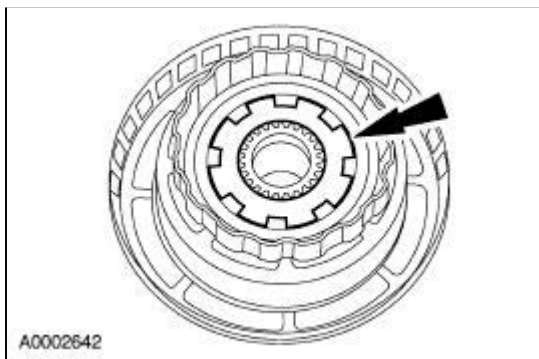


4. Remove and inspect the No. 2 overdrive planetary thrust bearing on the nose of the overdrive planetary gear carrier assembly.

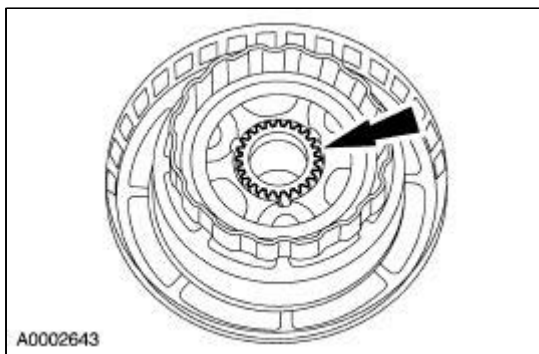


5. **NOTE:** Inspect the sun gear for damaged or worn teeth.

Remove the coast clutch-to-overdrive carrier adapter.

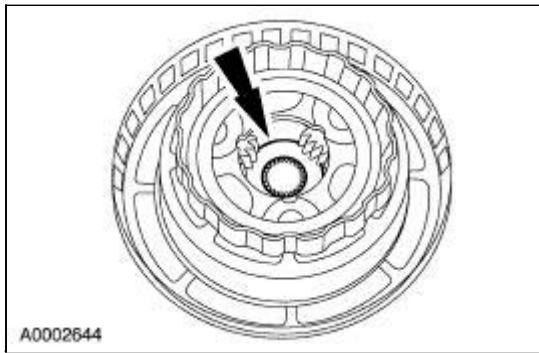


6. Remove the overdrive sun gear.



7.  **CAUTION:** Do not attempt to remove the No. 12 bearing from behind the pinion gears.

Inspect the No. 12 bearing for damage.

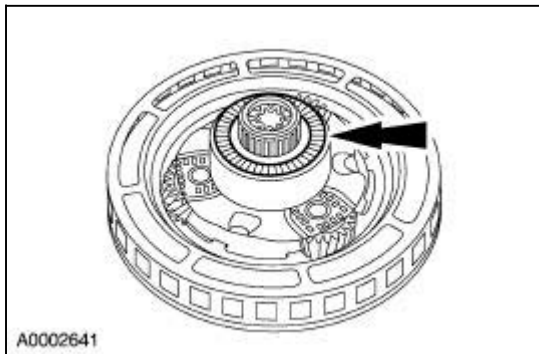


Assembly

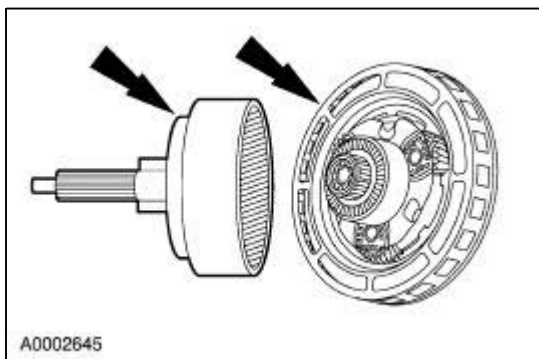
1. **NOTE:** Thoroughly clean all parts and blow dry with moisture-free compressed air.


NOTE: Use petroleum jelly to hold the No. 2 overdrive planetary thrust bearing in place.

Install the No. 2 overdrive planetary thrust bearing.

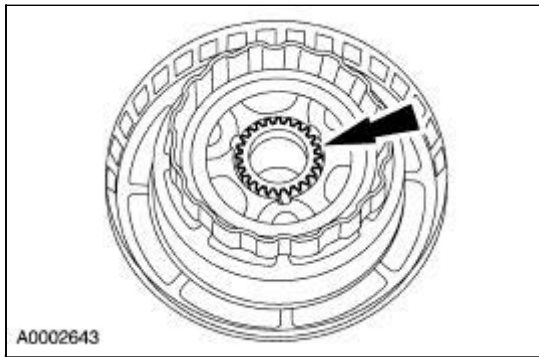


2. Install the overdrive planetary gear carrier into the center shaft and overdrive.



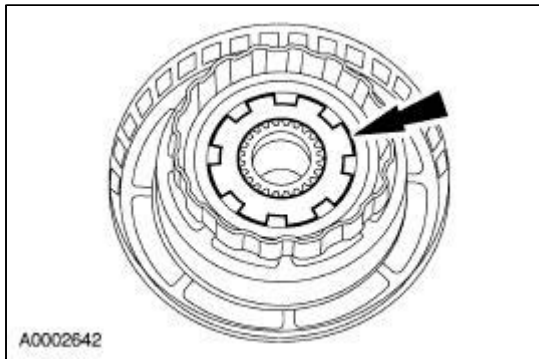
3.  **CAUTION:** Make sure that the No. 12 bearing is in place in the overdrive planetary prior to installing the overdrive sun gear.

Install the front sun gear with the recessed gear teeth facing toward the adapter.



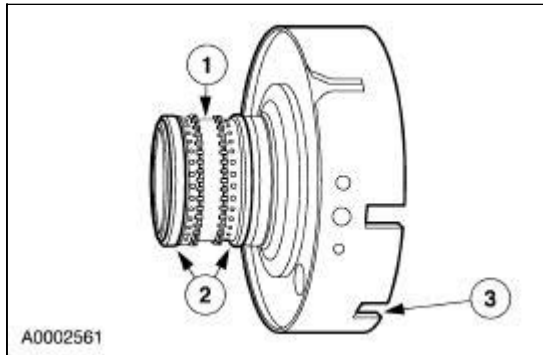
4. **NOTE:** Inspect the sun gear for damaged or worn teeth.

Install the coast clutch-to-overdrive carrier adapter.



Center Support

Disassembly and Assembly

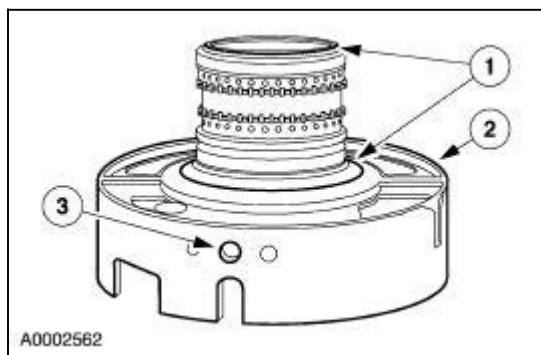


Item	Part Number	Description
1	—	Bearing
2	—	Seal rings
3	7A130	Center support

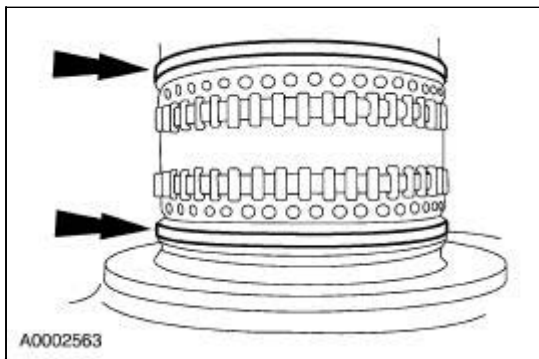
NOTE: Thoroughly clean center support assembly and blow dry with compressed air.

NOTE: The center support is repaired as an assembly. Any damage requires installing a new component.

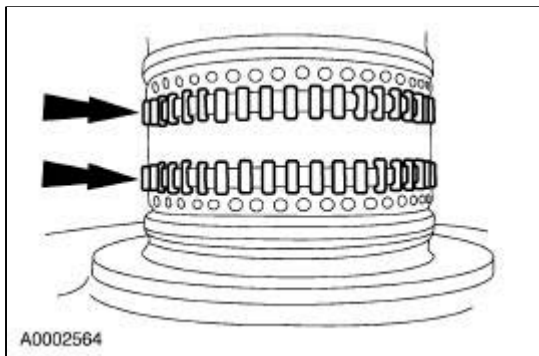
1. Inspect the center support assembly for wear or damage.
 1. Inspect the thrust surfaces for wear, scoring or damage.
 2. Inspect the center support sealing surface.
 3. Inspect the fluid passage for blockage or damage.



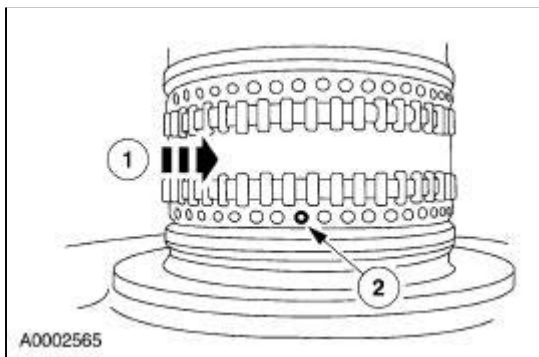
2. Inspect the seal rings for damage.



3. Inspect the bearing for missing rollers or damage.



4. Inspect the direct clutch feed hole for blockage or damage.
 1. Rotate center support bearing to locate the direct clutch feed hole.
 2. Inspect the direct clutch feed hole for blockage or damage.



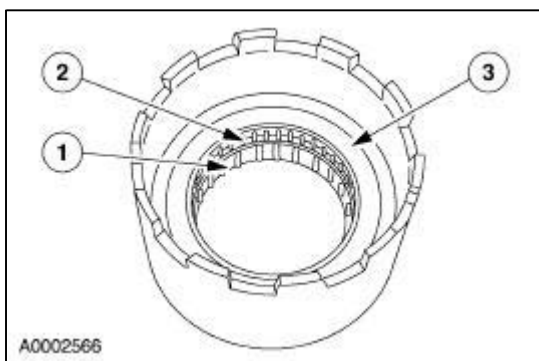
Reverse Brake Drum

Check

1. **NOTE:** The reverse one-way clutch is part of the reverse brake drum assembly. Install a new reverse brake drum as an assembly only.

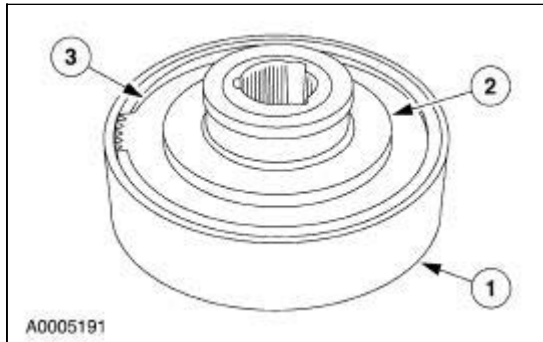
Inspect the reverse brake drum assembly and install a new reverse brake drum assembly if damaged.

1. Inspect the reverse brake drum sprags.
2. Inspect the reverse brake drum rollers.
3. Inspect the reverse brake drum.



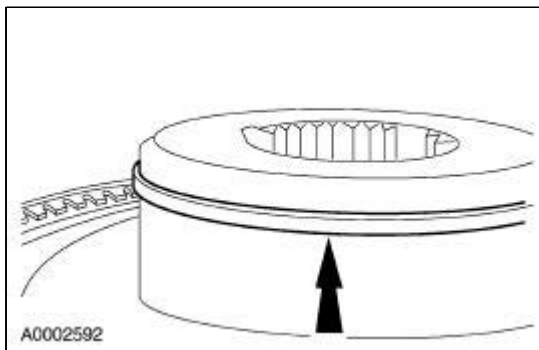
Output Shaft Ring Gear and Hub Shaft Assembly

Disassembly

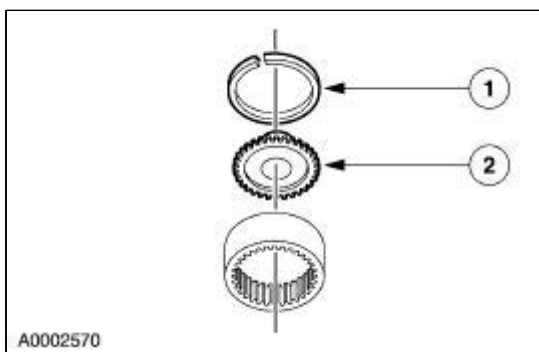


Item	Part Number	Description
1	7A153	Output shaft ring gear
2	7D164	Output shaft hub
3	7C122	Retaining ring

1. Inspect the output shaft ring gear and hub shaft assembly for damage. If repair is necessary use the following procedure.
2. Remove the seal.

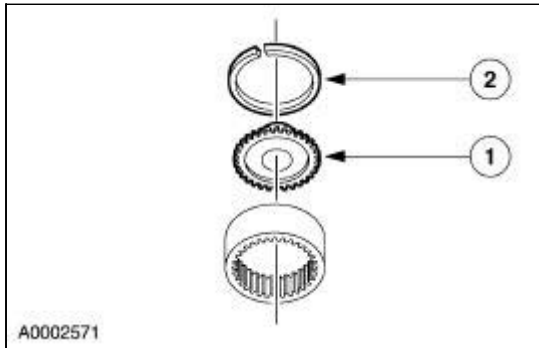


3. Remove the output shaft ring gear from the output shaft hub.
 1. Remove the retaining ring.
 2. Remove the output shaft ring gear.

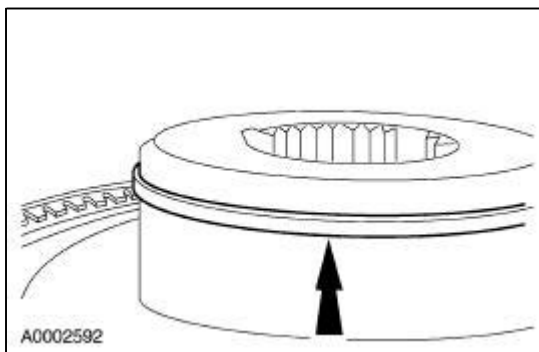


Assembly

1. Install the output shaft ring gear onto the output shaft hub.
 1. Install the output shaft ring gear.
 2. Install the retaining ring.



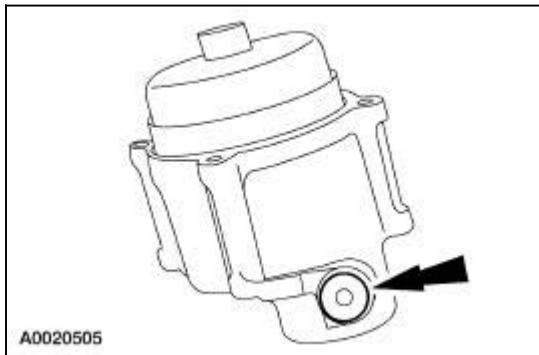
2. Install the seal.



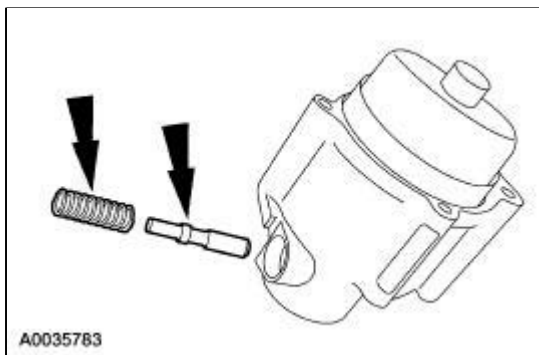
Reverse Servo Assembly


Disassembly

1. Remove the control valve spring retainer.



2. Remove the reverse servo spring and check valve.

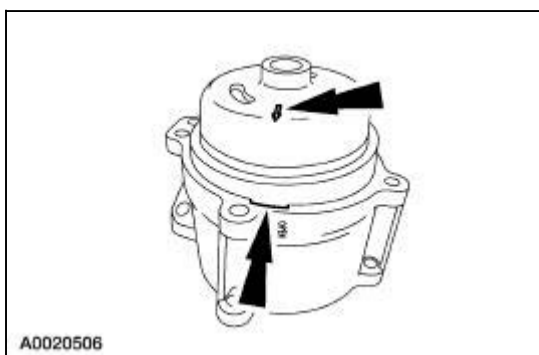


3.  **WARNING:** The upper and lower servo covers are under spring tension. Use care when separating the two halves. Failure to follow these instructions may result in personal injury.

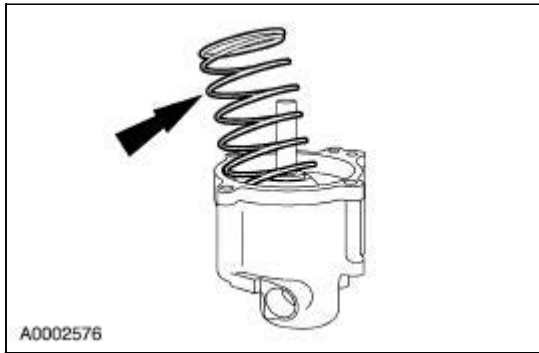
NOTE: Tabs on servo plate mate with slots on cover every 120 degrees.

Remove the reverse servo plate by turning in either direction to release.

- Align arrow on servo plate with any slot on cover.

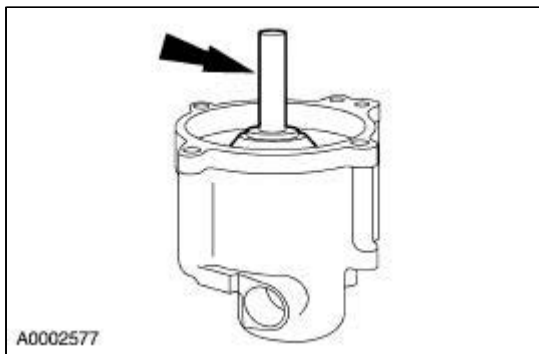


4. Remove the reverse servo spring.

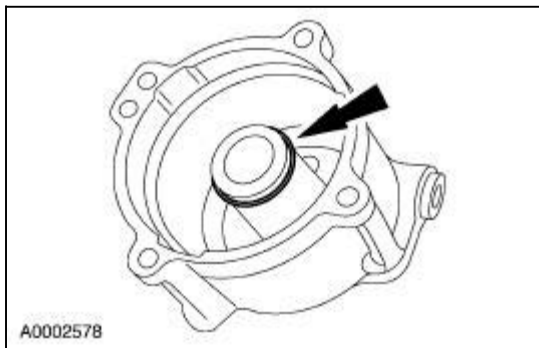


5. Remove the reverse servo piston and seal assembly.

- Inspect the seal for damage, install new reverse servo piston if necessary.



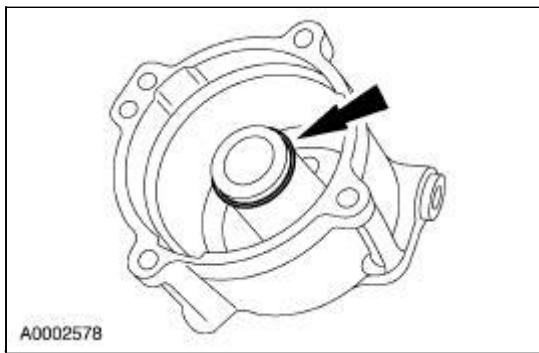
6. Remove and discard the reverse servo piston seal.



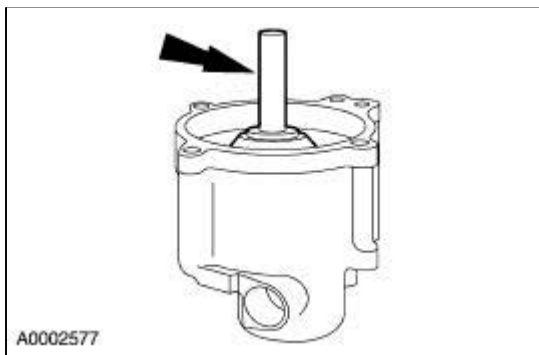
Assembly

1. **NOTE:** Try not to roll the seal onto the housing when installing the seal or damage to the seal could occur.

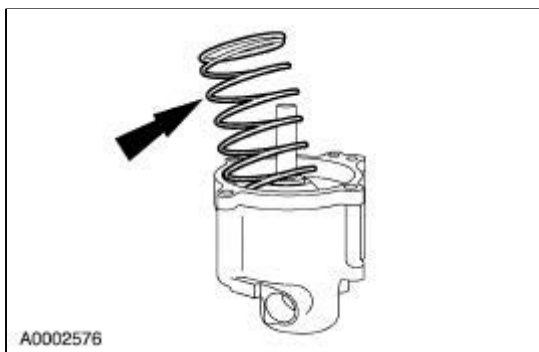
Lubricate and install a new reverse servo piston seal.



2. Lubricate and install reverse servo piston and seal assembly.

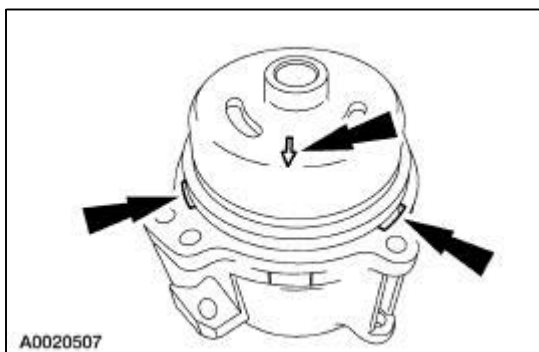


3. Install the reverse servo spring.

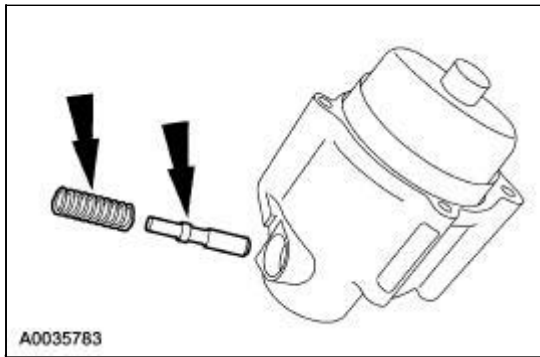


4.  **CAUTION:** The arrow on the servo plate must be aligned evenly between any two slots on the cover.

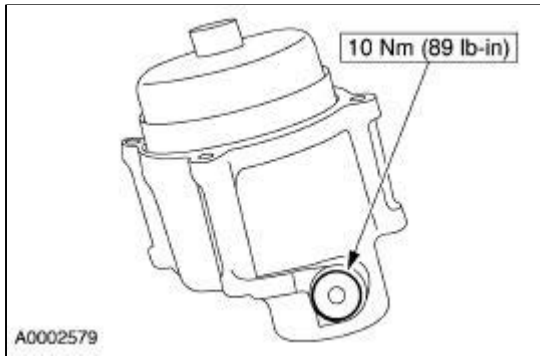
Install the reverse servo plate.



5. Install the reverse servo spring and check valve.




6. Install the control valve spring retainer.




Torque Converter

1. A new torque converter must be installed if one or more of the following statements are true:
 - A torque converter failure has been determined based on complete diagnostic procedures.
 - Converter stud(s), impeller hub or bushing are damaged.
 - Discoloration of the torque converter (due to overheating).
 - The torque converter is found to be out of specification when carrying out one of the following torque converter checks:
 - One-Way Clutch Check
 - End Play Check
 - Stator to Turbine Interference Check
 - Stator to Impeller Interference Check
 - Torque Converter Leak Check
 - Evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes:
 - major metallic failure
 - multiple clutches or clutch plate failures
 - sufficient component wear which results in metallic contamination
-

Torque Converter Cleaning And Inspection

1. If a new torque converter is being installed, continue with Substep 2 of Step 2.
2.  **CAUTION: The torque converter drain plug and seal are not reusable. Discard the drain plug and seal, install a new drain plug assembly.**

If a new torque converter is not being installed, the following procedures must be carried out:

1. The torque converter must be thoroughly cleaned.
 - Torque converter with drain plugs can be cleaned by using a suitable torque converter/fluid cooler cleaner.
 -  **CAUTION: Do not use water based cleaners or transmission damage will occur.**

A torque converter without drain plugs can be cleaned by hand. Partially fill the torque converter using only recommended transmission fluid for the applicable transmission. Hand-agitate the torque converter and then thoroughly drain the fluid. Fill the torque converter with new fluid specified for the transmission, and install.


2. All in-tank and auxiliary coolers must be thoroughly cleaned by forward and backward flushing. For additional information, refer to [Transmission Fluid Cooler — Backflushing and Cleaning](#) in this section.
 3. All cooler tubes must be thoroughly cleaned by backward and forward flushing. For additional information, refer to [Transmission Fluid Cooler — Backflushing and Cleaning](#) in this section.
 4. All cooler bypass valves (CBV), if equipped, must be thoroughly cleaned.
 5. Carry out the Transmission Fluid Cooler Flow Test. For additional information, refer to [Section 307-02](#).
 6. If the transmission cooling system fails the Transmission Fluid Cooler Flow Test, install new components as necessary. For additional information, refer to [Section 307-02](#).
 7. If new coolers are to be installed, use only factory-approved repair parts. For additional information, refer to [Section 303-03](#).
-

Torque Converter Flushing

Material

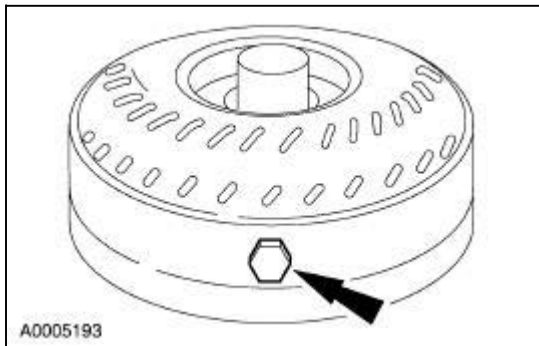
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

1.  **CAUTION:** The torque converter drain plug and seal are not reusable. Discard the drain plug and seal, install a new drain plug and seal assembly.

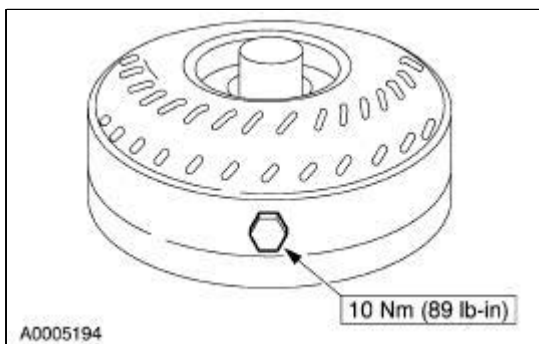
 **CAUTION:** Mineral spirits used to clean the torque converter must be fresh, non-water based, non-chlorinated and non-halogenated.

Using a suitable torque converter/fluid cooler cleaner, flush the torque converter.

2. After flushing, remove the drain plug and drain the remainder of the solvent.

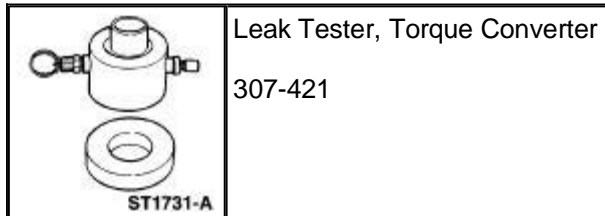


3. Add 1.9 liter (2 qt.) of clean automatic transmission fluid into the converter fluid filler tube and agitate by hand.
4. Thoroughly drain the solution.
5. Install a new torque converter drain plug.

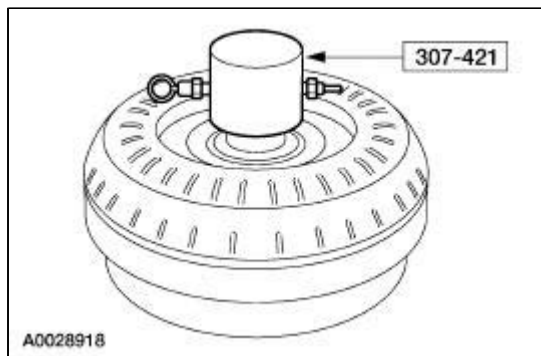



Torque Converter Leak Check

Special Tool(s)

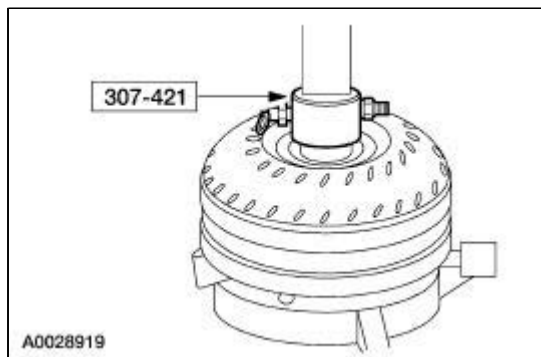


1. Clean the outside surface of the torque converter.
2. Install the special tools into converter hub.



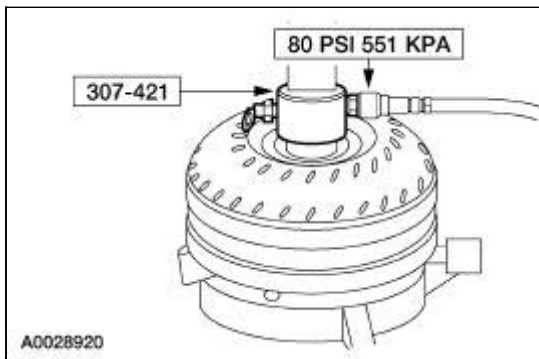
3.  **WARNING:** Always follow correct safety procedures while using the press. Failure to follow these instructions may result in personal injury.

Install the torque converter with the special tool installed into the arbor press.
Secure the press. Apply enough force from the press to seal the tool into the torque converter.

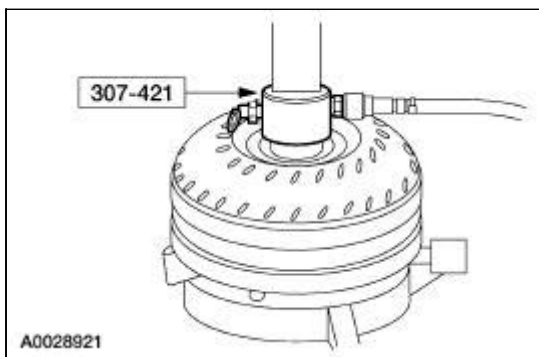


4. **NOTE:** Use clean, dry shop air.

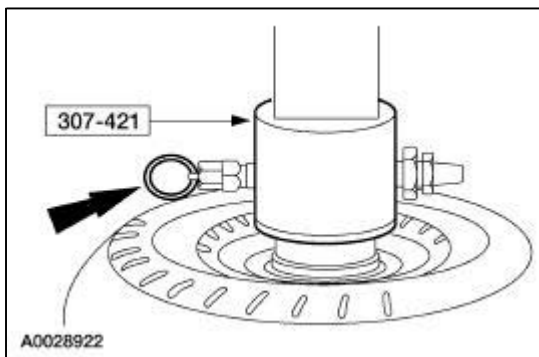
Apply air pressure to valve on the special tool.



5. With air pressure applied to the valve, inspect for leaks at the converter hub, the seams, drain plug, and the studs. A soap bubble solution can be applied around those areas to aid in the diagnosis. If a leak is found around the drain plug install a new drain plug and recheck the torque converter. If any other leaks are present, install a new or remanufactured converter.

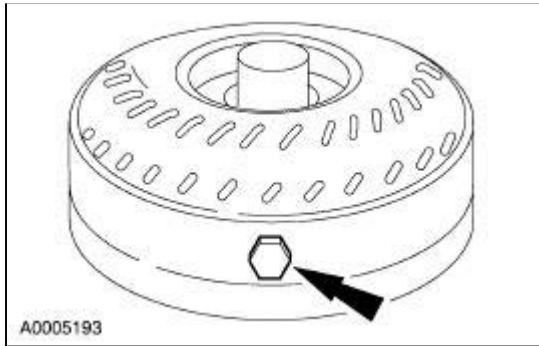


6. Remove the air hose. Release the pressure, and then slowly release the press. Remove the converter. Remove the tool.

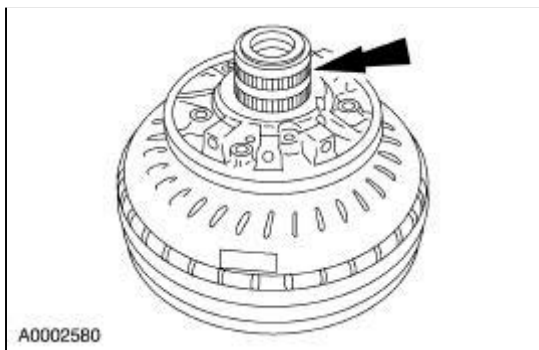


Torque Converter Impeller to Pump Stator Interference Check

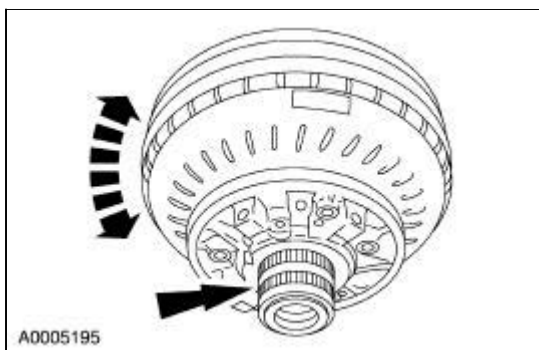
1. Remove the drain plug and drain the fluid from the torque converter.



2. Install fluid pump support into torque converter. Engage splines of the one-way clutch inner race with the mating splines of the overdrive pump support.





3. While holding the fluid pump support stationary, rotate the torque converter clockwise and counterclockwise. The torque converter should rotate freely with no signs of scraping. If there are signs of scraping, install a new or remanufactured torque converter.

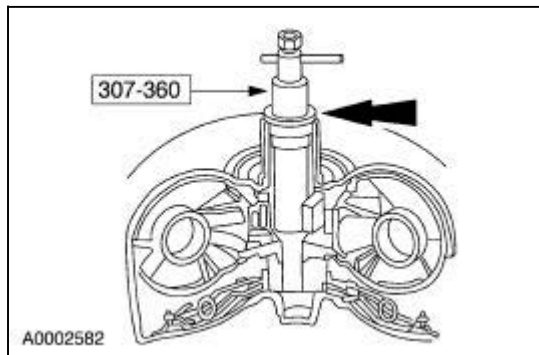


Torque Converter End Play Check

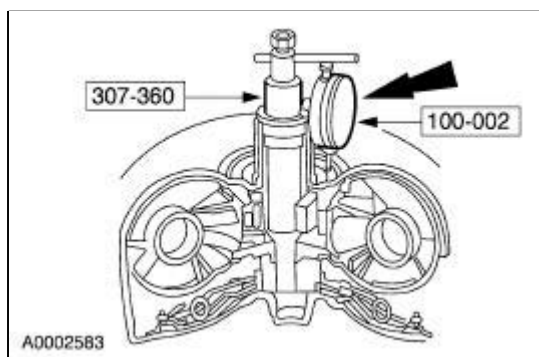
Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2128-A	End Play Gauge, Torque Converter 307-360

1. Install the special tool into the torque converter until it bottoms out.
 - Tighten the inner post until the tool is securely locked.



2. Install the special tool on the converter impeller housing and zero the dial.

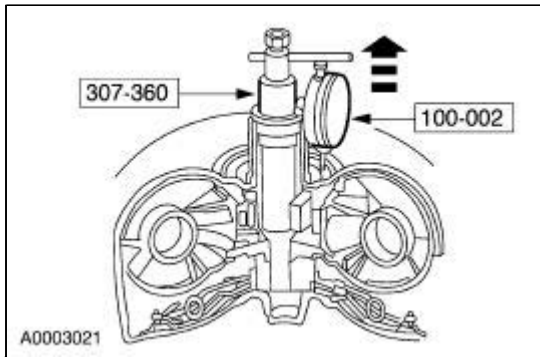


3. Lift up on the special tool and note the dial indicator reading. If the reading exceeds end play limits, install new or rebuilt torque converter.

Torque Converter End Play

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New or Rebuilt Torque Converter	Used Torque Converter
0.44 mm (0.017 in)	Max. 0.80 mm (0.031 in)

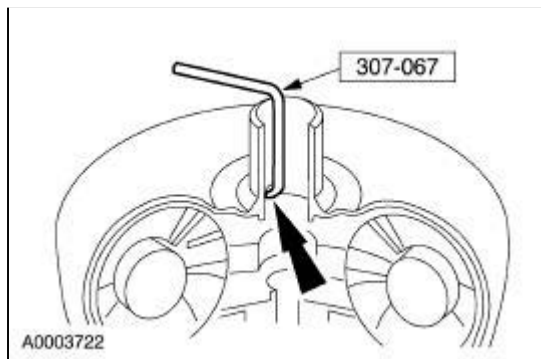


Torque Converter One-Way Clutch Check

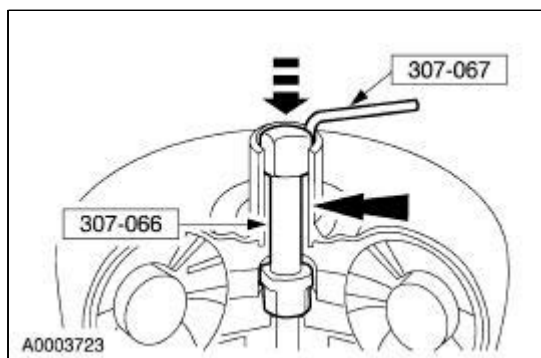
Special Tool(s)

A long, thin metal tool with a hook-shaped end and a straight handle. ST1195-A	Holding Tool, Torque Converter Clutch 307-067 (T77L-7902-R)
A metal adapter with a square end on one side and a cylindrical end on the other. ST2383-A	Torque Adapter, Torque Converter Clutch 307-066 (T77L-7902-B)

1. Insert the special tool in one of the grooves in the stator bearing retainer.

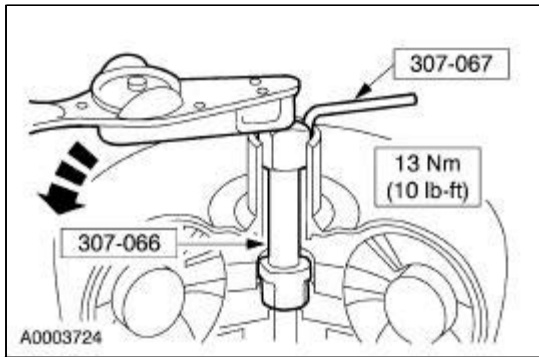


2. Install the special tools in the converter one-way clutch inner race spline.



3. Use the special tool to hold the stator bearing retainer while using the special tool to turn the converter one-way clutch inner race spline.
 - The torque converter one-way clutch should lock up and hold torque in the counter clockwise direction.
 - The torque converter one-way clutch should rotate freely in the clockwise direction.

- Try the clutch for lockup and hold in at least five positions.
- If the converter fails the lockup test torque, install a new or rebuilt torque converter.

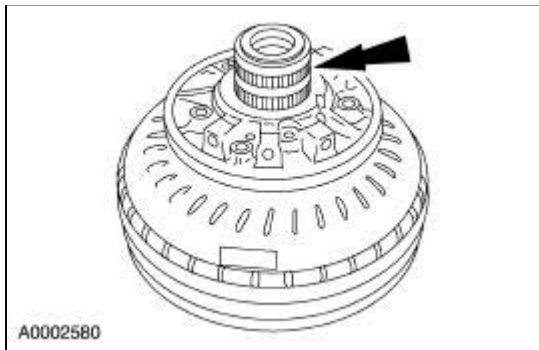


Torque Converter Turbine to Pump Stator Interference Check

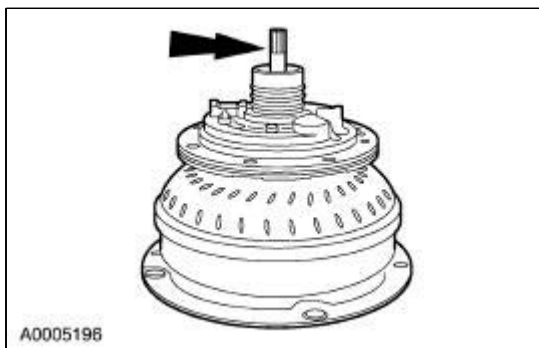
1. **NOTE:** The pump support may remain in the pump assembly during this test.

Position the torque converter with the pump drive up.

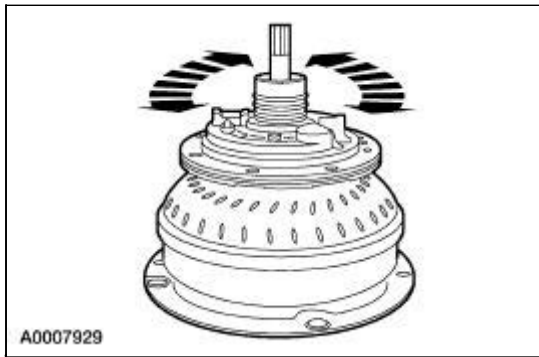
2. Install the pump support into the torque converter. Engage the splines of the one-way clutch inner race with the mating splines of the front pump support.



3. Install the input shaft engaging the splines with the turbine hub.









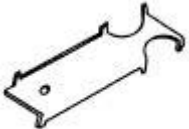
4. Check for stator to turbine interference.
 1. Hold the front pump support stationary.
 2. Attempt to rotate the input shaft.
 - The turbine and damper assemblies should rotate in both directions not exceeding maximum torque of 7 Nm (62 lb-in) without any signs of metallic interference or scraping noise.


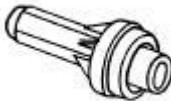
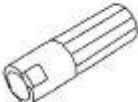







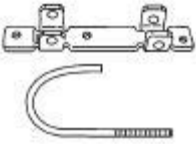







5. If interference exists, the stator front thrust washer may be worn, allowing the stator to hit the turbine. In such cases, a new or remanufactured torque converter must be installed.
 - The converter crankshaft pilot should be checked for nicks or damaged surfaces that could cause interference when installing the torque converter into the crankshaft. Check the converter front impeller hub for nicks or sharp edges that would damage the pump seal.
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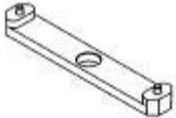
Transmission

Special Tool(s)

 <p>ST1792-A</p>	<p>Adjustment Set, Transmission Band 307-S022 (T71P-77370-A)</p>
 <p>ST1200-A</p>	<p>Remover, Bearing Cup 308-047 (T77F-1102-A)</p>
 <p>ST1635-A</p>	<p>Installer, Output Shaft Bearing 307-348 (T97T-77110-A)</p>
 <p>ST1186-A</p>	<p>Holding Fixture, Transmission 307-003 (T57L-500-B)</p>
 <p>ST1274-A</p>	<p>Depth Micrometer 303-D026 (D80P-4201-A)</p>
 <p>ST1214-A</p>	<p>Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent</p>
 <p>ST1633-A</p>	<p>Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)</p>
	<p>Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)</p>

 <p>ST1255-A</p>	
 <p>ST1791-A</p>	<p>Installer, Transmission Extension Housing Fluid Seal 307-038 (T74P-77052-A)</p>
 <p>ST1826-A</p>	<p>Sizer, Piston Seal 307-338 (T95L-70010-G)</p>
 <p>ST1817-A</p>	<p>Alignment Set, Fluid Pump 307-S039 (T74P-77103-X)</p>
 <p>ST2532-A</p>	<p>Alignment Gauge Transmission Fluid Pump 307-431</p>
 <p>ST2533-A</p>	<p>Alignment Gauge Transmission Fluid Pump 307-432</p>
 <p>ST2432-A</p>	<p>Gauge Bar 307-400</p>
 <p>ST1185-A</p>	<p>Slide Hammer 100-001 (T50T-100-A)</p>
	<p>Compressor, Servo Cover 307-402</p>

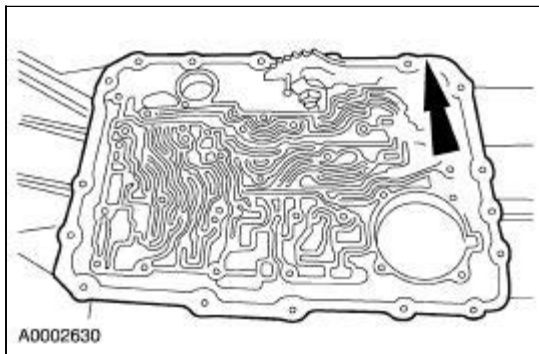
 <p>ST2393-A</p>	
 <p>ST1199-A</p>	<p>Installer, Shift Shaft Fluid Seal 307-050 (T74P-77498-A)</p>
 <p>ST1631-A</p>	<p>Handles, Torque Converter 307-091 (T81P-7902-C)</p>
 <p>ST1639-A</p>	<p>Aligner, Valve Body 307-334 (T95L-70010-C) (2 req'd)</p>
 <p>ST2440-A</p>	<p>Installer, Drive Pinion Flange 205-479</p>
 <p>ST2416-A</p>	<p>Installer, Output Shaft Flange 307-404</p>
 <p>ST2433-A</p>	<p>Alignment Pins, Transmission Fluid Pump 307-399</p>
 <p>ST2424-A</p>	<p>Compressor, Cushion Spring 307-401</p>
	<p>Retaining Ring Pliers 307-343 (T95P-77001-AHR)</p>

 <p>ST1104-B</p>	
 <p>ST2426-A</p>	<p>Aligner, Flex Plate 307-403</p>

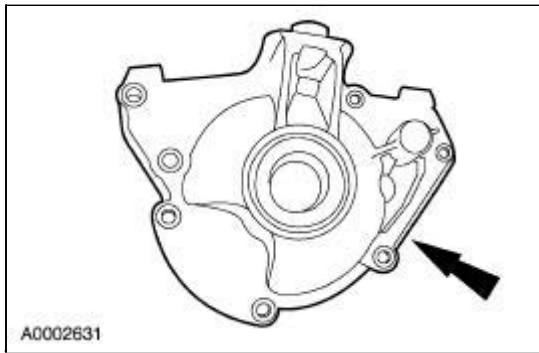
Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM	MERCON® V
Multi-Purpose Grease DOAZ-19584-AA	ESB-M1C93-B

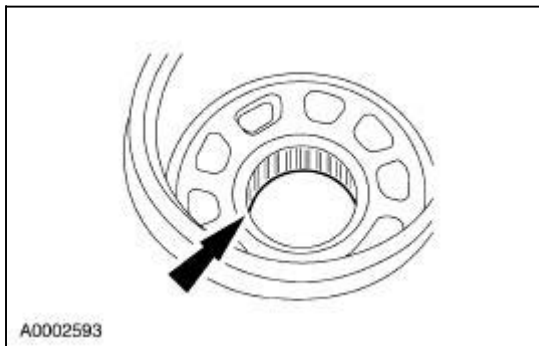
1. Thoroughly clean the transmission case and extension housing in solvent and blow dry with compressed air.
2. Inspect the transmission case for the following:
 - stripped bolt hole threads
 - gasket and mating surfaces for burrs or nicks
 - obstructed vent and fluid passages
 - cracks or warpage



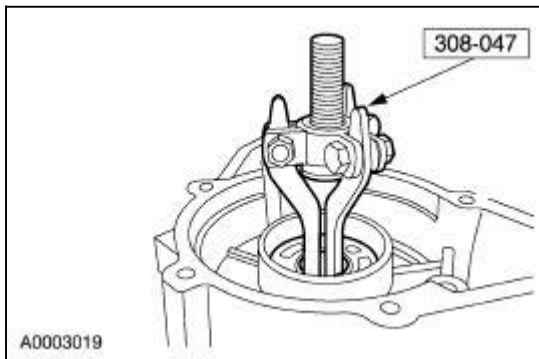
3. Inspect the extension housing for cracks, burrs or warpage.



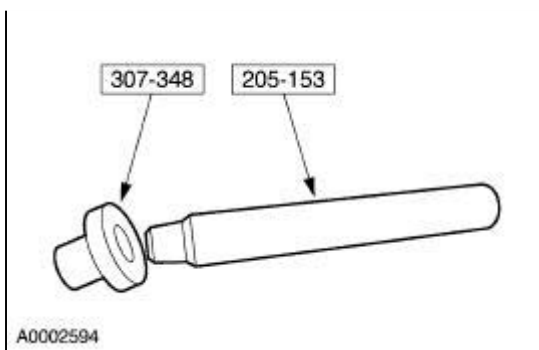
4. Inspect case bearing for damage. Install a new component as necessary. Follow Steps 5-8 if replacing the case bearing. If not replacing the case bearing, proceed to Step 9.



5. Using the special tool, remove the case bearing.
 - Use an oil stone to remove any nicks or burrs in the bearing case bore.

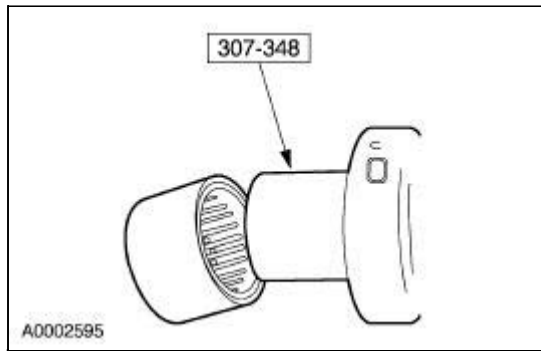


6. Assemble the special tools.

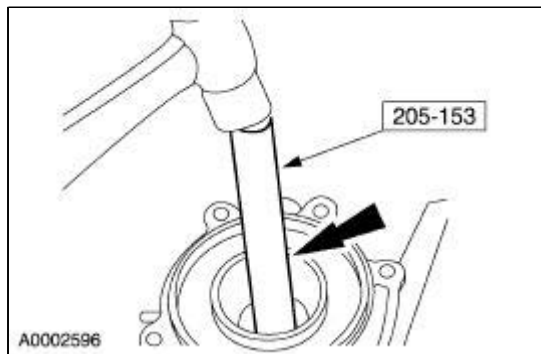


7.  **CAUTION: Make sure bearing seal ring is facing the drive handle.**

Install the bearing on the special tools.

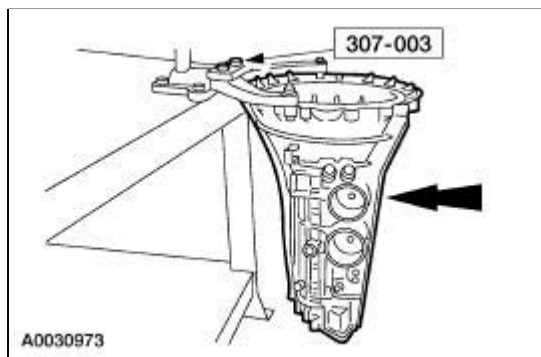


8. Using the special tool, tap case bearing into case bearing bore.

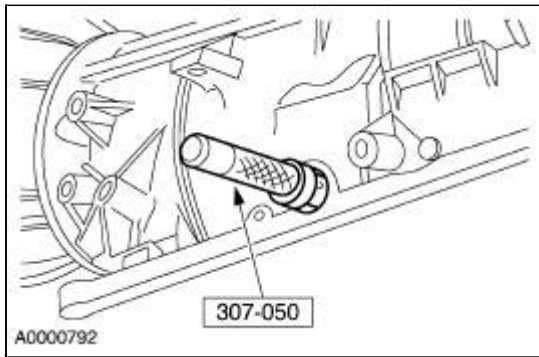


9.  **WARNING: Make sure the lock pin on bench-mounted holding fixture is secure. Failure to follow these instructions can result in personal injury.**

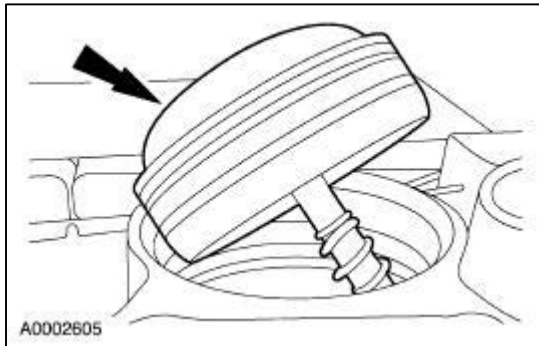
Using the special tool, install the transmission into the bench with the converter housing facing up.



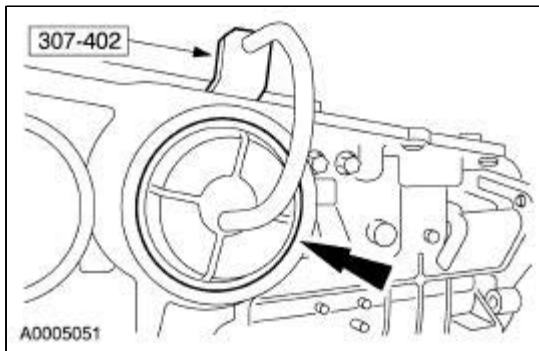
10. Using the special tool, install the manual control lever shaft seal and lubricate it with petroleum jelly.



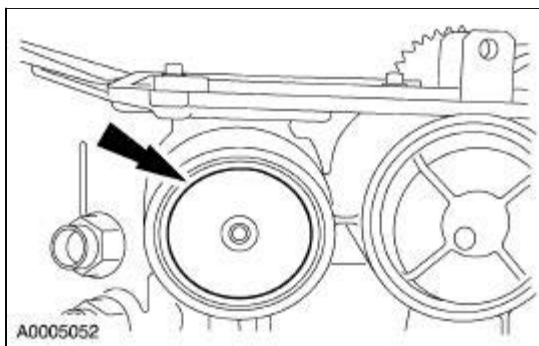
11. Install the intermediate servo piston and spring.
 - Lubricate the servo bore with clean automatic transmission fluid.



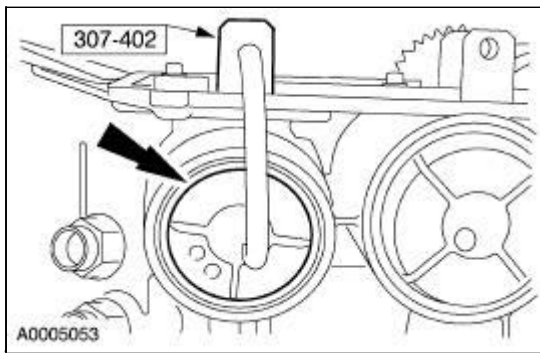
12. Using the special tool, install the retaining ring.



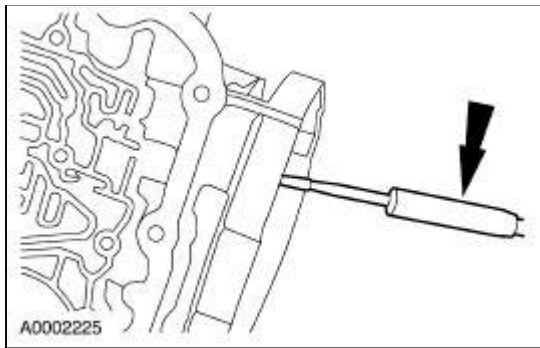
13. Install the overdrive band servo piston and spring.
 - Lubricate the servo bore with clean automatic transmission fluid.



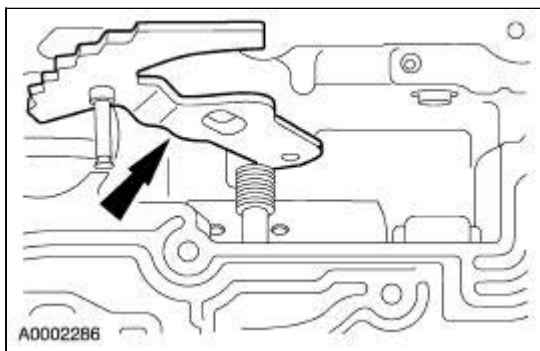
14. Using the special tools, install the retaining ring.



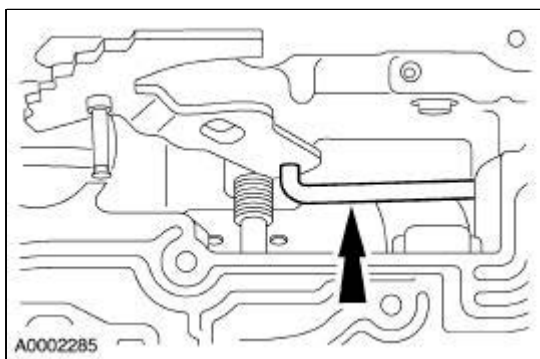
15. Install the parking lever rod.




16. Install the manual control lever.

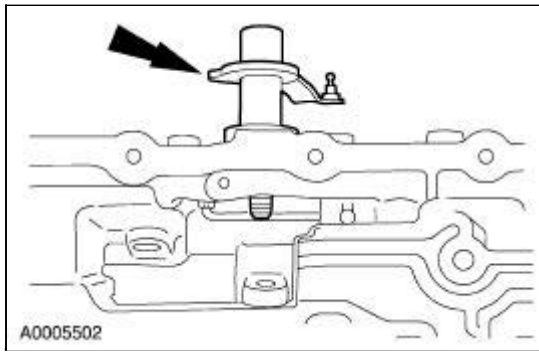


17. Assemble the manual valve inner lever and parking lever actuating rod as shown.

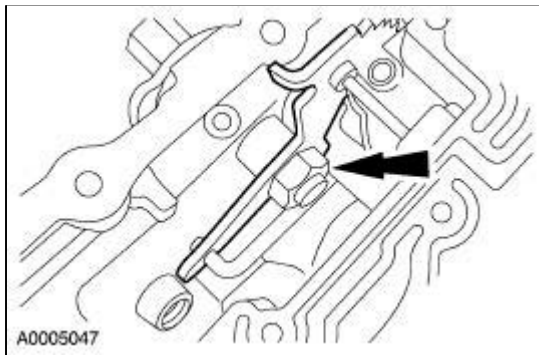



18.  **CAUTION: Align the flats on the manual valve inner lever with the flats on the manual control lever shaft.**

Install the manual control lever shaft.



19. Install the manual valve inner lever onto the manual shaft and loosely install the nut.

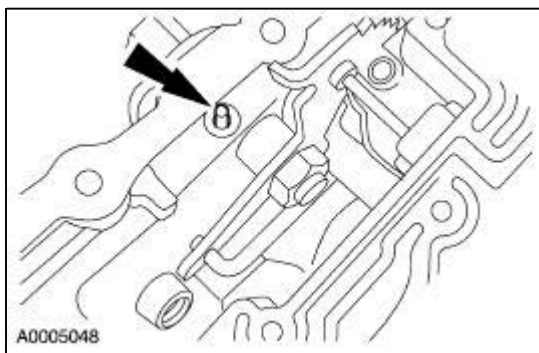


20.  **CAUTION:** Use care not to damage the fluid pan rail surface when installing the retaining pin.

NOTE: Align the manual control lever shaft alignment groove with the manual control lever shaft spring pin bore in the transmission case.

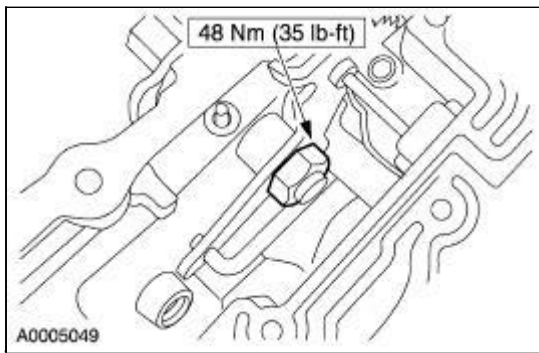
Install the manual control lever shaft spring pin.


- Tap the manual control lever shaft spring pin into the transmission case.



21.  **CAUTION:** To avoid damage, do not allow the wrench to strike the manual valve inner lever pin.

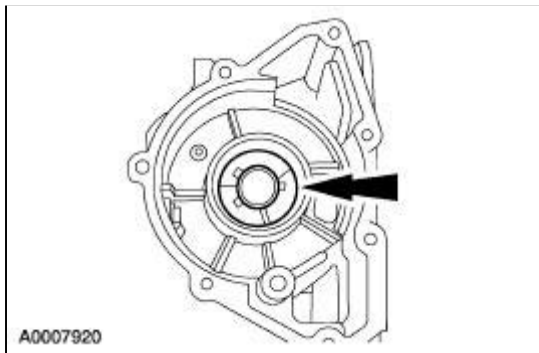
Tighten the nut.



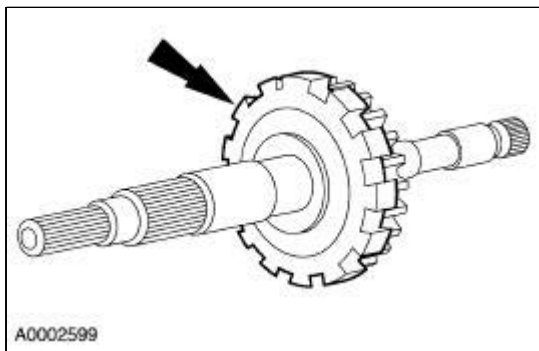
22.  **CAUTION:** The tabs on the output shaft thrust washer (No. 11) point into the case. Make sure the thrust washer is correctly seated.

Install the output shaft thrust washer (No. 11).

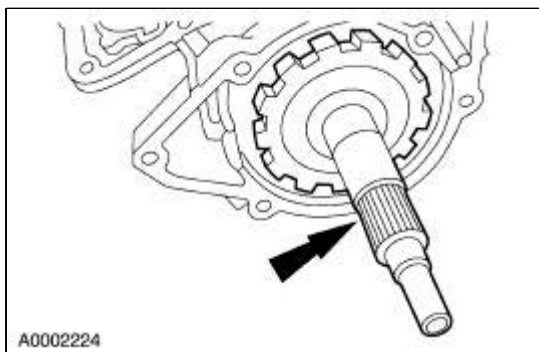
- Coat the output shaft thrust washer with petroleum jelly.



23. Install the park gear on the output shaft.

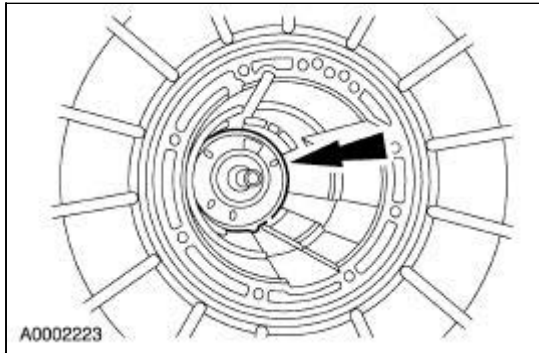


24. Install the output shaft and park gear.



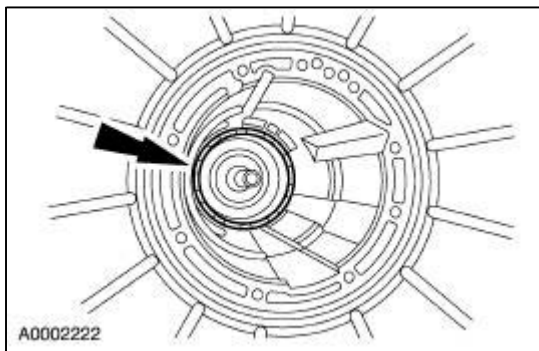
25.  **CAUTION:** Make sure band is resting on the two anchor pins in the case.

Install the low/reverse band.



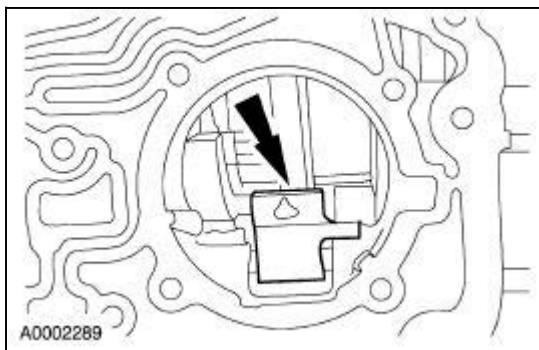
26. Install the low/reverse brake drum.

- Rotate the low/reverse brake drum clockwise to install.

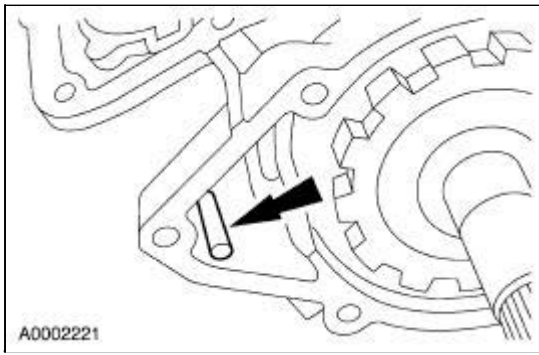


27. **NOTE:** The reverse band actuating lever must fit into the notches in the band.

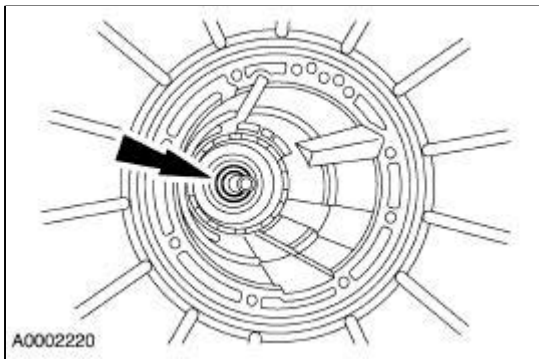
Install the reverse band actuating lever into the reverse band.



28. Install the reverse band actuating lever shaft into the case and into the reverse band actuating lever.

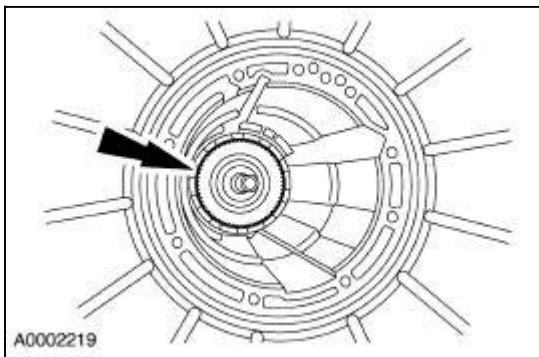


29. Install the No.10 needle bearing into the case.



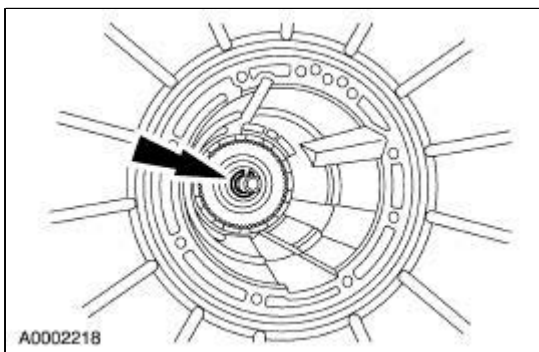
30.  **CAUTION: Do not damage the seal against the case during assembly.**

Install the output shaft ring gear, hub and seal.



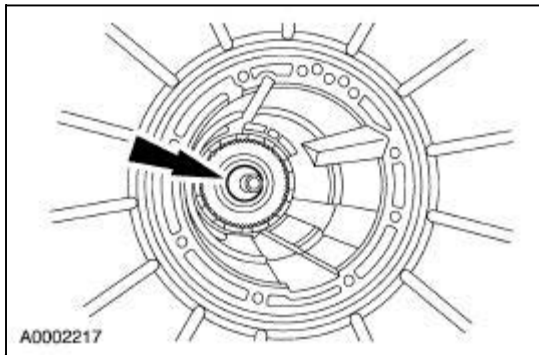
31.  **CAUTION: Always install a new output shaft retaining ring.**

Install a new output shaft retaining ring.

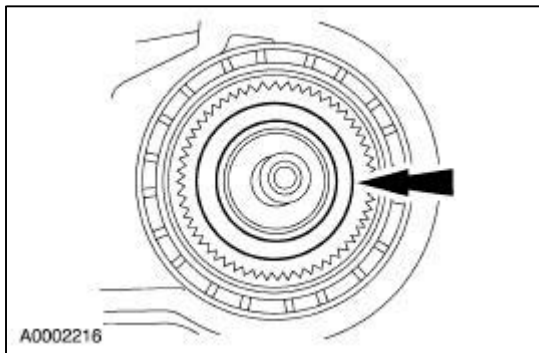



32. **NOTE:** Install the output shaft sleeve with the cone facing up. This sleeve will snap into place when correctly installed.

Install the output shaft sleeve.

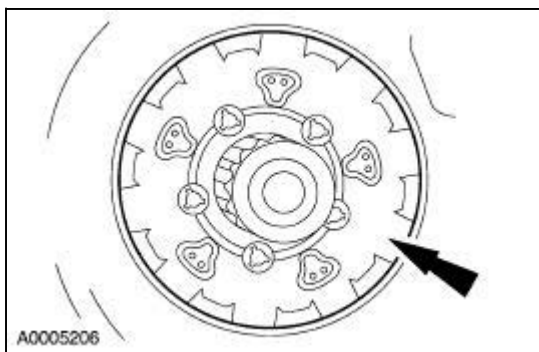


33. Install low/reverse planetary carrier needle bearing (No. 9) onto the output shaft ring gear and hub assembly.



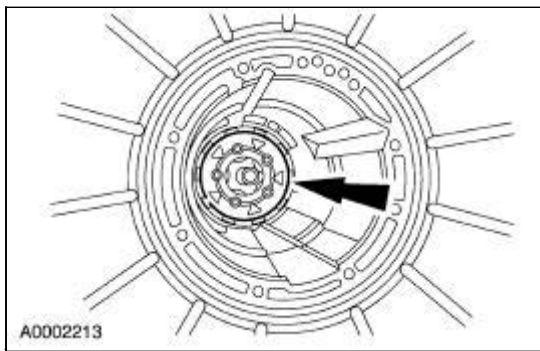
34.  **CAUTION:** Make sure the needle bearings stay in place.

Install the low/reverse planetary assembly.

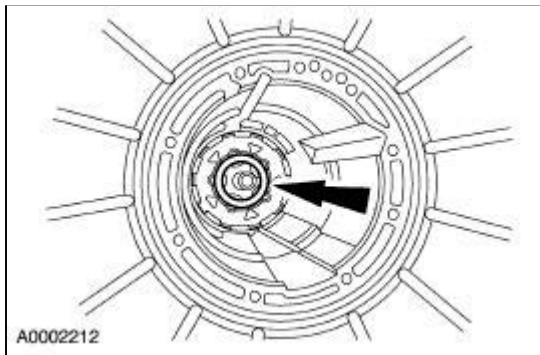


35.  **CAUTION:** The low/reverse brake drum must be pulled forward to install the low/reverse planet retaining ring.

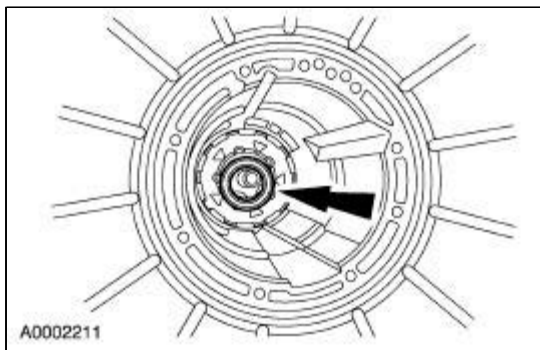
Install the retaining ring.




36. Install the No. 8 thrust bearing.

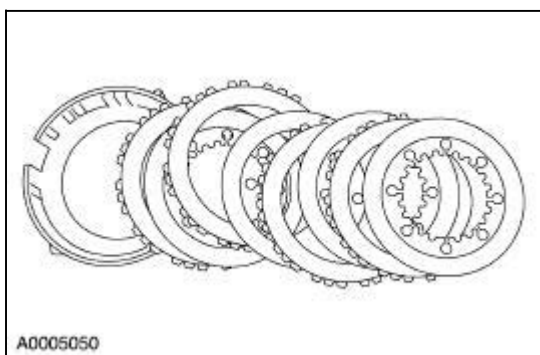


37. Install the low and reverse gear spacer.



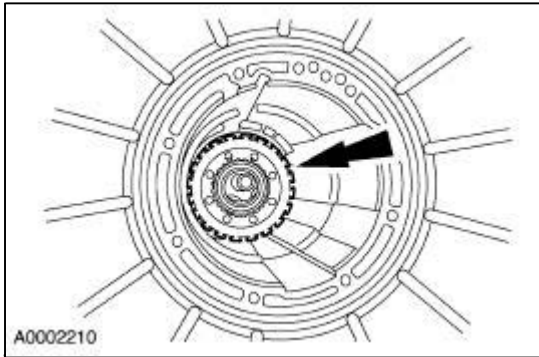
38.  **CAUTION:** If new clutch plates are being used, they should be soaked in clean automatic transmission fluid 30 minutes prior to installation. The friction side of the plates must face down toward cylinder.

Install the new clutch plates in an alternating order, starting with an internally splined clutch plate into the clutch cylinder.

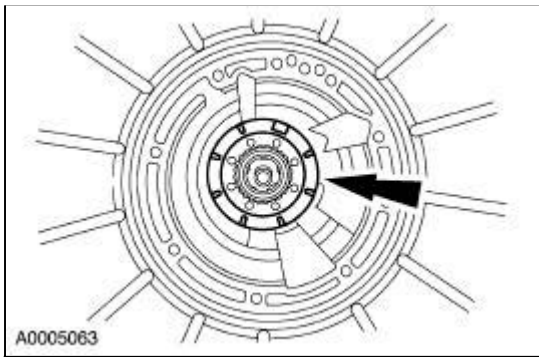


39. Install the clutch plate retaining ring.

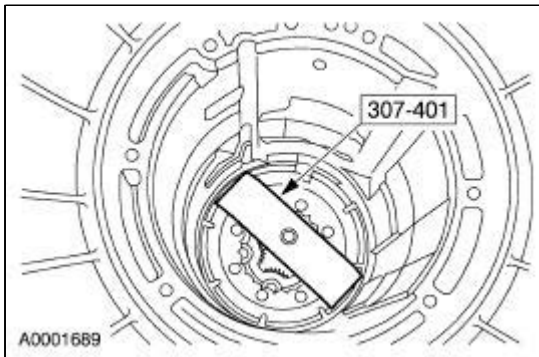
40. Install the intermediate clutch assembly.



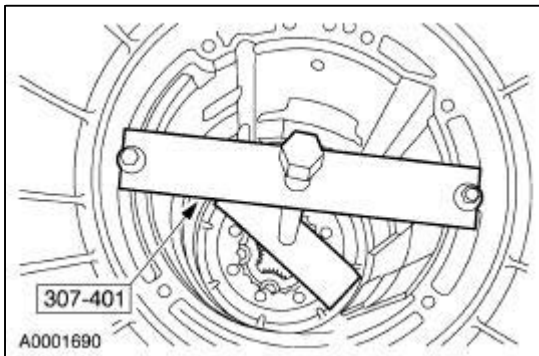
41. Install the intermediate clutch housing and piston assembly.



42. Install the special tools.

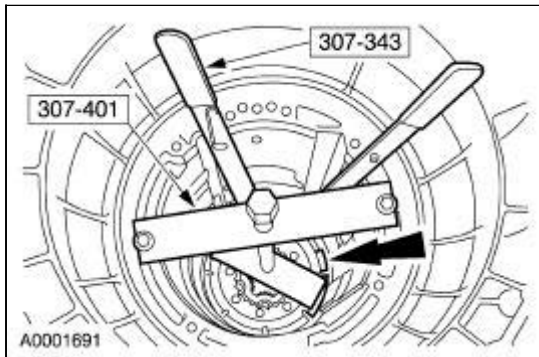


43. Install the special tools.



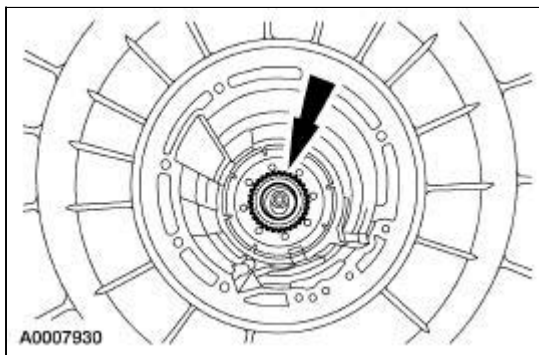
44.  **CAUTION:** Do not use the original intermediate clutch retaining ring that was removed during disassembly.

Using the special tools, install a new service intermediate clutch retaining ring.

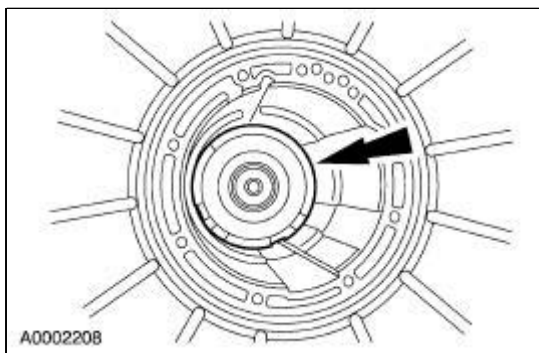


45. **NOTE:** The recess portion of the sprag must face down during installation.

Install the sprag and race assembly.

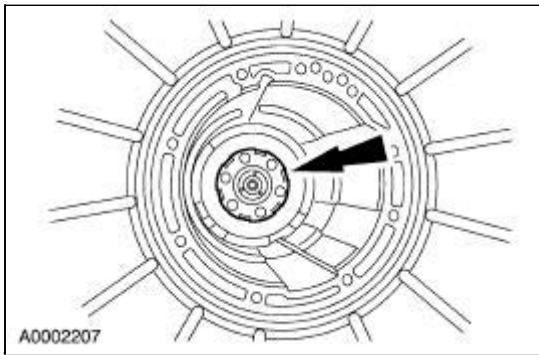


46. Install the input shell and sun gear assembly.

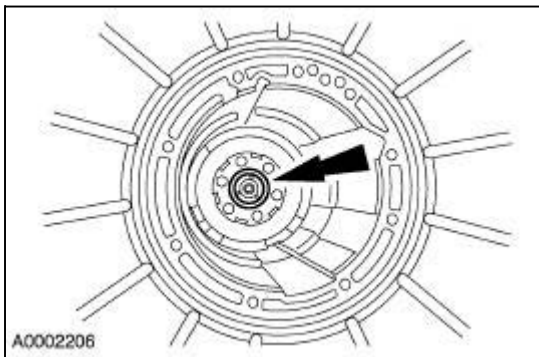


47. **NOTE:** The No. 13 bearing must be properly seated in the forward planet assembly so the sun gear can be installed correctly.

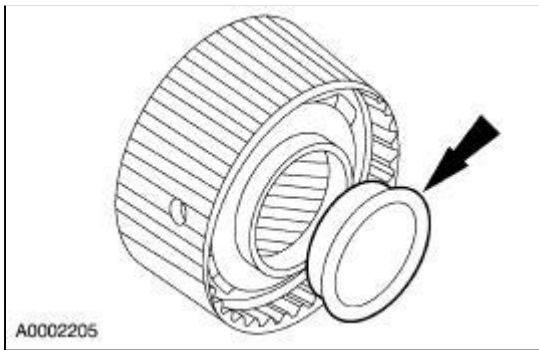
Install the forward planetary assembly.



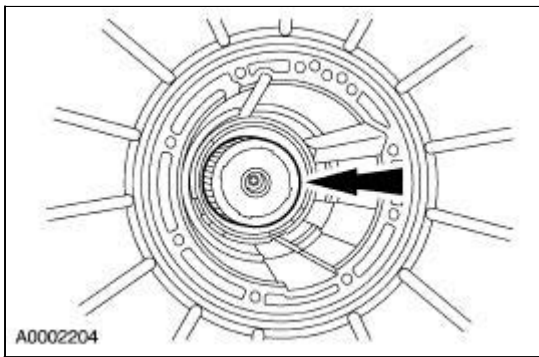
48. Install the No. 7 forward planet thrust bearing into the forward ring gear and hub assembly. Use petroleum jelly to hold the bearing in place.



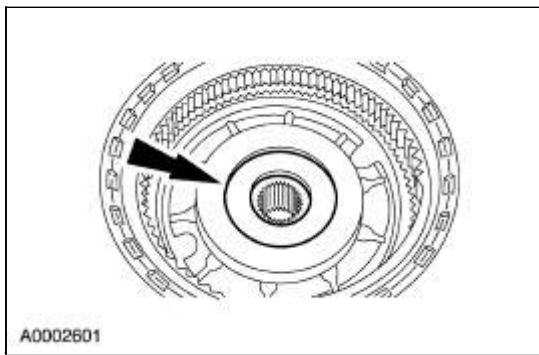
49. Install the No. 6B forward clutch thrust washer onto the forward ring gear hub.



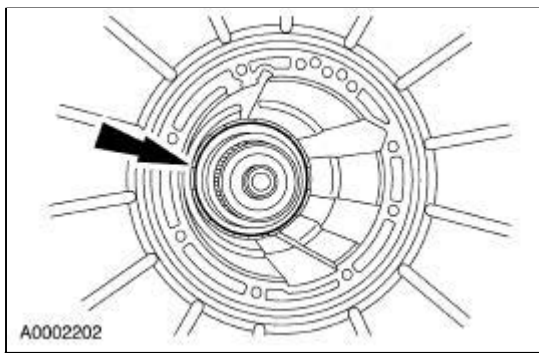
50. Install the forward ring gear and hub as an assembly.



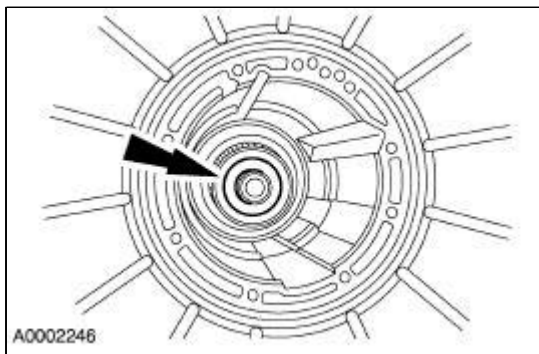
51. Install the No. 6A forward ring gear hub thrust bearing into the forward clutch. Use petroleum jelly to hold the bearing in place.



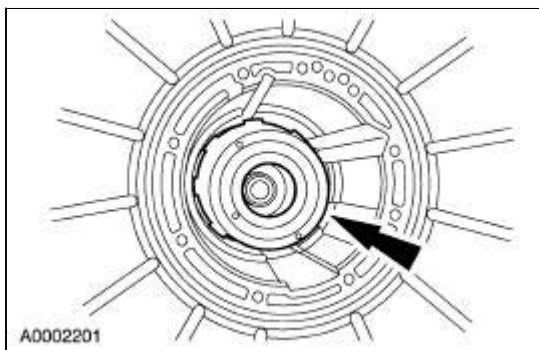
52. Install the forward clutch cylinder.



53. Install the No. 5 thrust bearing.

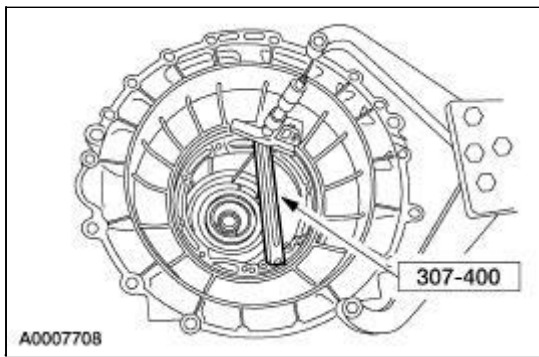



54. Install the direct clutch drum.



55. Using a depth micrometer with an 8-inch extension, measure from the top of the gauge bar to center support ledge in case at four places 90 degrees apart.

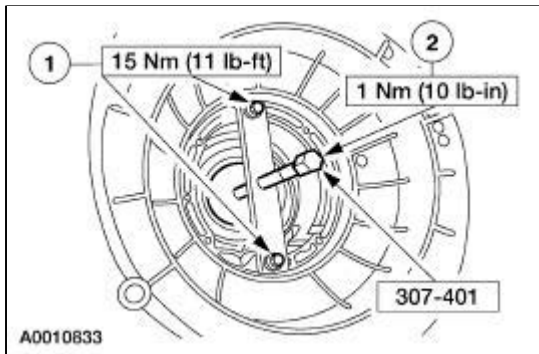
- Add the four measurements, divide by four, and record as dimension A.



56.  **CAUTION:** The torque specifications are critical for this procedure. Failure to use the correct torque specifications may cause transmission damage.

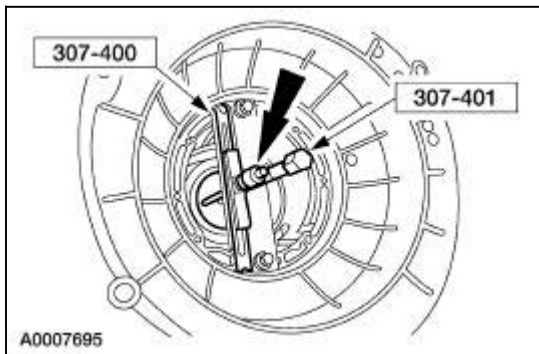
Install the special tool.

1. Install the special tool and the bolts using the two pump screw locations at approximately 6 and 12 o'clock positions.
2. Tighten the center screw.



57. **NOTE:** Align the disc holes on special tool with the slot in gauge bar for correct measurement.

Measure the distance from the top of the gauge bar to the drum bearing surface through the hole in the disc and record as dimension B. Repeat measurement 180 degrees opposite side of the special tool and record as dimension C.



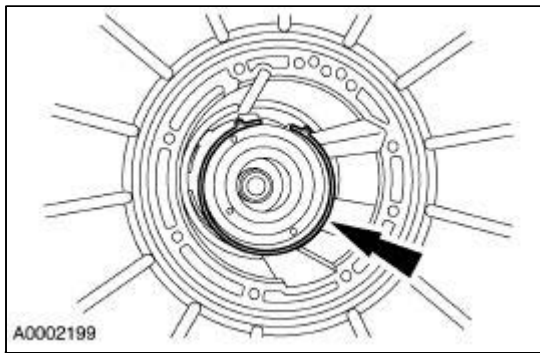
58. Add dimension B to C, divide by two and record as dimension D.
59. Subtract A from D, and record as dimension E.
60. Select bearing from the following chart, using dimension E.

Dimension E	Service Part Number (7D014)	Bearing Thickness	Identification (Notches)
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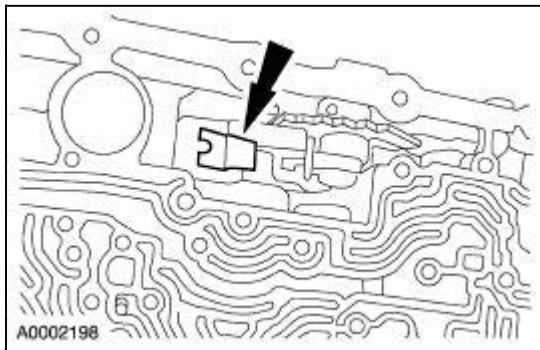
1.69-1.87 mm (0.066-0.073 in)	XW4Z-CA	2.65-2.80 mm (0.104-0.110 in)	None
1.88-2.05mm (0.073-0.080 in)	XW4X-DA	2.83-2.98mm (0.111-0.116 in)	One
2.05-2.22 mm (0.081- 0.088 in)	XW4Z-EA	3.01-3.16mm (0.118-0.124 in)	Two
2.33-2.43 mm (0.089-0.096 in)	XW4Z-FA	3.21-3.36 mm (0.126-0.132 in)	Three

61. **NOTE:** Make sure that the intermediate apply strut is aligned with the band notch.

Install the intermediate band.

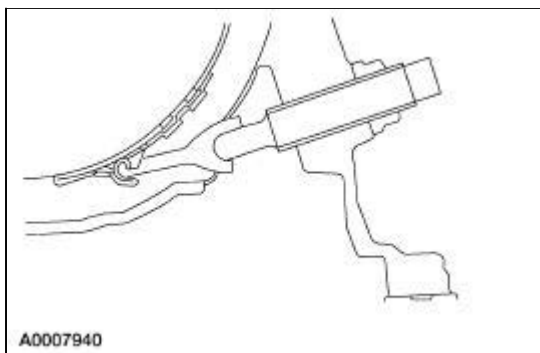


62. Install the intermediate band anchor strut.

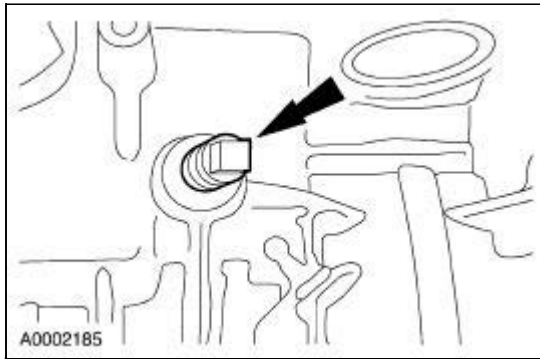


63. **⚠ CAUTION:** If the strut is installed incorrectly, transmission damage will occur.

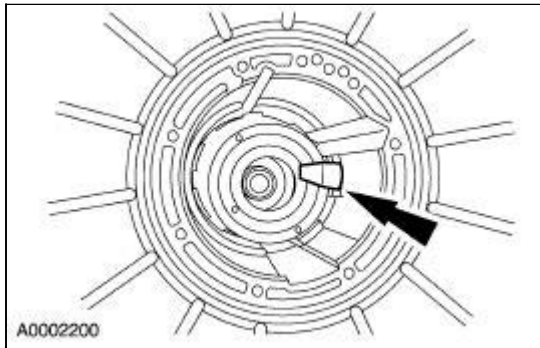
Check to make sure that the intermediate band anchor strut is installed in the correct orientation to the case and adjustment screw.



64. Loosely install the screw.

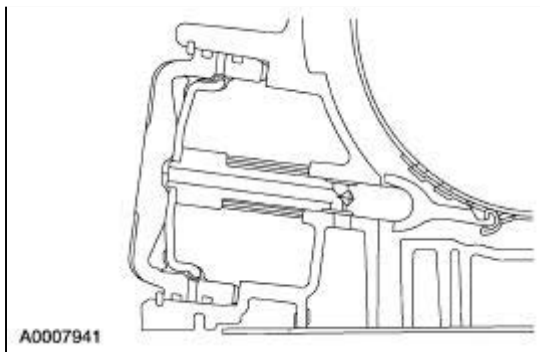


65. Install the intermediate band apply strut.



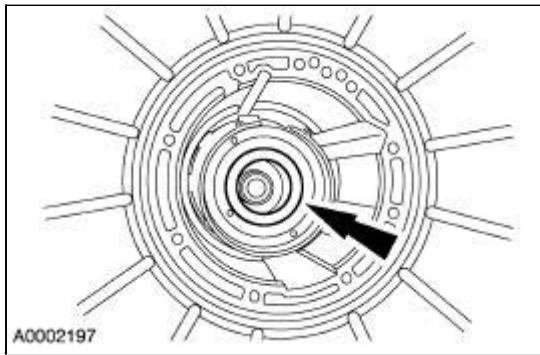
66.  **CAUTION: If the strut is installed incorrectly, transmission damage will occur.**

Check to make sure that the intermediate band apply strut is installed in the correct orientation to the case and piston rod.



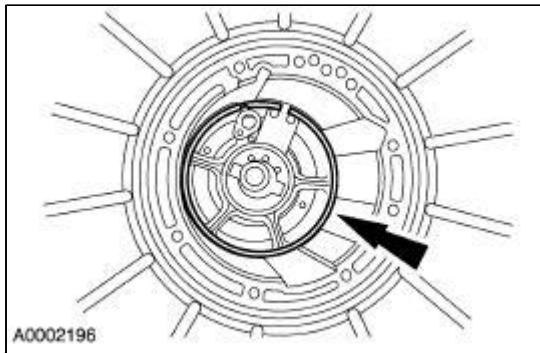
67. Install the selected No. 4 thrust washer on the direct clutch drum.

- Coat the thrust washer with petroleum jelly.

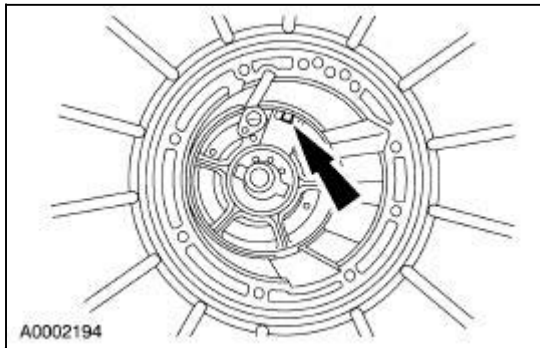


68. **NOTE:** Align the center support screw hole with correct case hole.

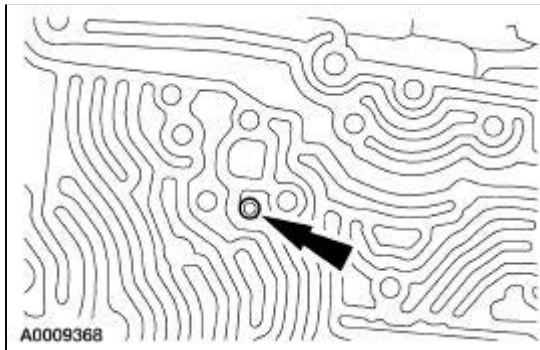
Install the center support.



69. Install the center support locknut and cage.



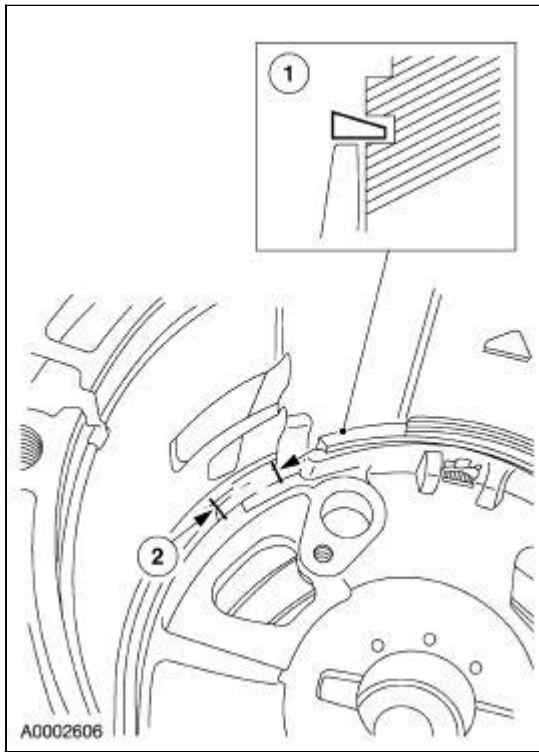
70. Loosely install the screw.



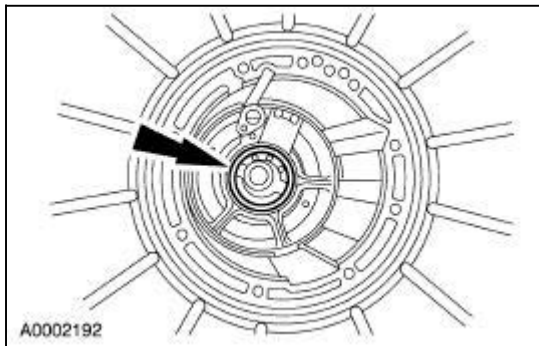
71.  **CAUTION:** Install the center support retaining ring with the tapered side facing up.

 **CAUTION:** Make sure the center support retaining ring does not obstruct the notch opening.

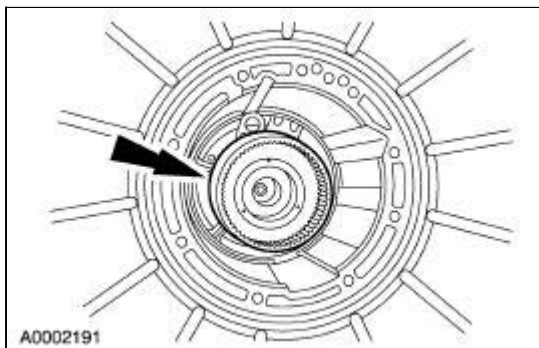
Install the center support retaining ring.




72. Install the center shaft thrust bearing (No. 3).

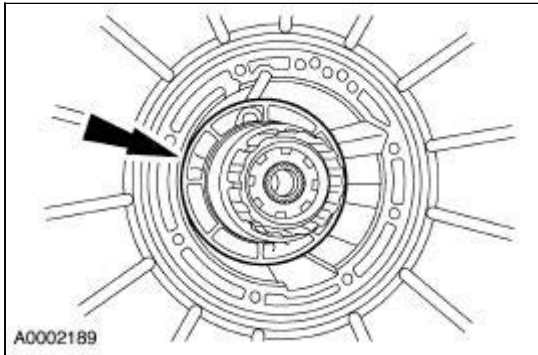


73. Install the overdrive ring gear, overdrive one-way clutch and center shaft assembly.

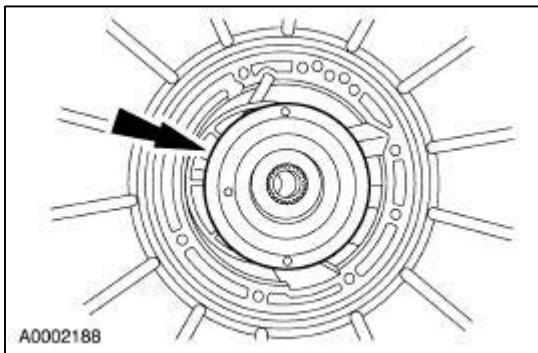


74.  **CAUTION:** Do not bend the trigger wheel. Make sure that the No. 2 thrust bearing is in this assembly.

Install the planetary gear overdrive carrier.

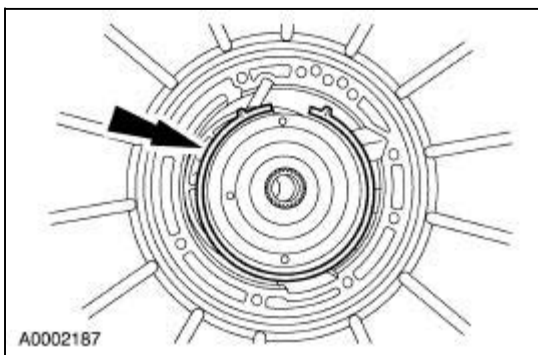


75. Install the overdrive brake drum and coast clutch drum assembly.

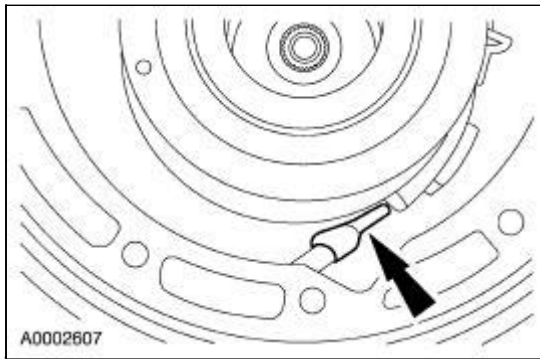



76. **NOTE:** If the overdrive band is reused, it must be installed in the same position from which it was removed.

Install the overdrive band.

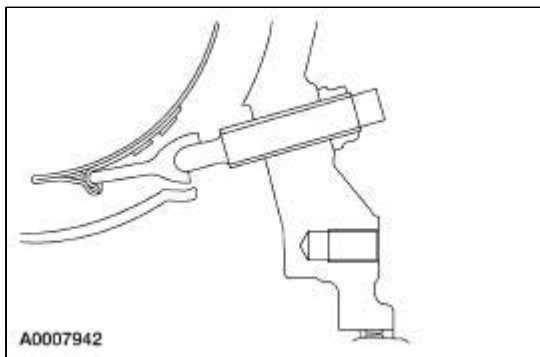


77. Install the overdrive anchor strut.

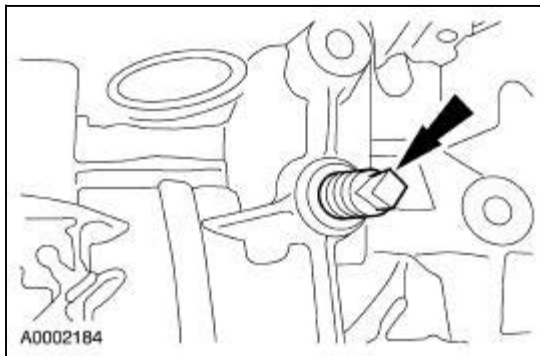


78.  **CAUTION: If the strut is installed incorrectly, transmission damage will occur.**

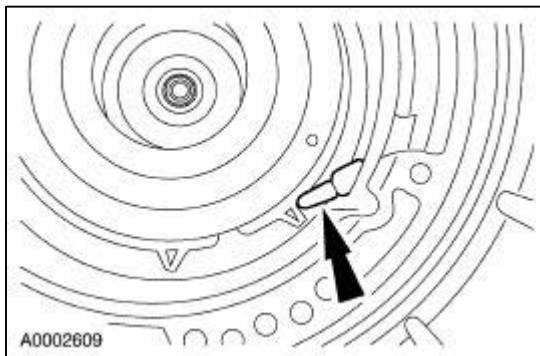
Check to make sure that the overdrive band anchor strut is installed in the correct orientation to the case and adjustment screw.




79. Loosely install the screw.

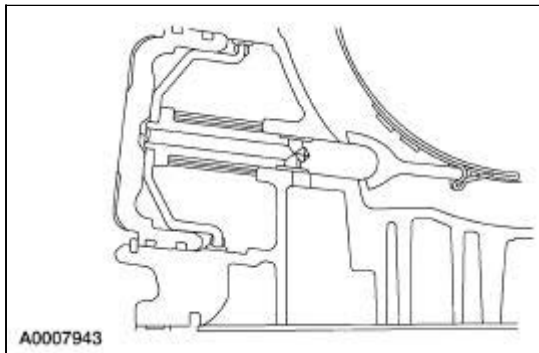



80. Install the overdrive apply strut.



81.  **CAUTION:** If the strut is installed incorrectly, transmission damage will occur.

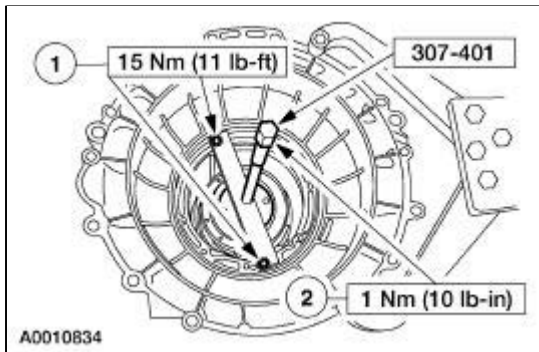
Check to make sure that the overdrive band apply strut is installed in the correct orientation to the case and piston rod.



82.  **CAUTION:** The torque specifications are critical for this procedure. Failure to use the correct torque specifications can cause transmission damage.

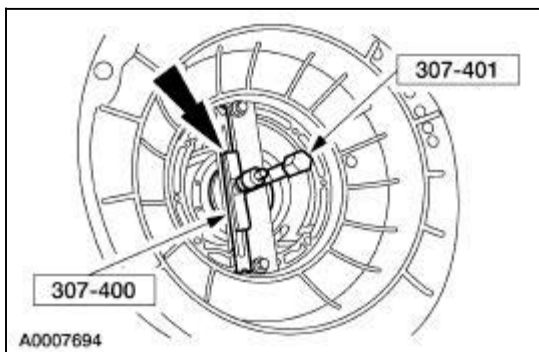
Install the special tool.

1. Install the special tool and the bolts, using the two pump screw locations at approximately 6 and 12 o'clock positions.
2. Tighten the center screw.



83. **NOTE:** Align the disc holes on special tool with the slot in gauge bar for correct measurement.

Measure the distance from the top of the gauge bar to the drum bearing surface through the hole in the disc and record as dimension A. Repeat measurement 180 degrees opposite side of the special tool and record as dimension B.

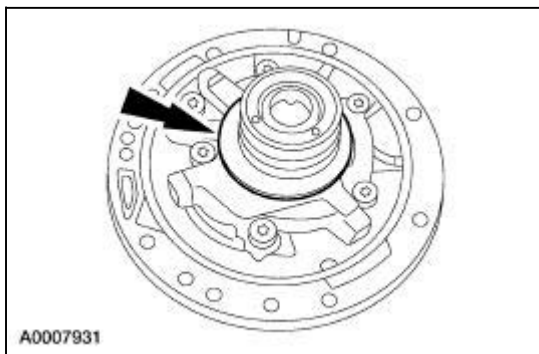


84. Add dimension A to B, divide by two and record as dimension C.

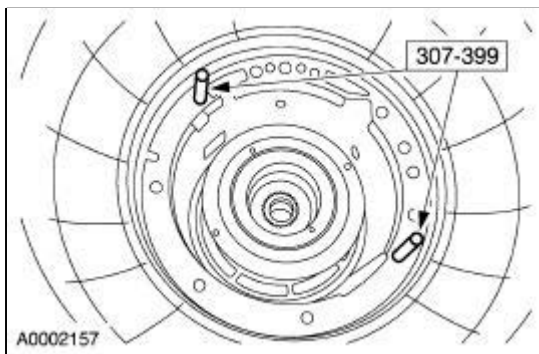
85. Subtract the thickness of the gauge bar (17.78 mm or 0.700 in) from dimension C, and record as dimension D.
86. Select the No.1 thrust bearing from the following chart, using dimension D.

Dimension D	Service Part Number (7D014)	Bearing Thickness	Identification (Color/ID)
38.04-38.28 mm (1.50-1.51 in)	XW4Z-XA	1.70-1.75 mm (0.06 in)	Brown/8
38.29-38.43 mm (1.51 in)	XW4Z-NA	1.85-1.90 mm (0.07 in)	Red/4
38.44-38.63 mm (1.51-1.52 in)	XW4Z-RA	2.05-2.10 mm (0.08 in)	Black/6
38.64-38.78 mm (1.52-1.53 in)	XW4Z-YA	2.20-2.25 mm (0.09 in)	Orange/9
38.79-38.97 mm (1.53 in)	XW4Z-ZA	2.40-2.45 mm (0.10 in)	Purple/10

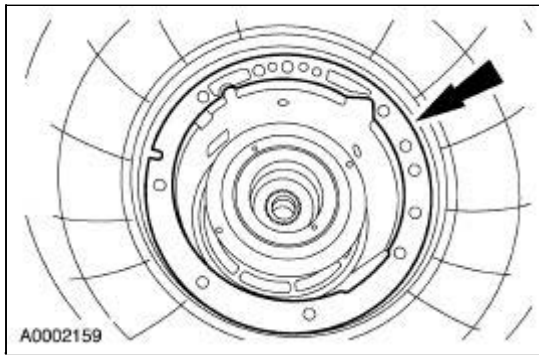
87. Install the selected No. 1 fluid pump input thrust washer.
- Coat the fluid pump input thrust washer with petroleum jelly.




88. Install the special tools into the transmission case.

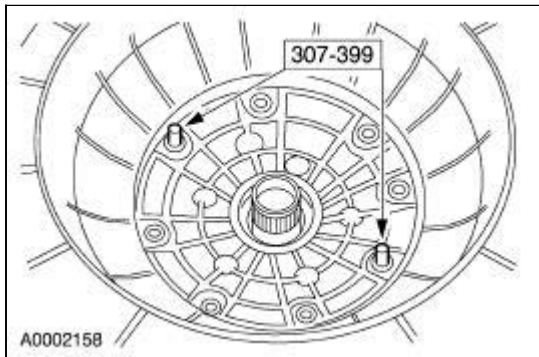



89. Install the pump gasket.



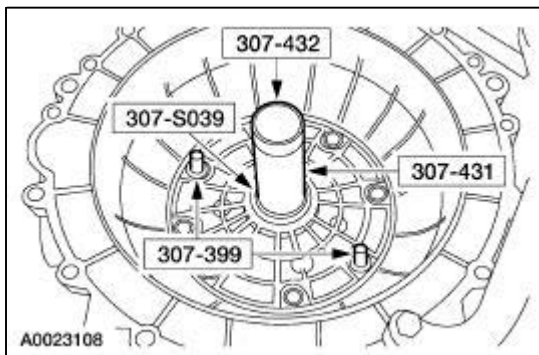
90.  **CAUTION:** Make sure that the fluid pump inlet thrust washer (No. 1), selective thrust washer, fluid pump gasket, and the fluid pump-to-case O-ring seal remain in the correct position throughout this step.

Install the fluid pump.

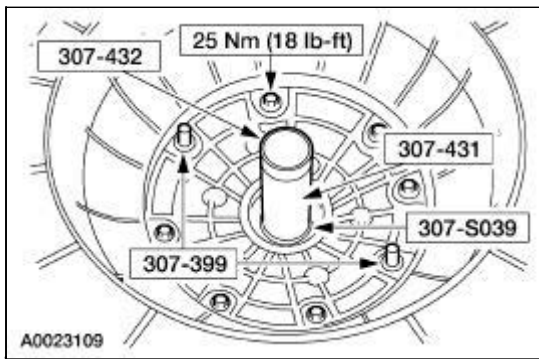


91.  **CAUTION:** The special tools must be used to correctly align the pump with the adapter plate to reduce gear noise, bushing failure and leakage.

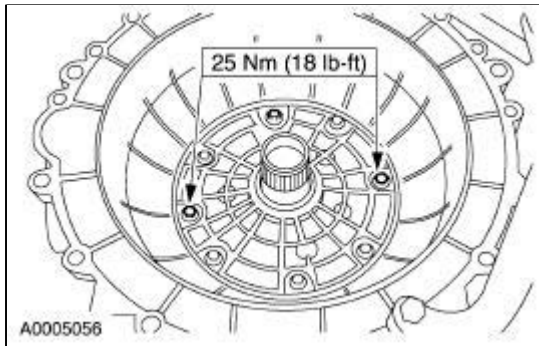
Using the special tool, align the fluid pump to the adapter plate.




92. Install screws. Tighten the screws in a star pattern.



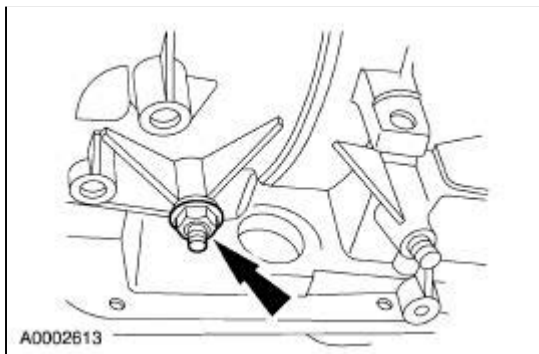
93. Remove the special tools and install the two remaining screws.



94.  **CAUTION:** Do not allow overdrive band adjustment screw to back out. Band strut could fall out of position.

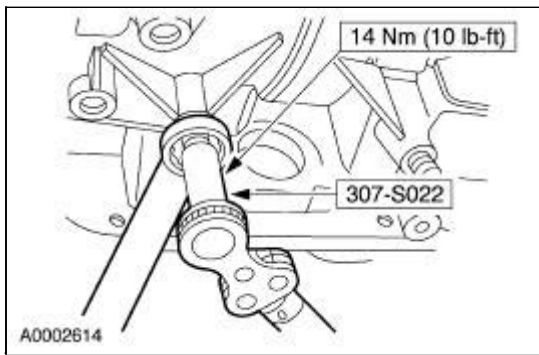
 **CAUTION:** Install, but do not tighten, a new locknut on the band adjustment screw. Apply petroleum jelly to the locknut seal.

Install a new locknut on the band adjustment screw.

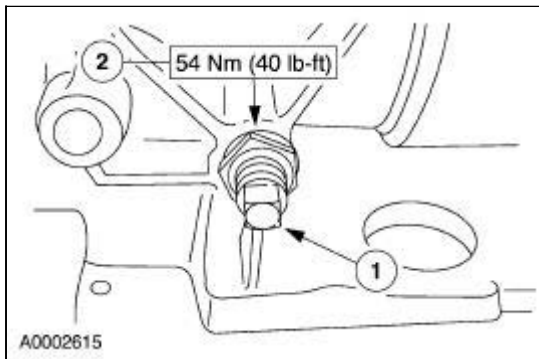


95.  **CAUTION:** The overdrive servo must be installed prior to band adjustment.

Using the special tool, tighten the overdrive band adjustment screw then back off the screw exactly (2) turns and hold that position.



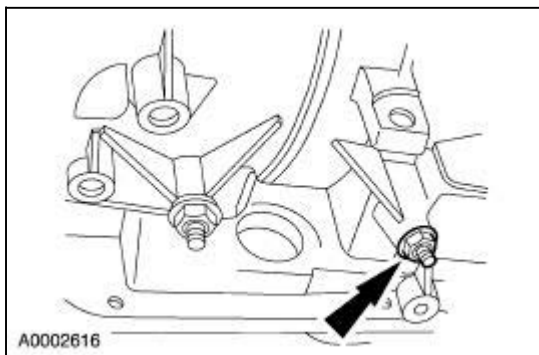
96. Tighten the overdrive band locknut.
1. Hold the overdrive band adjustment screw stationary.
 2. Tighten the overdrive band locknut.



97. **⚠ CAUTION: Do not allow the intermediate band adjusting screw to back out. Band strut could fall out of position.**

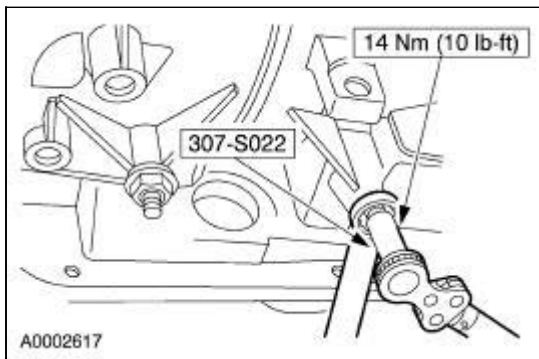
⚠ CAUTION: Install, but do not tighten, a new locknut on the band adjustment screw. Apply petroleum jelly to the locknut seal.

Install new nut on the band adjustment screw.

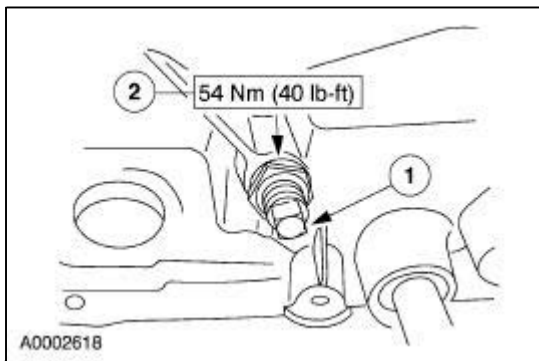


98. **⚠ CAUTION: The intermediate servo must be installed prior to band adjustment.**

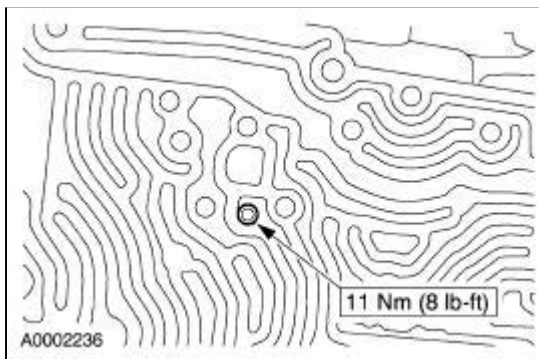
Tighten the intermediate band adjustment screw then back off the screw exactly (2) turns and hold that position.



99. Tighten the intermediate band locknut.
1. Hold the intermediate band adjustment screw stationary.
 2. Tighten the intermediate band locknut.

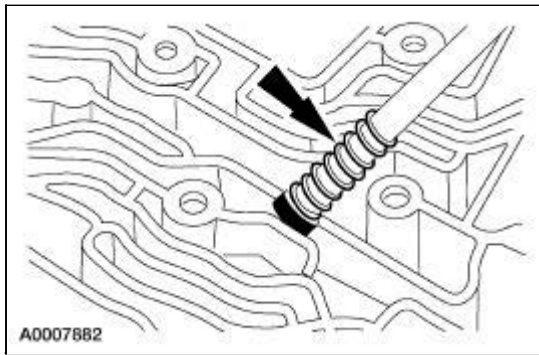


100. Tighten the center support screw.

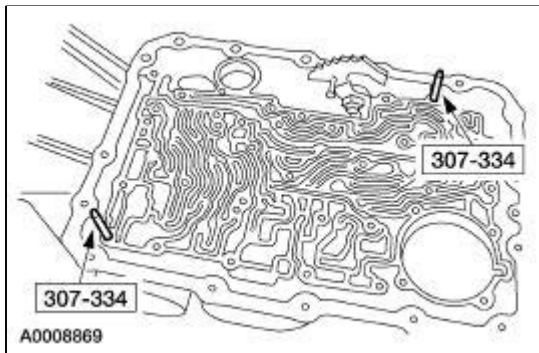


101. **⚠ CAUTION: The intermediate clutch fluid inlet tube seal and spring must be correctly seated in the case. Failure to correctly seat the inlet tube seal and spring will cause an internal fluid leak and transmission damage.**

Using a drift punch, correctly install and seat the intermediate clutch fluid inlet tube seal and spring into the case.

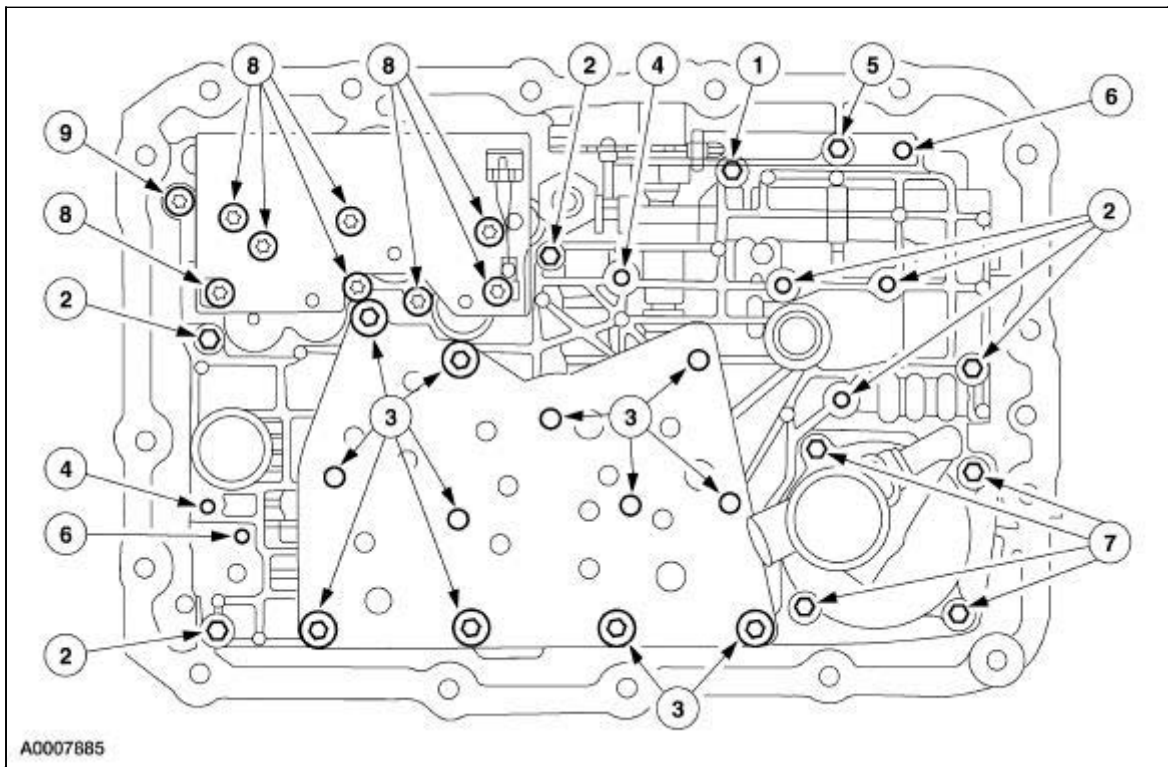


102. Install the special tools into the transmission case.

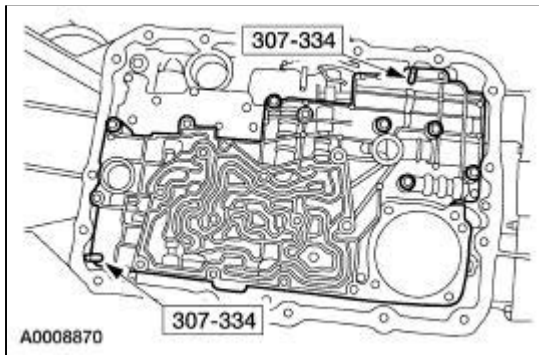


103. Refer to the following chart for bolt locations.

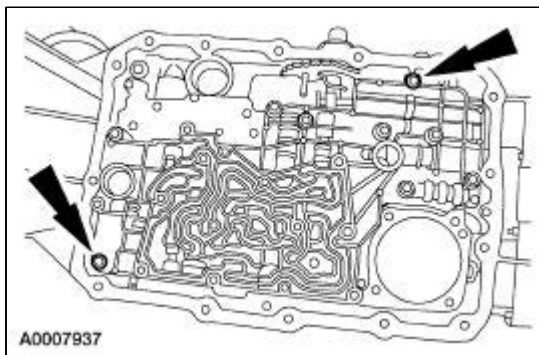
Item	Part No.	Part Name	Size
1	W702791-S300	Hex Bolt	M6X27
2	W500103-S1300	Hex Bolt	M6X45
3	W703133-S1300	Hex Bolt	M6X52
4	W705559-S300	Hex Bolt	M6X82.2
5	W500100-S300	Hex Bolt	M6X30
6	W701099-S1430	Cap Int Lob Screw	M6X20
7	W703135-S1300	Hex Bolt	M6X70
8	W703189-S1430	Cap Int Lob 8	M6X63
9	W702921-S430	Cap Int Lob 8	M6X25



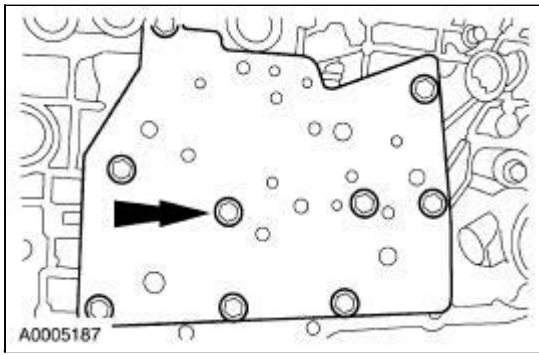
104. Install the main control valve body and loosely install the screws.



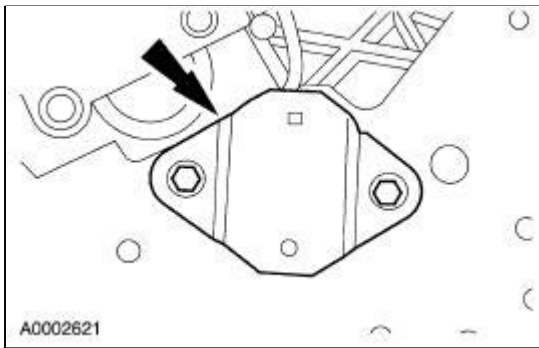
105. Remove the special tools and loosely install the screws.



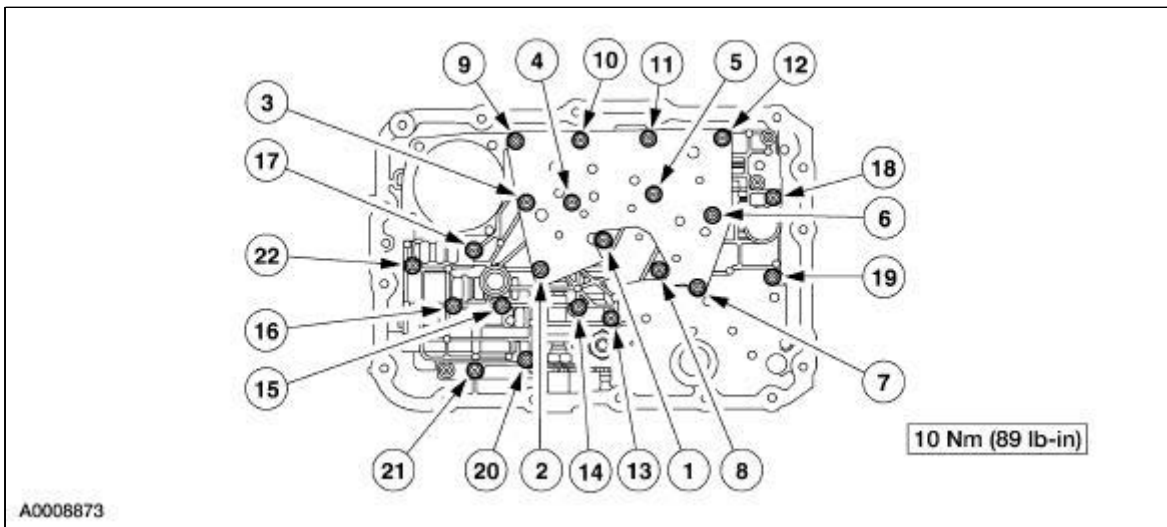
106. Install the valve body cover plate and gasket and loosely install the screws.



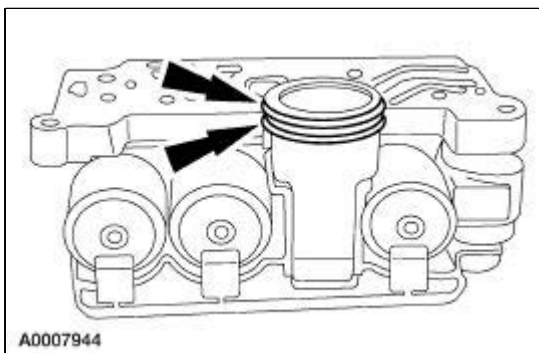
107. Install a new reverse pressure switch and loosely install the screws.




108. Tighten the screws in the sequence shown.

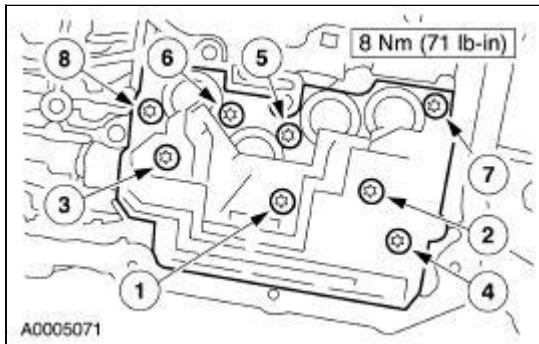


109. Install new O-ring seals on the solenoid body connector. Lubricate the O-ring seals with clean automatic transmission fluid.



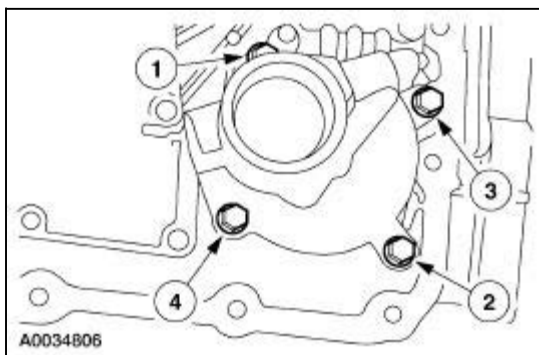
110.  **CAUTION: Inspect the transmission case bore to make sure it is free of debris and not damaged. If damaged, transmission leak can result.**

Install the solenoid body. Tighten bolts in sequence shown.

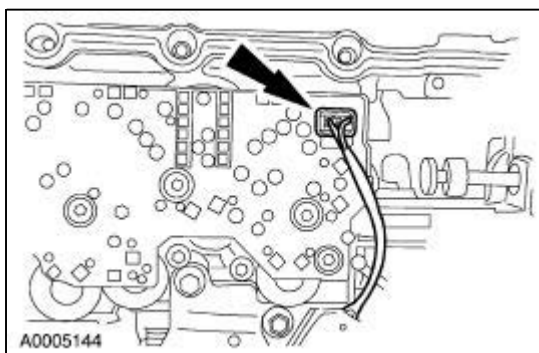


111. Install the reverse servo. Tighten the bolts in sequence shown in two stages.

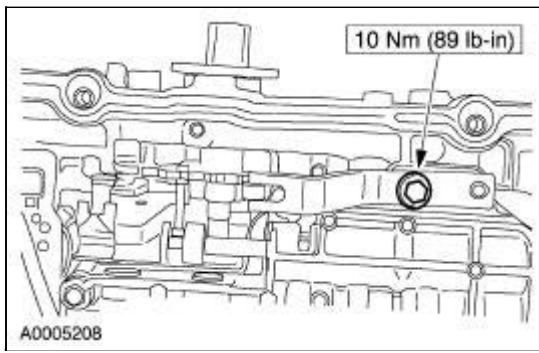
- Stage 1: Tighten bolts to 5 Nm (44 lb-in)
- Stage 2: Tighten bolts to 11 Nm (8 lb-ft)



112. Connect the reverse pressure switch connector.



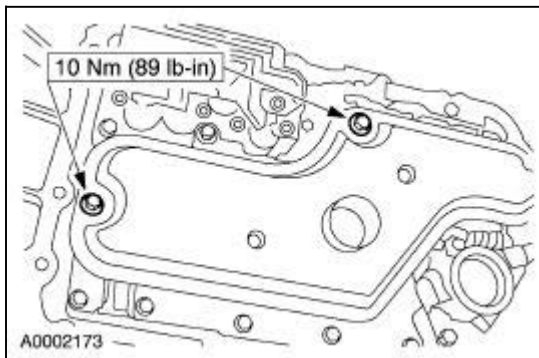
113. Install the manual valve detent spring.



114.  **CAUTION:** Lubricate the fluid filter O-ring seals with clean automatic transmission fluid or they can be damaged.

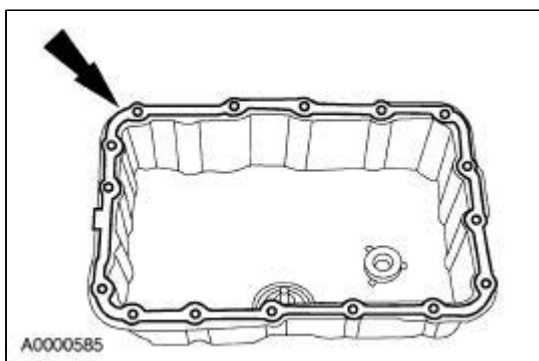
NOTE: Make sure that the fluid filter O-ring seals are correctly seated on the filter.

Lubricate the seals and install the transmission fluid filter.

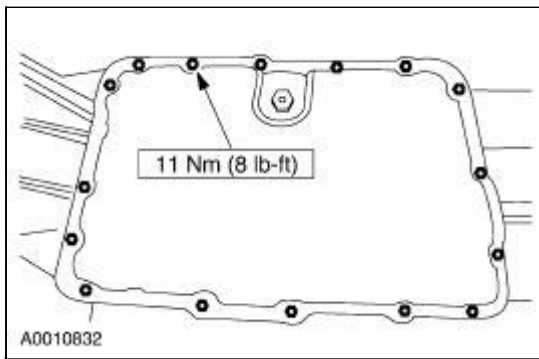


115. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect for damage. If not damaged, the gasket should be reused.

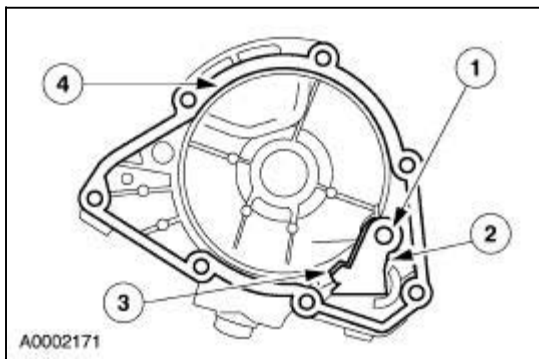
Install the transmission fluid pan and gasket.



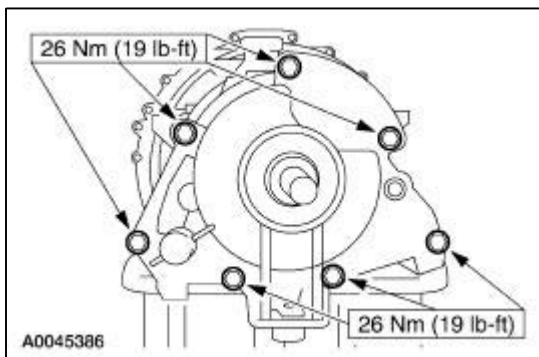
116. Tighten the screws in a crisscross sequence.



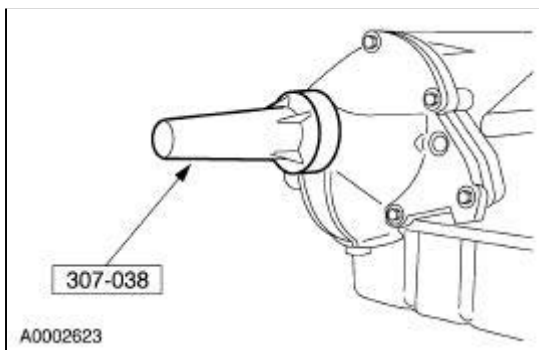
117. Install the parking pawl assembly and gasket.
1. Install the parking pawl shaft.
 2. Install the parking pawl.
 3. Install the parking pawl return spring.
 4. Install the gasket.



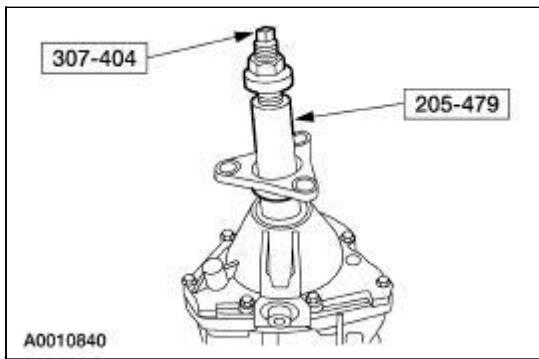
118. Install the extension housing.



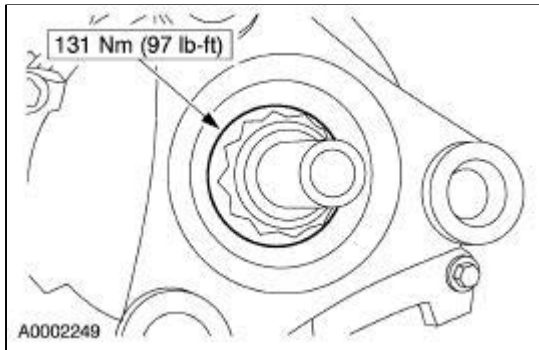
119. Using the special tool, install the extension housing seal.




120. Using the special tools, install the output shaft flange.

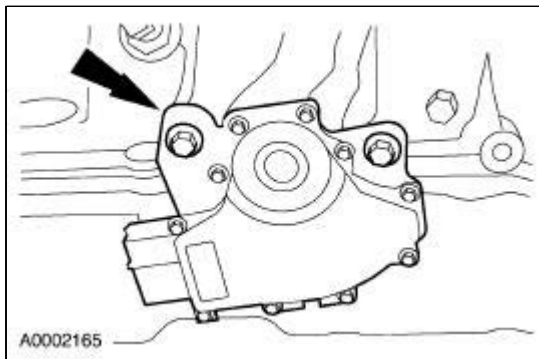



121. Install a new nut.



122.  **CAUTION:** The digital transmission range sensor must fit flush against the boss on the case to prevent damage to the sensor.

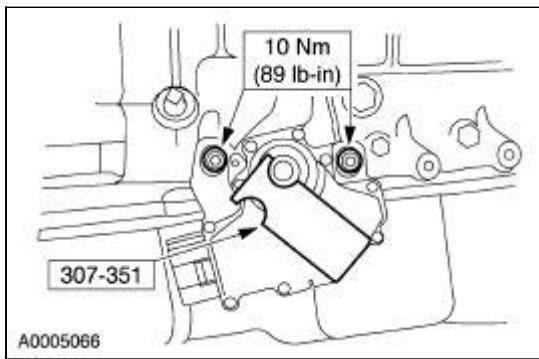
Install the digital transmission range (TR) sensor and loosely install the screws.



123.  **CAUTION:** Tightening one screw before tightening the other can cause the sensor to bind or become damaged.

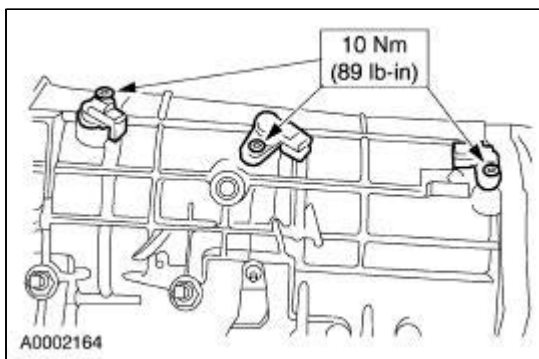
NOTE: The manual lever must be in the NEUTRAL position.

Using the special tool, align the digital TR sensor and tighten the screws in an alternating sequence.



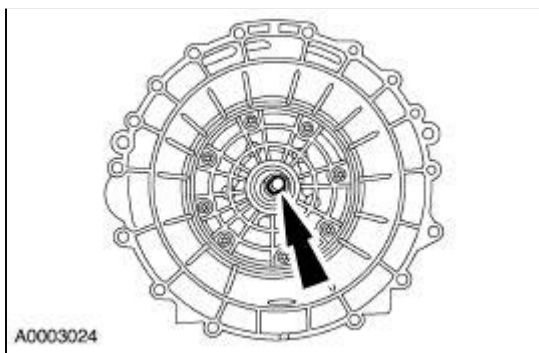
124. **NOTE:** Inspect O-ring seal for damage. Install new if damaged. Lubricate the O-ring seals with petroleum jelly to prevent damage to the O-ring seals.

Install the sensors.

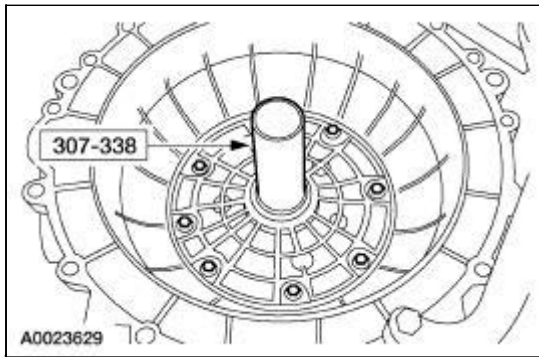


125. **⚠ CAUTION:** The splines of the input shaft are not the same length on both ends. The shaft end with the shorter splines goes into the fluid pump.

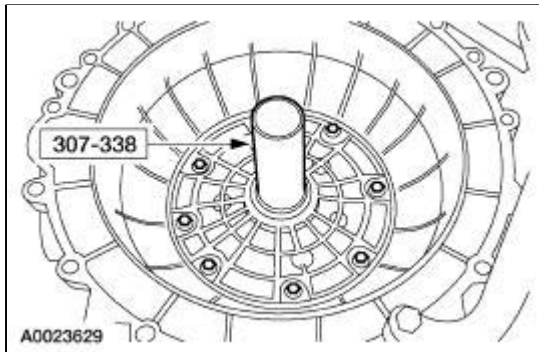
Install the input shaft.




126. Using the special tool, make sure that the fluid pump gear seal ring is fully seated.



127. Remove the special tool.

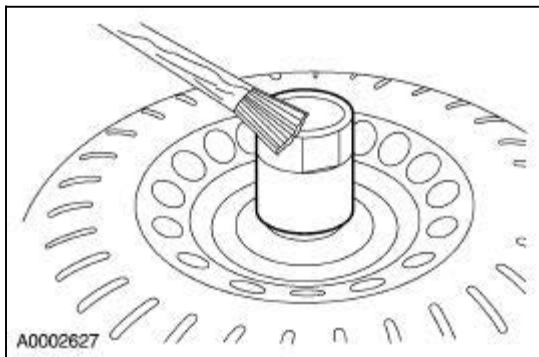


128.  **CAUTION:** Do not damage the fluid pump gear O-ring seal when installing torque converter.

 **CAUTION:** Make sure the converter hub is fully engaged in the pump support and gear and rotates freely. Do not damage the hub seal.

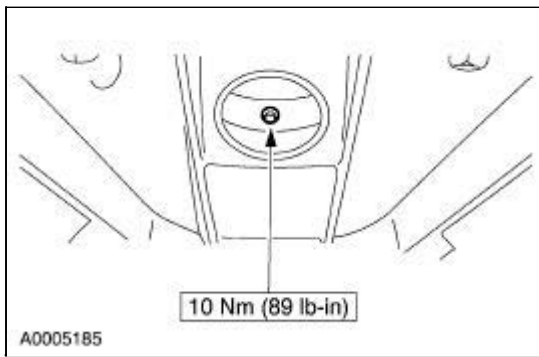
 **CAUTION:** If the torque converter slides out, the hub seal can be damaged.

Lubricate the converter hub with clean automatic transmission fluid.

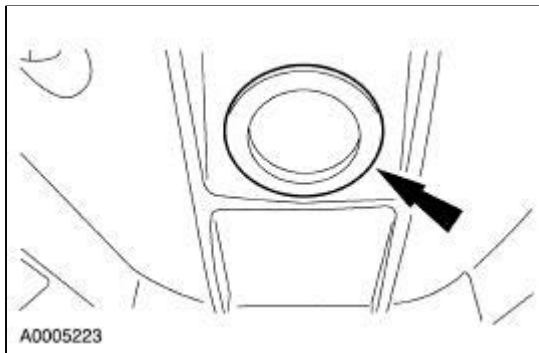


129. **NOTE:** A new converter drain plug must be used to prevent leakage.

Install the drain plug.

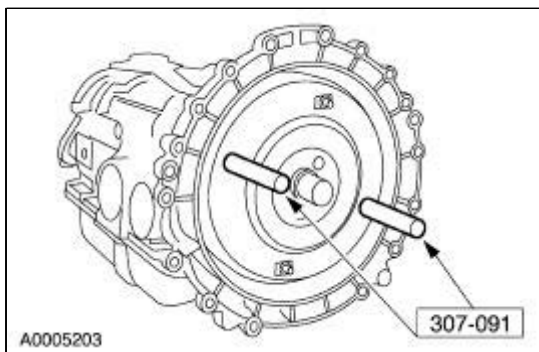


130. Install the converter housing access plug.

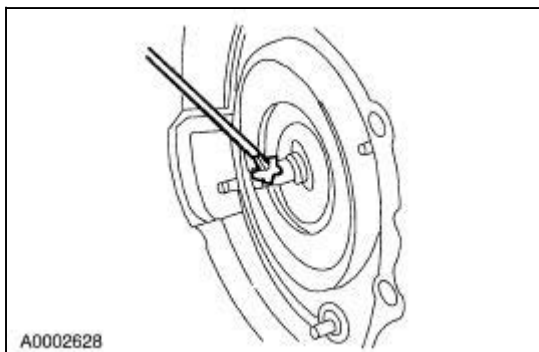



131.  **WARNING:** The torque converter can fall out if the transmission is tipped. Failure to follow these instructions may cause personal injury.

Using the special tools, install the torque converter by pushing and rotating.



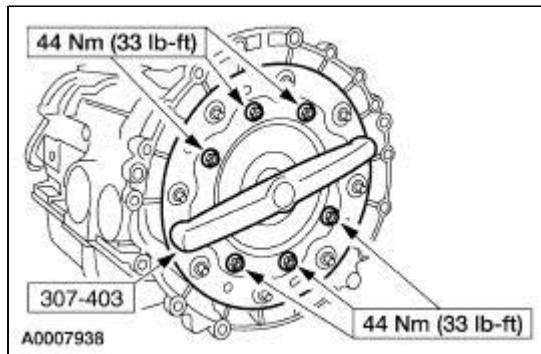
132. Lubricate the torque converter pilot hub with multi-purpose grease.



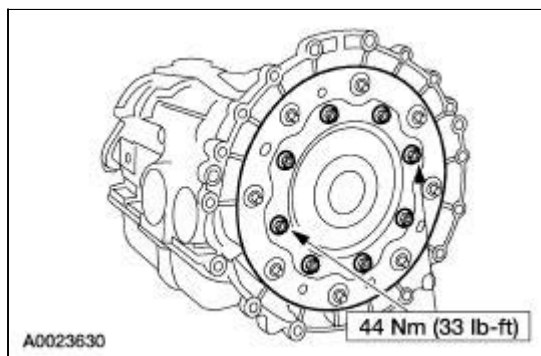
133.  **CAUTION:** The special tool must be used to correctly align the adapter plate to the converter or transmission damage can occur.

In order to correctly install the special service tool, it must be installed using one round and one oblong hole. Using two oblong holes will cause damage to the transmission.

If the vehicle is equipped, use the special tool to install the torque converter flex plate adapter assembly and eight nuts.

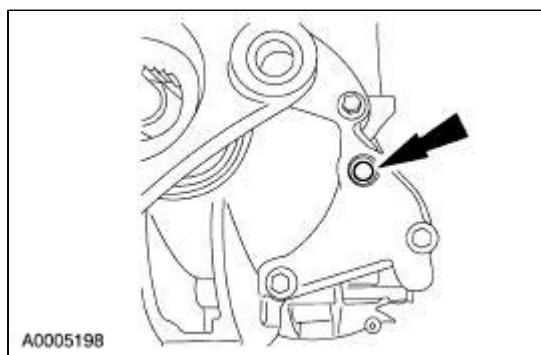


134. Install two torque converter flex plate adapter nuts.

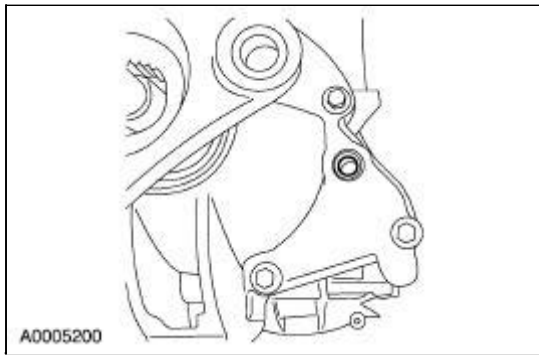


135. **NOTE:** Use the 5/16 inch Allen key to remove the fill plug.

Remove the fill plug.



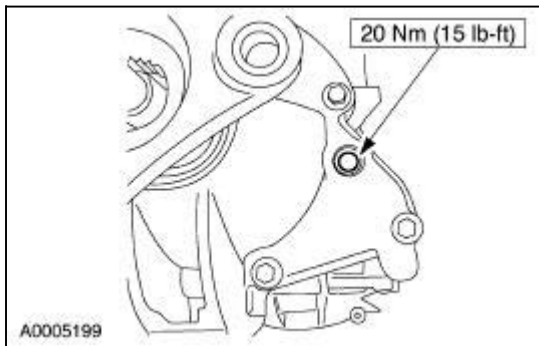
136. Fill the transmission with 8.5L (9 quarts) of clean automatic transmission fluid.



137.  **CAUTION:** When installing the fill plug, make sure not to cross thread the plug to prevent damage.

NOTE: Use a 5/16 inch Allen key to install the fill plug.

Install the fill plug.



138. Before installing transmission, make sure that the transmission cooling system (tube and cooler [s]) have been thoroughly flushed. If contamination cannot be removed or correct flow cannot be obtained, install a new cooler(s) and/or tubes. For additional information, refer to [Section 307-02](#).
-

Transmission

Special Tool(s)

 ST2455-A	Torquing Wrenches, Driveshaft Coupler 205-474
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Material

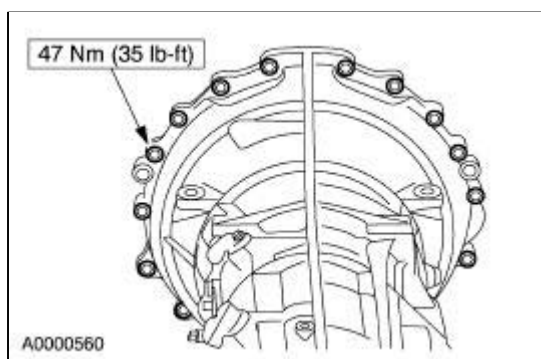
Item	Specification
Premium Long Life Grease XG-1-C	ESA-M1C75-B
Threadlock and Sealer E2FZ-19554-B	WSK-M2G351-A6

- WARNING:** Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions can result in personal injury.

Raise and position the transmission.

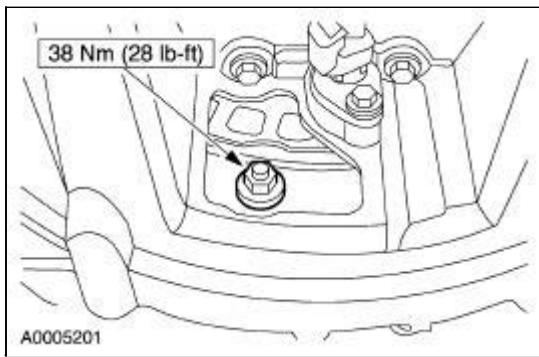
- NOTE:** Align the flexplate to converter marks made at removal.

Install the bolts.

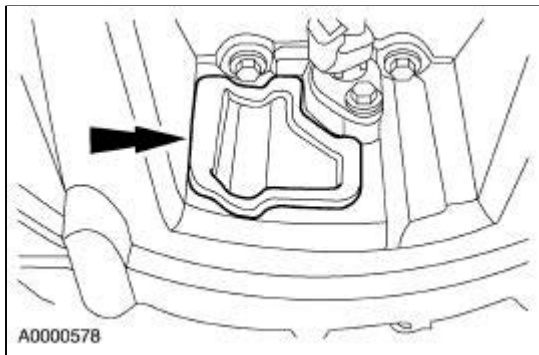


- NOTE:** Align the flexplate to converter marks made at removal.


Align the marks made during removal, and install the nuts.



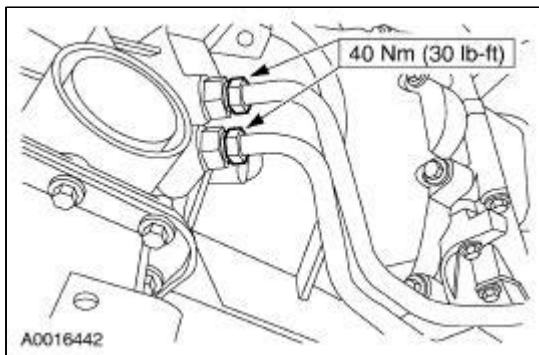
4. Install the access cover.



5. On 3.0L engines only, install the starter motor. For additional information, refer to [Section 303-06](#).

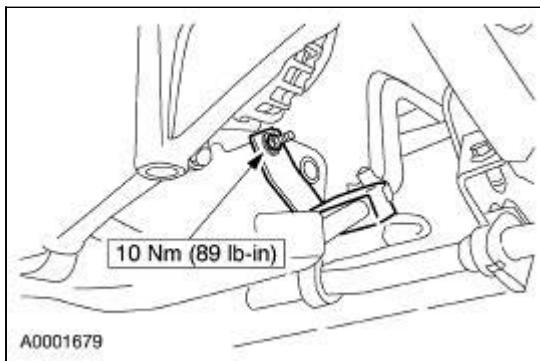
6.  **CAUTION:** Use care not to bend or force the cooler tubes otherwise damage to the cooler tubes and the transmission may result.

Install the transmission cooler tubes.

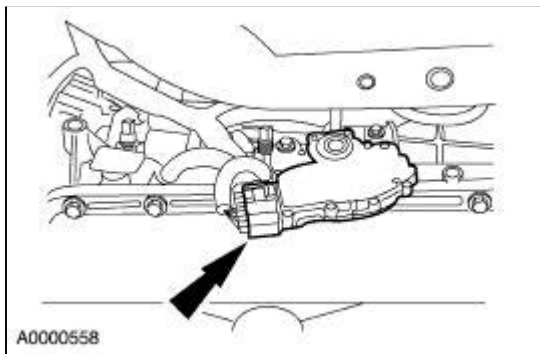



7. **NOTE:** V6 application shown, V8 application similar. The torque specification for the V8 is 18Nm (13 lb-ft).

Install the transmission cooler line bracket.



8. Reconnect the digital transmission range (TR) sensor connector.



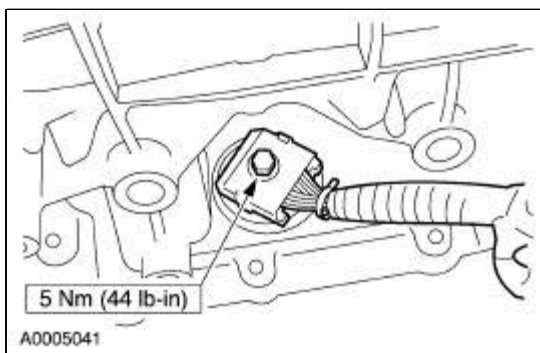
9.  **CAUTION:** Damage will occur to the solenoid body assembly if the screw is tightened above the specification.

NOTE: Always install new O-ring seals on vehicle harness connector.

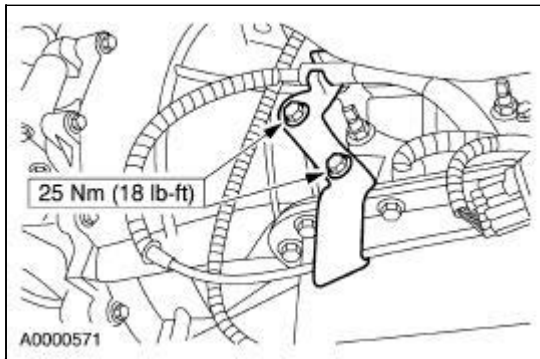
NOTE: Clean the area around connector to prevent contamination of the solenoid body connector.

NOTE: Use petroleum jelly to lubricate the O-ring seals to aid in the installation process.

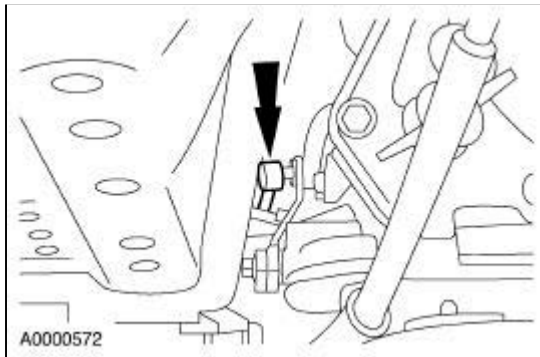
Install and lubricate new O-ring seals on the transmission connector and connect the connector.



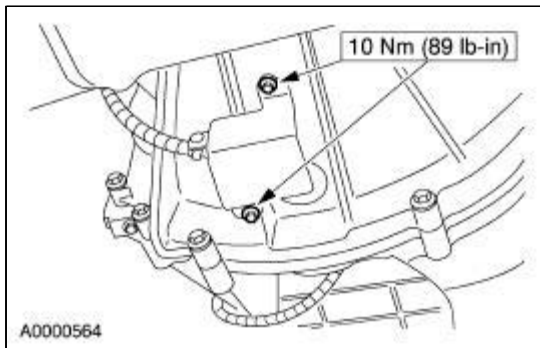
10. Install the shift cable bracket.



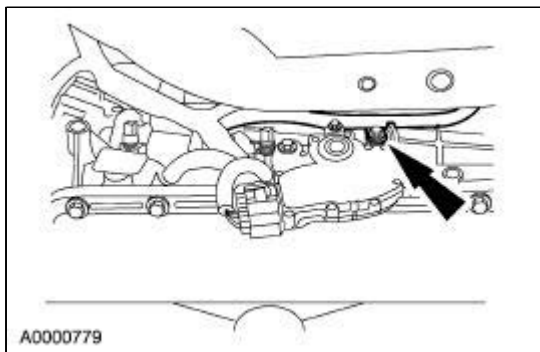
11. Connect the shifter cable.



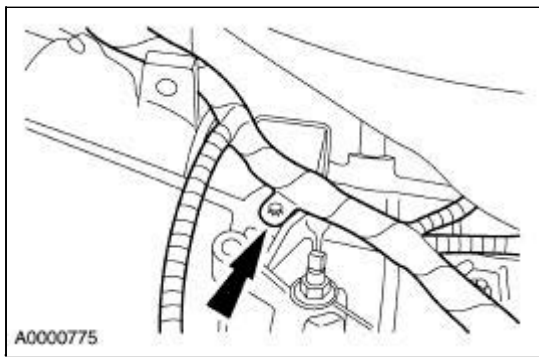
12. Install the heated oxygen sensor (HO2S) connector.



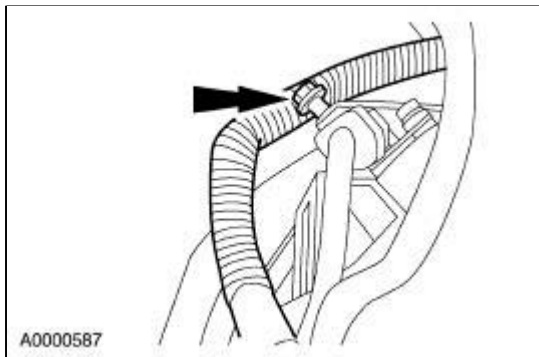
13. Connect the harness retainer.



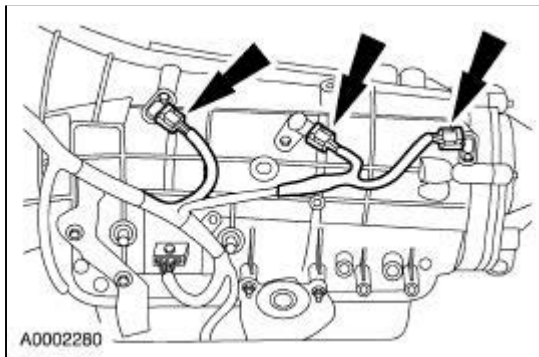
14. Connect the harness retainer.



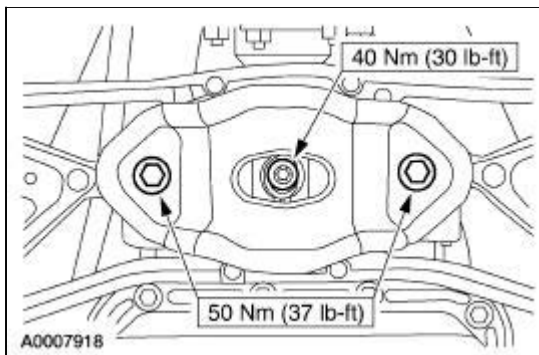
15. Install the harness screw.



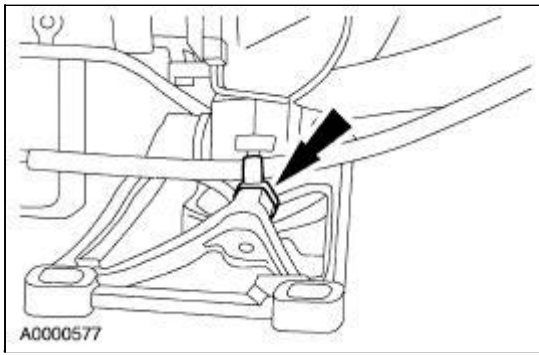
16. Connect the turbine shaft speed (TSS) sensor, output shaft speed (OSS) sensor, and intermediate shaft speed (ISS) sensor electrical connectors.



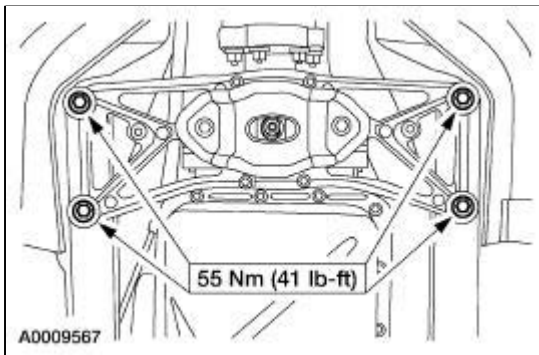
17. Install the rear transmission mount.



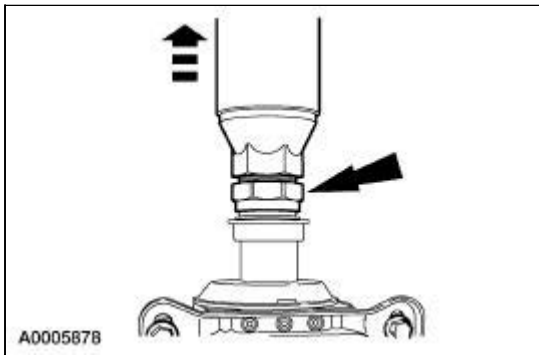
18. Install the shift cable.



19. Install the rear transmission mount.

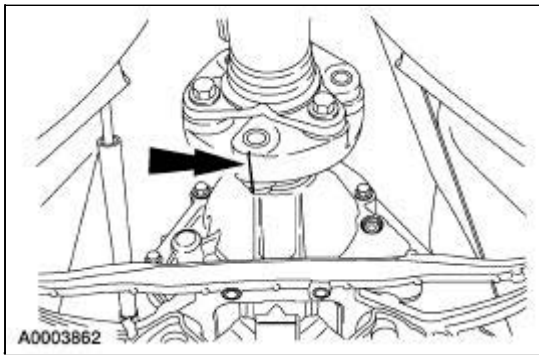


20. Remove the transmission jack.
21. Add one gram of grease to both alignment bushing cavities.
22. Loosen the nut and slide the front shaft assembly forward.

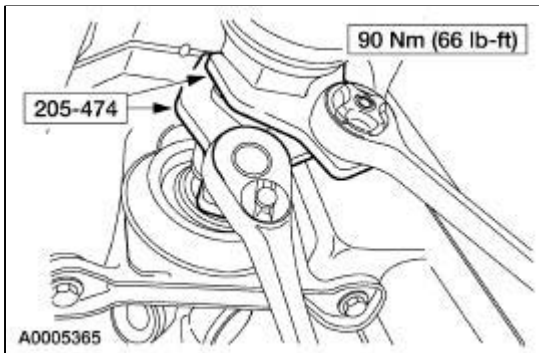


23.  **CAUTION: Align the index marks or driveshaft imbalance can occur.**

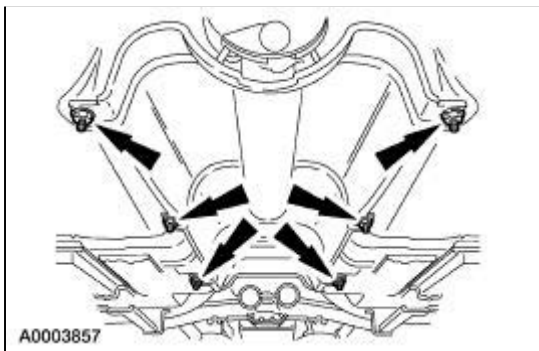
Align index marks and position the alignment bushing on the transmission flange piloting system.



24. Using the special tools, tighten the nut.



25. Install the heat shield.



26. Lower the vehicle.
27. **NOTE:** When the battery is disconnected or a new battery installed, certain transmission operating parameters can be lost. The powertrain control module (PCM) must relearn these parameters. During this learning process, you may experience slightly firm shifts, delayed, or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Connect the battery ground cable. For additional information, refer to [Section 414-01](#).

28. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
29. Carry out the fluid level check. For additional information, refer to [Transmission Fluid Level Check](#) in this section.
30. Verify that the shift cable is correctly adjusted. For additional information, refer to [Section 307-05](#).
31. Check the operation of the transmission and inspect for leaks.

General Specifications

Item	Specification
MERCON V Automatic Transmission Fluid XT-5-QM	MERCON V

Torque Specifications

Description	Nm	lb-ft	lb-in
Bolt retaining the transmission fluid cooler to the radiator	10	—	89
Nut retaining the fluid cooler tube bracket to the stud (V8 engine)	18	13	—
Nut retaining the fluid cooler tube bracket to the stud (V6 engine)	10	—	89
Nut retaining the fluid cooler tube to the transmission	35	26	—
Hose clamp retaining the transmission fluid cooler hose to the transmission fluid cooler tube	5	—	44

Transmission Cooling

The transmission fluid cooler is an oil-to-air (OTA) fluid cooler. The fluid cooler is mounted between the radiator and the A/C condenser.

- When the transmission fluid is cold and the thermostatic valve is closed, the transmission fluid does not circulate through the fluid cooler.
 - As the transmission fluid temperature increases, the thermostatic bypass valve opens and allows the transmission fluid to circulate through the fluid cooler.
-

Transmission Cooling



CAUTION: Whenever a transmission has been disassembled to install new parts, the transmission fluid cooler must be replaced and the transmission fluid cooler tubes must be cleaned and backflushed.

NOTE: Cleaning and backflushing the transmission fluid cooling system, along with normal cleaning and inspection procedures as outlined in this section during disassembly and reassembly, will keep contamination from reentering the transmission and causing a repeat repair.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material, or band material may have been carried into the torque converter and transmission fluid cooler. These contaminants are a major cause of recurring transmission troubles and must be removed from the system before the transmission is put back in use.

Inspection and Verification

When fluid leakage is found in the fluid cooler, install a new fluid cooler.

When there is evidence of transmission assembly or fluid contamination due to the following transmission failure modes, install a new fluid cooler.

- major metallic failure
- multiple clutches or clutch plate failure
- sufficient component wear which results in metallic contamination

Symptom Chart

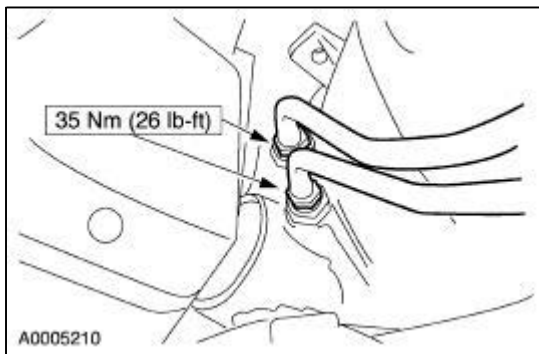
Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Transmission overheating 	<ul style="list-style-type: none"> ● Damaged OTA fluid cooler. ● System leaks. ● Incorrect fluid level. ● Fluid condition. ● Damaged, blocked, reversed, leaking, or restricted cooler tubes. ● Incorrect idle or performance. 	<ul style="list-style-type: none"> ● INSTALL a new OTA cooler. ● INSPECT for leaks. REPAIR as necessary. ● ADJUST to correct level. ● INSPECT according to instructions under Fluid Level Condition Check. REFER to Section 307-01. ● INSPECT cooler tubes. REPAIR as necessary. ● REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

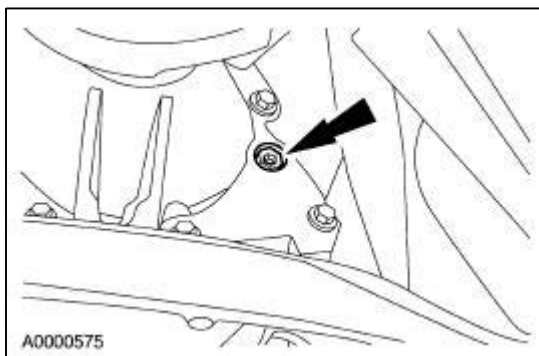
Transmission Fluid Cooler Flow Test

NOTE: The transmission linkage/cable adjustment, fluid level and line pressure must be within specification before carrying out this test. Refer to [Section 307-05](#) for adjustments.

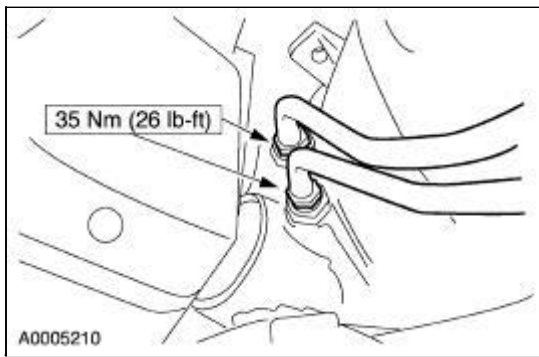
1. Refer to [Section 307-01](#) for fluid level check procedures and line pressure specifications.
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Remove the cooler return line (upper fitting) from the fitting on the transmission case.



4. Connect one end of a hose to the cooler return line and route other end of the hose up to a point where it can be inserted into the hole at the extension housing.



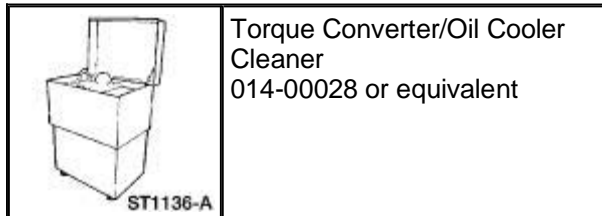
5. Start the engine and run it at idle with the transmission in NEUTRAL position.
6. Raise the vehicle.
7. Once a steady flow of fluid (without air bubbles) is observed, remove the hose from the fluid fill hole and place the hose in a measuring container for 15 seconds. After 15 seconds place the hose back into the fluid fill hole and turn the engine off. Measure the amount of fluid in the container. If adequate flow was observed, approximately 615 ml (20.8 oz) will be in the measuring container; the test is now complete.
8. If the flow is not liberal, stop the engine. Disconnect the hose from the cooler return line (upper line) and connect it to the transmission outline fitting on the transmission case.



9. Repeat Steps 6 and 8. If flow is now approximately 615 ml (20.8 oz) in 15 seconds, refer to [Transmission Fluid Cooler — Backflushing and Cleaning](#). For cleaning of the cooler, refer to [Transmission Cooling](#) for fluid cooler diagnosis. If the flow is still not approximately 615 ml (20.8 oz) in 15 seconds, repair the pump, main control and converter as necessary.
-

Transmission Fluid Cooler — Backflushing and Cleaning

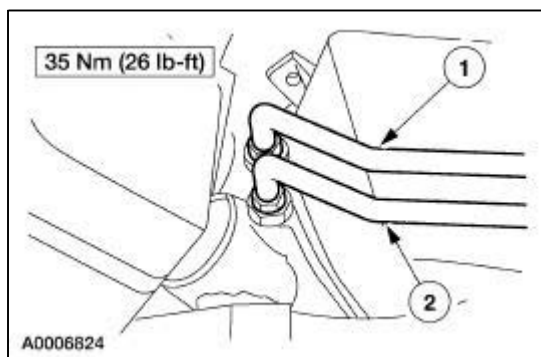
Special Tool(s)



CAUTION: Whenever a transmission has been disassembled to install new parts or because the valve body sticks from foreign material, the transmission fluid cooler must be cleaned using the Torque Converter/Oil Cooler Cleaner. Under no circumstances should torque converters be cleaned by hand agitation with solvent.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material, or band material may have been carried into the transmission cooler. These contaminants are a major cause of recurring transmission concerns.

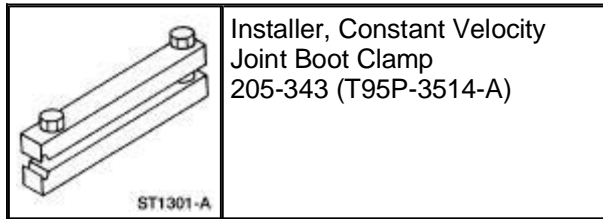
1. Using the special tool, backflush the torque converter. Test the equipment to make sure that a vigorous fluid flow is present before proceeding. Install a new system filter if flow is weak or contaminated.
2. To aid in attaching the cleaner to the transmission steel cooler tubes, connect two additional rubber hoses to the transmission end of the steel transmission cooler tubes.
 1. Connect the cleaner tank pressure line to the steel transmission inlet tube.
 2. Connect a tank return hose to the steel transmission outlet tube. Place the outlet end of this hose in the solvent.



3. Turn on solvent pump and allow the solvent to circulate a minimum of 5 minutes (cycling switch on and off will help dislodge contaminants in cooler system).
4. Switch off the solvent pump and disconnect the solvent pressure hose from the transmission cooler return line.
5. Use compressed air to blow out the cooler(s) and tubes (blow air into the transmission cooler return line) until all solvent is removed.
6. Remove the rubber return hose from the remaining steel cooler line.

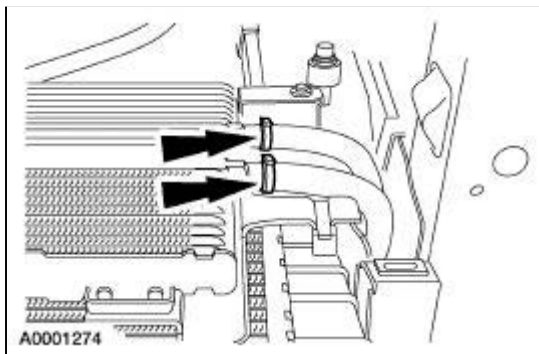
Combination Fluid Cooler

Special Tool(s)



Removal

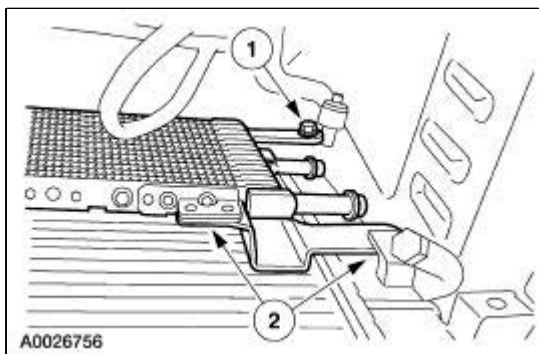
1. Remove the A/C condenser core. For additional information, refer to [Section 412-03](#).
2. Remove and discard the six hose clamps.



3. **NOTE:** Position a drain pan under the vehicle to catch any fluid that may spill.

Disconnect the six hoses from the cooler. Plug the hoses and the cooler.

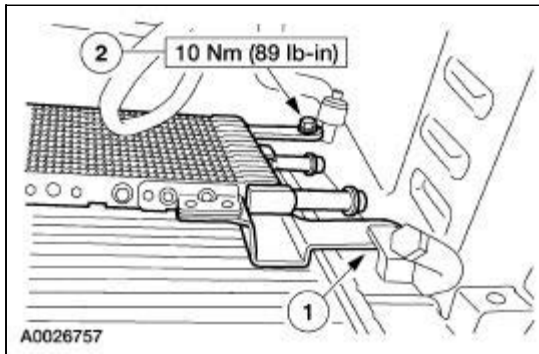
4. Remove the cooler.
 1. Remove the two bolts.
 2. Lift the cooler from the retainers and remove the cooler.



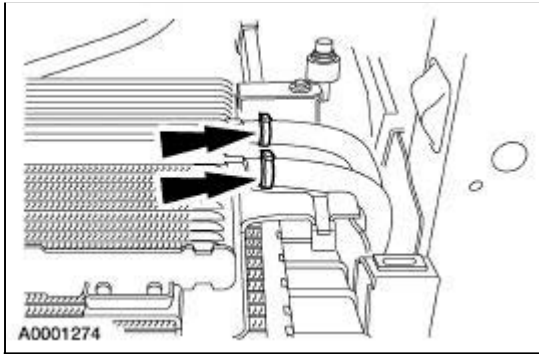
Installation

1. Install the cooler.

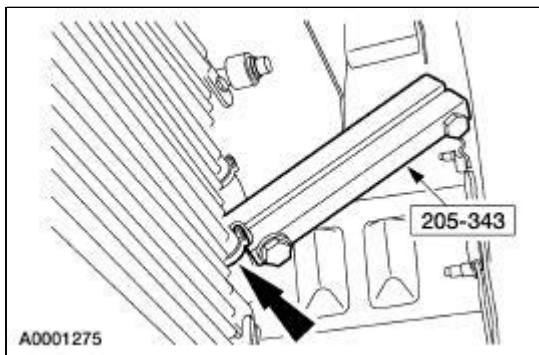
1. Position the cooler on the retainers.
2. Install the two bolts.



2. Position new hose clamps on the six hoses.
3. Remove the plugs from the six hoses and the cooler. Connect the six hoses to the cooler.



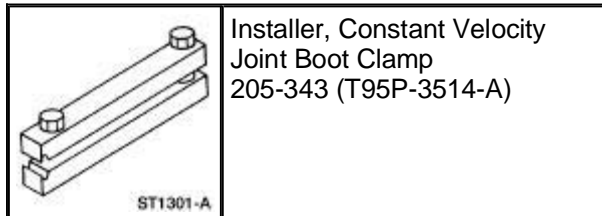
4. Using the special tool, tighten the six hose clamps.



5. Install the A/C condenser. For additional information, refer to [Section 412-03](#).
 6. Fill and leak check the power steering system. For additional information, refer to [Section 211-00](#).
 7. Fill and leak check the cooling fan system. For additional information, refer to [Section 303-03](#).
 8. Fill the automatic transmission and leak check the cooling system. For additional information, refer to [Section 307-01](#).
-

Transmission Fluid Cooler Tubes

Special Tool(s)



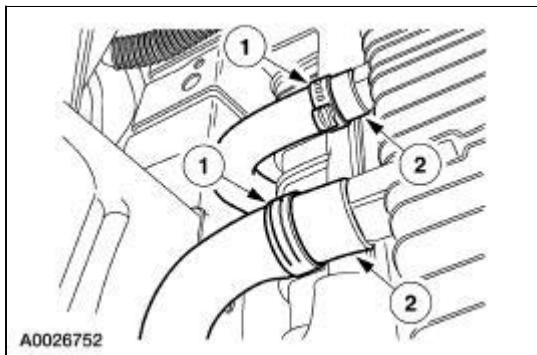
Removal

NOTE: This procedure describes the removal and installation of all the transmission cooling system tubes and hoses. Only disconnect those that require removal from the vehicle.

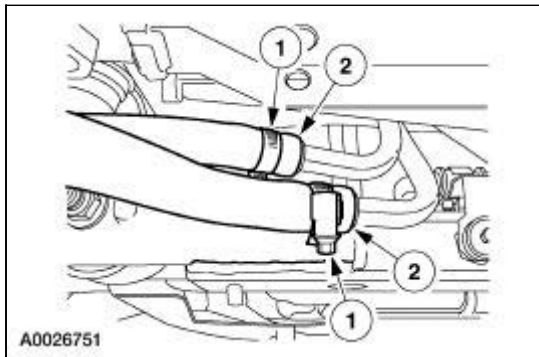
Hose removal

NOTE: Proceed to Disconnecting the tubes in this section if only removing the transmission fluid cooler tubes from the vehicle.

1. Remove the A/C condenser core. For additional information, refer to [Section 412-03](#).
2. Disconnect the transmission fluid cooler hose from the cooler.
 1. Cut and discard the clamp.
 2. Disconnect the transmission fluid cooler hose from the cooler.

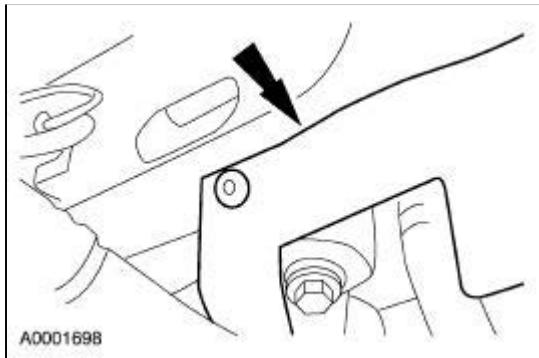


3. Disconnect the transmission fluid cooler hose from the transmission fluid cooler tube.
 1. Loosen and position the clamp aside.
 2. Disconnect the transmission fluid cooler hose from the transmission fluid cooler tube.
 - Proceed to Hose installation in this section if not removing the transmission fluid cooler tubes from the vehicle. Otherwise, proceed as follows.

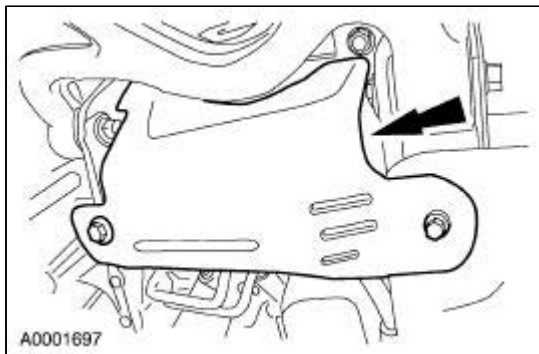


Disconnecting the tubes

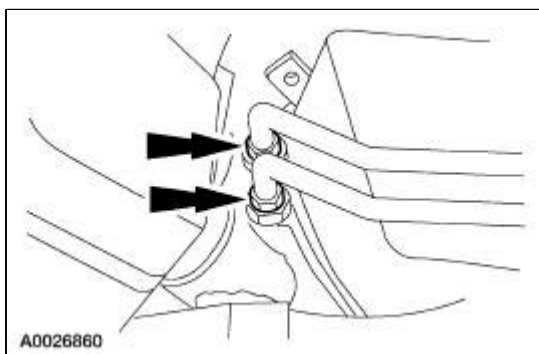
4. If not done previously, raise and support the vehicle. For additional information, refer to [Section 100-02](#).
5. If not done previously, remove the LH splash shield pushpin.



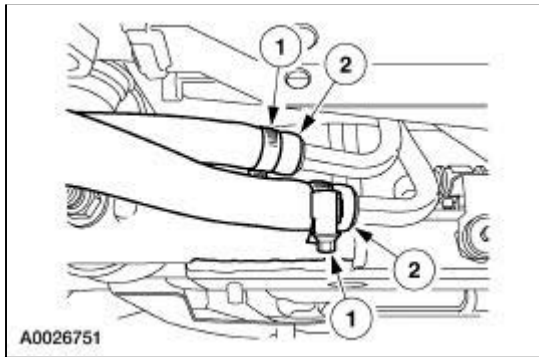
6. If not done previously, remove the bolts and the LH splash shield.



7. Disconnect the transmission fluid cooler tubes from the transmission.



8. If not done previously, disconnect the transmission fluid cooler hoses from the transmission fluid cooler tubes.
 1. Loosen and position the clamps aside.
 2. Disconnect the transmission fluid cooler hoses from the transmission fluid cooler tubes.



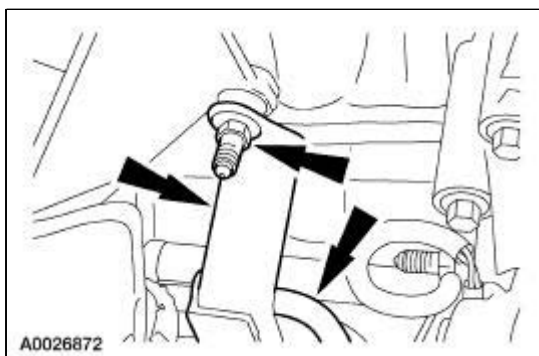
Tube removal, vehicle with V6 engine

9. Remove the nut, the fluid cooler tube bracket, and the fluid cooler tubes.



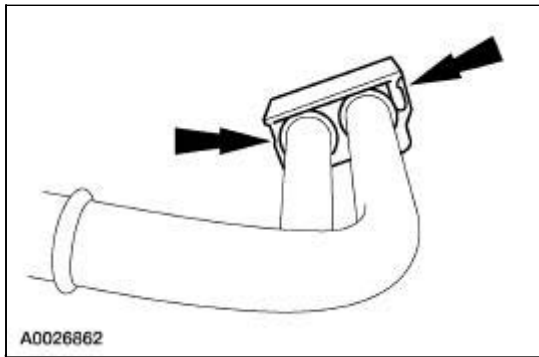
Tube removal, vehicle with V8 engine

10. Remove the nut, the fluid cooler tube bracket, and the fluid cooler tubes.



Routing bracket removal

11. Remove the fluid cooler tube routing bracket from the fluid cooler tubes.

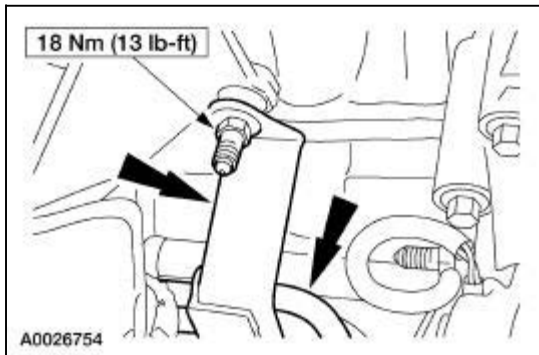


Installation

Tube installation, vehicle with V8 engine

NOTE: Proceed to Hose installation in this section if the transmission fluid cooler tubes were not removed from the vehicle.

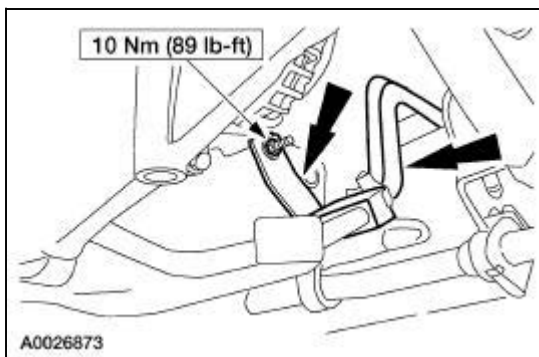
1. Position the transmission fluid cooler tubes and the fluid cooler tube bracket, and install the nut.



Tube installation, vehicle with V6 engine

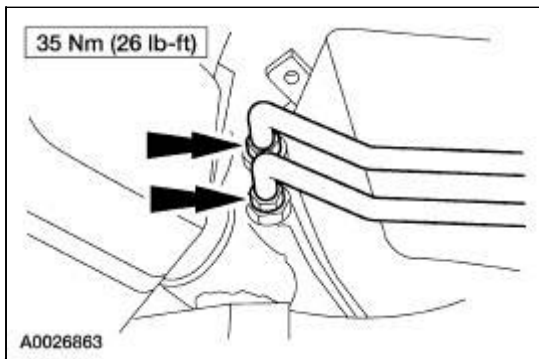
NOTE: Proceed to Hose installation in this section if the transmission fluid cooler tubes were not removed from the vehicle.

2. Position the transmission fluid cooler tubes and the fluid cooler tube bracket, and install the nut.



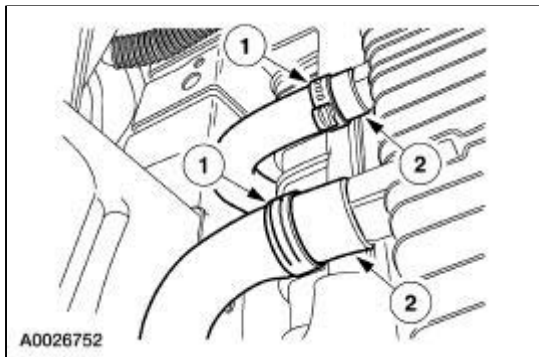
Connecting the tubes

3. Connect the transmission fluid cooler tubes to the transmission.
 - Proceed to Connecting the hose(s) in this section if the transmission fluid cooler hoses were not removed from the vehicle. Otherwise, proceed as follows.

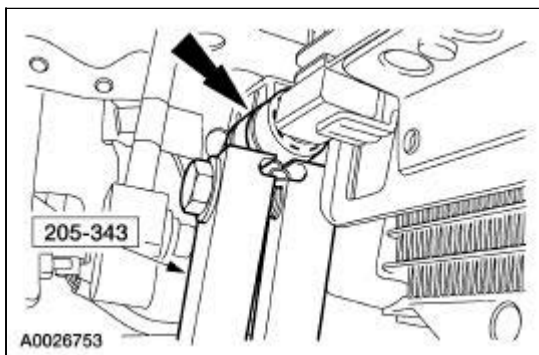


Hose installation

4. Connect the transmission fluid cooler hose(s) to the cooler.
 1. Position the clamp on the transmission fluid cooler hose.
 2. Connect the transmission fluid cooler hose to the cooler.

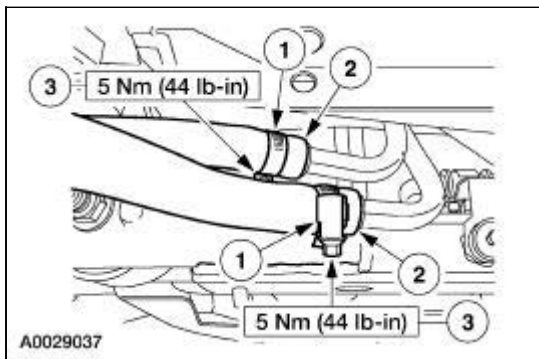


5. Using the special tool, tighten the clamp.
 - Repeat this step for the other hose clamp, if removed.



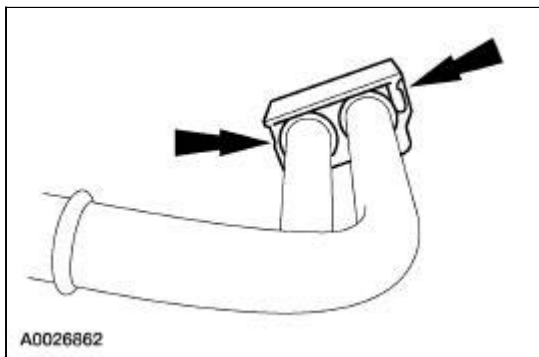
Connecting the hose(s)

6. Connect the transmission fluid cooler hose to the transmission fluid cooler tube.
 1. Position the clamp.
 2. Push the transmission fluid cooler hose onto the transmission fluid cooler tube until bottomed against the stop.
 3. Tighten the clamp.



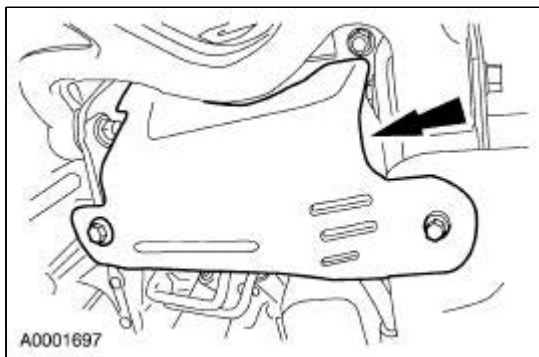
Final assembly

7. If removed, install the fluid cooler tube routing bracket.

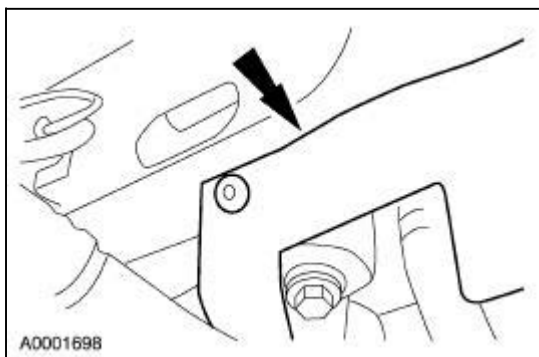


8. If removed, install the A/C condenser core. For additional information, refer to [Section 412-03](#).

9. Install the LH splash shield and the bolts.



10. Install LH splash shield pushpin.



11. Lower the vehicle.

12. Fill the automatic transmission and leak check the cooling system. For additional information, refer to [Section 307-01](#).

Torque Specifications

Description	Nm	lb-ft	lb-in
Shifter assembly bolts	7	—	62
Shift lock actuator bolts	9	—	80
Transmission shift cable and bracket bolts	27	20	—
Screw retaining the lower instrument panel steering column opening cover to the instrument panel	2-3	—	19-26
Bolt retaining the instrument panel steering column opening cover reinforcement to the instrument panel	3-5	—	31-45

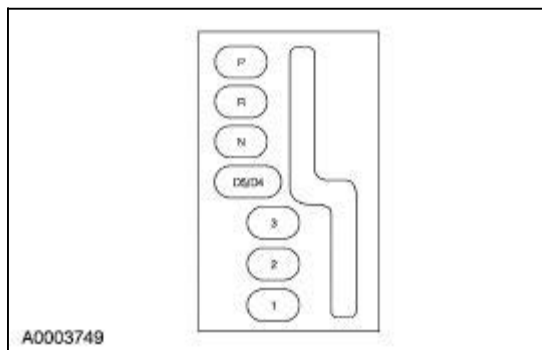
External Controls

The transmission shift cable transfers the transmission operating mode from the transmission range selector lever to the automatic transmission. The indicated position of the lever is transferred to the transmission through the cable and down to the manual control lever on the transmission.

Depending on the vehicle options selected the lever may have different range positions.

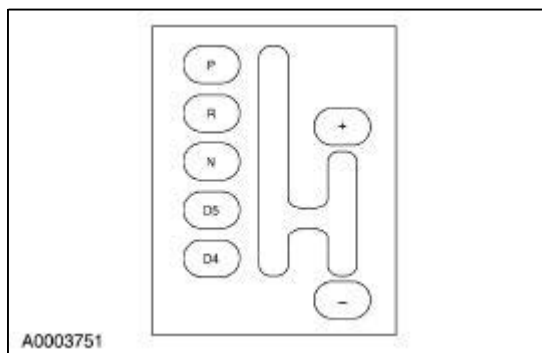
The standard lever has eight positions: P, R, N, D5, D4, 3, 2, and 1.

Base Range Shifter



The optional select shift transmission (SST) range selector lever has seven positions P, R, N, D5, or D4, + and -. The + and - option will allow the driver to manually upshift and downshift into any gear range.

Optional Range Shifter



Brake Shift Interlock System

The shift interlock system prevents shifting the transmission out of the PARK position unless the brake pedal is depressed. The shift interlock system consists of a shift lock actuator mounted on the ignition switch. The actuator is energized when the ignition switch is turned to RUN, locking the transmission range selector lever in the PARK position. When the brake pedal is applied and the brake pedal position (BPP) switch activated, the shift lock actuator is deactivated, allowing the selector lever to move out of the PARK position.

The ignition shift interlock cable locks the selector lever in the PARK position when the ignition switch is in the lock position. It also requires the selector lever to be in the PARK position in order to turn the

ignition switch to the lock position.

Select Shift Transmission (SST) Switches (+ and -)

The positions indicated by a (+) or a (-) allow the driver to manually select the appropriate upshift (+) or downshift (-) and gear range.

The SST switches are located within the transmission range selector assembly and are momentary contact switches that send a signal to the powertrain control module (PCM) each time the driver moves the selector lever into the upshift or downshift gear range.

The PCM uses the input signals from the SST+ and the SST- switches, along with other vehicle inputs, to determine which gear should be commanded.

Transmission Control Switch (TCS)

The TCS is a momentary contact switch that sends a signal to the PCM when the driver selects the D4 position, canceling operation of 5th (overdrive) gear.

The TCS is located within the range selector assembly for the base shifter only.

The PCM uses this signal to control the shift solenoids to disengage/disable 5th gear operation and activates coast clutch for the base shifter only. At the same time the PCM changes the instrument panel indicator to display D4.

When the driver moves the selector lever back to the D5 position, 5th gear operation is enabled, the coast clutch is released and the instrument panel indicator displays D5.

Park Sense Switch

The park sense switch prevents the redundant PRNDL from displaying "P" until the shifter is in the PARK position.


Electronic Transmission Error Indicator

The vehicle is equipped with a redundant electronic gearshift indicator. This character appears with the key in the RUN position and displays the same gear selection as shown on the selector lever floor console next to the range selector lever. If an "E" character flashes or remains on this indicates that a transmission malfunction has occurred.

External Controls

Refer to Wiring Diagrams Section [307-05](#) for schematic and connector information.

Special Tool(s)

 <p>ST1137-A</p>	<p>73III Automotive Meter 105-R0057 or equivalent</p>
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Inspection and Verification

1. Verify the customer concern by operating the transmission external control.
2. Visually inspect for obvious signs of mechanical and electrical damage; refer to the following charts:

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Shift lock actuator ● Transmission control switch ● SST (+/-) switches ● Shift cable and bracket ● Park sense switch 	<ul style="list-style-type: none"> ● Central junction box (CJB) Fuse: <ul style="list-style-type: none"> ■ 204 (5A) ■ 205 (5A) ● Damaged wiring harness ● Loose or corroded connections ● Powertrain control module (PCM)

Diagnostic Trouble Code Chart

Five Digit DTC	Component	Description	Condition	Symptom	Action
P0815	SST +/-	SST +/- circuit input signal failed.	PCM has detected an incorrect voltage SST input.	May not be able to shift in manual mode.	Go To Pinpoint Test C.
P1780	TCS	TCS input incorrect per selected position.	TCS voltage incorrect.	No overdrive cancel when range selector is moved.	Go To Pinpoint Test A.

3. If the concern is not visually evident, determine the symptom and proceed to the Symptom Chart.

Symptom Chart


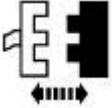

SYMPTOM CHART

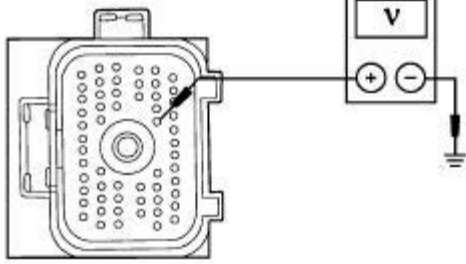
Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● The shift interlock system does not release or lock correctly 	<ul style="list-style-type: none"> ● Circuitry. ● Front electrical module (FEM). ● CJB Fuse 204 (5A) and 205 (5A). ● Shift lock actuator. ● Brake pedal position (BPP) switch. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D .
<ul style="list-style-type: none"> ● The shift control is out of correct gear relationship with bezel 	<ul style="list-style-type: none"> ● Transmission shift cable and bracket. ● Transmission control shifter. 	<ul style="list-style-type: none"> ● REFER to Cable Adjustment in this section.
<ul style="list-style-type: none"> ● Transmission range indicator does not correspond to the gear position display on instrument cluster 	<ul style="list-style-type: none"> ● Transmission shift cable bracket. ● Transmission shift cable loose from the transmission shift cable bracket. ● Shift cable. ● Digital transmission range (TR) sensor. ● Transmission shifter. 	<ul style="list-style-type: none"> ● TIGHTEN the bolts holding the transmission shift cable bracket. ● INSTALL a new cable. ● VERIFY the transmission shift cable adjustment. REFER to Cable Adjustment in this section. VERIFY correct digital transmission range (TR) sensor adjustment. REFER to Section 307-01 . ● REFER to Section 307-01 . ● INSTALL a new shifter assembly.
<ul style="list-style-type: none"> ● Unable to cancel overdrive 	<ul style="list-style-type: none"> ● Digital transmission range (TR) sensor (SST only). ● Fuse. ● TCS (base shifter only). ● TCS not cycled during self-test. ● Powertrain control module. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A .
<ul style="list-style-type: none"> ● Transmission does not shift in manual mode (SST only) 	<ul style="list-style-type: none"> ● Fuse. ● SST (+/- switches). ● SST (+/-) not cycled during self-test. ● Powertrain control 	<ul style="list-style-type: none"> ● GO to Pinpoint Test C .

	<ul style="list-style-type: none"> module. ● Circuitry. 	
<ul style="list-style-type: none"> ● Instrument panel does not indicate park 	<ul style="list-style-type: none"> ● Park sense switch. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test B.</u>
<ul style="list-style-type: none"> ● Rattle, buzz, or other noise 	<ul style="list-style-type: none"> ● Selector lever knob. ● Selector lever bezel. ● Shifter assembly. 	<ul style="list-style-type: none"> ● INSTALL a new selector lever knob. ● INSTALL a new selector lever bezel. ● TIGHTEN housing bolts.
<ul style="list-style-type: none"> ● Excessive shift effort 	<ul style="list-style-type: none"> ● Transmission shift cable. ● Transmission components. ● Shifter assembly. 	<ul style="list-style-type: none"> ● INSTALL a new transmission shift cable. ● REFER to <u>Section 307-01.</u> ● INSTALL new shifter assembly.
<ul style="list-style-type: none"> ● Transmission range shifter will not move 	<ul style="list-style-type: none"> ● Transmission shift cable. ● Transmission components. ● Transmission shift cable. ● Brake shift interlock system. ● Transmission shifter assembly. 	<ul style="list-style-type: none"> ● INSTALL new transmission shift cable. ● REFER to <u>Section 307-01.</u> ● INSTALL a new transmission shift cable. ● GO to <u>Pinpoint Test D.</u> ● INSTALL new shifter assembly.

Pinpoint Tests

PINPOINT TEST A: OVERDRIVE CANCEL SWITCH NOT WORKING

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK INPUT TO PCM	
<p>1</p>  <p>2</p>  <p>PCM C175a</p> <p>3</p>  <p>4</p>	<p>4 Measure the voltage between PCM</p>



A0005935

C175a pin 41, circuit 8-TA21 (WH/GN), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
REFER to Section 413-01.

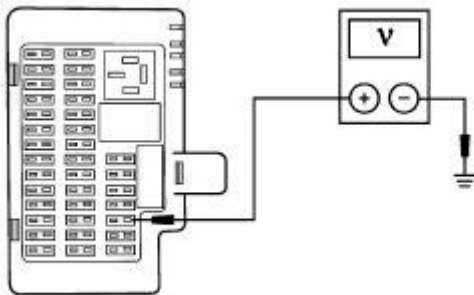
→ **No**
GO to A2.

A2 CHECK FOR VOLTAGE TO FUSE 205 (5A)

1



2



A0005938

2 Measure the voltage between primary junction box fuse 205 (5A) input pin and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to A3.

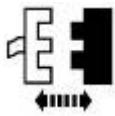
→ **No**
REPAIR the circuit. TEST the system for normal operation.

A3 CHECK FOR VOLTAGE INPUT TO THE SHIFTER

1



2

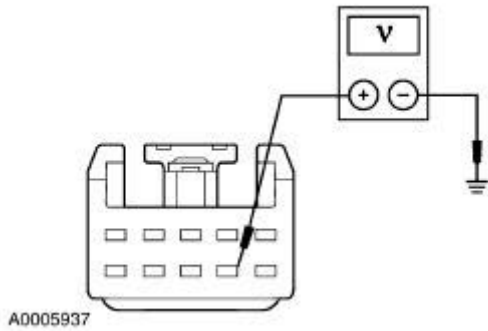


Transmission Shift Selector C307

3



4



4 Measure the voltage between transmission shift selector C307 pin 7, circuit 15-TA21 (GN/BK), harness side and ground.

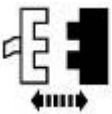
• Is the voltage greater than 10 volts?

→ **Yes**
GO to A4.

→ **No**
REPAIR circuit 15-DA5 (GN/OG) or 15-TA21 (GN/BK). TEST the system for normal operation.

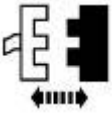
A4 CHECK CIRCUIT 8-TA21 (WH/GN) FOR SHORT TO GROUND

1



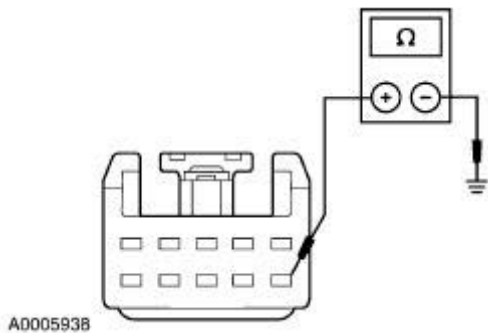
PCM C175a

2



Transmission Shift Selector C307


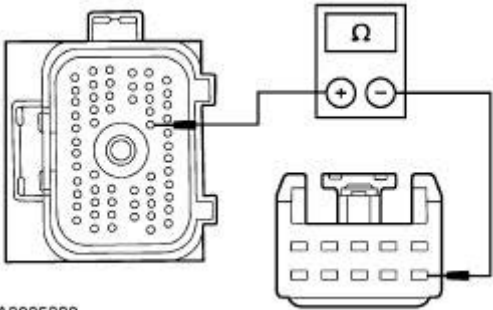
3



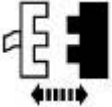

3 Measure the resistance between transmission shift selector C307 pin 6, circuit 8-TA21 (WH/GN), harness side and ground.

	<ul style="list-style-type: none"> ● Is the resistance greater than 10,000 ohms? <p>→ Yes GO to <u>A5</u>.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
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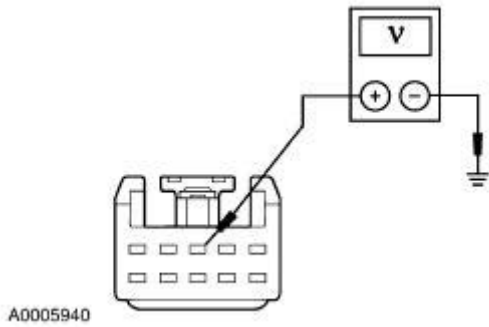
A5 CHECK CIRCUIT 8-TA21 (WH/GN) FOR AN OPEN

<p>1</p>  <p>2</p>  <p>A0005939</p>	<p>2</p> <p>Measure the resistance between PCM C175a pin 41, circuit 8-TA21 (WH/GN), harness side and transmission shift selector C307 pin 6, circuit 8-TA21 (WH/GN), harness side.</p> <ul style="list-style-type: none"> ● Is the resistance less than 5 ohms? <p>→ Yes INSTALL a new shifter harness. TEST the system for normal operation.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
--	---

PINPOINT TEST B: THE PARK SWITCH NOT WORKING

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CIRCUIT 15-TA34 (GN/YE) FOR OPEN	
<p>1</p>  <p>Transmission Shift Selector C307</p> <p>2</p> 	

3



3

Measure the voltage between transmission shift selector C307 pin 3, circuit 15-TA34 (GN/YE), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to B2.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

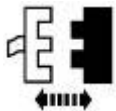
B2 CHECK FOR VOLTAGE ON CIRCUIT 8-TA34 (WH)

1



Transmission Shift Selector C307

2



Instrument Cluster C220b

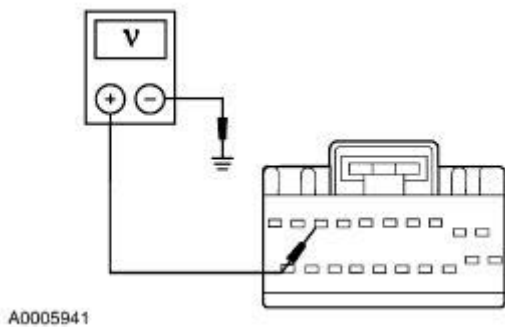
3



4



5



5

Measure the voltage between instrument cluster C220b pin 8, circuit 8-TA34 (WH), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
INSTALL a new instrument cluster.
REFER to [Section 413-01](#). TEST the system for normal operation.

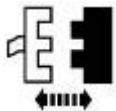
→ **No**
GO to [B3](#).

B3 CHECK CIRCUIT 8-TA34 (WH) FOR SHORT TO GROUND

1

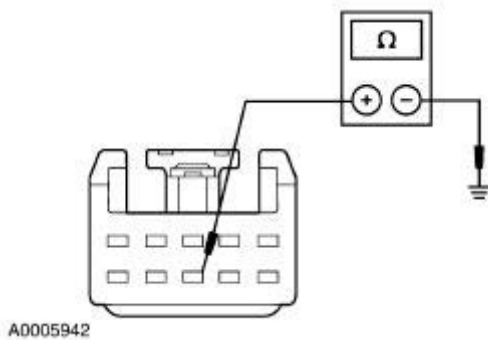


2



Transmission Shift Selector C307

3



3 Measure the resistance between transmission shift selector C307 pin 8, circuit 8-TA34 (WH), harness side and ground.

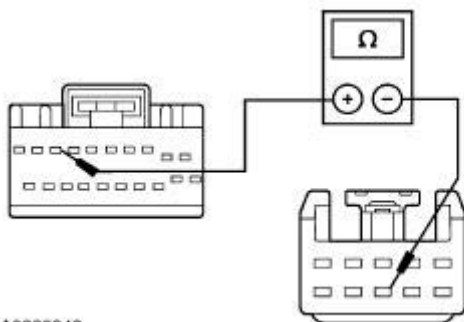
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to [B4](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation.

B4 CHECK CIRCUIT 8-TA34 (WH) FOR OPEN

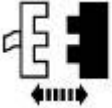
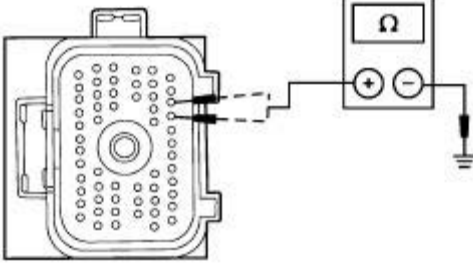
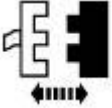
1

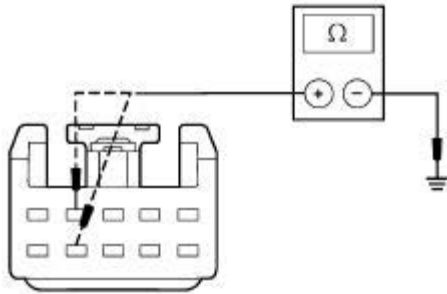


1 Measure the resistance between transmission shift selector C307 pin 8, circuit 8-TA34 (WH), harness side and instrument cluster C220b pin 8, circuit 8-TA34 (WH), harness side.

	<ul style="list-style-type: none"> ● Is the resistance less than 5 ohms? <p>→ Yes INSTALL a new shifter harness. TEST the system for normal operation.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
--	---

PINPOINT TEST C: THE TRANSMISSION MANUAL SHIFT (+/-) IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK CIRCUITS 8-TA67 (WH/VT) AND 8-TA68 (WH/BK) INPUT TO THE PCM	
<p>1</p>  <p>PCM C175a</p> <p>2</p>  <p>A0005947</p>	<p>2</p> <p>Measure the resistance between PCM C175a pin 49, circuit 8-TA67 (WH/VT), harness side and ground; and between PCM C175a pin 50, circuit 8-TA68 (WH/BK), harness side and ground, while activating the shifter to the manual up and down position.</p> <ul style="list-style-type: none"> ● Are the resistances less than 5 ohms? <p>→ Yes GO to <u>C4</u>.</p> <p>→ No GO to <u>C2</u>.</p>
C2 CHECK TRANSMISSION SHIFT SELECTOR CIRCUITS 31-TA67 (BK/WH) AND 31-TA68 (BK/RD) FOR OPEN	
<p>1</p>  <p>Transmission Shift Selector 307</p> <p>2</p>	<p>2</p> <p>Measure the resistance between transmission shift selector C307 pin 9, circuit 31-TA67 (BK/WH), harness side</p>



A0008895

and ground; and between shifter C307 pin 4, circuit 31-TA68 (BK/RD), harness side and ground.

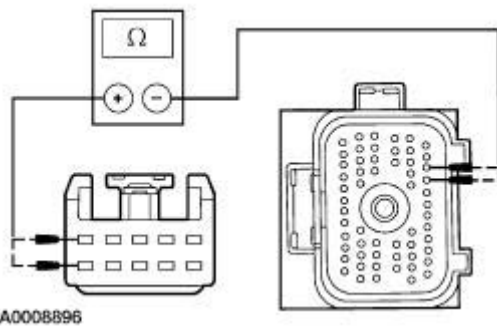
- Are the resistances less than 5 ohms?

→ **Yes**
GO to C3.

→ **No**
REPAIR the circuits. TEST the system for normal operation.

C3 CHECK CIRCUITS 8-TA67 (WH/VT) AND 8-TA68 (WH/BK) FOR OPEN

1



A0008896

1

Measure the resistance between shifter C307 pin 10, circuit 8-TA67 (WH/VT), harness side and PCM C175a pin 49, circuit 8-TA67 (WH/VT) harness side; and C307 pin 5, circuit 8-TA68 (WH/BK), harness side, and PCM C175a pin 50, circuit 8-TA68 (WH/BK), harness side.

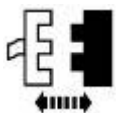
- Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new shifter harness. TEST the system for normal operation.

→ **No**
REPAIR the circuits. TEST the system for normal operation.

C4 CHECK CIRCUITS 8-TA67 (WH/VT) AND 8-TA68 (WH/BK) FOR SHORT TO GROUND

1

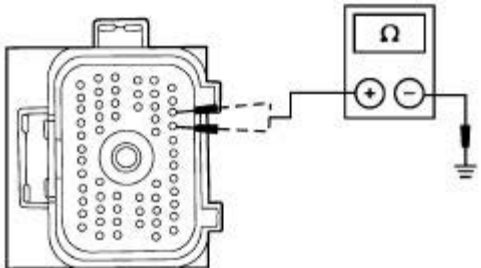


Shifter C307

2

2

Measure the resistance between PCM C175a pin 49, circuit 8-TA67 (WH/VT), harness side and ground; and between PCM C175a pin 50, circuit 8-TA68



A0005947

(WH/BK), harness side and ground.

- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to C5.

→ **No**
REPAIR the circuit. TEST system for normal operation.

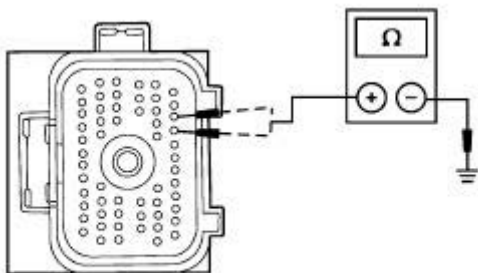
C5 CHECK THE TRANSMISSION SHIFT SELECTOR SWITCHES

1



Transmission Shift Selector C307

2



A0005947

2

Measure the resistance between PCM C175a pin 49, circuit 8-TA67 (WH/VT), harness side and ground; and between PCM C175a pin 50, circuit 8-TA68 (WH/BK), harness side and ground while activating the manual up and down position.

- Is the resistance less than 5 ohms with the switch on and greater than 10,000 ohms with the switch off?

→ **Yes**
INSTALL a new PCM.

→ **No**
INSTALL a new harness. TEST the system for normal operation.

PINPOINT TEST D: BRAKE SHIFT INTERLOCK INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
------------	-------------------------

D1 CHECK FOR FEM DTCs

1 Retrieve FEM DTCs. Refer to Section 417-01.

- Are any DTCs retrieved related to the brake switch?

→ **Yes**
GO to D1; REFER to Section 417-01.

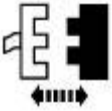
→ **No**
GO to D2.

D2 CHECK FOR VOLTAGE ON CIRCUIT 7S-TA33 (YE/VT)

1



2

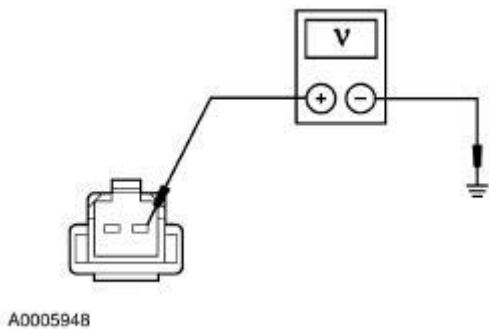


Brake Shift Interlock C322

3



5



4 Press and hold the brake pedal.

5 Measure the voltage between brake shift interlock C322 pin 2, circuit 7S-TA33 (YE/VT), harness side and ground.

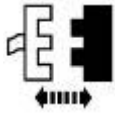
- Is the voltage greater than 10 volts?

→ **Yes**
GO to D5.

→ **No**
GO to D3.

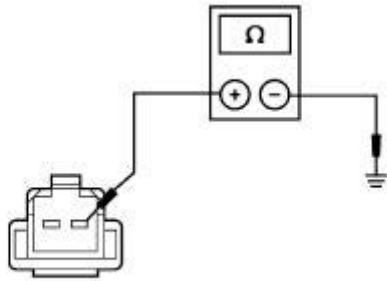
D3 CHECK CIRCUIT 75-TA33 (YE/VT) FOR SHORT TO GROUND

1



FEM C201f

2



A0005949

2

Measure the resistance between brake shift interlock C322 pin 2, circuit 7S-TA33 (YE/VT), harness side and ground.

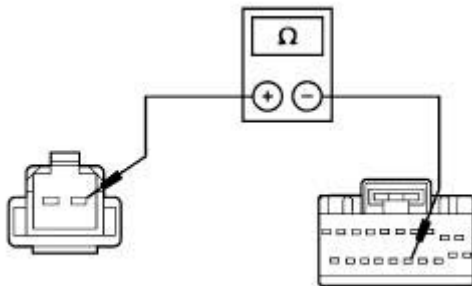
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to D4.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

D4 CHECK CIRCUIT 7S-TA33 (YE/VT) FOR OPEN

1



A0005950

1

Measure the resistance between brake shift interlock C322 pin 2, circuit 7S-TA33 (YE/VT), harness side and FEM C201f pin 15, circuit 7S-TA33 (YE/VT), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new FEM; REFER to Section 419-10.

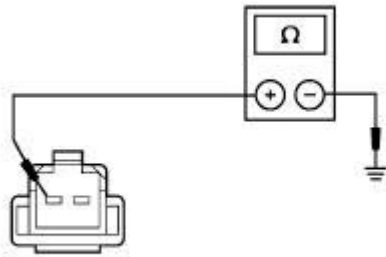
→ **No**
REPAIR the circuit. TEST the system for normal operation.

D5 CHECK CIRCUIT 31-TA33 (BK) FOR AN OPEN

1

1

Measure the resistance between brake shift interlock C322 pin 1, circuit 31-TA33 (BK), harness side and ground.



A0005951

- Is the resistance less than 5 ohms?

→ **Yes**

INSTALL a new brake shift interlock actuator; REFER to Brake Shift Interlock Actuator. TEST the system for normal operation.

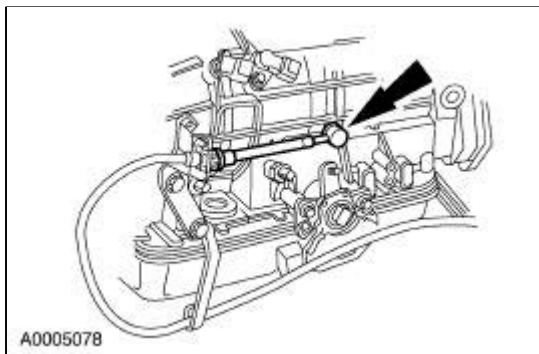
→ **No**

REPAIR the circuit. TEST the system for normal operation.

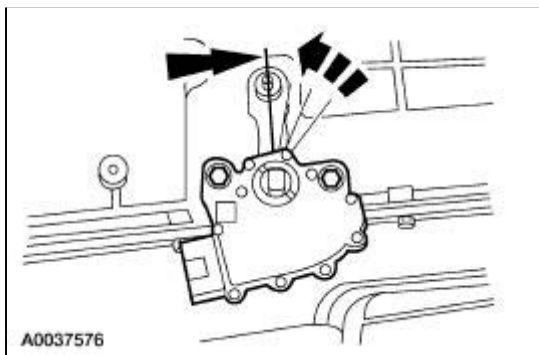
Cable Adjustment

Shift Cable

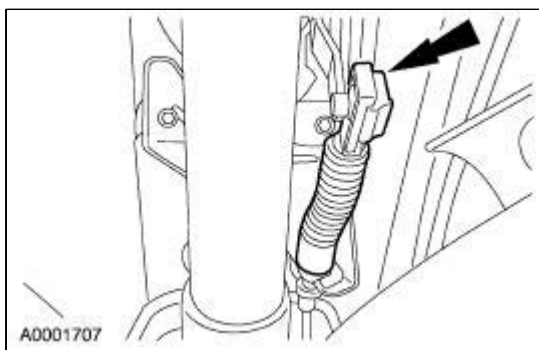
1. Place the gearshift lever (7210) in the D5 position.
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Disconnect the transmission shift cable from the manual control lever (7A256).



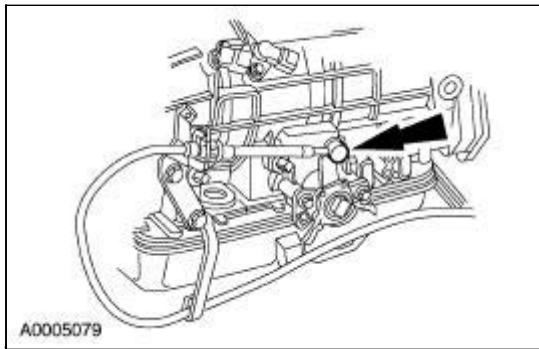
4. Place the manual control lever in the D5 position. This is three positions from the most rearward position.



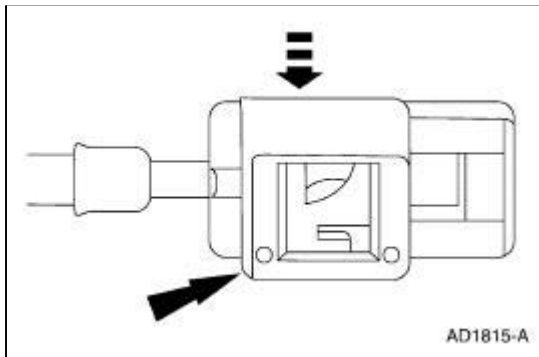
5. Disconnect the transmission shift cable from the selector lever.



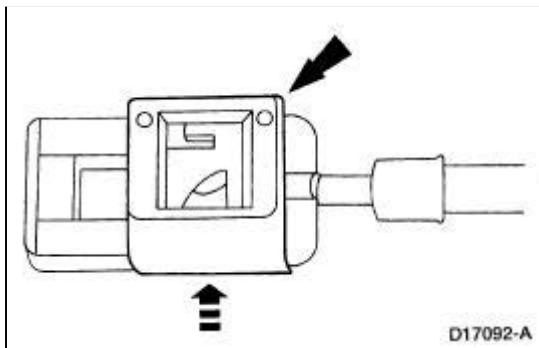
6. Connect the transmission shift cable to the manual control lever.



7. Unlock the adjuster at the end of the cable.



8. Connect the shift cable to the shifter and lock the end of the adjuster.



9. Lower the vehicle.
 10. Carefully move the manual control lever from detent to detent and compare with transmission settings. Verify that the vehicle will start in PARK or NEUTRAL and backup lamps illuminate in REVERSE. If not, Steps 1-5 must be repeated and include digital transmission range (TR) sensor adjustment in NEUTRAL. For additional information, refer to [Section 307-01](#).
 - Adjust as necessary.
-

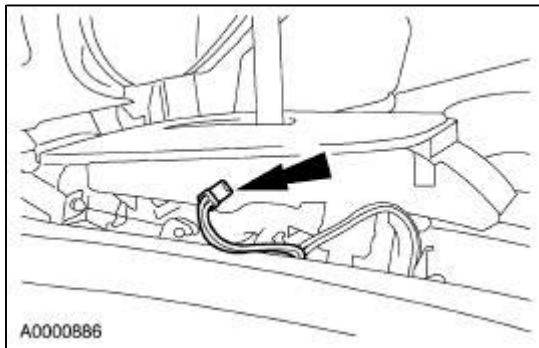
Brake Shift Interlock Actuator

Removal and Installation

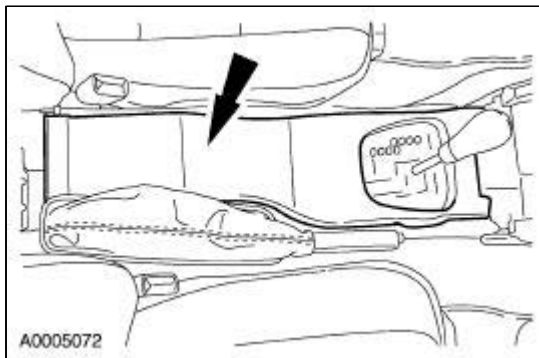
1. **NOTE:** If equipped with the traction control switch, the switch will need to be disconnected prior to removing the center console.

Remove the center console. For additional information, refer to [Section 501-12](#).

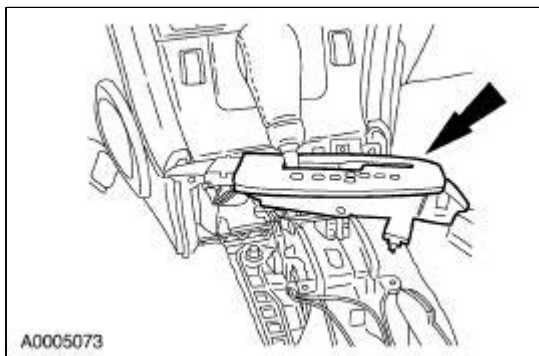
2. Remove the PRNDL indicator bulb.



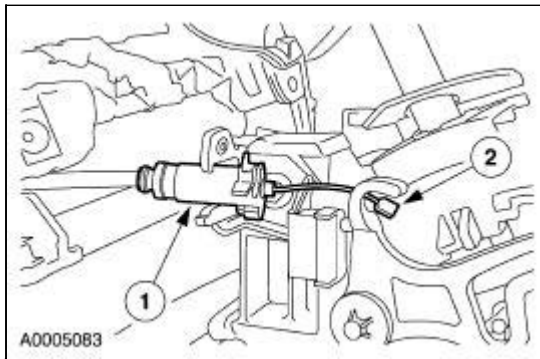
3. Remove the rear A/C air duct.



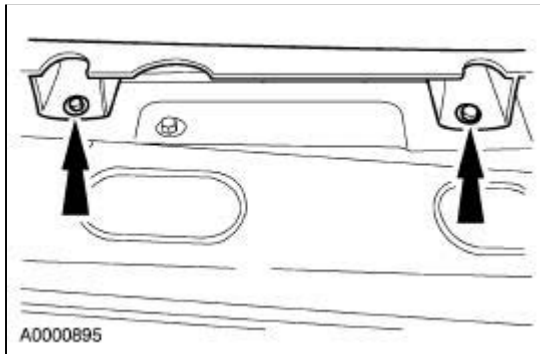
4. Rotate the shifter bezel.



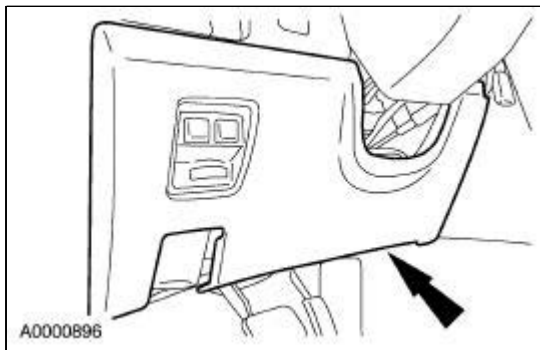
5. Disconnect the cable from the lever.
 1. Remove the shift interlock cable from the bracket.
 2. Disconnect the cable from the lever.



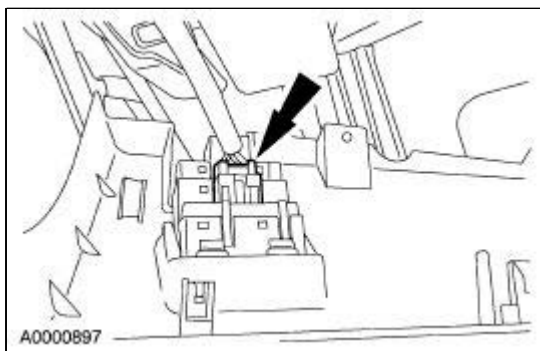
6. Remove the lower steering column cover screws.



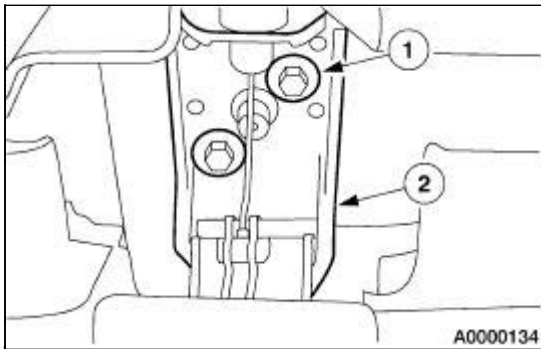
7. Remove the instrument panel steering column cover.



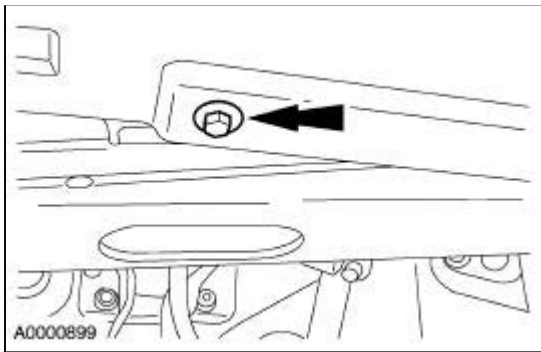
8. Disconnect the electrical connector.



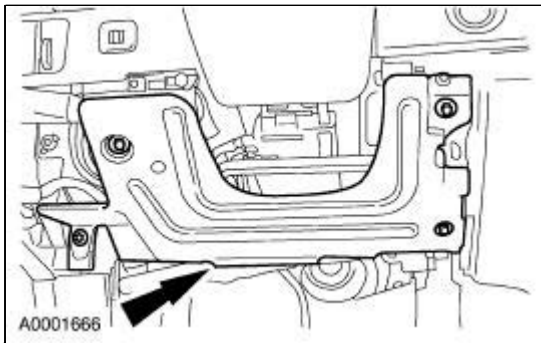
9. Position the hood release cable and bracket aside.
 1. Remove the screws.
 2. Position the hood release cable and bracket aside.



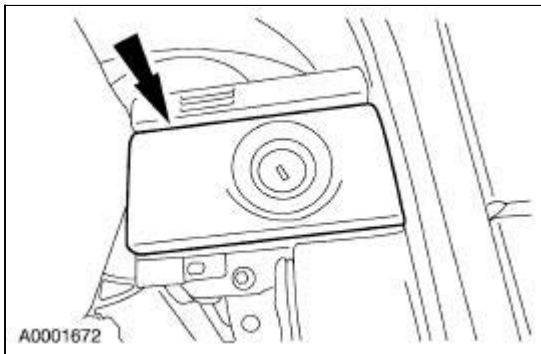
10. Remove the floor heat duct screw.



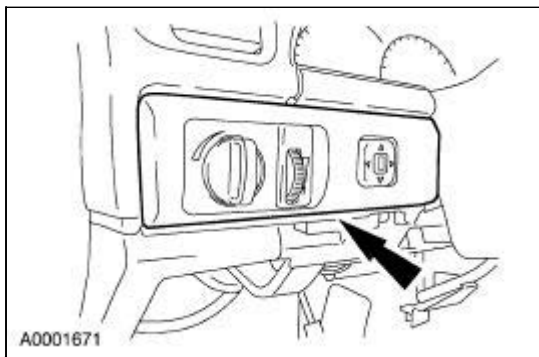
11. Remove the lower reinforcement panel.



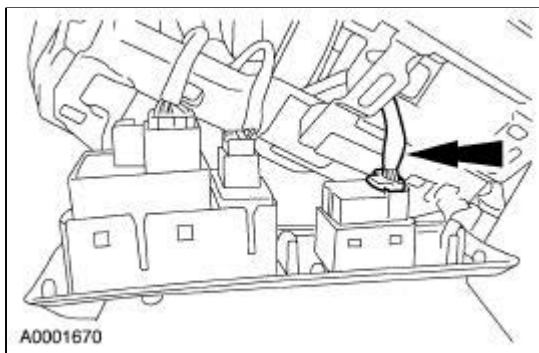
12. Remove the inner instrument panel finish panel.



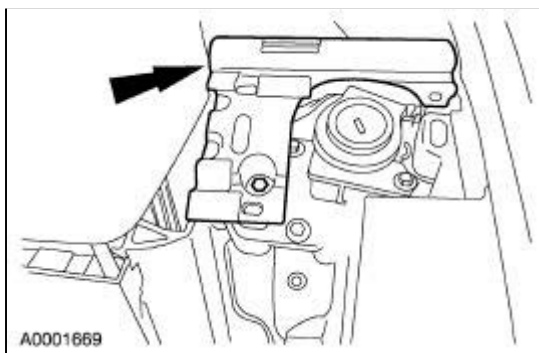
13. Remove the outer instrument panel finish panel.



14. Disconnect the power mirror switch.

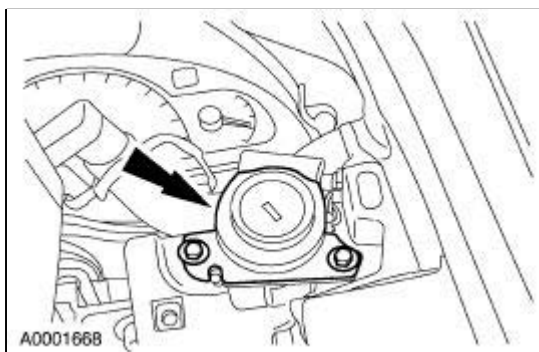


15. Remove the inner trim support panel.

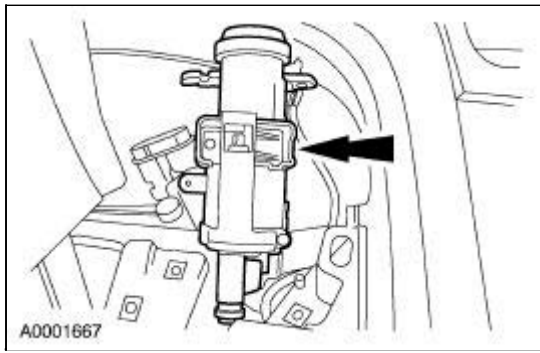


16. Remove the ignition switch.

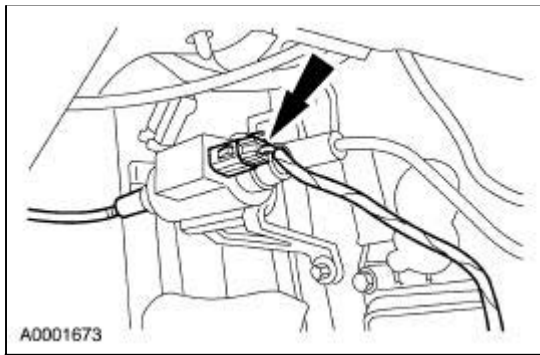
- Remove the screws.
- Remove the ignition switch.



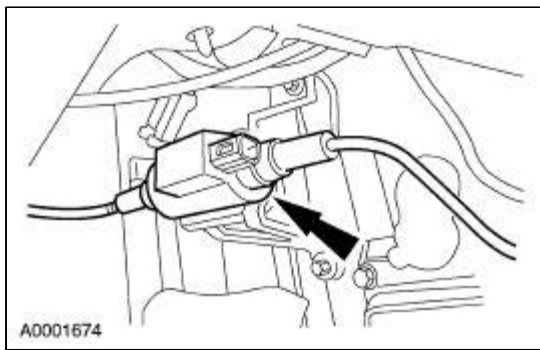
17. Remove two screws for the shift lock actuator cable.



18. Disconnect the electrical connector.



19. Remove the cable from the bracket and remove the cable.

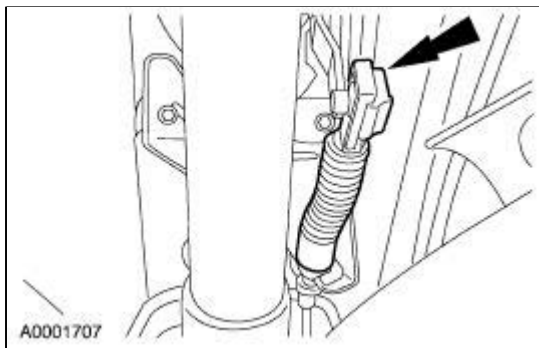


20. To install, reverse the removal procedure.

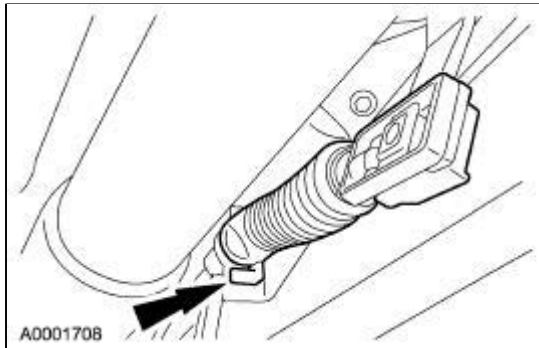
Cable

Removal and Installation

1. Position the gearshift lever in the D-5 position.
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Disconnect the transmission shift cable from the selector lever.

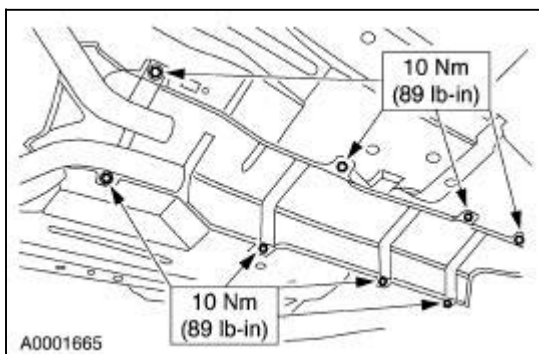


4. Disconnect the transmission shift cable from the bracket.

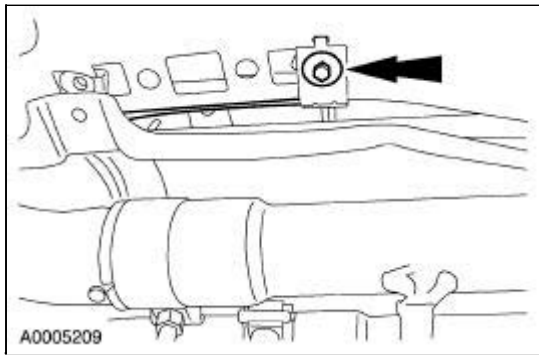


5. **NOTE:** It is not necessary to remove the exhaust.

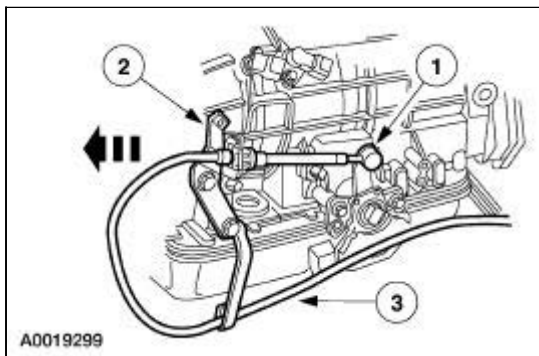
Remove the bolts from the heat shield and allow the shield to rest on the exhaust.



6. Remove the bolt at the shift cable bracket.



7. Remove the transmission shift cable.
 1. Disconnect the shift cable from the transmission manual control lever.
 2. Depress the tab and slide the shift cable out of the shift cable bracket.
 3. Remove the shift cable.



8. **NOTE:** A cable adjustment must be performed after the installation procedure.

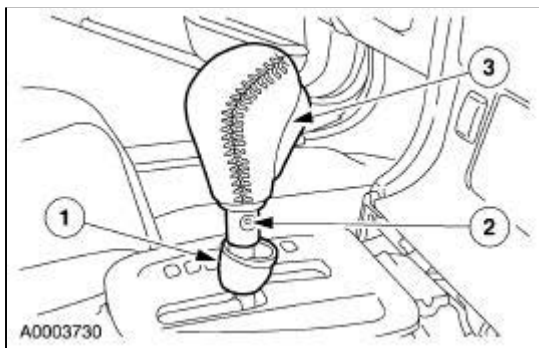
To install, reverse the removal procedure.

- Adjust the shifter cable. For additional information, refer to [Cable Adjustment](#) in this section.
-

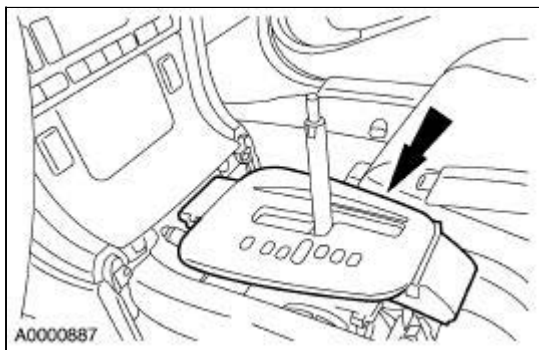
Selector Lever

Removal and Installation

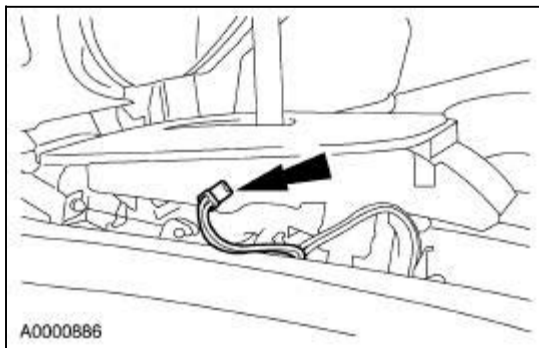
1. Remove the center console. For additional information, refer to [Section 501-12](#).
2. Remove the handle and the cover.
 1. Slide the cover down.
 2. Remove the two screws.
 3. Remove the handle and the cover.



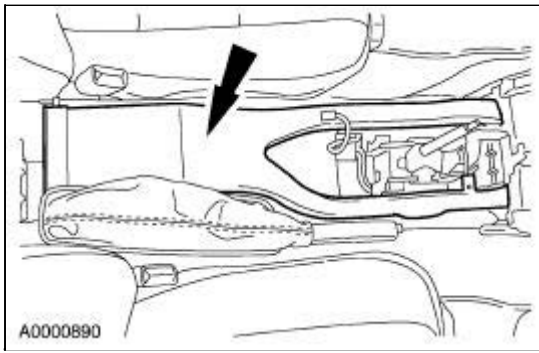
3. Remove the shift bezel.



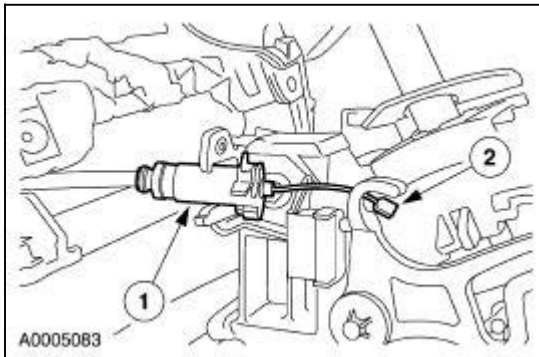
4. Remove the PRNDL indicator bulb.



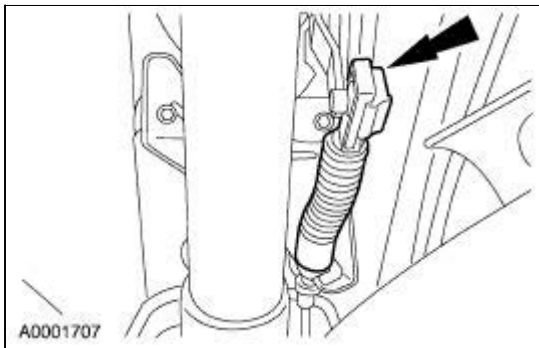
5. Remove the rear A/C air duct.



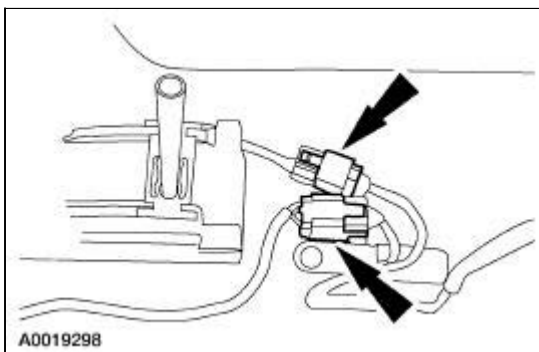
6. Disconnect the cable from the lever.
 1. Remove the shift interlock cable from the bracket.
 2. Disconnect the cable from the lever.



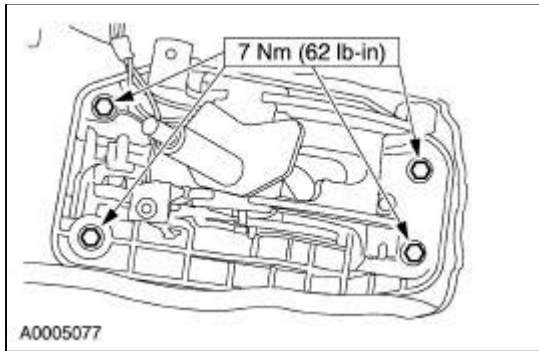
7. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
8. Disconnect the transmission shift cable from the selector lever.



9. Lower the vehicle.
10. Disconnect the two electrical connectors.



11. Remove the shifter assembly.
 - Remove the bolts.
 - Remove the shifter assembly.



12. **NOTE:** A cable adjustment must be performed after the installation procedure.

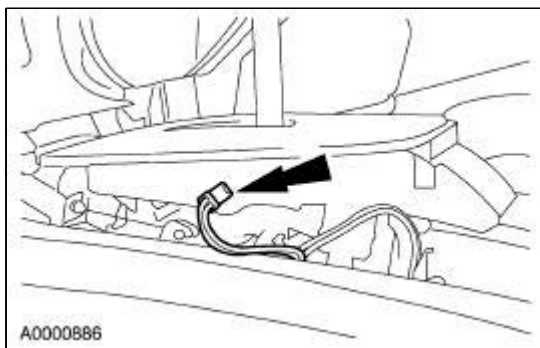
To install, reverse the removal procedure.

- Adjust the shifter cable. For additional information, refer to [Cable Adjustment](#) in this section.
-

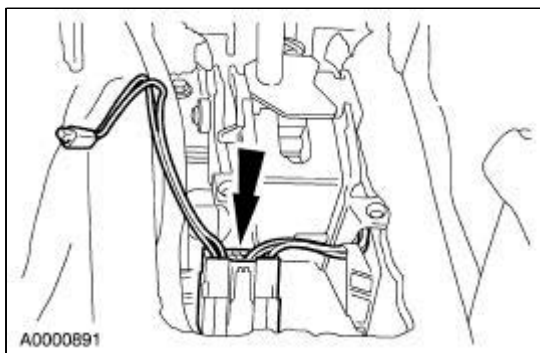
Transmission Control Switch

Removal and Installation

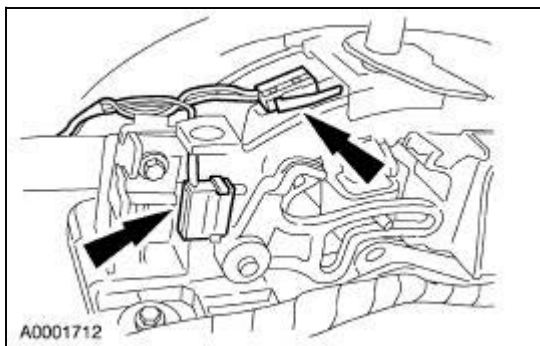
1. Remove the center console. For additional information, refer to [Section 501-12](#).
2. Remove the PRNDL indicator bulb.



3. Disconnect the electrical connector.



4. Disconnect the switches and remove the harness.



5. To install, reverse the removal procedure.

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid C6AZ-19542-AB	ESA-M6C25-A, DOT 3

DESCRIPTION AND OPERATION

Manual Transmission and Clutch

The clutch system consists of the following components:

- a flywheel
- a clutch disc
- a clutch pressure plate
- a clutch master cylinder
- a clutch slave cylinder
- a clutch release hub and bearing

The clutch master cylinder transmits fluid pressure to the slave cylinder, which in turn moves the clutch release hub and bearing.

The clutch master cylinder uses brake fluid and shares a common reservoir with the brake master cylinder.

The clutch is a single plate, dry-friction disc with a diaphragm-style spring clutch pressure plate. The clutch disc has a hub which is splined to the input shaft. The clutch disc has friction material where it contacts the flywheel and the pressure plate. The clutch pressure plate applies pressure to the clutch disc, holding it tightly against the surface of the flywheel.

In the engaged position, the diaphragm spring holds the clutch pressure plate against the clutch disc so that engine torque is transmitted to the input shaft. When the clutch pedal is depressed, the clutch release hub and bearing pushes the diaphragm spring center toward the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted to the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission and enabling the gears to be changed.

Manual Transmission and Clutch

Inspection and Verification - Clutch

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
<ul style="list-style-type: none"> ● Transmission oil leak ● Loose or missing screws or nuts

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Inspection and Verification - Manual Transmission

The following checks should be carried out before repairing or installing a new transmission:

Transmission Noise

If transmission noises are reported, check the transmission fluid level. If damage has occurred due to a lack of fluid, install a new transmission. For additional information, refer to [Section 308-03](#).

Oil Leakage

- Check that the leaking fluid is actually transmission fluid and not hydraulic fluid (from the hydraulically operated clutch) or engine oil.
- Check the transmission fluid level and, as necessary, drain off any excess fluid.
- Clean the transmission and the adjacent areas carefully before the road test.

Symptom Chart - Poor Gear Shifting

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Significant effort required when downshifting or synchronizer clashing 	<ul style="list-style-type: none"> ● Inadequate gear synchronization . 	<ul style="list-style-type: none"> ● INSTALL a new transmission. REFER to Section 308-03.
<ul style="list-style-type: none"> ● Gear jumps out of engagement while 	<ul style="list-style-type: none"> ● Transmission assembly error (missing snap rings 	<ul style="list-style-type: none"> ● INSTALL a new transmission. REFER

driving	or circlips synchronizer components). ● Manufacturing error (incorrect gear wheel tooting or synchronizer ring).	to Section 308-03 .
● Gearshift problems in different gears (stiff or partially seized)	● Linkage.	● REPAIR the transmission accordingly. CHECK the transmission for any resulting damage.
● Brief scratching noise during gear shifting	● Inadequate gear synchronization.	● INSTALL a new transmission. REFER to Section 308-03 .

Symptom Chart - Oil Leakage

Symptom Chart

Condition	Possible Sources	Action
● Leak from transmission housing	<ul style="list-style-type: none"> ● Leak from crankshaft rear seal. ● Leak from clutch hydraulics. ● Sealing lip on input shaft damaged. 	<ul style="list-style-type: none"> ● INSTALL a new crankshaft seal. ● For additional information, REFER to Pinpoint Test H . ● INSTALL a new input shaft seal.

Symptom Chart - General Concerns

Symptom Chart

Condition	Possible Sources	Action
● Clicking noises in reverse gear	● Gear wheels.	● RUN the vehicle on a hoist to establish that the noise is coming from the transmission. If the noise is coming from the transmission, INSTALL a new transmission.
● Gear wheels banging when shifting	<ul style="list-style-type: none"> ● Damaged clutch. ● Selector forks or synchronizer rings. 	<ul style="list-style-type: none"> ● CHECK the clutch is clearing correctly. <ul style="list-style-type: none"> ■ No-For additional information, REFER to Pinpoint Test A . ■ Yes-CHECK transmission oil level. If transmission oil level is okay INSTALL a new transmission. REFER to Section 308-03 . ● INSTALL a new transmission. REFER to Section 308-03 .
● Noises in the forward gears	● Transmission fluid level low.	● FILL the transmission with correct amount of fluid.

	<ul style="list-style-type: none"> ● The engine/transmission assembly is in contact with the chassis/body. ● Engine/transmission flange bolts. ● Input and output shaft bearings. 	<ul style="list-style-type: none"> ● INSPECT for points of contact for damaged engine/transmission isolator, support insulator. ● TIGHTEN the transmission flange bolts. For additional information, REFER to Section 308-03. ● INSTALL a new transmission. REFER to Section 308-03.
<ul style="list-style-type: none"> ● Gears jump out of engagement 	<ul style="list-style-type: none"> ● Engine/transmission support insulator. ● Internal components. 	<ul style="list-style-type: none"> ● REPAIR or INSTALL new components as necessary. ● INSTALL a new transmission. REFER to Section 308-03.
<ul style="list-style-type: none"> ● One of the gears cannot be selected 	<ul style="list-style-type: none"> ● Gearshift linkage malfunction. ● Transmission internal selection problem. 	<ul style="list-style-type: none"> ● CHECK gearshift linkage correctly attached to transmission case, sector arm and the rear mounted to body. <ul style="list-style-type: none"> ■ CHECK gearshift linkage functions correctly. ● INSTALL a new transmission. REFER to Section 308-03.
<ul style="list-style-type: none"> ● Gears jump out of engagement 	<ul style="list-style-type: none"> ● Gearshift linkage fault. ● Internal selector mechanism loose. ● Synchronizer fault. 	<ul style="list-style-type: none"> ● CHECK gearshift linkage for correct function. ● INSTALL a new transmission. REFER to Section 308-03. ● INSTALL a new transmission. REFER to Section 308-03.
<ul style="list-style-type: none"> ● Clattering, or rattling noises 	<ul style="list-style-type: none"> ● Gearshift mechanism grounding out. ● Gearshift lever joint. ● Gearshift lever knob loose. 	<ul style="list-style-type: none"> ● MAKE SURE that the gearshift mechanism is correctly located and the rear mount to body is correctly located. <ul style="list-style-type: none"> ■ MAKE SURE that there are no components interfering with the gearshift linkage. ■ MAKE SURE the air conditioning ducts and wiring harness are not interfering with the gearshift levers inside the center console. ● CHECK free play in bearing between the lever and support housing, and between the lever and shift arm. ● TIGHTEN the gearshift lever knob or, INSTALL a new gearshift lever knob as

	<ul style="list-style-type: none"> ● Trim ring loose on knob/lever. 	<p>necessary.</p> <ul style="list-style-type: none"> ● MAKE SURE the trim ring is securely located onto the gear knob. INSTALL a new trim ring if necessary.
<ul style="list-style-type: none"> ● Gearshift linkage has excessive play 	<ul style="list-style-type: none"> ● Gear lever bearing worn. ● Gearshift selector rod assembly damaged or worn. ● Stabilizer bar support insulator damaged or worn. ● Stabilizer to transmission bushings worn. 	<ul style="list-style-type: none"> ● CHECK free play in bearing. INSTALL a new gear lever bearing if necessary. ● INSTALL a new gearshift selector rod assembly. ● INSTALL a new stabilizer bar support insulator. ● INSTALL new transmission bushings.
<ul style="list-style-type: none"> ● Gearshift linkage does not operate freely 	<ul style="list-style-type: none"> ● Excessive friction in gear lever bearing. ● Gearshift selector rod assembly damaged or worn. ● Possible fault in transmission. 	<ul style="list-style-type: none"> ● INSTALL a new gear lever bearing. ● INSTALL a new gearshift selector rod assembly. ● INSTALL a new transmission. REFER to Section 308-03.

Symptom Chart - Clutch

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Clutch slippage 	<ul style="list-style-type: none"> ● Clutch pedal free play. ● Sticking clutch pedal. ● Diaphragm springs. ● Clutch pressure plate. ● Clutch disc facing. ● Hardened or oiled clutch disc facing surface. ● Flywheel. ● Excessive temperature. ● Slave cylinder sticking. ● Adjuster ring at fully worn position. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A. ● ALLOW the clutch to fully cool. ● CHECK that the slave cylinder travels freely over its complete travel. ● INSTALL a new clutch drive plate.
<ul style="list-style-type: none"> ● Clutch chatter or shudder 	<ul style="list-style-type: none"> ● Engine mounts. ● Oil on clutch disc facing. ● Diaphragm springs. ● Clutch pressure plate. ● Clutch disc facing. ● Flywheel. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B.
<ul style="list-style-type: none"> ● Clutch drag 	<ul style="list-style-type: none"> ● Insufficient brake fluid. ● Air in hydraulic system. ● Clutch pedal free play. ● Diaphragm springs. ● Clutch disc. ● Clutch disc splines. ● Oil on clutch disc facing. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test C.

	<ul style="list-style-type: none"> ● Insufficient clutch pedal travel. 	<ul style="list-style-type: none"> ● MAKE SURE the clutch pedal has its full range of travel. ● MAKE SURE the clutch pedal returns to the fully released position and the reservoir is full.
<ul style="list-style-type: none"> ● Clutch pedal pulsation 	<ul style="list-style-type: none"> ● Clutch and brake pedal pivot shaft not correctly lubricated. ● Flywheel. ● Damaged springs in pressure plate. ● Release bearing noisy or worn. ● Cover assembly. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D. ● INSTALL a new release bearing. ● CHECK runout of clutch cover. INSTALL a new clutch cover.
<ul style="list-style-type: none"> ● Clutch pedal related vibrations 	<ul style="list-style-type: none"> ● Engine component grounding against frame. ● Accessory drive belt. ● Flywheel bolts. ● Flywheel. ● Imbalanced clutch pressure plate. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test E.
<ul style="list-style-type: none"> ● Hard shifting 	<ul style="list-style-type: none"> ● Insufficient brake fluid. ● Clutch pedal free play. ● Manual transmission concern. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test F.
<ul style="list-style-type: none"> ● Excessive noise 	<ul style="list-style-type: none"> ● Clutch pedal free play. ● Clutch release bearing. ● Poor lubrication of clutch release bearing. ● Pilot bearing. ● Excessive crankshaft end play. ● If the noise is heard from the transmission when the engine is started and switched off with the clutch engaged, and the noise disappears if the clutch pedal is depressed. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test G. ● INSTALL a new flywheel.
<ul style="list-style-type: none"> ● Fluid leakage 	<ul style="list-style-type: none"> ● Clutch master cylinder. ● Clutch slave cylinder. ● Clutch hydraulic tubes. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test H.

PINPOINT TEST A: CLUTCH SLIPPAGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 TEST CLUTCH SLIPPAGE	
	<ol style="list-style-type: none"> 1 Lock wheels and apply the parking brake. 2 Start the engine and engage 4th gear. 3 Run the engine at approximately 2,000 rpm. 4 Release the clutch pedal slowly.

● Does the engine stall when the clutch pedal is fully released?

→ **Yes**
Clutch is OK.

→ **No**
GO to A2.

A2 TEST CLUTCH FOR CLEARING

1 Start engine, fully depress the clutch pedal, partially engage reverse gear, slowly engage clutch until a grating noise is heard, depress the clutch slowly until grating stops.

2 Measure pedal travel from the pedal to the floor.

● Is the measurement between 25 mm and 40 mm (0.98 in and 1.57 in)?

→ **Yes**
GO to A3.

→ **No**
GO to A5.

A3 TEST FULL PEDAL TRAVEL

1 Measure the clutch pedal travel from fully up to the fully compressed position.

● Is the measurement between 133 mm and 143 mm (5.23 in and 5.62 in)?

→ **Yes**
GO to A4.

→ **No**
CHECK clutch pedal for obstructions. TEST the system for normal operation.

A4 CHECK CLUTCH PEDAL SHAFT LUBRICATION

1 Check the clutch pedal shaft lubrication.

● Is the clutch pedal shaft sufficiently lubricated?

→ **Yes**
GO to A5.

→ **No**
LUBRICATE the clutch pedal shaft.

A5 TEST CLUTCH PRESSURE PLATE

1 Remove clutch pressure plate. For additional information, refer to Section 308-01.

● Does the clutch pressure plate have signs of wear or damage?

→ **Yes**
INSTALL a new clutch pressure plate.

	→ No GO to <u>A6</u> .
A6 TEST CLUTCH FRICTION DISC	
	<p>1 Visually check the clutch friction disc.</p> <ul style="list-style-type: none"> ● Is the clutch friction disc oil-fouled or does it have burn marks? <p>→ Yes INSTALL a new clutch friction disc. TEST the system for normal operation.</p> <p>→ No CHECK the flywheel.</p>

PINPOINT TEST B: CLUTCH CHATTER OR SHUDDER

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 TEST CLUTCH CHATTER OR SHUDDER	
	<p>1 Start the engine and engage 1st gear.</p> <p>2 Run the engine between 1,200 rpm and 1,500 rpm.</p> <p>3 Release clutch pedal slowly.</p> <ul style="list-style-type: none"> ● Does the vehicle shudder when it begins to move? <p>→ Yes GO to <u>B2</u>.</p> <p>→ No Clutch is OK.</p>
B2 TEST ENGINE/TRANSMISSION SUPPORT INSULATOR	
	<p>1 Check engine/transmission mountings and support insulator for damage or loose bolts.</p> <ul style="list-style-type: none"> ● Are the engine/transmission mountings or support insulator loose or damaged? <p>→ Yes TIGHTEN the bolts or INSTALL new bolts as necessary. TEST the system for normal operation.</p> <p>→ No GO to <u>B3</u>.</p>
B3 TEST CLUTCH PRESSURE PLATE	
	<p>1 Remove the clutch pressure plate. For additional information, refer to <u>Section 308-01</u>.</p> <ul style="list-style-type: none"> ● Does the clutch pressure plate have signs of wear or damage? <p>→ Yes</p>

	<p>INSTALL a new clutch pressure plate.</p> <p>→ No GO to <u>B4</u>.</p>
B4 TEST CLUTCH FRICTION DISC	
	<p>1 Visually check the clutch friction disc.</p> <ul style="list-style-type: none"> ● Is the clutch friction disc oil-fouled or does it have burn marks? <p>→ Yes INSTALL a new clutch friction disc. TEST the system for normal operation.</p> <p>→ No CHECK the flywheel.</p>

PINPOINT TEST C: CLUTCH DRAG

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK BRAKE FLUID LEVEL	
NOTE: The hydraulic clutch fluid is supplied from the brake master cylinder.	
	<p>1 Check the brake fluid level.</p> <ul style="list-style-type: none"> ● Is the brake fluid level between the MAX and MIN marks on the brake fluid reservoir? <p>→ Yes GO to <u>C2</u>.</p> <p>→ No FILL brake fluid, and CHECK the brake and clutch system for leaks. TEST system for normal operation.</p>
C2 TEST CLUTCH PEDAL FREE TRAVEL	
	<p>1 Operate clutch pedal manually to the point of resistance and release.</p> <p>2 Measure pedal travel.</p> <ul style="list-style-type: none"> ● Is the measured dimension within 10 mm (0.39 in)? <p>→ Yes GO to <u>C3</u>.</p> <p>→ No GO to <u>C5</u>.</p>
C3 TEST FULL PEDAL TRAVEL	
	<p>1 Measure the clutch pedal travel from fully up to the fully compressed position.</p> <ul style="list-style-type: none"> ● Is the measurement between 133 mm and 143 mm (5.23 in and 5.62 in)?

	<p>→ Yes GO to <u>C4</u>.</p> <p>→ No CHECK clutch pedal for obstructions. TEST the system for normal operation.</p>
C4 CHECK CLUTCH PEDAL SHAFT LUBRICATION	
	<p>1 Check the clutch pedal shaft lubrication.</p> <p>● Is the clutch pedal shaft sufficiently lubricated?</p> <p>→ Yes GO to <u>C5</u>.</p> <p>→ No LUBRICATE the clutch pedal shaft.</p>
C5 TEST CLUTCH PRESSURE PLATE	
	<p>1 Remove clutch pressure plate. For additional information, refer to <u>Section 308-01</u>.</p> <p>● Does the clutch pressure plate have signs of wear or damage?</p> <p>→ Yes INSTALL a new clutch pressure plate.</p> <p>→ No GO to <u>C6</u>.</p>
C6 TEST CLUTCH FRICTION DISC	
	<p>1 Visually check the clutch friction disc.</p> <p>● Is the clutch friction disc oil-fouled or does it have burn marks?</p> <p>→ Yes INSTALL a new clutch friction disc. TEST the system for normal operation.</p> <p>→ No CHECK the flywheel.</p>

PINPOINT TEST D: CLUTCH PEDAL PULSATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK CLUTCH PEDAL SHAFT LUBRICATION	
	<p>1 Check the clutch pedal shaft lubrication.</p> <p>● Is the clutch pedal shaft sufficiently lubricated?</p> <p>→ Yes CHECK the flywheel.</p> <p>→ No</p>

LUBRICATE the clutch pedal shaft. TEST the system for normal operation.

PINPOINT TEST E: CLUTCH RELATED VIBRATIONS

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK FOR ENGINE COMPONENT GROUNDING	
	<p>1 Raise and support the vehicle. For additional information, refer to Section 100-02.</p> <p>2 Check the engine mountings for grounding on the body frame.</p> <p>3 Check the exhaust manifold or other engine component grounding on the body or frame.</p> <p>● Is there evidence of grounding on body or frame?</p> <p>→ Yes REPAIR or INSTALL a new component as necessary. TEST the system for normal operation.</p> <p>→ No GO to E2.</p>
E2 CHECK FOR ACCESSORY DRIVE VIBRATIONS	
	<p>1 Feel accessory vibration at clutch engage/disengage when engine torque changes.</p> <p>2 Disconnect the accessory drive belt and check for vibration.</p> <p>● Does the vibration stop when the drive belt is removed from the engine?</p> <p>→ Yes REPAIR or INSTALL new accessory drive belt components. For additional information, REFER to Section 303-05.</p> <p>→ No GO to E3.</p>
E3 CHECK FOR RELEASE BEARING NOISE	
	<p>1 Start the engine.</p> <p>2 Depress and hold clutch pedal.</p> <p>● Is a whirring, grating or grinding noise present?</p> <p>→ Yes INSTALL a new clutch slave cylinder. For additional information, REFER to Section 308-02. TEST the system for normal operation.</p> <p>→ No GO to E4.</p>
E4 INSPECT FLYWHEEL	
	<p>1 Remove the transmission. For additional information, refer to Section 308-</p>

03.

2 Inspect for loose flywheel bolts.

3 Carry out flywheel runout check. For additional information, refer to [Section 303-00](#).

● **Is the flywheel OK?**

→ **Yes**
DIAGNOSE engine vibration concern. For additional information, REFER to [Section 303-00](#).

→ **No**
TIGHTEN flywheel bolts or INSTALL a new flywheel. For additional information, REFER to [Section 308-01](#). TEST the system for normal operation.

PINPOINT TEST F: HARD SHIFTING

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK FLUID LEVEL	
NOTE: The hydraulic clutch fluid is supplied from the brake master cylinder.	
	<p>1 Inspect the fluid level in the brake master cylinder reservoir.</p> <p>● Is the fluid within the MAX and MIN level marks?</p> <p>→ Yes GO to F2.</p> <p>→ No FILL brake fluid, CHECK for leaks in the clutch and brake system. TEST the system for normal operation.</p>
F2 TEST CLUTCH PEDAL FREE TRAVEL	
	<p>1 Operate clutch pedal manually to the point of resistance and release.</p> <p>2 Measure pedal travel.</p> <p>● Is the measured dimension within 10 mm (0.39 in)?</p> <p>→ Yes GO to F3.</p> <p>→ No GO to F5.</p>
F3 TEST FULL PEDAL TRAVEL	
	<p>1 Measure the clutch pedal travel from fully up to the fully compressed position.</p> <p>● Is the measurement between 133 mm and 143 mm (5.23 in and 5.62 in)?</p>

	<p>→ Yes GO to <u>F4</u>.</p> <p>→ No CHECK clutch pedal for obstructions. TEST the system for normal operation.</p>
F4 CHECK CLUTCH PEDAL SHAFT LUBRICATION	
	<p>1 Check the clutch pedal shaft lubrication.</p> <p>● Is the clutch pedal shaft sufficiently lubricated?</p> <p>→ Yes GO to <u>F5</u>.</p> <p>→ No LUBRICATE the clutch pedal shaft.</p>
F5 TEST CLUTCH PRESSURE PLATE	
	<p>1 Remove clutch pressure plate. For additional information, refer to <u>Section 308-01</u>.</p> <p>● Does the clutch pressure plate have signs of wear or damage?</p> <p>→ Yes INSTALL a new clutch pressure plate.</p> <p>→ No GO to <u>F6</u>.</p>
F6 TEST CLUTCH FRICTION DISC	
	<p>1 Visually check the clutch friction disc.</p> <p>● Is the clutch friction disc oil-fouled or does it have burn marks?</p> <p>→ Yes INSTALL a new clutch friction disc. TEST the system for normal operation.</p> <p>→ No CHECK the flywheel.</p>

PINPOINT TEST G: EXCESSIVE NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK TRANSMISSION NEUTRAL POSITION	
	<p>1 Start the engine and run it in Neutral.</p> <p>2 Depress clutch pedal fully.</p> <p>● Are there noises when the clutch is operated?</p> <p>→ Yes GO to <u>G2</u>.</p>

	<p>→ No System is OK.</p>
G2 TEST CLUTCH PEDAL FREE TRAVEL	
	<p>1 Press the clutch down manually until resistance is felt, then release it again.</p> <p>2 Measure pedal travel.</p> <p>● Is the measured dimension within 10 mm (0.39 in)?</p> <p>→ Yes GO to <u>G3</u>.</p> <p>→ No INSTALL a new clutch master cylinder. For additional information, REFER to <u>Section 308-02</u>. TEST the system for normal operation.</p>
G3 TEST CLUTCH SLAVE CYLINDER WITH RELEASE BEARING	
	<p>1 Remove the transmission. For additional information, refer to <u>Section 308-03</u>.</p> <p>2 Check the clutch slave cylinder bolts.</p> <p>3 Check the release bearing for wear and rust.</p> <p>● Are the bolts loose or are there signs of wear or rust?</p> <p>→ Yes TIGHTEN the bolts or INSTALL a new clutch slave cylinder with the release bearing. TEST the system for normal operation.</p> <p>→ No GO to <u>G4</u>.</p>
G4 CHECK CLUTCH FRICTION DISC TORSION SPRINGS	
	<p>1 Check torsion springs for wear.</p> <p>● Do the torsion springs have signs of wear?</p> <p>→ Yes INSTALL a new clutch friction disc. TEST the system for normal operation.</p> <p>→ No CHECK crankshaft end play. For additional information, REFER to <u>Section 303-00</u>. TEST the system for normal operation.</p>

PINPOINT TEST H: FLUID LEAKAGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 INSPECT CLUTCH MASTER CYLINDER	
	<p>1 Inspect the clutch master cylinder for leakage.</p> <p>● Is the clutch master cylinder OK?</p>

→ **Yes**
GO to H2.

→ **No**
INSTALL a new clutch master cylinder as necessary. For additional information, REFER to Section 308-02. TEST the system for normal operation.

H2 INSPECT CLUTCH SLAVE CYLINDER

1 Inspect the clutch slave cylinder for leaks.

- **Is the clutch slave cylinder OK?**

→ **Yes**
GO to H3.

→ **No**
INSTALL a new clutch slave cylinder as necessary. For additional information, REFER to Section 308-02. TEST the system for normal operation.

H3 INSPECT SYSTEM HYDRAULIC TUBES

1 Inspect the clutch hydraulic tubes for loose or damaged fittings causing leakage.


- **Are the clutch hydraulic tubes OK?**


→ **Yes**
CARRY OUT road test to verify customer complaint.

→ **No**
INSTALL new components as necessary. TEST the system for normal operation.

GENERAL PROCEDURES

Bleed Procedure

1.  **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

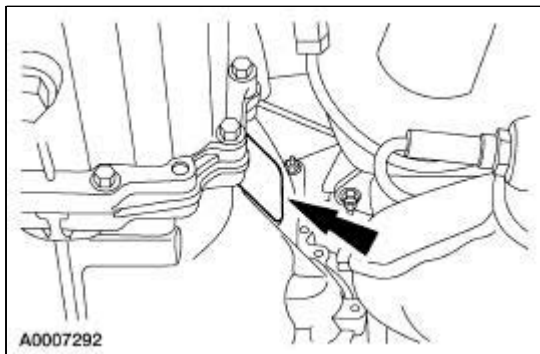
 **CAUTION:** Brake fluid is harmful to painted or plastic surfaces. If the brake fluid is spilled onto a painted or plastic surface, wash it immediately with water.

NOTE: Make sure of absolute cleanliness when filling the brake fluid reservoir.

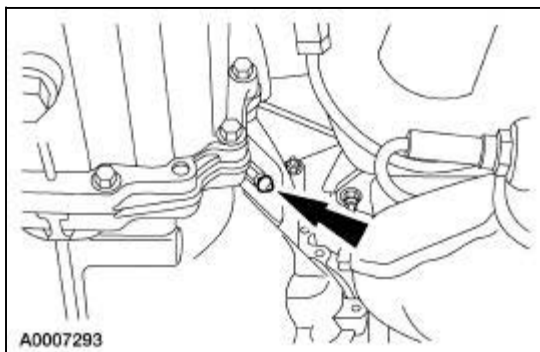
NOTE: Do not re-use brake fluid.

Fill the brake fluid reservoir with High Performance DOT3 Motor Vehicle Brake Fluid C6AZ-19542-AB or equivalent meeting Ford specification ESA-M6C25-A, DOT3.

2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Remove the dust cover.



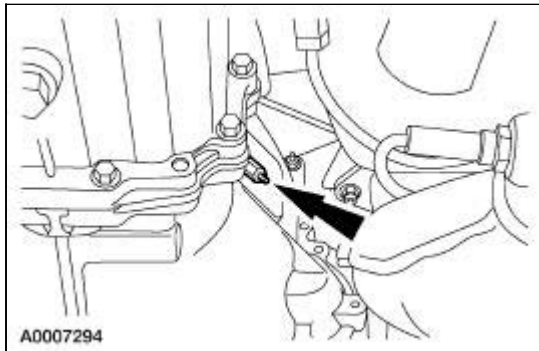
4. Remove the bleed nipple cover.



5. Bleed the clutch system.
 - Attach a proprietary bleed jar to the bleed nipple and open the bleed nipple one turn.
 - Depress the clutch pedal repeatedly until the emerging fluid is free of bubbles; always

make sure that there is sufficient fluid (5 mm [0.2 in] above the MAX) in the reservoir.

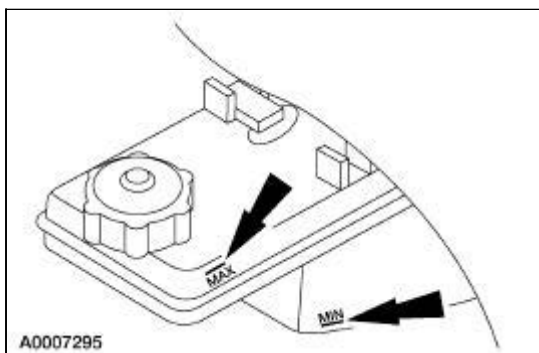
- After bleeding, tighten the bleed nipple.
- Install the bleed nipple cover.
- Install the dust cover.
- After bleeding, lower the vehicle and depress the clutch 10 times and check that it is functioning correctly.



6. **NOTE:** Make sure of absolute cleanliness when filling the brake fluid reservoir.

Check the brake fluid level.


- The fluid level should be between the MIN and MAX marks. If the level drops below the MIN mark, the brake warning indicator will light up.
- As necessary, fill the brake fluid reservoir with High Performance DOT3 Motor Vehicle Brake Fluid C6AZ-19542-AB or equivalent meeting Ford specification ESA-M6C25-A, DOT3.



GENERAL PROCEDURES

Release Hub and Bearing Check

1. Turn the clutch release hub and bearing in both directions and check for any binding or abnormal noise.

2.  **CAUTION: The clutch release hub and bearing is sealed and must not be immersed in any type of cleaning fluid.**

Check for worn or damaged clutch release hub and bearing fork contact surfaces.

3. Install the clutch release hub and bearing on the input shaft and check for a smooth sliding condition.
 4. Check driveshaft splines for rust, scoring, or damage.
-

Torque Specifications

Description	Nm	lb-ft	lb-in
Flywheel bolts	80	59	—
Pressure plate bolts	23	17	—

Clutch

The clutch transfers the engine torque to the transmission.

The clutch consists of a disc and a pressure plate with a diaphragm spring, bolted to the flywheel.

When the clutch pedal is operated the power transmission from the engine to the transmission is interrupted. The clutch is therefore engaged when the pedal is not depressed. Pressing down the pedal disengages the clutch.

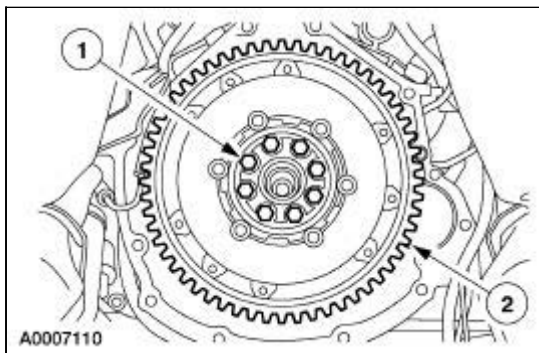
Clutch

Refer to Section 308-00 .

Flywheel

Removal

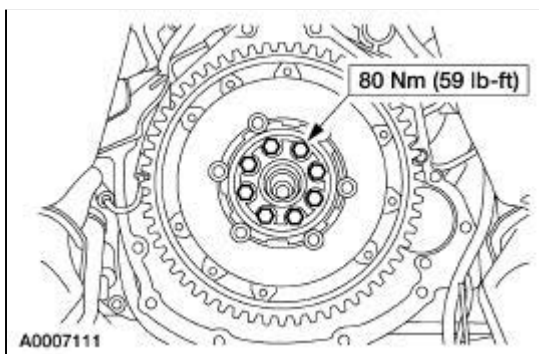
1. Remove the manual transmission. For additional information, refer to [Section 308-03](#).
2. Remove the clutch disc and pressure plate. For additional information, refer to [Disc and Pressure Plate](#).
3. Remove the flywheel.
 1. Remove the bolts.
 2. Remove the flywheel.



Installation

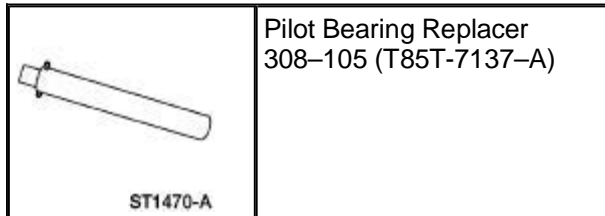
1. **NOTE:** One of the flywheel holes is offset for installation.

To install, reverse the removal procedure.



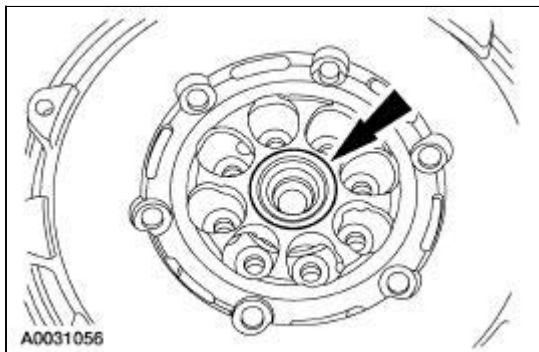
Bearing —Pilot

Special Tool(s)



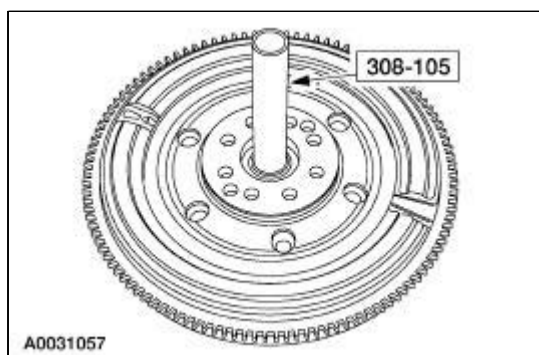
Removal

1. Remove the manual transmission. For additional information, refer to [Section 308-03](#).
2. Remove the clutch disc and the clutch pressure plate. For additional information, refer to [Disc and Pressure Plate](#) in this section.
3. Remove the pilot bearing from the flywheel.



Installation

1. Using the special tool, install the pilot bearing into the flywheel.



2. Install the clutch disc and the clutch pressure plate. For additional information, refer to [Disc and Pressure Plate](#) in this section.
3. Install the manual transmission.

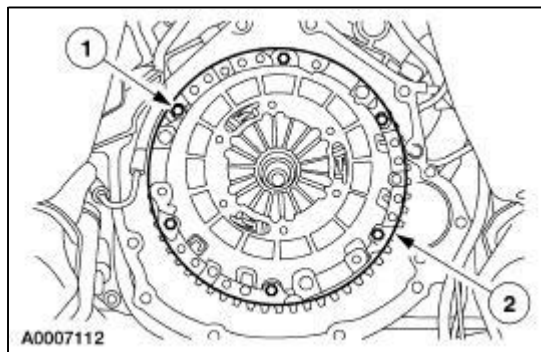
Disc and Pressure Plate

Special Tool(s)



Removal

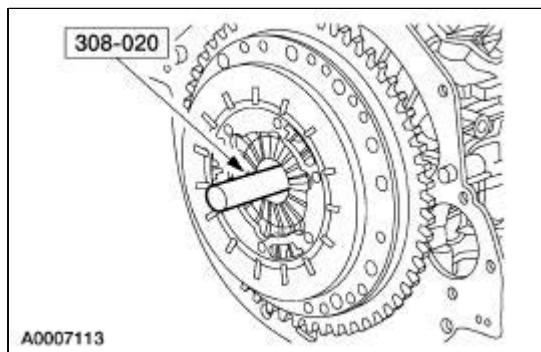
1. Remove the manual transmission. For additional information, refer to [Section 308-03](#).
2. Remove the clutch disc and pressure plate.
 1. Remove the pressure plate bolts in a uniform sequence.
 2. Remove the clutch disc and pressure plate.



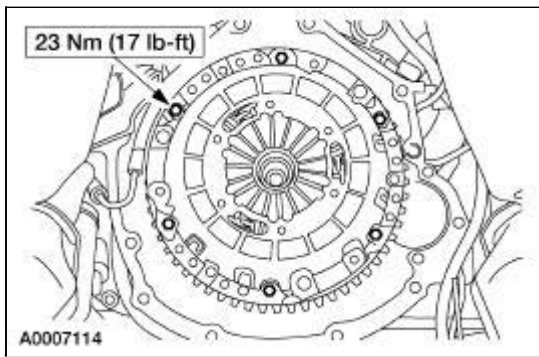
Installation

1. **NOTE:** The clutch disc is marked "Flywheel side" for correct installation.

Using the special tool, align the clutch assembly.



2. Locate the clutch pressure plate on the flywheel dowels and tighten the bolts in a diagonal sequence.



3. Remove the special tool.
4. **NOTE:** Make sure that the input shaft of the transmission is moved squarely into the hub of clutch disc. Do not bend in any direction.

Install the manual transmission. For additional information, refer to [Section 308-03](#).

General Specifications

Item	Specification
Clutch System	
Clutch control	Hydraulic
System adjustment	Automatic
Clutch pedal type	Suspended
Fluid	
High Performance DOT 3 Motor Vehicle Brake Fluid C6AZ-19542-AB	ESA-M6C25-A, DOT 3
Lubricant	
Premium Long-Life Grease XG-1-C, XG-1-K	ESA-M1C75-B
Super Premium SAE 5W-30 Motor Oil	WSS-M2C153-G

Torque Specifications

Description	Nm	lb-ft	lb-in
Slave cylinder-to-transmission bolts	22	16	—
Clutch master cylinder nuts	10	—	89
Hydraulic tube bracket nut	10	—	89
Clutch pedal position (CPP) switch bracket bolts.	10	—	89

Clutch Controls

The clutch control system consists of the following components:

- clutch master cylinder reservoir and tubing
- clutch master cylinder
- clutch hydraulic tube

For removal and installation procedures, refer to [Section 206-06](#).

The clutch control system disengages the clutch when the clutch pedal is depressed and engages the clutch when released. When the clutch pedal is depressed it pushes the clutch master cylinder plunger. This develops hydraulic pressure and applies the clutch slave cylinder which engages the clutch release hub and bearing. The clutch release hub and bearing and clutch pressure plate diaphragm springs release the pressure on the clutch disc. This in turn disengages the transmission from the engine.

The hydraulic clutch system adjusts automatically to compensate for clutch disc wear. The clutch linkage is not adjustable.

Clutch Controls

Refer to Section 308-00 .

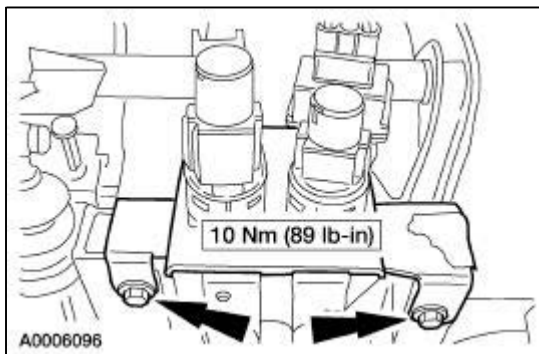
Clutch Pedal

Removal and Installation

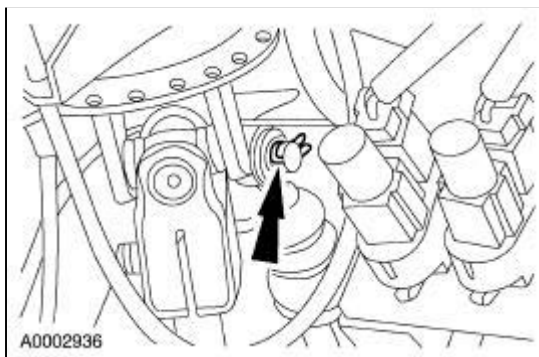
1. **NOTE:** Disconnect the footwell lamp electrical connector.

Remove the instrument panel insulator.

2. Remove the clutch pedal position (CPP) switch bracket bolts and position the bracket out of the way.

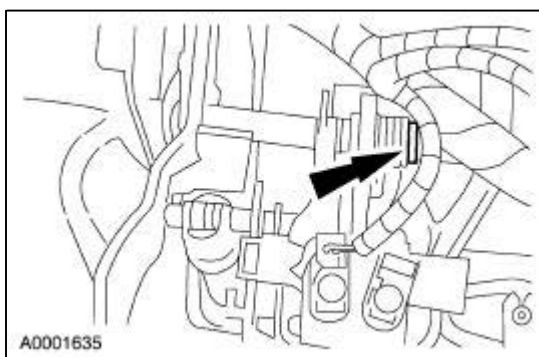


3. Remove the snap ring and disconnect the clutch master cylinder push rod.

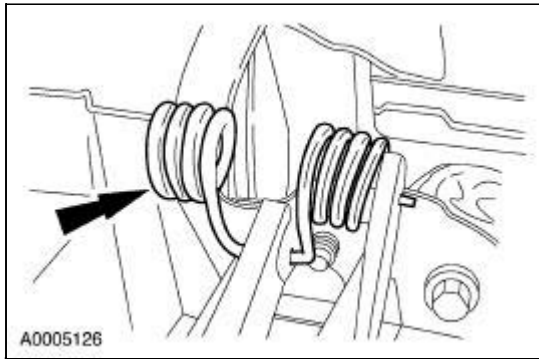


4. **NOTE:** When the clutch pedal shaft is removed from the bracket, the brake pedal, brake and clutch pedal bushings and the spring washer become accessible.

Remove the clutch pedal snap ring and the clutch pedal shaft.



5. Remove the clutch pedal return spring and the clutch pedal.



6. **NOTE:** Position the return spring in the "V" at the top of the pedal arm.

NOTE: Before the installation of the clutch pedal shaft or clutch pedal, remove and inspect the brake and clutch pedal bushings. Clean and lubricate with a light film of Super Premium SAE 5W-30 Motor Oil or equivalent meeting Ford specification WSS-M2C153-G and install a new brake and clutch pedal bushing if excessive wear is evident.


To install, reverse the removal procedure.


Clutch Master Cylinder

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid C6AZ-19542-AB	ESA-M6C25-A, DOT 3

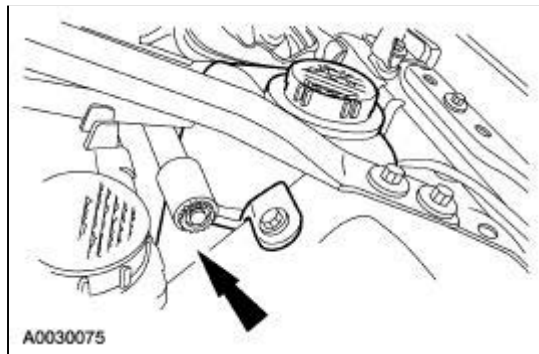
Removal and Installation

-  **WARNING:** Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

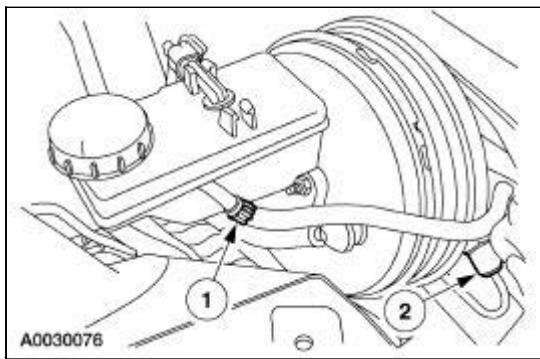
 **CAUTION:** Brake fluid is harmful to painted or plastic surfaces. If the brake fluid is spilled onto a painted or plastic surface, wash it immediately with water.

Remove the hose at the clutch master cylinder reservoir.

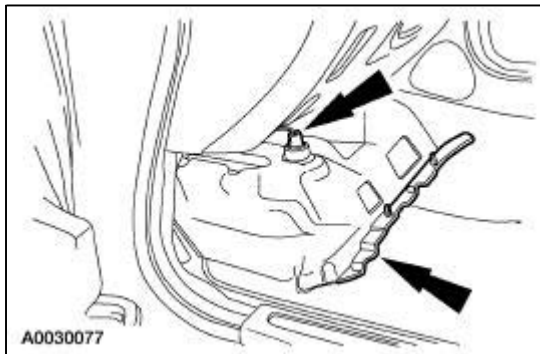
- Remove the degas bottle. For additional information, refer to [Section 303-03](#).
 - Only partially drain the coolant system.



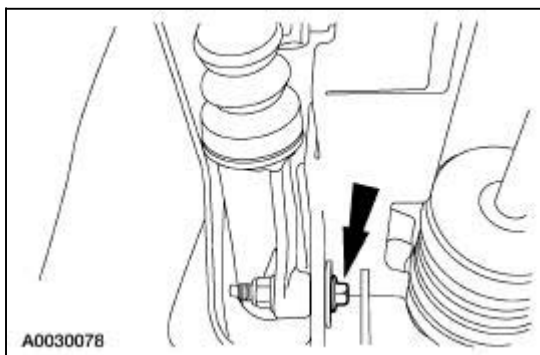
- Partially drain the brake master cylinder.
 - Drain to just below the clutch reservoir nipple.
- Remove the clutch hydraulic lines.
 - Disconnect the reservoir line from the brake master cylinder.
 - Plug the reservoir line. Discard the hose clamp.
 - Disconnect the clutch master cylinder hydraulic line.



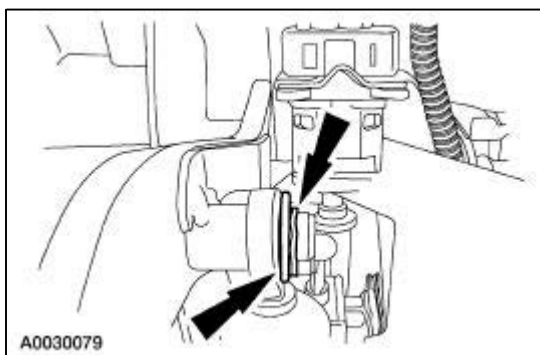
5. Remove the two retainers and lower the instrument panel insulator. Disconnect the footwell lamp electrical connector, then remove from the vehicle.



6. Remove the instrument panel finish panel.
7. Remove the two bolts.

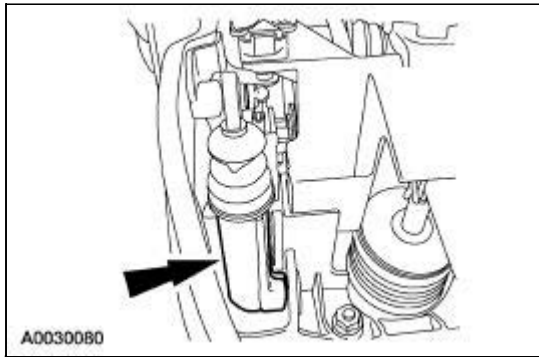


8. Remove the clip and washer from the clutch pedal arm.

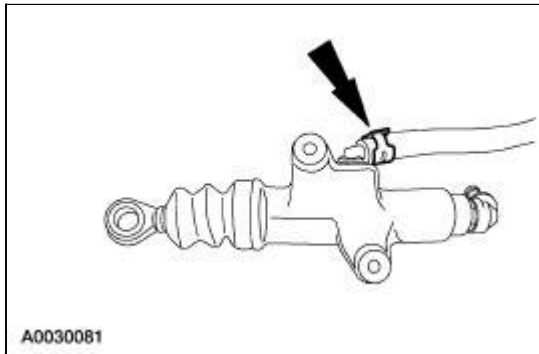


9. Disengage the clutch master cylinder from the clutch arm, then remove the clutch master

cylinder.



10. Remove the reservoir line from the clutch master cylinder

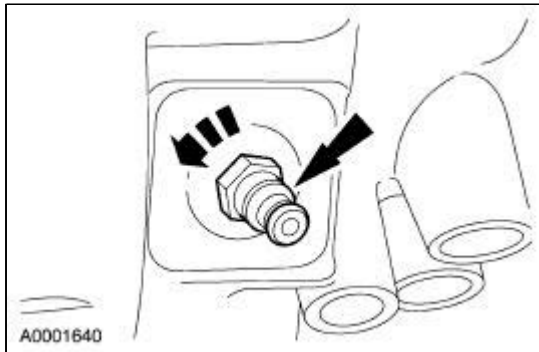


11. To install, reverse the removal procedure.
 - Install new hose clamps on the reservoir line.
 - Refill the brake master cylinder with the specified fluid.
 - Refill the coolant system.
 - Bleed the clutch hydraulic system. For additional information, refer to [Section 308-00](#) .
-

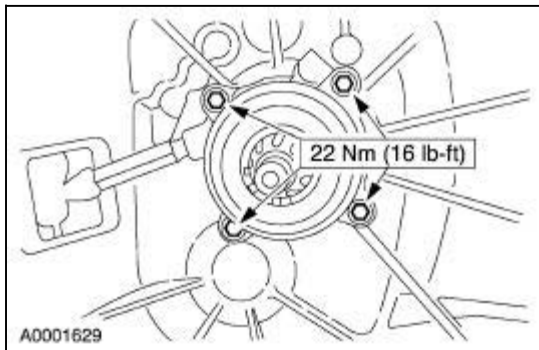
Slave Cylinder

Removal and Installation

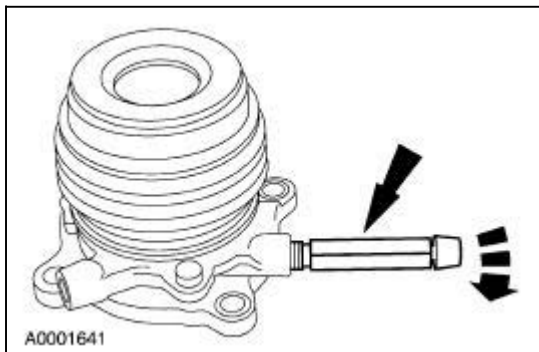
1. Remove the transmission. For additional information, refer to [Section 308-03](#).
2. Remove the hydraulic tube connector.



3. Remove the bolts and the slave cylinder.



4. Remove the drain tube.

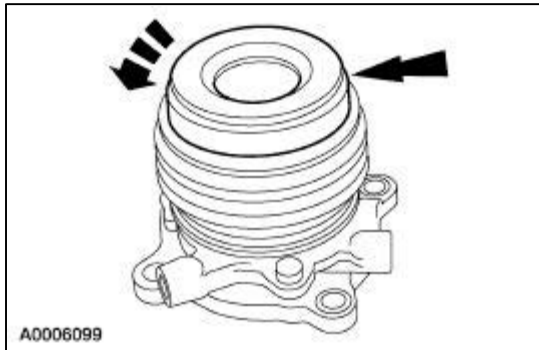


5. **⚠ CAUTION:** The clutch release hub and bearing is pre-lubricated and should not be cleaned with solvent. The clutch release hub and bearing are installed as an assembly. Do not disassemble for inspection.

Wipe oil and dirt off the clutch release hub and bearing.

6. Inspect the clutch release hub and bearing as follows:

- Rotate outer race while applying pressure. If bearing rotation is rough, install a new clutch release hub and bearing.
- Inspect for any surface scoring or burrs that may impede the sliding motion of the clutch release hub and bearing. Any scoring or burrs should be polished off with a fine grade of emery paper.



7. To install, reverse the removal procedure.

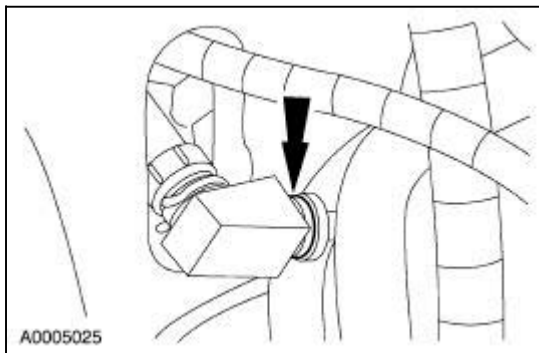
- Bleed the clutch hydraulic system. For additional information, refer to [Section 308-00](#).
-

Hydraulic Tubes

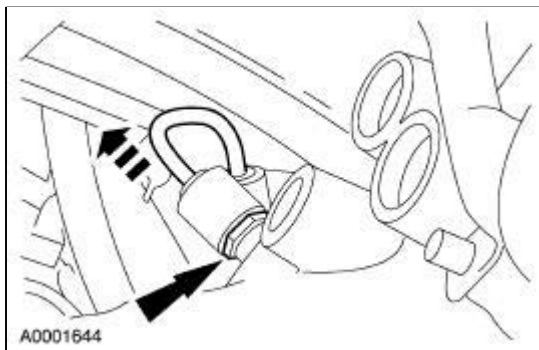
⚠ WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

⚠ CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled into a painted or plastic surface, immediately wash it with water.

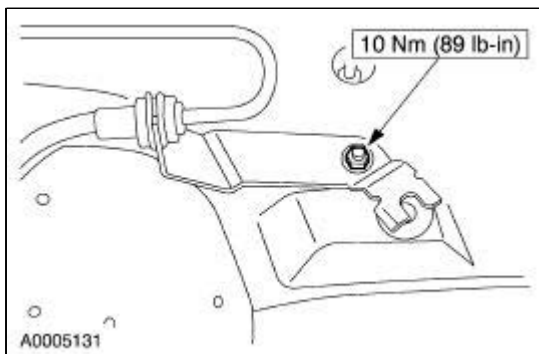
1. Remove the snap ring and tube from the clutch master cylinder connector.



2. Disconnect the clutch slave cylinder hydraulic line.



3. Remove the nut, bracket and hydraulic tube from the vehicle.



4. **NOTE:** Check the clutch slave cylinder port to make sure the old O-ring seal has been removed. Install a new O-ring seal.

To install, reverse the removal procedure.

- Bleed the system. For additional information, refer to Section 308-00.
-

General Specifications

Item	Specification
Premium Long Life Grease XG-1-K	ESA-M1C75-B

Torque Specifications

Description	Nm	lb-ft	lb-in
Transmission flexible joint bolts	85	63	—
Bellhousing bolts	47	35	—
Starter motor bolts - 4.0L	25	18	—
Transmission support bolts	55	41	—
Transmission pinion nut — Stage 1	170	125	—
Transmission pinion nut — Stage 3	120	89	—
Support insulator bolt	40	30	—
Vehicle speed sensor bolt	11	8	—
Transmission drain plug	50	37	—
Balance add on nuts	24	18	—
Driveshaft yoke lock nuts	90	66	—

Manual Transmission

The transmission consists of the following:

- A two part die cast aluminum housing
- Bevel cut gears that rotate on needle roller bearings
- An input shaft and output shaft that rotate on ball bearings
- A layshaft that rotates on roller bearings
- Selector shaft assemblies

The engine rotational torque is transmitted from the crankshaft through the clutch to the transmission input shaft, which then transmits drive to a layshaft and then the output shaft by utilizing an arrangement of gears. When reverse gear is selected, the direction of the output shaft is changed by an idler gear assembly.

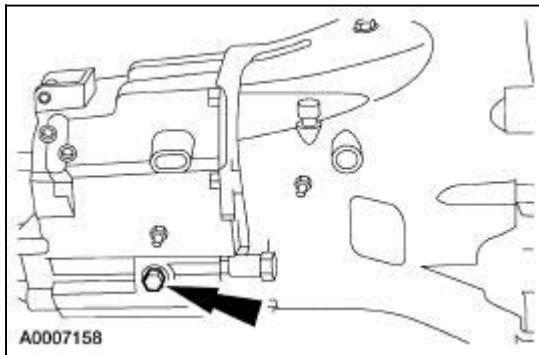
In neutral, none of the gears are connected to the input or output shaft through the relevant synchronizer unit. No torque is transmitted to the driveline.

Manual Transmission

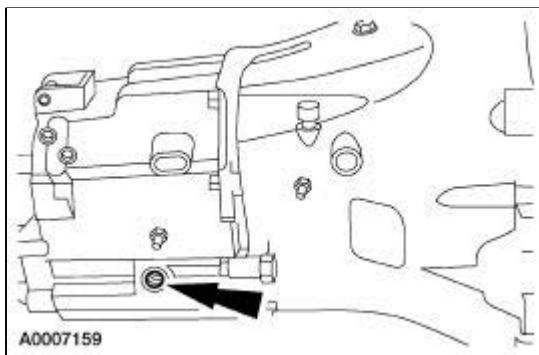
Refer to Section 308-00 .

Fill Procedure

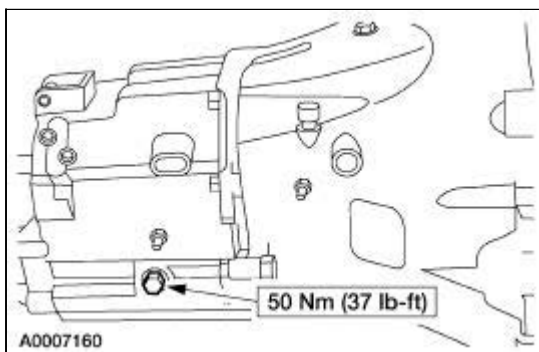
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the fill plug.



3. Fill the transmission to 0.5 mm (0.02 in) below the lower edge of the fill plug bore.



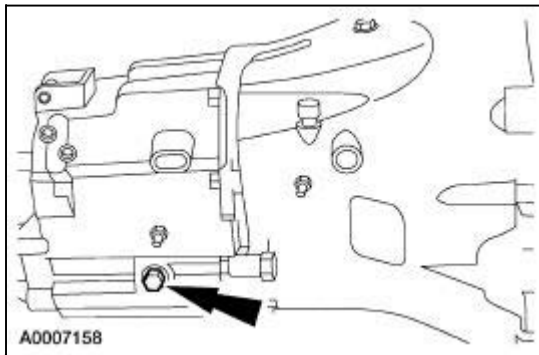
4. Install the fill plug.



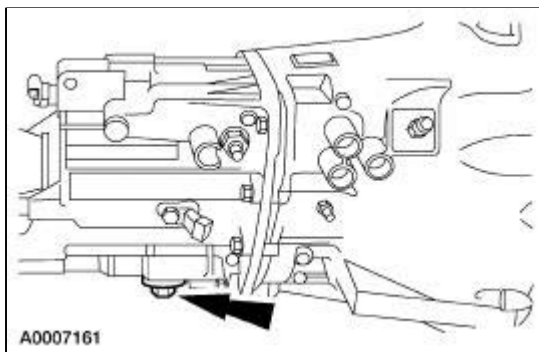
5. Lower the vehicle.

Drain Procedure

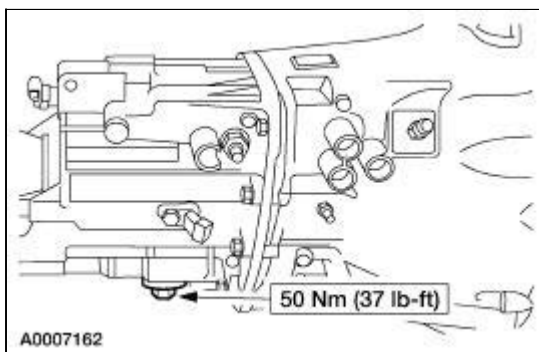
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the fill plug.



3. Remove the drain plug and drain fluid into a suitable container.



4. Install the drain plug.

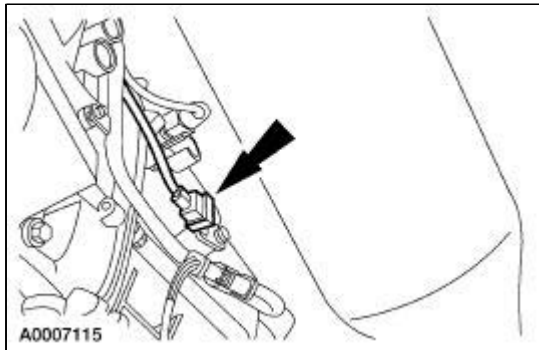


5. Fill the transmission as necessary. For additional information, refer to [Fill Procedure](#) in this section.

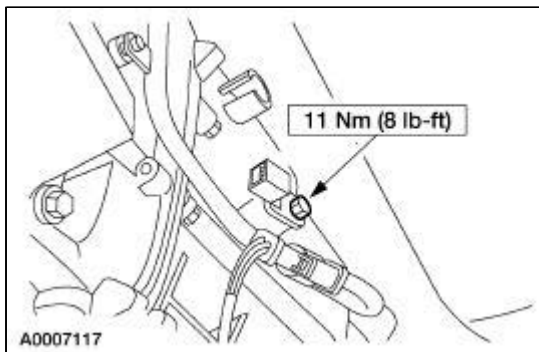
Vehicle Speed Sensor (VSS)

Removal and Installation

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Disconnect the vehicle speed sensor (VSS) electrical connector.



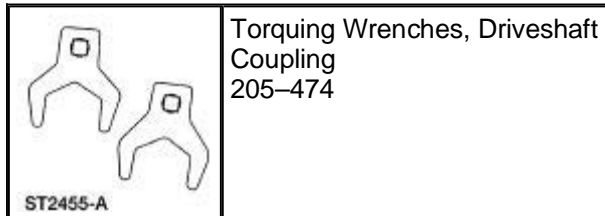
3. Remove the bolt and the VSS.



4. To install, reverse the removal procedure.
-

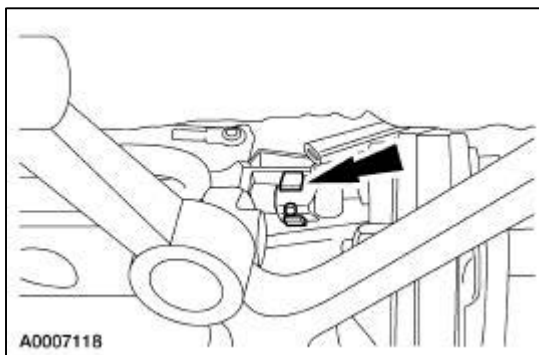
Seal —Selector Shaft

Special Tool(s)

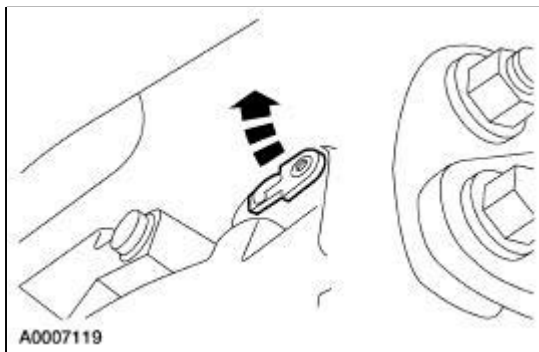


Removal

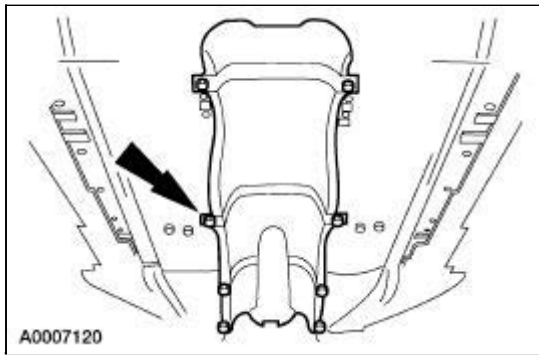
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Disconnect the selector rod.
 - Remove the selector rod locating pin.



3. Disconnect the stabilizer rod.
 - Remove the stabilizer rod locating pin.



4. Remove the intermediate muffler. For additional information, refer to [Section 309-00](#).
5. Remove the bolts and the center heat shield.



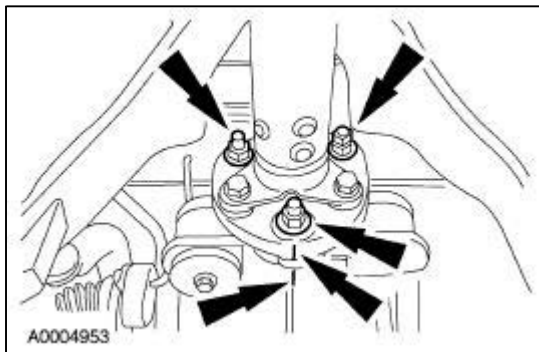
6.  **CAUTION:** The transmission flange bolts, nuts, and washers must be removed as matched sets and installed in the original location. The system balance add-on nuts (if equipped) must be installed in the original location.

 **CAUTION:** Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

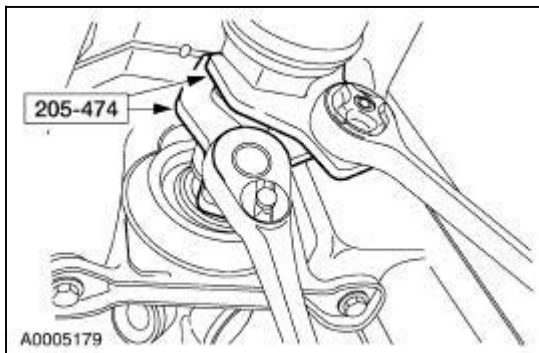
NOTE: Support the front section of the driveshaft.

Disconnect the transmission flexible joint.

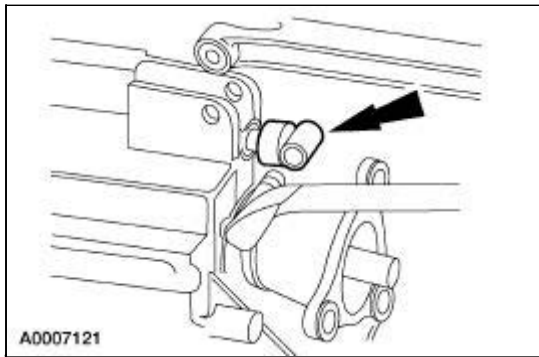
- Mark the position of the driveshaft in relation to the transmission flange.
- Mark the position of each nut and bolt in relation to the transmission flexible joint.



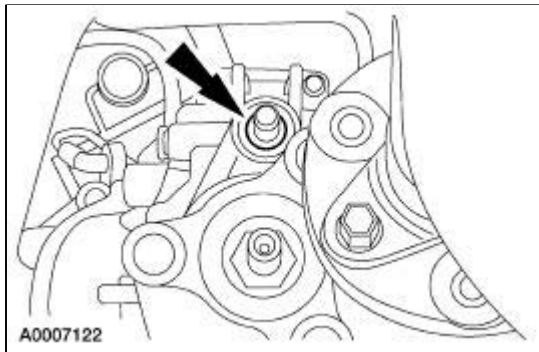
7. Shorten the length of the driveshaft.
- Using the special tool, loosen the driveshaft locknut and move the driveshaft front section towards the center bearing.



8. Remove the selector rod link.



9. Install a second oil seal over the existing seal.



Installation

1. Install the selector rod link.
2. **NOTE:** Install one gram of Premium Long Life Grease, XG-1-K or equivalent meeting Ford specifications ESA-M1C75-B, in the alignment bushing prior to installation.

Slide the driveshaft forward until the flexible coupling engages with the transmission flange.

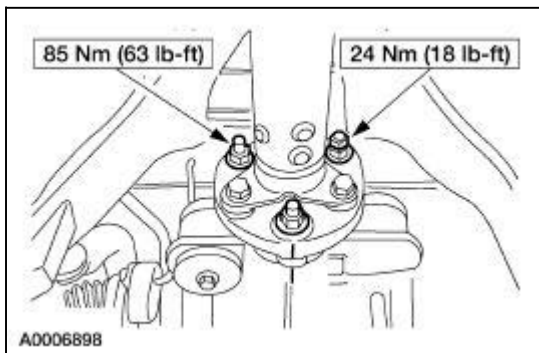
3. **⚠ CAUTION:** Make sure to match the transmission flange attaching bolts, nuts, washers, and balance add-on nuts (if equipped) in their original locations.



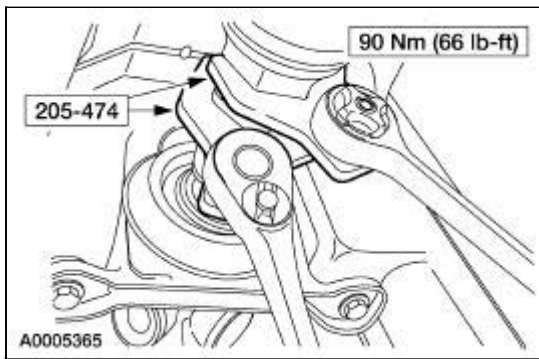
CAUTION: Tighten the transmission flange bolts and nuts with hand tools only.

NOTE: Align the driveshaft index matchmarks.

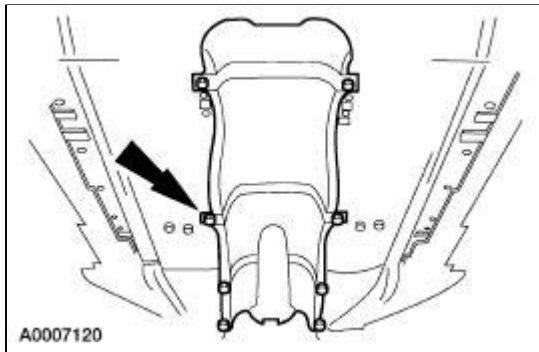
Install the flex coupling bolts, washers and attaching nuts.



4. Using the special tools, tighten the driveshaft yoke locking nuts.



5. Install the bolts and the center heat shield.



6. Install the intermediate muffler.
 7. Install the stabilizer rod and stabilizer rod pin.
 8. Install the selector rod and the selector rod pin.
 9. Lower the vehicle.
-

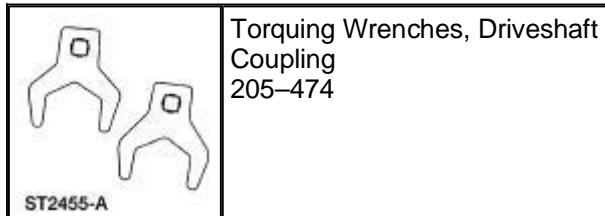
Seal —Input Shaft

Removal and Installation

1. Remove the manual transmission. For additional information, refer to Transmission in this section.
 2. Remove the clutch slave cylinder. For additional information, refer to Section 308-02.
 3. Remove the input shaft seal.
 4. To install, reverse the removal procedure.
-

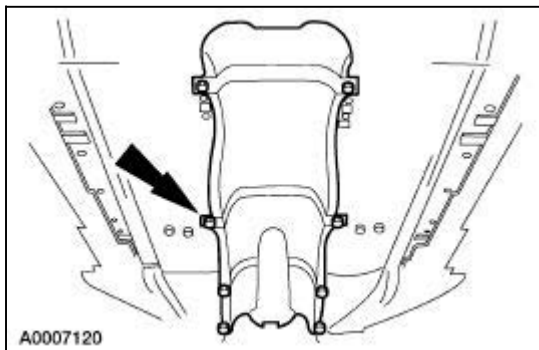
Seal —Output Shaft


Special Tool(s)




Removal

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the intermediate muffler. For additional information, refer to [Section 309-00](#).
3. Remove the bolts and the center heat shield.



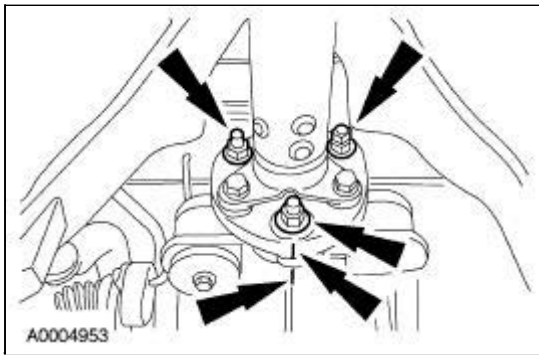
4.  **CAUTION:** The transmission flange bolts, nuts, and washers must be removed as matched sets and installed in the original locations. The system balance add-on nuts must be installed in the original locations.

 **CAUTION:** Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

NOTE: Make sure to disconnect the coupling from the transmission flange only.

Detach the transmission flexible joint.

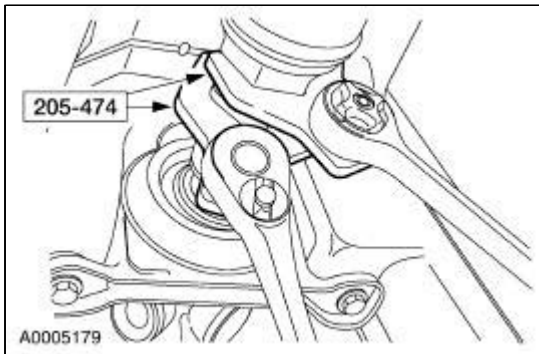
- Using different color paint markers, place index matchmarks on the transmission flange, driveshaft flexible coupling and the transmission bolts, nuts, washers and add-on nuts, so the driveshaft and the transmission flange can be aligned correctly during installation.



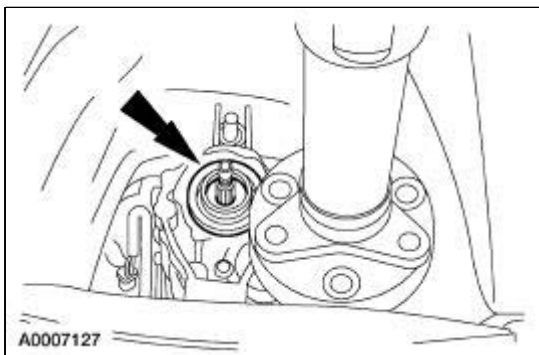
5. **NOTE:** Support the front section of the driveshaft.

Shorten the length of the driveshaft.

- Using the special tool, loosen the driveshaft locknut and move the driveshaft front section towards the center bearing.

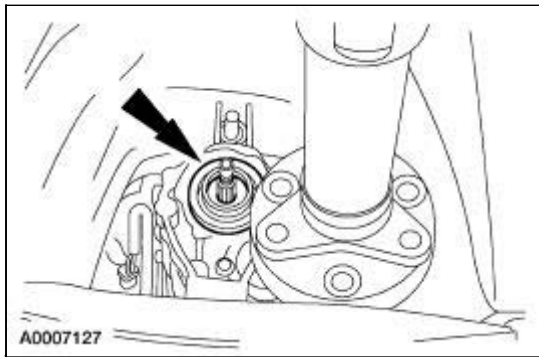


6. Remove the output shaft flange nut.
7. Remove the output shaft flange.
8. Remove the output shaft oil seal.




Installation

1. Install the output shaft oil seal.



2. Install the output shaft flange.
 - Stage 1: tighten the nut to 170 Nm (125 lb-ft).
 - Stage 2: loosen the nut by 1/2 turn.
 - Stage 3: tighten the nut to 120 Nm (89 lb-ft).
3. Install the output shaft nut.
4. **NOTE:** Install one gram of Premium Long Life Grease, XG-1-K or equivalent meeting Ford specifications ESA-M1C75-B, in the alignment bushing prior to installation.

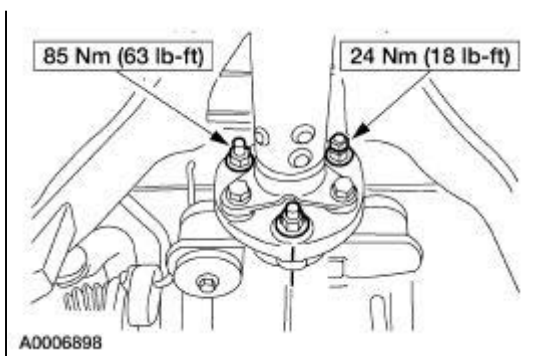
Slide the driveshaft forward until the flexible coupling engages the transmission flange.

5.  **CAUTION: Make sure to match the bolts, washers, attaching nuts and balance nuts (if equipped) to their original locations.**

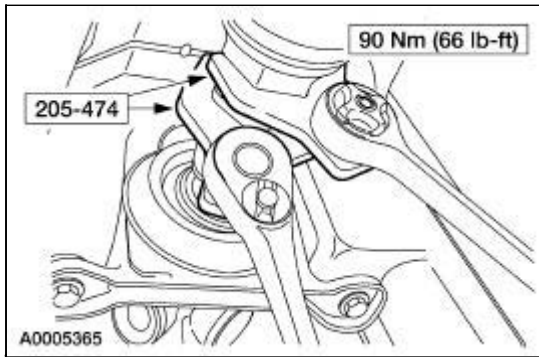
 **CAUTION: Tighten the transmission flange bolts and nuts with hand tools only.**

NOTE: Align the driveshaft index matchmarks.

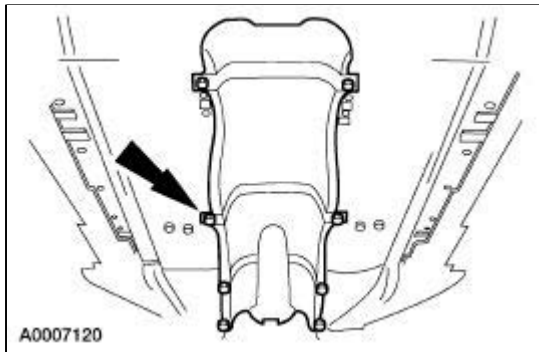
Install the flex coupling bolts, washers and attaching nuts.



6. Using the special tools, tighten the driveshaft yoke nuts.



7. Install the bolts and the center heat shield.

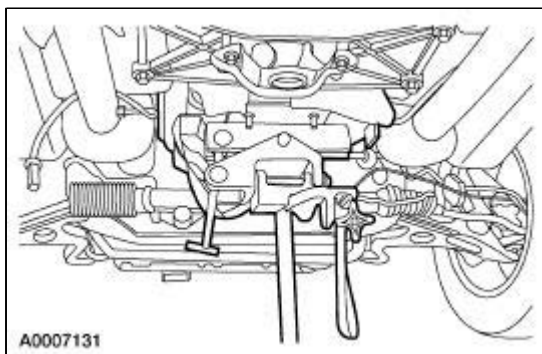


8. Lower the vehicle.
-

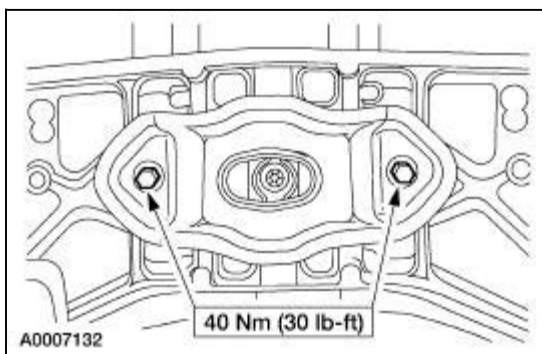
Support Insulator

Removal and Installation

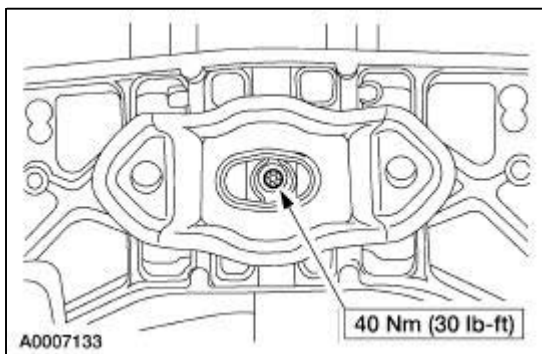
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Position the transmission jack and install a holding strap around the transmission.



3. Remove the transmission support insulator.



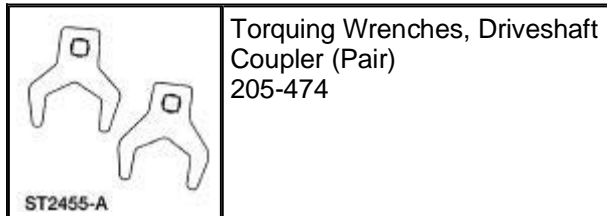
4. Remove the transmission support.



5. To install, reverse the removal procedure.

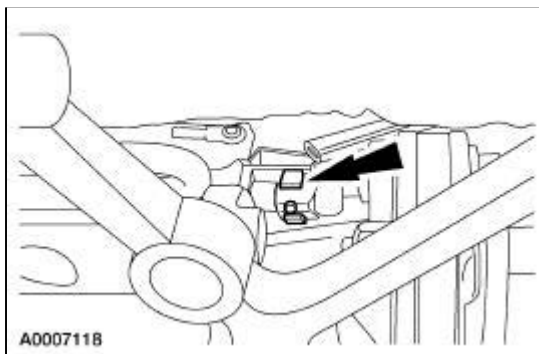
Transmission

Special Tool(s)

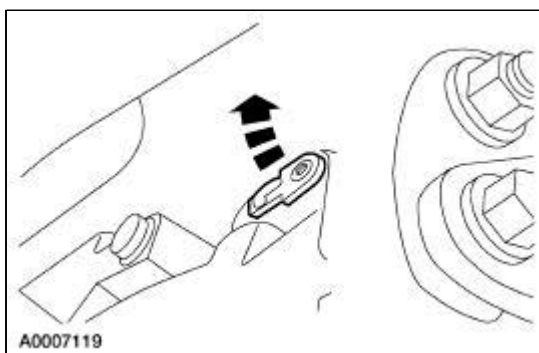


Removal

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Remove the starter motor. For additional information, refer to [Section 303-06](#).
4. Disconnect the selector rod.
 - Remove the selector rod locating pin.

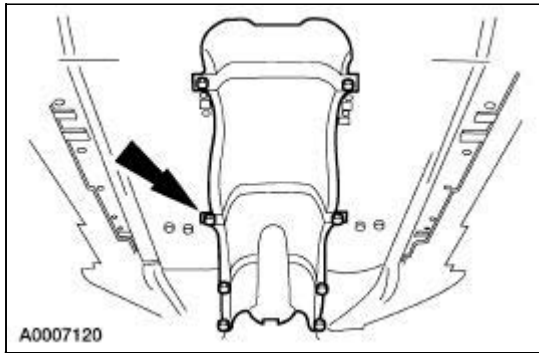


5. Disconnect the stabilizer rod.
 - Remove the stabilizer rod locating pin.




6. Remove the intermediate muffler. For additional information, refer to [Section 309-00](#).

7. Remove the bolts and the center heat shield.



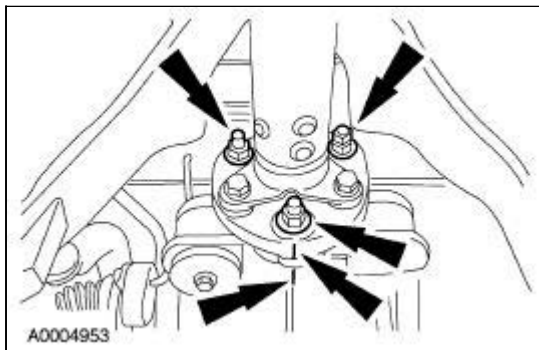
8.  **CAUTION:** The transmission flange bolts, nuts and washers must be removed as matched sets and installed in their original location. The system balance add-on nuts (if equipped) must be installed in their original location.

 **CAUTION:** Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

 **CAUTION:** Support the front section of the driveshaft.

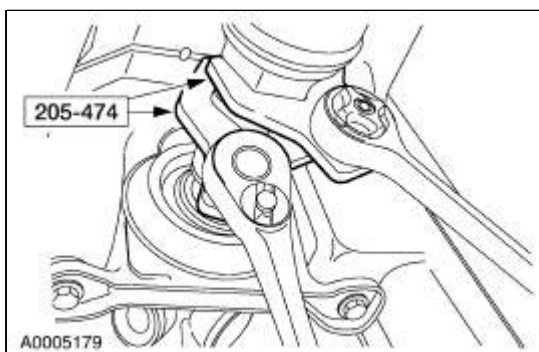
Disconnect the transmission flexible joint.

- Using different color paint markers, place index matchmarks on the transmission flange, driveshaft flexible coupling and the transmission bolts, nuts, washer and system balance and on nuts so the driveshaft and transmission flange may be correctly aligned during installation.

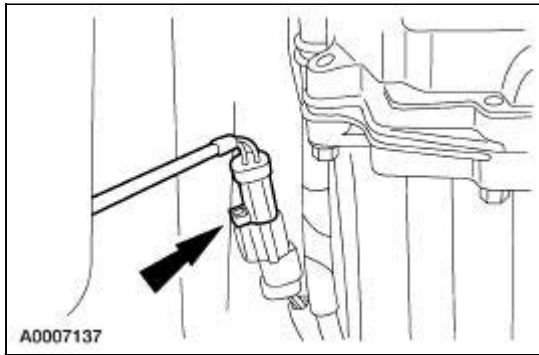


9. Shorten the length of the driveshaft.

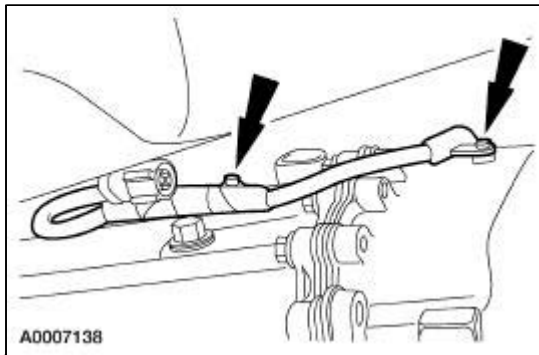
- Using the special tools, loosen the driveshaft yoke locknut and move the driveshaft front section towards the center bearing.



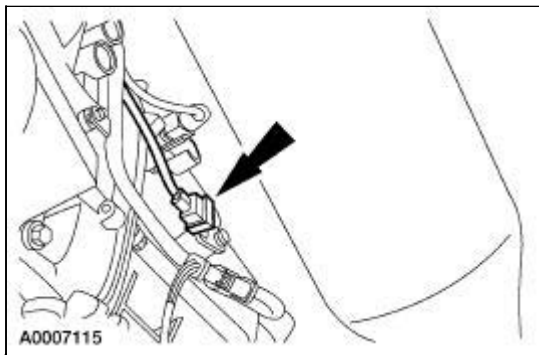
10. Disconnect the right-hand bank catalyst monitor sensor electrical connector.



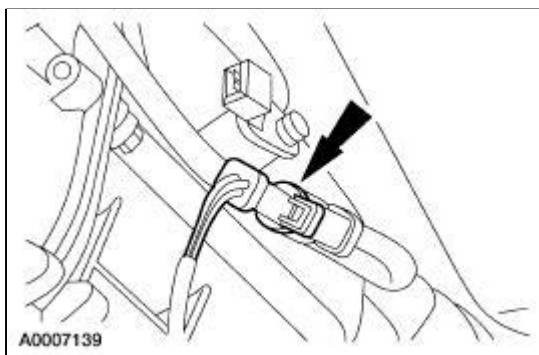
11. Remove the electrical wiring harness from the transmission.



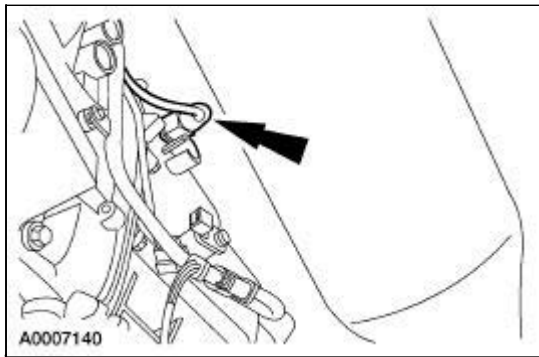
12. Disconnect the vehicle speed sensor electrical connector.



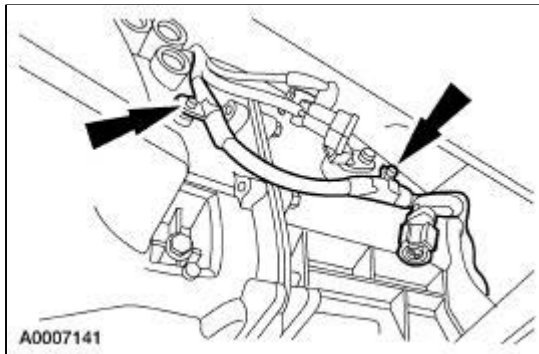
13. Disconnect the left-hand bank catalyst monitor sensor electrical connector.



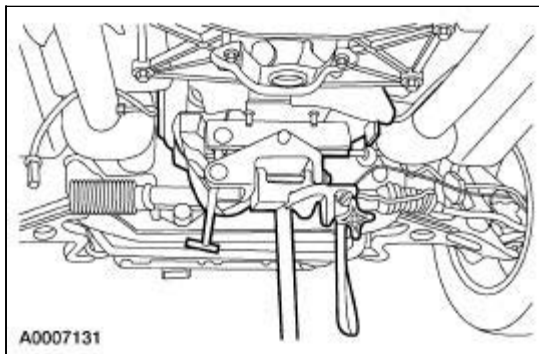
14. Disconnect the reverse light switch electrical connector.



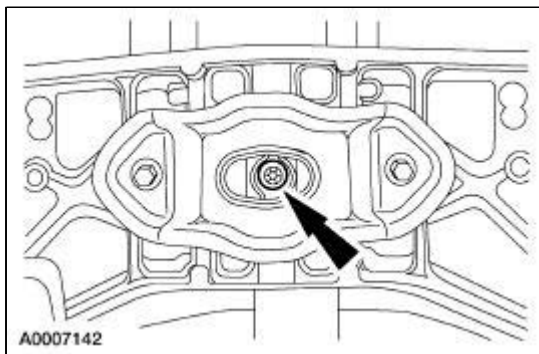
15. Detach the electrical wiring harness from the transmission.



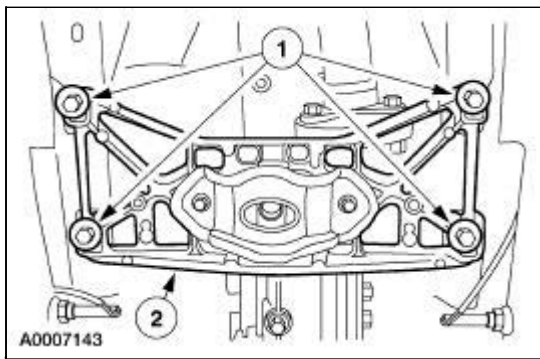
16. Position the transmission jack and install a holding strap around the transmission.



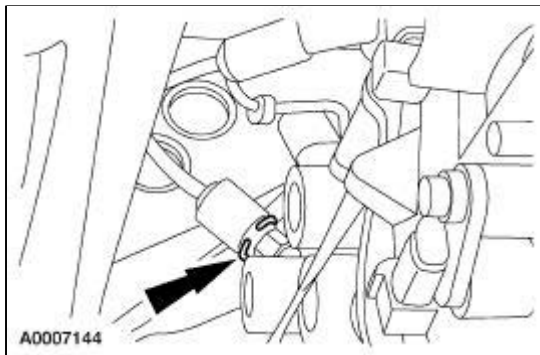
17. Remove the support insulator.



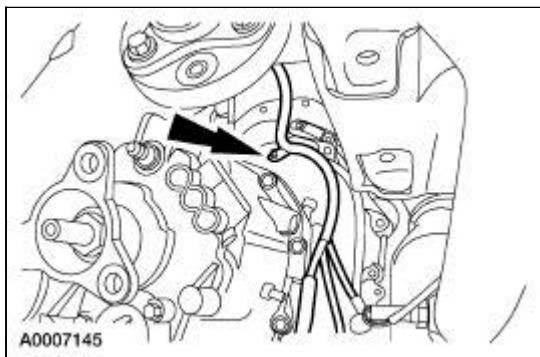
18. Remove the transmission support.
1. Remove the bolts.
 2. Remove the support.



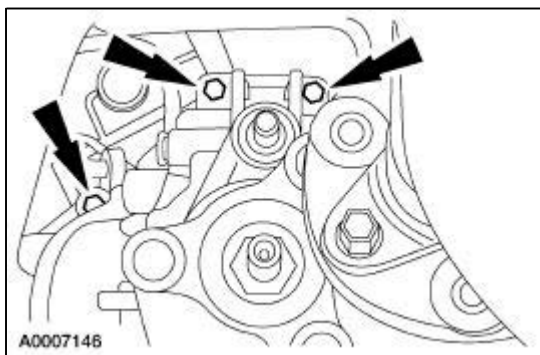
19. Partially lower the transmission.
20. Disconnect the slave cylinder supply tube.
 - Remove the slave cylinder supply tube retaining clip.
 - Plug the hose to prevent loss of fluid.



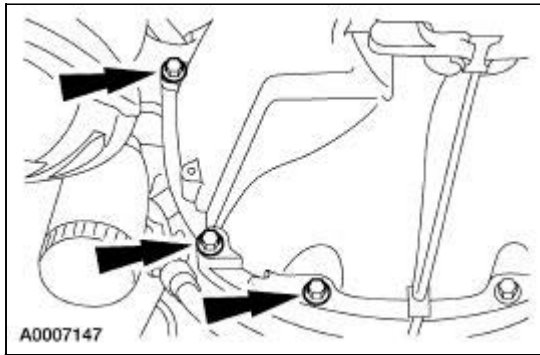
21. Remove the transmission wiring electrical harness from the transmission.



22. Remove the bellhousing bolts.

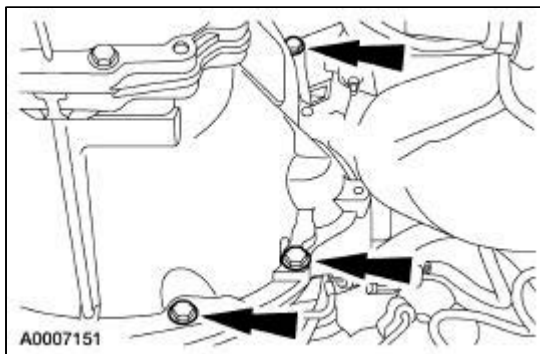


23. Remove the bellhousing bolts.



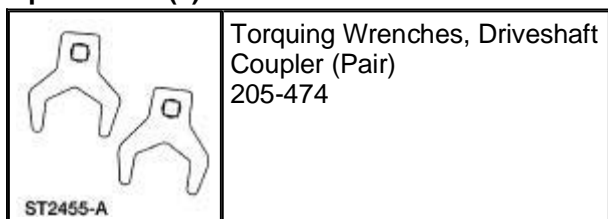
24. Remove the transmission.

- Remove the remaining bellhousing bolts.

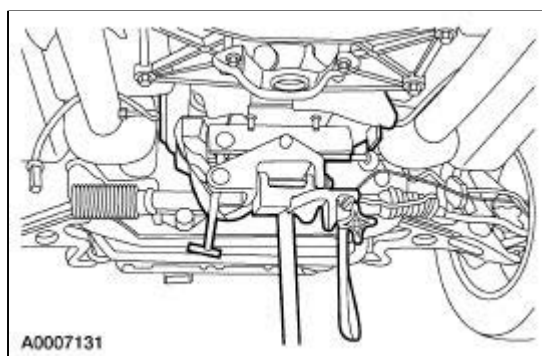


Transmission

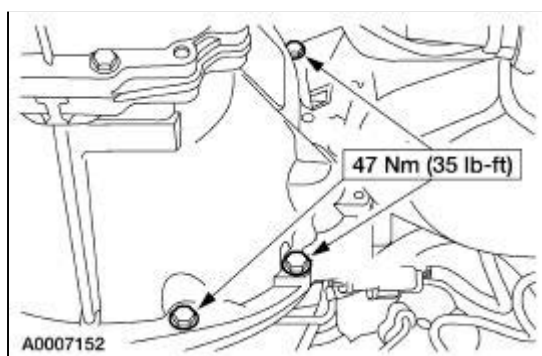
Special Tool(s)



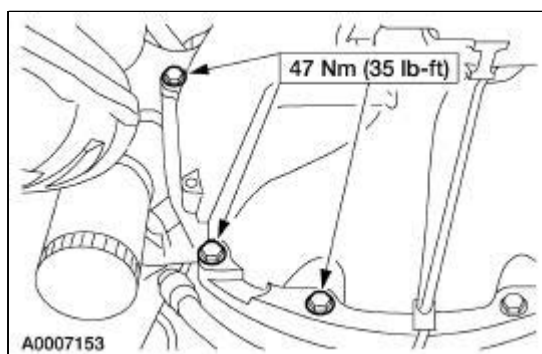
1. Position the transmission to the engine using the transmission jack.



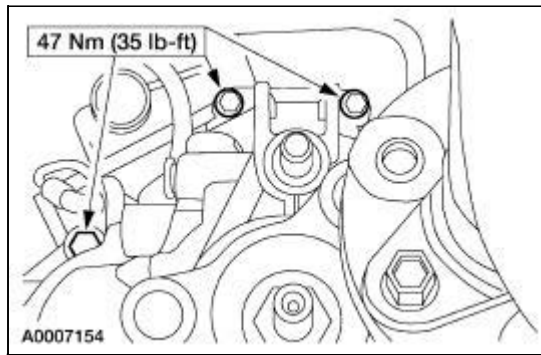
2. Install the bellhousing bolts.



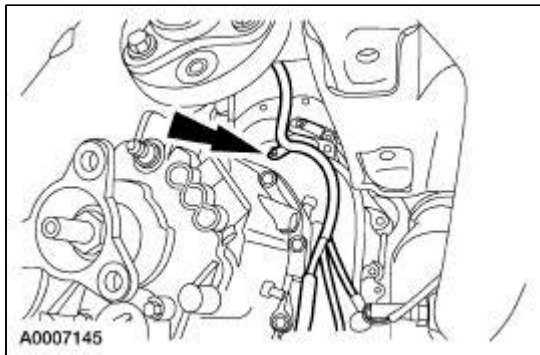
3. Install the bellhousing bolts.



4. Install the remaining bellhousing bolts.

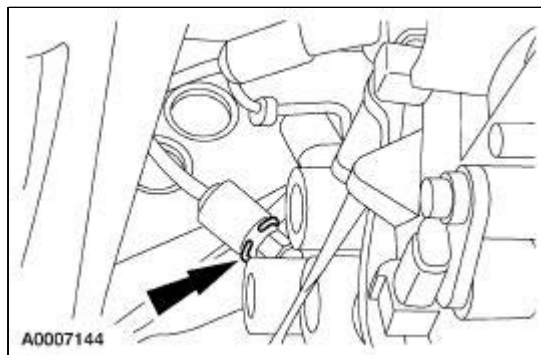


5. Attach the transmission wiring harness to the transmission.

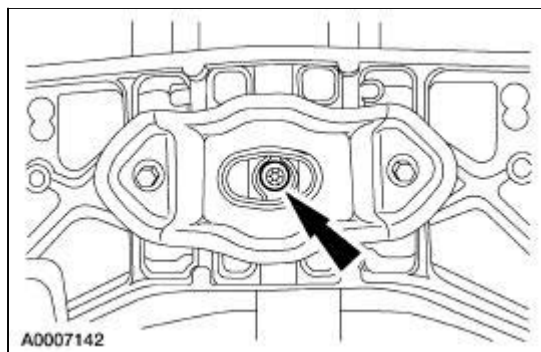


6. **NOTE:** Install a new O-ring seal and clip to the supply tube.

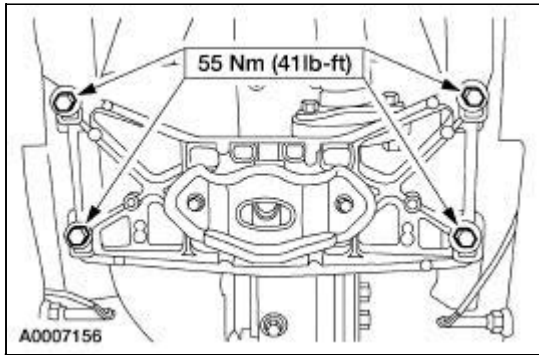
Connect the slave cylinder supply tube.



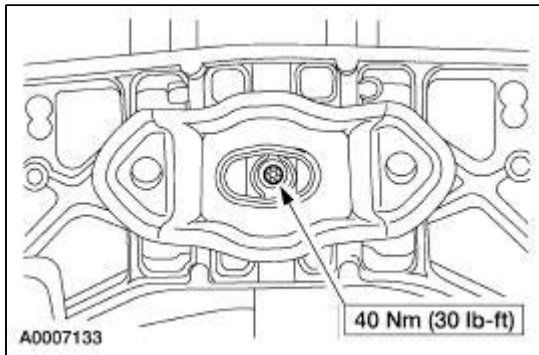
7. Loosely install the transmission support insulator.



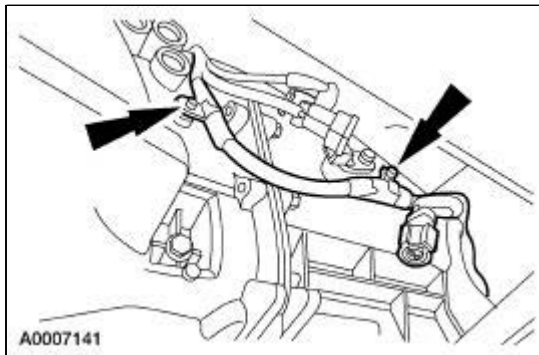
8. Install the transmission support.



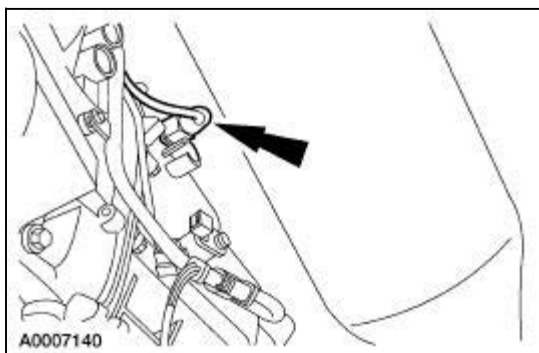
9. Tighten the transmission support insulator center bolt.



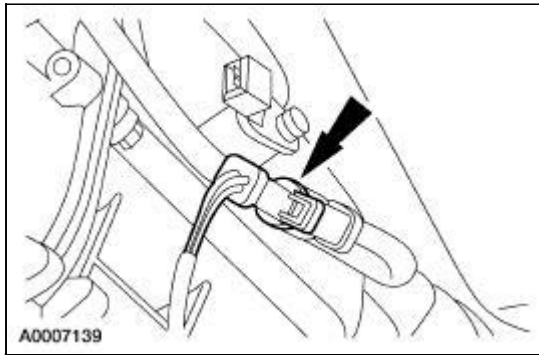
10. Remove the transmission jack.
11. Attach the electrical wiring harness to the transmission.



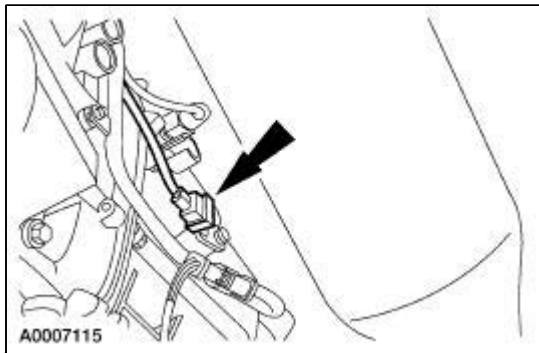
12. Connect the reverse switch electrical connector.



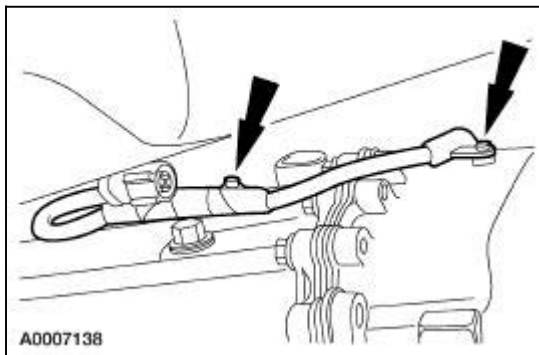
13. Connect the left-hand catalyst monitor sensor electrical connector.



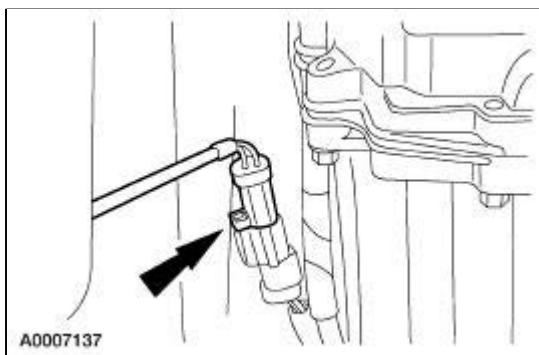
14. Connect the speed sensor electrical connector.



15. Attach the right-hand electrical wiring harness to the transmission.




16. Connect the right-hand catalyst sensor electrical connector.



17. **NOTE:** Install one gram of Premium Long Life Grease, XG-1-K or equivalent meeting Ford specifications ESA-M1C75-B, in the alignment bushing prior to installation.

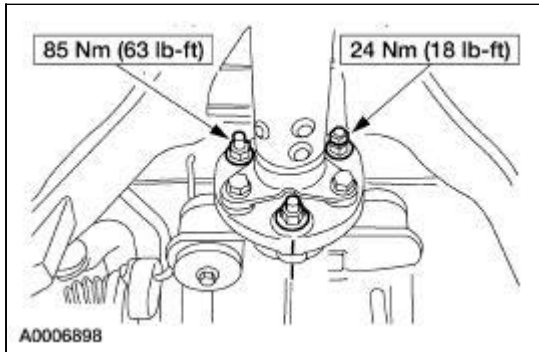
Slide the driveshaft forward until the flexible coupling engages with the transmission flange.

18.  **CAUTION: Make sure to match the bolts, washers, attaching nuts and balance add-on nuts (if equipped) to their original location.**

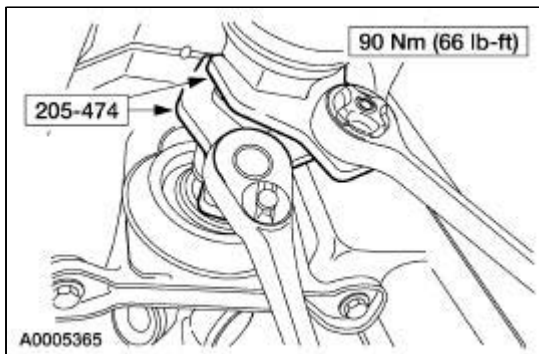
 **CAUTION: Tighten the transmission flange bolts and nuts with hand tools only.**

NOTE: Align the driveshaft index matchmarks.

Install the transmission flex coupling bolts, washers and attaching nuts.



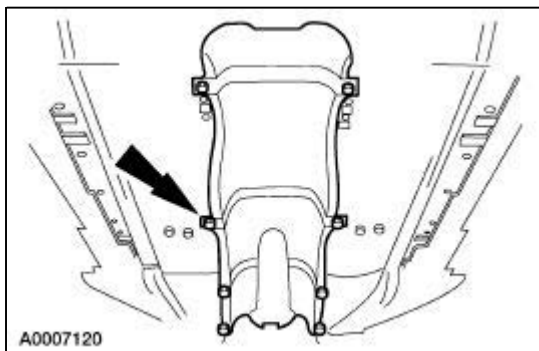
19. Using the special tools, tighten the driveshaft yoke locknuts.



20. Install the stabilizer rod and stabilizer rod pin

21. Install the selector rod and selector rod pin.

22. Install the bolts and the center heat shield.



23. Install the intermediate muffler.

24. Install the starter motor. For additional information, refer to [Section 303-06](#) .
 25. Bleed the clutch slave cylinder hydraulic system. For addition information, refer to [Section 308-00](#) .
 26. Lower the vehicle.
 27. Reconnect the battery ground cable.
-

General Specifications

Item	Specification
Silicone Lubricant F5AZ-19553	ESR-M13P4-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Three way catalytic converter to exhaust manifold nuts	40	30	—
Muffler and resonator assembly nuts	47	35	—
Heat shield bolts and nuts	10	—	89
Worm Clamp	7	—	62
Muffler brace bolts	25	18	—62

Exhaust System



WARNING: The normal operating temperature of the exhaust system is very high. Never attempt to repair any part of the system until it has cooled. Be especially careful when working around the three way catalytic converter. The temperature of the three way catalytic converter rises to a high level after only a few minutes of engine operation. Failure to follow these instructions may result in personal injury.



CAUTION: When repairing the exhaust system or removing exhaust components, disconnect all heated oxygen sensors (HO2S) at the wiring connectors to prevent damage to the heated oxygen sensors and wiring harness. For additional information, refer to [Section 303-14](#) for the location of the heated oxygen sensors.

The exhaust system:

- contains dual three way catalytic converters.
 - has a crossover pipe downstream of the three way catalytic converters.
 - has two upstream heated oxygen sensors mounted before the three way catalytic converters.
 - the production muffler and tailpipe assembly is a one-piece design.
-

Exhaust System

Inspection and Verification

1. Verify the customer concern by running the engine at 2000 rpm or by road testing the vehicle.
2. Visually inspect the components of the exhaust system and the related controls that may affect exhaust gas quality or cause a loss of power.
3. Visually inspect for obvious signs of mechanical and electrical damage. For additional information, refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Leaking fuel injector tips ● Damaged air inlet passages ● Inoperative exhaust gas recirculation (EGR) valve ● Exhaust pipe pinched, crushed ● Damaged, loose vacuum hoses ● Incorrect idle speed ● Dirty engine air cleaner ● Damaged catalytic converter 	<ul style="list-style-type: none"> ● Loose heated oxygen sensors ● Misrouted, damaged wiring ● Damaged, loose connectors ● Damaged ignition system

4. Exercise the wiring and connectors of the components for obvious problems due to looseness, corrosion, or other damage. This must be done while the engine is fully warmed and the system controls are activated.
5. Check the vacuum lines and connections for looseness, pinching, leakage, splitting, blockage, or other damage.
6. If a vacuum line or orifice (restrictor) blockage is suspected, correct the cause before proceeding to the next step.
7. If the concern is not visually evident, determine the symptom and proceed to the Symptom Chart.

Symptom Chart


Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Noisy or Leaking Exhaust 	<ul style="list-style-type: none"> ● Exhaust leak. ● Misaligned exhaust. ● Loose clamps. ● Restricted exhaust. ● Loose or missing heated oxygen sensors (HO2S). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.
<ul style="list-style-type: none"> ● Loss of Power 	<ul style="list-style-type: none"> ● Kinked or damaged exhaust 	<ul style="list-style-type: none"> ● GO to Pinpoint





	pipe. ● Clogged catalytic converter. ● Foreign object in exhaust pipe.	<u>Test B.</u>
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Pinpoint Tests

PINPOINT TEST A: NOISY OR LEAKING EXHAUST

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK THE CLAMPS AND BRACKETS	
<div style="border: 1px solid black; padding: 5px; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">1</div>  </div>	<div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">2</div> Inspect the exhaust system for loose or broken clamps and brackets. <ul style="list-style-type: none"> ● Are the clamps and brackets OK? <p>→ Yes GO to <u>A2</u>.</p> <p>→ No REPAIR or INSTALL new clamps or brackets. TEST the system for normal operation.</p> </div>
A2 CHECK THE EXHAUST COMPONENTS	
	<div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">1</div> Inspect the exhaust components for punctures, split seams, or incorrect welds. <ul style="list-style-type: none"> ● Are the exhaust components OK? <p>→ Yes GO to <u>A3</u>.</p> <p>→ No INSTALL new exhaust components. TEST the system for normal operation.</p> </div>
A3 CHECK THE EXHAUST MANIFOLD	
	<div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">1</div> Inspect the exhaust manifold for loose fasteners or cracks. <ul style="list-style-type: none"> ● Is the exhaust manifold OK? <p>→ Yes GO to <u>Pinpoint Test B</u>.</p> <p>→ No TIGHTEN loose fasteners or INSTALL a new exhaust manifold. Refer to <u>Section 303-01A</u> or <u>Section 303-01B</u>. TEST the system for normal operation.</p> </div>

PINPOINT TEST B: LOSS OF POWER

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CARRY OUT A VACUUM TEST	
<p>1</p> 	<p>2 Carry out an intake manifold vacuum test. Refer to Component Tests in Section 303-00 .</p> <ul style="list-style-type: none"> ● Is the exhaust system OK? <p>→ Yes REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the engine.</p> <p>→ No GO to B2 .</p>
B2 CARRY OUT A VACUUM TEST - EXHAUST SYSTEM DISCONNECTED AT THE EXHAUST MANIFOLD	
<p>1</p>  <p>3</p> 	<p>2 Disconnect the exhaust system at the exhaust manifold.</p> <p>4 Carry out an intake manifold vacuum test. Refer to Component Tests in Section 303-00 .</p> <ul style="list-style-type: none"> ● Is the exhaust system OK? <p>→ Yes GO to B3 .</p> <p>→ No GO to B4 .</p>
B3 CARRY OUT A VACUUM TEST - EXHAUST SYSTEM DISCONNECTED AT THE MUFFLER	
<p>1</p> 	<p>2 Reconnect the exhaust system at the exhaust manifold.</p> <p>3 Disconnect the exhaust system at the muffler.</p>

4



5 Carry out an intake manifold vacuum test. Refer to Component Tests in [Section 303-00](#).

● **Is the exhaust system OK?**

→ **Yes**
INSTALL a new muffler and tailpipe. Refer to [Muffler](#) in this section. TEST the system for normal operation.

→ **No**
INSTALL a new three way catalytic converter. For additional information, refer to [Three Way Catalytic Converter \(TWC\)](#) in this section. TEST the system for normal operation.

B4 CHECK THE EXHAUST MANIFOLD

1



2 Connect the exhaust system at the muffler. Refer to [Muffler](#) in this section.

3 Remove the exhaust manifold. Refer to [Section 303-01A](#) or [Section 303-01B](#).

4 Inspect the ports for casting flash.

● **Is there casting flash present?**

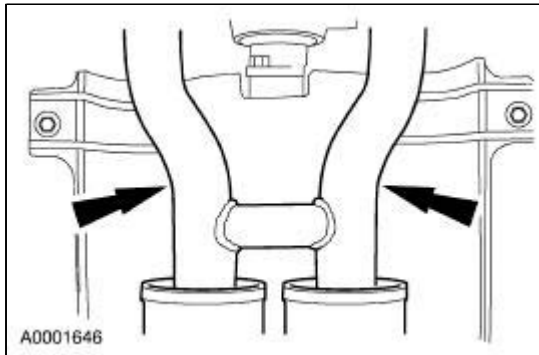
→ **Yes**
REMOVE the casting flash or INSTALL a new exhaust manifold. Refer to [Section 303-01A](#) or [Section 303-01B](#). TEST the system for normal operation.

→ **No**
REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the engine.

Muffler

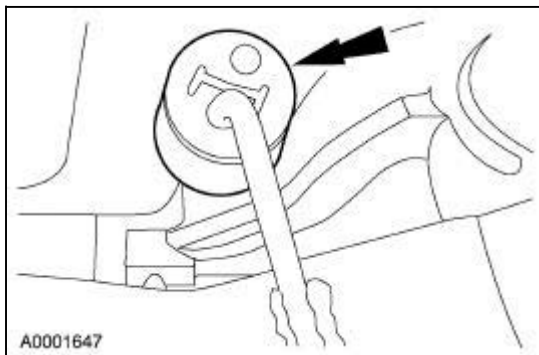
Removal and Installation

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Support the exhaust pipes at the rear of the resonators.

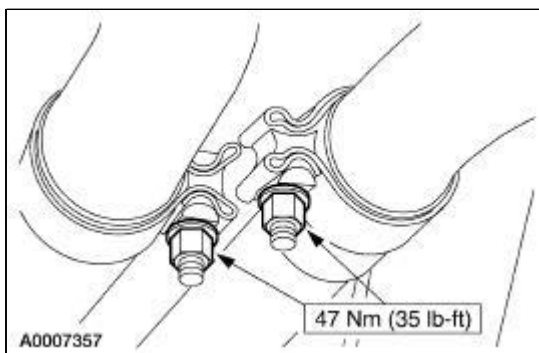


3. **NOTE:** The exhaust hanger bracket insulators can be reused if they show no signs of damage. Lubricate before removal with Silicone Lubricant F5AZ-19553-AA meeting Ford specification ESR-M13P4-A or equivalent.

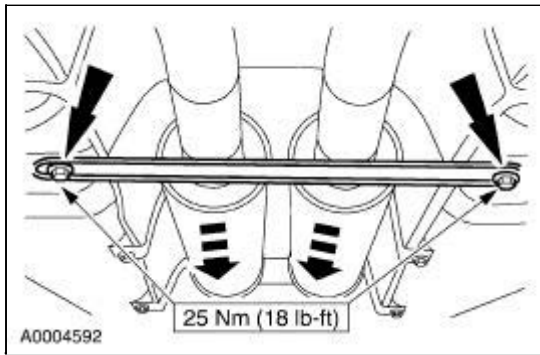
Remove the exhaust hanger insulators (5F262).



4. Remove the nuts.



5. Remove the bolts, the brace and the mufflers (5230).

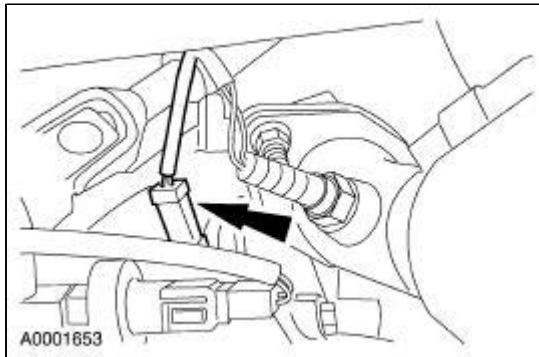


6. To install, reverse the removal procedure.

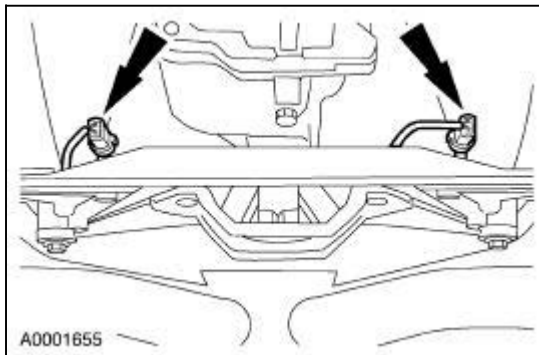
Three Way Catalytic Converter (TWC)

Removal and Installation

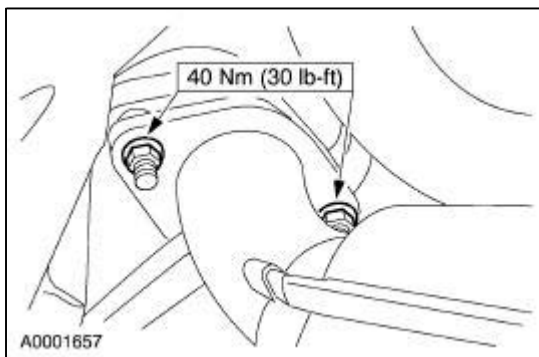
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Disconnect the two HO2S connectors.



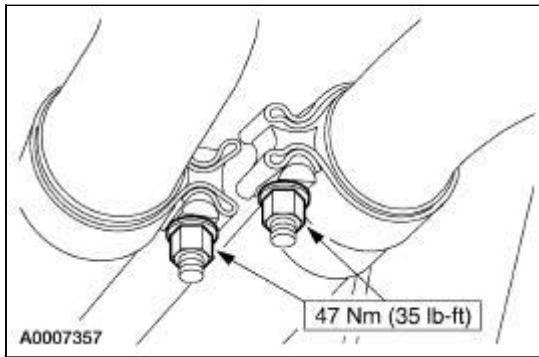
3. Disconnect the two catalyst monitor connectors.



4. Remove the four nuts.



5. Remove the nuts and the three way catalytic converter.



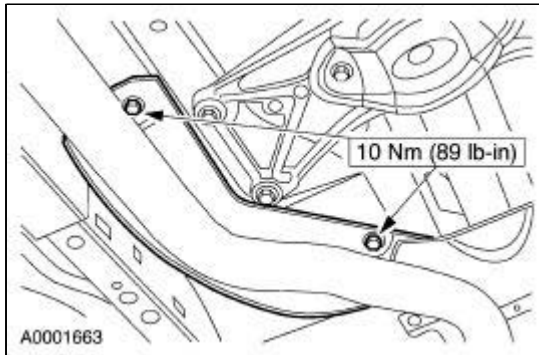
6. Transfer the two HO2S sensors and the two catalyst monitors if a new TWC is being installed.
 - Apply High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA or equivalent meeting Ford specification ESE-M12A4-A to the HO2S sensor and catalyst monitor threads.

 7. To install, reverse the removal procedure.
-

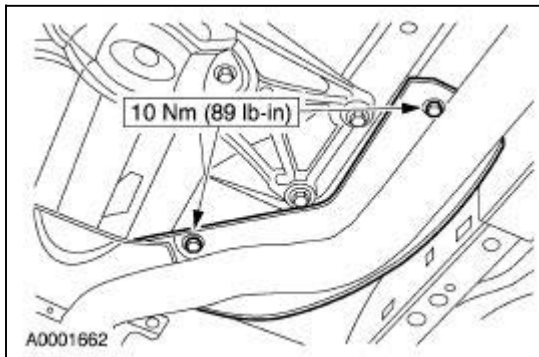
Heat Shield —Front

Removal and Installation

1. Raise the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the bolts and the LH heat shield.



3. Remove the bolts and the RH heat shield.

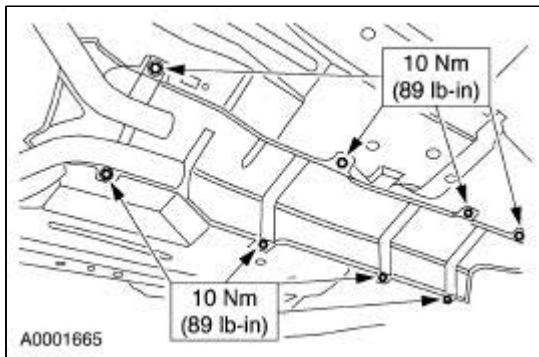


4. To install, reverse the removal procedure.

Heat Shield —Underbody

Removal and Installation

1. Remove the muffler (5230). For additional information, refer to [Muffler](#) in this section.
2. Remove the bolts, the nuts and the heat shield.

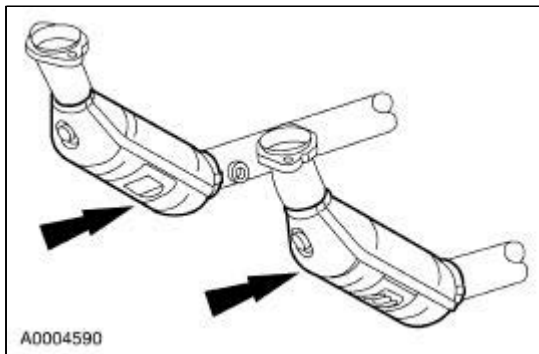


3. To install, reverse the removal procedure.
-

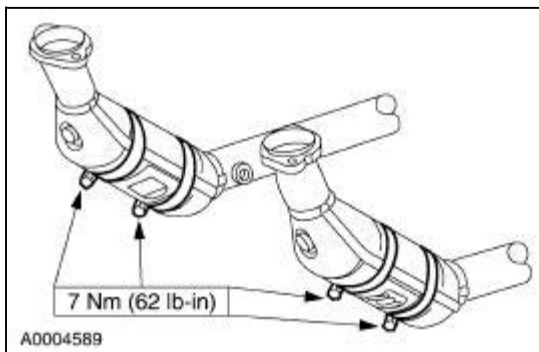
Heat Shield —Three Way Catalytic Converter

Removal

1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Inspect the catalytic converters for loose or missing heat shields.



3. Install worm clamps for heat shields that are loose.



4. If the heat shields are missing, install new heat shields. If new heat shields are not available, install a new catalytic converter. For additional information, refer to [Three Way Catalytic Converter \(TWC\)](#).
5. Lower the vehicle.

General Specifications

Item	Specification
Fuel tank capacity	68 liters (18 gal.)
Engine running fuel pressure	207-308 kPa (30-65 psi)
Key on, engine off fuel pressure	207-380 kPa (30-65 psi)
SAE 5W30 Motor Oil XO-5W30-QSP	WSS-M2C153-G

Fuel System

The vehicle:

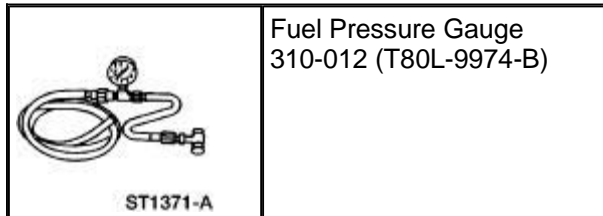
- is equipped with a multiport fuel injection (MFI) system.
 - uses separately controlled fuel injectors (9F593) mounted to the intake manifold for each cylinder.
 - fuel injectors are supplied with pressurized fuel from the fuel delivery module (9H307) through the jet pump transfer module, through the fuel injection supply manifold (9D280).
 - fuel injection supply manifold is controlled by the electronic fuel delivery module which is enabled by the powertrain control module (PCM) (12A650).
 - uses an electronic returnless fuel system.
 - has a dual-container (saddle type) fuel tank (9002), each half equipped with a fuel level sensor (9275).
 - has a jet pump transfer module (9275) in the left fuel tank half to supply fuel to the right, which contains the fuel delivery module (9H307) that supplies fuel under pressure to the fuel injection supply manifold.
 - has an inertia fuel shutoff (IFS) switch (9341), located behind the driver side left foot kick panel, which shuts off the fuel in the event of collision.
 - has a fuel system filter (9155), located behind the left front wheel well splash shield.
-


Fuel System


Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Pressure Relief

Special Tool(s)

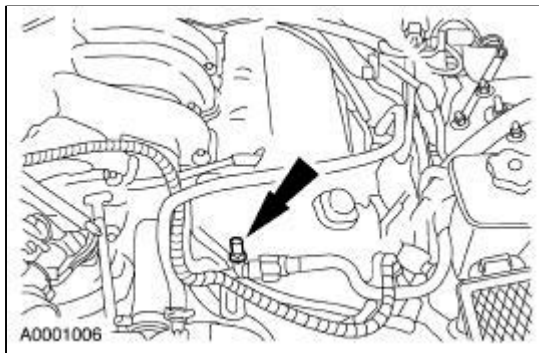


 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

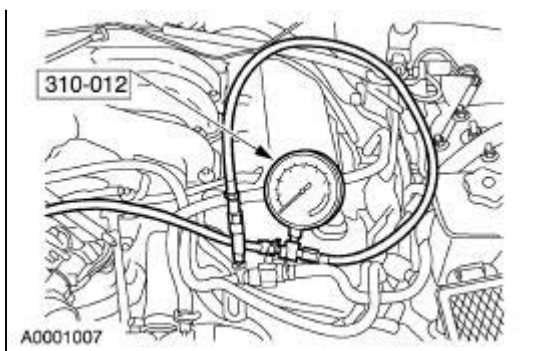
 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

1. **NOTE:** 3.0L shown, 3.9L similar.


Remove the Schrader valve cap and install the special tool.



2. Slowly open the manual valve on the special tool and relieve the fuel pressure.
 - This will drain some fuel out of the system.



Draining

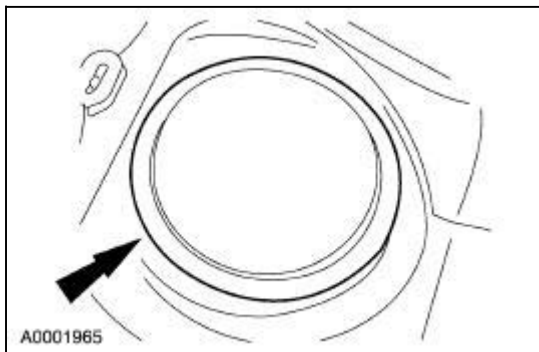
 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.


NOTE: It will be necessary to adapt fuel line connector, part number XW4Z-9B376-AA, to the Fuel Storage Tanker hose to accomplish this draining procedure.

1. **NOTE:** When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 miles) or more to relearn the strategy.

Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).

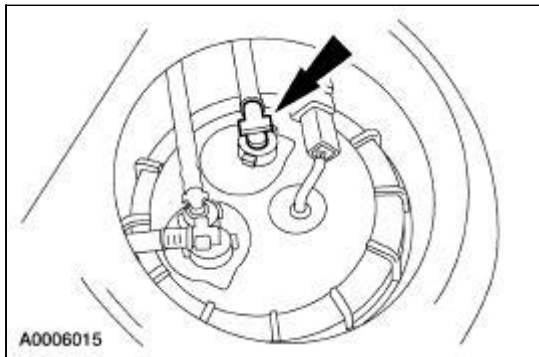
2. Relieve the fuel pressure. For additional information, refer to [Pressure Relief](#) in this section.
3. Remove the rear seat bottom and any insulation padding covering the fuel module access cover. For additional information, refer to [Section 501-10](#).
4. Remove the fuel delivery module (FDM) and jet pump module access covers.



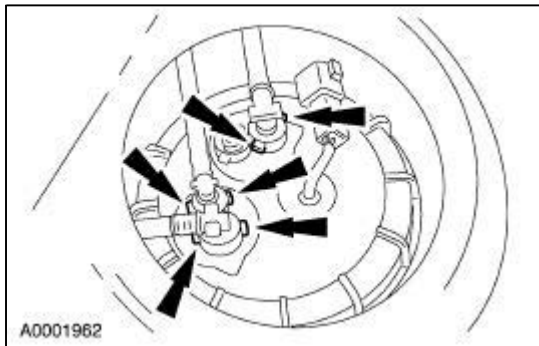
5.  **CAUTION:** To disconnect the fuel line connector from the outlet fitting on the module, carefully press down on the fuel line connector while pressing the release tabs. Pull straight up to remove. Failure to follow this procedure could result in damage to the fitting or fuel line.

NOTE: Both sides of the tank must be drained individually to make sure all possible fuel is removed from the tank.

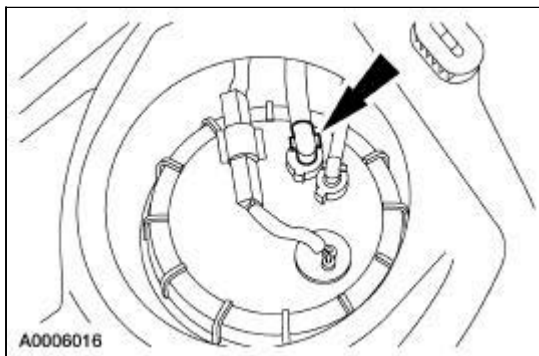
Remove the black connector elbow on the fuel tank crossover lines (jet pump module, LH side).



6. Press the release tabs on the module fitting, turn the fuel line slightly, pull straight up to remove the black fuel line connector elbow.





7. Attach the fuel line draining connector to the fuel storage tanker hose and the outlet fitting on the jet pump module. Siphon the fuel until the tank side is empty.
8. Attach the fuel draining connector to the fuel delivery module (FDM) (LH side) and repeat the procedure until the tank is empty. Remove the fuel delivery module and siphon any remaining fuel out of the tank. For additional information, refer to [Section 310-01](#) for fuel delivery module flange removal.





Coupling — Spring Lock

Special Tool(s)

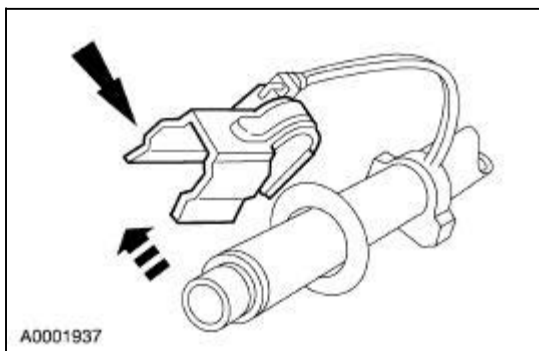
 ST1146-A	Spring Lock Coupler Tool (3/8 inch) 310-D004 (D87L-9280-A) or equivalent
 ST1147-A	Spring Lock Coupler Tool (1/2 inch) 310-D005 (D87L-9280-B) or equivalent

Disconnect

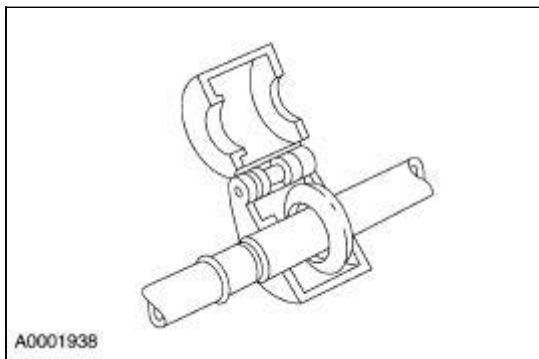
 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

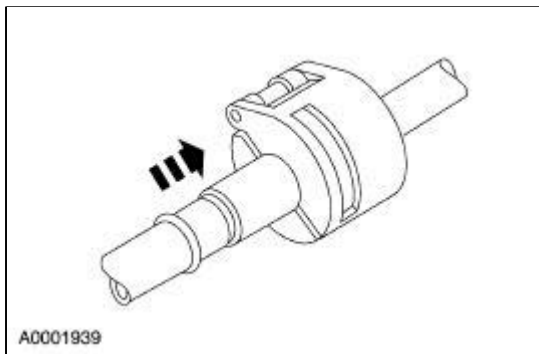
1. Relieve the fuel pressure. For additional information, refer to [Pressure Relief](#) in this section.
2. Remove the fuel tube clip.



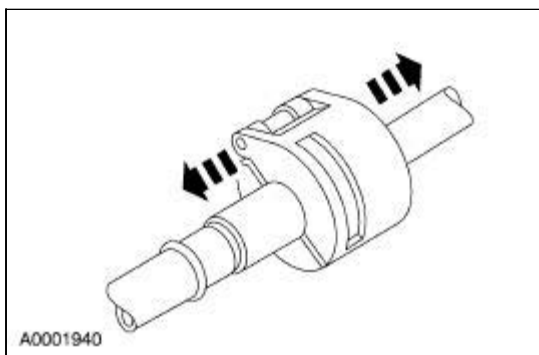
3. Install the special tool.



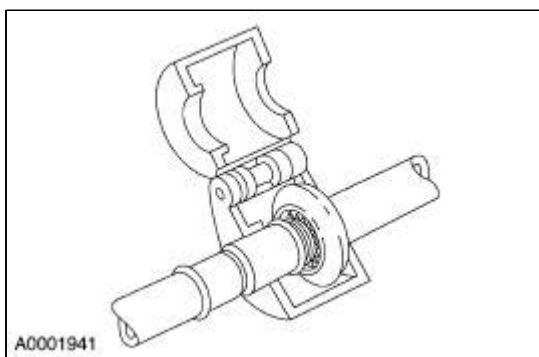
4. Close and push the special tool into the open side of the cage.



5. Separate the fitting.



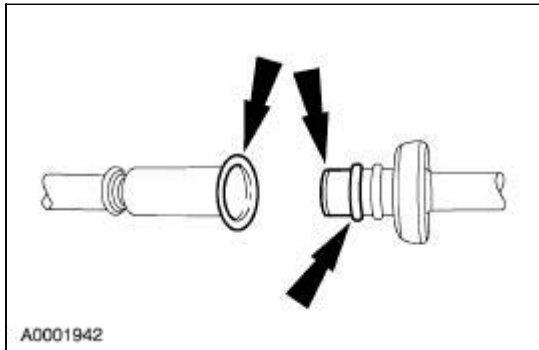
6. Remove the special tool.



Connect


1. Connect the fitting.
 - Inspect and clean both the coupling ends.


- Lubricate the O-ring seals with clean SAE 5W30 Motor Oil XO-5W30-QSP meeting Ford specification WSS-M2C153-G.
- Connect the fitting.
- Pull on the fitting to make sure it is fully engaged.
- Install the safety clip.




Fittings —R-Clip

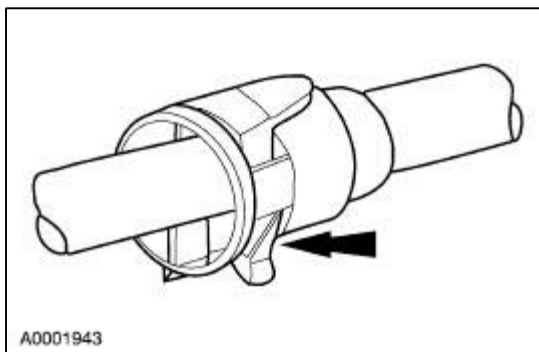
Removal

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

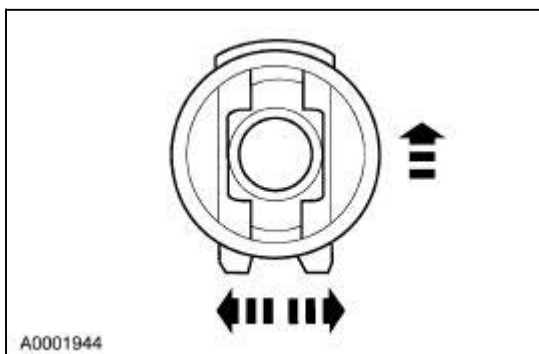
 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Before replacing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

 **CAUTION:** Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

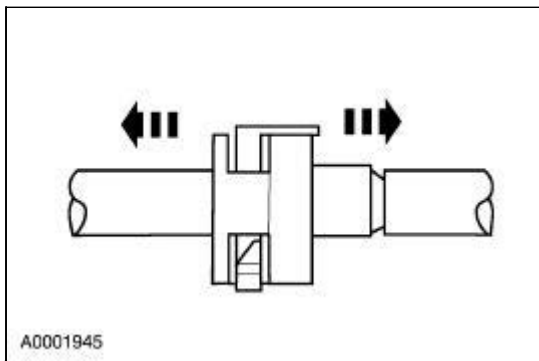
1. Remove the shipping tab by bending it downward.



2. Spread the R-clip legs and push the clip into the fitting.

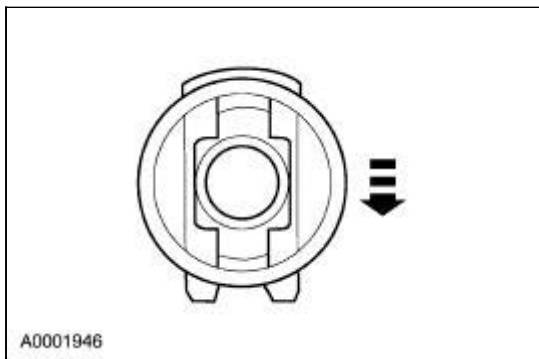


3. Separate the fitting from the tube.

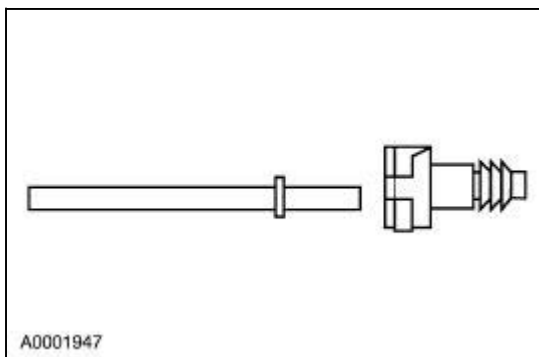


Installation

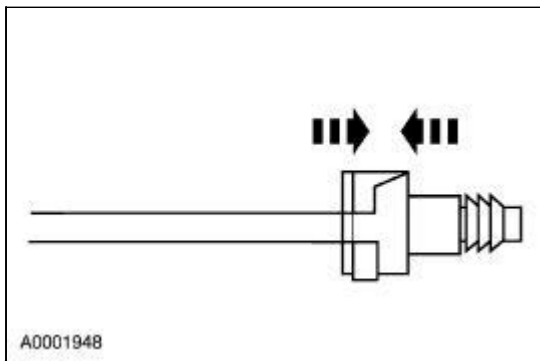
1. Inspect the fitting and the tube for damage. Remove any dirt or obstructions.
2. Apply a light coat of clean SAE 5W30 Motor Oil XO-5W30-QSP meeting Ford specification WSS-M2C153-G to the male tube end.
3. Insert the R-clip into the fitting.



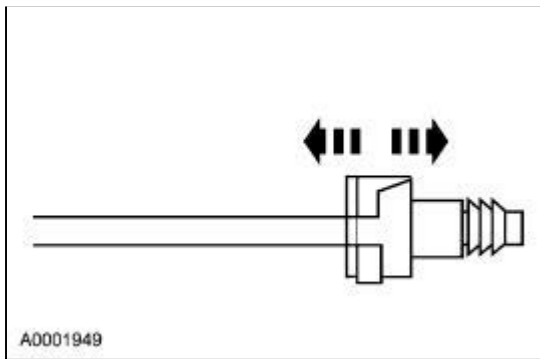
4. Align the tube and the fitting.



5. Insert the tube into the fitting and push together until a click is heard.




6. Pull on the connection to make sure it is fully engaged.



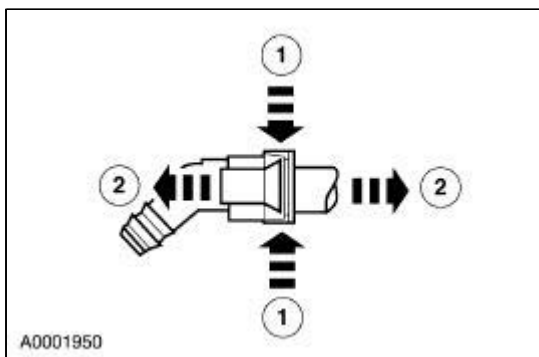
Fittings — Vapor Tube

Disconnect

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2.  **WARNING:** The evaporative emission system contains fuel vapor and condensed fuel vapor. Although not present in large quantities, it still presents the danger of explosion or fire.

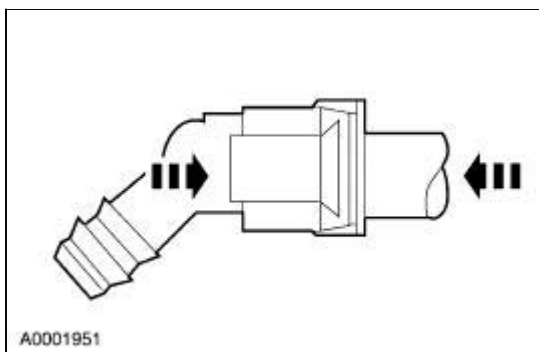
Disconnect the vapor tube from the fitting.

1. Squeeze the fitting.
2. Disconnect the vapor tube from the fitting.

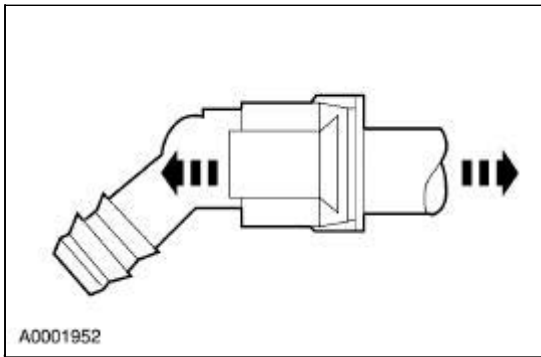


Connect

1. Inspect the fitting and the tube for damage.
2. Remove any dirt or obstructions.
3. Push the tube into the fitting until it snaps in place.



4. Pull on the connection to make sure the fitting is secure.



A0001952

General Specifications

Item	Specification
Capacity	
Fuel tank	68 liters (18 gallons)
Fuel pressure	
Engine running	207-447 kPa (30-65 psi)
Key on engine off	207-447 kPa (30-65 psi)
Lubricants	
Surfactant (Merpol)	ESE-M99B144-B
Petroleum	ESW-M1C115-A or ESB-M1C99-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Exhaust heat shield nuts	10	—	89
Exhaust heat shield bolts	10	—	89
Fuel filter mounting bracket bolt	10	—	89
Fuel tank strap bolts	35	26	—
Fuel tank filler pipe bolt	12	9	—
Fuel delivery module lockring retainer nut	80	59	—

Fuel Tank and Lines

The fuel system consists of:

- the fuel tank (9002).
- the fuel tank filler pipe (9034) which contains a restrictor plate to permit only unleaded fuel to be pumped into the fuel tank.
- a 1/8 turn type fuel tank filler cap (9030).
- a fuel filter (9155) providing filtration to protect the fuel injectors.
- an electronic returnless fuel system.
- a single fuel line accommodating the returnless system.
- a jet pump module which maintains the fuel levels in both tank sides and contains a fuel level sensor.
 - a check valve which maintains system pressure after the pump is shut off.
- a fuel delivery module (9H307) which provides pressurized fuel to the engine and contains:
 - a fuel level sensor (9275).
 - an inlet filter.


The fuel pump is controlled by the powertrain control module (PCM) (12A650) which energizes the fuel pump relay. Electrical power to the pump is provided through the inertia fuel shutoff (IFS) switch (9341), which is located in the passenger compartment behind the lower A-pillar trim panel.


Fuel Tank and Lines


Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Tank

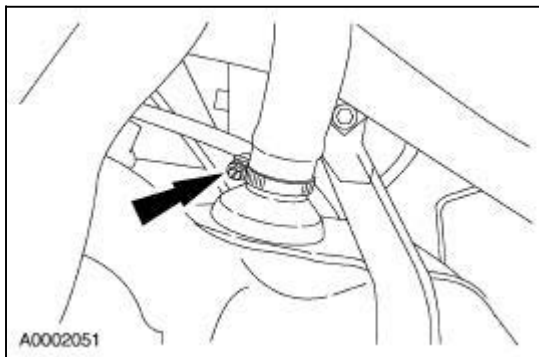
Removal

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

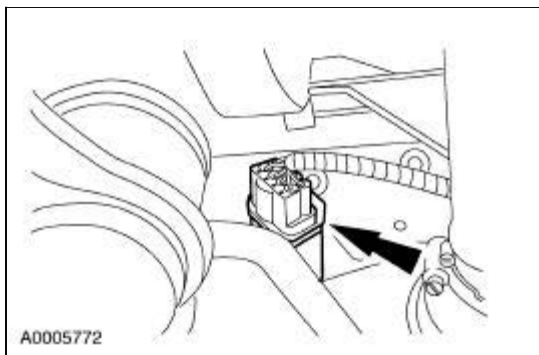
 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel causing personal injury or a fire hazard.

1. Drain the fuel tank (9002). For additional information, refer to [Section 310-00](#).
2. Remove the driveshaft. For additional information, refer to [Section 205-01](#).
3.  **CAUTION:** Some fuel will remain in filler pipe after draining the fuel tank. Carefully drain the filler pipe into an approved container.

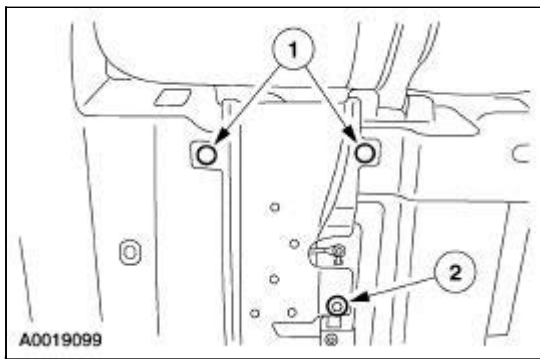
Loosen the hose clamp at the fuel tank filler pipe and disconnect the filler pipe.



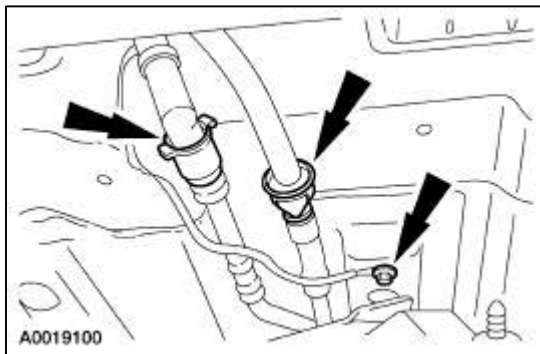
4. Disconnect the fuel tank electrical connector.



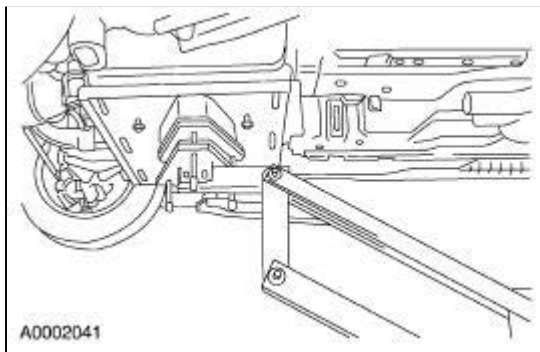
5. Position the fuel line shield aside.
 1. Remove the pin-type retainers.
 2. Remove the bolt.



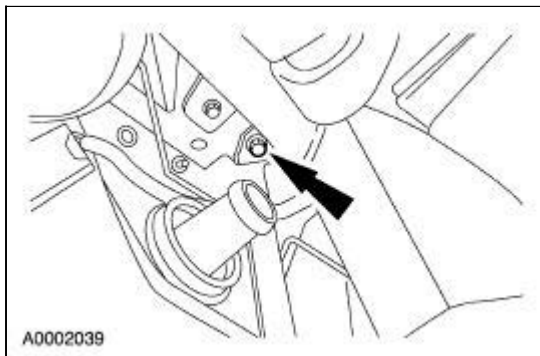
6. Disconnect the fuel delivery line and vapor tube located forward of the fuel tank on the left side.
 - Disconnect the ground strap.



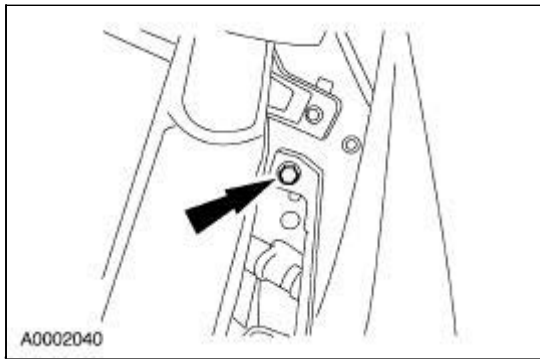
7. Position a suitable lifting device to support the fuel tank.



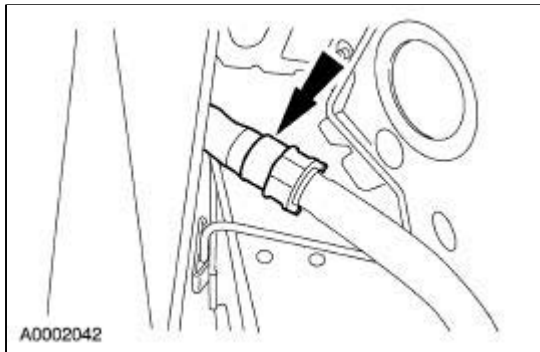
8. Remove the right fuel tank support strap bolt and position the fuel tank support strap aside.



9. Remove the left fuel tank support strap bolt and position the fuel tank support strap aside.



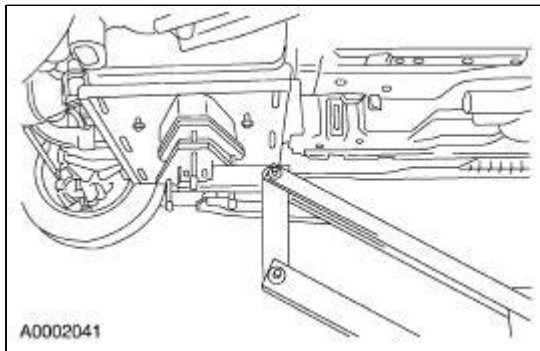
10. Partially lower the fuel tank and disconnect the vapor tube at the top rear of the fuel tank.



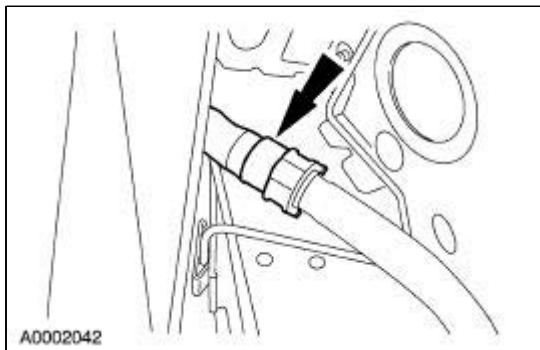
11. Lower the fuel tank.

Installation

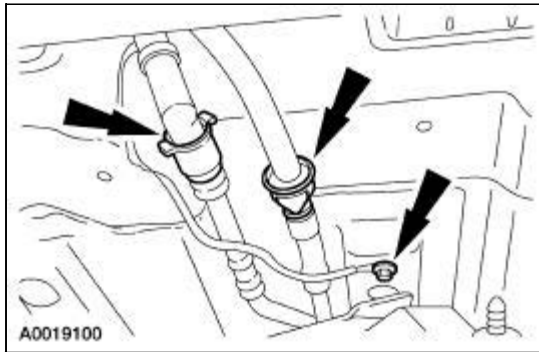
1. Raise the fuel tank slightly below the fully installed position.



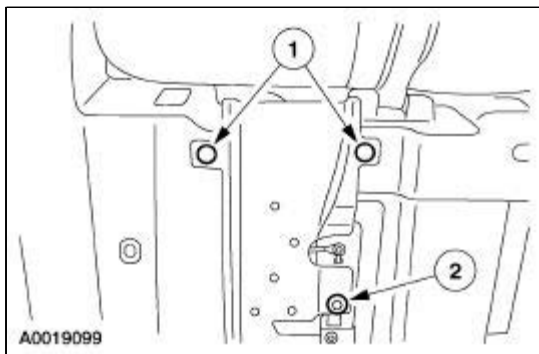
2. Connect the vapor tube at the top rear of the fuel tank.



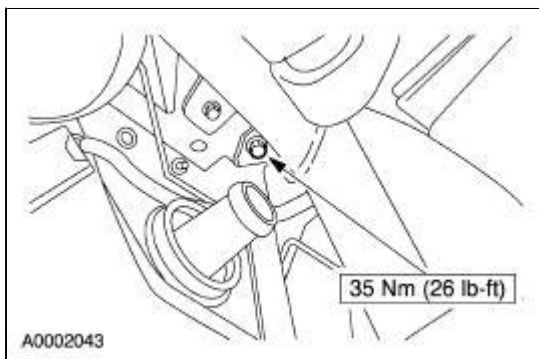
3. Connect the fuel delivery line and vapor tube.
 - Connect the ground strap.



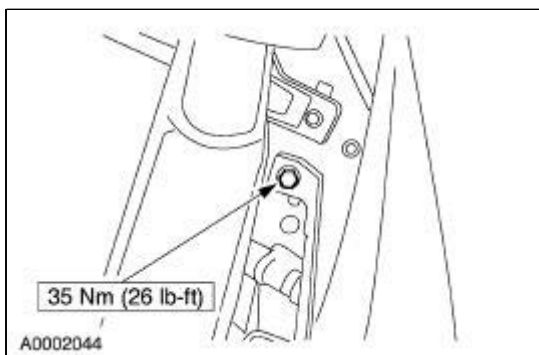
4. Install the fuel line shield.
 1. Install the pin-type retainers.
 2. Install the bolt.



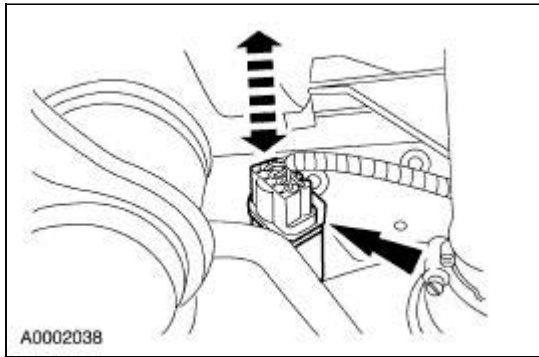
5. Raise the tank into position and install the right support strap and bolt.



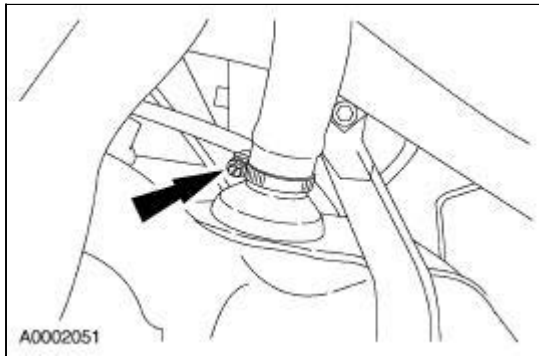
6. Install the left support strap and bolt. Remove the lifting device.



7. Connect the fuel tank electrical connector.



8. Connect the fuel tank filler pipe hose and tighten clamp.



9. Install the driveshaft. For additional information, refer to [Section 205-01](#).
10. **NOTE:** When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 miles) or more to relearn the strategy.

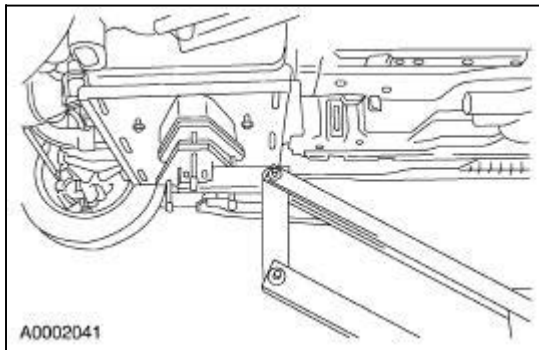
Connect the battery negative cable.

11. Turn the ignition key to the ON position to pressurize the fuel system.
 12. Visually inspect the fuel system for leaks.
-

Support Straps

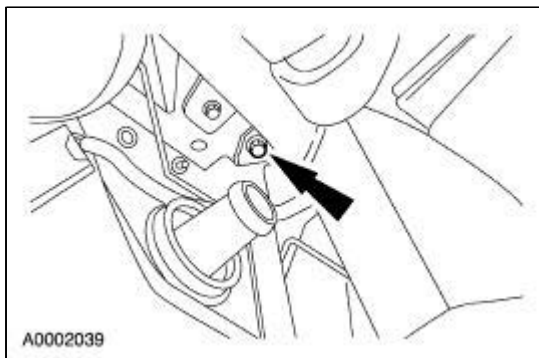
Removal and Installation

1. Position a suitable lifting device to support the fuel tank.

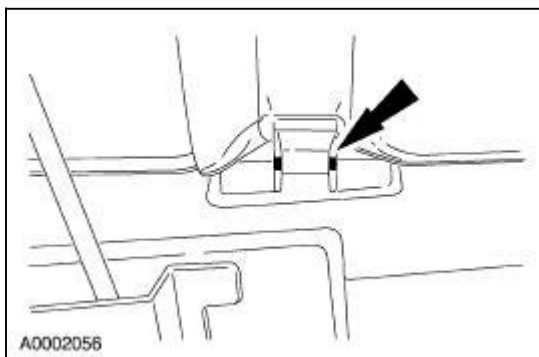


2. **NOTE:** Left support strap and pin shown, right side similar.

Remove the fuel tank support strap bolt.




3. Push the strap upward and align the retaining pin with the access hole. Remove the pin and the support strap.




4. To install, reverse the removal procedure.


Module —Fuel Delivery

Special Tool(s)

 ST2376-A	Fuel Sender Wrench 310-069
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Removal and Installation

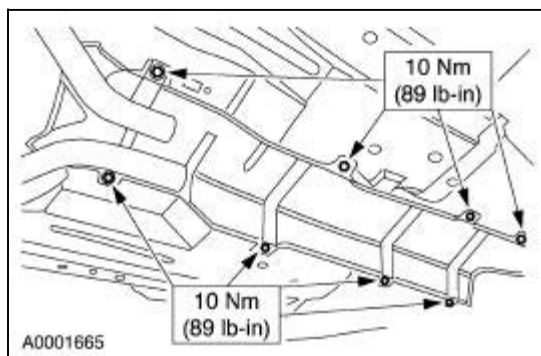
 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

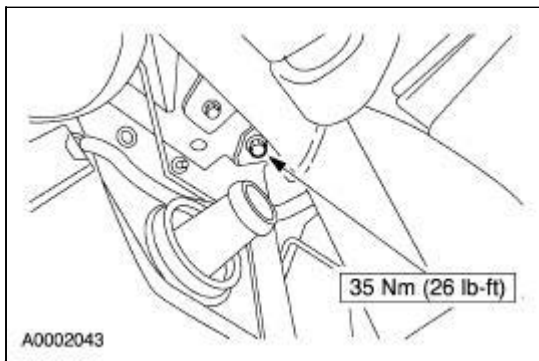
1. **NOTE:** It is not necessary to remove the fuel tank to carry out this procedure. The Fuel Delivery Module can be accessed under the rear seat bottom.

Drain the fuel tank (9002). For additional information, refer to [Section 310-00](#).

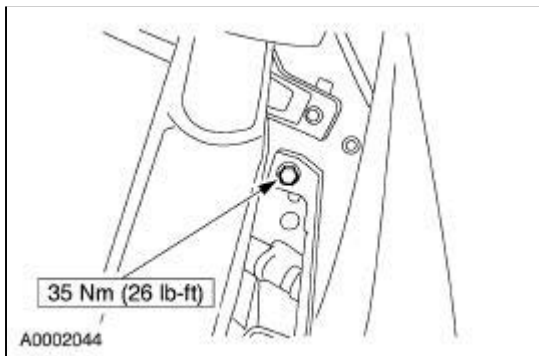
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Remove the bolts and the nuts and position the exhaust heat shield on the exhaust system.



4. Loosen the right support strap approximately one inch.



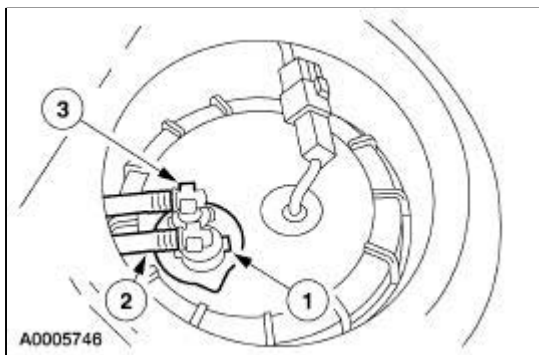
5. Loosen the left support strap approximately one inch.



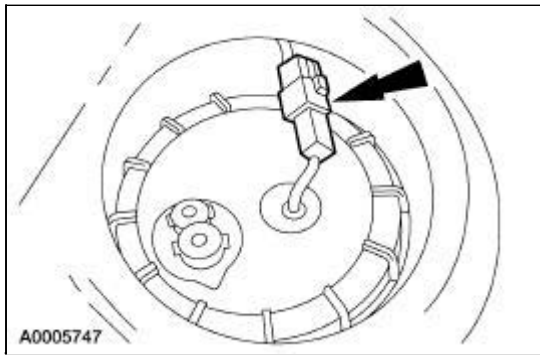
6. Lower the hoist.
7. **NOTE:** Make sure the fuel line connector is fully seated prior to compressing the release tabs.

Disconnect the module fuel line connectors.

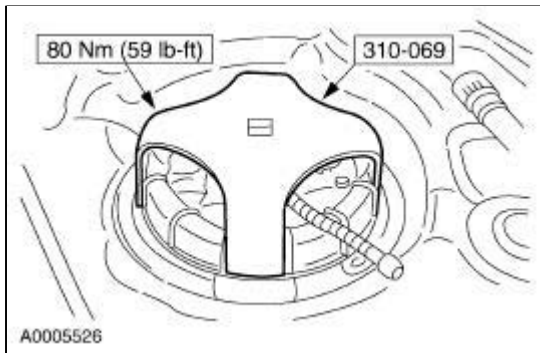
1. Press the release tabs on the module fitting.
2. Turn the fuel line slightly.
3. Pull straight up to remove the fuel line connector.



8. Disconnect the electrical connector.



9. Install the special tool and loosen the locking retainer nut.



10. Continue removing the locking retainer nut by hand.

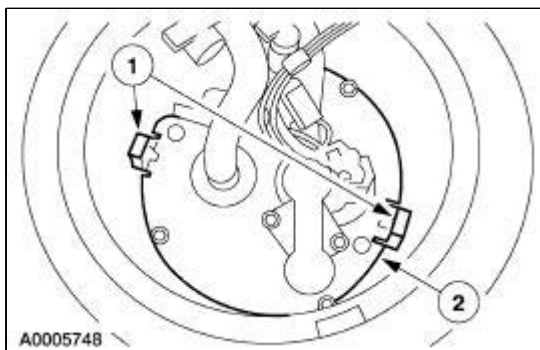
11. Separate the fuel filter.
 - Lift up on the module top flange and position it aside.
 - Cut the tie strap securing the in tank filter to the locking tab of the module.

12.  **CAUTION: The fuel module must be handled carefully to avoid damage to the float arm and the filter during removal.**

NOTE: The module will contain some residual fuel. Lift straight up and out of the retainer cup and tilt while in tank (float side down) to drain some fuel out of the reservoir. Then straighten and lift straight up and out of the tank. Drain excess fuel into suitable container.

Remove the fuel delivery module.

1. Press the lock tabs and release the module from the tank mounting flange.
2. Remove the module from the tank.

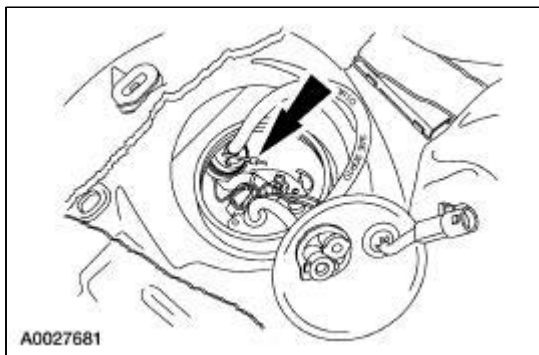
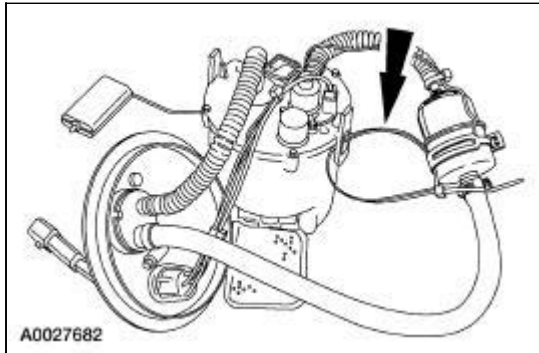


13. **NOTE:** New module assembly flange gaskets must be used. Gently position the module seal by hand and make sure it remains in position during installation. Align the module with the in-tank

retaining bracket and push down on the module until the latches snap into position onto bracket. Make sure the fuel line tube connectors are fully seated into the outlet connector fittings.


To install, reverse the removal procedure.

- Loosely install a new tie strap to secure the in tank filter to the locking tab of the module. Tighten the tie strap after the module is placed in the fuel tank.





Fuel Transfer Pump

Special Tool(s)

 ST2376-A	Fuel Sender Wrench 310-069
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Removal and Installation

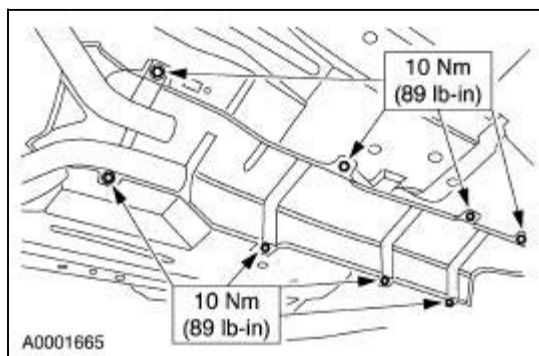
 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

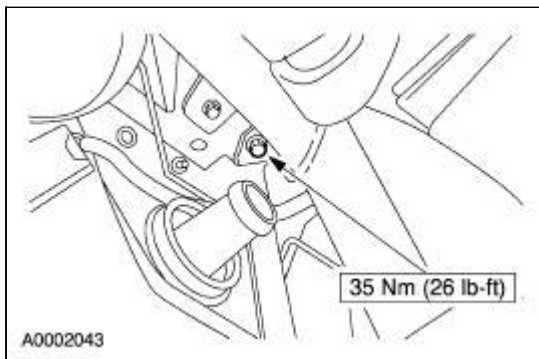
1. **NOTE:** It is not necessary to remove the fuel tank to carry out this procedure. The Fuel Transfer Pump can be accessed under the rear seat bottom.

Drain the fuel tank (9002). For additional information, refer to [Section 310-00](#).

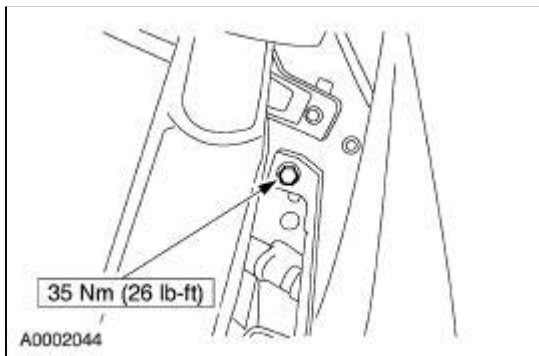
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Remove the bolts and the nuts and position the exhaust heat shield on the exhaust system.



4. Loosen the right support strap approximately one inch.



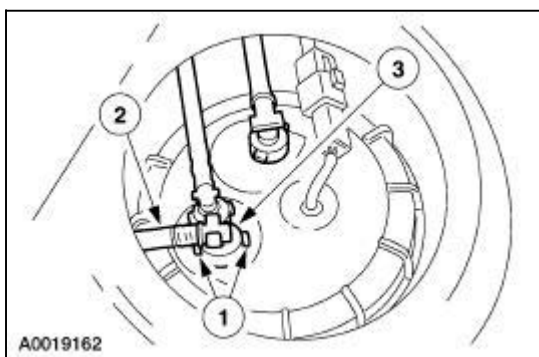
5. Loosen the left support strap approximately one inch.



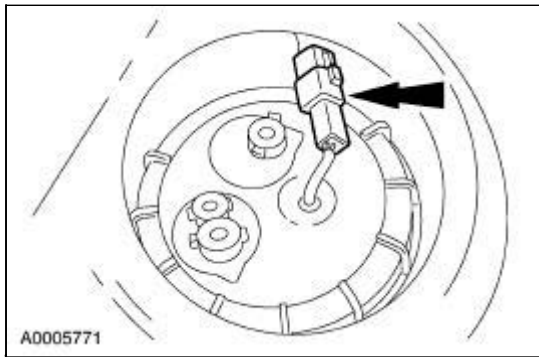
6. Lower the hoist.
7. **NOTE:** Make sure the fuel line connector is fully seated prior to compressing the the release tabs.

Disconnect the module fuel line connectors.

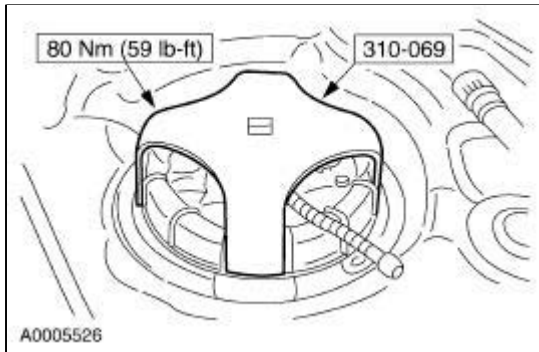
1. Press the release tabs on the module fitting.
2. Turn the fuel line slightly.
3. Pull straight up to remove the fuel line connector.



8. Disconnect the electrical connector.



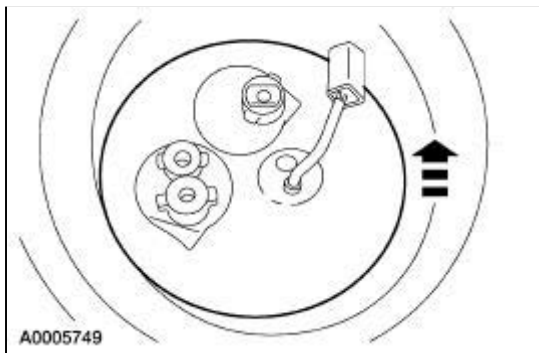
9. Install the special tool and loosen the locking retainer nut.



10. Continue removing the locking retainer nut by hand.

11.  **CAUTION: The fuel module must be handled carefully to avoid damage to the float arm and the filter during removal.**

Remove the fuel delivery module.





12. **NOTE:** New module assembly flange gaskets must be used. Gently position the module seal by hand and make sure it remains in position during installation. Make sure the fuel line tube connectors are fully seated into the outlet connector fittings.

To install, reverse the removal procedure.

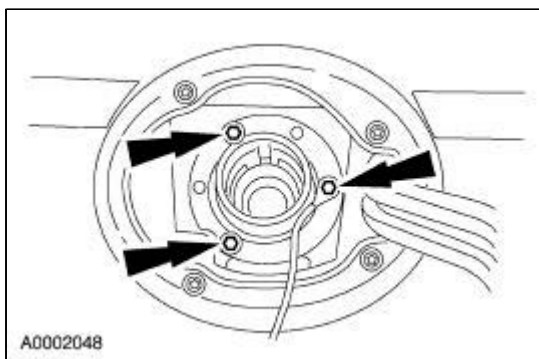
Filler Pipe

Removal and Installation

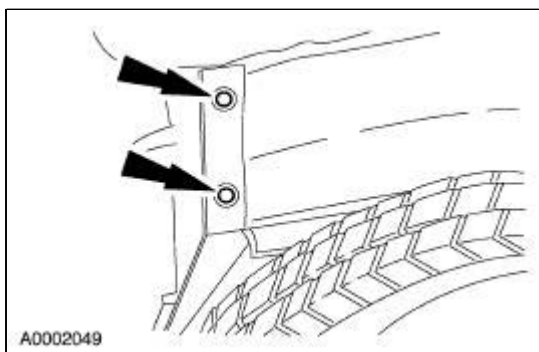
 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

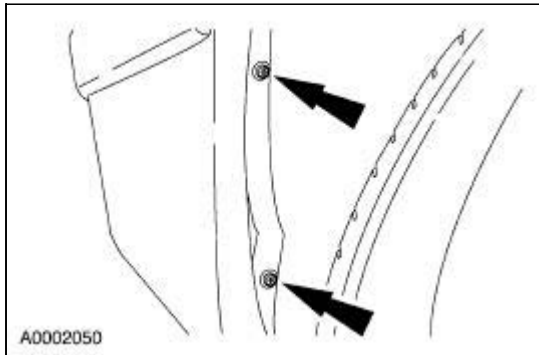
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Relieve the fuel system pressure. For additional information, refer to [Section 310-00](#).
3. Drain the fuel tank (9002) until it is less than half full. For additional information, refer to [Section 310-00](#).
4. Remove the fuel filler cap.
5. Remove the bolts at the fuel filler neck housing.



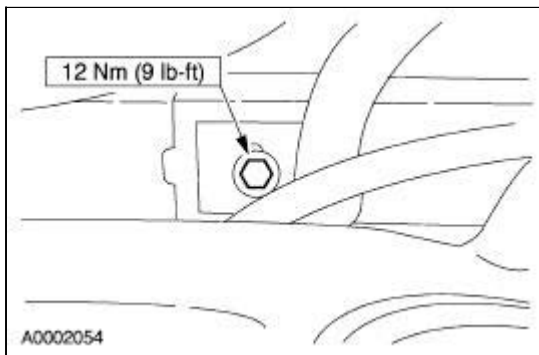
6. Raise the vehicle. For additional information, refer to [Section 100-02](#).
7. Remove the right rear inner wheel well pin-type retainers securing the splash shield.



8. Remove the right wheel well screws securing the splash shield.

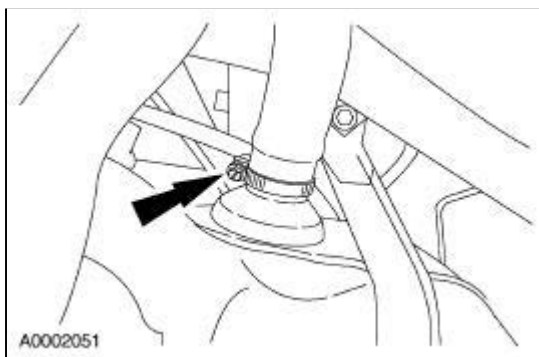


9. Remove the bolt at the filler pipe.



10.  **CAUTION:** Some fuel will remain in filler pipe after draining the fuel tank. Carefully drain the filler pipe into an approved container.

Loosen the hose clamp at the fuel tank filler pipe and disconnect the filler pipe.




11. Remove the filler pipe through the wheel well opening.
12. **NOTE:** Lubricate the fuel tank filler pipe end with a lubricant meeting Ford specification ESE-M99B144B for ease of installation.


NOTE: When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 miles) or more to relearn the strategy.

To install, reverse the removal procedure.

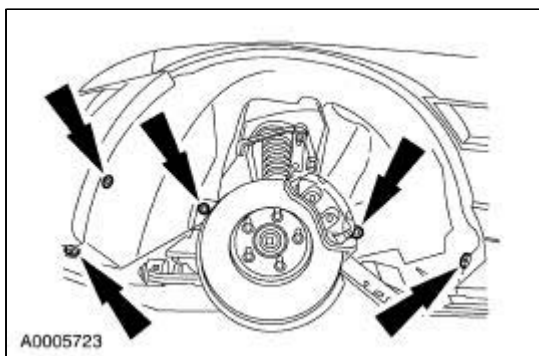
Filter

Removal and Installation

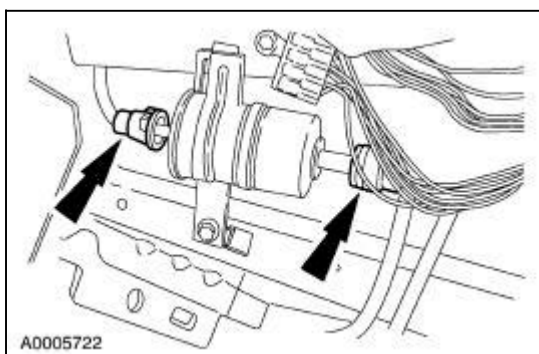
 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited, resulting in possible personal injury.

 **WARNING:** Fuel in the fuel system remains under high pressure even when the engine is not running. Before repairing or disconnecting any of the fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel, causing personal injury or a fire hazard.

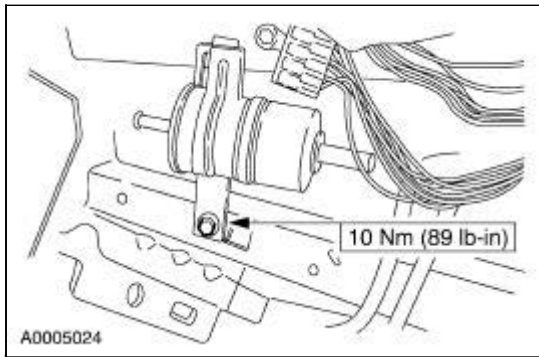
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Relieve the fuel system pressure. For additional information, refer to [Section 310-00](#).
3. Raise the vehicle. For additional information, refer to [Section 100-02](#).
4. Remove the left front wheel and tire assembly. For additional information, refer to [Section 204-04](#).
5. Remove the left wheel well splash shield screws and pin-type fasteners.



6. Disconnect the fuel line R-clip fittings.



7. Remove the bolt at the fuel filter (9155) bracket and remove the filter.



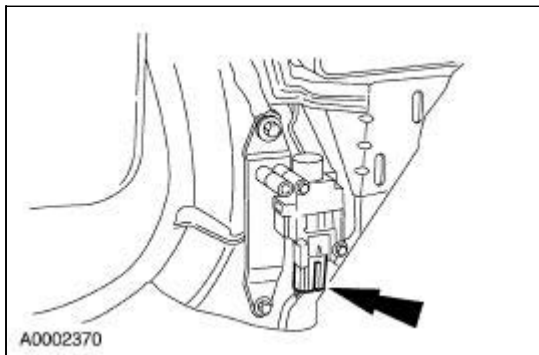
8. If necessary, separate the filter from the bracket for reuse.
9. **NOTE:** When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 miles) or more to relearn the strategy.

To install, reverse the removal procedure.

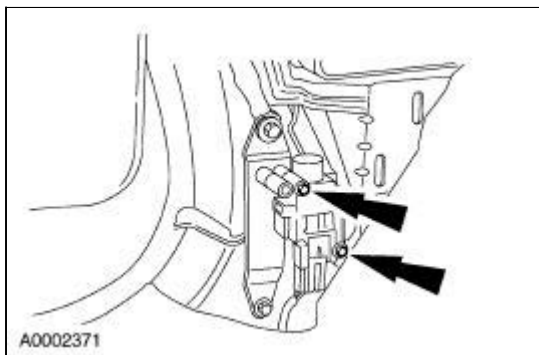
Inertia Fuel Shutoff (IFS) Switch

Removal and Installation

1. Remove the left hand lower A-pillar trim panel. For additional information, refer to [Section 501-05](#).
2. Disconnect the connector from the inertia fuel shutoff (IFS) switch (9341).



3. Remove the screws from the IFS switch and remove the switch.



4. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-in
Accelerator pedal and shaft-to-dash panel bolt and nut	9	80
Accelerator cable bracket bolts	9	80
Accelerator cable housing-to-dash panel bolts	9	80

Acceleration Control

The throttle is controlled by the accelerator cable (9A758) which is connected to the accelerator pedal and shaft (9726).

- The accelerator pedal and shaft should travel smoothly from the idle to the wide-open throttle (WOT) positions. Hesitation on return or prevention of return to the idle position must not occur.
 - Surrounding components such as wiring, hoses, sound insulator and floor covering must not contact the sliding inner member of the accelerator cable or the accelerator pedal and shaft.
 - The sliding inner member accelerator cable should not be lubricated and is not repairable.
-

Acceleration Control

Inspection and Verification

NOTE: Care should be exercised when carrying out a repair on or around the accelerator pedal and shaft or controls.

1. Inspect the accelerator pedal and shaft (9726) and the attached accelerator cable for damage or distortion which would bind or limit accelerator travel.
2. Inspect the accelerator cable (9A758) for kinks or fraying which may cause binding.
3. Inspect the engine idle speed adjustment to make sure of correct idle speed specification after any adjustment or repair.
4. Inspect the throttle body (9E926) for excessive wear or damage.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Excessive effort needed to depress accelerator pedal and shaft 	<ul style="list-style-type: none"> ● Worn accelerator lever pivot bushing. ● Accelerator cable binding. ● Worn or damaged throttle body. 	<ul style="list-style-type: none"> ● INSTALL a new accelerator pedal and shaft. ● INSTALL a new accelerator cable. ● INSTALL a new throttle body . REFER to Section 303-04A or Section 303-04B .
<ul style="list-style-type: none"> ● Accelerator pedal and shaft feels rough or raspy 	<ul style="list-style-type: none"> ● Frayed or binding accelerator cable. ● Worn or damaged throttle body. 	<ul style="list-style-type: none"> ● INSTALL a new accelerator cable. ● INSTALL a new throttle body . REFER to Section 303-04A or Section 303-04B .
<ul style="list-style-type: none"> ● Accelerator pedal and shaft bind or stick 	<ul style="list-style-type: none"> ● Kinked accelerator cable. ● Foreign object caught in accelerator pedal. ● Worn or damaged throttle body. 	<ul style="list-style-type: none"> ● INSTALL a new accelerator cable. ● CHECK the accelerator pedal. ● INSTALL a new throttle body. REFER to Section 303-04A or Section 303-04B .
<ul style="list-style-type: none"> ● High engine idle speed 	<ul style="list-style-type: none"> ● Kinked accelerator cable. ● Foreign object 	<ul style="list-style-type: none"> ● INSTALL a new accelerator cable. ● CHECK the accelerator pedal.

caught in
accelerator
pedal.

- Incorrect engine idle speed.

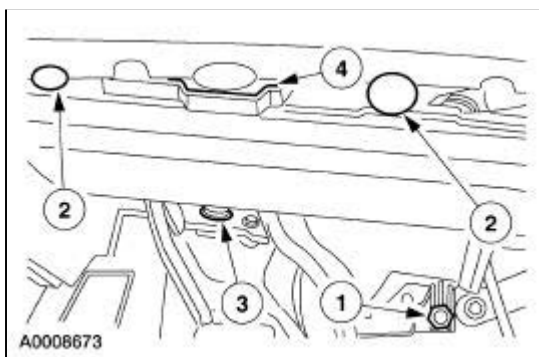
- REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the idle control system.
-

Accelerator Pedal and Shaft

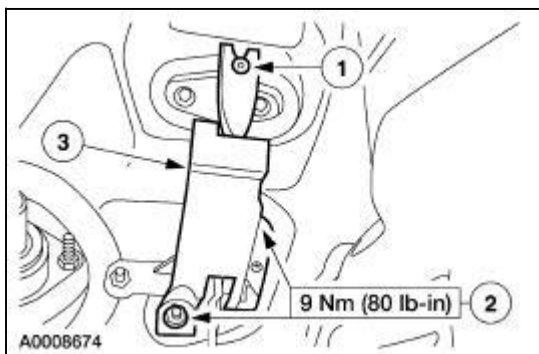
Removal and Installation

NOTE: LH drive shown, RH drive similar.

1. Remove the hush panel.
 1. Remove the nut.
 2. Remove the pin-type retainers.
 3. Disconnect the lamp from the hush panel.
 4. Remove the hush panel.



2. Remove the accelerator pedal and shaft.
 1. Disconnect the accelerator cable from the accelerator pedal and shaft.
 2. Remove the bolt and nut.
 3. Remove the accelerator pedal and shaft.



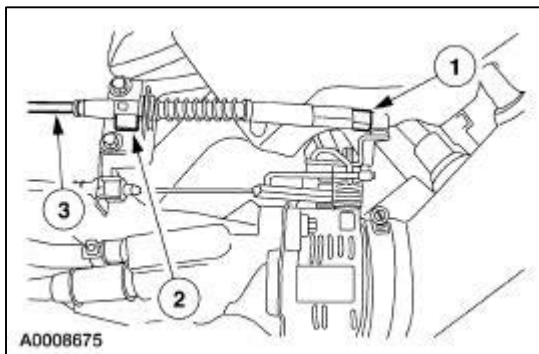
3. To install, reverse the removal procedure.

Accelerator Cable

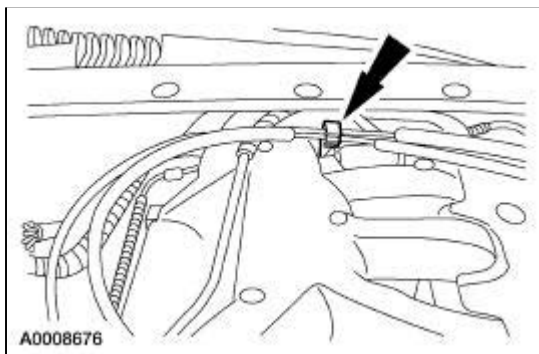
Removal and Installation

NOTE: 3.0L shown, 3.9L accelerator cable bracket is molded into the manifold. LH drive shown, RH drive similar.

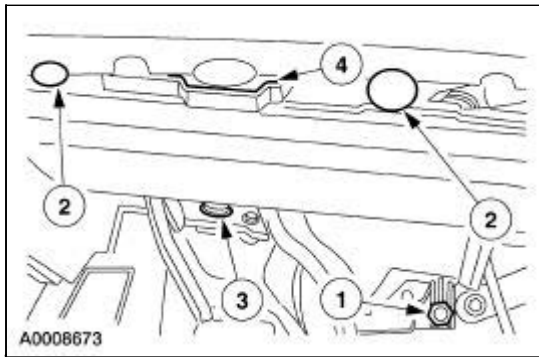
1. Using a trim tool, disconnect the accelerator cable from the throttle body lever and accelerator cable bracket.
 1. Disconnect the accelerator cable from the throttle body lever.
 2. Depress the lock tab and rotate the fitting 90 degrees counterclockwise.
 3. Slide the cable up and out of the bracket.



2. Disconnect the accelerator cable from the retaining clip.



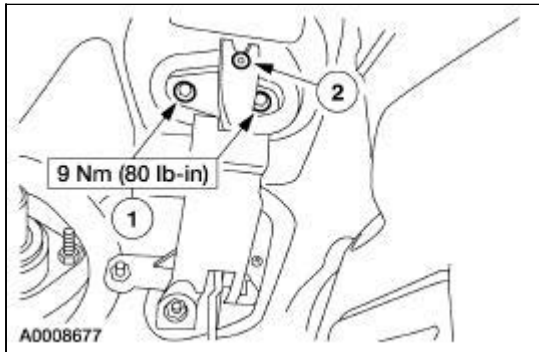
3. Remove the hush panel.
 1. Remove the nut.
 2. Remove the pin-type retainers.
 3. Disconnect the lamp from the hush panel.
 4. Remove the hush panel.




4.  **CAUTION: Be careful not to kink or nick the cable core wire.**

Remove the accelerator cable.

1. Remove the bolts.
2. Disconnect the accelerator cable and remove.



5.  **CAUTION: If the accelerator cable is to be reused, inspect the locking tabs of the cable end ball stud fitting. If the locking tabs are damaged or broken, a new accelerator cable must be installed.**

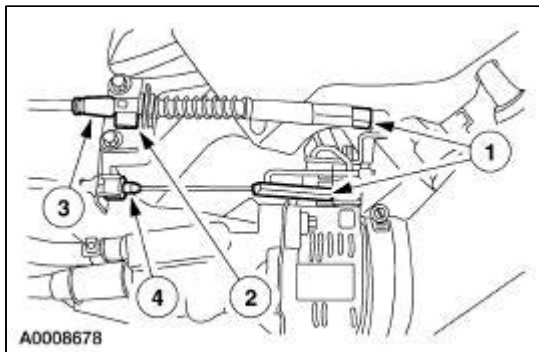
NOTE: The accelerator cable assembly may be supplied in two pieces. It will be necessary to snap the pieces together prior to installation.

To install, reverse the removal procedure.

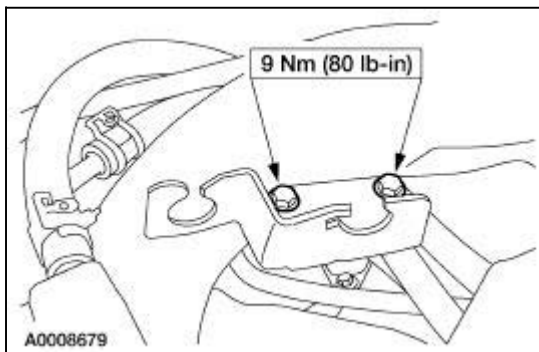
Accelerator Cable Bracket —3.0L

Removal and Installation

1. Disconnect the accelerator cable and speed control cable from the bracket.
 1. Disconnect the accelerator cable and speed control cable from the throttle levers.
 2. Depress the lock tab and rotate the fitting 90 degrees counter clockwise.
 3. Slide the cable up and out of the bracket.
 4. Depress the lock tabs and disconnect the speed control cable from the bracket.



2. Remove the bolts and the accelerator cable bracket.



3. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-in
Bracket to speed control servo bolts	9	80
Bracket mounting bolts	9	80

Vehicle Speed Control

The vehicle speed control consists of the following components:

- powertrain control module (PCM)
 - speed control servo
 - speed control set telltale
 - speed control actuator switches
 - deactivator switch
 - brake pedal position (BPP) switch
 - clutch pedal position (CPP) switch (manual transmission only)
 - digital transmission range (DTR) sensor (automatic transmission only)
 - speed control actuator cable
-

Vehicle Speed Control

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool

Refer to Wiring Diagrams Section 310-03-00, Vehicle Speed Control for schematic and electrical information.

Principles of Operation

The speed control system is designed to maintain a selected vehicle speed between approximately 48 and 200 km/h (30 and 125 mph).

The electronic stepper motor (internal to the speed control servo) is controlled by turning the three phases of the motor ON and OFF in sequence. The sequence determines the motor direction (open throttle or closed throttle based on vehicle speed).

The speed control module is fully integrated into the powertrain control module (PCM). The PCM strategy uses engine control to accelerate smoothly. In instances where the vehicle tends to want to exceed set speed, the PCM will invoke an engine braking strategy to help maintain the desired vehicle speed.

Whenever the system is engaged and active, a speed control set indicator will be illuminated in the instrument cluster.

The brake pedal position (BPP) switch is normally closed to ground. When the brake pedal is applied with the speed control system engaged, the BPP switch closes to battery voltage, putting the vehicle speed control in stand-by mode.

NOTE: The deactivator switch is provided as an additional safety feature.

Normally, when the brake pedal is depressed, the PCM will deactivate the speed control system. Under increased brake pedal effort, the deactivator switch, a normally closed switch, will open and remove power to the speed control servo clutch, releasing the throttle independently of the PCM.

The clutch pedal position (CPP) switch is incorporated on vehicles equipped with manual transmissions. When the clutch pedal is applied with the vehicle speed control system engaged, the

normally closed switch opens and signals the PCM to deactivate the speed control.

The air bag sliding contact provides the electrical interface between the steering column wiring and the speed control actuator switches in the steering wheel.

The PCM sends an standard corporate protocol (SCP) output message to the instrument cluster to indicate when the vehicle speed control system is active.

Inspection and Verification

1. Verify the customer concern by operating the speed control to duplicate the condition.
2. Verify the speedometer operates correctly without speed control by test driving the vehicle. If the speedometer does not operate correctly, refer to [Section 413-01](#).
3. Verify the stoplamps operate correctly with the ignition switch in the OFF position. If the stoplamps do not operate correctly, refer to [Section 417-01](#).
4. Verify the parking brake is not applied and is operating correctly. If the parking brake is not operating correctly, refer to [Section 206-05](#).
5. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none">● Speed control actuator cable● Throttle lever● Speed control servo	<ul style="list-style-type: none">● Central junction box (CJB) fuse 235 (5A)● Underhood auxiliary junction box (AJB) fuse 106 (15A)● Underhood AJB fuse 118 (40A)● Connections● Pins● Circuitry

6. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel, and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
7. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
8. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for PCM, go to Pinpoint Test A.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the KOEO Test.

9. If the DTCs retrieved are related to the concern, go to PCM Diagnostic Trouble Code (DTC) Index to continue diagnostics.
10. If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue diagnostics.

PCM Diagnostic Trouble Code (DTC) Index

NOTE: DTC P0703 and DTC P1572 must be repaired before any other DTC.

DTCs	Description	Source	Action
P0500	Vehicle Speed Error	PCM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1565	Speed Control Command Switches High/Out of Range	PCM	GO to Pinpoint Test C .
P1566	Speed Control Command Switches Low/Out of Range	PCM	GO to Pinpoint Test D .
P1567	NGSC Drive Fault	PCM	GO to Pinpoint Test E .
P1568	NGSC Servo Self-Test Failure	PCM	GO to Pinpoint Test F .
P1572	Brake On/Off Failure	PCM	GO to Pinpoint Test G .
P0703	Brake Switch Input Malfunction	PCM	GO to Pinpoint Test G .

Symptom Chart

Symptom Chart


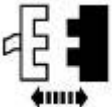

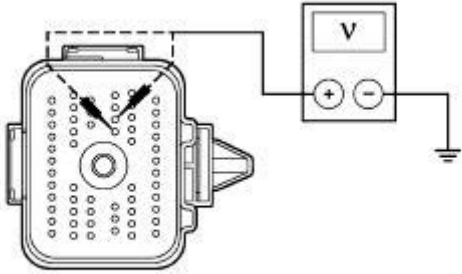
NOTE: Refer to Wiring Diagrams for connector numbers stated in the pinpoint test.

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● No communication with the powertrain control module (PCM) 	<ul style="list-style-type: none"> ● Underhood auxiliary junction box (AJB) fuse 118 (40A). ● Central junction box (CJB) fuses: <ul style="list-style-type: none"> ■ 204 (5A). ■ 207 (5A). ● Circuitry. ● PCM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.
<ul style="list-style-type: none"> ● Unable to enter self-test 	<ul style="list-style-type: none"> ● PCM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B.
<ul style="list-style-type: none"> ● The speed control switch is inoperative—no DTCs 	<ul style="list-style-type: none"> ● Speed control actuator switch. 	<ul style="list-style-type: none"> ● INSTALL a new speed control actuator switch. REFER to Switch—Speed Control Actuator in this section.
<ul style="list-style-type: none"> ● The speed control indicator is always on 	<ul style="list-style-type: none"> ● Instrument cluster. 	<ul style="list-style-type: none"> ● REFER to Section 413-01.

<ul style="list-style-type: none"> ● The speed control is inoperative—no DTCs 	<ul style="list-style-type: none"> ● Circuitry. ● Parking brake switch. ● Clutch pedal position (CPP) switch (for manual transmission only). ● Digital transmission range (DTR) sensor (for automatic transmission only). ● Low battery voltage. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test H</u>.
--	---	---

Pinpoint Test

PINPOINT TEST A: NO COMMUNICATION WITH THE POWERTRAIN CONTROL MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>A1 CHECK THE PCM POWER CIRCUITS</p>	
<p>1 </p> <p>2 </p> <p>PCM C175a</p> <p>3 </p> <p>4 </p> <p>A0003407</p>	<p>4 Measure the voltage between PCM C175a pin 32, circuit 15S-RE8 (GN/YE), harness side, and ground; and between PCM C175a pin 33, circuit 15S-RE21 (GN/OG), harness side, and ground.</p> <ul style="list-style-type: none"> ● Are the voltages greater than 10 volts? <p>→ Yes GO to <u>A2</u>.</p>

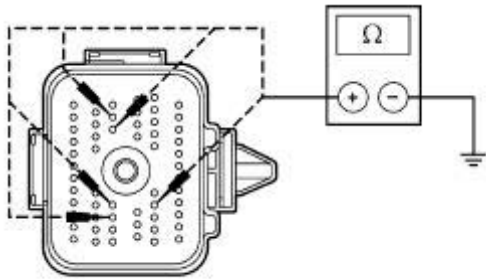
→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

A2 CHECK THE PCM GROUND CIRCUITS

1



2



A0004303

2 Measure the resistance between PCM C175a, and ground, as follows:

Pin	Circuit
24	31-RE8 (BK/YE)
25	31-RE21 (BK/RD)
26	31-RE26 (BK/RD)
27	31-RE25 (BK/RD)
43	91-RE27 (BN/YE)

• Are the resistances less than 5 ohms?

→ **Yes**
REFER to Section 418-00 .

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.


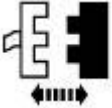

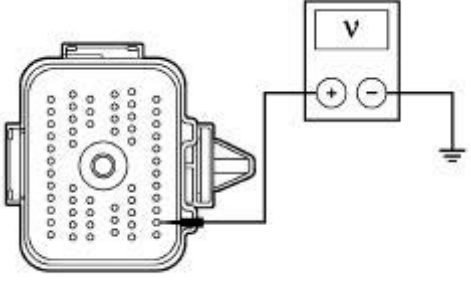

PINPOINT TEST B: UNABLE TO ENTER SELF-TEST

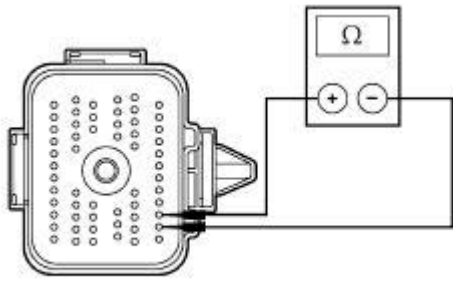
CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK THE COMMUNICATION TO THE PCM	<p>1 Check the communication to the PCM.</p> <p>• Does the diagnostic tool communicate with the PCM?</p> <p>→ Yes GO to <u>B2</u> .</p> <p>→ No GO to <u>Pinpoint Test A</u> .</p>
B2 CHECK THE PCM COMMUNICATION PID	<p>1 Monitor the PCM SCINT_F PID.</p> <p>• Does the PCM SCINT_F PID indicate NO?</p> <p>→ Yes</p>

REFER to Section 418-00.

→ **No**
INSTALL a new PCM. REFER to Section 303-14. CLEAR the DTCs.
REPEAT the self-test.

PINPOINT TEST C: DTC P1565 —SPEED CONTROL COMMAND SWITCHES HIGH/OUT OF RANGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK FOR SHORT TO POWER	
<p>1</p>  <p>2</p>  <p>PCM C175a</p> <p>3</p>  <p>4</p>  <p>A0005461</p>	<p>4</p> <p>Measure the voltage between PCM C175a pin 57, circuit 7PG-24 (YE/BU), harness side and ground.</p> <p>● Is any voltage present?</p> <p>→ Yes GO to <u>C6</u>.</p> <p>→ No GO to <u>C2</u>.</p>
C2 CHECK FOR OPEN CIRCUIT	
<p>1</p>  <p>2</p>	<p>2</p> <p>Measure the resistance between PCM</p>



A0005462

C175a pin 57, circuit 7PG-24 (YE/BU), harness side, and PCM C175a pin 56, circuit 31S-PG24, (BK/OG), harness side.

● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to C3.

→ **No**
INSTALL a new PCM. REFER to Section 303-14. CLEAR the DTCs. REPEAT the self-test.

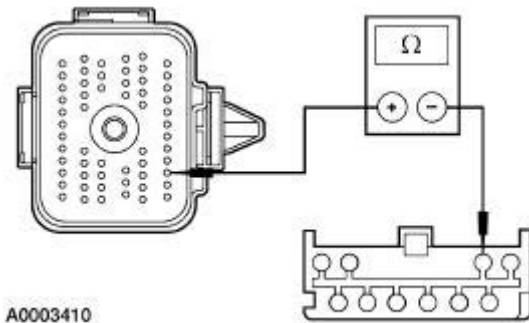
C3 CHECK CIRCUIT 31S-PG24 (BK/OG) FOR OPEN

1



Air Bag Sliding Contact C218a

2



A0003410

2

Measure the resistance between PCM C175a pin 56, circuit 31S-PG24 (BK/OG), harness side and air bag sliding contact C218a pin 8, circuit 31S-PG24 (BK/OG), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to C4.

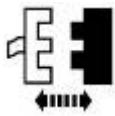
→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C4 CHECK THE AIR BAG SLIDING CONTACT

2

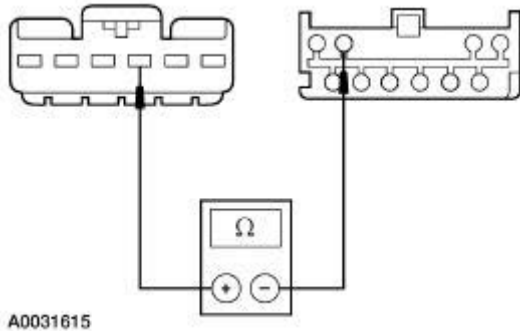
1

Remove the driver side air bag. Refer to Section 501-20B.



Horn Switch C217

3



3

Measure the resistance between air bag sliding contact C218a pin 8, circuit 31S-PG24 (BK/OG), (component side), and horn switch C217 pin 3, harness side (top of the air bag sliding contact).

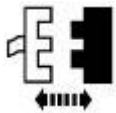
● Is the resistance less than 5 ohms?

→ **Yes**
GO to C5.

→ **No**
INSTALL a new air bag sliding contact. REFER to Section 501-20B. CLEAR the DTCs. REPEAT the self-test.

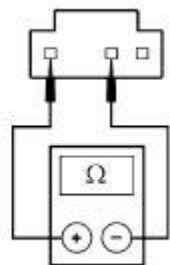
C5 CHECK THE SPEED CONTROL ACTUATOR SWITCHES

1



Speed Control Actuator Switch C203

2



2

Measure the resistance between speed control actuator switch pin 2 (component side), and speed control actuator switch pin 4 (component side).

● Is the resistance approximately 4.3k ohms?

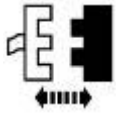
→ **Yes**
INSTALL a new horn switch. REFER to Section 413-06. CLEAR the DTCs. REPEAT the self-test.

→ **No**
INSTALL a new speed control actuator

switch. REFER to Switch—Speed Control Actuator in this section. CLEAR the DTCs. REPEAT the self-test.

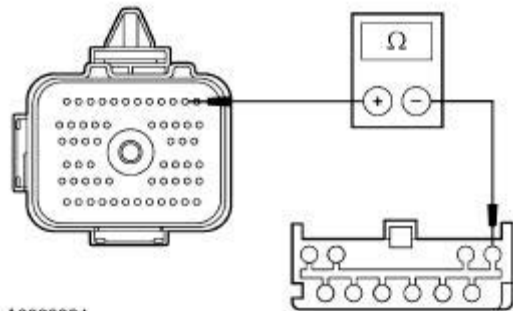
C6 CHECK THE AIR BAG SLIDING CONTACT

1



Air Bag Sliding Contact C218a

2



A0023264

2

Measure the resistance between PCM C175a pin 57, circuit 7PG-24 (YE/BU), harness side, and air bag sliding contact C218a pin 7, circuit 7PG-24 (YE/BU), harness side.

● **Is the resistance less than 5 ohms?**


→ **Yes**

INSTALL a new air bag sliding contact. REFER to Section 501-20B. CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST D: DTC P1566—SPEED CONTROL COMMAND SWITCHES LOW/OUT OF RANGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK FOR SHORT TO GROUND OR STUCK ACTUATOR SWITCH	
<p>1</p> 	<p>2</p> <p>Monitor the PCM PIDs SET/ACL, COAST, RESUME, CANCEL, and SC_ON without depressing any speed control actuator switch.</p> <p>● Do any of the PCM PIDs indicate YES?</p> <p>→ Yes INSTALL a new speed control actuator</p>

switch. REFER to Switch—Speed Control Actuator in this section. CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to D2.

D2 CHECK CIRCUIT 7-PG24 (YE/BU) AND 31S-PG24 (BK/OG)

1

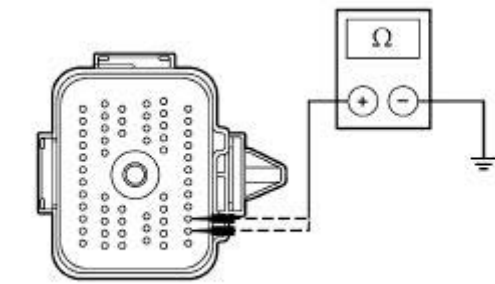


2



PCM C175a

3



A0005465

3 Measure the resistance between PCM C175a pin 57, circuit 7PG-24 (YE/BU), harness side, and ground; and between PCM C175a pin 56, circuit 31S-PG24 (BK/OG), harness side, and ground.

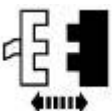
● Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to D5.

→ **No**
GO to D3.

D3 CHECK THE HORN SWITCH FOR A SHORT

2

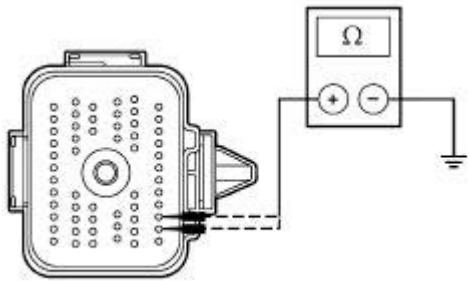


Horn Switch C217

3

1 Remove the driver side air bag. Refer to Section 501-20B.

3 Measure the resistance between PCM C175a pin 57, circuit 7PG-24 (YE/BU), harness side, and ground; and between PCM C175a pin 56, circuit 31S-PG24 (BK/OG), harness side, and ground.



A0005465

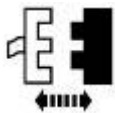
- Are the resistances greater than 10,000 ohms?

→ **Yes**
 INSTALL a new horn switch. REFER to [Section 413-06](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
 GO to [D4](#).

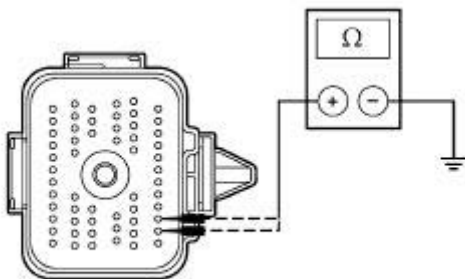
D4 CHECK THE AIR BAG SLIDING CONTACT

1



Air Bag Sliding Contact C218a

2



A0005465

- 2 Measure the resistance between PCM C175a pin 57, circuit 7PG-24 (YE/BU), harness side, and ground; and between PCM C175a pin 56, circuit 31S-PG24 (BK/OG), harness side, and ground.

- Are the resistances greater than 10,000 ohms?

→ **Yes**
 INSTALL a new air bag sliding contact. REFER to [Section 501-20B](#). CLEAR the DTCs. REPEAT the self-test.

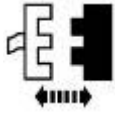
→ **No**
 REPAIR circuit 7-PG24 (YE/BU) and circuit 31S-PG24 (BK/OG) as necessary. CLEAR the DTCs. REPEAT the self-test.

D5 CHECK FOR A SHORT CIRCUIT

1

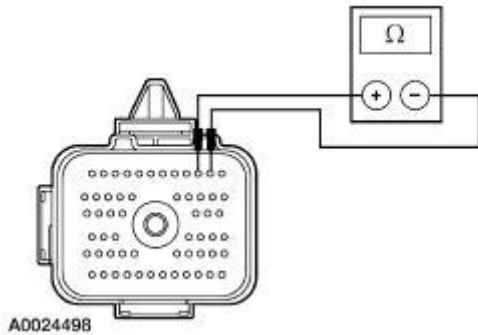


2



PCM C175a

3



3

Measure the resistance between PCM C175a pin 57, circuit 7-PG24 (YE/BU), harness side, and PCM C175a pin 56, circuit 31S-PG24 (BK/OG), harness side.

- Is the resistance greater than 10,000 ohms?

→ Yes

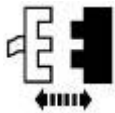
INSTALL a new PCM. REFER to [Section 303-14](#). CLEAR the DTCs. REPEAT the self-test.

→ No

GO to [D6](#).

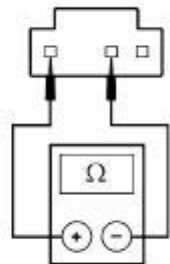
D6 CHECK THE SPEED CONTROL ACTUATOR SWITCH

1



Speed Control Actuator Switch C203

2



A0003411

2

Measure the resistance between speed control actuator switch pin 2 (component side), and speed control actuator switch pin 4 (component side).

- Is the resistance approximately 4.3k ohms?

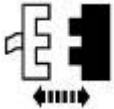
→ Yes

GO to D7.

→ **No**
INSTALL a new speed control actuator switch. REFER to Switch—Speed Control Actuator in this section. CLEAR the DTCs. REPEAT the self-test.

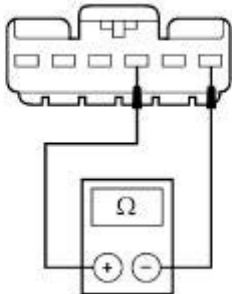
D7 CHECK THE HORN SWITCH

2



Horn Switch C217

3



A0031616

1 Remove the driver side air bag. Refer to Section 501-20B.

3 Measure the resistance between horn switch C217 pin 1, harness side, and horn switch C217 pin 3, harness side.

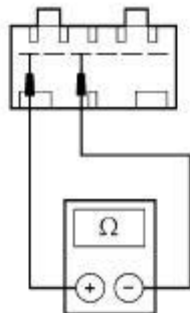
- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to D8.

→ **No**
INSTALL a new horn switch. REFER to Section 413-06. CLEAR the DTCs. REPEAT the self-test.

D8 CHECK THE AIR BAG SLIDING CONTACT FOR A SHORT

1




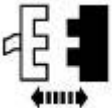

A0031617

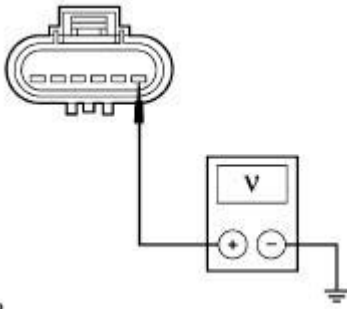
1 Measure the resistance between horn switch C217 pin 1 (component side), and horn switch C217 pin 3 (component side).

- Is the resistance greater than 10,000 ohms?

	<p>→ Yes REPAIR circuit 7-PG24 (YE/BU) and circuit 31S-PG24 (BK/OG) as necessary. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No INSTALL a new air bag sliding contact. REFER to Section 501-20B. CLEAR the DTCs. REPEAT the self-test.</p>
--	--

PINPOINT TEST E: DTC P1567—NGSC DRIVER FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK THE PCM PIDS	
	<p>1 Test drive the vehicle above 48 km/h (30 mph) with and without the speed control engaged, while monitoring the PCM PID SCINT_F and SC_HW_F.</p> <ul style="list-style-type: none"> ● Does either PCM PID SCINT_F or SC_HW_F indicate YES? <p>→ Yes If the PCM PID SCINT_F indicates YES, INSTALL a new PCM. REFER to Section 303-14. CLEAR the DTCs. REPEAT the self-test.</p> <p>If the PCM PID SC_HW_F indicates YES, GO to E2.</p> <p>→ No GO to E7.</p>
E2 CHECK CIRCUIT 15S-PG12 (GN/WH) FOR AN OPEN	
<p>1</p>  <p>2</p>  <p style="text-align: center;">Speed Control Servo C122</p> <p>3</p>  <p>4</p>	<p>4 Measure the voltage between speed control servo C122 pin 1, circuit 15S-PG12 (GN/WH), harness side, and ground.</p>



A0005468

- Is the voltage greater than 10 volts?

→ **Yes**
GO to E3.

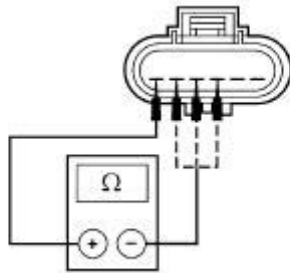
→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

E3 CHECK THE SPEED CONTROL SERVO

1



2



A0006460

- 2 Measure the resistance between speed control servo pins (component side), as follows:

Speed Control Servo	Speed Control Servo
Pin 1	Pin 2
Pin 1	Pin 3
Pin 1	Pin 4

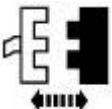
- Are the resistances between 2 and 3 ohms?

→ **Yes**
GO to E4.

→ **No**
INSTALL a new speed control servo.
REFER to Speed Control Actuator in this section. CLEAR the DTCs. REPEAT the self-test.

E4 CHECK THE SPEED CONTROL SERVO CIRCUITRY FOR SHORT TO POWER

1

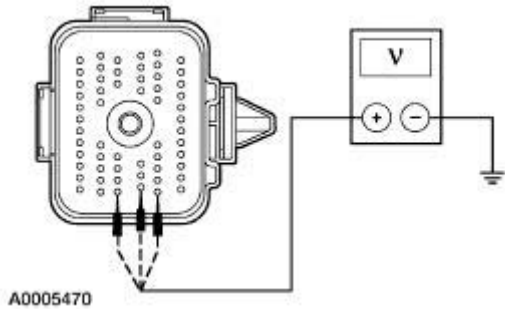


PCM C175a

2



3



3 Measure the voltage between PCM C175a, harness side and ground, as follows:

PCM C175a	Circuit
Pin 29	10-PG12 (GY/WH)
Pin 36	8-PG21 (WH/GN)
Pin 46	10-PG21 (GY/OG)

• Is any voltage present?

→ **Yes**
REPAIR the circuit(s). CLEAR the DTCs.
REPEAT the self-test.

→ **No**
GO to E5.

E5 CHECK THE SPEED CONTROL SERVO CIRCUITRY FOR AN OPEN

1



2 Measure the resistance between PCM C175a, harness side, and speed control servo C122, harness side, as follows:

PCM C175a	Speed Control Servo C122	Circuit
Pin 29	Pin 4	10-PG12 (GY/WH)
Pin 36	Pin 3	8-PG21 (WH/GN)
Pin 46	Pin 2	10-PG21 (GY/OG)

• Are the resistances less than 5 ohms?

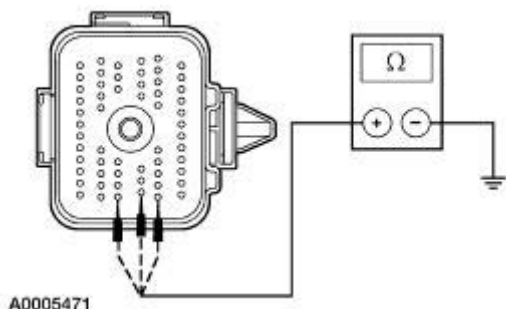
→ **Yes**
GO to E6.

→ **No**

REPAIR the circuit(s). CLEAR the DTCs.
REPEAT the self-test.

E6 CHECK THE SPEED CONTROL SERVO CIRCUITRY FOR SHORT TO GROUND

1



1

Measure the resistance between PCM C175a, harness side, and ground, as follows:

PCM C175a	Circuit
Pin 29	10-PG12 (GY/WH)
Pin 36	8-PG21 (WH/GN)
Pin 46	10-PG21 (GY/OG)

• Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to E7.

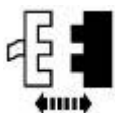
→ **No**
REPAIR the circuit(s). CLEAR the DTCs.
REPEAT the self-test.

E7 CHECK THE DEACTIVATOR SWITCH CIRCUITRY FOR AN OPEN

1

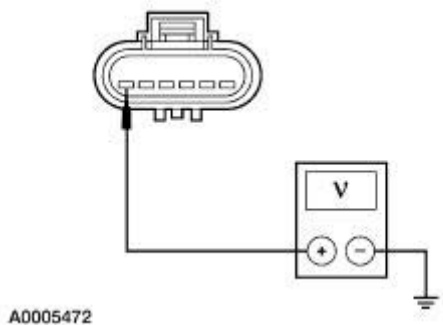


2



Speed Control Servo C122

3



3

Measure the voltage between speed control servo C122 pin 6, circuit 29S-PG16 (OG/YE), harness side, and ground.

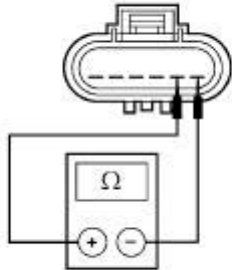
• Is the voltage greater than 10 volts?

→ **Yes**
GO to E8.

→ **No**
REPAIR circuit 29S-PG16 (OG/YE) or circuit 29S-PG1 (OG/YE). CLEAR the DTCs. REPEAT the self-test.

E8 CHECK THE SPEED CONTROL SERVO

1



A0005473

1 Measure the resistance between speed control servo pin 5 (component side), and speed control servo pin 6 (component side).

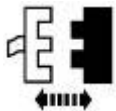
- Is the resistance between 20 and 30 ohms?

→ **Yes**
GO to E9.

→ **No**
INSTALL a new speed control servo. REFER to Speed Control Actuator in this section. CLEAR the DTCs. REPEAT the self-test.

E9 CHECK CIRCUIT 8-PG12 (WH/VT) FOR SHORT TO POWER

1

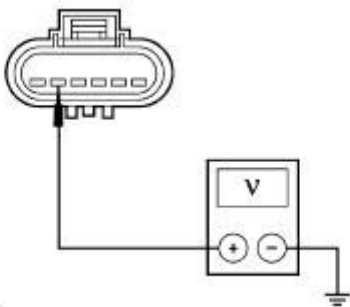


PCM C175a

2



3



A0005474

3 Measure the voltage between speed control servo C122 pin 5, circuit 8-PG12 (WH/VT), harness side, and ground.

- Is any voltage present?

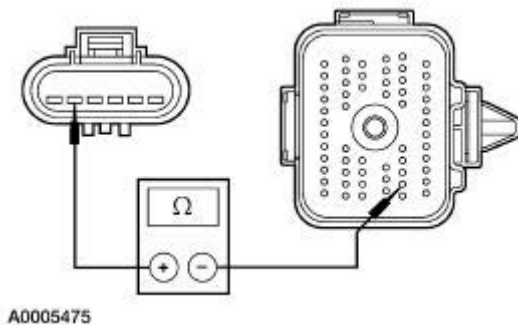
- **Yes**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.
- **No**
GO to E10.

E10 CHECK CIRCUIT 8-PG12 (WH/VT) FOR AN OPEN

1



2



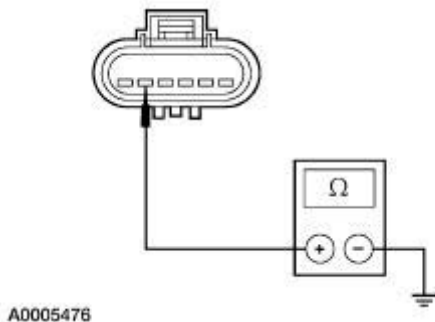
- 2 Measure the resistance between speed control servo C122 pin 5, circuit 8-PG12 (WH/VT), harness side, and PCM C175a pin 45, circuit 8-PG12 (WH/VT), harness side.

● **Is the resistance less than 5 ohms?**

- **Yes**
GO to E11.
- **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

E11 CHECK CIRCUIT 8-PG12 (WH/VT) FOR SHORT TO GROUND

1



- 1 Measure the resistance between speed control servo C122 pin 5, circuit 8-PG12 (WH/VT), harness side, and ground.

● **Is the resistance greater than 10,000 ohms?**

- **Yes**
INSTALL a new PCM. REFER to Section 303-14. CLEAR the DTCs. REPEAT the self-test.

→ **No**
 REPAIR the circuit. CLEAR the DTCs.
 REPEAT the self-test.

PINPOINT TEST F: DTC P1568—NGSC SERVO SELF-TEST FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE SPEED CONTROL ACTUATOR CABLE	
	<p>1 Disconnect the speed control actuator cable at the throttle body.</p> <p>2 Check the speed control actuator cable slack by pulling the speed control cable end taut from within the speed control cable housing.</p> <p>● Is the speed control actuator cable slack greater than 0 mm (0 in) and less than 6 mm (0.24 in)?</p> <p>→ Yes GO to <u>F2</u>.</p> <p>→ No INSTALL a new speed control actuator cable. REFER to <u>Speed Control Actuator</u> in this section. CLEAR the DTCs. REPEAT the self-test.</p>
F2 CHECK FOR DAMAGE, STICKING OR BINDING SPEED CONTROL ACTUATOR CABLE	
	<p>1 Disconnect the speed control actuator cable from the speed control servo.</p> <p>2 Check the speed control actuator cable for damage, sticking or binding.</p> <p>● Is the speed control actuator cable OK?</p> <p>→ Yes GO to <u>F3</u>.</p> <p>→ No INSTALL a new speed control actuator cable. REFER to <u>Speed Control Actuator</u> in this section. CLEAR the DTCs. REPEAT the self-test.</p>
F3 CHECK THE SPEED CONTROL SERVO OUTPUT	
	<p>1 Check the speed control servo pulley for movement while triggering the on-demand self-test.</p> <p>● Does the speed control servo pulley move?</p>

- **Yes**
REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
- **No**
GO to F4.

F4 CHECK THE SPEED CONTROL SERVO

1



2



Speed Control Servo C122

- 3 Measure the resistance between speed control servo pins (component side), as follows:

Speed Control Servo	Speed Control Servo	Expected Value
Pin 1	Pin 2	Between 2 and 3 ohms
Pin 1	Pin 3	Between 2 and 3 ohms
Pin 1	Pin 4	Between 2 and 3 ohms
Pin 5	Pin 6	Between 20 and 30 ohms

- Are the resistances OK?

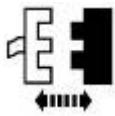
- **Yes**
GO to F5.
- **No**
INSTALL a new speed control servo. REFER to Speed Control Actuator in this section. CLEAR the DTCs. REPEAT the self-test.

F5 CHECK THE SPEED CONTROL SERVO CIRCUITRY FOR SHORT TO POWER

1



2

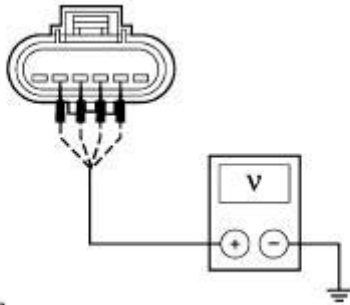


PCM C175a

3



4



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4 Measure the voltage between speed control servo C122, harness side and ground, as follows:

Speed Control Servo C122	Circuit
Pin 5	8-PG12 (WH/VT)
Pin 4	10-PG12 (GY/WH)
Pin 3	8-PG21 (WH/GN)
Pin 2	10-PG21 (GY/OG)

• Is any voltage present?

→ **Yes**
REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to F6.

F6 CHECK THE SPEED CONTROL SERVO CIRCUITRY FOR AN OPEN CIRCUIT

1



2 Measure the resistance between PCM C175a, harness side and speed control servo C122, harness side, as follows:

PCM C175a	Speed control servo C122	Circuit
Pin 45	Pin 5	8-PG12 (WH/VT)
Pin 29	Pin 4	10-PG12 (GY/WH)
Pin 36	Pin 3	8-PG21 (WH/GN)
Pin 46	Pin 2	10-PG21

(GY/OG)

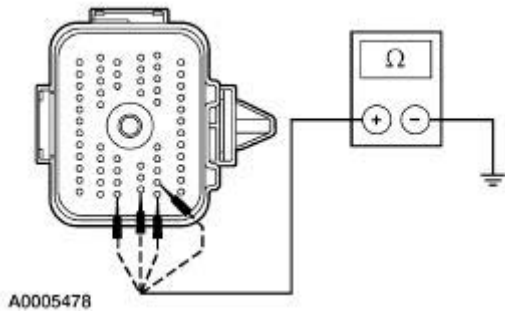
- Are the resistances less than 5 ohms?

→ **Yes**
GO to F7.

→ **No**
REPAIR the circuit(s). CLEAR the DTCs.
REPEAT the self-test.

F7 CHECK THE SPEED CONTROL SERVO CIRCUITRY FOR SHORT TO GROUND

1



1

Measure the resistances between PCM C175a, harness side, and ground, as follows:

PCM C175a	Circuit
Pin 45	8-PG12 (WH/VT)
Pin 29	10-PG12 (GY/WH)
Pin 36	8-PG21 (WH/GN)
Pin 46	10-PG21 (GY/OG)

- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to F8.

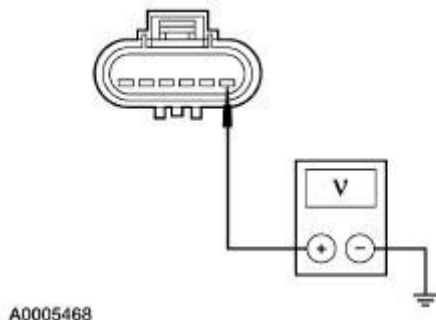
→ **No**
REPAIR the circuit(s). CLEAR the DTCs.
REPEAT the self-test.

F8 CHECK CIRCUIT 15S-PG12 (GN/WH) FOR AN OPEN

1



2



2

Measure the voltage between speed control servo C122 pin 1, circuit 15S-PG12 (GN/WH), harness side and ground.

- Is the voltage greater than 10 volts?

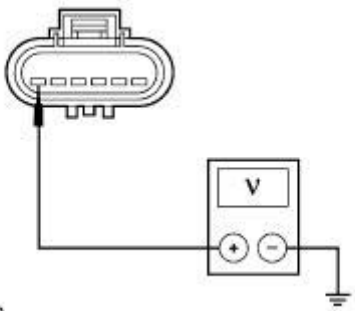
- **Yes**
GO to F9.
- **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

F9 CHECK THE DEACTIVATOR SWITCH CIRCUITRY FOR AN OPEN

1



2




- 2 Measure the voltage between speed control servo C122 pin 6, circuit 29S-PG16 (OG/YE), harness side and ground.

● **Is the voltage greater than 10 volts?**

- **Yes**
INSTALL a new speed control servo.
REFER to Speed Control Actuator in this section. CLEAR the DTCs. REPEAT the self-test.
- **No**
REPAIR circuit 29S-PG16 (OG/YE) or circuit 29S-PG1 (OG/YE) as necessary.
CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST G: DTC P1572, DTC P0703—BRAKE ON/OFF FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Make sure the deactivator switch is correctly adjusted before proceeding.	
G1 MONITOR THE PCM PID BPA_SW	
<p>1</p> 	<p>2 Monitor the PCM PID BPA_SW without depressing the brake pedal.</p> <p>● Does the PCM BPA_SW PID</p>

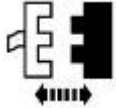
indicate ON?

→ **Yes**
GO to G2.

→ **No**
GO to G5.

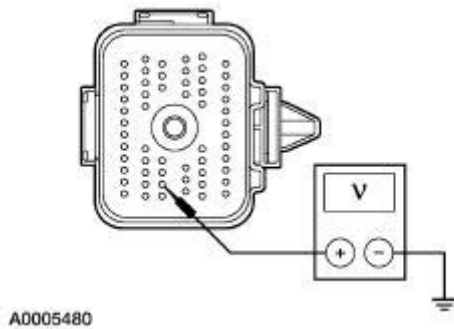
G2 CHECK FOR AN OPEN CIRCUIT

1



PCM C175a

2



2 Measure the voltage between PCM C175a pin 28, circuit 29S-RE21 (OG/GN), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
INSTALL a new PCM. REFER to Section 303-14. CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to G3.

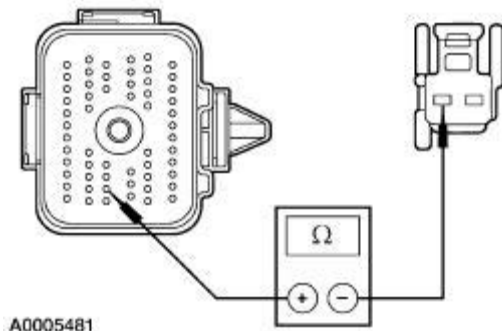
G3 CHECK CIRCUIT 29S-PG1 (OG/YE)

1



Deactivator Switch C277

2



2 Measure the resistance between PCM C175a pin 28, circuit 29S-RE21 (OG/GN), harness side, and deactivator switch C277 pin 2, circuit 29S-PG1 (OG/YE), harness side.

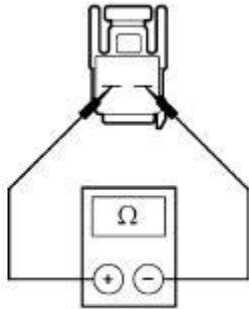
● Is the resistance less than 5 ohms?

→ **Yes**
GO to G4.

→ **No**
REPAIR circuit 29S-RE21 (OG/GN) and circuit 29S-PG1 (OG/YE) as necessary. CLEAR the DTCs. REPEAT the self-test.

G4 CHECK THE DEACTIVATOR SWITCH

1



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1

Measure the resistance between deactivator switch pins, (component side) while depressing and releasing the brake pedal.

● Is the resistance less than 5 ohms with the brake pedal released and greater than 10,000 ohms with the brake pedal depressed?

→ **Yes**
REPAIR circuit 29-PG6 (OG/YE). CLEAR the DTCs. REPEAT the self-test.

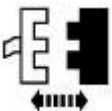
→ **No**
INSTALL a new deactivator switch. REFER to Switch—Deactivator in this section. CLEAR the DTCs. REPEAT the self-test.

G5 CHECK THE BRAKE PEDAL POSITION (BPP) INPUT TO PCM

1



2



PCM C175a

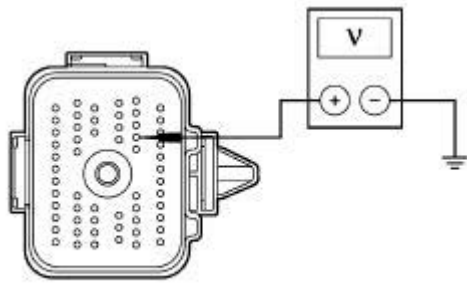
3



4

4

Measure the voltage between PCM C175a pin 40, circuit 29S-RE13 (OG), harness side and ground, while



A0005483

depressing the brake pedal.

- Is the voltage greater than 10 volts?


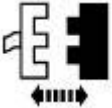
→ **Yes**

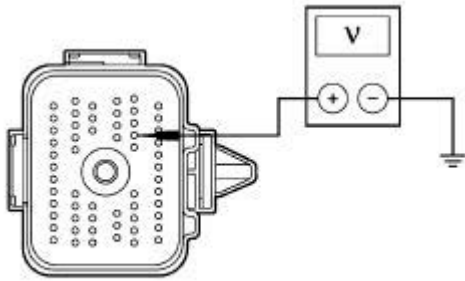
INSTALL a new PCM. REFER to [Section 303-14](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST H: THE SPEED CONTROL IS INOPERATIVE—NO DTCs

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK THE PCM PID IDBRKSW	
	<p>1 Monitor the PCM PID IDBRKSW.</p> <ul style="list-style-type: none"> ● Does the PCM PID IDBRKSW indicate OFF? <p>→ Yes GO to H3.</p> <p>→ No GO to H2.</p>
H2 CHECK THE BPP INPUT TO THE PCM	
<p>1</p>  <p>2</p>  <p>PCM C175a</p> <p>3</p>	<p>3 Measure the voltage between PCM C175a pin 40, circuit 29S-RE13 (OG), harness side and ground.</p>



A0005483

- **Is any voltage present?**

→ **Yes**

REFER to [Section 417-01](#).

→ **No**

INSTALL a new PCM. REFER to [Section 303-14](#). CLEAR the DTCs. REPEAT the self-test.

H3 CHECK THE PCM PID PBA_SW

1 Monitor the PCM PID PBA_SW.

- **Does the PCM PID PBA_SW indicate OFF with the parking brake released?**

→ **Yes**

If equipped with a manual transmission, GO to [H4](#).

If equipped with an automatic transmission, GO to [H8](#).

→ **No**

REFER to [Section 413-01](#).

H4 CHECK THE PCM PID CPP

1 Monitor the PCM PID CPP.

- **Does the PCM PID CPP indicate NO?**

→ **Yes**

GO to [H11](#).

→ **No**

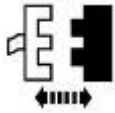
GO to [H5](#).

H5 CHECK THE CPP SWITCH

1

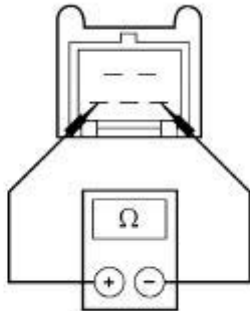


2



CPP Switch C258

3



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3

Measure the resistance between CPP switch pins 1 (component side), and CPP switch pin 3 (component side), while depressing and releasing the switch.

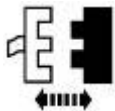
- Is the resistance less than 5 ohms in one direction and greater than 10,000 ohms in the other?

→ **Yes**
GO to H6.

→ **No**
INSTALL a new CPP switch. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test.

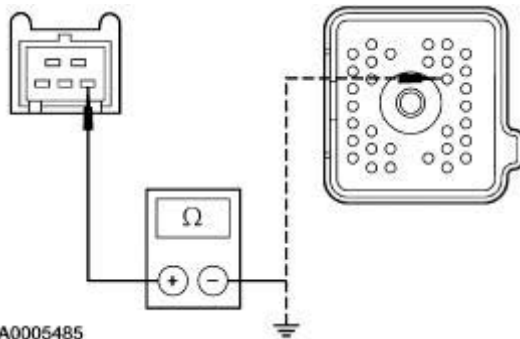
H6 CHECK CIRCUIT 8-TC18 (WH) FOR AN OPEN

1



PCM C175b

2



A0005485

2

Measure the resistance between CPP switch C258 pin 1, circuit 8-TC18 (WH), harness side, and PCM C175b pin 22, circuit 8-TC18 (WH), harness side; and between CPP switch C258 pin 1, circuit 8-TC18 (WH), harness side and ground.

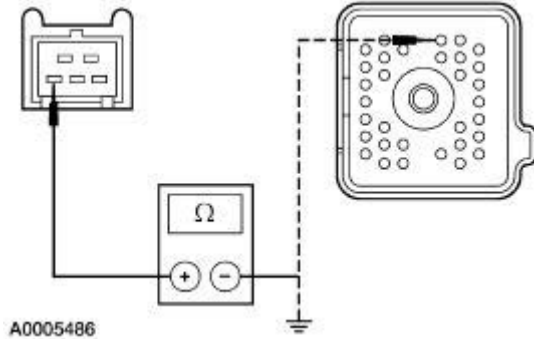
- Is the resistance less than 5 ohms between the CPP switch and PCM; and greater than 10,000 ohms between the CPP switch and ground?

→ **Yes**
GO to H7.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

H7 CHECK CIRCUIT 9-RE8 (BN) AND CIRCUIT 9S-TC18

1



1

Measure the resistance between CPP switch C258 pin 3, circuit 9S-TC18 (BN), harness side, and PCM C175a pin 17, circuit 9-RE8 (BN), harness side; and between CPP switch C258 pin 3, circuit 9S-TC18 (BN), harness side, and ground.

- **Is the resistance less than 5 ohms between the CPP switch and PCM; and greater than 10,000 ohms between the CPP switch and ground?**

→ **Yes**
INSTALL a new PCM. REFER to [Section 303-14](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

H8 CHECK THE DTR SENSOR

1

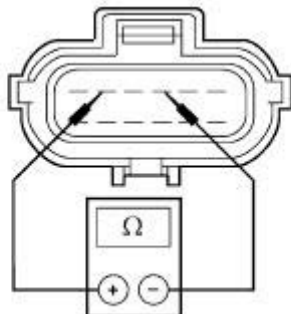


2



DTR Sensor C167

3



3

Measure the resistance between DTR sensor pin 2 (component side), and DTR sensor pin 4 (component side), while placing the transmission selector in P and D5.

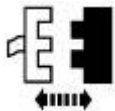
- Is the resistance less than 5 ohms when the transmission selector is in P and greater than 10,000 ohms when the transmission selector is in D5?

→ **Yes**
GO to H9.

→ **No**
INSTALL a new DTR sensor. REFER to Section 307-01. CLEAR the DTCs. REPEAT the self-test.

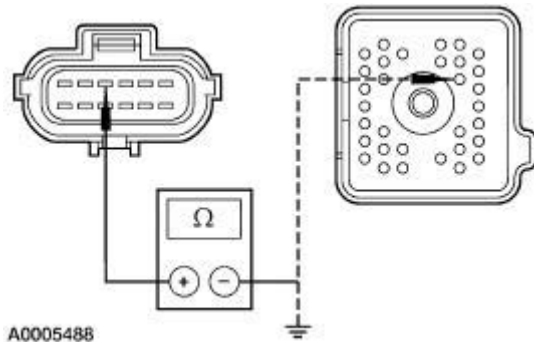
H9 CHECK CIRCUIT 8-TA40 (WH/GN) FOR AN OPEN

1



PCM C175b

2



2

Measure the resistance between DTR sensor C167 pin 4, circuit 8-TA40 (WH/GN), harness side, and PCM C175b pin 22, circuit 8-TA40 (WH/GN), harness side; and between DTR sensor C167 pin 4, circuit 8-TA40 (WH/GN), harness side and ground.

- Is the resistance less than 5 ohms between the DTR sensor and PCM; and greater than 10,000 ohms between the DTR sensor and ground?

→ **Yes**
GO to H10.

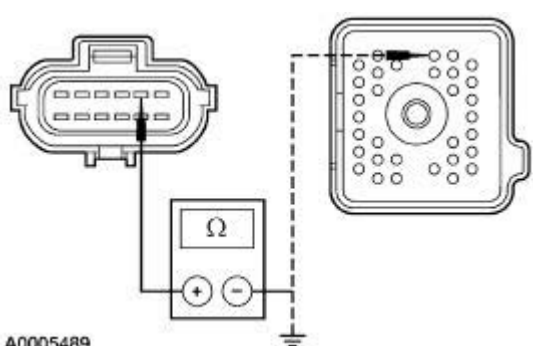
→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

H10 CHECK CIRCUIT 9-TA1 (BN) AND CIRCUIT 9-TA18 (BN/YE)

1

1

Measure the resistance between DTR sensor C167 pin 2, circuit 9-TA18 (BN/YE), harness side, and PCM C175b pin 17, circuit 9-TA1 (BN/YE), harness side; and between DTR sensor C167 pin 2, circuit 9-TA18 (BN/YE), harness side, and ground.



- Is the resistance less than 5 ohms between the DTR sensor and PCM; and greater than 10,000 ohms between the DTR sensor and ground?

→ **Yes**
GO to H11.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

H11 CHECK THE PCM PID SCCS

1 Monitor the PCM PID SCCS, while depressing and releasing the speed control actuator switches. Refer to the PCM Parameter Identification (PID) Index.

- Does the PCM PID SCCS operate correctly?

→ **Yes**
GO to H12.

→ **No**
INSTALL a new speed control actuator switch. REFER to Switch—Speed Control Actuator in this section. CLEAR the DTCs. REPEAT the self-test.

H12 CHECK THE PCM PID VBAT

1 Monitor the PCM PID VBAT.

- Does the PCM PID VBAT indicate greater than 10 volts with the engine running?

→ **Yes**
REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

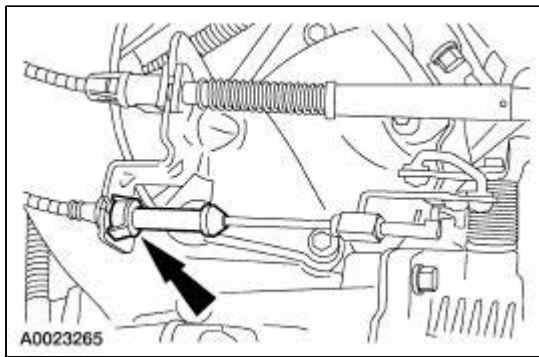
→ **No**
REFER to Section 414-00.

Speed Control Cable

Removal and Installation

1. Remove the speed control servo. Refer to [Speed Control Actuator](#) in this section.
2. Lower the vehicle.
3. **NOTE:** 3.9L shown, 3.0L similar.

Remove the speed control actuator cable from the throttle bracket by squeezing the locking ears.



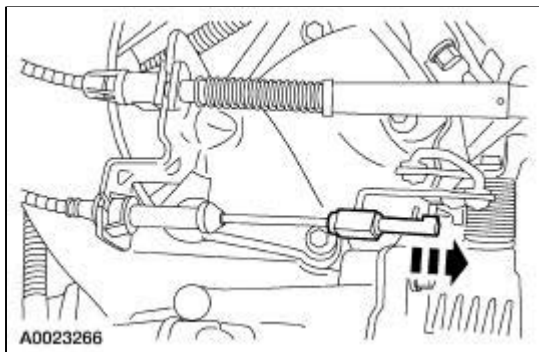
4. To install, reverse the removal procedure.
-

Speed Control Actuator

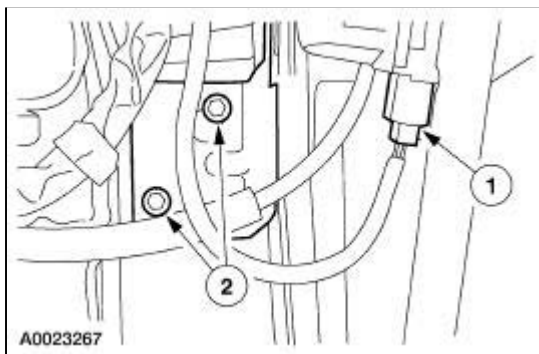
Removal

1. If equipped, remove the engine cover.
2. **NOTE:** 3.9L shown, 3.0L similar.

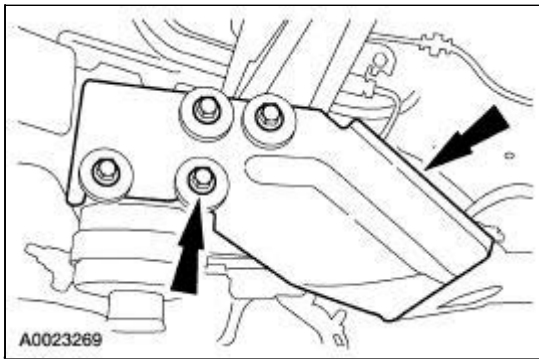
Detach the speed control actuator cable end from the throttle nailhead by pushing forward.



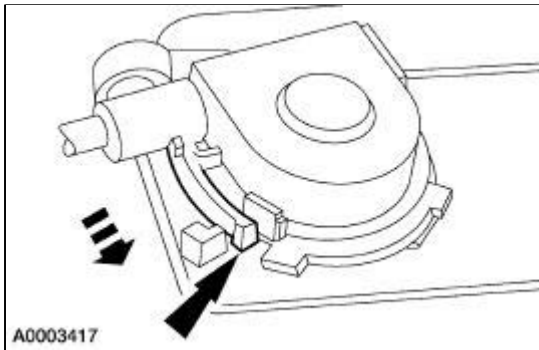
3. Remove the LF wheel and tire. For additional information, refer to [Section 204-04](#).
4. Remove the LF inner splash shield.
5. Position the speed control servo bracket assembly aside.
 1. Disconnect the electrical connector.
 2. Remove the bolts.



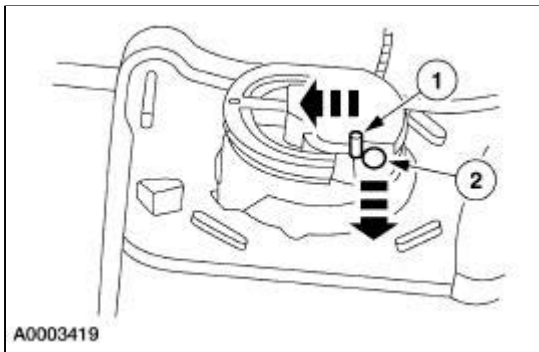
6. Remove the bolts and separate the bracket from the speed control servo.



7. Depress the locking tab and rotate the speed control actuator cable cap to remove.

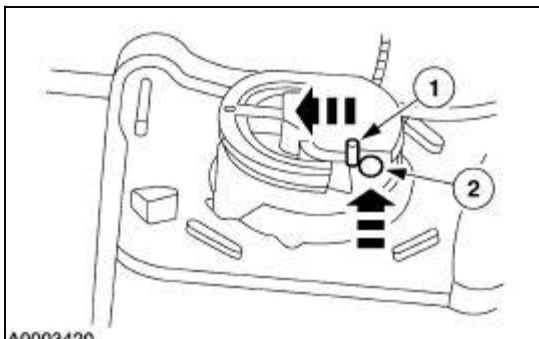



8. Disconnect the speed control actuator cable from the speed control servo pulley.
 1. Gently push the retaining spring.
 2. Disconnect the speed control cable slug from the speed control servo pulley.




Installation

1. Insert the speed control cable slug into the speed control servo pulley slot.
 1. Gently push the retaining spring.
 2. Insert the speed control cable slug completely into the speed control servo pulley slot.

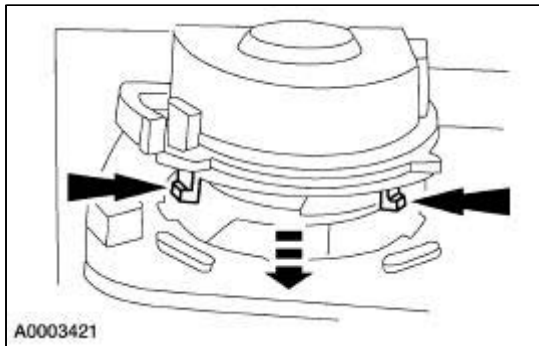


2.  **CAUTION:** It is necessary to squarely seat the speed control actuator cable cap and seal around the speed control servo pulley.

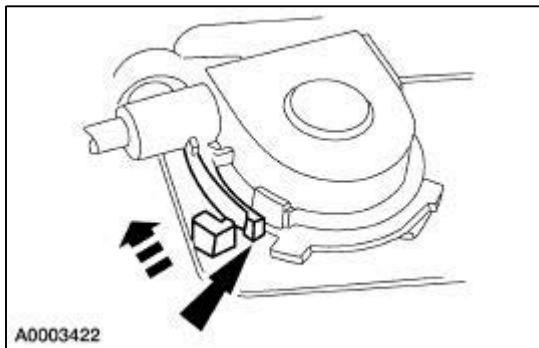
 **CAUTION:** Incorrect wrapping of the speed control actuator cable around the speed control servo pulley may result in high idle conditions.

NOTE: Make sure the rubber seal is fully seated onto the speed control actuator cable cap.

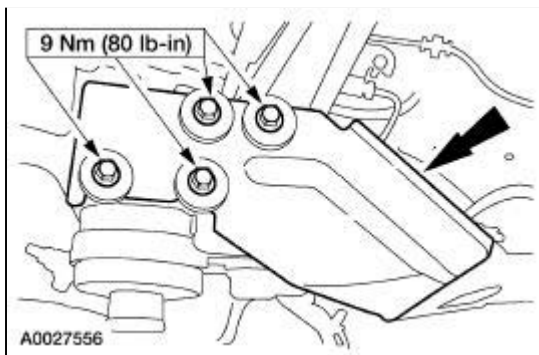
Align the speed control actuator cable cap tabs with the slots in the speed control servo housing.



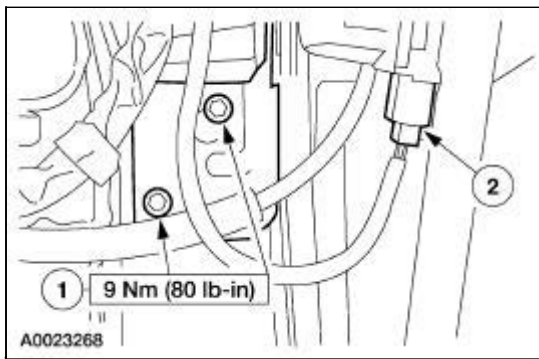
3. Rotate the speed control actuator cable cap until the locking tab engages.



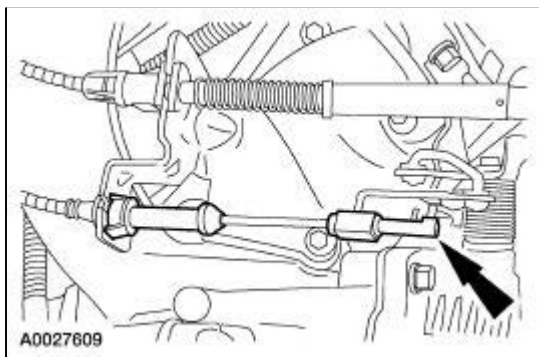
4. Attach the bracket to the speed control servo and install the bolts.



5. Install the speed control servo bracket assembly.
1. Install the bolts.
2. Connect the electrical connector.



6. Install the LF inner splash shield.
7. Install the wheel and tire. For additional information, refer to [Section 204-04](#).
8. Attach the speed control actuator cable end to the throttle nailhead.



9. If equipped, install the engine cover.
-

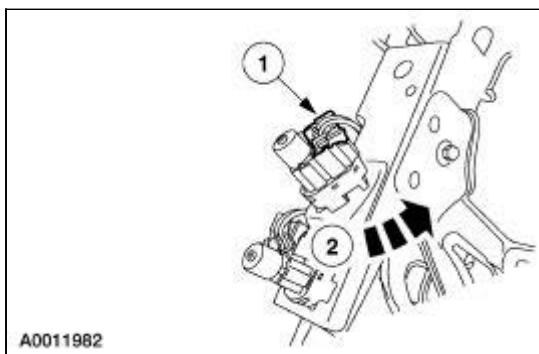
Switch —Deactivator

Removal

1. **NOTE:** Disconnect the footwell lamp electrical connector.

Remove the instrument panel insulator.

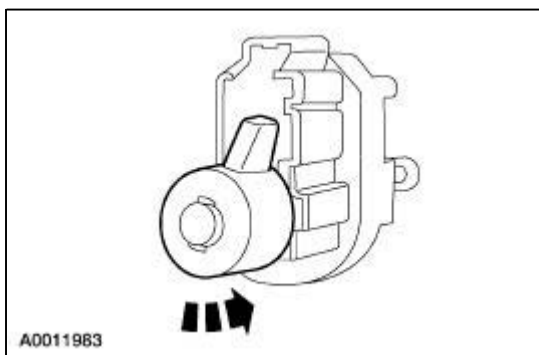
2. Remove the deactivator switch.
 1. Disconnect the electrical connector.
 2. Rotate and remove the deactivator switch.



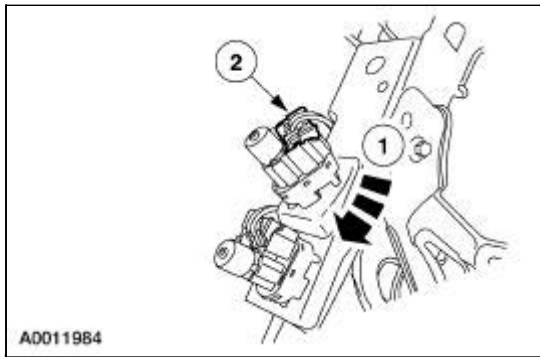
Installation

 **CAUTION:** Initial installation of a deactivator switch allows for one adjustment. If additional adjustments are necessary, install a new switch.

1. Rotate the lock knob counterclockwise to the stop to unlock.



2. With the engine running, fully depress and hold the brake pedal.
3. Install the deactivator switch.
 1. Position the deactivator switch in the bracket and rotate clockwise.
 2. Connect the electrical connector.

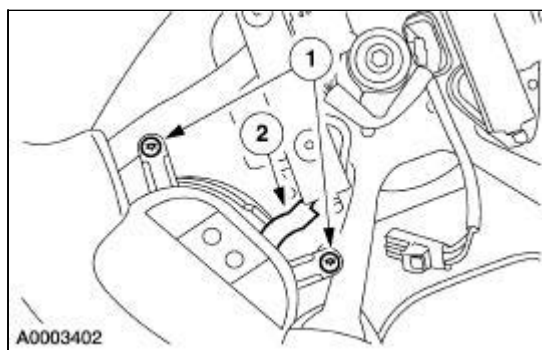


4. Slowly release the brake pedal.
-

Switch —Speed Control Actuator

Removal and Installation

1. Remove the driver side air bag; refer to [Section 501-20B](#) .
2. Remove the speed control actuator switch.
 1. Remove the screws.
 2. Disconnect the electrical connector.



3. To install, reverse the removal procedure.
-

General Specifications


Item	Specification
A/C Compressor	
A/C compressor type	SC90V variable scroll
A/C compressor displacement	90 cc (5.5 cu in)
A/C compressor rotation	Clockwise
Magnetic Clutch	
Air gap between pulley and clutch plate	0.35-0.75 mm (0.014-0.030 in)
Coolant Hose Lubricant	
MERPOL®	ESE-M99B144-B
Refrigerant Lubricant	
PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C)	WSH-M1C231-B
Capacity	207 ml (7 oz)
Refrigerant	
R-134a Refrigerant YN-19	WSH-M17B19-A
Capacity	0.79 kg (28 oz)
Refrigerant System Cleaner	
A/C Systems Flushing Solvent F4AZ-19579-A	—
Evaporator Core Orifice	
	Thermostatic expansion valve (TXV) system
Color	N/A
Diameter	N/A
A/C Pressure Relief Valve ^a	
Open	3,792-4,137 kPa (550-600 psi)
A/C Cycling Switch	N/A
Pressure Cutoff Switch	N/A
A/C Pressure Sensor	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.


^a Manifold gauge set pressures may vary slightly depending on the distance between the service gauge port valve and the A/C pressure relief valve locations.


Torque Specifications

Description	Nm	lb-in
Peanut fitting nut	8	71


Climate Control System

 **WARNING:** To avoid accidental deployment and possible injury, the air bag system backup power supply must be depleted before repairing any climate control components. To deplete the backup power supply, disconnect the battery ground cable and wait one minute.

 **WARNING:** Carbon monoxide is colorless, odorless and dangerous. If it is necessary to operate the engine with vehicle in a closed area such as a garage, always use an exhaust collector to vent the exhaust gases outside the closed area.

 **WARNING:** R-134a is classified as a safe refrigerant, but misuse can make it dangerous. The following precautions must be observed:

- Always wear safety goggles when repairing an air conditioning system.
- Avoid contact with liquid refrigerant R-134a. R-134a vaporizes at approximately -25°C (-13°F) under atmospheric pressure and it will freeze skin tissue.
- Never allow refrigerant R-134a gas to escape in quantity in an occupied space. R-134a is non-toxic, but it will displace the oxygen needed to support life.
- Never use a torch in an atmosphere containing R-134a gas. R-134a is non-toxic at all normal conditions, but when it is exposed to high temperatures, such as a torch flame, it decomposes. During decomposition it releases irritating and toxic gases (as described in the MSDS sheet from the manufacturer). Decomposition products are hydrofluoric acid, carbon dioxide and water.
- Do not allow any portion of the charged air conditioning system to become too hot. The pressure in an air conditioning system rises as the temperature rises and temperatures of approximately 85°C (185°F) can be dangerous.
- Allow the engine to cool sufficiently prior to carrying out maintenance or serious burns and injury can occur.

 **CAUTION:** To avoid damaging the vehicle or A/C components, the following precautions must be observed:

- The A/C refrigerant of all vehicles must be identified and analyzed prior to refrigerant charging. Failure to do so can contaminate the shop bulk refrigerant and other vehicles.
- Do not add R-12 refrigerant to an A/C system that requires the use of R-134a refrigerant. These two types of refrigerant must never be mixed. Doing so can damage the A/C system.
- Charge the A/C system with the engine running. Use the low-pressure side of the A/C system when charging to prevent refrigerant slugging from damaging the A/C compressor.
- Use only R-134a refrigerant. Due to environmental concerns, when the air conditioning system is drained, the refrigerant must be collected using refrigerant recovery/recycling equipment. Federal law **REQUIRES** that R-134a be recovered into appropriate recovery equipment and the process be conducted by qualified technicians who have been certified by an approved organization, such as MACS, ASI, etc. Use of a recovery machine dedicated to R-134a is necessary to reduce the possibility of oil and refrigerant incompatibility concerns. Refer to the instructions provided by the equipment manufacturer when removing refrigerant from or charging the air conditioning system.

- Refrigerant R-134a must not be mixed with air for leak testing or used with air for any other purpose above atmospheric pressure. R-134a is combustible when mixed with high concentrations of air and higher pressures.
- A number of manufacturers are producing refrigerant products that are described as direct substitutes for refrigerant R-134a. The use of any unauthorized substitute refrigerant can severely damage the A/C components. If repair is required, use only new or recycled refrigerant R-134a.



CAUTION: To avoid contamination of the A/C system:

- Never open or loosen a connection before discharging the system.
- When loosening a connection, if any residual pressure is evident, allow it to leak out before opening the fitting.
- Before charging, evacuate a system that has been opened to install a new component or a system that has discharged through leakage.
- Seal open fittings with a cap or plug immediately after disconnecting a component from the system.
- Clean the outside of the fittings thoroughly before disconnecting a component from the system.
- Do not remove the sealing caps from a new component until ready to install.
- Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open an oil container until ready to use, and install the cap immediately after using. Store the oil in a clean, moisture-free container.
- Install a new O-ring seal before connecting an open fitting. Coat the fitting and the O-ring seal with refrigerant oil before connecting.
- When installing a refrigerant line, avoid sharp bends. Position the line away from the exhaust or any sharp edges that can chafe the line.
- Tighten threaded fittings only to specifications. The steel and aluminum fittings used in the refrigerant system will not tolerate overtightening.
- When disconnecting a fitting, use a wrench on both halves of the fitting to prevent twisting of the refrigerant lines or tubes.
- Do not open a refrigerant system or uncap a new component unless it is as close as possible to room temperature. This will prevent condensation from forming inside a component that is cooler than the surrounding air.

The electronic automatic temperature control system maintains the selected vehicle interior temperature by heating and/or cooling the air.

- During A/C operation the system also reduces the relative humidity of the air.
- The driver may override the automatic mode of operation.

Principles of Operation

There are four main principles involved with the basic theory of operation:

- heat transfer
- latent heat of vaporization
- relative humidity
- effect of pressure on boiling or condensation

Heat Transfer

If two substances of different temperature are placed near each other, the heat in the warmer substance will transfer to the colder substance.

Latent Heat of Vaporization

When a liquid boils (converts to gas) it absorbs heat without raising the temperature of the resulting gas. When the gas condenses (converts back to a liquid), it gives off heat without lowering the temperature of the resulting liquid.

Relative Humidity

The amount of moisture (water vapor content) that the air can hold is directly related to the air temperature. The more heat there is in the air, the more moisture the air can hold. The lower the moisture content in the air, the more comfortable you feel. Removing moisture from the air lowers its relative humidity and improves personal comfort.

Effects of Pressure on Boiling or Condensation

As the pressure is increased on a liquid, the temperature at which the liquid boils (converts to gas) also increases. Conversely, when the pressure on a liquid is reduced, its boiling point is also reduced. When in the gas state, an increase in pressure causes an increase in temperature, while a decrease in pressure will decrease the temperature of the gas.

The Refrigerant Cycle

During stabilized conditions (air conditioning system shutdown), the refrigerant is in a vaporized state and pressures are equal throughout the system. When the A/C compressor is in operation it increases pressure on the refrigerant vapor, raising its temperature. The high-pressure and high-temperature vapor is then released into the top of the A/C condenser core.

The A/C condenser, being close to ambient temperature, causes the refrigerant vapor to condense into a liquid when heat is removed from the refrigerant by ambient air passing over the fins and tubing. The now liquid refrigerant, still at high pressure, exits from the bottom of the A/C condenser and enters the inlet side of the A/C receiver/drier. The receiver/drier is designed to remove moisture from the refrigerant.

The outlet of the receiver/drier is connected to the thermostatic expansion valve (TXV). The TXV provides the orifice which is the restriction in the refrigerant system and separates the high and low pressure sides of the A/C system. As the liquid refrigerant passes across this restriction, its pressure and boiling point are reduced.

The liquid refrigerant is now at its lowest pressure and temperature. As it passes through the A/C evaporator, it absorbs heat from the airflow passing over the plate/fin sections of the A/C evaporator. This addition of heat causes the refrigerant to boil (convert to gas). The now cooler air can no longer support the same humidity level of the warmer air and this excess moisture condenses on the exterior of the evaporator coils and fins and drains outside the vehicle.

The refrigerant cycle is now repeated with the A/C compressor again increasing the pressure and temperature of the refrigerant.

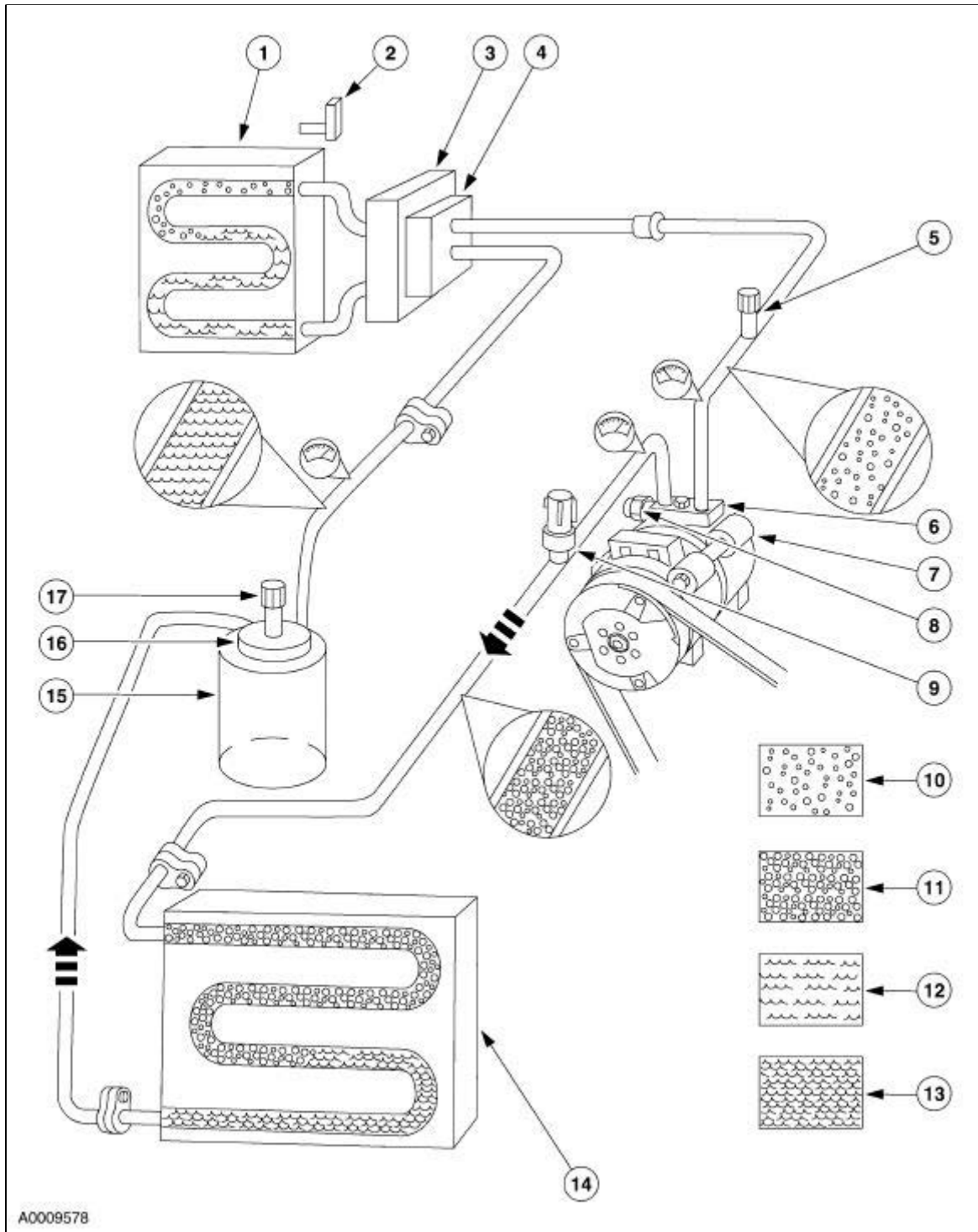
A thermistor which monitors the temperature of the air that has passed through the evaporator core controls A/C clutch cycling. If the temperature of the evaporator core discharge air is low enough to cause the condensed water vapor to freeze, the A/C clutch is disengaged by the vehicle powertrain control module (PCM).

The high-side line pressure is also monitored so that A/C compressor operation will be interrupted if the system pressure becomes too high or is determined to be too low (low charge condition).

The A/C compressor thermal protection switch will interrupt compressor operation if the compressor housing exceeds temperature limits.

The A/C compressor relief valve will open and vent refrigerant to relieve unusually high system pressure.

Clutch Cycling Thermostatic Expansion Valve Type Refrigerant System



Item	Part Number	Description
1	19860	A/C evaporator core

2	19C734	A/C evaporator core outlet temperature thermistor
3	19849	Thermostatic expansion valve
4	19835	Manifold and tube assembly—thermostatic expansion valve
5	19D701	A/C charge valve port (low side)
6	19D734	Manifold and tube assembly—A/C compressor
7	19703	A/C compressor
8	19D644	A/C pressure relief valve
9	19D594	A/C pressure transducer
10	—	Low pressure vapor
11	—	High pressure vapor
12	—	Low pressure liquid
13	—	High pressure liquid
14	19712	A/C condenser core
15	19959	A/C receiver/drier
16	19835	Manifold and tube assembly—receiver/drier
17	19D701	A/C charge valve port (high side)

Dual Automatic Temperature Control (DATC) Module Description

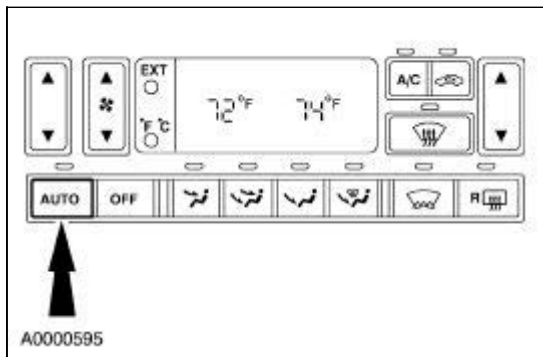
The DATC system automatically maintains a selected temperature for vehicle interior comfort and regulates the volume of airflow between the instrument panel registers, floor ducts, windshield defroster nozzle, and side window demisters. The system will automatically select between fresh and recirculated air with an optional manual override. The DATC system will also include a manual A/C override, blower speed override, and airflow direction overrides.

The dual temperature zone feature provides the driver and the front seat passenger with their own independent temperature set points. The DATC system provides both the driver and front seat passenger with their selected temperature for interior comfort. In situations where the difference between the driver and the front seat passenger set points are very large, the DATC will tend to favor the driver's setting and make the front seat passenger as comfortable as possible.

The driver and front seat passenger will not have independent air distribution mode or fan controls so the system is dual temperature only. In some cases the passenger temperature set point may influence the air distribution mode or blower speed in automatic mode.

System Air Flow

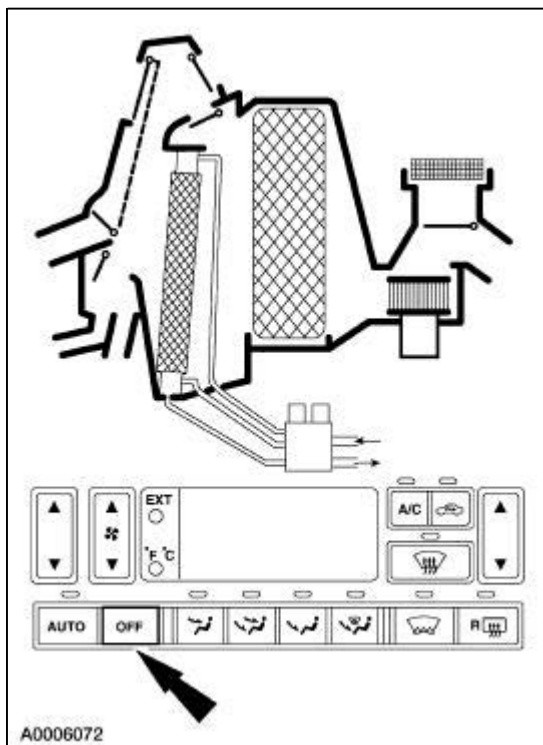
AUTO



When AUTO is selected:

- The temperature control setting(s) are manually set to the desired setting(s).
- The air inlet door actuator is automatically controlled by the DATC module, based on the temperature setting(s), but can be manually overridden by selecting the recirculation button.
- The panel door, floor door, defrost door and cold air bypass door actuators are automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by selecting any of the air distribution buttons.
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature setting(s).
- The A/C compressor is automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by selecting the A/C button. The A/C compressor will not operate if the outside temperature is lower than approximately 2°C (35°F).
- The blower motor is on. The blower motor speed is automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by adjusting the blower speed rocker button.

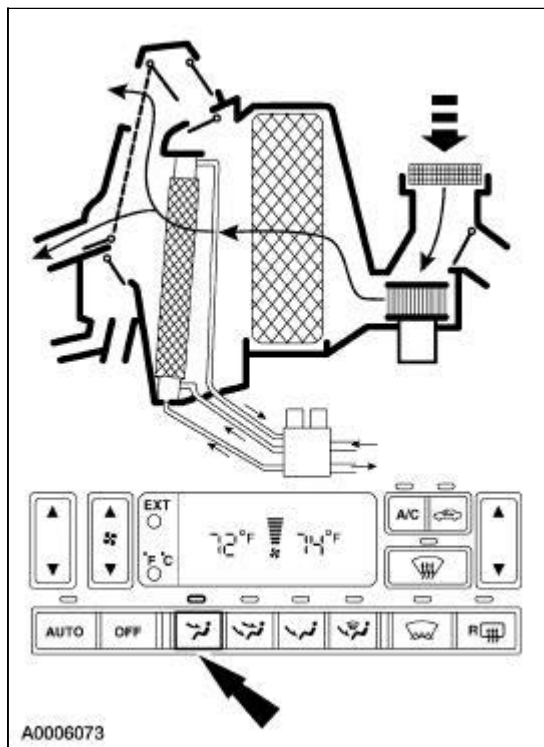
OFF



When OFF is selected:

- The air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment.
- The floor door actuator positions the floor door in the open position, and the panel door actuator, defrost door actuator, and cold air bypass door actuator position the panel door, defrost door, and cold air bypass door in the closed positions. This closes off airflow to the defrost duct, the side window demisters, the floor duct and the instrument panel A/C registers.
- The dual coolant control valve is in the closed position, preventing the flow of hot coolant to the heater core.
- The blower motor is off.

PANEL

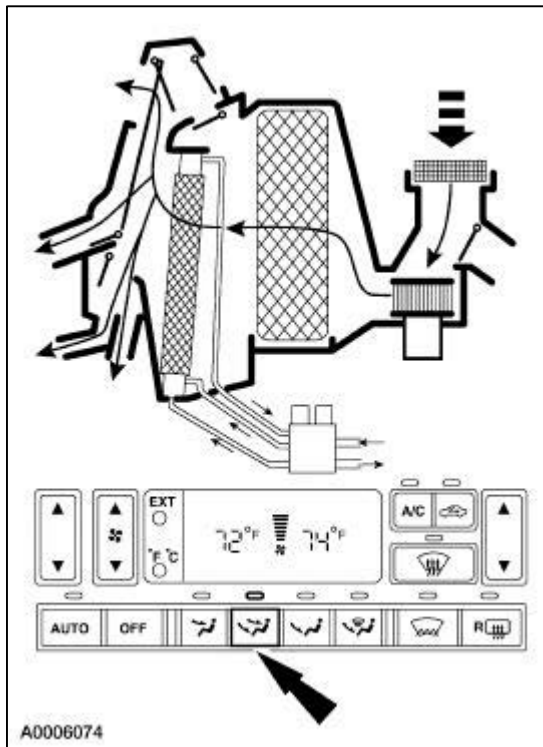


When PANEL is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator on), the air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator off), the air inlet door actuator positions the air inlet door to admit only outside air into the passenger compartment.
- The panel door actuator positions the panel door in the open position and the floor door and defrost door actuators position the floor door and defrost door in the closed position, directing airflow to the instrument panel A/C registers. The cold air bypass door actuator is automatically controlled by the DATC module based on the temperature setting(s).
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature setting(s).
- The A/C request button is enabled. When the A/C request button is selected (indicator on), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator off), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.

- The blower motor is on.

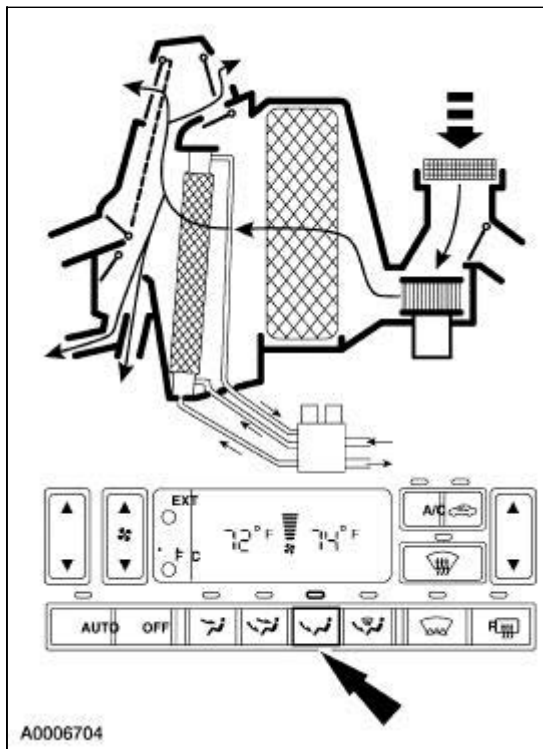
PANEL/FLOOR



When PANEL/FLOOR is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator on), the air inlet door actuator positions the air inlet door as to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator off), the air inlet door actuator positions the air inlet door to admit only outside air into the passenger compartment.
- The panel door and floor door actuators position the panel door and floor door in the open position and the defrost door actuator positions the defrost door in the closed position, directing airflow to the instrument panel A/C registers and the floor duct. The cold air bypass door actuator is automatically controlled by the DATC module based on the temperature setting(s).
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature setting(s).
- The A/C request button is enabled. When the A/C request button is selected (indicator on), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator off), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.
- The blower motor is on.

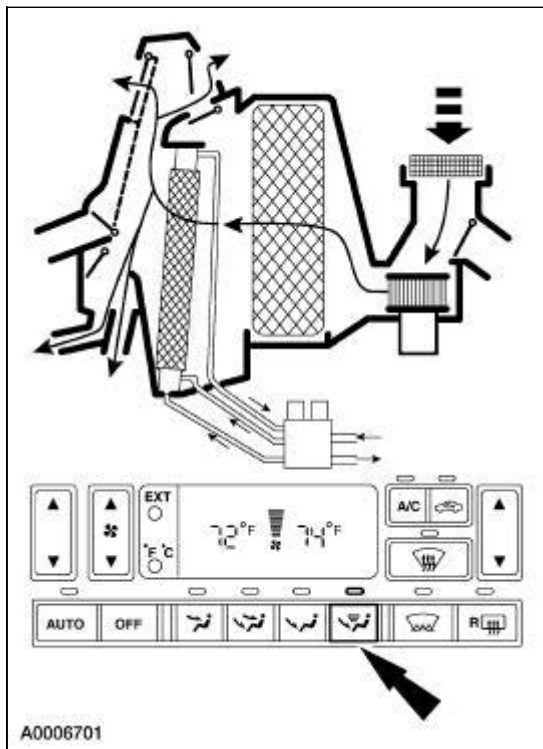
FLOOR



When FLOOR is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator on), the air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator off), the air inlet door actuator positions the air inlet door as to admit only outside air into the passenger compartment. The DATC will automatically revert to the outside air position after approximately 1 to 4 minutes to prevent window fogging.
- The floor door actuator positions the floor door in the open position and the panel door and defrost door actuators position the panel door and defrost door in the closed position, directing airflow to the floor duct. A small amount of airflow from the outboard instrument panel A/C registers will be present. The cold air bypass door actuator is automatically controlled by the DATC module based on the temperature setting(s).
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature settings.
- The A/C request button is enabled. When the A/C request button is selected (indicator on), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator off), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.
- The blower motor is on.

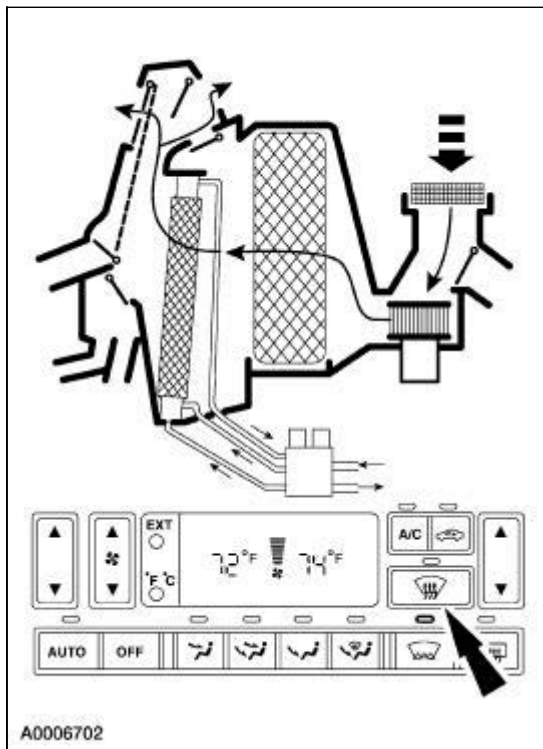
FLOOR/DEFROST



When FLOOR/DEFROST is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator on), the air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator off), the air inlet door actuator positions the air inlet door as to admit only outside air into the passenger compartment. The DATC will automatically revert to the outside air position after approximately 1 to 4 minutes to prevent window fogging.
- The floor door and defrost door actuators position the floor door and defrost door in the open position and the panel door actuator positions the panel door in the closed position, directing airflow to the floor duct, the windshield defroster ducts, and the side window demisters. A small amount of airflow from the outboard instrument panel A/C registers will be present. The cold air bypass door actuator is automatically controlled by the DATC module based on the temperature setting(s).
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature settings.
- The A/C request button is enabled. When the A/C request button is selected (indicator on), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator off), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.
- The blower motor is on.

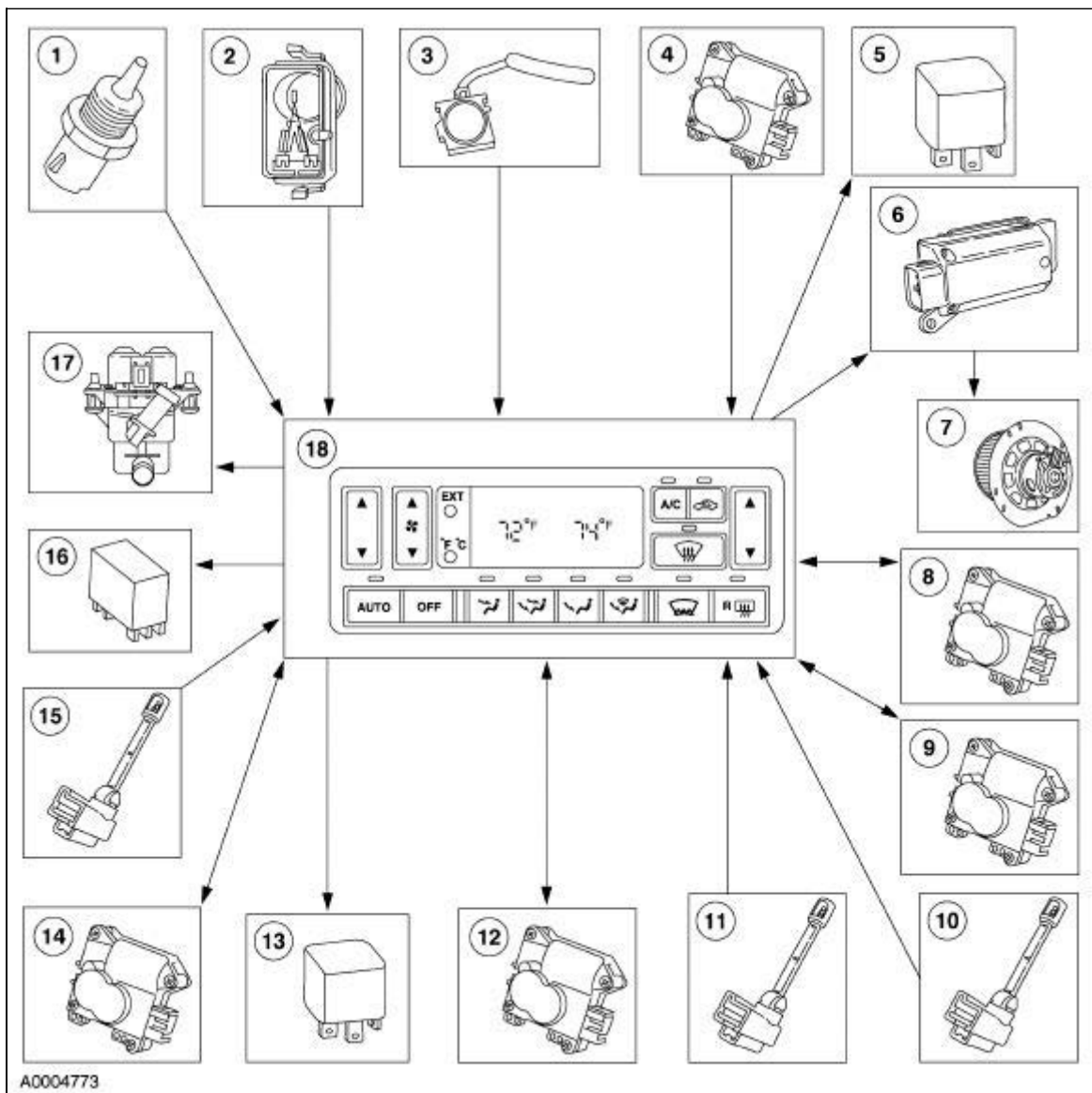
DEFROST



When DEFROST is selected:

- The Recirc request button is disabled. The air inlet door actuator positions the air inlet door to admit only outside air into the passenger compartment.
- The defrost door actuator positions the defrost door in the open position and the panel door, floor door, and cold air bypass door actuators position the panel door, floor door, and cold air bypass door in the closed position, directing airflow to the windshield defroster ducts and the side window demisters. A small amount of airflow from the outboard instrument panel A/C registers will be present.
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature settings.
- The A/C request button is disabled. To reduce fogging, the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F).
- The blower motor is on.

Climate Control System Electrical Components—Directly Linked to DATC Module

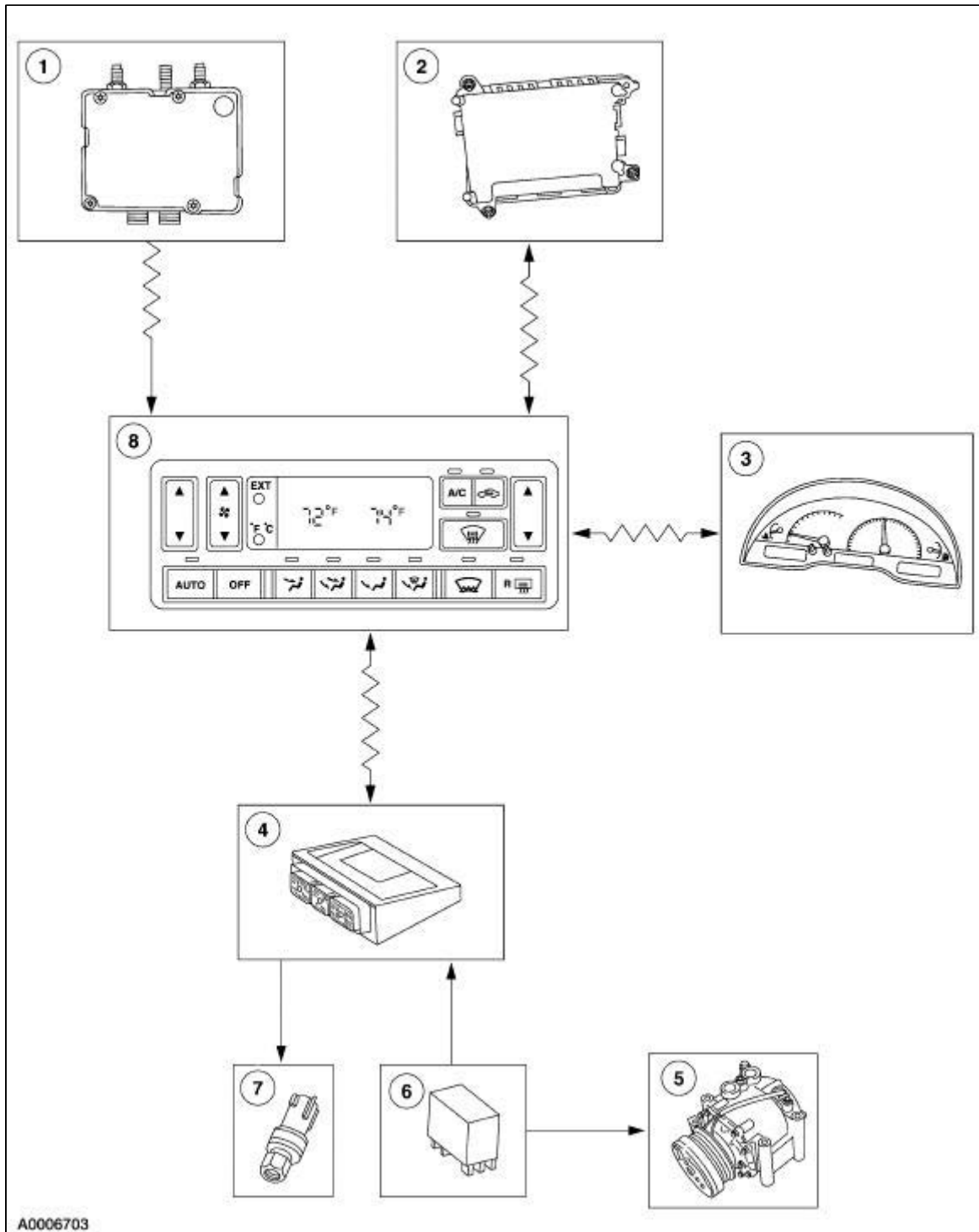


A0004773

Item	Part Number	Description
1	12A647	Ambient air temperature sensor
2	19C734	In-vehicle temperature control sensor
3	19E663	Dual sunload sensor
4	19E616	Panel door actuator
5	14N089	Blower motor ignition relay
6	19E624	Blower motor speed control
7	19805	Blower motor
7	18504	Blower wheel (not serviced with motor)
8	19E616	Air inlet door actuator
9	19E616	Cold air bypass door actuator
10	19C734	Passenger air discharge temperature sensor
11	19C734	Evaporator discharge air temperature sensor
12	19E616	Floor door actuator
13	14N089	Heated wiper park relay
14	19E616	Defrost door actuator

15	19C734	Driver air discharge temperature sensor
16	14N089	Electric water pump relay
17	18495	Dual coolant control valve
18	19980	Dual automatic temperature control module

Climate Control System Components — J1850 Communications Network (SCP) Linked



A0006703




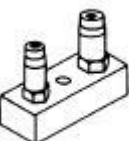


Item	Part Number	Description
1	2C219	ABS module

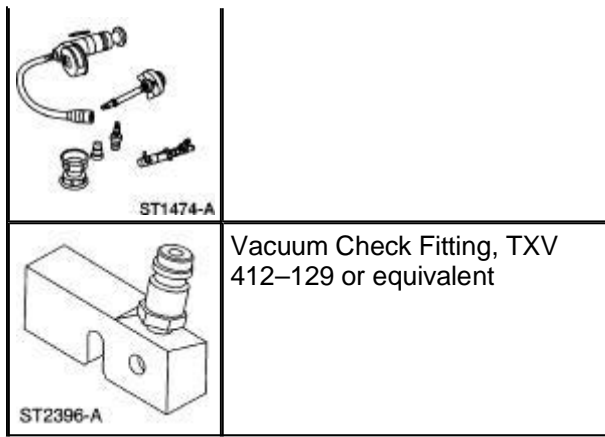
2	24994	Rear electronic module (REM)
3	10849	Instrument cluster module
4	12A696	Powertrain control module
5	19703	A/C compressor
6	14N089	A/C clutch relay
7	19D594	A/C pressure transducer
8	19980	Dual automatic temperature control module

Climate Control System

Refer to Wiring Diagrams Section [412-00](#) for schematic and connector information.

Special Tool(s)

 <p>ST2332-A</p>	<p>Worldwide Diagnostic System (WDS) 418-224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool</p>
 <p>ST1137-A</p>	<p>Fluke 77 III Automotive Meter 105-R0056 or equivalent</p>
 <p>ST1928-A</p>	<p>R-134a Manifold Gauge Set 176-R032A or equivalent</p>
 <p>ST1501-A</p>	<p>A/C Pressure Test Adapter 412-093 (T94P-19623-E)</p>
 <p>ST1252-A</p>	<p>Set, A/C Fittings 412-DS028 (014-00333, D93L-19703B) or equivalent</p>
 <p>ST2351-A</p>	<p>Refrigerant Leak Detector 216-00001 or equivalent</p>
	<p>Pressure Test Kit 014-R1072 or equivalent</p>



Inspection and Verification

1. Verify the customer's concern by operating the climate control system to duplicate the condition.
2. Inspect to determine if one of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Loose, missing or damaged A/C compressor drive belt ● Loose or disconnected A/C clutch ● Broken or leaking refrigerant lines ● Obstructed in-vehicle temperature sensor ● Disconnected in-vehicle temperature aspirator hose ● A/C registers are not working (open/close) ● Front floor ducts not in place ● Incorrectly installed in-vehicle temperature sensor ● Incorrectly installed ambient air temperature sensor 	<ul style="list-style-type: none"> ● Fuse(s) ● Blower motor inoperative ● A/C compressor inoperative ● Circuit short/open. ● Disconnected, loose fitting, or incorrectly installed electrical connectors and pins ● Cooling fan inoperative ● Relays not functional or not installed

3. As pinpoint tests and measurements are being performed, be sure to inspect for any disconnected, loose fitting, or incorrectly installed component, module and in-line electrical connectors and pins.
4. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.
5. If the concern remains after the inspection, connect the scan tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the scan tool menu. If the vehicle selection cannot be entered:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
 - check that the battery voltage is greater than 9V.

If the scan tool still does not allow the vehicle selection to be entered, refer to the scan tool manual.

6. Carry out the Data Link Diagnostic Test using the scan tool. If the scan tool responds with:
 - CKT 914 and CKT 915 = ALL MODULE NO RESPONSE/NOT EQUIPPED, go to Module Communication Network Diagnostics in [Section 418-00](#) to diagnose the network concern.
 - If the powertrain control module (PCM) is not listed for a communication concern, turn the A/C controls to OFF and execute the self-test diagnostics for the PCM.
 - If the DATC module is not listed for a communication concern, execute the self-test diagnostics for the DATC module.
7. If any PCM or DATC DTCs are retrieved, and are related to the concern, go to the Powertrain Control Module Diagnostic Trouble Code (DTC) Index or the Dual Automatic Temperature Control (DATC) Module Diagnostic Trouble Code (DTC) Index in this section to continue the diagnostics.
8. If no DTCs related to the concern are retrieved, GO to [Symptom Chart](#) to continue the diagnostics.
9. If the DATC module cannot be accessed by the scan tool, [Go To Pinpoint Test A](#).

Dual Electronic Automatic Temperature Control (DATC) Module Diagnostic Trouble Codes—DTCs

If using the scan tool or front panel diagnostics to check for DATC DTCs:

1. Check continuous DTCs.
2. Run DATC self-test. Refer to Front Panel DATC Self-Test (On-demand Diagnostic Trouble Codes — DTCs).

General information:

- If the DTC is continuous only and does not appear in the self-test, this indicates an intermittent fault condition, such as a poor wiring connection or a loose terminal. If the DATC does not appear after running the self-test it may also indicate that the DTC may no longer exist.
- If the DTC is continuous and appears in the self-test, this indicates a hard fault. A hard fault suggests a permanent wiring failure, disconnected connector or component failure.

Front Panel DATC Module Self-Test (On-demand Diagnostic Trouble Codes—DTCs)

On-demand DTCs are those that are reported by an ECU when a failure is detected while executing a diagnostic test. For the DATC module this means that all faults (hard) that occur while the module is conducting a self-test shall be reported as an on-demand DTC.

- The DATC module self-test will not detect concerns associated with data link messages such as engine coolant temperature or vehicle speed signals. The scan tool must be used to retrieve these concerns.
- The vehicle interior temperature should be between 0-32°C (32-90°F) when carrying out the self-test. If the temperatures are not within the specified ranges, false temperature sensor DTCs may be displayed.

The DATC module self-test through the front panel display:

- can be initiated at any time. Normal operation of the system stops when the self-test is activated.
- is entered by pressing the OFF and FLOOR buttons simultaneously and then pressing the AUTO button within two seconds. The display will show counts of 1 to 25 in the center of the

display window. Record all DTCs displayed.

- concludes by reporting all on-demand DTCs. Follow the diagnostics procedure given under ACTION in the DTC index for each DTC given.
- reports individual on-demand DTCs as four-digit DTCs (less the alpha character).
- will calibrate all the mode doors and check all analog inputs. The DATC module will only report on-demand (hard) faults that occurred while the DATC module was conducting its self-test.
- will light all control panel display segments if no faults are detected.
- will report individual on-demand DTCs without the °C symbol lit.

To exit the self-test, press any button. This will clear all on-demand codes from the DATC module memory. If no button is pushed DTCs will continue to be displayed.

Upon exit from the self-test the DATC module returns to operational status. The DATC module executes a hard (cold boot) reset which places the DATC system in the OFF mode.

If a condition exists but no DTCs appear during the self-test, GO to Symptom Chart Condition: The DATC System Is Inoperative, Intermittent or Incorrect Operation.

Always exit the self-test before powering the system down (system turned OFF).

Front Panel DATC Module Display—Retrieve Continuous Diagnostic Trouble Codes (DTCs)

Continuous DTCs are fault codes recorded by the DATC module which have occurred during normal operation. For the DATC module this means that all faults (intermittent or hard) that occur while the module is in an operational state shall be reported as a continuous DTC.

- To retrieve continuous DTCs, press the OFF and PANEL buttons simultaneously, followed by pressing the AUTO button within two seconds.
- The DATC module will report all continuous DTCs to the vacuum fluorescent (VF) display.
- The DATC module will not carry out a self-test; it will only display continuous faults codes which are stored in memory.
- All VF display segments will light if no faults are detected.
- Individual continuous DTCs will be reported with the °C symbol lit.
- DTCs shall be reported as a four-digit DTC (less the alpha character).
- Pressing the front defrost button will exit the retrieve continuous DTCs mode and clear all continuous DTCs from DATC module memory.
- Pressing any other button (other than DEFROST) will exit the retrieve continuous DTCs mode and maintain all continuous DTCs in DATC module memory.
- Upon exit from the retrieve continuous DTCs mode the DATC module returns to operational status. The DATC module executes a hard (cold boot) reset which places the DATC system in the OFF mode.

Diagnostic Trouble Code Index

Powertrain Control Module (PCM) Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
P1460	WOT A/C cutout internal driver malfunction	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1461	A/C pressure sensor circuit high input	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

P1462	A/C pressure sensor circuit low input	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1463	A/C pressure sensor insufficient pressure variation	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1469	Low A/C cycling period	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1474	Low speed fan internal driver failure	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1479	High speed fan internal driver failure	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1464	A/C demand out of self-test range	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Dual Electronic Automatic Temperature Control (DATC) Module Diagnostic Trouble Code (DTC) Index

DTC	Run-Time (Intermittent) Faults or Self-Test (Hard) Faults	Description	Action to Take
B1242	1242	Recirculation door actuator circuit failure	Go To Pinpoint Test C .
B1251	1251	In-vehicle temperature sensor circuit open	Go To Pinpoint Test D .
B1253	1253	In-vehicle temperature sensor circuit short to ground	Go To Pinpoint Test D .
B1255	1255	Ambient air temperature sensor open	Go To Pinpoint Test F .
B1257	1257	Ambient air temperature sensor short to ground	Go To Pinpoint Test F .
B1259	1259	A/C solar radiation sensor open circuit	Go To Pinpoint Test G .
B1261	1261	A/C solar radiation sensor circuit short to ground	Go To Pinpoint Test G .
B1262	1262	Defrost door actuator circuit failure	Go To Pinpoint Test C .
B1263	1263	Panel door actuator circuit failure	Go To Pinpoint Test C .
B1264	1264	Floor door actuator circuit failure	Go To Pinpoint Test C .
B1265	1265	Cold air bypass door actuator circuit failure	Go To Pinpoint Test C .
B1342	1342	ECU defective	INSTALL a new DATC module.
B1676	1676	Battery voltage out of range	REFER to Section 414-00 .
B1946	1946	Evaporator discharge temperature sensor open circuit	Go To Pinpoint Test E .
B1947	1947	Evaporator discharge temperature sensor circuit	Go To Pinpoint Test E .

		short to ground	
B1966	1966	Driver heater core discharge temperature sensor open circuit	Go To Pinpoint Test E .
B1967	1967	Driver heater core discharge temperature sensor short circuit	Go To Pinpoint Test E .
B2428	2428	Passenger heater core discharge temperature sensor open circuit	Go To Pinpoint Test E .
B2429	2429	Passenger heater core discharge temperature sensor short circuit	Go To Pinpoint Test E .
B2477	2477	Module configuration failure	RECONFIGURE the DATC module. REFER to Section 418-01 .
U1041	5041	SCP invalid or missing data for function read vehicle speed	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1073	5073	SCP invalid or missing data for engine coolant	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1027	5027	SCP invalid or missing data for engine rpm	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1178	5178	SCP invalid or missing data for voice command	This code will only appear if the vehicle is equipped with voice command.
U1222	5222	SCP invalid or missing data for interior lamps	REFER to Section 417-02 .

Symptom Chart

Symptom Chart


Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the dual automatic temperature control (DATC) module 	<ul style="list-style-type: none"> Fuse. Circuitry. DATC module communication network. DATC module not connected. 	<ul style="list-style-type: none"> Go To Pinpoint Test A .
<ul style="list-style-type: none"> The DATC system is inoperative, intermittent or incorrectly operating 	<ul style="list-style-type: none"> Circuitry. Input sensors or erratic input signals. Charging system. In car temperature control sensor hose and elbow (No aspiration). Air trapped in heater coolant circuits. 	<ul style="list-style-type: none"> Go To Pinpoint Test B .

	<ul style="list-style-type: none"> ● Missing or invalid SCP messages. 	
<ul style="list-style-type: none"> ● Incorrect/erratic direction of airflow from outlets 	<ul style="list-style-type: none"> ● Circuitry. ● Door actuator. ● Airflow door binding or stuck. ● DATC module. ● Door actuator arm not connected to the door crank. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test C.
<ul style="list-style-type: none"> ● Insufficient, erratic, or no heat 	<ul style="list-style-type: none"> ● Circuitry. ● Low engine coolant level. ● Air trapped in heater coolant circuit. ● Plugged or partially plugged heater core. ● Bypass door actuator binding or stuck open. ● Coolant control valve. ● DATC module. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test H.
<ul style="list-style-type: none"> ● Insufficient heat during engine idle 	<ul style="list-style-type: none"> ● Low engine coolant level. ● Cold engine. ● Bypass door actuator binding or stuck. ● Auxiliary coolant pump (V8 only). ● Engine coolant thermostat. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test I.
<ul style="list-style-type: none"> ● Full heat only in all modes 	<ul style="list-style-type: none"> ● Fuse(s). ● Circuitry. ● Coolant control valve. ● DATC module. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test J.
<ul style="list-style-type: none"> ● The dual temperature control is inoperative/does not operate correctly 	<ul style="list-style-type: none"> ● Circuitry. ● DATC module configuration. ● DATC module. ● Coolant control valve. ● Low coolant level. ● Air trapped in coolant circuit. ● Incorrect heater hose connections. ● Air temperature sensors. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test K.
<ul style="list-style-type: none"> ● The air conditioning (A/C) is inoperative/does not operate correctly 	<ul style="list-style-type: none"> ● Fuse(s). ● Circuitry. ● A/C clutch relay. ● Evaporator discharge temperature sensor. ● A/C system discharged or low charge. ● A/C pressure transducer. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test L.

	<ul style="list-style-type: none"> ● DATC module. ● PCM. 	
<ul style="list-style-type: none"> ● The air conditioning (A/C) is always on 	<ul style="list-style-type: none"> ● Circuitry. ● A/C control. ● A/C clutch relay. ● Evaporator air discharge sensor. ● DATC module. ● PCM 	<ul style="list-style-type: none"> ● Go To Pinpoint Test M.
<ul style="list-style-type: none"> ● The blower motor is inoperative 	<ul style="list-style-type: none"> ● Circuitry. ● Blower motor. ● Blower motor speed control. ● Blower motor relay. ● DATC module. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test N.
<ul style="list-style-type: none"> ● The blower motor does not operate correctly 	<ul style="list-style-type: none"> ● Blower motor speed control. ● DATC module. ● Circuitry. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test O.
<ul style="list-style-type: none"> ● The temperature set point does not repeat after turning the ignition switch off 	<ul style="list-style-type: none"> ● Fuse. ● Circuitry. ● DATC module. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test P.
<ul style="list-style-type: none"> ● The temperature display will not switch between Celsius and Fahrenheit 	<ul style="list-style-type: none"> ● DATC module. 	<ul style="list-style-type: none"> ● INSTALL a new DATC module. REFER to Section 412-04 . TEST the system for normal operation.
<ul style="list-style-type: none"> ● The exterior temperature display does not function correctly 	<ul style="list-style-type: none"> ● Circuitry. ● DATC module. ● Ambient temperature sensor. ● Ambient temperature sensor mounting. ● Missing or invalid vehicle speed SCP signal. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test Q.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE DUAL AUTOMATIC TEMPERATURE CONTROL (DATC) MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK THE CJB FUSE 220 (10A)	
<p>1</p> 	<p>2 Turn the headlights on.</p>

● Does the DATC backlighting come on?

→ **Yes**
GO to A2.

→ **No**
INSTALL a new fuse. TEST the system for normal operation.

A2 CHECK THE CJB FUSE 214 (10A)

1



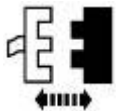
● Does the vacuum fluorescent (VF) display and indicators come on when DATC buttons are pushed?

→ **Yes**
GO to A3.

→ **No**
INSTALL a new fuse. TEST the system for normal operation.

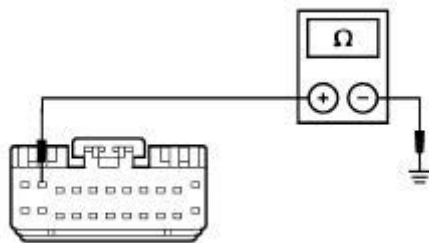
A3 CHECK CIRCUIT 31-FA10 (BK) FOR AN OPEN

1



DATC Module C228a

2



A0002036

2 Measure the resistance between DATC module C228a pin 2, circuit 31-FA10 (BK), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to A4.

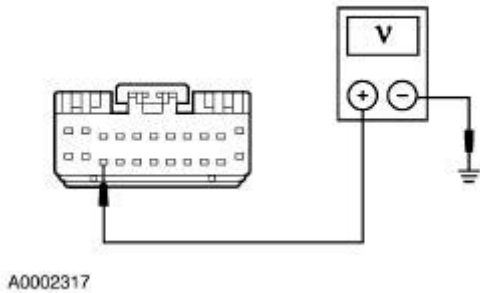
→ **No**
REPAIR circuit 31-FA10 (BK). TEST the system for normal operation.

A4 CHECK CIRCUIT 29-FA10 (OG/GN) FOR VOLTAGE

1



2



2 Measure the voltage between DATC module C228a pin 14, circuit 29-FA10 (OG/GN), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to A5.

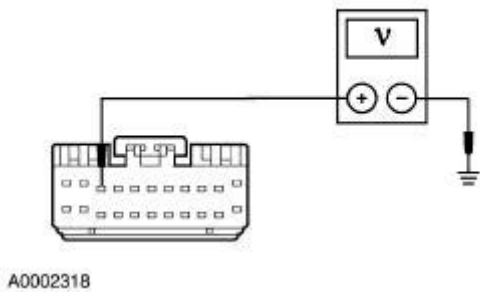
→ **No**
REPAIR circuit 29-FA10 (OG/GN). TEST the system for normal operation.

A5 CHECK CIRCUIT 20-FA10 (PK/OG) FOR VOLTAGE

1



2




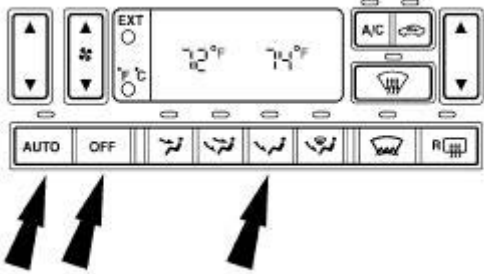

2 Measure the voltage between DATC module C228a pin 3, circuit 20-FA10 (PK/OG), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
REFER to Section 418-00 to diagnose the network concern.

→ **No**
REPAIR circuit 20-FA10 (PK/OG). TEST the system for normal operation.

PINPOINT TEST B: THE DATC SYSTEM IS INOPERATIVE, INTERMITTENT OR INCORRECT OPERATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 REQUEST CONTINUOUS CODES AND CARRY OUT THE DATC MODULE SELF-TEST	
<p>1</p>  <p>2</p>  <p>A0002319</p>	<p>2</p> <p>Carry out the DATC module self-test and retrieve continuous DTCs. Record the DTCs displayed, if any.</p> <ul style="list-style-type: none"> • Are any DTCs displayed? <p>→ Yes REFER to the DATC Module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as necessary.</p> <p>→ No GO to <u>B2</u>.</p>
B2 CHECK THE DISPLAY	
NOTE: If after the self-test there are no DTCs, the DATC will display ALL segments.	
<p>1</p>  <p>A0002401</p>	<p>1</p> <p>Observe the function symbols displayed.</p> <ul style="list-style-type: none"> • Is the display correct and complete without any missing elements? <p>→ Yes EXIT the self-test by pressing any button. GO to <u>B3</u>.</p>

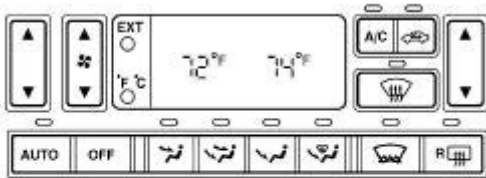
→ **No**
INSTALL a new DATC module. REFER to Section 412-04 . TEST the system for normal operation.

B3 VERIFY AUTOMATIC OPERATION

1



2



A0002320

2 Press the AUTO button.

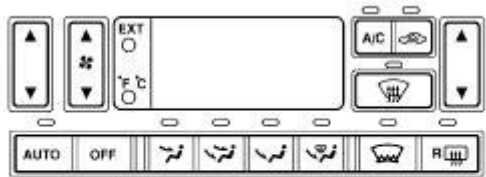
- Does the indicator above the AUTO button illuminate and the selected temperature for both the driver and passenger appear in the display window?

→ **Yes**
GO to B4 .

→ **No**
INSTALL a new DATC module. REFER to Section 412-04 . TEST the system for normal operation.

B4 CHECK THE OFF POSITION

2



A0003980

1 Make sure the A/C system is operating and the blower motor is running.

2 Press the OFF button.

- Does the temperature set point display turn off or revert to the external temperature, do all indicator lights turn off, and the

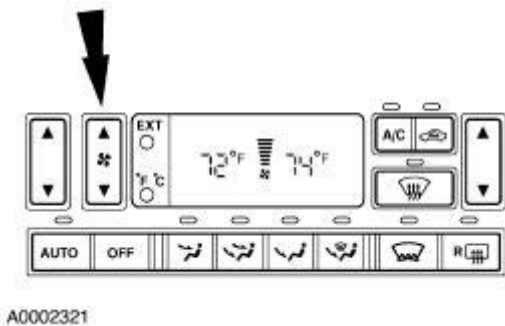
blower motor turn off?

- **Yes**
GO to B5.

- **No**
If the indicator lights do not turn off, **INSTALL** a new DATC module. REFER to Section 412-04 . If the blower motor does not turn off, Go To Pinpoint Test Q .

B5 CHECK THE BLOWER SPEED MANUAL OVERRIDE OPERATION

1



1

Press the blower motor speed override control fully up and down.

- **Does the blower motor vary from high to low speed and does the bar graph display vary with the blower speed?**

- **Yes**
GO to B6.

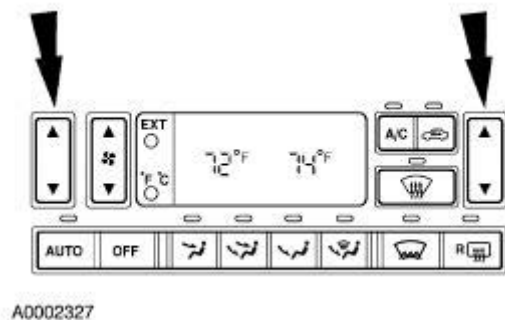
- **No**
Go To Pinpoint Test O .

B6 CHECK THE TEMPERATURE SET SWITCHES

NOTE: When carrying out this pinpoint test step, allow time for the system to respond.

NOTE: The passenger temperature select is inoperative when the driver setpoint is 16°C (60°F) or 32°C (90°F).

1



1

With the engine at operating temperature, select PANEL mode. Press the driver and passenger temperature set buttons for warmer and cooler temperatures.

- **Does each temperature display vary and does each air temperature vary as higher and lower temperatures are selected?**

- **Yes**
GO to B7.
- **No**
Go To Pinpoint Test H.

B7 VERIFY THE PANEL FLOOR MODE SWITCH.

1



A0002402

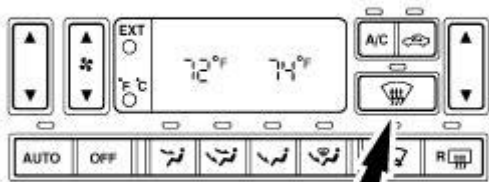
1 Press the panel floor override button.

- Does the indicator light above the button illuminate and is air discharged from both the panel and floor ducts?

- **Yes**
GO to B8.
- **No**
If indicator does not turn on, INSTALL a new DATC module. REFER to Section 412-04. TEST the system for normal operation. If airflow is not correct, Go To Pinpoint Test C.

B8 VERIFY THE FRONT DEFROST OVERRIDE OPERATION

1



A0002322

1 Press the override button for front defrost operation.

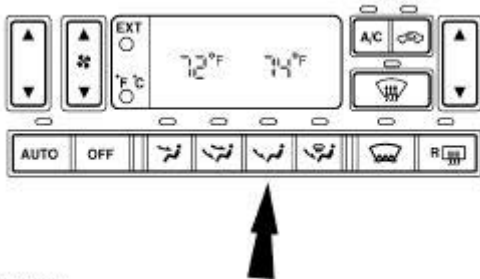
- Does the indicator light above the button illuminate and is air being discharged from the windshield defroster nozzle and the side window demisters?

- **Yes**
GO to B9.

→ **No**
If indicator does not turn on, **INSTALL** a new DATC module. REFER to [Section 412-04](#). TEST the system for normal operation. If airflow is not correct, [Go To Pinpoint Test C](#).

B9 VERIFY THE FLOOR OVERRIDE OPERATION

1



A0002323

1 Press the override button for floor operation.

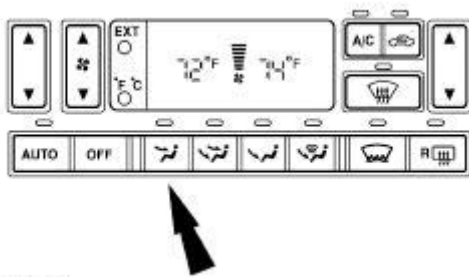
- Does the indicator light above the button illuminate and is air being discharged from the floor duct?

→ **Yes**
GO to [B10](#).

→ **No**
If indicator does not turn on, **INSTALL** a new DATC module. REFER to [Section 412-04](#). TEST the system for normal operation. If airflow is not correct, [Go To Pinpoint Test C](#).

B10 VERIFY THE PANEL OVERRIDE OPERATION

1



A0002324

1 Press the override button for panel operation.

- Does the indicator light above the button illuminate and is air being discharged from the instrument panel registers and the rear seat A/C register?

→ **Yes**
GO to [B11](#).

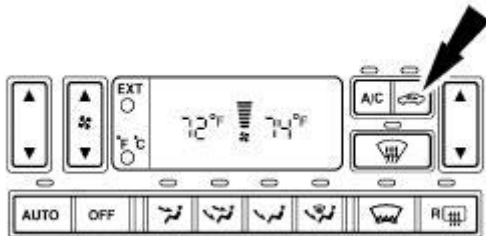
→ **No**

If indicator does not turn on, **INSTALL** a new DATC module. REFER to [Section 412-04](#) . TEST the system for normal operation. If airflow is not correct, [Go To Pinpoint Test C](#) .

B11 VERIFY RECIRC OPERATION

NOTE: Recirc does not operate in floor/defrost or defrost modes.

1



A0003981

1

With panel override selected, press the override button for recirc operation.

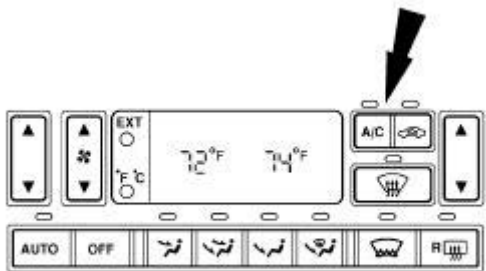
- Does the indicator light above the button illuminate and does the recirc door move to the alternate position?

→ **Yes**
GO to [B12](#) .

→ **No**
If the indicator does not turn on, **INSTALL** a new DATC module. REFER to [Section 412-04](#) . TEST the system for normal operation. If airflow is not correct, [Go To Pinpoint Test C](#) .

B12 VERIFY A/C CLUTCH ENGAGEMENT AND DISENGAGEMENT IN THE A/C MODE

1



A0002325

1

With the engine running and panel override selected, press the override button for A/C operation.

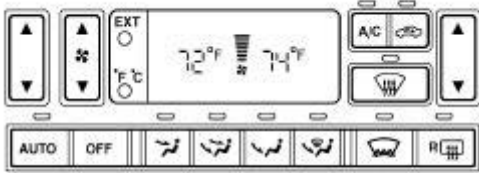
- Does the indicator light above the button turn on or off and does the A/C clutch engage or disengage when the A/C override button is pressed?

→ **Yes**
GO to [B13](#) .

→ **No**
Go To Pinpoint Test L.

B13 VERIFY HEATED WIPER PARK OPERATION

1



A0003962

1 With the engine running, press the heated wiper park button.

- Does the indicator light above the button illuminate and does the wiper rest relay engage?

→ **Yes**
GO to B14.

→ **No**
REFER to Section 501-11.

B14 VERIFY REAR DEFROST OPERATION

1



A0002326

1 With the engine running, press the rear defrost button.

- Does the indicator illuminate and does the rear window defrost?

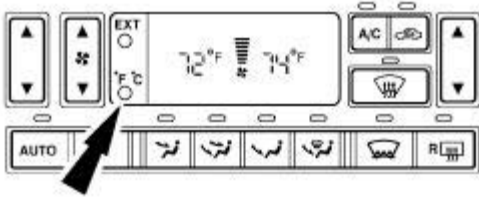
→ **Yes**
GO to B15.

→ **No**
REFER to Section 501-11.

B15 VERIFY °F °C OPERATION

1

1 Repeatedly press the °F °C button.



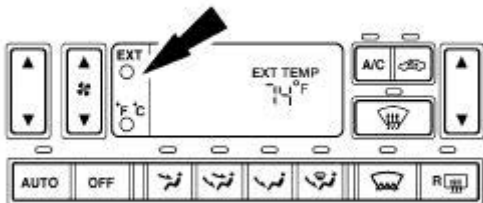
A0003983

- Does the display alternate between °F to °C or °C to °F as the button is pressed?

- **Yes**
GO to B16.
- **No**
INSTALL a new DATC module. REFER to Section 412-04. TEST the system for normal operation.

B16 VERIFY EXT BUTTON OPERATION

1



A0006071

- 1 Press the EXT button.

- Does the display alternate between external air temperature and the set point displays?

- **Yes**
GO to B17.
- **No**
Go To Pinpoint Test Q.

B17 RECHECK DATC MODULE CONFIGURATION

2





PID CNFG Data

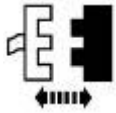
- 1 Enter Module Identification mode.
- 2 Read PID CNFG data 1.

	<ul style="list-style-type: none"> ● Does the data read 4N_3N_2Y? <p>→ Yes The test is complete. The system is functioning normally.</p> <p>→ No RECONFIGURE the DATC module. REFER to Section 418-01.</p>
--	---

PINPOINT TEST C: INCORRECT/ERRATIC DIRECTION OF AIRFLOW FROM OUTLETS

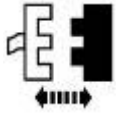
CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 REQUEST CONTINUOUS DTCs AND CARRY OUT THE DATC SELF-TEST	
<p>1</p> 	<p>2 Request Continuous DTCs and carry out the DATC Module Self-Test. Record the DTCs displayed, if any.</p> <ul style="list-style-type: none"> ● Were any DTCs displayed? <p>→ Yes Record any DTCs displayed. GO to C3.</p> <p>→ No GO to C2.</p>
C2 CHECK THE ACTUATOR DOOR AND LINKAGE	
	<p>1 Inspect the actuator door and linkage for a binding or sticking condition.</p> <ul style="list-style-type: none"> ● Was a condition found? <p>→ Yes REPAIR the door or linkage. REFER to Section 412-02. TEST the system for normal operation.</p> <p>→ No INSTALL a new DATC module. REFER to Section 412-04. TEST the system for normal operation.</p>
C3 CHECK THE DOOR ACTUATOR OPEN OPERATION	
<p>1</p> 	

2



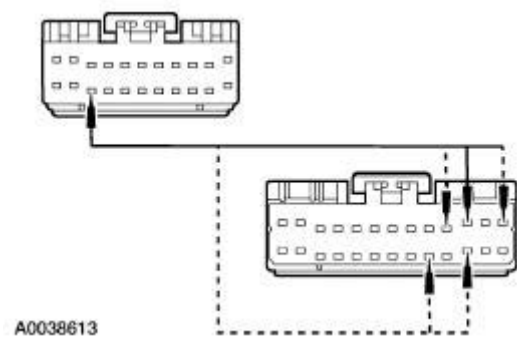
DATC Module C228a

3



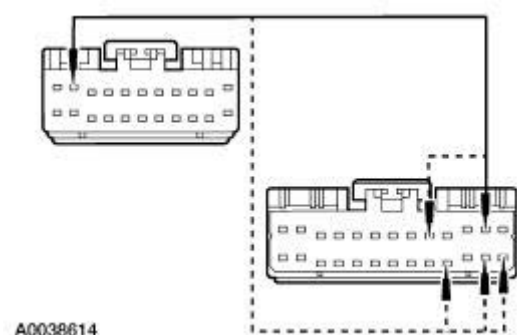
DATC Module C228b

4



A0038613

5



A0038614

4

Connect a fused jumper wire between DATC module C228a pin 14, circuit 29-FA10 (OG/GN), harness side and harness side of the connector/pin indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Actuator/ Door
B1265	C228b-11	32-FB2 (WH/RD)	Cold Air Bypass
B1242	C228b-10	32-FB8 (WH/RD)	Air Recirculation
B1262	C228b-13	32-FB5 (WH/BK)	Defrost
B1263	C228b-24	32-FB7 (WH)	Panel Mode
B1264	C228b-22	32-FB6 (WH/VT)	Floor Mode

5

Connect a fused jumper wire between DATC module C228a pin 2, circuit 31-FA10 (BK), harness side and harness side of the connector/pin indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Actuator/ Door
B1265	C228b-12	33-FB2 (YE/RD)	Cold Air Bypass
B1242	C228b-9	33-FB8 (YE/RD)	Air Recirculation
B1262	C228b-26	33-FB5 (YE/BK)	Defrost
B1263	C228b-25	33-FB7 (YE)	Panel Mode
B1264	C228b-23	33-FB6 (YE/VT)	Floor Mode

- Does the actuator motor move in the open direction?

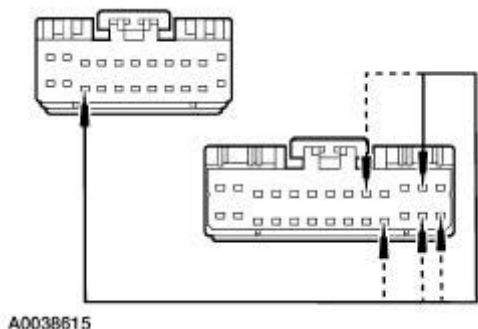
→ Yes

GO to C4.

→ **No**
GO to C5.

C4 CHECK THE DOOR ACTUATOR CLOSE OPERATION

1

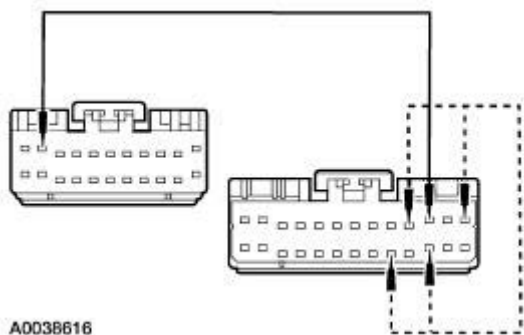


1

Connect a fused jumper wire between DATC module C228a pin 14, circuit 29-FA10 (OG/GN), harness side and harness side of the connector/pin indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Actuator/Door
B1265	C228b-12	33-FB2 (YE/RD)	Cold Air Bypass
B1242	C228b-9	33-FB8 (YE/RD)	Air Recirculation
B1262	C228b-26	33-FB5 (YE/BK)	Defrost
B1263	C228b-25	33-FB7 (YE)	Panel Mode
B1264	C228b-23	33-FB6 (YE/VT)	Floor Mode

2



2

Connect a fused jumper wire between DATC module C228a pin 2, circuit 31-FA10 (BK), harness side and harness side of the connector/pin indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Actuator/Door
B1265	C228b-11	32-FB2 (WH/RD)	Cold Air Bypass
B1242	C228b-10	32-FB8 (WH/RD)	Air Recirculation
B1262	C228b-13	32-FB5 (WH/BK)	Defrost
B1263	C228b-24	32-FB7 (WH)	Panel Mode
B1264	C228b-22	32-FB6 (WH/VT)	Floor Mode

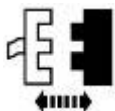
● **Does the actuator motor move in the closed direction?**

→ **Yes**
GO to C11.

→ **No**
GO to C5.

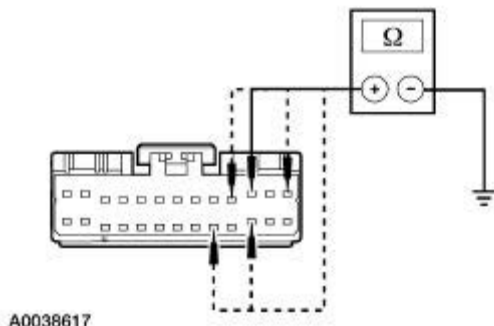
C5 CHECK ACTUATOR MOTOR OPEN CIRCUIT FOR A SHORT TO GROUND

1



Affected Actuator

2



2

Measure the resistance between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground.

DTC	Pin	Circuit
B1265	C228b-11	32-FB2 (WH/RD)
B1242	C228b-10	32-FB8 (WH/RD)
B1262	C228b-13	32-FB5 (WH/BK)
B1263	C228b-24	32-FB7 (WH)
B1264	C228b-22	32-FB6 (WH/VT)

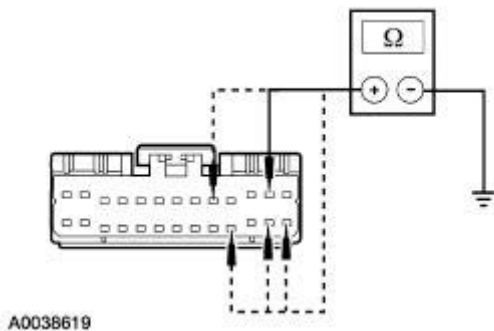
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to C6.

→ **No**
REPAIR the affected circuit for a short to ground. TEST the system for normal operation.

C6 CHECK ACTUATOR MOTOR CLOSE CIRCUIT FOR A SHORT TO GROUND

1



1

Measure the resistance between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground.

DTC	Pin	Circuit
B1265	C228b-12	33-FB2 (YE/RD)
B1242	C228b-9	33-FB8 (YE/RD)
B1262	C228b-26	33-FB5 (YE/BK)
B1263	C228b-25	33-FB7 (YE)
B1264	C228b-23	33-FB6 (YE/VT)

● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to C7.

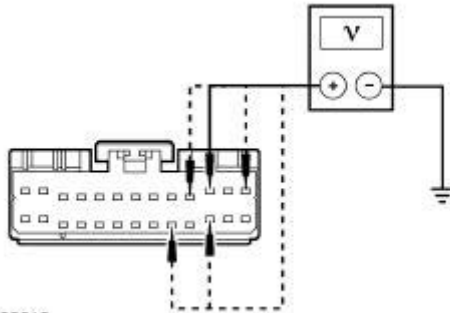
→ **No**
REPAIR the affected circuit for a short to ground. TEST the system for normal operation.

C7 CHECK ACTUATOR MOTOR OPEN CIRCUIT FOR A SHORT TO POWER

1



2



A0038618

2

Measure the voltage between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground.

DTC	Pin	Circuit
B1265	C228b-11	32-FB2 (WH/RD)
B1242	C228b-10	32-FB8 (WH/RD)
B1262	C228b-13	32-FB5 (WH/BK)
B1263	C228b-24	32-FB7 (WH)
B1264	C228b-22	32-FB6 (WH/VT)

● Is voltage present?

→ **Yes**

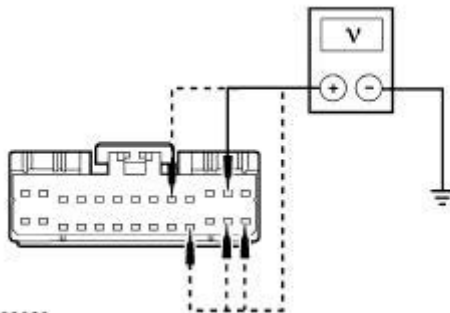
REPAIR the affected circuit for a short to power. TEST the system for normal operation.

→ **No**

GO to C8.

C8 CHECK ACTUATOR MOTOR CLOSE CIRCUIT FOR A SHORT TO POWER

1



A0038620

1

Measure the voltage between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground.

DTC	Pin	Circuit
B1265	C228b-12	33-FB2 (YE/RD)
B1242	C228b-9	33-FB8 (YE/RD)
B1262	C228b-26	33-FB5 (YE/BK)
B1263	C228b-25	33-FB7 (YE)
B1264	C228b-23	33-FB6 (YE/VT)

● Is voltage present?

→ **Yes**

REPAIR the affected circuit for a short to power. TEST the system for normal operation.

→ **No**

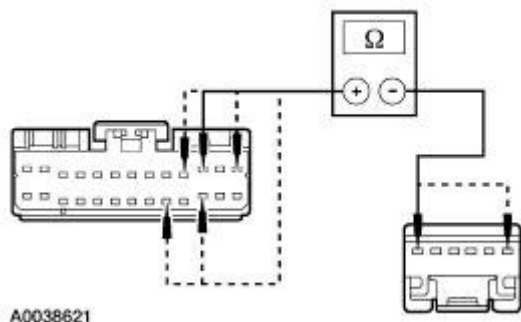
GO to C9.

C9 CHECK ACTUATOR MOTOR OPEN CIRCUIT FOR AN OPEN

1



2



A0038621

2

Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin
B1265	C228b-11	32-FB2 (WH/RD)	C295-1
B1242	C228b-10	32-FB8 (WH/RD)	C289-6
B1262	C228b-13	32-FB5 (WH/BK)	C232-6
B1263	C228b-24	32-FB7 (WH)	C236-6
B1264	C228b-22	32-FB6 (WH/VT)	C234-1

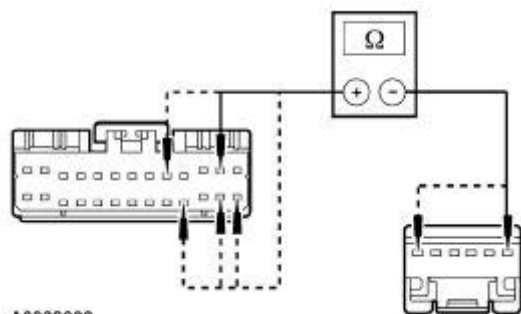
● Is the resistance less than 5 ohms?

→ **Yes**
GO to C10.

→ **No**
REPAIR the affected circuit for an open.
TEST the system for normal operation.

C10 CHECK ACTUATOR MOTOR CLOSE CIRCUIT FOR AN OPEN

1



A0038622

1

Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin
B1265	C228b-12	33-FB2 (YE/RD)	C295-6
B1242	C228b-9	33-FB8 (YE/RD)	C289-1
B1262	C228b-26	33-FB5 (YE/BK)	C232-1
B1263	C228b-25	33-FB7 (YE)	C236-1
B1264	C228b-23	33-FB6 (YE/VT)	C234-6

● Is the resistance less than 5 ohms?

→ **Yes**
INSPECT for binding or stuck linkage/door. If no condition is found, INSTALL a new door

actuator. REFER to [Section 412-04](#) . TEST the system for normal operation.

→ **No**
REPAIR the affected circuit for an open.
TEST the system for normal operation.

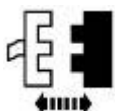
C11 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE

1



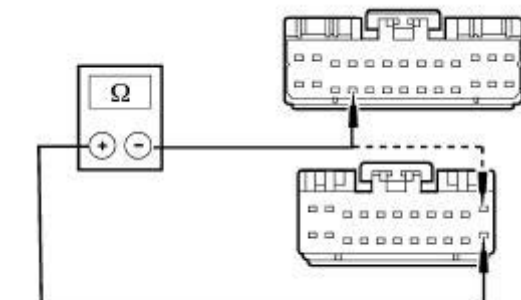
Affected Actuator

2



Actuators Not Affected

3



A0038623

3 Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1265	C228a-11	9-FA1 (BN)	C228a-22	7-FA1 (YE)
B1242	C228a-11	9-FA1 (BN)	C228a-22	7-FA1 (YE)
B1262	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE)
B1263	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE)
B1264	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE)

● Is the resistance between 5,000 and 6,000 ohms?

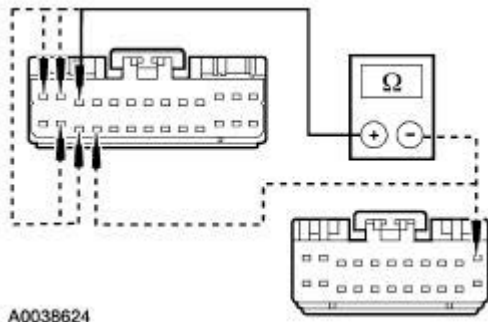
→ **Yes**
GO to [C12](#) .

→ **No**
If the resistance is greater than 6,000 ohms, GO to [C14](#) .
If the resistance is less than 5,000 ohms, GO to [C22](#) .

C12 CHECK POTENTIOMETER LOW SIDE RESISTANCE

1

1 Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).



A0038624

DTC	Pin	Circuit	Pin	Circuit
B1265	C228a-11	9-FA1 (BN)	C228b-2	8-FB2 (WH/RD)
B1242	C228a-11	9-FA1 (BN)	C228b-15	8-FB8 (WH/RD)
B1262	C228b-17	9-FA2 (BN/RD)	C228a-1	8-FB5 (WH/BK)
B1263	C228b-17	9-FA2 (BN/RD)	C228b-3	8-FB7 (WH)
B1264	C228b-17	9-FA2 (BN/RD)	C228b-16	8-FB6 (WH/VT)

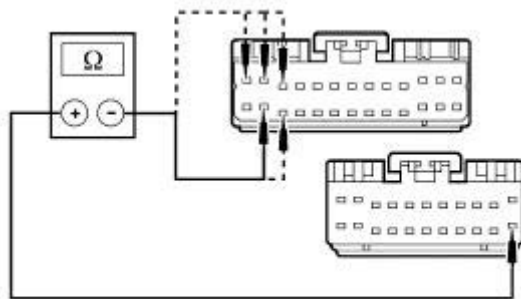
● Is the resistance between 250 and 5,250 ohms?

→ **Yes**
GO to C13.

→ **No**
If the resistance is greater than 5,250 ohms, GO to C15.
If the resistance is less than 250 ohms, GO to C23.

C13 CHECK POTENTIOMETER HIGH SIDE RESISTANCE

1



A0038625

1

Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1265	C228a-22	7-FA1 (YE)	C228b-2	8-FB2 (WH/RD)
B1242	C228a-22	7-FA1 (YE)	C228b-15	8-FB8 (WH/RD)
B1262	C228b-22	7-FA1 (YE)	C228b-1	8-FB5 (WH/BK)
B1263	C228b-22	7-FA1 (YE)	C228b-3	8-FB7 (WH)
B1264	C228b-22	7-FA1 (YE)	C228b-16	8-FB6 (WH/VT)

● Is the resistance between 250 and 5,250 ohms?

→ **Yes**
GO to C17.

→ **No**
If the resistance is greater than 5,250 ohms,
GO to C14.
If the resistance is less than 250 ohms, GO to
C24.

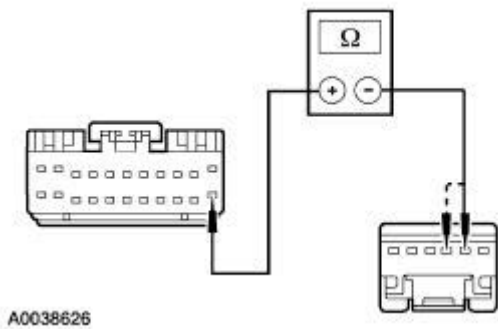
C14 CHECK THE ACTUATOR REFERENCE CIRCUIT FOR AN OPEN

1



Affected Actuator

2



A0038626

2 Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1265	C228a-22	7-FA1 (YE)	C295-5	7-FB2 (YE/RD)
B1242	C228a-22	7-FA1 (YE)	C289-4	7-FB8 (YE/RD)
B1262	C228b-22	7-FA1 (YE)	C232-4	7-FB5 (YE/BK)
B1263	C228b-22	7-FA1 (YE)	C236-4	7-FB7 (YE)
B1264	C228b-22	7-FA1 (YE)	C234-5	7-FB6 (YE/VT)

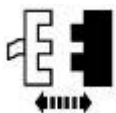
● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to C15.

→ **No**
REPAIR the affected circuit for an open.
TEST the system for normal operation.

C15 CHECK THE ACTUATOR RETURN CIRCUIT FOR AN OPEN

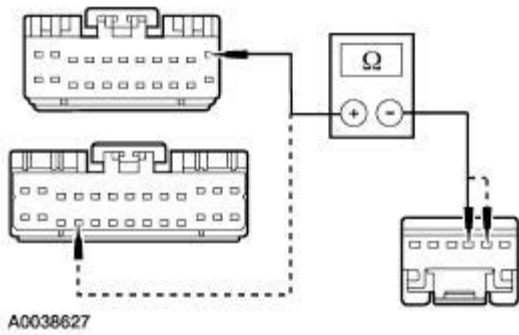
1



Affected Actuator

2

2 Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).



A0038627

DTC	Pin	Circuit	Pin	Circuit
B1265	C228a-11	9-FA1 (BN)	C295-4	9-FB2 (BN/RD)
B1242	C228a-11	9-FA1 (BN)	C289-5	9-FB8 (BN/RD)
B1262	C228b-17	9-FA2 (BN/RD)	C232-5	9-FB5 (BN/YE)
B1263	C228b-17	9-FA2 (BN/RD)	C236-5	9-FB7 (BN)
B1264	C228b-17	9-FA2 (BN/RD)	C234-4	9-FB6 (BN/WH)

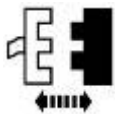
● Is the resistance less than 5 ohms?

→ **Yes**
GO to C16.

→ **No**
REPAIR the affected circuit for an open.
TEST the system for normal operation.

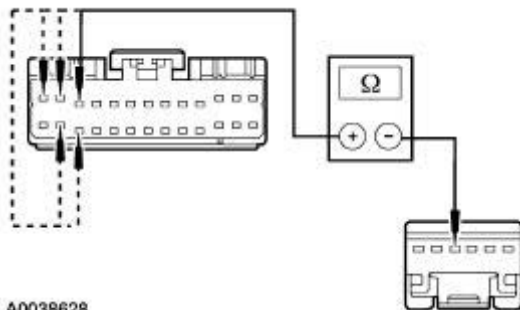
C16 CHECK THE ACTUATOR FEEDBACK CIRCUIT FOR AN OPEN

1



Affected Actuator

2



A0038628

2 Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin
B1265	C228b-2	8-FB2 (WH/RD)	C295-3
B1242	C228b-15	8-FB8 (WH/RD)	C289-3
B1262	C228b-1	8-FB5 (WH/BK)	C232-3
B1263	C228b-3	8-FB7 (WH)	C236-3
B1264	C228b-16	8-FB6 (WH/VT)	C234-3

● Is the resistance less than 5 ohms?

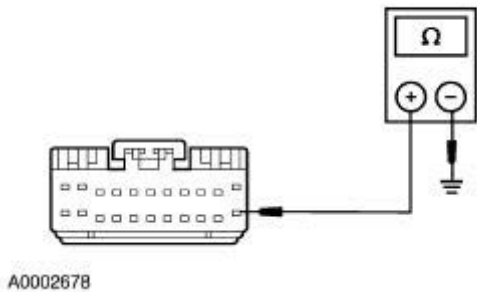
→ **Yes**

INSTALL a new door actuator. REFER to [Section 412-04](#). TEST the system for normal operation.

→ **No**
REPAIR the affected circuit for an open. TEST the system for normal operation.

C17 CHECK THE ACTUATOR REFERENCE CIRCUIT FOR A SHORT TO GROUND

1



1 Measure the resistance between DATC module C228a pin 22, circuit 7-FA1 (YE), harness side and ground.

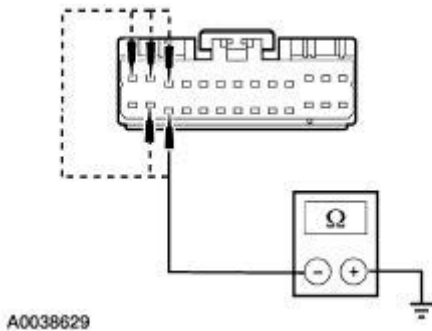
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to [C18](#).

→ **No**
REPAIR the affected circuit for a short to ground. TEST the system for normal operation.

C18 CHECK THE ACTUATOR FEEDBACK CIRCUIT FOR A SHORT TO GROUND

1



1 Measure the resistance between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground.

DTC	Pin	Circuit
B1265	C228b-2	8-FB2 (WH/RD)
B1242	C228b-15	8-FB8 (WH/RD)
B1262	C228b-1	8-FB5 (WH/BK)
B1263	C228b-3	8-FB7 (WH)
B1264	C228b-16	8-FB6 (WH/VT)

● Is the resistance greater than 10,000 ohms?

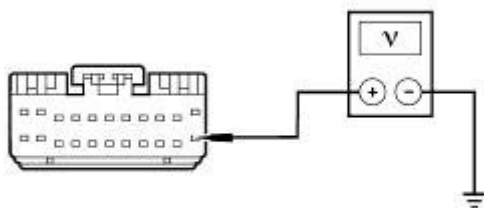
→ **Yes**
GO to [C19](#).

→ **No**
REPAIR the affected circuit for a short to ground. TEST the system for normal operation.

operation.

C19 CHECK THE ACTUATOR REFERENCE CIRCUIT FOR A SHORT TO POWER

1



A0038630

1 Measure the voltage between DATC module C228a pin 22, circuit 7-FA1 (YE), harness side and ground.

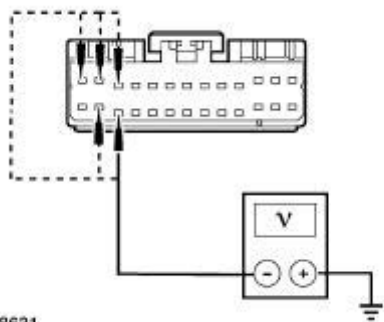
● Is voltage present?

→ **Yes**
REPAIR the affected circuit for a short to power. TEST the system for normal operation.

→ **No**
GO to C20.

C20 CHECK THE ACTUATOR FEEDBACK CIRCUIT FOR A SHORT TO POWER

1



A0038631

1 Measure the voltage between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground.

DTC	Pin	Circuit
B1265	C228b-2	8-FB2 (WH/RD)
B1242	C228b-15	8-FB8 (WH/RD)
B1262	C228b-1	8-FB5 (WH/BK)
B1263	C228b-3	8-FB7 (WH)
B1264	C228b-16	8-FB6 (WH/VT)

● Is voltage present?

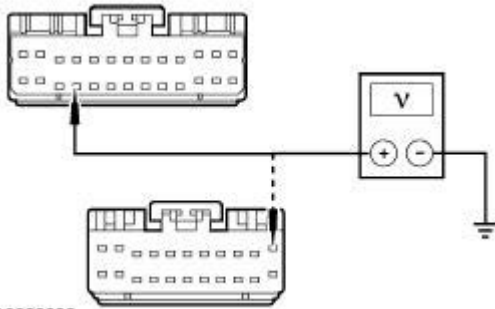
→ **Yes**
REPAIR the affected circuit for a short to power. TEST the system for normal operation.

→ **No**
GO to C21.

C21 CHECK THE ACTUATOR RETURN CIRCUIT FOR A SHORT TO POWER

1

1 Measure the voltage between the harness side of the connector/pin indicated below that corresponds to the recorded DTC(s) and ground.



A0038632

DTC	Pin	Circuit
B1265	C228a-11	9-FA1 (BN)
B1242	C228a-11	9-FA1 (BN)
B1262	C228b-17	9-FA2 (BN/RD)
B1263	C228b-17	9-FA2 (BN/RD)
B1264	C228b-17	9-FA2 (BN/RD)

● **Is voltage present?**

→ **Yes**

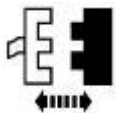
REPAIR the affected circuit for a short to power. TEST the system for normal operation.

→ **No**

INSTALL a new DATC module. REFER to [Section 412-04](#). TEST the system for normal operation.

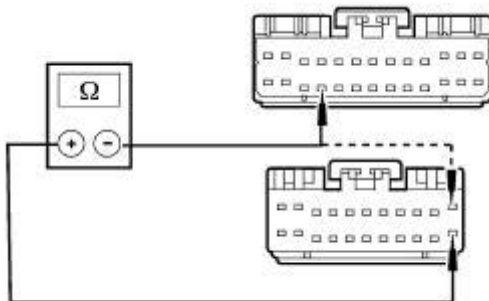
C22 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE SHORT TOGETHER

1



Affected Actuator

2



A0038623

2

Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1265	C228a-11	9-FA1 (BN)	C228a-22	7-FA1 (YE)
B1242	C228a-11	9-FA1 (BN)	C228a-22	7-FA1 (YE)
B1262	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE)
B1263	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE)
B1264	C228b-17	9-FA2 (BN/RD)	C228a-22	7-FA1 (YE)

● **Is the resistance less than 5 ohms?**

→ **Yes**

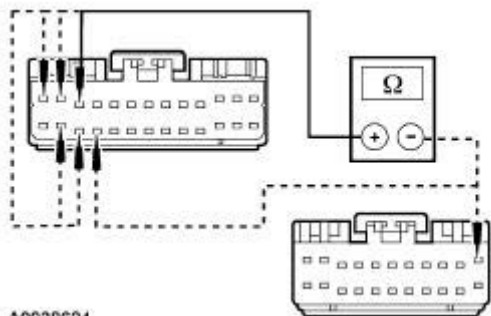
REPAIR the affected circuits for a short together. TEST the system for normal

operation.

→ **No**
 INSTALL a new door actuator. REFER to [Section 412-04](#). TEST the system for normal operation.

C23 CHECK POTENTIOMETER LOW SIDE RESISTANCE SHORT TOGETHER

1



1 Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1265	C228a-11	9-FA1 (BN)	C228b-2	8-FB2 (WH/RD)
B1242	C228a-11	9-FA1 (BN)	C228b-15	8-FB8 (WH/RD)
B1262	C228b-17	9-FA2 (BN/RD)	C228b-1	8-FB5 (WH/BK)
B1263	C228b-17	9-FA2 (BN/RD)	C228b-3	8-FB7 (WH)
B1264	C228b-17	9-FA2 (BN/RD)	C228b-16	8-FB6 (WH/VT)

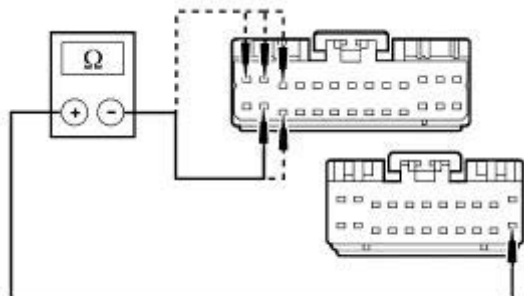
● Is the resistance less than 5 ohms?

→ **Yes**
 REPAIR the affected circuits for a short together. TEST the system for normal operation.

→ **No**
 INSTALL a new door actuator. REFER to [Section 412-04](#). TEST the system for normal operation.

C24 CHECK POTENTIOMETER HIGH SIDE RESISTANCE SHORT TOGETHER

1



1 Measure the resistance between the harness side of the connectors/pins indicated below that corresponds to the recorded DTC(s).

DTC	Pin	Circuit	Pin	Circuit
B1265	C228a-22	7-FA1 (YE)	C228b-2	8-FB2 (WH/RD)
B1242	C228a-22	7-FA1 (YE)	C228b-15	8-FB8 (WH/RD)
B1262	C228b-22	7-FA1 (YE)	C228b-	8-FB5 (WH/

			1	BK)
B1263	C228b-22	7-FA1 (YE)	C228b-3	8-FB7 (WH)
B1264	C228b-22	7-FA1 (YE)	C228b-16	8-FB6 (WH/VT)

● Is the resistance less than 5 ohms?


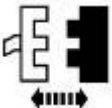
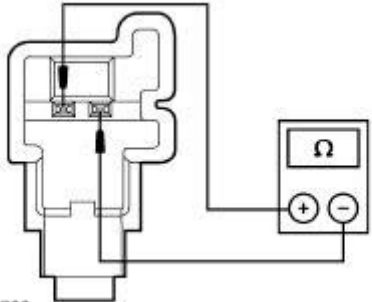
→ **Yes**

REPAIR the affected circuits for a short together. TEST the system for normal operation.

→ **No**

INSTALL a new door actuator. REFER to Section 412-04. TEST the system for normal operation.

PINPOINT TEST D: DTC B1251: DTC B1253 IN-VEHICLE TEMPERATURE SENSOR NOT OPERATING CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK THE SENSOR RESISTANCE	
<p>1 </p> <p>2  In-Vehicle Temperature Sensor C233</p> <p>3  A0004766</p>	<p>3 Measure the resistance between in-vehicle temperature sensor terminals.</p> <p>● Is the resistance within the specified values for these temperature ranges: 10-20°C (50-68°F) 37,000-58,000 ohms; 20-30°C (68-86°F) 24,000-37,000 ohms; 30-</p>

40°C (86-104°F) 16,000-24,000 ohms?

→ **Yes**
GO to D2.

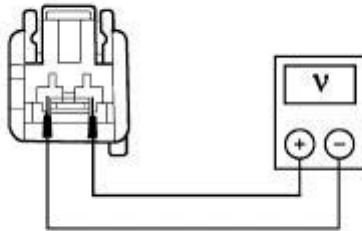
→ **No**
INSTALL a new in-vehicle temperature sensor. REFER to Section 412-04. TEST the system for normal operation.

D2 CHECK THE DATC SENSOR OUTPUT VOLTAGE

1



2



A0001977

2 Measure the voltage between in-vehicle temperature sensor C233, circuits 9-FA48 (BN/GN), harness side and 8-FA48 (WH/GN), harness side.

● **Is the voltage between 4.7 and 5.1 volts?**

→ **Yes**
GO to D6.

→ **No**
If DTC B1253 is present, GO to D3.

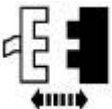
If DTC B1251 is present, GO to D4.

D3 CHECK CIRCUIT 8-FA48 (WH/GN) FOR A SHORT

1



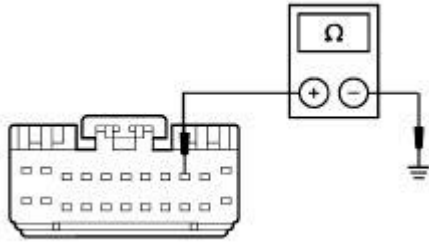
2



DATC Module C228a

3

3 Measure the resistance between DATC module C228a pin 9, circuit 8-FA48 (WH/GN), harness side and ground.



A0001979

- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to D6.

→ **No**
REPAIR circuit 8-FA48 (WH/GN). TEST the system for normal operation.

D4 CHECK CIRCUIT 8-FA48 (WH/GN) FOR AN OPEN

1

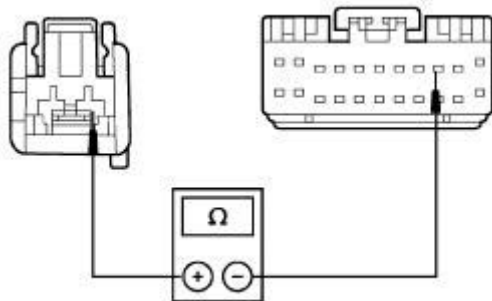


2



DATC Module C228b

3



A0001978

- 3 Measure the resistance between DATC module C228b pin 9, circuit 8-FA48 (WH/GN), harness side and the in-vehicle temperature sensor C233 circuit 8-FA48 (WH/GN), harness side.

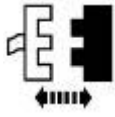
- Is the resistance less than 5 ohms?

→ **Yes**
GO to D5.

→ **No**
REPAIR circuit 8-FA48 (WH/GN). TEST the system for normal operation.

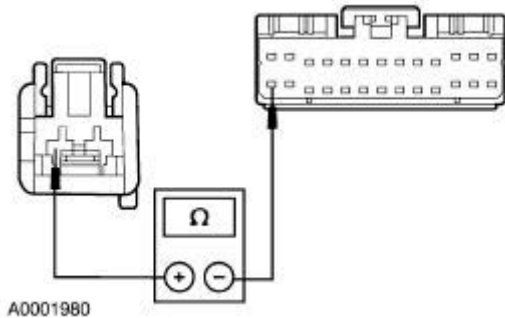
D5 CHECK CIRCUIT 9-FA48 (BN/GN) FOR AN OPEN

1



DATC Module C228b

2



2

Measure the resistance between DATC pin C228b pin 14, circuit 9-FA48 (BN/GN), harness side and the in-vehicle temperature sensor C233 circuit 9-FA48 (BN/GN), harness side.

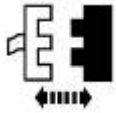
● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to D6.

→ **No**
REPAIR circuit 9-FA48 (BN/GN). TEST the system for normal operation.

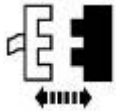
D6 INSPECT THE CONNECTIONS

1



DATC Module C228a

2



DATC Module C228b

3


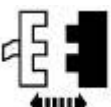
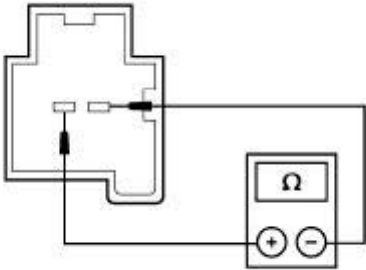
Inspect the in-vehicle temperature sensor connector pins and DATC module C228b pin 14, circuit 9-FA48 (BN/GN), harness side and DATC module C228a pin 9, circuit 8-FA48 (WH/GN), harness side for signs of damage, loose fits or incorrect installation.

● **Are the connector pins undamaged and installed correctly?**

→ **Yes**
RECONNECT the sensor and rerun self-test. If DTC is still present, INSTALL a new DATC module. REFER to Section 412-04. TEST the system for normal operation.

→ **No**
 REPAIR the damaged or loose connector pins. TEST the system for normal operation.

PINPOINT TEST E: EVAPORATOR OR HEATER CORE DISCHARGE AIR TEMPERATURE SENSORS NOT OPERATING CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS																												
<p>NOTE: Evaporator core, driver side heater core and passenger side heater core discharge air temperature sensors have the same diagnostic procedure.</p>																													
<p>E1 CHECK THE SENSOR RESISTANCE</p>																													
<p>1</p>  <p>2</p>  <p>Sensor</p> <p>3</p>  <p>A0004761</p>	<p>2</p> <p>Refer to the table and disconnect the sensor associated with the DTCs recorded from the DATC module self-test:</p> <table border="1"> <thead> <tr> <th>Sensor</th> <th>Condition</th> <th>DTC</th> <th>Connector</th> </tr> </thead> <tbody> <tr> <td>Evap air discharge</td> <td>Open</td> <td>B1946</td> <td>C296</td> </tr> <tr> <td>Evap air discharge</td> <td>Short</td> <td>B1947</td> <td>C296</td> </tr> <tr> <td>Driver air</td> <td>Open</td> <td>B1966</td> <td>C255</td> </tr> <tr> <td>Driver air</td> <td>Short</td> <td>B1967</td> <td>C255</td> </tr> <tr> <td>Passenger air</td> <td>Open</td> <td>B2428</td> <td>C235</td> </tr> <tr> <td>Passenger air</td> <td>Short</td> <td>B2429</td> <td>C235</td> </tr> </tbody> </table> <p>3</p> <p>Measure the resistance between sensor terminals.</p> <ul style="list-style-type: none"> Is the resistance within the specified values for these temperature ranges: 10-20°C (50-68°F) 37,000-58,000 ohms; 20-30°C (68-86°F) 24,000-37,000 ohms; 30-40°C (86-104°F) 16,000-24,000 ohms? 	Sensor	Condition	DTC	Connector	Evap air discharge	Open	B1946	C296	Evap air discharge	Short	B1947	C296	Driver air	Open	B1966	C255	Driver air	Short	B1967	C255	Passenger air	Open	B2428	C235	Passenger air	Short	B2429	C235
Sensor	Condition	DTC	Connector																										
Evap air discharge	Open	B1946	C296																										
Evap air discharge	Short	B1947	C296																										
Driver air	Open	B1966	C255																										
Driver air	Short	B1967	C255																										
Passenger air	Open	B2428	C235																										
Passenger air	Short	B2429	C235																										

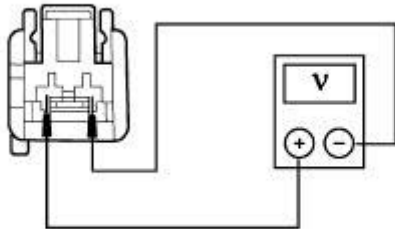
- **Yes**
GO to E2.
- **No**
INSTALL a new sensor. TEST the system for normal operation.

E2 CHECK THE DATC SENSOR OUTPUT VOLTAGE

1



2



A0004762

2 Refer to the following chart and measure the voltage between temperature sensor harness side circuits.

Connector	Circuit	Circuit
C296	8-FA44 (WH/RD)	9-FA44 (BN/RD)
C255	8-FA51 (WH/BK)	9-FA51 (BN/YE)
C235	8-FA47 (WH/GN)	9-FA47 (BN/GN)

● Is the voltage between 4.7 and 5.1 volts?

- **Yes**
GO to E6.
- **No**
If DTC B1946, B1966 or B2428 is present, GO to E3.
- If DTC B1947, B1967 or B2429 is present, GO to E4.

E3 CHECK THE REFERENCE CIRCUIT FOR AN OPEN

1



2

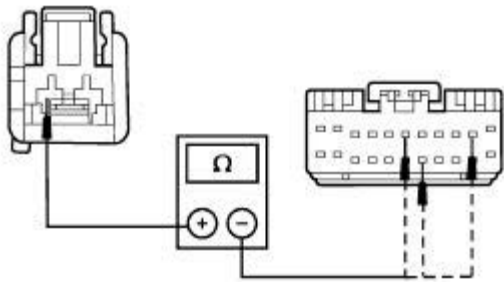


DATC Module C228a

3

3 Refer to the following chart and measure the resistance of the reference circuit between DATC module C228a and the sensor connector.

			DATC
--	--	--	------



A0004763

Sensor	Connector	Circuit	C228b Pin
Evap Discharge	C296	8-FA44 (WH/RD)	10
Passenger Side	C255	8-FA51 (WH/BK)	6
Driver	C235	8-FA47 (WH/GN)	18

● Is the resistance less than 5 ohms?

→ **Yes**
GO to E5.

→ **No**
REPAIR the affected circuit. TEST the system for normal operation.

E4 CHECK THE REFERENCE CIRCUIT FOR A SHORT TO GROUND

1

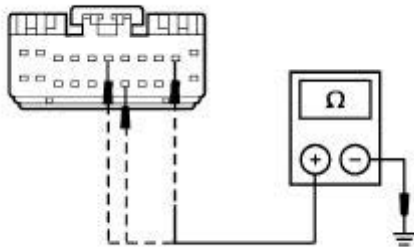


2



DATC Module C228a

3



A0004764

3 Refer to the following chart and measure the resistance of the sensor reference circuit between DATC module C228b and ground.

Temperature Sensor	DATC Module C228b Pin	Circuit
Evaporator Core	10	8-FA44 (WH/RD)
Passenger	6	8-FA51 (WH/BK)
Driver	18	8-FA47 (WH/GN)

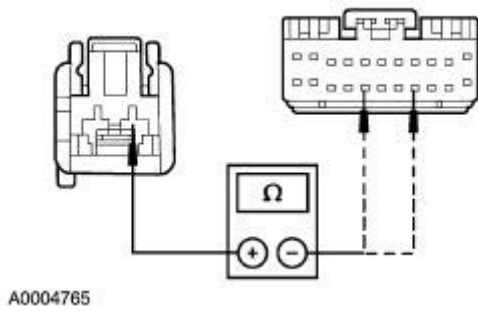
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to E6.

→ **No**
REPAIR the affected circuit. TEST the system for normal operation.

E5 CHECK RETURN CIRCUIT FOR AN OPEN

1



1

Refer to the following chart and measure the resistance of the return circuit between sensor and DATC module C228a for an open.

Sensor Connector	DATC Module C228b Pin	Circuit
Evap/C296	16	9-FA44 (BN/RD)
Passenger/C255	19	9-FA51 (BN/YE)
Driver/C235	19	9-FA47 (BN/GN)

- Is the resistance less than 5 ohms?

→ **Yes**
GO to E6.

→ **No**
REPAIR the affected circuit. TEST the system for normal operation.

E6 INSPECT THE CONNECTIONS

1

NOTE: If inspecting the evaporator core discharge air temperature sensor, also inspect the in-line connector C260 for correct installation or damaged pins.

Refer to the following chart and inspect the temperature sensor pins and DATC module pins for signs of damage, loose fits or incorrect installation.


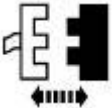
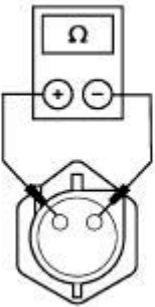

Temperature Sensor	Connector
Evaporator Core	C296 and C260
Heater Core RH	C255
Heater Core LH	C235

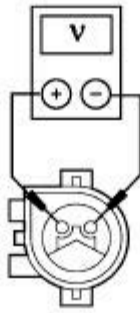
- Are the connector pins undamaged and installed correctly?

→ **Yes**
RECONNECT the connectors and RERUN the self-test. If the DTCs are still present, INSTALL a new DATC module. REFER to Section 412-04. TEST the system for normal operation.

→ **No**
REPAIR the damaged or loose connector pins. TEST the system for normal operation.

PINPOINT TEST F: DTC B1255 OR B1257 — AMBIENT AIR TEMPERATURE SENSOR CIRCUIT OPEN OR SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE AMBIENT TEMPERATURE SENSOR RESISTANCE	
<div style="margin-bottom: 10px;"> 1  </div> <div style="margin-bottom: 10px;"> 2  <p style="text-align: center; margin-top: 5px;">Ambient Temperature Sensor C132</p> </div> <div style="margin-bottom: 10px;"> 3  <p style="text-align: center; margin-top: 10px;">A0002817</p> </div>	<div style="margin-bottom: 20px;"> 3 Measure the resistance between ambient temperature sensor terminals. </div> <div style="margin-bottom: 20px;"> <ul style="list-style-type: none"> ● Is the resistance within the specified values for these temperature ranges: 10-20°C (50-68°F) 37,000-58,000 ohms; 20-30°C (68-86°F) 24,000-37,000 ohms; 30-40°C (86-104°F) 16,000-24,000 ohms? </div> <div style="margin-bottom: 20px;"> <p>→ Yes GO to <u>F2</u>.</p> </div> <div> <p>→ No INSTALL a new A/C ambient air temperature sensor. REFER to <u>Section 412-04</u>. TEST the system for normal operation.</p> </div>
F2 CHECK THE DATC SENSOR OUTPUT VOLTAGE	
<div style="margin-bottom: 10px;"> 1  </div> <div style="margin-bottom: 10px;"> 2 </div>	<div style="margin-bottom: 20px;"> 2 Measure the voltage between ambient temperature sensor C132, circuits 8-FA49 (WH/VT), harness side and 9-FA49 (BN/WH), harness side. </div>



A0002818

● Is the voltage between 4.7 and 5.1 volts?

→ **Yes**
GO to F6.

→ **No**
If DTC B1255, GO to F3.
If DTC B1257, GO to F4.

F3 CHECK CIRCUIT 8-FA49 (WH/VT) FOR AN OPEN

1

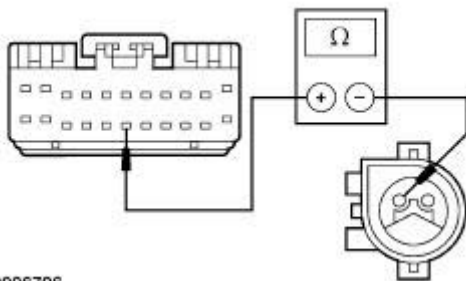


2



DATC Module C228a

3



A0006706

3 Measure the resistance between DATC module C228a pin 17, circuit 8-FA49 (WH/VT), harness side and ambient temperature sensor connector C132 circuit 8-FA49 (WH/VT), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to F5.

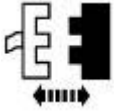
→ **No**
REPAIR circuit 8-FA49 (WH/VT). TEST the system for normal operation.

F4 CHECK CIRCUIT 8-FA49 (WH/VT) FOR A SHORT

1

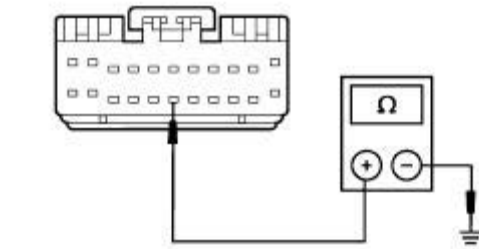


2



DATC Module C228a

3



A0001983

3

Measure the resistance between DATC module C228a pin 17, circuit 8-FA49 (WH/VT), harness side and ground.

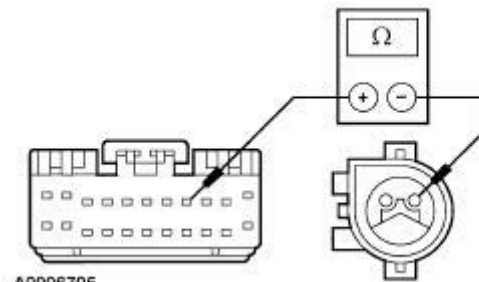
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to F6.

→ **No**
REPAIR circuit 8-FA49 (WH/VT). TEST the system for normal operation.

F5 CHECK CIRCUIT 9-FA49 (BN/WH) FOR AN OPEN

1



A0006705

1

Measure the resistance between DATC module C228a pin 8, circuit 9-FA49 (BN/WH), harness side and the ambient temperature sensor connector C132 circuit 9-FA49 (BN/WH), harness side.

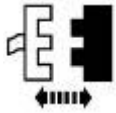
● Is the resistance less than 5 ohms?

→ **Yes**
GO to F6.

→ **No**
REPAIR circuit 9-FA49 (BN/WH). TEST the system for normal operation.

F6 INSPECT THE CONNECTIONS

1



DATC Module C228a

2

Inspect the A/C ambient temperature sensor connector pins, in-line connector C264 pin 8, circuit 8-FA49 (WH/VT) and pin 7, circuit 9-FA49 (BN/WH) and DATC module C228a pin 17, circuit 8-FA49 (WH/VT), harness side and pin 8, circuit 9-FA49 (BN/WH), harness side for signs of damage, loose fits or incorrect installation.

- **Are the connector pins undamaged and installed correctly?**


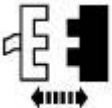
→ **Yes**

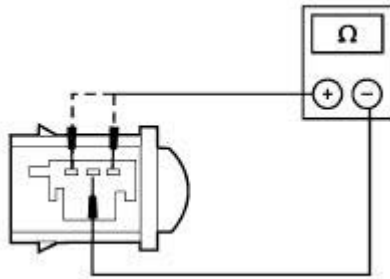
RECONNECT the connector and RERUN the self-test. If the DTCs are still present, INSTALL a new DATC module. REFER to Section 412-04 . TEST the system for normal operation.

→ **No**

REPAIR the damaged or loose connector pins. TEST the system for normal operation.

PINPOINT TEST G: DTC B1259 OR B1261 — SOLAR RADIATION SENSOR CIRCUIT OPEN OR SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE SOLAR RADIATION SENSOR RESISTANCE	
<p>1</p>  <p>2</p>  <p>Solar Radiation Sensor C286</p> <p>3</p>	<p>3 NOTE: Connect the ground lead of the multimeter to the sensor ground terminal.</p> <p>Measure the resistance between each solar radiation sensor terminal and the ground terminal.</p>



A0003985

- Are the resistances between 39,000 and 41,000 ohms?

→ **Yes**
GO to G2.

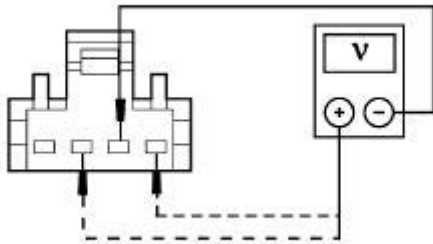
→ **No**
INSTALL a new A/C solar radiation sensor. TEST the system for normal operation.

G2 CHECK THE DATC OUTPUT VOLTAGE

1



2



A0002819

- 2 Measure the voltage between solar radiation C286, circuits 8-FA53 (WH/BU), harness side and 9-FA53 (BN/BU), harness side and between circuits 10-FA53 (GY/VT), harness side and 9-FA53 (BN/BU), harness side.

- Are the voltages between 4.7 and 5.1 volts?

→ **Yes**
GO to G8.

→ **No**
If DTC B1259 is present, GO to G5.

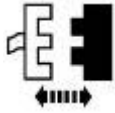
If DTC B1261 is present, GO to G3.

G3 CHECK CIRCUIT 10-FA53 (GY/VT) FOR A SHORT TO GROUND

1

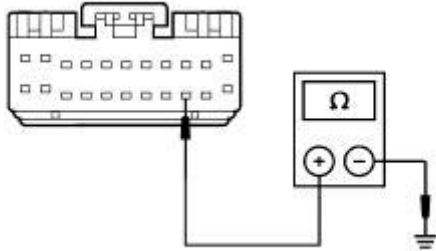


2



DATC Module C228a

3



A0001987

3

Measure the resistance between DATC module C228a pin 20, circuit 10-FA53 (GY/VT), harness side and ground.

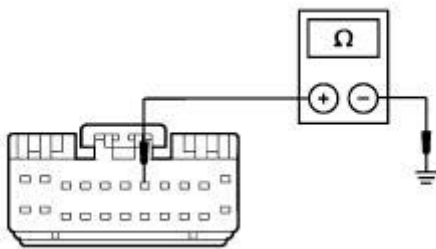
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to G4.

→ **No**
REPAIR circuit 10-FA53 (GY/VT). TEST the system for normal operation.

G4 CHECK CIRCUIT 8-FA53 (WH/BU) FOR A SHORT TO GROUND

1



A0003986

1

Measure the resistance between DATC module C228a pin 7, circuit 8-FA53 (WH/BU), harness side and ground.

● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to G8.

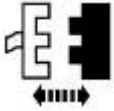
→ **No**
REPAIR circuit 8-FA53 (WH/BU). TEST the system for normal operation.

G5 CHECK CIRCUIT 10-FA53 (GY/VT) FOR AN OPEN

1

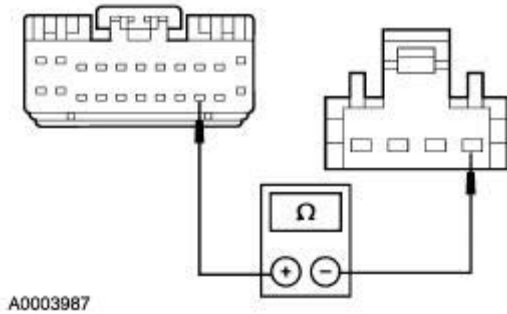


2



DATC Module C228a

3



A0003987

3

Measure the resistance between DATC module C228a pin 20, circuit 10-FA53 (GY/VT), harness side and solar radiation sensor C286 circuit 10-FA53 (GY/VT), harness side.

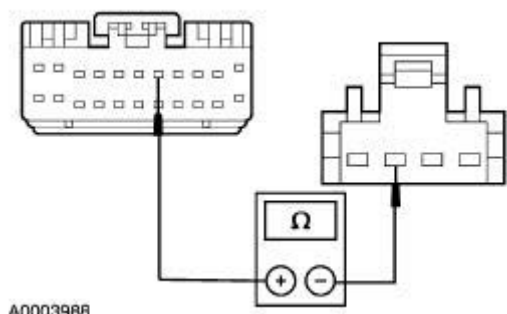
● Is the resistance less than 5 ohms?

→ **Yes**
GO to G6.

→ **No**
REPAIR circuit 10-FA53 (GY/VT). TEST the system for normal operation.

G6 CHECK CIRCUIT 8-FA53 (WH/BU) FOR AN OPEN

1



A0003988

1

Measure the resistance between DATC module C228a pin 7, circuit 8-FA53 (WH/BU), harness side and the solar radiation sensor C286 circuit 8-FA53 (WH/BU), harness side.

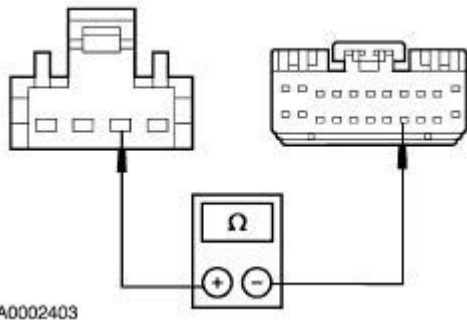
● Is the resistance less than 5 ohms?

→ **Yes**
GO to G7.

→ **No**
REPAIR circuit 8-FA53 (WH/BU). TEST the system for normal operation.

G7 CHECK THE RETURN CIRCUIT FOR AN OPEN

1



A0002403

- 1 Measure the resistance between DATC module C228a pin 19, circuit 9-FA3 (BN/RD), harness side and solar radiation C286, circuit 9-FA53 (BN/BU), harness side.

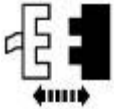
- Is the resistance less than 5 ohms?

→ **Yes**
GO to G8.

→ **No**
REPAIR the affected circuit. TEST the system for normal operation.

G8 INSPECT THE CONNECTIONS

1



DATC Module C228a


- 2 Inspect the solar radiation sensor C286, in-line connector C219 pin 1, circuit 8-FA53 (WH/BU) and pin 3, circuit 10-FA53 (GY/VT) and DATC module C228a pin 20, circuit 10-FA53 (GY/VT), harness side, pin 7, circuit 8-FA53 (WH/BU), harness side, and pin 19, circuit 9-FA3 (BN/RD), harness side for signs of damage, loose fits or incorrect installation.

- Are the connector pins undamaged and installed correctly?

→ **Yes**
RECONNECT the connectors and RERUN the self-test. If the DTC is still present, INSTALL a new DATC module. REFER to Section 412-04 . TEST the system for normal operation.

→ **No**
REPAIR the damaged or loose connector pins. TEST the system for normal operation.

PINPOINT TEST H: INSUFFICIENT, ERRATIC, OR NO HEAT

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>⚠ CAUTION: The coolant control valve jumper harness-to-engine compartment wiring harness connector halves are identified as C134. Make sure to carefully identify the correct half of the connector before carrying out any electrical measurements. Failure to do so can result in damage to the DATC module.</p>	
<p>H1 CHECK FOR CORRECT COOLANT LEVEL</p>	
<p>1</p> 	<p>2 Check the engine coolant level with the engine at cold and hot temperatures.</p> <ul style="list-style-type: none"> ● Is the engine coolant at the correct level (both cold and hot)? <p>→ Yes GO to <u>H4</u>.</p> <p>→ No GO to <u>H2</u>.</p>
<p>H2 CHECK THE ENGINE COOLING SYSTEM FOR LEAKS</p>	
<p>⚠ WARNING: Never remove the pressure relief cap under any condition while the engine is operating. Failure to follow these instructions can result in damage to the cooling system or engine, or can result in personal injury. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap from a hot degas bottle. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When certain all the pressure has been released, use the cloth to remove the pressure relief cap.</p>	
	<p>1 Fill and bleed the engine cooling system. Refer to <u>Section 303-03</u>.</p> <p>2 Pressure check the engine cooling system, including the pressure relief cap. Refer to <u>Section 303-03</u>.</p> <ul style="list-style-type: none"> ● Does the engine cooling system, including the pressure relief cap, hold pressure? <p>→ Yes GO to <u>H3</u>.</p> <p>→ No REPAIR the engine cooling system leak. TEST the system for normal operation.</p>
<p>H3 VERIFY THE FAULT WAS A LOW ENGINE COOLANT LEVEL</p>	
<p>NOTE: When carrying out this test step, allow time for the system to respond.</p>	

1




2 With the engine at normal operating temperature, set the DATC module driver and passenger side temperature settings to full hot (32°C [90°F]) and note the discharge air temperature.

● Is the discharge air temperature at full hot?

→ **Yes**
Test is complete.

→ **No**
GO to H4.

H4 BLEED THE ENGINE COOLING SYSTEM

 **WARNING:** Never remove the pressure relief cap under any condition while the engine is operating. Failure to follow these instructions can result in damage to the cooling system or engine, or can result in personal injury. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap from a hot degas bottle. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When certain all the pressure has been released, use the cloth to remove the pressure relief cap.

NOTE: When carrying out this test step, allow time for the system to respond.

1 Bleed the engine cooling system. Refer to Section 303-03.


2 With the engine at normal operating temperature, set the DATC module driver and passenger side temperature settings to full hot (32°C [90°F]) and note the discharge air temperature.

● Is the discharge air temperature at full hot?

→ **Yes**
Test is complete.

→ **No**
GO to H5.

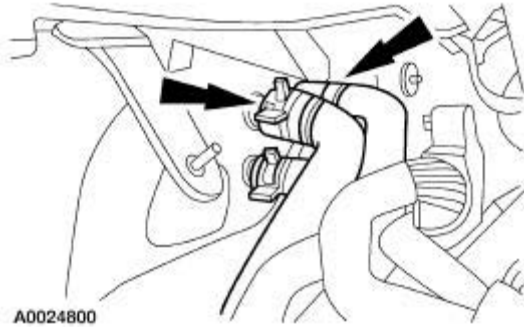
H5 CHECK FOR HOT COOLANT AT THE HEATER CORE INLET HOSES

 **WARNING:** The heater core inlet hoses will become too hot to handle and can cause serious burns if the system is working correctly. Failure to follow these instructions can result in personal injury.

1



2



2 Carefully feel both heater core inlet hoses.

● Are both heater core inlet hoses too hot to handle?

→ **Yes**
CARRY OUT the heater core component test. REFER to Heater Core under Component Tests in this section to determine whether a plugged or partially plugged condition exists.

→ **No**
GO to H6.

H6 CHECK THE COOLANT CONTROL VALVE

NOTE: Disconnecting the coolant control valve defaults the DATC system to full hot.

NOTE: When carrying out this test step, allow time for the system to respond.

1



Coolant Control Valve Jumper Harness and Engine Compartment Wiring Harness C134

2



3 **NOTE:** For 3.9L engines, run the engine at 3,000 rpm to compensate for the disconnected auxiliary coolant pump.

With the engine at normal operating temperature, set the DATC module driver and passenger side settings to full hot (32°C [90°F]) and note the discharge air temperature.

● Is the discharge air temperature at full hot?

→ **Yes**
GO to H8.

→ **No**
GO to H7.

H7 CHECK THE THERMOSTAT

1



2 Carry out the thermostat component test. Refer to Section 303-03.

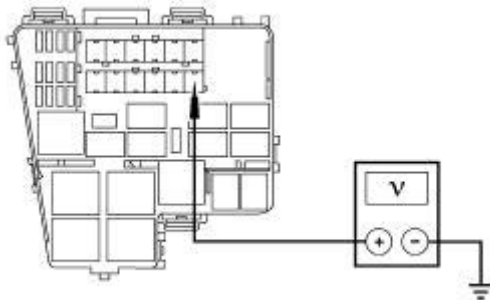
● Is the thermostat operating correctly?

→ **Yes**
INSTALL a new coolant control valve.
TEST the system for normal operation.

→ **No**
INSTALL a new thermostat. TEST the system for normal operation.

H8 CHECK SOURCE VOLTAGE FOR TESTING

1



1 Measure the voltage between the underhood auxiliary junction box (UAJB) fuse terminal F124, circuit 30-KA23 (RD/OG) and ground.


● Is the voltage greater than 10 volts?

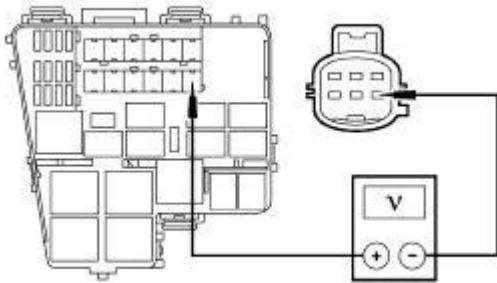
→ **Yes**
GO to H9.

→ **No**
REPAIR circuit 30-KA23 (RD/OG). GO to H9.

H9 CHECK THE DATC GROUND SIGNAL CIRCUIT 91S-FB4 (BN/GN)

1

1  **CAUTION:** Do not short the engine compartment wiring harness C134 pins 3 or 6 to pins 1



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or 4. Damage to the DATC module can result if this occurs.

Measure the voltage between the UAJB fuse terminal F124, circuit 30-KA23 (RD/OG) and the engine compartment wiring harness C134 pin 6, circuit 91S-FB4 (BN/GN).

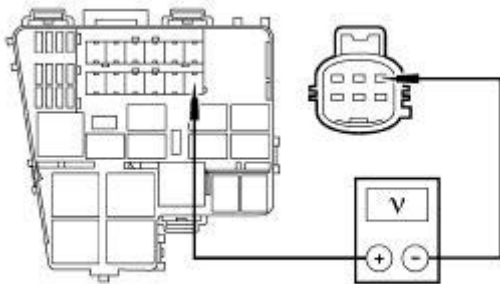
- Is the voltage greater than 10 volts?

→ **Yes**
GO to H11.

→ **No**
GO to H10.

H10 CHECK THE DATC GROUND SIGNAL CIRCUIT 91S-FB3 (BN/BU)

1



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CAUTION: Do not short the engine compartment wiring harness C134 pins 3 or 6 to pins 1 or 4. Damage to the DATC module can result if this occurs.

Measure the voltage between the UAJB fuse terminal F124, circuit 30-KA23 (RD/OG) and the engine compartment wiring harness C134 pin 3, circuit 91S-FB3 (BN/BU).

- Is the voltage greater than 10 volts?

→ **Yes**
GO to H12.

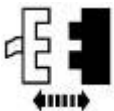
→ **No**
GO to H13.

H11 CHECK CIRCUIT 91S-FB4 (BN/GN) FOR A SHORT TO GROUND

1



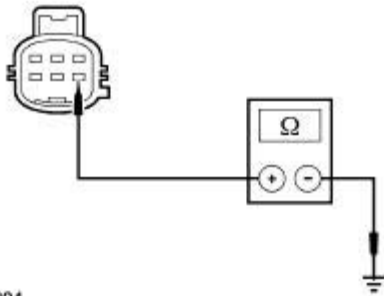
2



DATC Module C228b

3

CAUTION: Do not short the



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engine compartment wiring harness C134 pins 3 or 6 to pins 1 or 4. Damage to the DATC module can result if this occurs.

Measure the resistance between the engine compartment wiring harness C134 pin 6, circuit 91S-FB4 (BN/GN) and ground.

- **Is the resistance greater than 10,000 ohms?**

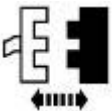
- **Yes**
INSTALL a new DATC module. TEST the system for normal operation.
- **No**
REPAIR circuit 91S-FB4 (BN/GN). TEST the system for normal operation.

H12 CHECK CIRCUIT 91S-FB3 (BN/BU) FOR A SHORT TO GROUND

1

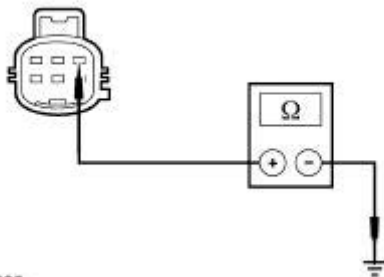


2




DATC Module C228b

3



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- 3  **CAUTION: Do not short the engine compartment wiring harness C134 pins 3 or 6 to pins 1 or 4. Damage to the DATC module can result if this occurs.**

Measure the resistance between the engine compartment wiring harness C134 pin 3, circuit 91S-FB3 (BN/BU) and ground.

- **Is the resistance greater than 10,000 ohms?**

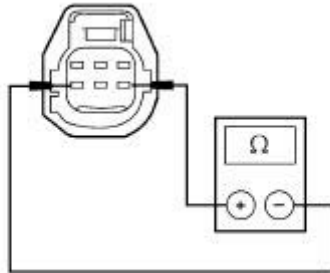
- **Yes**
INSTALL a new DATC module. TEST the system for normal operation.
- **No**
REPAIR circuit 91S-FB3 (BN/BU). TEST the system for normal operation.

H13 CHECK THE COOLANT CONTROL VALVE SOLENOID RESISTANCE

1

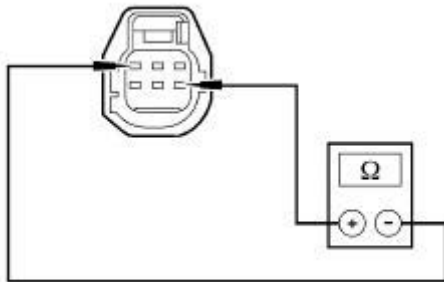


2



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3



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2

Measure the resistance between the coolant control valve jumper harness C134 pin 4, circuit 30-FB3 (RD/OG) and pin 6, circuit 91S-FB4 (BN/GN).

3

Measure the resistance between the coolant control valve jumper harness C134 pin 4, circuit 30-FB3 (RD/OG) and pin 3, circuit 91S-FB3 (BN/BU).

● **Do both resistances measure between 10-23 ohms?**

→ **Yes**

INSTALL a new coolant control valve.
TEST the system for normal operation.

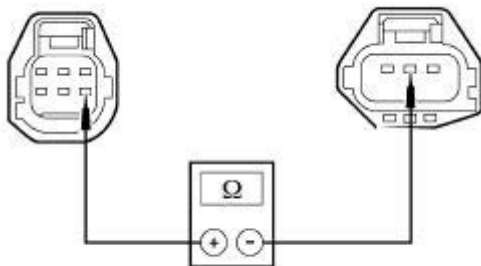
→ **No**

If the resistance is greater than 23 ohms, GO to H14.

If the resistance is less than 10 ohms, GO to H15.

H14 CHECK THE COOLANT CONTROL VALVE JUMPER HARNESS

1

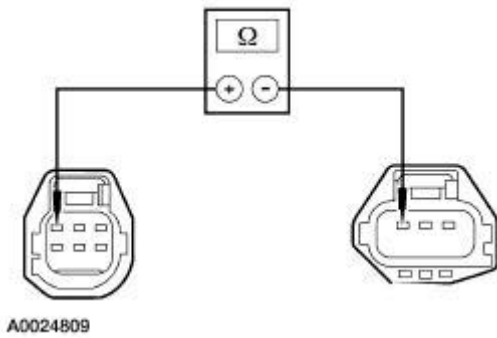


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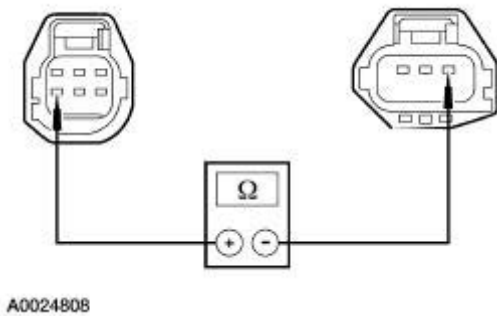
1

Measure the resistance between the coolant control valve jumper harness C134 pin 4, circuit 30-FB3 (RD/OG) and the coolant control valve C1034 pin 2, circuit 30-FB3 (RD/OG).

2



3



2

Measure the resistance between the coolant control valve jumper harness C134 pin 3, circuit 91S-FB3 (BN/BU) and the coolant control valve C1034 pin 3, circuit 91S-FB3 (BN/BU).

3

Measure the resistance between the coolant control valve jumper harness C134 pin 6, circuit 91S-FB4 (BN/GN) and the coolant control valve C1034 pin 1, circuit 91S-FB4 (BN/GN).

• **Are the resistances less than 5 ohms?**

→ **Yes**

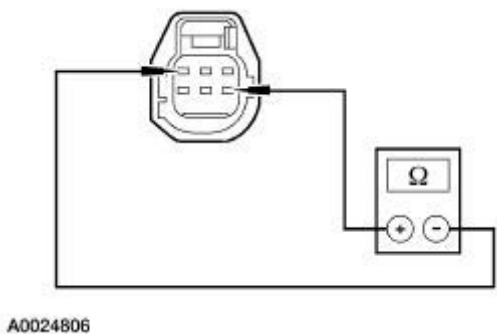
INSTALL a new coolant control valve.
TEST the system for normal operation.
If system operation is still not correct,
INSTALL a new DATC module.

→ **No**

REPAIR the affected circuit(s) of the coolant control valve jumper harness.
TEST the system for normal operation.

H15 CHECK THE COOLANT CONTROL VALVE JUMPER HARNESS CIRCUITS 91S-FB3 (BN/BU) AND 91S-FB4 (BN/GN) FOR A SHORT TO VOLTAGE

1



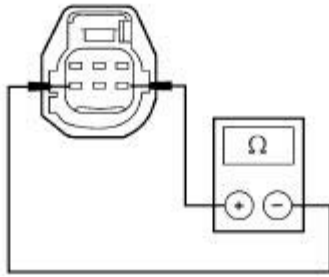
2

1

Measure the resistance between the coolant control valve jumper harness C134 pin 3, circuit 91S-FB3 (BN/BU) and pin 4, circuit 30-FB3 (RD/OG).

2

Measure the resistance between the coolant control valve jumper harness C134 pin 6, circuit 91S-FB4 (BN/GN) and pin 4, circuit 30-FB3 (RD/OG).




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- Are the resistances greater than 10,000 ohms?

- **Yes**
INSTALL a new coolant control valve.
TEST the system for normal operation.
- **No**
REPAIR the affected circuit(s) of the coolant control valve jumper harness.
TEST the system for normal operation.
If system operation is still not correct,
INSTALL a new DATC module.

PINPOINT TEST I: INSUFFICIENT HEAT DURING ENGINE IDLE— 3.9L ENGINE

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 CARRY OUT THE DATC MODULE SELF-TEST	
<p>1</p> 	<p>2 Carry out the DATC module self-test and retrieve continuous DTCs. Refer to Climate Control System. Record the DTCs displayed, if any.</p> <ul style="list-style-type: none"> ● Are any DTCs displayed? <p>→ Yes REFER to the DATC Module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as necessary.</p> <p>→ No GO to I2.</p>
I2 RECHECK DATC MODULE CONFIGURATION	
	<p>1 Enter Module Identification mode.</p>

2



PID CNFG Data

2

Read PID CNFG data 1.

● Does the data read 4N_3N_2Y?

→ Yes

GO to 13.

→ No

RECONFIGURE the DATC module.
REFER to Section 418-01.

13 CHECK THE COOLANT LEVEL

1

Check the coolant level with the engine at hot and cold temperatures.

● Is the engine coolant at the correct level (hot and cold)?

→ Yes

GO to 14.

→ No

REFILL the system and PRESSURE TEST for leaks. REFER to Section 303-03. In addition, if the coolant level had dropped below the "MIN" level, SET the system to MAX heat and RUN the engine at 3,000 rpm for 3 to 5 minutes until hot air blows from the outlets. RECHECK coolant level. GO to 14.

14 CHECK FOR AUXILIARY COOLANT PUMP OPERATION

1



2



3

In the active command mode, request Climate Control System and select Pump/VCB or set driver side temperature to 32°C (90°F).

● Can the auxiliary cooling pump be heard running or be felt running?

→ Yes

System is operating correctly.

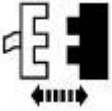
→ **No**
GO to 15.

15 CHECK THE AUXILIARY PUMP MOTOR

1



2

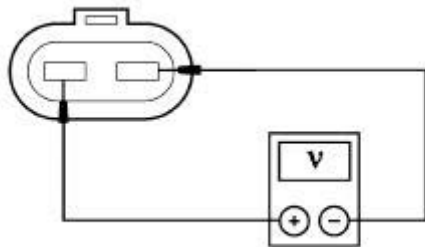


Auxiliary Coolant Pump C163

3



5



A0002330

4 Make sure the active command Pump/VBC is still selected or the driver side temperature is set to 32°C (90°F).

5 Measure the voltage between auxiliary coolant pump C163, circuit 30S-FB1 (RD/YE), harness side and circuit 31-FB1 (BK), harness side.

● **Is the voltage greater than 10 volts?**

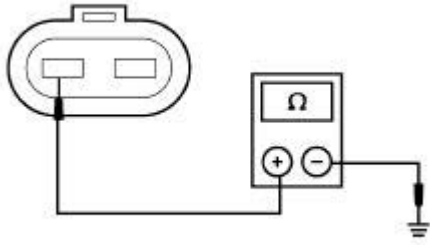
→ **Yes**
INSPECT terminals for damage and correct installation. If pins are installed correctly, INSTALL a new auxiliary coolant pump. REFER to Section 412-02. TEST the system for normal operation.

→ **No**
GO to 16.

16 CHECK CIRCUIT 31-FB1 (BK) FOR AN OPEN

1

1 Measure the resistance between auxiliary coolant pump C163, circuit 31-FB1 (BK), harness side and ground.



A0002331

● Is the resistance less than 5 ohms?

→ **Yes**
GO to 17.

→ **No**
REPAIR circuit 31-FB1 (BK). TEST the system for normal operation.

17 CHECK THE AUXILIARY COOLANT PUMP RELAY

1

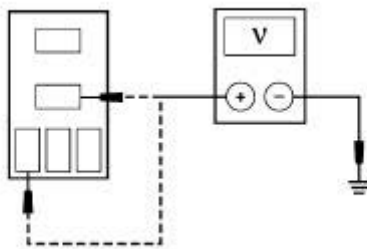


2



Auxiliary Coolant Pump Relay C1005

3



A0006707

3 Measure the voltage between CJB auxiliary coolant pump relay pins 2 and 5, circuit 30-FA74A (RD), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to 18.

→ **No**
REPAIR circuit 30-FA74A (RD). TEST the system for normal operation.

18 CARRY OUT THE RELAY COMPONENT TEST

1 Carry out the relay component test.

Refer to Wiring Diagrams Section 700-09 for schematic and connector information.

● **Is the relay OK?**

→ **Yes**
GO to I9.

→ **No**
INSTALL a new auxiliary coolant pump relay. REFER to Section 412-04. TEST the system for normal operation.

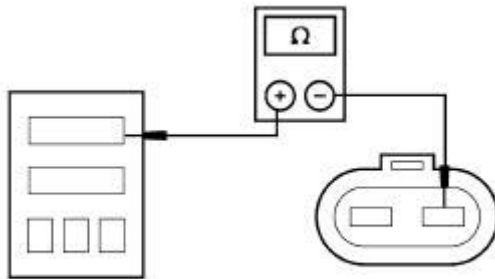
I9 CHECK CIRCUIT 30S-FB1 (RD/YE) FOR AN OPEN

1



Auxiliary Coolant Pump Relay C1005

2



A0002334

2

Measure the resistance between auxiliary coolant pump C163, circuit 30S-FB1 (RD/YE), harness side and auxiliary coolant pump relay pin 3, circuit 30S-FB1 (RD/YE), harness side.

● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to I10.

→ **No**
REPAIR circuit 30S-FB1 (RD/YE). TEST the system for normal operation.

I10 CHECK THE DATC MODULE

1



2



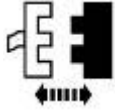
Auxiliary Coolant Pump Relay C1005

3



Auxiliary Coolant Pump C163

4



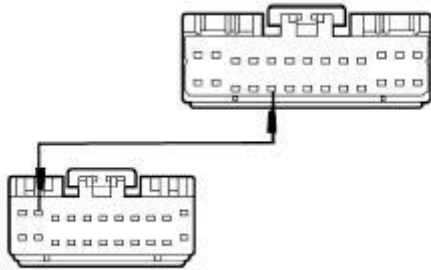
DATC Module C228b

5



DATC Module C228a

6



A0002332

6 Connect a fused jumper wire between DATC module C228b pin 18, circuit 91S-FA76 (BN/BU), harness side and DATC module C228a pin 2, circuit 31-FA10 (BK), harness side.

• Does the auxiliary coolant pump motor operate?

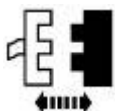
→ Yes
INSPECT all connectors and terminals, RECONNECT the connectors, and TEST the system for normal operation. If condition still exists, INSTALL a new DATC module. REFER to Section 412-04. TEST the system for normal operation.

→ No
GO to I11.

I11 CHECK CIRCUIT 91S-FA76 (BK/OG) FOR A SHORT TO POWER

NOTE: If a short to power is found, it is necessary to install a new DATC module.

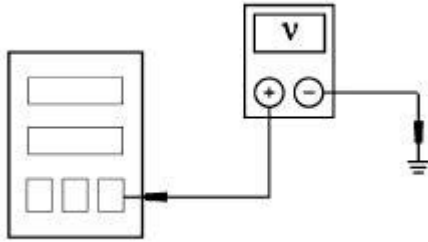
1



Auxiliary Coolant Pump Relay C1005

2

2 Measure the voltage between auxiliary coolant pump relay pin 2, circuit 91S-FA76 (BK/OG), harness side and ground.



A0002333

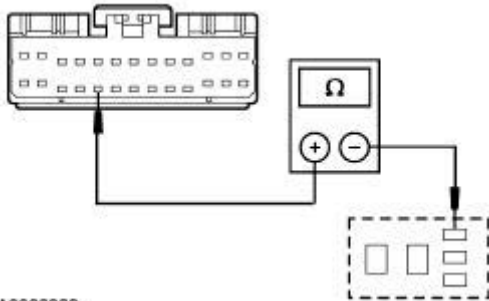
● Is any voltage present?

→ **Yes**
REPAIR circuit 91S-FA76 (BK/OG).
INSTALL a new DATC module. REFER to
Section 412-04 . TEST the system for
normal operation.

→ **No**
GO to I12 .

I12 CHECK CIRCUIT 91S-FA76 (BK/OG) FOR AN OPEN

1



A0003989

1


Measure the resistance between
auxiliary coolant pump relay circuit 91S-
FA76 (BK/OG), harness side and DATC
module C228b pin 18, circuit 91S-FA76
(BK/OG), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSPECT all connectors and terminals,
RECONNECT the connectors and TEST
the system. If condition still exists,
INSTALL a new DATC module. REFER to
Section 412-04 . TEST the system for
normal operation.

→ **No**
REPAIR circuit 91S-FA76 (BK/OG). TEST
the system for normal operation.

PINPOINT TEST J: FULL HEAT ONLY IN ALL MODES

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CAUTION: The coolant control valve jumper harness-to-engine compartment wiring

harness connector halves are identified as C134. Make sure to carefully identify the correct half of the connector before carrying out any electrical measurements. Failure to do so can result in damage to the DATC module.

J1 CHECK CIRCUIT 30-FB3 (RD/OG)

1

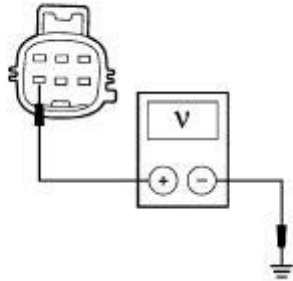


2




Coolant Control Valve Jumper Harness and Engine Compartment Wiring Harness C134

3



A0007536

3  **CAUTION: Do not short the engine compartment wiring harness C134 pins 3 or 6 to pins 1 or 4. Damage to the DATC module can result if this occurs.**

Measure the voltage between the engine compartment wiring harness C134 pin 4, circuit 30-FB3 (RD/OG) and ground.

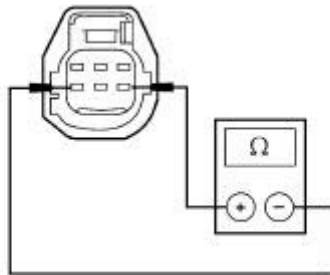
● Is the voltage greater than 10 volts?

→ **Yes**
GO to J2.

→ **No**
REPAIR circuit 30-FB3 (RD/OG) or circuit 30-FA1 (RD). TEST the system for normal operation.

J2 CHECK THE COOLANT CONTROL VALVE DRIVER SIDE SOLENOID RESISTANCE

1



A0007541

1 Measure the resistance between the coolant control valve jumper harness C134 pin 4, circuit 30-FB3 (RD/OG) and pin 6, circuit 91S-FB4 (BN/GN).

● Does the resistance measure between 10-23 ohms?

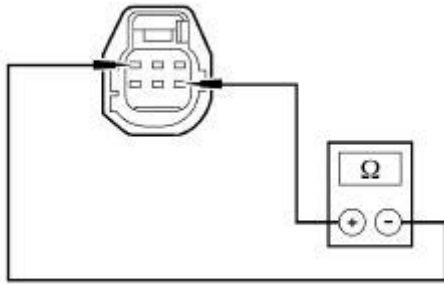
→ **Yes**
GO to J3.

→ **No**
If the resistance is greater than 23 ohms, GO to J7.

If the resistance is less than 10 ohms,
GO to J9.

J3 CHECK THE COOLANT CONTROL VALVE PASSENGER SIDE SOLENOID RESISTANCE

1



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1

Measure the resistance between the coolant control valve jumper harness C134 pin 4, circuit 30-FB3 (RD/OG) and pin 3, circuit 91S-FB3 (BN/BU).

● **Does the resistance measure between 10-23 ohms?**

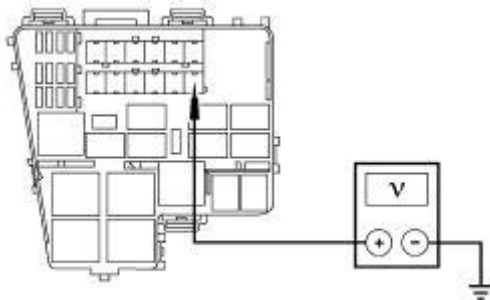
→ **Yes**
GO to J4.

→ **No**
If the resistance is greater than 23 ohms, GO to J8.

If the resistance is less than 10 ohms,
GO to J10.

J4 CHECK SOURCE VOLTAGE FOR TESTING

1



A0024801

1

Measure the voltage between the underhood auxiliary junction box (UJJB) fuse terminal F124, circuit 30-KA23 (RD/OG) and ground.

● **Is the voltage greater than 10 volts?**

→ **Yes**
GO to J5.

→ **No**

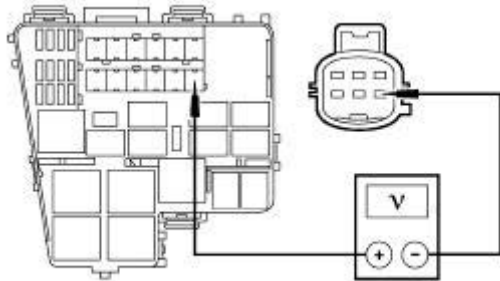
REPAIR circuit 30-KA23 (RD/OG). GO to J5.

J5 CHECK THE DATC GROUND SIGNAL CIRCUIT 91S-FB4 (BN/GN)

1




3



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2 Press the PANEL button and set the driver and passenger side temperature settings to full cool on the DATC module.

3  **CAUTION: Do not short the engine compartment wiring harness C134 pins 3 or 6 to pins 1 or 4. Damage to the DATC module can result if this occurs.**

Measure the voltage between the UAJB fuse terminal F124, circuit 30-KA23 (RD/OG) and the engine compartment wiring harness C134 pin 6, circuit 91S-FB4 (BN/GN).

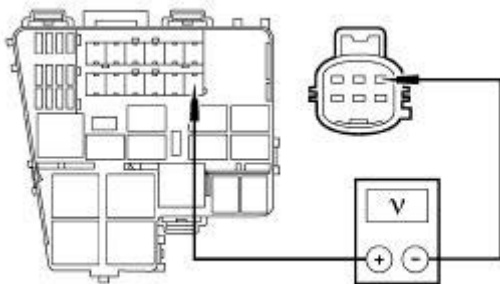
- Is the voltage greater than 10 volts?

→ **Yes**
GO to J6.


→ **No**
GO to J11.

J6 CHECK THE DATC GROUND SIGNAL CIRCUIT 91S-FB3 (BN/BU)

1



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1  **CAUTION: Do not short the engine compartment wiring harness C134 pins 3 or 6 to pins 1 or 4. Damage to the DATC module can result if this occurs.**

Measure the voltage between the UAJB fuse terminal F124, circuit 30-KA23 (RD/OG) and the engine compartment wiring harness C134 pin 3, circuit 91S-FB3 (BN/BU).

- Is the voltage greater than 10 volts?

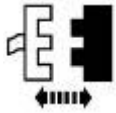
→ **Yes**
INSTALL a new coolant control valve.
TEST the system for normal operation.

→ **No**

GO to J12.

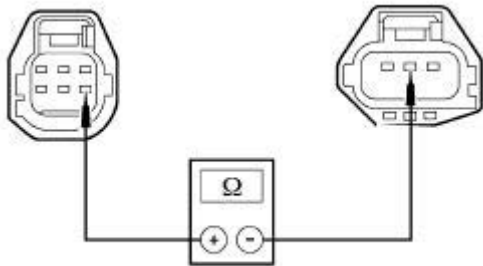
J7 CHECK THE COOLANT CONTROL VALVE JUMPER HARNESS CIRCUITS 30-FB3 (RD/OG) AND 91S-FB3 (BN/BU)

1



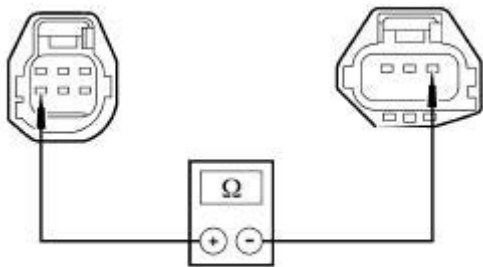
Coolant Control Valve C1034

2



A0024807

3



A0024808

2

Measure the resistance between the coolant control valve jumper harness C134 pin 4, circuit 30-FB3 (RD/OG) and the coolant control valve C1034 pin 2, circuit 30-FB3 (RD/OG).

3

Measure the resistance between the coolant control valve jumper harness C134 pin 6, circuit 91S-FB4 (BN/GN) and the coolant control valve C1034 pin 1, circuit 91S-FB4 (BN/GN).

● **Are the resistances less than 5 ohms?**

→ **Yes**

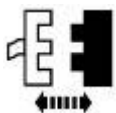
INSTALL a new coolant control valve.
TEST the system for normal operation.

→ **No**

REPAIR the affected circuit(s) of the coolant control valve jumper harness.
TEST the system for normal operation.

J8 CHECK THE COOLANT CONTROL VALVE JUMPER HARNESS CIRCUITS 30-FB3 (RD/OG) AND 91S-FB3 (BN/BU)

1

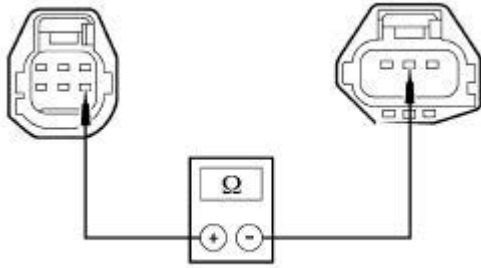


Coolant Control Valve C1034

2

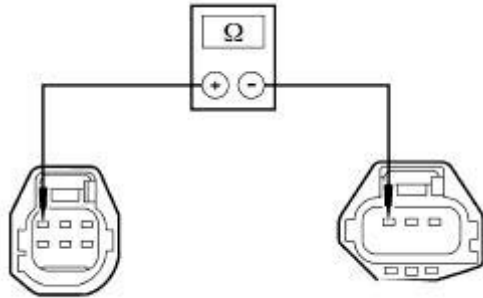
2

Measure the resistance between the coolant control valve jumper harness C134 pin 4, circuit 30-FB3 (RD/OG)



A0024807

3



A0024809

and the coolant control valve C1034 pin 2, circuit 30-FB3 (RD/OG).

3 Measure the resistance between the coolant control valve jumper harness C134 pin 3, circuit 91S-FB3 (BN/BU) and the coolant control valve C1034 pin 3, circuit 91S-FB3 (BN/BU).

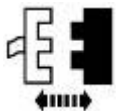
- Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new coolant control valve.
TEST the system for normal operation.

→ **No**
REPAIR the affected circuit(s) of the coolant control valve jumper harness.
TEST the system for normal operation.

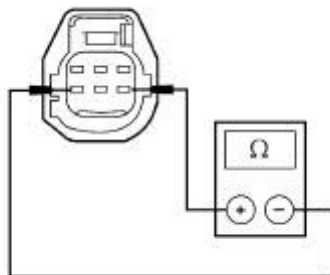
J9 CHECK THE COOLANT CONTROL VALVE JUMPER HARNESS CIRCUIT 91S-FB4 (BN/GN) FOR A SHORT

1



Coolant Control Valve C1034

2



A0007541

2 Measure the resistance between the coolant control valve jumper harness C134 pin 6, circuit 91S-FB4 (BN/GN) and pin 4, circuit 30-FB3 (RD/OG).

- Is the resistance greater than

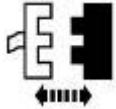
10,000 ohms?

→ **Yes**
INSTALL a new coolant control valve.
TEST the system for normal operation.

→ **No**
REPAIR the affected circuit(s). TEST
the system for normal operation.

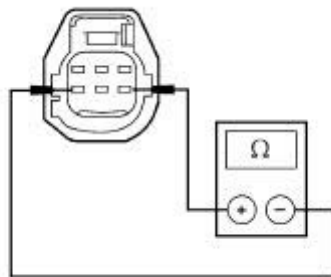
J10 CHECK THE COOLANT CONTROL VALVE JUMPER HARNESS CIRCUIT 91S-FB3 (BN/BU) FOR A SHORT

1



Coolant Control Valve C1034

2



A0007541

2 Measure the resistance between the coolant control valve jumper harness C134 pin 3, circuit 91S-FB3 (BN/BU) and pin 4, circuit 30-FB3 (RD/OG).

● **Is the resistance greater than 10,000 ohms?**

→ **Yes**
INSTALL a new coolant control valve.
TEST the system for normal operation.

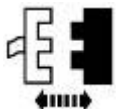
→ **No**
REPAIR the affected circuit(s). TEST
the system for normal operation.

J11 CHECK CIRCUIT 91S-FB4 (BN/GN) FOR AN OPEN

1



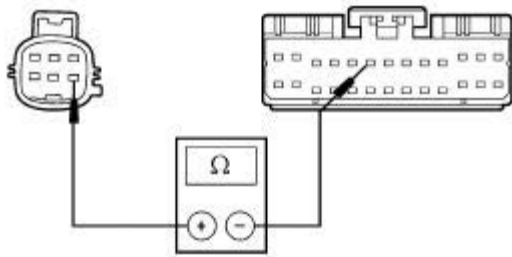
2



DATC Module C228b

3

3 Measure the resistance between the engine compartment wiring harness C134 pin 6, circuit 91S-FB4 (BN/GN) and the DATC module C228b pin 6,



A0007542

circuit 91S-FB4 (BN/GN).

- Is the resistance less than 5 ohms?

→ **Yes**
GO to J13.

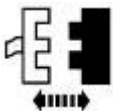
→ **No**
REPAIR circuit 91S-FB4 (BN/GN).
TEST the system for normal operation.

J12 CHECK CIRCUIT 91S-FB3 (BN/BU) FOR AN OPEN

1

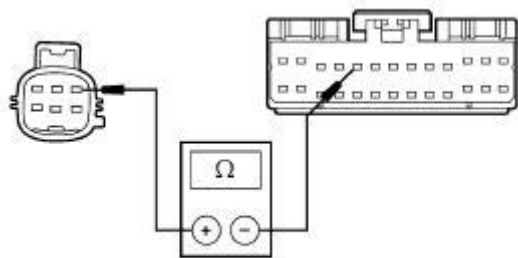


2



DATC Module C228b

3



A0007544

- 3 Measure the resistance between the engine compartment wiring harness C134 pin 3, circuit 91S-FB3 (BN/BU) and the DATC module C228b pin 5, circuit 91S-FB3 (BN/BU).

- Is the resistance less than 5 ohms?

→ **Yes**
GO to J14.

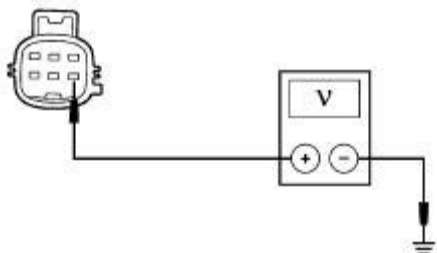
→ **No**
REPAIR circuit 91S-FB3 (BN/BU).
TEST the system for normal operation.

J13 CHECK CIRCUIT 91S-FB4 (BN/GN) FOR A SHORT TO VOLTAGE

1



2



A0007543

2



CAUTION: Do not short the engine compartment wiring harness C134 pins 3 or 6 to pins 1 or 4. Damage to the DATC module can result if this occurs.

Measure the voltage between the engine compartment wiring harness C134 pin 6, circuit 91S-FB4 (BN/GN) and ground.

● **Is voltage present?**

→ **Yes**

REPAIR circuit 91S-FB4 (BN/GN). If system operation is still not correct, INSTALL a new DATC module. TEST the system for normal operation.

→ **No**

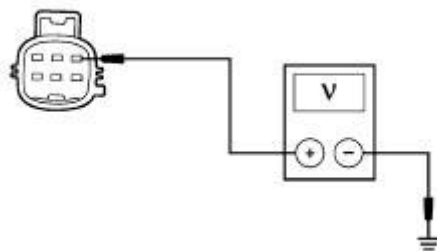
GO to J15.

J14 CHECK CIRCUIT 91S-FB3 (BN/BU) FOR A SHORT TO VOLTAGE

1



2



A0007545

2



CAUTION: Do not short the engine compartment wiring harness C134 pins 3 or 6 to pins 1 or 4. Damage to the DATC module can result if this occurs.

Measure the voltage between the engine compartment wiring harness C134 pin 3, circuit 91S-FB3 (BN/BU) and ground.

● **Is voltage present?**

→ **Yes**

REPAIR circuit 91S-FB3 (BN/BU). If system operation is still not correct, INSTALL a new DATC module. TEST the system for normal operation.

→ **No**

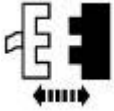
GO to J16.

J15 CHECK THE COOLANT CONTROL VALVE JUMPER HARNESS CIRCUIT 91S-FB4 (BN/GN) FOR A SHORT TO VOLTAGE

1

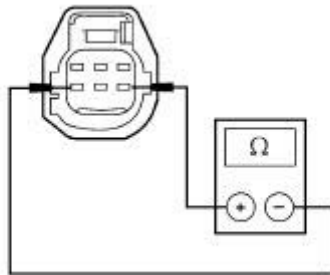


2



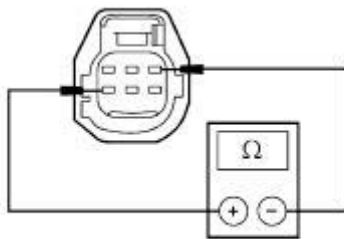
Coolant Control Valve C1034

3



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4



A0006758

3 Measure the resistance between the coolant control valve jumper harness C134 pin 6, circuit 91S-FB4 (BN/GN) and pin 4, circuit 30-FB3 (RD/OG).

4 **NOTE:** Carry out this step only on vehicles equipped with a 3.9L engine.

Measure the resistance between the coolant control valve jumper harness C134 pin 6, circuit 91S-FB4 (BN/GN) and pin 1, circuit 30S-FB1 (RD/YE).

● Are the resistances greater than 10,000 ohms?

→ **Yes**
INSTALL a new DATC module. TEST the system for normal operation.

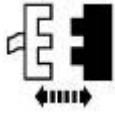
→ **No**
REPAIR the affected circuit(s) of the coolant control valve jumper harness. If system operation is still not correct, INSTALL a new DATC module. TEST the system for normal operation.

J16 CHECK THE COOLANT CONTROL VALVE JUMPER HARNESS CIRCUIT 91S-FB3 (BN/BU) FOR A SHORT TO VOLTAGE

1

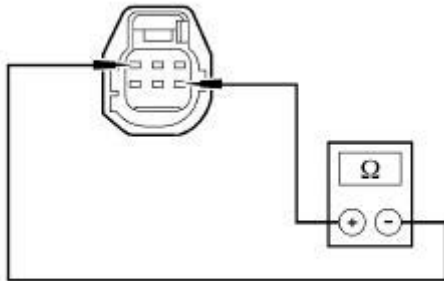


2



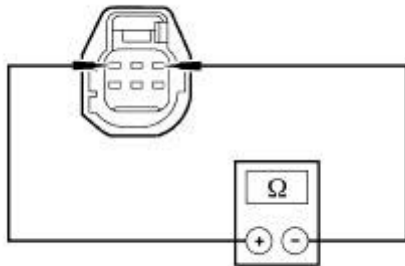
Coolant Control Valve C1034

3



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4



A0024812

3

Measure the resistance between the coolant control valve jumper harness C134 pin 3, circuit 91S-FB3 (BN/BU) and pin 4, circuit 30-FB3 (RD/OG).

4

NOTE: Carry out this step only on vehicles equipped with a 3.9L engine.

Measure the resistance between the coolant control valve jumper harness C134 pin 3, circuit 91S-FB3 (BN/BU) and pin 1, circuit 30S-FB1 (RD/YE).

• Are the resistances greater than 10,000 ohms?


→ **Yes**

INSTALL a new DATC module. TEST the system for normal operation.

→ **No**

REPAIR the affected circuit(s) of the coolant control valve jumper harness. If system operation is still not correct, INSTALL a new DATC module. TEST the system for normal operation.

PINPOINT TEST K: THE DUAL TEMPERATURE CONTROL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
	CAUTION: The coolant control valve jumper harness-to-engine compartment wiring

harness connector halves are identified as C134. Make sure to carefully identify the correct half of the connector before carrying out any electrical measurements. Failure to do so can result in damage to the DATC module.

K1 CHECK COOLANT SYSTEM

- 1 Check the coolant level with the engine at hot and cold temperatures.
- **Is the engine coolant at the correct level (hot and cold)?**
- **Yes**
GO to K2.
- **No**
REFILL the cooling system and PRESSURE TEST for leaks. REFER to Section 303-03. In addition, if the coolant level has dropped below the "MIN" level, SET the system to MAX heat and RUN the engine at 3,000 rpm for 3 to 5 minutes to remove air from the system. RECHECK coolant level.

K2 VERIFY A/C OPERATION

1



- 2 Press the OFF button then press the A/C button on the DATC panel.
- **Does the A/C clutch engage?**
- **Yes**
GO to K3.
- **No**
Go To Pinpoint Test L.

K3 VERIFY THE CONCERN

NOTE: When carrying out this test step, allow time for the system to respond.

- 1 With the engine at normal operating temperature, select PANEL mode and A/C on the DATC module.
- 2 Using the driver side temperature control, set the driver side temperature to 16°C (60° F) and then set to 32°C (90° F).
- **Do both the driver side and passenger side air temperatures go to full cool then to full heat?**
- **Yes**

GO to K4.

→ **No**

If driver side only does not go to full cool and then full heat, GO to K9. If passenger side only does not go to full cool and then full heat, GO to K12. If both sides have only full heat, Go To Pinpoint Test J. If both sides have only full cool, Go To Pinpoint Test H.

K4 CHECK MODULE CONFIGURATION

2



PID CNFG Data

1 Enter Module Identification mode.

2 Read PID CNFG data 1.

- Does PID CNFG data read ON and 4N_3N_2Y?

→ **Yes**

GO to K5.

→ **No**

RECONFIGURE the DATC module. REFER to Section 418-01.

K5 REQUEST CONTINUOUS CODES AND CARRY OUT THE DATC SELF-TEST

1 Request Continuous DTCs and carry out the DATC Module Self-Test. Refer to Climate Control System. Record the DTCs displayed, if any.

- Are any DTCs displayed?

→ **Yes**

REFER to the DATC Module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as necessary.

→ **No**

GO to K6.

K6 CHECK THE TEMPERATURE SENSORS FOR CORRECT INSTALLATION

1



2 Check the driver side, passenger side, evaporator core, and ambient air temperature sensors for correct installation.

3 Check the in-vehicle temperature sensor and venturi hose for correct installation.

● **Are the sensors installed correctly?**

→ **Yes**
GO to K7.

→ **No**
CORRECT the sensor installation. TEST the system for normal operation.

K7 CHECK FOR CORRECT HEATER HOSE CONNECTIONS

NOTE: The hose assembly that connects to the inboard port on the coolant control valve connects to the inboard port (driver side) on the heater core.

1 Check the heater hose connections for correct installation. Refer to Section 412-02.

● **Are the heater hoses installed correctly?**

→ **Yes**
GO to K8.

→ **No**
CORRECT the heater hose installation. TEST the system for normal operation.

K8 CHECK THE DRIVER SIDE TEMPERATURE CONTROL

NOTE: When carrying out this test step, allow time for the system to respond.

1 Select panel and A/C modes.

2 Set the passenger side temperature to 24° C (75° F).

3 Using the driver side temperature control buttons, set the temperature to 19° C (65° F) and then to 29° C (85° F).

● **Does the driver side temperature decrease and then increase?**

→ **Yes**
GO to K9.

→ **No**
If the driver side air temperature has full cool only, GO to K10.

If the driver side air temperature has full heat only, GO to K11.

K9 CHECK THE PASSENGER SIDE TEMPERATURE CONTROL

NOTE: When carrying out this test step, allow time for the system to respond.

1 Select PANEL and A/C modes.

2 Set the driver side temperature to 24° C (75° F).

3 Using the passenger side temperature control buttons, set the temperature to 19° C (65° F) and then to 29° C (85° F).

- **Does the passenger side air temperature decrease and then increase?**

→ **Yes**

The system is operating correctly.

→ **No**

If the passenger side air temperature has full cool only, GO to K10.

If the passenger side air temperature has full heat only, GO to K11.

K10 CHECK FOR CORRECT COOLANT FLOW TO THE HEATER CORE

2



1 Remove the passenger side cowl cover.

3 With the engine running at normal operating temperature and the DATC module set to 32° C (90° F), see if both inlet heater hoses are too hot to handle.

- **Are both inlet heater hoses too hot to handle?**

→ **Yes**

GO to K12.

→ **No**

Go To Pinpoint Test H.

K11 CHECK CORRECT COOLANT CONTROL VALVE OPERATION

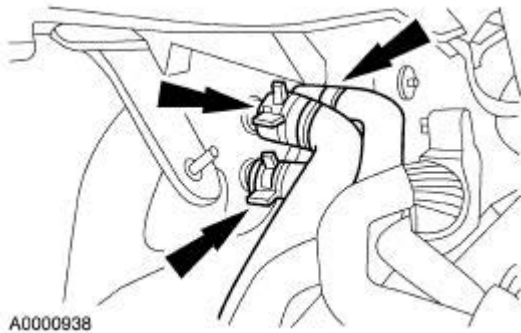


WARNING: The heater core inlet hoses will become too hot to handle and can cause serious burns if the system is working correctly. Failure to follow these instructions can result in personal injury.

2

1 Remove the passenger side cowl cover.

2 Clamp off the three heater hoses going to the heater core, as close to the heater core as possible.



A0000938

3



4 Set the DATC module to 16° C (60° F).

● **Is cooling restored?**

→ **Yes**

Concern is with coolant control valve operation. Go To Pinpoint Test J.

→ **No**

GO to K12.

K12 CHECK CIRCUITS 8-FA51 (WH/BK) AND 8-FA47 (WH/GN)

1

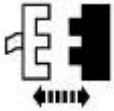


2



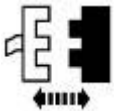
Passenger Side Discharge Air Temperature Sensor C255

3



Driver Side Discharge Air Temperature Sensor C235

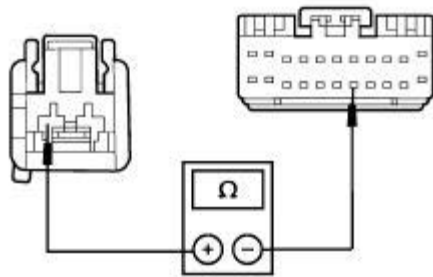
4



DATC Module C228a

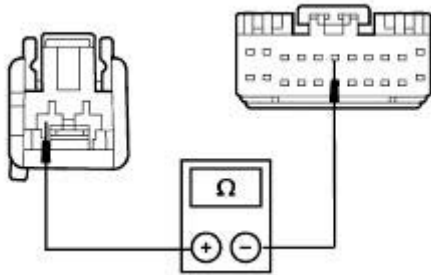
5

5 Measure the resistance between the passenger side discharge air temperature sensor C255, circuit 8-FA51 (WH/BK) and the DATC module C228a pin 18, circuit 8-FA51 (WH/BK).



A0004987

6



A0004988

6

Measure the resistance between the driver side discharge air temperature sensor C235, circuit 8-FA47 (WH/GN) and the DATC module C228a pin 6, circuit 8-FA47 (WH/GN).

- Are the resistances less than 5 ohms?

→ Yes

RECHECK all connections, RECONNECT and RETEST the system. If the condition still exists, INSTALL a new DATC module. TEST the system for normal operation.

→ No

CHECK to make sure that circuit 8-FA47 (WH/GN) is connected to DATC module C228a pin 6 and that circuit 8-FA51 (WH/BK) is connected to DATC module C228a pin 18. REPAIR as required. TEST the system for normal operation.

PINPOINT TEST L: THE AIR CONDITIONING (A/C) IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ambient temperature must be above 0° C (32° F) to permit the A/C compressor to operate.	
L1 VERIFY CUSTOMER COMPLAINT	
	<ol style="list-style-type: none"> 1 Make sure the engine is at operating temperature. 2 Select panel and A/C modes. <ul style="list-style-type: none"> • Is full heat present in all

temperature settings?

→ **Yes**
Go To Pinpoint Test J.

→ **No**
GO to L2.

L2 CARRY OUT THE PCM AND DATC MODULE SELF-TESTS

1



2



3 Carry out the PCM self-test. Record any DTCs displayed.

4 Carry out the DATC module self-test and retrieve continuous DTCs. Refer to Climate Control System. Record the DTCs displayed, if any.

● **Were any DTCs displayed?**

→ **Yes**
REFER to the PCM or DATC Module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as necessary.

→ **No**
GO to L3.

L3 CHECK THE PID WACF WITH THE A/C OFF

NOTE: When PCM PID WACF is YES, this is the same fault as DTC P1460.

1



3



PCM PID WACF

2 Press the OFF button on the DATC module.

● **Does the PCM PID WACF read YES?**

- **Yes**
REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue the diagnosis.
- **No**
GO to L4.

L4 CHECK PID WACF WITH THE A/C ON

NOTE: When PCM PID WACF is YES, this is the same fault as DTC P1460.

1



3



PCM PID WACF

- 2 Press the DATC PANEL and A/C override button. Make sure the A/C indicator LED is on.

● **Does the PCM PID WACF read YES?**

- **Yes**
REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue the diagnosis.
- **No**
GO to L5.

L5 CHECK PID ACCS WITH THE A/C ON

1



PID EXT_FT2

2



PID ACPEVAP

5

- 1 Make sure PID EXT_FT2 reading is greater than 0°C (32°F).
- 2 Make sure that the PID ACPEVAP reading is greater than 2°C (35°F).
- 3 Make sure the engine is at idle.
- 4 Press the DATC PANEL and the A/C override buttons. Make sure the A/C indicator LED is on.



PCM PID ACCS

● Does the PCM PID ACCS read ON?

→ Yes
GO to L6.

→ No
INSTALL a new DATC module. REFER to Section 412-04. TEST the system for normal operation.

L6 CHECK PID WAC WITH THE A/C ON

2



PCM PID WAC

1 Press the DATC PANEL and the A/C override button. Make sure the A/C indicator LED is on.

● Does the PID WAC read ON?

→ Yes
GO to L7.

→ No
REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue the diagnosis.

L7 CHECK THE REFRIGERANT SYSTEM PRESSURE

1



2 Connect the manifold set to the service ports. Refer to Manifold Gauge Set Connection in this section.

● Is the pressure between 345 kPa (50 psi) and 1,724 kPa (250 psi)?

→ Yes
GO to L8.

→ No
CHECK the system for refrigerant system leaks. REPAIR as necessary.

TEST the system for normal operation.

L8 CHECK FOR POWER TO THE A/C RELAY

1



2

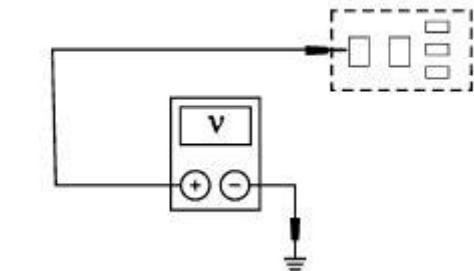


A/C Clutch Relay

3



4



A0002816

4 Measure the voltage between A/C clutch relay C1008 pin 3, circuit 30-FA79 (RD/OG), harness side and ground.

● Is the voltage greater than 10 volts?

→ Yes
GO to L13.

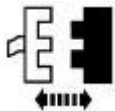
→ No
GO to L9.

L9 CHECK UAJB FUSE 101 (10A)

1



2



UAJB Fuse 101 (10A)

● Is UAJB fuse 101 (10A) OK?

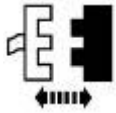
→ Yes
REPAIR circuit 30-FA79 (RD) for an

open. TEST the system for normal operation.

→ **No**
GO to L10.

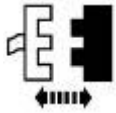
L10 CHECK CIRCUIT 30-FA79 (RD) FOR A SHORT TO GROUND

1



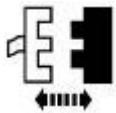
A/C Clutch Relay C1008

2



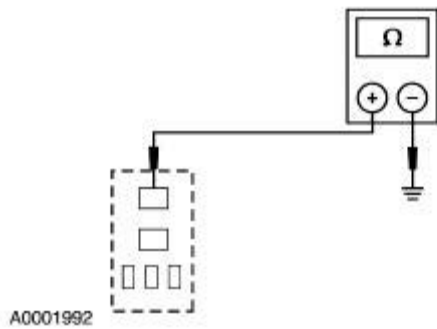
Auxiliary Coolant Pump C1005 (3.9L only)

3



Coolant Control Valve Jumper Harness and Engine Compartment Wiring Harness C134

4



4 Measure the resistance between at A/C clutch relay pin 3, circuit 30-FA79 (RD), harness side and ground.

● **Is the resistance greater than 10,000 ohms?**

→ **Yes**
GO to L11.

→ **No**
REPAIR circuit 30-FA79 (RD) or circuit 30-FA74 (RD). TEST the system for normal operation.

L11 CHECK A/C CLUTCH RELAY

1 Carry out the relay component test. Refer to

Refer to Wiring Diagrams Section 700-09 for schematic and connector information.

● **Is the relay OK?**

→ **Yes**
GO to L12.

→ **No**
INSTALL a new relay. TEST the system for normal operation.

L12 CHECK CIRCUIT 15S-FA6 (GN/YE) FOR A SHORT TO GROUND

1



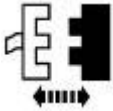
A/C Clutch Relay C1008

2



UAJB Fuse 101 (10A)

3



A/C Clutch C100

4



5 Push the A/C button.

● **Does UAJB fuse 101 (10A) open?**

→ **Yes**
REPAIR circuit 15S-FA6 (GN/YE).
TEST the system for normal operation.

→ **No**
If V6 engine, REPAIR circuit 30-FA74/30-FBB3 for a short to ground.
TEST the system for normal operation.
If V8 engine, Go To Pinpoint Test I.

L13 CHECK A/C CLUTCH RELAY C1008

1 Carry out the relay component test.
Refer to

Refer to Wiring Diagrams Section 700-09 for schematic and connector information.

● **IS the relay OK?**

→ **Yes**
GO to L14.

→ **No**
INSTALL a new relay. TEST the system for normal operation.

L14 CHECK THE A/C CLUTCH INPUT

1



2



A/C Clutch Relay

3

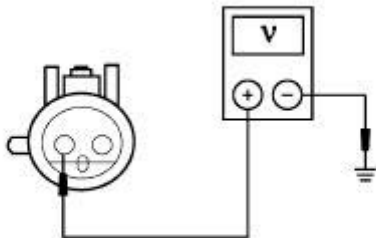


A/C Clutch Field Coil C100

4



5



A0001957

5 With the engine running measure the voltage between A/C clutch field coil C100, circuit 15S-FA6 (GN/YE), harness side and ground.

● **Is the voltage greater than 10 volts?**

→ **Yes**
GO to L15.

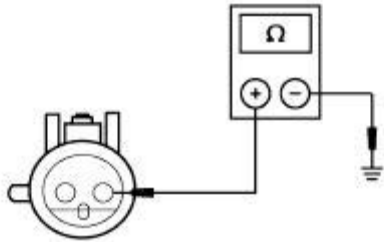
→ **No**
REPAIR circuit 15S-FA6 (GN/YE).
TEST the system for normal operation.

L15 CHECK THE A/C CLUTCH GROUND CIRCUIT FOR AN OPEN

1



2



A0001959

2 Measure the resistance between A/C clutch C100, circuit 31-FA6 (BK), harness side and ground.

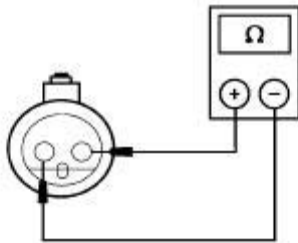
● Is the resistance 5 ohms or less?

→ **Yes**
GO to L16.

→ **No**
REPAIR circuit 31-FA6 (BK). TEST the system for normal operation.

L16 CHECK THE A/C CLUTCH FIELD COIL RESISTANCE

1



A0003990

1 Measure the resistance between A/C clutch field coil terminals.

● Is the resistance greater than 6 ohms?

→ **Yes**
INSTALL a new A/C clutch field coil. REFER to Section 412-03.

→ **No**
GO to L17.



L17 CHECK THE CLUTCH AIR GAP

1 Check the A/C clutch air gap. Refer to A/C Clutch Air Gap Adjustment in this section.

● Is the air gap within specifications?

	<p>→ Yes RECONNECT all connectors. START vehicle and select A/C and PANEL modes. If UAJB fuse 101 opens, install a new A/C clutch field. REFER to Section 412-03.</p> <p>→ No ADJUST the air gap. TEST the system for normal operation.</p>
--	---

PINPOINT TEST M: THE AIR CONDITIONING (A/C) IS ALWAYS ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1 CARRY OUT THE PCM AND DATC MODULE SELF-TESTS	
<p>1 </p> <p>2 </p>	<p>3 Carry out the PCM self-test. Record any DTCs.</p> <p>4 Carry out the DATC module self-test and retrieve continuous DTCs. Refer to Climate Control System under Diagnosis and Testing in this section. Record the DTCs displayed, if any.</p> <ul style="list-style-type: none"> • Are any PCM or DATC DTCs displayed? <p>→ Yes REFER to the PCM or DATC Module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as necessary.</p> <p>→ No GO to M2.</p>
M2 CHECK DATC BUTTONS	
	<p>1 With the engine running, toggle between DATC OFF button and the A/C button.</p> <ul style="list-style-type: none"> • DOES the A/C indicator light turn on when the A/C button is pushed and off when the OFF button is pushed?

- **Yes**
GO to M3.
- **No**
INSTALL a new DATC module. REFER to Section 412-04. TEST the system for normal operation.

M3 CHECK PCM PID ACCS

1



PCM PID ACCS

2



- 3 Push the DATC OFF button, then push the A/C button.

- **Does the A/C indicator light turn off and on and the PCM PID ACCS continue to read ON?**

- **Yes**
RERUN the Data Link Diagnostic Test.

- **No**
GO to M4.

M4 CHECK PID WACF WITH THE A/C OFF

1



3



PCM PID WACF

- 2 Push the DATC OFF button.

- **Does PCM PID WACF read YES?**

- **Yes**
REPAIR circuit 91S-FA79 (BK/OG) for a short to ground. TEST the system for normal operation.

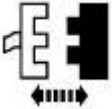
- **No**
GO to M5.

M5 CHECK FOR POWER ALWAYS ON CIRCUIT 15S-FA6 (GN/YE)

1



2

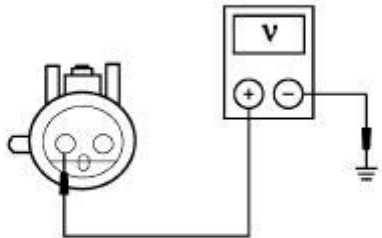


A/C Clutch C100

3



5



A0001957

4 Make sure the DATC is in the OFF position.

5 Measure the voltage between A/C clutch field coil C100, circuit 15S-FA6 (GN/YE), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to M6.

→ No
CHECK the A/C clutch air gap. REFER to A/C Clutch Air Gap Adjustment in this section.

M6 CHECK THE A/C CLUTCH RELAY

1



2





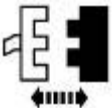

A/C Clutch Relay

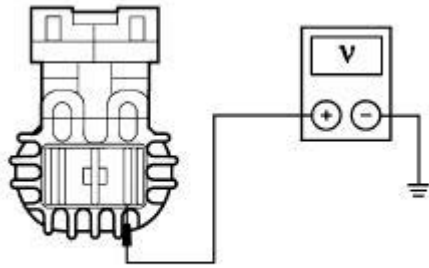
3



	<p>4 Carry out the relay component test. Refer to the Wiring Diagram Manual.</p> <ul style="list-style-type: none"> ● Is the relay OK? <p>→ Yes REPAIR circuit 15S-FA6 (GN/YE) for a short to the power. TEST the system for normal operation.</p> <p>→ No INSTALL a new A/C clutch relay. TEST the system for normal operation.</p>
--	--

PINPOINT TEST N: THE BLOWER MOTOR IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
N1 VERIFY THE BLOWER MOTOR OPERATION	
<p>1</p> 	<p>2 Press the PANEL button on the DATC module. Adjust the blower motor setting to LO and then to HI.</p> <ul style="list-style-type: none"> ● Is the blower motor inoperative in all settings? <p>→ Yes GO to <u>N2</u>.</p> <p>→ No <u>Go To Pinpoint Test O</u>.</p>
N2 CHECK FOR VOLTAGE TO THE BLOWER MOTOR	
<p>1</p>  <p>2</p>  <p style="text-align: center;">Blower Motor C288</p> <p>3</p>  <p>4</p>	<p>4 Measure the voltage between the blower</p>



AM0416-A

motor C288, circuit 30S-FA18 (RD/BK) and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to N3.

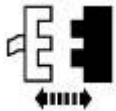
→ **No**
GO to N8.

N3 CHECK CIRCUIT 31-FA45 (BK)

1

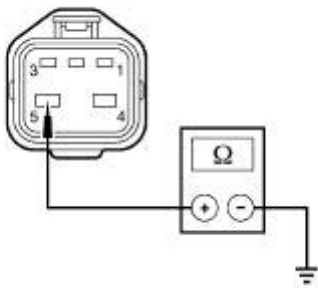


2



Blower Motor Speed Control C297

3



A0032576

3 Measure the resistance between the blower motor speed control C297 pin 5, circuit 31-FA45 (BK) and ground.

● Is the resistance less than 5 ohms?

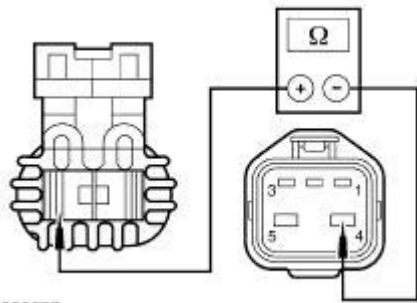
→ **Yes**
GO to N4.

→ **No**
REPAIR circuit 31-FA45 (BK). TEST the system for normal operation.

N4 CHECK CIRCUIT 31S-FA18 (BK/RD)

1

1 Measure the resistance between the blower motor C288, circuit 31S-FA18



(BK/RD) and the blower motor speed control C297 pin 4, circuit 31S-FA18 (BK/RD).

● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to N5.

→ **No**
REPAIR circuit 31S-FA18 (BK/RD). TEST the system for normal operation.

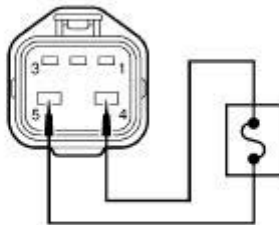
N5 CHECK THE BLOWER MOTOR

1



Blower Motor C288

2



2 Connect a fused jumper lead between the blower motor speed control C297 pin 4, circuit 31S-FA18 (BK/RD) and pin 5, circuit 31-FA45 (BK).

3



● **Does the blower motor operate?**

→ **Yes**
GO to N6.

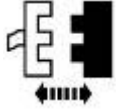
→ **No**
INSTALL a new blower motor. TEST the system for normal operation.

N6 CHECK CIRCUIT 10-FA45 (GY/VT) FOR AN OPEN OR SHORT TO GROUND

1

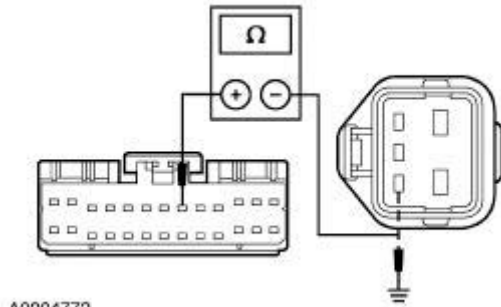


3



DATC Module C228b

4



A0004772

2 Removed the fused jumper lead from the blower motor speed control C297.

4 Measure the resistance between the DATC module C228b pin 8, circuit 10-FA45 (GY/VT) and the blower motor speed control C297 pin 3, circuit 10-FA45 (GY/VT), and measure the resistance between the DATC module C228b pin 8, circuit 10-FA45 (GY/VT) and ground.

- Is the resistance less than 5 ohms between the DATC module and the blower motor speed control and greater than 10,000 ohms between the DATC module and ground?

→ Yes
GO to N7.

→ No
REPAIR circuit 10-FA45 (GY/VT). TEST the system for normal operation.

N7 CHECK THE DATC MODULE OUTPUT

1



DATC Module C228b

2



Blower Motor Speed Control C297

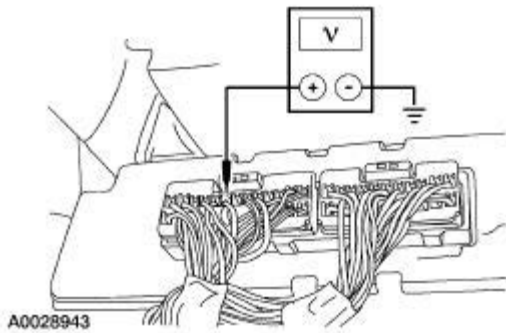
3



4

3 Adjust the blower motor speed to HI (7 bars).

4 Measure the voltage between the DATC module C228b pin 8, circuit 10-FA45



(GY/VT) and ground by back-probing the DATC module C228b.

- **Is the voltage within 2 volts of battery voltage?**

→ **Yes**
 INSTALL a new blower motor speed control. TEST the system for normal operation.

→ **No**
 INSTALL a new DATC module. TEST the system for normal operation.

N8 CHECK CIRCUIT 30S-FA18 (RD/BK)

1

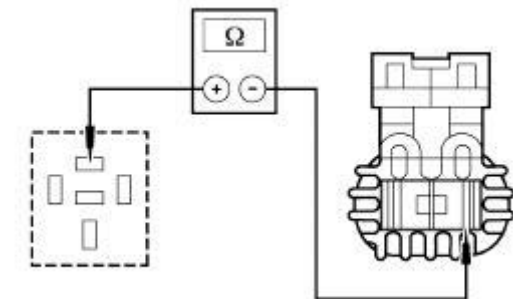


2



Blower Motor Relay C1011

3



A0032572

3 Measure the resistance between the blower motor relay C1011 socket pin 87, circuit 30S-FA18 (RD/BK) and the blower motor C288, circuit 30S-FA18 (RD/BK).

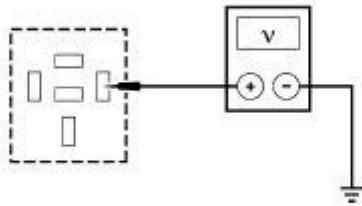
- **Is the resistance less than 5 ohms?**

→ **Yes**
 GO to N9.

→ **No**
 REPAIR circuit 30S-FA18 (RD/BK). TEST the system for normal operation.

N9 CHECK CIRCUIT 30-FA24A (RD/OG)

1



A0020210

1

Measure the voltage between the blower motor relay C1011 socket pin 86, circuit 30-FA24A (RD/OG) and ground.

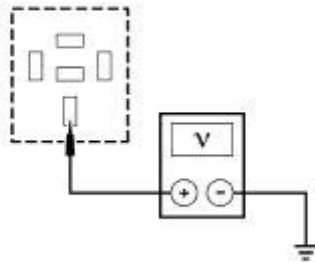
● Is the voltage greater than 10 volts?

→ **Yes**
GO to N10.

→ **No**
REPAIR circuit 30-FA24A (RD/OG).
TEST the system for normal operation.

N10 CHECK CIRCUIT 30-FA24 (RD/OG)

1



A0032581

1

Measure the voltage between the blower motor relay C1011 socket pin 30, circuit 30-FA24 (RD/OG) and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to N11.

→ **No**
REPAIR circuit 30-FA24 (RD/OG). TEST
the system for normal operation.

N11 CHECK THE DATC MODULE OUTPUT

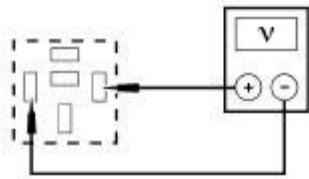
1



2

2

Measure the voltage between the blower motor relay C1011 socket pin 86, circuit 30-FA24A (RD/OG) and socket pin 85, circuit 31S-FA23 (BK/BU).



A0034149

● Is the voltage greater than 10 volts?

→ **Yes**
 INSTALL a new blower motor relay. TEST the system for normal operation.

→ **No**
 GO to N12.

N12 CHECK CIRCUIT 31S-FA23 (BK/BU) FOR SHORT TO VOLTAGE

1



2

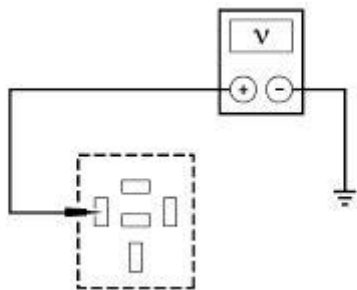


DATC Module C228b

3



4



A0013862

4 Measure the voltage between the blower motor relay C1011 socket pin 85, circuit 31S-FA23 (BK/BU) and ground.

● Is voltage present?

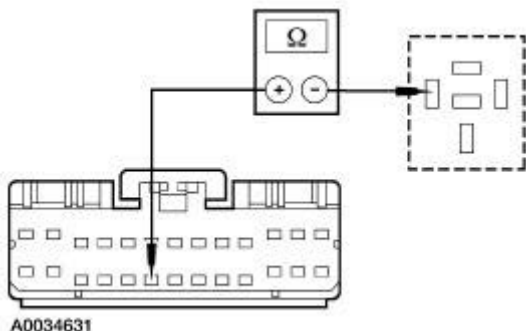
→ **Yes**
 REPAIR circuit 31S-FA23 (BK/BU). TEST the system for normal operation.

→ **No**

GO to N13.

N13 CHECK CIRCUIT 31S-FA23 (BK/BU)

1



1



Measure the resistance between the DATC module C228b pin 19, circuit 31S-FA23 (BK/BU) and the blower motor relay C1011 socket pin 85, circuit 31S-FA23 (BK/BU).

● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new DATC module. TEST the system for normal operation.

→ **No**
REPAIR circuit 31S-FA23 (BK/BU). TEST the system for normal operation.

PINPOINT TEST O: THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
O1 VERIFY THE BLOWER MOTOR OPERATION	
<p>1</p> 	<p>2</p> <p>Press the PANEL button on the DATC module. Adjust the blower motor setting to LO and then to HI.</p> <p>● Does the blower motor operate at any setting?</p> <p>→ Yes GO to <u>O2</u>.</p> <p>→ No Go To Pinpoint Test N.</p>
O2 CHECK CIRCUIT 31S-FA18 (BK/RD)	
<p>1</p> 	

2



Blower Motor Speed Control C297

3



● **Does the blower motor operate?**

→ **Yes**
REPAIR circuit 31S-FA18 (BK/RD). TEST the system for normal operation.

→ **No**
GO to O3.

O3 CHECK THE BLOWER MOTOR SPEED CONTROL

1



2



Blower Motor Speed Control C297

3



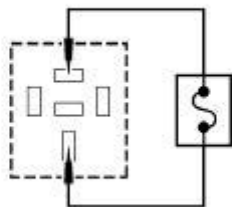
DATC Module C228a and C228b

4



Blower Motor Relay C1011

5



5 Connect a fused jumper lead between the blower motor relay C1011 socket pin 30, circuit 30-FA24 (RD/OG) and socket pin 87, circuit 30S-FA18 (RD/BK).

● **Does the blower motor operate?**

→ **Yes**
 INSTALL a new blower motor speed control. TEST the system for normal operation.

→ **No**
 GO to O4.

O4 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR AN OPEN

1

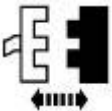


2



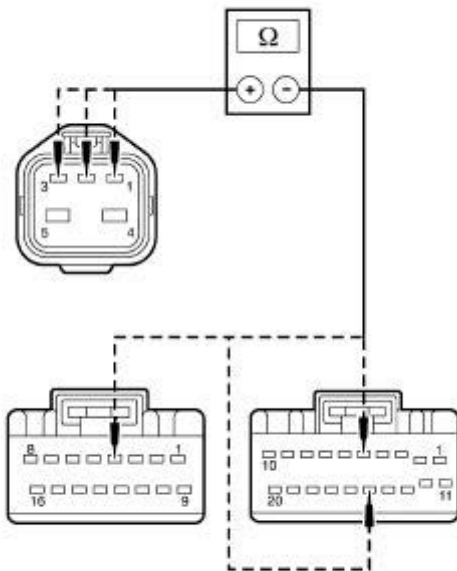
Blower Motor Relay C1011

3



Blower Motor Speed Control C297

4



A0033861

4 Measure the resistance between the blower motor speed control C297 :

- pin 1, circuit 8-FA45 (WH/BU) and the DATC module C228a pin 5, circuit 8-FA45 (WH/BU).
- pin 2, circuit 9-FA45 (BN/BU) and the DATC module C228a pin 15, circuit 9-FA45 (BN/BU).
- pin 3, circuit 10-FA45 (GY/VT) and the DATC module C228b pin 8, circuit 10-FA45 (GY/VT).

● **Are the resistances less than 5 ohms?**

→ **Yes**
 GO to O5.

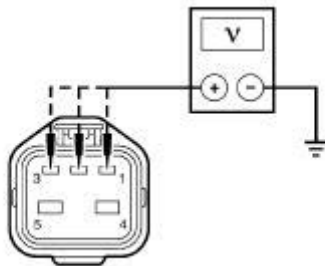
→ **No**
REPAIR the affected circuit. TEST the system for normal operation.

O5 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE

1



2



A0033862

2 Measure the voltage between the blower motor speed control C297:

- pin 1, circuit 8-FA45 (WH/BU) and ground.
- pin 2, circuit 9-FA45 (BN/BU) and ground.
- pin 3, circuit 10-FA45 (GY/VT) and ground.

● **Is voltage present?**

→ **Yes**
REPAIR the affected circuit. TEST the system for normal operation.

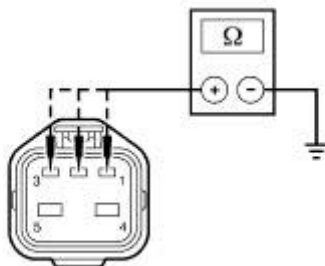
→ **No**
GO to O6.

O6 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND

1



2



A0033863

2 Measure the resistance between the blower motor speed control C297:

- pin 1, circuit 8-FA45 (WH/BU) and ground.
- pin 2, circuit 9-FA45 (BN/BU) and ground.
- pin 3, circuit 10-FA45 (GY/VT) and ground.

● **Are the resistances greater than 10,000 ohms?**

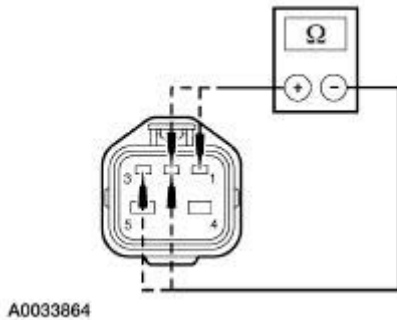
→ **Yes**

GO to O7.

→ **No**
REPAIR the affected circuit. TEST the system for normal operation.

O7 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR SHORTS

1



1 Measure the resistance between the blower motor speed control C297:

- pin 1, circuit 8-FA45 (WH/BU) and pin 2, circuit 9-FA45 (BN/BU).
- pin 1, circuit 8-FA45 (WH/BU) and pin 3, circuit 10-FA45 (GY/VT).
- pin 2, circuit 9-FA45 (BN/BU) and pin 3, circuit 10-FA45 (GY/VT).

● **Are the resistances greater than 10,000 ohms?**

→ **Yes**
GO to O8.

→ **No**
REPAIR the affected circuits. TEST the system for normal operation.

O8 CHECK THE DATC MODULE HIGH BLOWER OUTPUT

1



DATC Module C228a and C228b

2



Blower Motor Speed Control C297

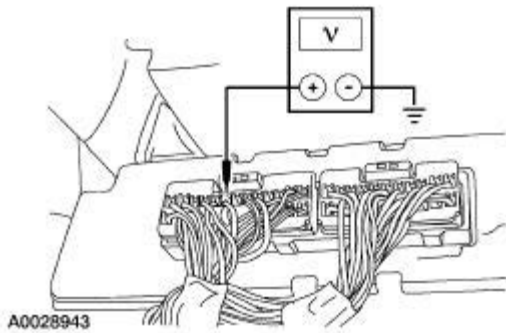
3



4

3 Adjust the blower motor speed to HI (7 bars).

4 Measure the voltage between the DATC module C228b pin 8, circuit 10-FA45 (GY/VT) and ground by back-probing the DATC module C228b.



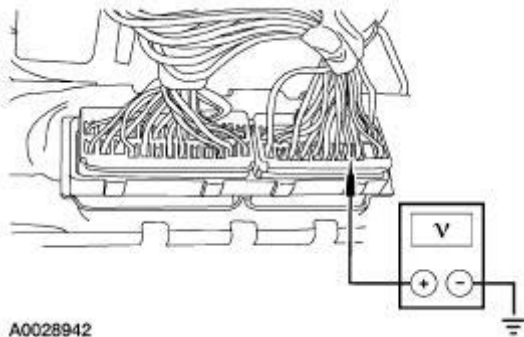
- Is the voltage within 2 volts of battery voltage?

→ **Yes**
GO to O9.

→ **No**
INSTALL a new DATC module. TEST the system for normal operation.

O9 CHECK THE DATC MODULE BLOWER CONTROL OUTPUT

2



1 Adjust the blower motor speed to LO (1 bar).

2 Measure the voltage between the DATC module C228a pin 15, circuit 9-FA45 (BN/BU) and ground by back-probing the DATC module C228a.

- Is the voltage greater than 1 volt?

→ **Yes**
INSTALL a new blower motor speed control. TEST the system for normal operation.

→ **No**
INSTALL a new DATC module. TEST the system for normal operation.

PINPOINT TEST P: THE TEMPERATURE SET POINT DOES NOT REPEAT AFTER TURNING THE IGNITION SWITCH OFF

CONDITIONS	DETAILS/RESULTS/ACTIONS
P1 DUPLICATE THE PROBLEM	

NOTE: Some vehicles are shipped with a transit relay. Make sure the transit relay packaged in the trunk is not installed.

2



4



1 Set the driver side temperature to 72° F and the passenger side temperature to 74°F.

3 Wait 5 seconds.

• Do the set points repeat?

→ **Yes**
The system is operating correctly.

→ **No**
GO to P2.

P2 CHECK THE MEMORY BACKUP SUPPLY TO THE DATC MODULE

1

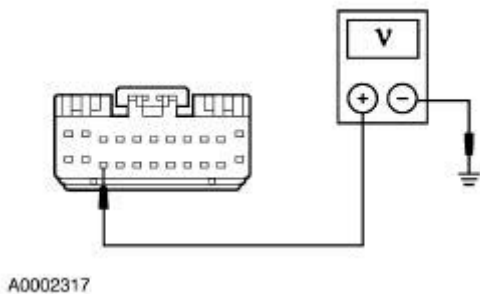


2



DATC Module C228a

3



3 Measure the voltage between DATC module C228a pin 14, circuit 29-FA10 (OG/GN), harness side and ground.

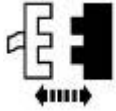
• Is the voltage greater than 10 volts?

→ **Yes**
INSTALL a new DATC module. REFER to Section 412-04 . TEST the system for normal operation.

→ **No**
GO to P3.

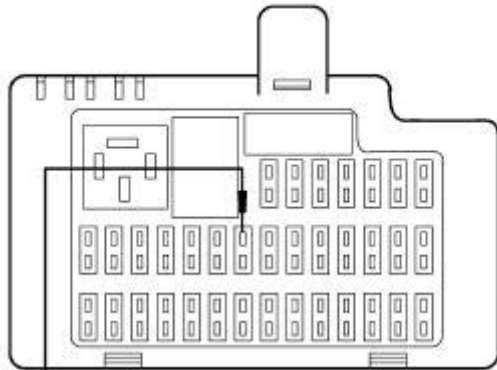
P3 CHECK CIRCUIT 29-FA10 (OG/GN) FOR AN OPEN

1



CJB Fuse 220 (10A)

2



A0002328

2

Measure the resistance between CJB fuse 214 (10A) socket at circuit 29-FA10 (OG/GN), harness side and DATC module C228b pin 14, circuit 29-FA10 (OG/GN), harness side.

● **Is the resistance less than 5 ohms?**

→ **Yes**

REPAIR circuit 20-DD6 (PK/WH) for an open. TEST the system for normal operation.

→ **No**

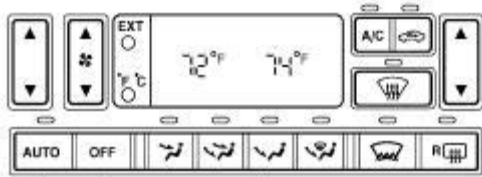
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST Q: THE EXTERIOR TEMPERATURE DISPLAY DOES NOT FUNCTION CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
Q1 CARRY OUT THE DATC MODULE SELF-TEST	
1	



2



A0002319

2

Carry out the DATC module self-test and retrieve continuous DTCs. Refer to Climate Control System . Record the DTCs displayed, if any.

● Are any DTCs displayed?

→ Yes

REFER to the DATC Module Diagnostic Trouble Code (DTC) Index. CARRY OUT the necessary diagnosis and REPAIR as necessary.

→ No

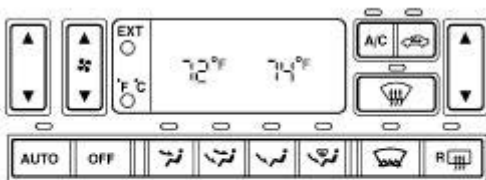
GO to Q2.

Q2 CHECK THE EXTERIOR TEMPERATURE DISPLAY

1



2

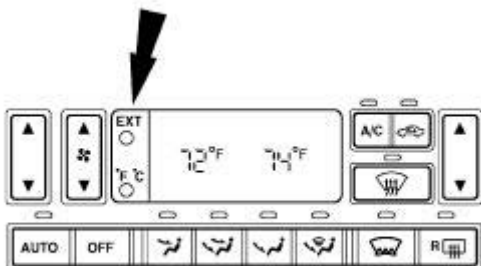


A0002320

2

Press the AUTO button.

3



A0002425

3

Press and repress the EXT button.

	<ul style="list-style-type: none"> ● Did the display alternate between interior set temperatures and exterior temperatures? <p>→ Yes GO to <u>Q3</u>.</p> <p>→ No INSTALL a new DATC module. REFER to <u>Section 412-04</u>. TEST the system for normal operation.</p>
Q3 VERIFY ACCURACY OF AMBIENT AIR TEMPERATURE SENSOR	
	<p>1 Check the mounting of the sensor and note the ambient temperature.</p> <ul style="list-style-type: none"> ● Does the temperature displayed match the ambient temperature? <p>→ Yes System is working correctly.</p> <p>→ No INSTALL a new sensor. REFER to <u>Section 412-04</u>. TEST the system for normal operation.</p>

Component Tests

Heater Core



WARNING: Carbon monoxide is colorless, odorless and dangerous. If it is necessary to operate the engine with the vehicle in a closed area such as a garage, always use an exhaust collector to vent the exhaust gases outside the closed area.

1. **NOTE:** Testing of returned heater cores reveals that a large percentage of heater cores are good and did not require the installation of a new heater core. If a heater core leak is suspected, the heater core must be tested by following the plugged heater core component test before the heater core pressure test. Carry out a system inspection by checking the heater system thoroughly as follows:

Inspect for evidence of coolant leakage at the heater hose to heater core attachments. A coolant leak in the heater hose could follow the heater core tube to the heater core and appear as a leak in the heater core.

2. **NOTE:** Spring-type clamps are installed as original equipment. Installation and overtightening of non-specification clamps can cause leakage at the heater hose connection and damage the heater core.

Check the integrity of the heater hose clamps.

Heater Core—Plugged



WARNING: The heater core inlet hose will become too hot to handle if the system is working correctly.

1. Check to see that the engine coolant is at the correct level.
2. Start the engine and turn on the heater.
3. When the engine coolant reaches operating temperature, feel the heater core outlet hose to see if it is hot.
If it is not hot:
 - the heater core may have an air pocket.
 - the heater core may be plugged.
 - the thermostat may not be working correctly.

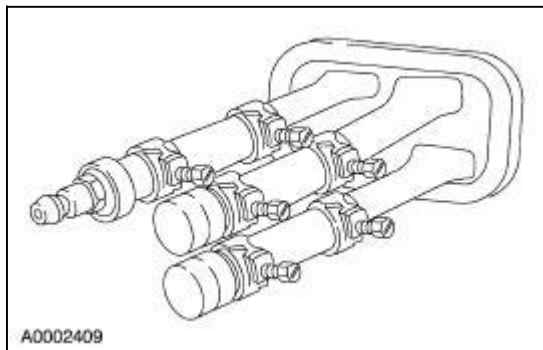
Heater Core—Pressure Test

Use the Pressure Test Kit to carry out the pressure test.

1. **NOTE:** Due to space limitations, a bench test may be necessary for pressure testing.

Drain the coolant from the cooling system.

2. Disconnect the heater hoses from the heater core. For additional information, refer to [Section 412-02](#).
3. Install a short piece of heater hose, approximately 101 mm (4 inches) long on each heater core tube.
4. Fill the heater core and heater hoses with water and install the two plugs BT-7422-B and the adapter BT-7422-A from the Pressure Test Kit. Secure the heater hoses, plug and adapter with hose clamps.

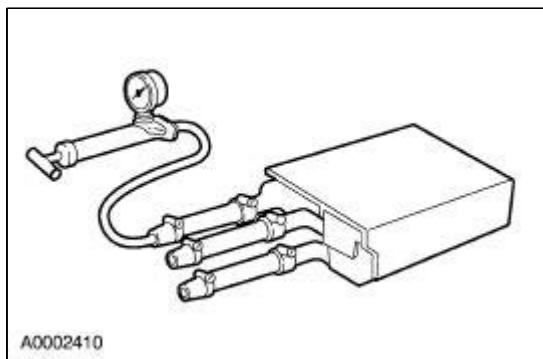


5. Attach the pump and gauge assembly from the Pressure Test Kit to the adapter.
6. Close the bleed valve at the base of the gauge. Pump 241 kPa (35 psi) of air pressure into the heater core.
7. Observe the pressure gauge for a minimum of three minutes.
8. If the pressure drops, check the heater hose connections to the core tubes for leaks. If the

heater hoses do not leak, remove the heater core from the vehicle and carry out the bench test.

Heater Core—Bench Test

1. Remove the heater core from the vehicle. For additional information, refer to [Section 412-02](#).
2. Drain all of the coolant from the heater core.
3. Connect the 101 mm (4 inch) test heater hoses with plug and adapter to the core tubes. Then connect the Pressure Test Kit to the adapter.
4. Apply 241 kPa (35 psi) of air pressure to the heater core. Submerge the heater core in water.
5. If a leak is observed, install a new heater core.



Evaporator/Condenser Core—On-Vehicle Leak Test

1. Discharge and recover the refrigerant. For additional information, refer to [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) in this section.
2. Disconnect the suspect evaporator core or condenser core from the A/C system. For additional information, refer to [Section 412-03](#).
3. Clean the manifold fittings.
4. Connect the appropriate test fittings from the Set, A/C Fittings to the condenser core tube connections.
5. Connect the Vacuum Check Fitting, TXV to the thermostatic expansion valve.
6. **NOTE:** The automatic shut-off valves on some gauge set hoses do not open when connected to the test fittings. If available, use hoses without shut-off valves. If hoses with shut-off valves are used, make sure the valve opens when attached to the test fittings or install an adapter which will activate the valve. The test is not valid if the shut-off valve does not open.

Connect the red and blue hoses from the R-134a Manifold Gauge Set to the test fittings on the evaporator core or condenser core. Connect the yellow hose to a known good vacuum pump.

7. Open both gauge set valves and start the vacuum pump. Allow the vacuum pump to operate for a minimum of 45 minutes after the gauge set low pressure gauge indicates 101 kPa (30 in-Hg). The 45 minute evacuation is necessary to remove any refrigerant from oil left in the evaporator core or condenser core. If the refrigerant is not completely removed from the oil, outgassing will degrade the vacuum and appear as a refrigerant leak.

8. If the low pressure gauge reading will not drop to 101 kPa (30 in-Hg) when the valves on the gauge and manifold set are open and the vacuum pump is operating, close the gauge set valves and observe the low pressure gauge. If the pressure rises rapidly to zero, a large leak is indicated. Recheck the test fitting connections and gauge set connections before installing a new evaporator core or condenser core.
9. After evacuating for 45 minutes, close the gauge set valves and stop the vacuum pump. Observe the low pressure gauge; it should remain at the 101 kPa (30 in-Hg) mark.
 - If the low pressure gauge reading rises 34 or more kPa (10 or more in-Hg) of vacuum from the 101 kPa (30 in-Hg) position in 10 minutes, a leak is indicated.
 - If a very small leak is suspected, wait 30 minutes and observe the vacuum gauge.
 - If a small amount of vacuum is lost, operate the vacuum pump with gauge valves open for an additional 30 minutes to remove any remaining refrigerant from the oil in the evaporator core or condenser core. Then recheck for loss of vacuum.
 - If a very small leak is suspected, allow the system to sit overnight with vacuum applied and check for vacuum loss.
10. If the evaporator core or condenser core does leak, as verified by the above procedure, install a new evaporator core or condenser core. For additional information, refer to [Section 412-03](#).

A/C Compressor—External Leak Test

1. Install the A/C Pressure Test Adapter on the port of the A/C compressor using the existing manifold retaining bolt.
 2. Connect the high and low pressure lines of a manifold gauge set or a refrigerant recovery/recycling station such as the R-134a A/C service center to the corresponding fittings on the A/C Pressure Test Adapter.
 3. Attach the center hose of a manifold gauge set to a refrigerant container standing in an upright position.
 4. Hand-rotate the compressor shaft 10 complete revolutions to distribute the oil inside the A/C compressor.
 5. Open the low pressure gauge valve, the high pressure gauge valve and the valve on the refrigerant container to allow the refrigerant vapor to flow into the A/C compressor.
 6. Using the Refrigerant Leak Detector, check for leaks at the compressor shaft.
 7. If a shaft or external leak is found, install a new A/C compressor. For additional information, refer to [Section 412-03](#).
 8. When the leak test is complete, recover the refrigerant from the compressor.
-

Air Conditioning (A/C) System Check — Retail Procedure

NOTE: This Retail Procedure is not eligible for claiming on Ford paid repairs (warranty and ESP).

NOTE: The engine should be run at idle for 10 minutes with the air conditioning on and set to MAX A/C before carrying out this retail procedure.

NOTE: Read and follow all of the Warnings, Cautions and Notes at the beginning of this section before continuing.

1. Visual inspection

Open the hood and visually inspect the heating and air conditioning systems for the following:

- Coolant reservoir for correct coolant level
- Heater hoses for deterioration or loose connections
- Radiator and condenser for debris or damaged fins restricting airflow, loose mounting or connections
- Accessory drive belt(s) and cooling fan(s) for wear or physical damage
- Refrigerant lines and connections for physical damage or loose connections
- Compressor for physical damage or loose connections
- Suction accumulator/drier for physical damage or loose connections
- Wiring and connectors for excessive wear, loose or damaged connections, or incorrect routing

2. A/C refrigerant analysis

- Carry out air conditioning refrigerant analysis. For additional information, refer to [Refrigerant Identification Testing](#) in this section.
- If the refrigerant fails the analysis, discontinue diagnosis and make recommendations for repairs.
- If the refrigerant passes the analysis, carry out the air conditioning system check.

3. Air conditioning system check

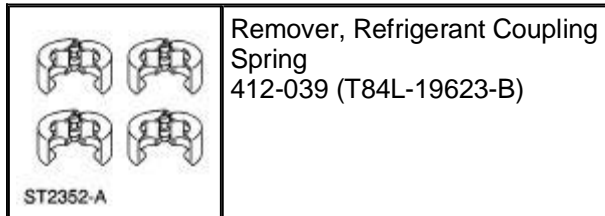
- Connect manifold gauge set or charging station with gauges to refrigerant system.
- With the vehicle in park, parking brake set, thermometer installed in center panel vent, and air conditioning system on and set to MAX A/C, start the engine.
- Record air refrigerant system pressures while running the engine at 1,500 rpm and allow engine to return to idle.
- Operate the blower motor in all control positions and check for correct blower speed changes.
- With the blower motor on HI, operate air discharge mode selector in all positions and check for correct airflow in each position.
- Operate the temperature blend selector in all positions and check for correct change in discharge temperature. Check the air discharge temperature with the selector in the coolest position and the air conditioning on and set to MAX A/C to determine if the air discharge temperature is acceptable for the current ambient air temperature.
- Carry out the EATC self-test (if applicable).
If the refrigerant system pressures were low, carry out the refrigerant system leak test.

4. Refrigerant system leak test

- Use either an ultraviolet (UV) or an electronic leak detector to check for leaks at all refrigerant lines, connections, and components.
After all tests have been completed, report all findings and recommended repairs to your service advisor before carrying out further diagnostic procedures.
-

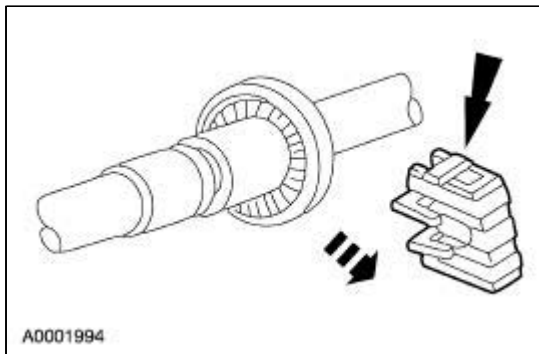
Spring Lock Coupling

Special Tool(s)

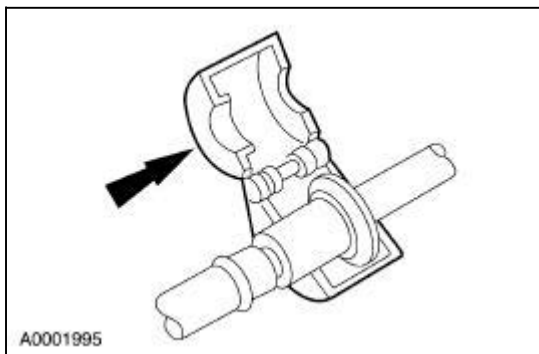


Disconnect

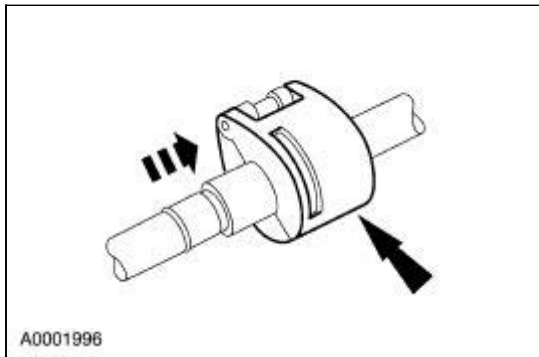
1. Remove the A/C tube lock coupling clip (19E746), if equipped.



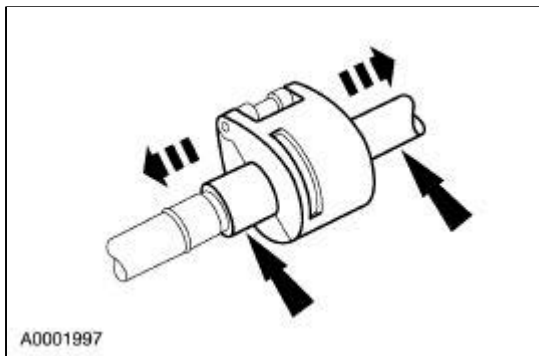
2. Fit the special tool to the spring lock coupling.




3. Push the tool into the cage opening to release the female fitting from the A/C tube lock coupling spring (19E576).

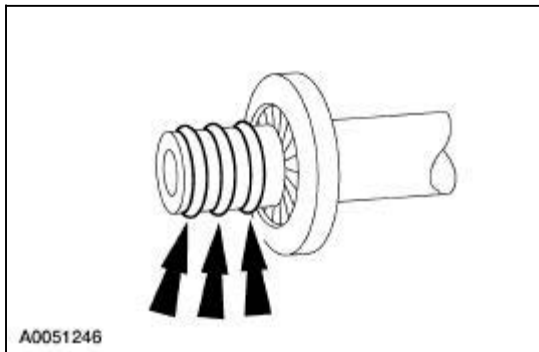



4. Pull the spring lock coupling fittings apart.



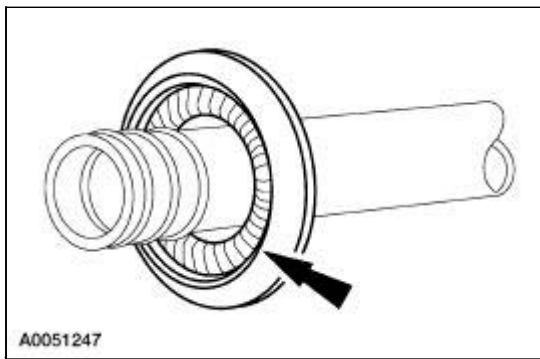
5.  **CAUTION:** Do not use metal tools to remove the O-ring seals. They can cause axial scratches across the O-ring seal grooves, resulting in refrigerant leaks.

Remove the O-ring seals with a non-metallic tool.



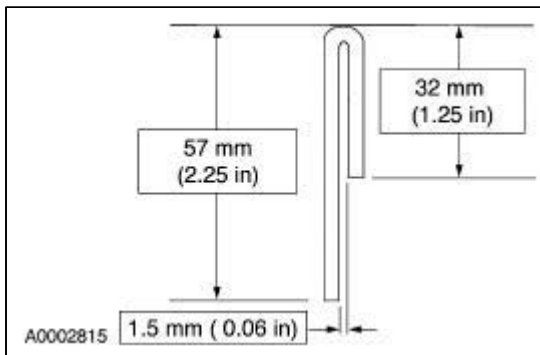
6.  **CAUTION:** Do not use a screwdriver or similar tool to remove the A/C tube lock coupling spring; this can cause axial scratches across the O-ring seal grooves resulting in refrigerant leaks.

Remove the A/C tube lock coupling spring with a small hooked wire.



Cleaning

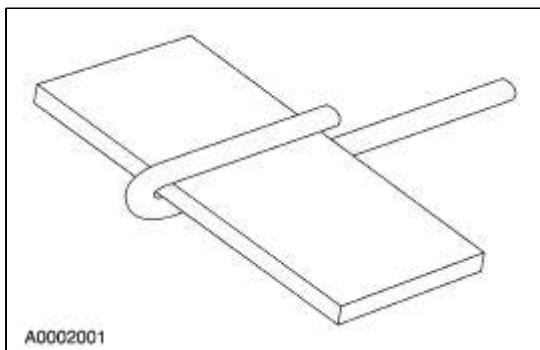
1. Fabricate a cleaning tool from a 1/8 inch diameter brazing rod.



2. Cut an abrasive pad from maroon colored 3M Scotch Brite® with the dimensions corresponding to the coupling size.

Coupling Size	Pad Size
3/8 inch	25 x 50 mm (1 x 2 inch)
1/2 inch	25 x 50 mm (1 x 2 inch)
5/8 inch	25 x 76 mm (1 x 3 inch)
3/4 inch	25 x 102 mm (1 x 4 inch)

3. Assemble the pad to the tool.

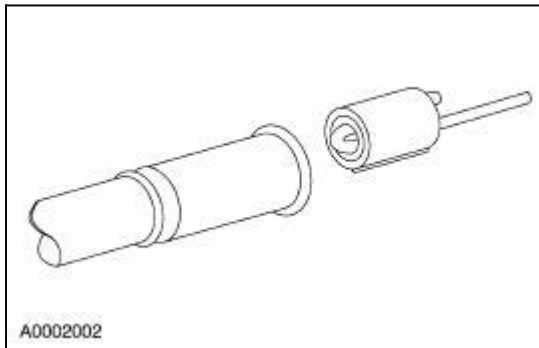


4. Coat the abrasive pad with PAG Refrigerant Compressor Oil (R-134a Systems) or equivalent.
5. Roll the pad on the tool and install it in a variable speed drill motor.

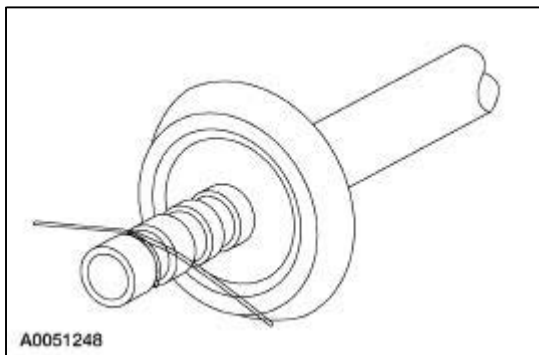
6.  **CAUTION: Maintain low speed drill rotation when inserting or removing the cleaning**

tool to prevent axial scratches which may cause future leaks.

Polish for one minute at moderate speed (less than 1,500 rpm) or until the surface is clean and free of scratches or foreign material.



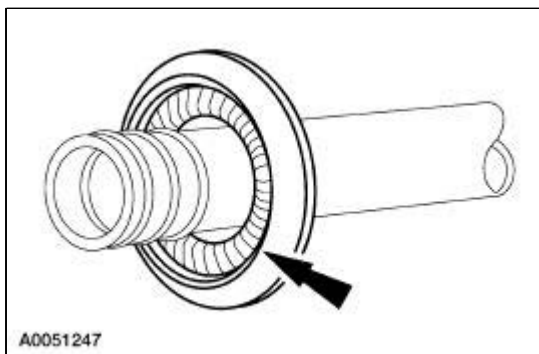
7. Clean the fitting with a lint-free cloth.
8. Inspect the surface for grooves or scratches. If grooves and scratches are still present, install a new component.
9. Clean the O-ring seal grooves with a 300 mm (12 inch) length of natural fiber string.
 - Loop the string around the grooves and pull the string back and forth.



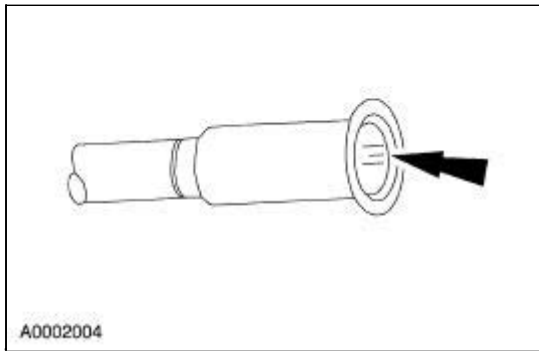
10. Remove any foreign material from the grooves with a lint-free cloth.

Connect

1. Install the A/C tube lock coupling spring.



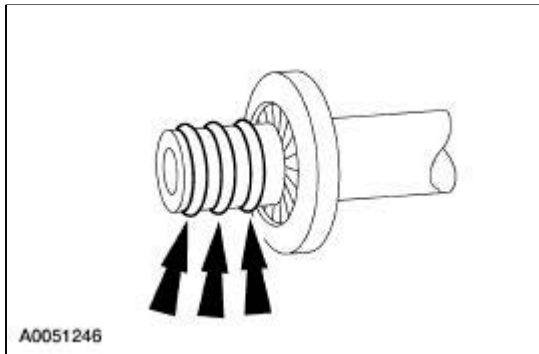
2. Lubricate the inside of the coupling with PAG Refrigerant Compressor Oil (R-134a Systems) or equivalent.



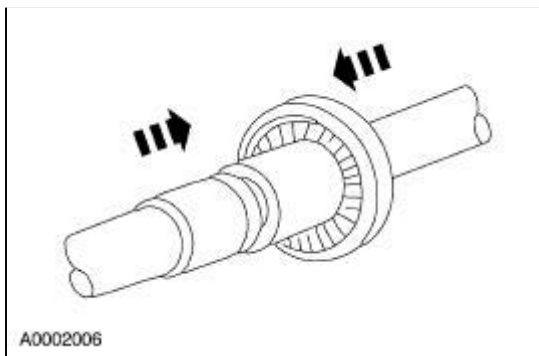
3.  **CAUTION:** Use only the new O-ring seals. The use of any O-ring seals other than those specified in the Ford Master Parts Catalog may result in intermittent leakage during vehicle operation.

Install the O-ring seals.

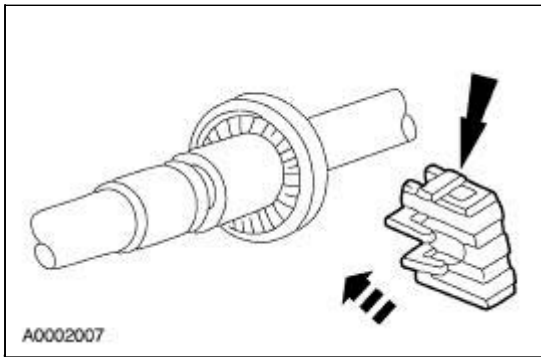
- Lubricate the O-ring seals with PAG Refrigerant Compressor Oil (R-134a Systems) or equivalent.



4. Connect the spring lock coupling fittings with a twisting motion until the A/C tube lock coupling spring snaps over the flared end of the female fitting.



5. Install the A/C tube lock coupling clip.



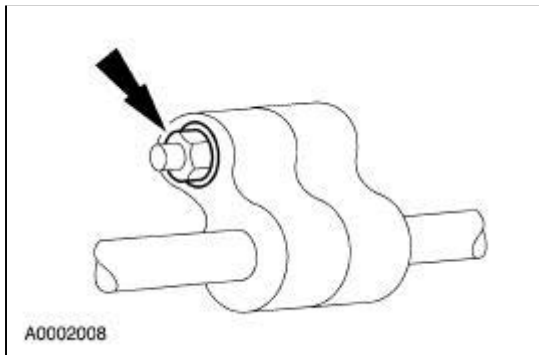
A0002007

Air Conditioning Line (Peanut) Fitting

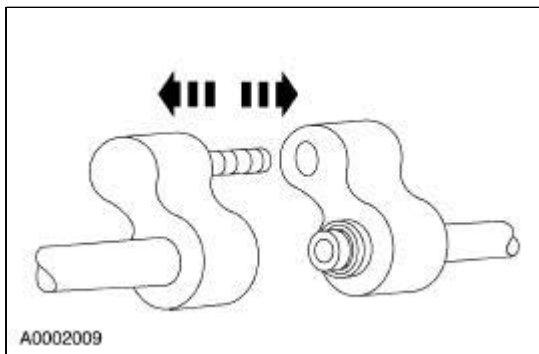
Disconnect


1.  **CAUTION: Support the female fitting with a wrench to prevent the tubes from twisting.**

Remove the nut from the peanut fitting.

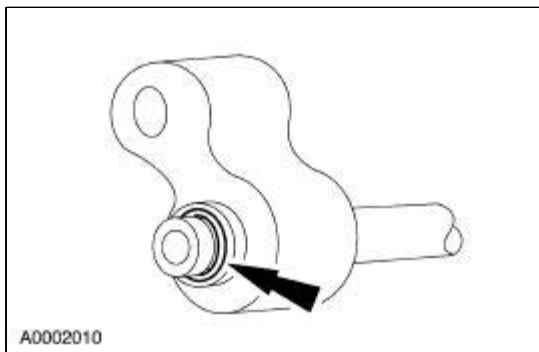


2. Pull the peanut fitting apart.




3.  **CAUTION: Do not use metal tools to remove the O-ring seal. They can cause axial scratches across the O-ring seal groove, resulting in refrigerant leaks.**

Remove the O-ring seal with a non-metallic tool.

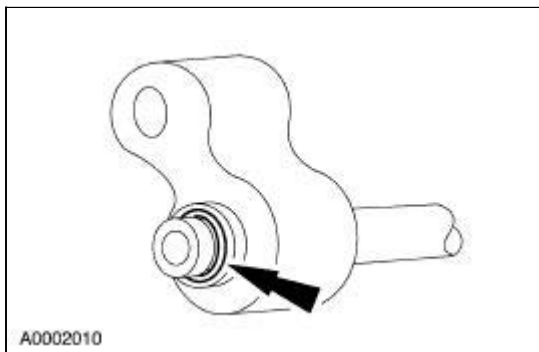


Connect

1. Clean all dirt or foreign material from the fittings.
2.  **CAUTION: Use only the new O-ring seals. The use of any O-ring seals other than those specified in the Ford Master Parts Catalog may result in intermittent leakage during vehicle operation.**

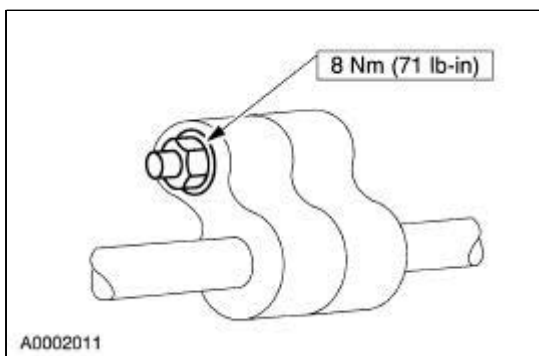
Install the O-ring seal.

- Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.





3. Lubricate the inside of the fittings with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.
4. **NOTE:** When correctly assembled, the male and female fittings should be flush.

Assemble the male and female fittings together.



Heater Hose Coupling


Special Tool(s)


 ST1648-A	Remover, Heater Hose Inlet Tube 412-042 (T85T-18539-AH)
 ST2589-A	Disconnect Tool, Heater Hose 412-127

Material

Item	Specification
MERPOL® —	ESE-M99B144-B

Disconnect

 **CAUTION:** Do not attempt to install a new bushing, spacer or O-rings in the heater hose coupling; damage to the heater hose coupling can result. If the heater hose coupling is the cause of a coolant leak, the affected heater hose must be replaced as an assembly.

-  **WARNING:** The engine must be off, fully cool and the cooling system fully depressurized before attempting to disconnect any heater water hoses. Failure to comply with this warning can result in serious injury or burns from hot liquid escaping out of the engine cooling system.

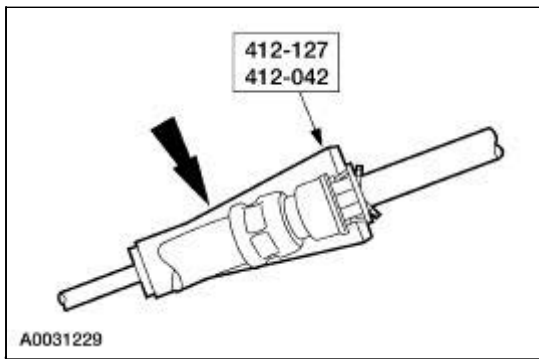
Depressurize the engine cooling system.

- Push the heater hose toward the tube to fully expose the locking tabs.

- NOTE:** When compressing the white coupling retainer with the special tool, the special tool must be perpendicular to and on the highest point of the coupling.

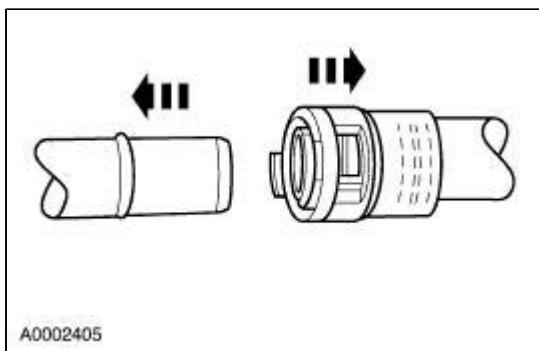
NOTE: If the heater hose coupling is accessible, the retainer tabs can be compressed by hand to disconnect the heater hose.

Push the special tool over the coupling retainer windows to compress the retainer locking tabs.

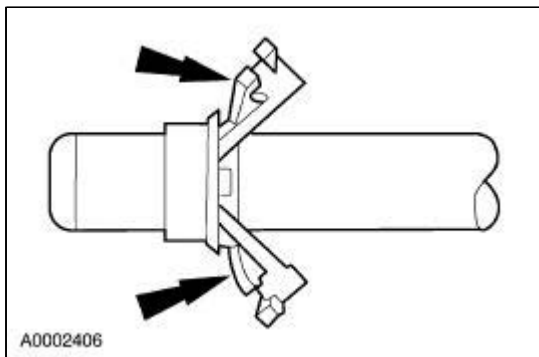


4. **NOTE:** A slight twisting motion while pulling on the heater water hose may be necessary to assist in the removal.

Pull the heater hose away from the heater core tube.

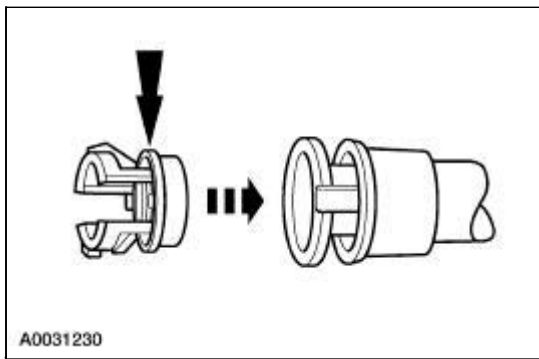


5. Spread the retainer tabs apart and slide the retainer off the tube.
 - Discard the retainer.

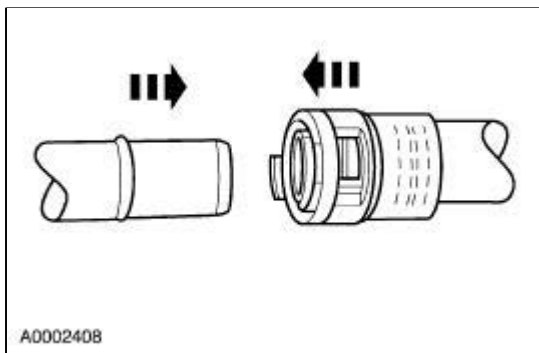


Connect

1. Clean the tubes and lubricate with coolant hose lubricant or plain water.
2. Install a new coupling retainer (18D434) into the heater hose coupling housing.



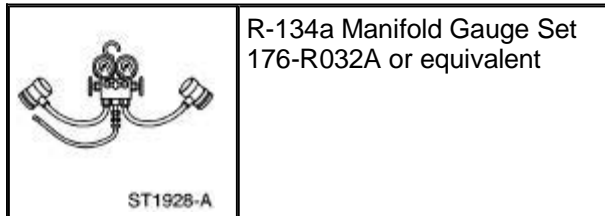
3. Push the heater hose coupling onto the tube.



4. Make sure the heater hose coupling is fully engaged by lightly pulling on the heater hose.
-

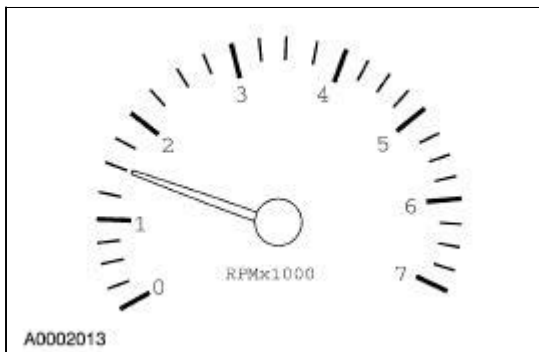
Refrigerant System Tests

Special Tool(s)



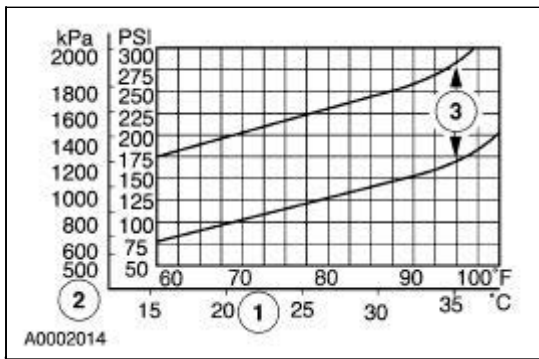
1. Connect the R-134a Manifold Gauge Set. For additional information, refer to [Manifold Gauge Set Connection](#) in this section.
2. Adjust the climate controls for maximum cooling.
 - Start the engine.
 - Select MAX A/C operation.
 - Set the blower motor speed to maximum.
3. Stabilize the in-vehicle temperature at 21-27°C (70-80°F).
4. **NOTE:** When the ambient temperatures exceed 38°C (100°F), do not run the engine above normal idle speed.

Maintain the engine speed at 1,500 rpm.



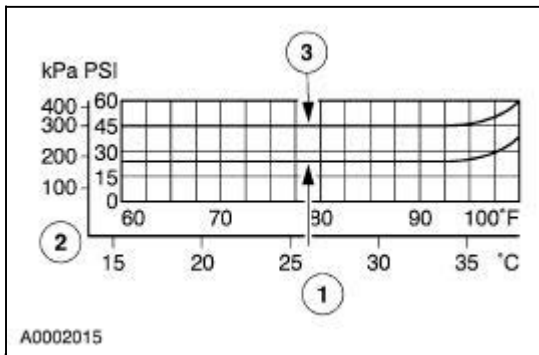
5. Determine the compressor discharge (high) pressure.
 1. Record the ambient temperature.
 2. Record the discharge (high) pressure.
 3. **NOTE:** In ambient temperatures between 38-43°C (100-110°F), the system performance pressures will be the same as those for ambient temperatures shown on the chart in the 32-38°C (90-100°F) range.

The system performance is acceptable when the pressure reading falls between the upper and lower limits shown.



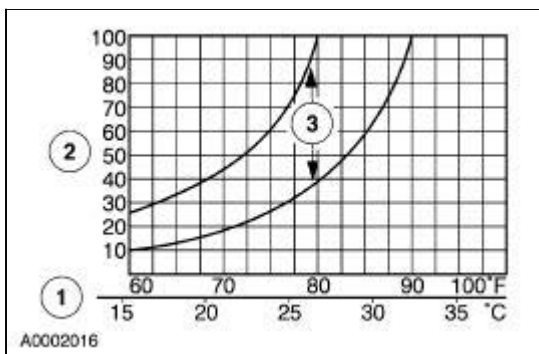
6. Determine the compressor suction (low) pressure.
 1. Record the ambient temperature.
 2. Record the suction (low) pressure.
 3. **NOTE:** In ambient temperatures between 38-43°C (100-110°F), the system performance pressures will be the same as those for ambient temperatures shown on the chart in the 32-38°C (90-100°F) range.

The system performance is acceptable when the pressure reading falls between the upper and lower limits shown.



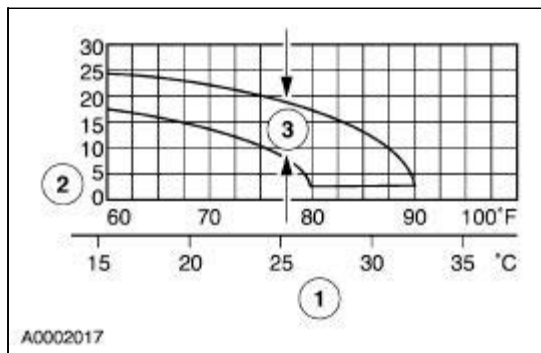
7. Determine the A/C clutch ON time.
 1. Record the ambient temperature.
 2. Record the A/C clutch ON time in seconds.
 3. **NOTE:** When the ambient temperature is above 26°C (80°F), the A/C clutch may not cycle.

The system performance is acceptable when the recorded time falls between the upper and lower limits shown.



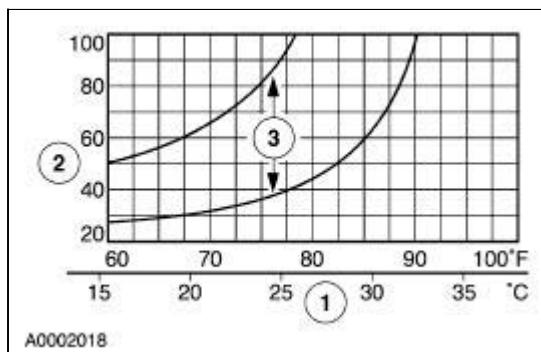
8. Determine the A/C clutch OFF time.
 1. Record the ambient temperature.
 2. Record the A/C clutch OFF time in seconds.
 3. **NOTE:** When the ambient temperature is above 26°C (80°F), the A/C clutch may not cycle.

The system performance is acceptable when the recorded time falls between the upper and lower limits shown.



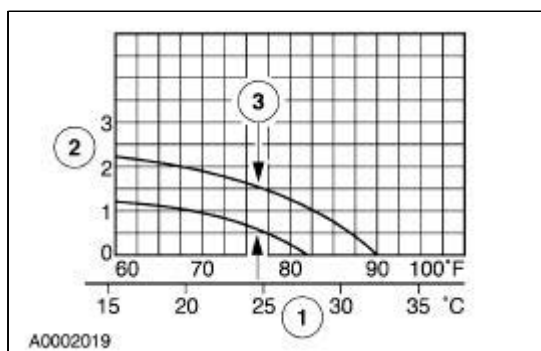
9. Determine the total A/C clutch cycle time.
 1. Record the ambient temperature.
 2. Record the time the A/C clutch is engaged plus the time it is disengaged (time ON plus time OFF).
 3. **NOTE:** When the ambient temperature is above 26°C (80°F), the A/C clutch may not cycle.

The system performance is acceptable when the recorded time falls between the upper and lower limits shown.



10. Determine the A/C clutch cycle rate per minute.
 1. Record the ambient temperature.
 2. Record the number of A/C clutch cycles occurring in one minute.
 3. **NOTE:** When the ambient temperature is above 26°C (80°F), the A/C clutch may not cycle.

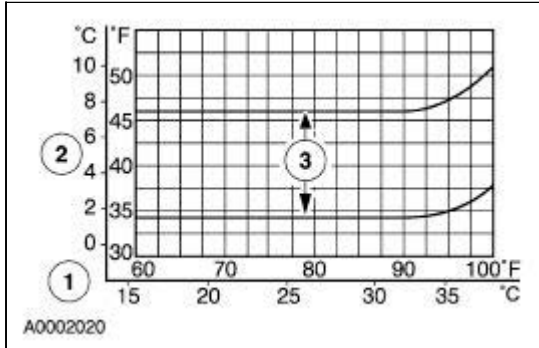
The system performance is acceptable when the recorded number of cycles falls between the upper and lower limits shown.



11. Determine the center A/C register discharge temperature.
 1. Record the ambient temperature.

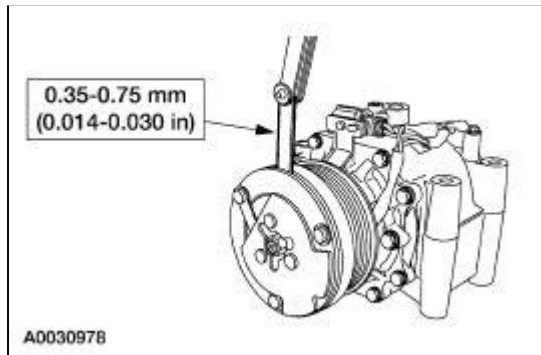
2. Record the center A/C register discharge temperature.
3. **NOTE:** In ambient temperatures between 38-43°C (100-110°F), the A/C register discharge temperatures will be the same as those for ambient temperatures shown on the chart in the 32-38°C (90-100°F) range.

The system performance is acceptable when the center A/C register discharge temperature falls between the upper and lower limits shown.



A/C Clutch Air Gap Adjustment

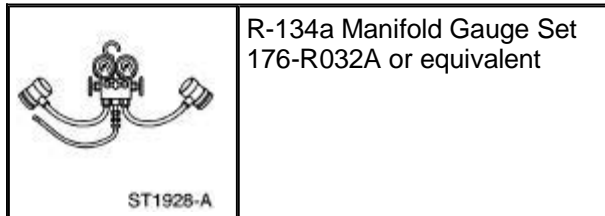
1. Check the A/C clutch air gap at three equally spaced places between the clutch hub and the A/C clutch pulley.



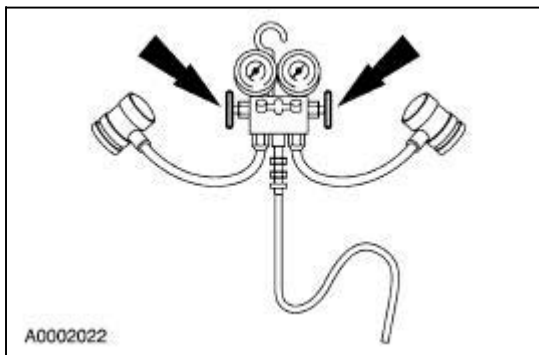
2. Remove the A/C clutch. Add or remove spacers between the A/C clutch and the compressor shaft until clearance is within specifications. For additional information, refer to [Section 412-03](#).
-

Manifold Gauge Set Connection

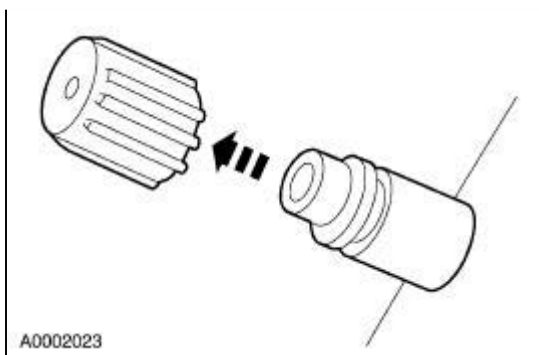
Special Tool(s)



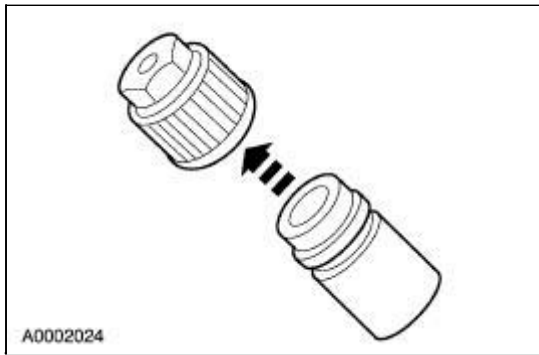
1. Turn both valves on the R-134a Manifold Gauge Set clockwise to close the low- and high-pressure hoses to the center manifold and center hose.



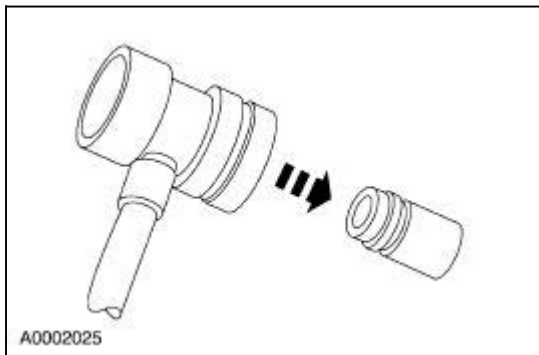
2. Remove the A/C charging valve cap (19D702) from the low-pressure service gauge port valve.



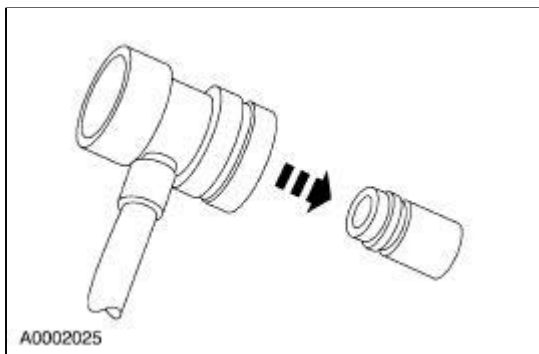
3. Remove the A/C charging valve cap from the high-pressure service gauge port valve.



4. Connect the R-134a Manifold Gauge Set low-pressure hose and the R-134a low side quick disconnect to the low-pressure service gauge port valve.

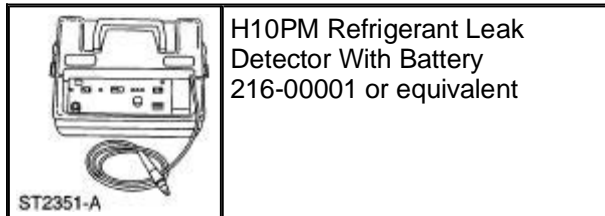


5. Connect the R-134a Manifold Gauge Set high-pressure hose and the R-134a high side quick disconnect to the high-pressure service gauge port valve.



Electronic Leak Detection

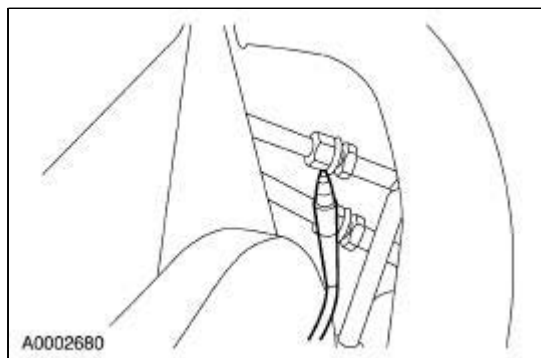
Special Tool(s)



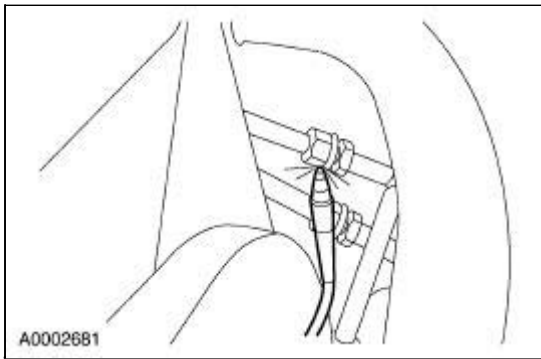
CAUTION: Good ventilation is necessary in the area where electronic A/C leak testing is to be carried out. If the surrounding air is contaminated with refrigerant gas, the leak detector will indicate this gas all the time. Odors from other chemicals such as antifreeze, diesel fuel, disc brake cleaner, or other cleaning solvents can cause the same problem. A fan, even in a well-ventilated area, is very helpful in removing small traces of contamination from the air that might affect the leak detector.

1. **NOTE:** The system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off.

Leak test the refrigerant system using the Refrigerant Leak Detector. Follow the instructions included with the leak detector for handling and operation techniques.










2. If a leak is found, discharge and recover the refrigerant. For additional information, refer to [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) in this section.
 - Repair the system.
 - Test the system for normal operation.



Fluorescent Dye Leak Detection

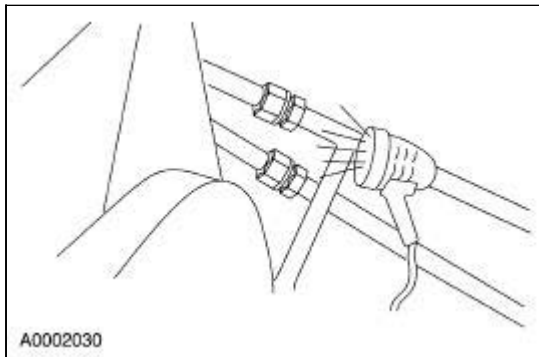
Special Tool(s)

 ST1834-A	R-134a Refrigerant Service Center 023-00153 or equivalent
 ST1261-A	120 Watt UV Spot Lamp 164-R0721 or equivalent
 ST1705-B	R-134a Fluorescent Dye Injector 164-R0775 or equivalent
 ST2651-A	High Intensity UV Lamp — 12 Volt 164-R6000
 ST2650-A	R-134a Leak Detection Dye 164-R6060
 ST1928-A	R-134a Manifold Gauge Set 176-R032A
 ST2649-A	Deluxe Injector Loop Kit 219-00069

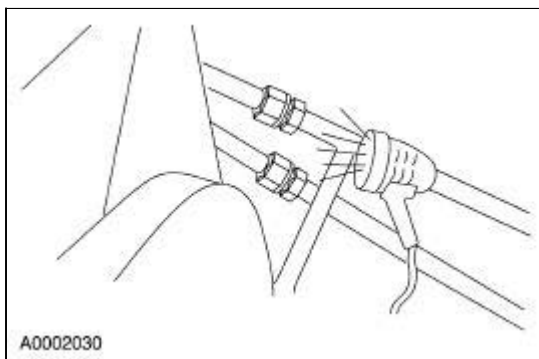
Fluorescent Dye Detection

NOTE: Ford Motor Company vehicles are produced with R-134a fluorescent dye installed in the refrigerant system from the factory. The location of leaks can be pinpointed by the bright yellow-green glow of the fluorescent dye under a UV lamp. Since more than one leak can exist, make sure to inspect each component, line, and fitting in the refrigerant system for a leak.

1. Check for leaks using the special tool.
 - Inspect all components, lines, and fittings of the refrigerant system.



2. If a leak is found, recover the refrigerant. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.
3. Repair the refrigerant system leak(s).
4. Evacuate and charge the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.
5. After the leak(s) is/are repaired, remove any traces of fluorescent dye with a general purpose oil solvent.
6. Verify the repair by running the vehicle for a short period of time and rechecking the area of the leak with the special tool.



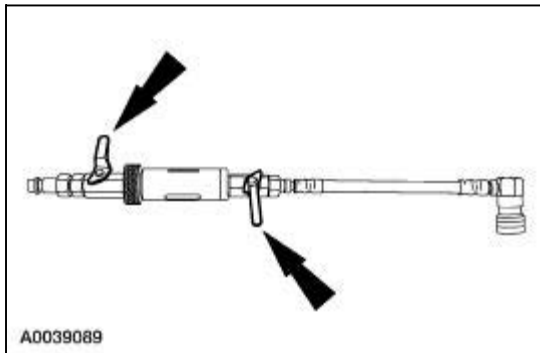
Fluorescent Dye Injection — Using an A/C Refrigerant Center and Dye Injector

NOTE: Before using the R-134a fluorescent dye injector for the first time, refer to the manufacturers instructions on evacuation of any non-condensable gasses from the hoses.

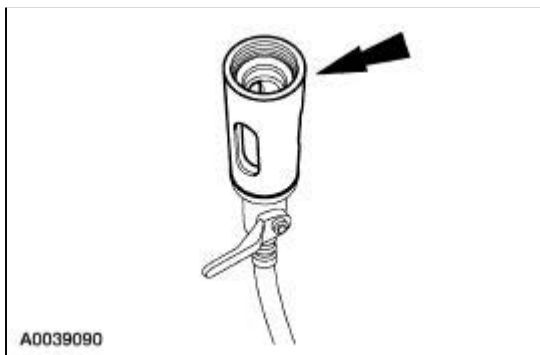
NOTE: Only connect the R-134a fluorescent dye injector to a manifold and gauge set or R-134a service center when fluorescent dye is to be injected. The R-134a fluorescent dye injector has a one way check valve that will prevent refrigerant system recovery and evacuation.

NOTE: Refrigerant system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off.

1. Install an R-134a A/C refrigerant service center or a manifold and gauge set. For additional information, refer to Manifold and Gauge Set Connection in this section.
2. Verify that the valves on the special tool are closed.



3. Fill the special tool reservoir with 7 ml (0.25 oz) of fluorescent dye.



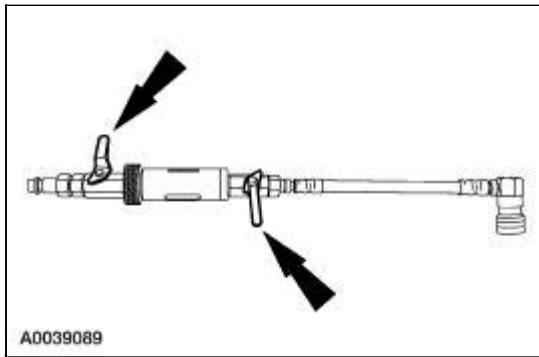
4. Install the special tool between the low-pressure service gauge port valve and the R-134a refrigerant service center or manifold gauge set.
5. Open all valves and inject the fluorescent dye into the refrigerant system.
6. When fluorescent dye injection is complete, close all valves.
7. Recover the refrigerant from the R-134a fluorescent dye injector.
8. Remove the fluorescent dye injector from the low-pressure service gauge port valve and the R-134a A/C refrigerant service center or manifold gauge set.

Fluorescent Dye Injection — Using a Dye Injector Loop Kit

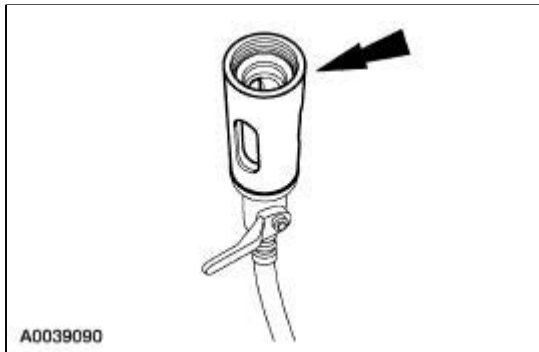
NOTE: Before using the R-134a fluorescent dye injector for the first time, refer to the equipment manufacturers instructions on evacuation of non-condensable gasses from the hoses.

NOTE: Refrigerant system pressure should be between 413-551 kPa (60-80 psi) at 24°C.


1. Verify that the valves on the special tool are closed.



2. Fill the special tool reservoir with 7 ml (0.25 oz) of fluorescent dye.

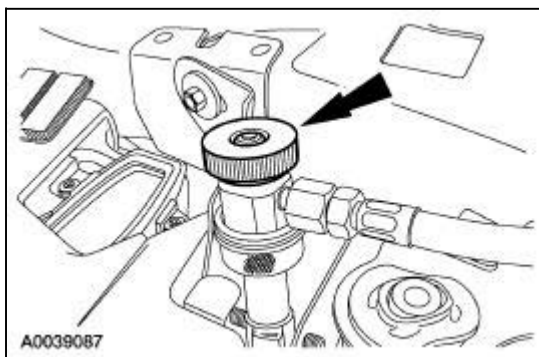


3. Install the special tool between the high-pressure and low-pressure service gauge port valves.

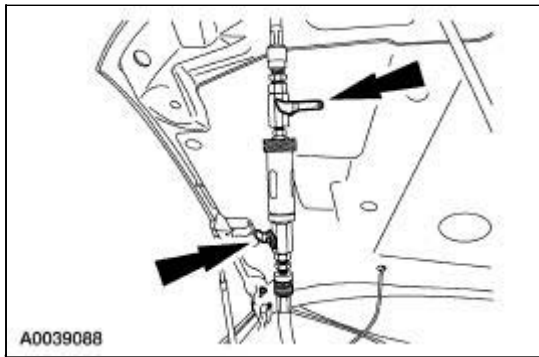
4.  **CAUTION: Make sure all tools and hoses are clear of the engine cooling fan and drive belt before starting the engine.**

Start the engine.

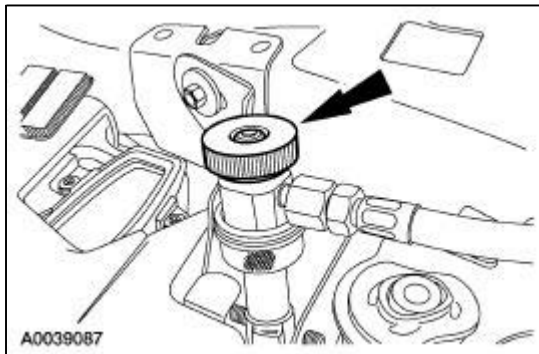
5. Open the high-pressure service valve.



6. Open the special tool valves and inject the fluorescent dye into the refrigerant system.

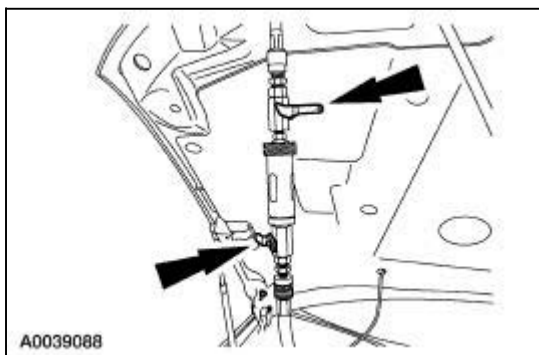


7. Close the high-pressure service valve to allow the pressure inside the special tool to equalize with the suction side of the refrigerant system.



8. **NOTE:** Close the valves on the special tool while the A/C compressor is operating.

Close the valves on the special tool.




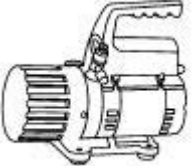
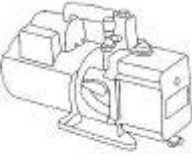


9. **NOTE:** Leave all valves on the special tool closed when not in use.

Disconnect the high-pressure and low-pressure service valves and remove the special tool from the vehicle.

Air Conditioning (A/C) System Recovery, Evacuation and Charging

Special Tool(s)

 <p>ST1228-A</p>	<p>R-134a A/C Refrigerant Center 176-00002 or equivalent</p>
 <p>ST1834-A</p>	<p>R-134a A/C Refrigerant Center 023-00153 or equivalent</p>
 <p>ST1928-A</p>	<p>R-134a Manifold Gauge Set 176-R032A or equivalent</p>
 <p>ST1685-A</p>	<p>1.2 CFM Vacuum Pump 023-00162 or equivalent</p>
 <p>ST1686-A</p>	<p>4.0 CFM Vacuum Pump 023-00163 or equivalent</p>

Refrigerant System Recovery

NOTE: Ford Motor Company recommends use of an A/C service center to carry out recovery, evacuation, and charging of the refrigerant system. If an A/C service center is not available, refrigerant system recovery, evacuation, and charging may be accomplished using a separate recovery station, vacuum pump, charging cylinder, and manifold gauge set.

1. Prior to recovering the refrigerant system, you must verify the purity of the refrigerant. For additional information, refer to [Refrigerant Identification Testing](#) in this section.
2. **NOTE:** Some R-134a service centers require the use of an A/C manifold gauge set. For additional information, refer to [Manifold Gauge Set Connection](#) in this section.

Connect an R-134a A/C service center to the low- and high-pressure service gauge port valves.

3. Recover the refrigerant from the system following the operating instructions provided by the equipment manufacturer.
4. Once the service center has recovered the vehicle A/C system refrigerant, close the service center inlet valve (if equipped). Then switch off the power supply.
5. Allow the vehicle A/C system to remain closed for about two minutes. Observe the system vacuum level as shown on the gauge. If the vacuum does not decrease, disconnect the refrigerant center hose(s).
6. If the system vacuum does decrease, repeat Steps 2 through 5 until the vacuum level remains stable for two minutes.
7. Carry out the required repairs.

Refrigerant System Evacuation

NOTE: Ford Motor Company recommends use of an A/C service center to carry out recovery, evacuation, and charging of the refrigerant system. If an A/C service center is not available, refrigerant system recovery, evacuation, and charging may be accomplished using a separate recovery station, vacuum pump, charging cylinder, and manifold gauge set.

1. Connect an R-134a service center to the low- and high-pressure service gauge port valves.
2. Evacuate the system until the low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) of vacuum and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the vacuum pump for a minimum of 45 minutes.
3. Turn off the vacuum pump. Observe the low-pressure gauge for five minutes to make sure that the system vacuum is held. If vacuum is not held for five minutes, leak test the system, service the leak, and evacuate the system again.


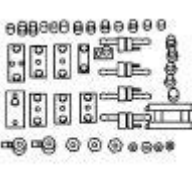
Refrigerant System Charging


NOTE: Ford Motor Company recommends use of an A/C service center to carry out recovery, evacuation, and charging of the refrigerant system. If an A/C service center is not available, refrigerant system recovery, evacuation, and charging may be accomplished using a separate recovery station, vacuum pump, charging cylinder, and manifold gauge set.


1. Correctly oil match the system to verify that the correct amount of refrigerant oil is present in the system. For additional information, refer to [Refrigerant Oil Adding](#) in this section.
 2. Charge the system with the specified amounts of refrigerant oil and refrigerant.
 3. When no more refrigerant is being drawn into the system, start the engine and select MAX A/C operation. Adjust the blower motor speed to the maximum and allow the remaining refrigerant to be drawn into the system. Continue to add refrigerant into the system until the specified weight of R-134a has been added. Close the charging cylinder valve and allow the system to pull any remaining refrigerant from the hose. When the low-pressure drops to approximately 207 kPa (30 psi), close the charging hose valve.
-


Air Conditioning (A/C) System Flushing


Special Tool(s)

 ST2466-A	A/C Flush and Purge Machine 219-00022 (part of 219-00023) or equivalent
 ST2469-A	A/C Flush and Purge Fitting Kit 219-00024 (part of 219-00023) or equivalent

 **WARNING:** Use extreme care and observe all safety and service precautions related to the use of refrigerants.

 **WARNING:** Due to refrigerant hazards, always wear safety goggles and non-penetrable gloves when working on or flushing A/C systems.

 **CAUTION:** An A/C refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer's procedures and instructions.

 **CAUTION:** Suction accumulator/drier, muffler, hoses, thermal expansion valve, and fixed orifice tube should be removed when flushing the A/C system. Internal plumbing of these devices makes it impossible to correctly remove any residual-flushing agent. Except for the hoses, these components are typically discarded after A/C system contamination. Hoses can normally be reused unless they are clogged with foreign material. The 3.785 liters (1 gallon) of A/C Systems Flushing Solvent F4AZ-19579-A and FL1-A filter used in A/C Flush and Purge Machine 219-00022 are intended for use on one vehicle only. They may be used to flush both the A/C condenser core and the A/C evaporator core on an individual vehicle, but under no circumstances should they be used on more than one vehicle.

1. **NOTE:** Prior to using the A/C Flush and Purge Machine 219-00022 for the first time, review the operating instructions.

NOTE: Only the A/C Flush and Purge Machine kit 219-00023, which includes A/C Flush and Purge Machine 219-00022, A/C Flush and Purge Fitting Kit 219-00024, and the Ford Part number F4AZ-19579-A A/C Systems Flushing Solvent, is approved for use on Ford vehicles. No other flushing device or solvent is approved for flushing heat exchangers. Use of any other flusher or solvent may cause damage to the A/C system and the flushing unit.

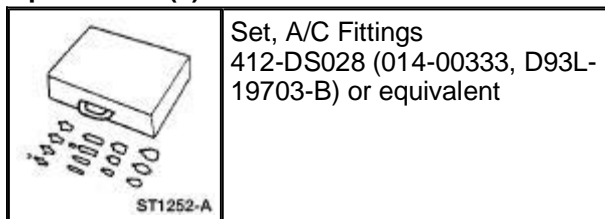
Ford Motor Company has approved a procedure to provide technicians with a non-CFC method of flushing contaminated A/C system heat exchangers, A/C evaporator core, and A/C condenser core. The procedure allows the specific components to be cleaned and flushed while installed in their normal in-vehicle location. The types of contamination flushed include particle matter that results from A/C compressor or desiccant failure within the suction accumulator/drier and gummy residue that can form when refrigerant oil is overheated during A/C compressor seizure. The flushing process is a two-step procedure that involves the use of an A/C Flush and Purge Machine 219-00022 to:

- Circulate the flushing solvent through the heat exchanger in the reverse direction of normal refrigerant flow (back-flushing). Particulate matter picked up during flushing is filtered from the returning solvent before the solvent is returned to the reservoir for continued circulation.
 - Remove the flushing solvent from the heat exchanger. In this step of the procedure, pressurized air 621-862 kPa (90-125 psi) is used to push and evaporate any remaining flush solvent from the heat exchanger.
2. Discharge the A/C system. Observe all safety precautions. For additional information, refer to the procedure in this section.
 3. Disconnect the refrigerant lines from the heat exchanger(s) to be flushed.
 4. Connect the A/C Flush and Purge Machine 219-00022 and A/C Flush and Purge Fitting Kit 219-00024 to the heat exchanger to be flushed. Do not flush through the A/C evaporator core orifice, mufflers or hoses. Internal plumbing and material make-up of these components make it impossible to correctly remove foreign material or residual flushing solvent.
 5. Use 3.785 liters (one gallon) of A/C Systems Flushing Solvent part number F4AZ-19579-A to flush the heat exchanger for a minimum of 15 minutes. The flush solvent may be used for one or both heat exchangers in the A/C system. However, the flush solvent is intended for one vehicle only. The filter used on the flushing unit is also intended for use on one vehicle only.
 6. Flush the component for a minimum of 15 minutes.
 7. Apply 621-862 kPa (90-125 psi) pressurized air to the component for a minimum of 30 minutes. The 30-minute purge time is required to force and evaporate all residual solvent from the A/C system component. Failure to successfully remove all residual solvent within the component can result in system damage when reconnected and operated. Dispose of the used flush solvent and filter in accordance with local, state and federal emissions.
 8. **NOTE:** A/C system filtering as described in this section is optional if system flushing is carried out. However, the filter kit use is recommended after flushing if the A/C system contamination is extensive.

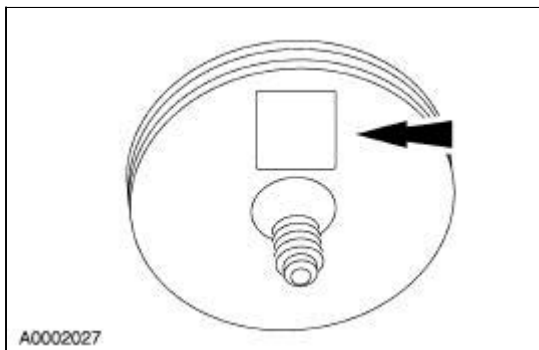
Install a new A/C evaporator core orifice in any vehicle being serviced for A/C compressor or desiccant failure.
 9. Install new refrigerant hoses if clogged with foreign material.
 10. Reconnect the heat exchanger being serviced.
 11. Add additional refrigerant oil as required. For additional information, refer to the procedure in this section.
 12. Evacuate, leak test and charge the A/C system. For additional information, refer to the procedure in this section.
 13. Check the system for normal operation.

Refrigerant System Filtering After A/C Component Replacement

Special Tool(s)



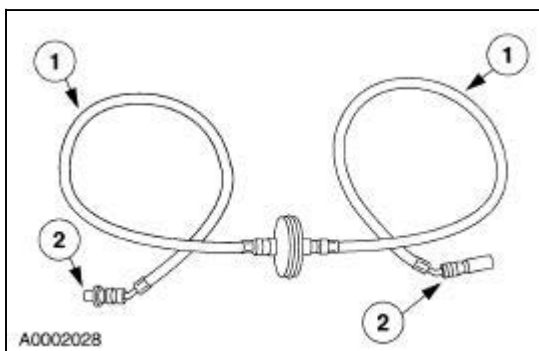
1. Install the new A/C compressor. For additional information, refer to [Section 412-03](#).
2. Install the new receiver/drier. For additional information, refer to [Section 412-03](#).
3. Install the new thermostatic expansion valve. For additional information, refer to [Section 412-03](#).
4. Orient the filter inlet toward the A/C condenser core.



5. **NOTE:** The pancake filter is not permanently installed and will be removed at the end of this procedure.

Temporarily install the pancake filter between the A/C condenser core and the condenser to evaporator tube (19835).

1. Use flexible refrigerant hose of 17,238 kPa (2,500 psi) burst rating.
2. Make the connections using the R-12/R-134a Air Conditioning Test Fitting Set.



6. Correctly oil match the system. For additional information, refer to [Refrigerant Oil Adding](#) in this section.
 7. Evacuate and charge the system. For additional information, refer to [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) in this section.
 8. Check all refrigerant system hoses, lines and the position of the newly installed filters to be sure they do not interfere with other engine compartment components. If necessary, use tie straps to make adjustments.
 9. Provide adequate airflow to the front of the vehicle (with a fan, if necessary). Select A/C operation and set the blower motor speed to maximum. Start the engine and let it idle briefly. Make sure the A/C system is operating correctly.
 10. Gradually bring the engine up to 1,200 rpm by running it at lower rpms for short periods (first at 800 rpm, then at 1,000 rpm). Set the engine at 1,200 rpm and run it for one hour with the A/C system operating.
 11. Stop the engine.
 12. Recover the refrigerant from the system. For additional information, refer to [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) in this section.
 13. Remove the fittings, flexible hoses and pancake filter from between the A/C condenser core and the condenser to evaporator tube.
 14. Discard the pancake filter. It can be used one time only.
 15. Reconnect the condenser to evaporator tube to the A/C condenser core.
 16. Evacuate and charge the system. For additional information, refer to [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) in this section.
-

Refrigerant Oil Adding



CAUTION: During normal A/C operation, oil is circulated through the system with the refrigerant, and a small amount is retained in each component. If certain components of the system are removed, some of the refrigerant oil will go with the component. To maintain the original total oil charge, it is necessary to compensate for the oil lost by adding oil to the system with the new part.

NOTE: Installation of new components such as the A/C pressure transducer do not require additional oil.

1. **NOTE:** New A/C compressors are shipped without compressor oil.

Rotate the A/C compressor shaft six to eight revolutions while collecting the oil in a clean measuring device.

- If the amount of oil drained from the old A/C compressor is between 90-150 ml (3-5 ounces), pour the same amount plus 30 ml (1 ounce) of clean PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B into the new A/C compressor.
 - If the amount of oil that was removed from the old A/C compressor is greater than 150 ml (5 ounces), pour the same amount drained of clean PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B into the new A/C compressor.
 - If the amount of oil that was removed from the old A/C compressor is less than 90 ml (3 ounces), pour 90 ml (3 ounces) of clean PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B into the new A/C compressor.
2. For the receiver/drier, drill one 12.7 mm (0.5 in) hole in the receiver/drier cylinder and drain the oil into a calibrated container.
 - Add a quantity of new oil to match that drained from the old receiver/drier plus 59 ml (2 ounces) of clean PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.
 3. For the A/C evaporator core add 30 ml (1 ounce) of clean PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B to the receiver/drier inlet tube.
 4. For the A/C condenser core, add 30 ml (1 ounce) of clean PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B to the A/C condenser core or the receiver/drier inlet tube.
 5. Add 20 ml (.75 ounces) of clean PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B to the receiver/drier inlet tube when carrying out each of the following repairs:
 - installation of a new TXV
 - installation of a new A/C compressor pressure relief valve (19D644)
 - installation of a new refrigerant line
 - repair of an O-ring seal leak
 - repair of a charge port leak

Inspection and Assembly Requirements —Following An A/C Compressor Failure



CAUTION: To prevent refrigerant system contamination and possible failure of the new A/C compressor, carry out the following procedures:

1. Install a new thermostatic expansion valve (TXV). For additional information, refer to [Section 412-03](#).
2. Remove the A/C compressor. For additional information, refer to [Section 412-03](#).
 - Drain the residual refrigerant oil from the A/C compressor and measure the volume for correct system oil matching. For additional information, refer to [Refrigerant Oil Adding](#) in this section.
3. **NOTE:** The thermostatic expansion valve cannot be cleaned and a new thermostatic expansion valve must be installed.

Remove the receiver/drier. For additional information, refer to [Section 412-03](#).

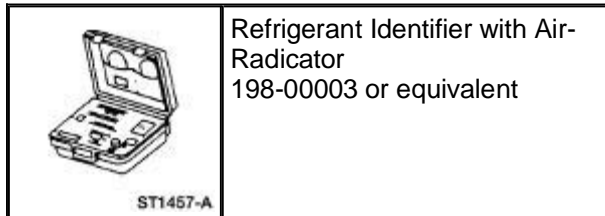
- Drain the residual refrigerant oil from the receiver/drier and measure the volume for correct oil system matching. For additional information, refer to [Refrigerant Oil Adding](#) in this section.
4. **NOTE:** System flushing is the preferred method of cleaning. However, if flushing equipment is not available, carry out system filtering.

Carry out an A/C system flushing or filtering procedure:

- If A/C system flushing equipment is available, clean the A/C condenser core by flushing. For additional information, refer to [Air Conditioning \(A/C\) System Flushing](#) in this section.
 - If A/C system flushing equipment is not available, carry out a system filtering procedure. For additional information, refer to [Refrigerant System Filtering After A/C Component Replacement](#) in this section.
5. Install the new A/C compressor. For additional information, refer to [Section 412-03](#).
 6. Install the new receiver/drier, if necessary. For additional information, refer to [Section 412-03](#).
 7. Install the new TXV. For additional information, refer to [Section 412-03](#).
 8. Correctly oil match the system. For additional information, refer to [Refrigerant Oil Adding](#) in this section.
 9. Evacuate and charge the system. For additional information, refer to [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) in this section.
-


Refrigerant Identification Testing

Special Tool(s)




1. **NOTE:** An A/C refrigerant analyzer must be used to identify gas samples taken directly from the refrigeration system or storage containers prior to recovering or charging the refrigerant system.

Follow the instructions included with the Deluxe Refrigerant Diagnostic Tool to obtain the sample for testing.

2. The diagnostic tool will display one of the following:
 - If the purity level of R-134a or R-12 is 98% or greater by weight, the green "PASS" light emitting diode (LED) will light. The weight concentrations of R-134a, R-12, R-22, hydrocarbons, and air will be displayed on the digital display.
 - If refrigerants R-134a or R-12 do not meet the 98% purity levels, the red "FAIL" LED will light and a horn will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22, and hydrocarbons will be displayed on the digital display.
 - If hydrocarbon concentrations are 2% or greater by weight, the red "FAIL" LED will light, "Hydrocarbon High" will be displayed on the digital display, and a horn will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22, and hydrocarbons will also be displayed on the digital display.
3. The percentage of air contained in the sample will be displayed if the R-134a or R-12 content is 98% or greater. The diagnostic tool eliminates the effect of air when determining the refrigerant sample content because air is not considered a contaminant, although air can affect A/C system performance. When the diagnostic tool has determined that a refrigerant source is pure (R-134a or R-12 is 98% or greater by weight) and air concentration levels are 2% or greater by weight, the diagnostic tool will prompt the user if an air purge is desired.
4. If contaminated refrigerant is detected, repeat the refrigerant identification test to verify that the refrigerant is indeed contaminated.
5.  **CAUTION: If contaminated refrigerant is detected, DO NOT recover the refrigerant into R-134a or R-12 recovery/recycling equipment.**

Recover any contaminated refrigerant using suitable recovery-only equipment designed for capturing and storing contaminated refrigerant. For additional information, refer to Contaminated Refrigerant Handling in this section.

Contaminated Refrigerant Handling

1.  **CAUTION:** If contaminated refrigerant is detected, **DO NOT** recover the refrigerant into your recovery/recycling equipment.

Recover the contaminated refrigerant using suitable recovery-only equipment designed for capturing and storing contaminated refrigerant.

- This equipment must only be used to recover contaminated refrigerant to prevent the spread to other vehicles.
- If this equipment is not available, contact an A/C repair facility in your area with the correct equipment to carry out this repair.

2. Determine and correct the cause of the customer's initial concern.
3. **NOTE:** Residual refrigerant oil in the receiver/drier must be drained and measured for correct oil system matching. For additional information, refer to [Refrigerant Oil Adding](#) in this section.

The receiver/drier cannot be cleaned and a new receiver/drier must be installed. Remove the receiver/drier. For additional information, refer to [Section 412-03](#).

4. Clean the A/C evaporator core and the A/C condenser core by flushing. For additional information, refer to [Air Conditioning \(A/C\) System Flushing](#) in this section.
 5. Install the new receiver/drier. For additional information, refer to [Section 412-03](#).
 6. Correctly oil match the system. For additional information, refer to [Refrigerant Oil Adding](#) in this section.
 7. Evacuate and charge the system. For additional information, refer to [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) in this section.
 8. Dispose of contaminated refrigerant according to all federal, state and local regulations.
-

Torque Specifications

Description	Nm	lb-ft	lb-in
Cross-vehicle support bolts	25	18	—
Cabin air filter plenum bolts	6	—	53
Plenum chamber center screws to cross-vehicle beam	6	—	53
Plenum chamber lower screw to cross-vehicle beam	6	—	53

Air Distribution And Filtering

NOTE: The air distribution system of this vehicle is factory equipped with a cabin air filter.

There are two sources of air available to the air distribution system:

- outside air
- recirculated air

Air distribution within the vehicle is controlled by the dual electronic automatic temperature control (DATC) system in the AUTOMATIC mode, but it can be overridden by the driver if desired. Airflow control doors are used to direct airflow within the evaporator and blower assembly (19B555) and within the plenum chamber (19740). Electrically powered actuators (19E616) are used to position the airflow control doors. For additional information, refer to [Section 412-00](#) for description and operation of each of the system functions.

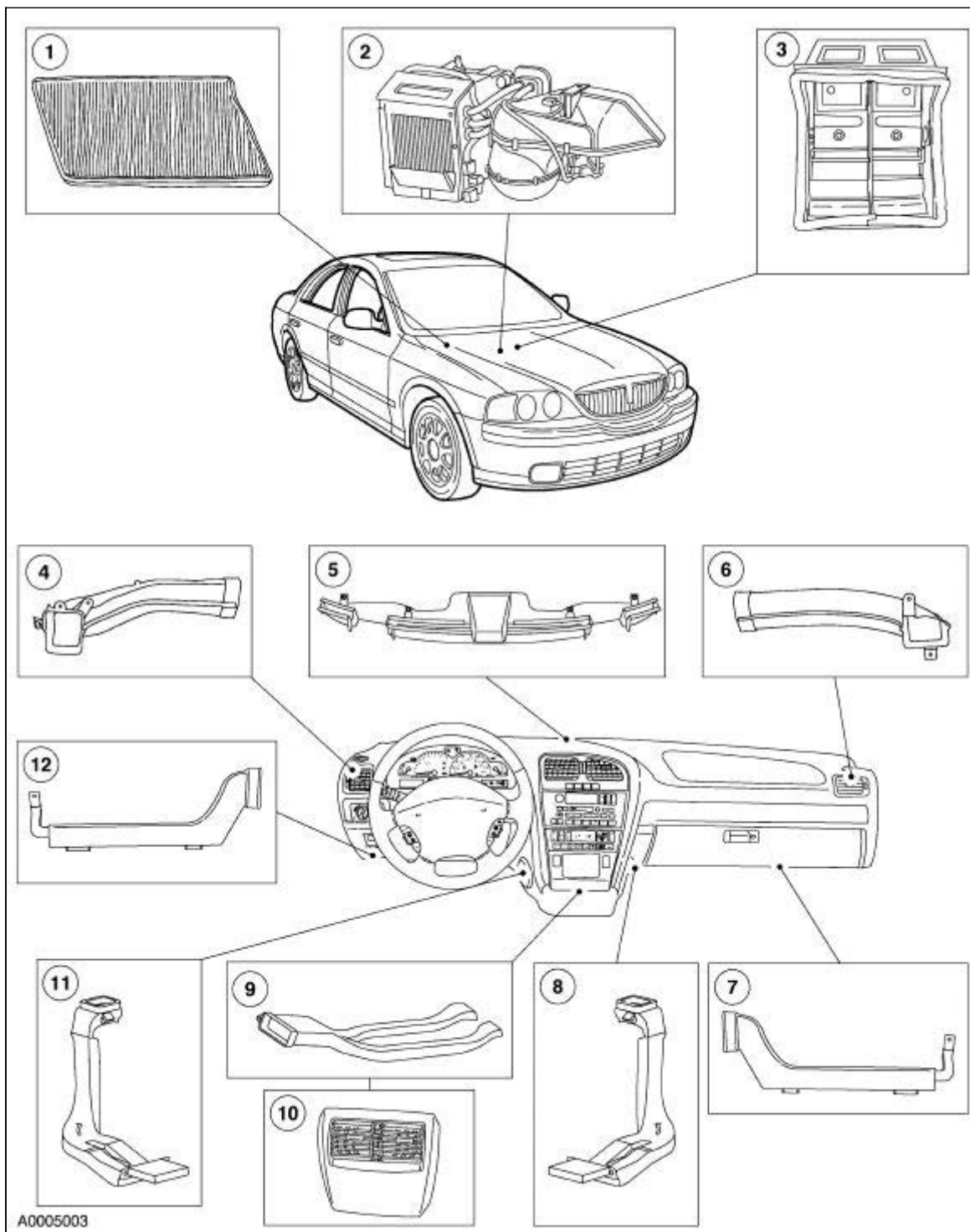
Recirculated air can be selected by pushing the recirculating air button on the dual automatic temperature control panel. It may also be commanded by the DATC during AUTOMATIC and OFF modes. If the recirculating mode is selected in floor mode, the DATC module will automatically discontinue the recirculating air mode in floor mode, to reduce fogging of the windows.

Air enters the passenger compartment from the:

- instrument panel A/C registers (19893).
- heater outlet floor duct.
- windshield defroster hose nozzle (18490).
- side window demisters.
- center console rear A/C registers.
- rear seat floor ducts (18C464).

Passenger compartment air is exhausted from the vehicle through open windows or luggage compartment air vents.

Component Locations



A0005003

Item	Part Number	Description
1	19N619	Cabin air filter
2	19850	A/C evaporator housing
3	19740	Plenum chamber
4	19B680	LH register duct
5	18C433	Defroster duct
6	19A843	RH register duct
7	—	RH floor duct
8	18C464	RH rear seat duct

9	19E766	Center console duct
10	—	Center console register
11	18C464	LH rear seat duct
12	—	LH floor duct

Air Distribution And Filtering

Refer to Section 412-00 .

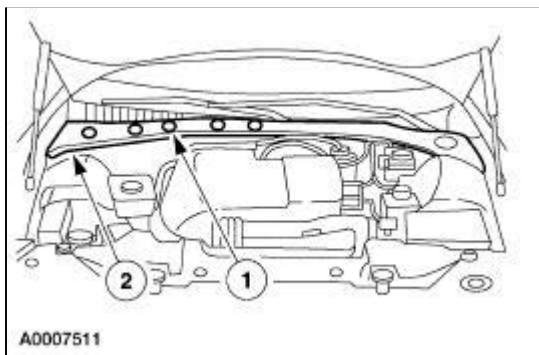
Cabin Air Filter

Removal and Installation

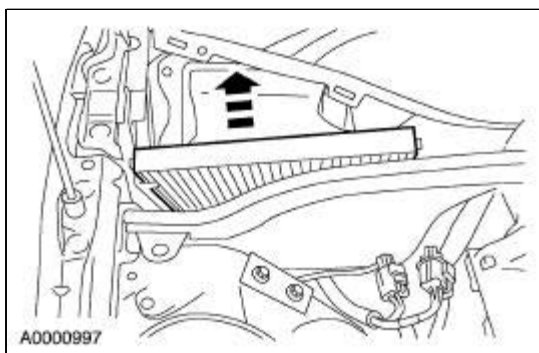
1. **NOTE:** The fasteners are reusable.

Remove the right side of the cowl vent screen.

1. Remove the two-part pin-type retainers and separate the Velcro® attachment of the rubber hinge cover to the rear outboard corner of the cowl vent screen.
2. Pull up on the cowl vent screen to release the lower clips.



2. Push on the RH corner of the filter to release the clip. Release the LH clip and remove the cabin air filter.

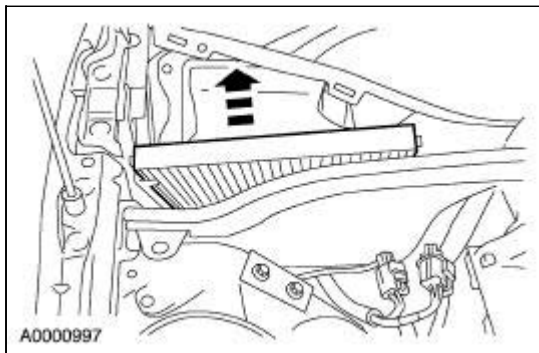


3. To install, reverse the removal procedure.

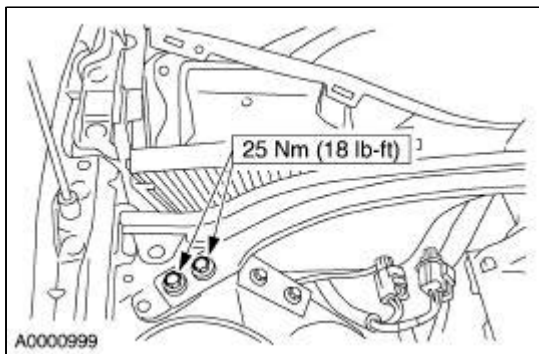
Fresh Air Inlet Duct

Removal and Installation

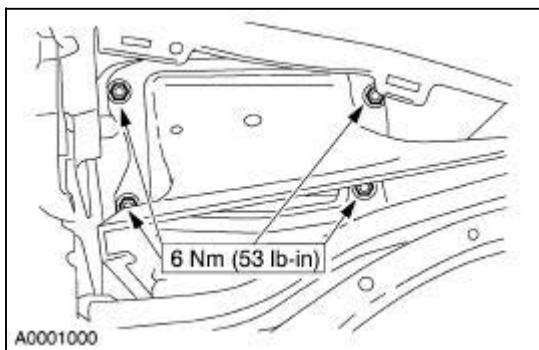
1. Remove the cowl vent screen. For additional information, refer to [Section 501-02](#).
2. Push on the RH corner of the filter to release the clip. Release the LH clip and remove the cabin air filter.



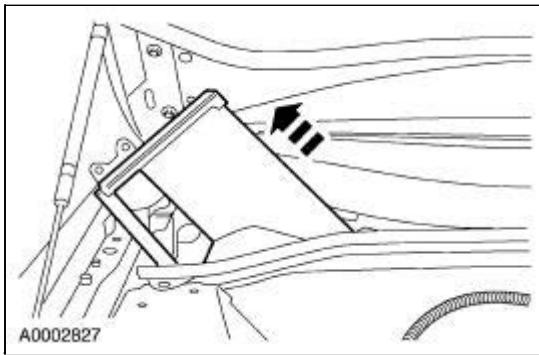
3. Remove the seven bolts and remove the cross-vehicle support.



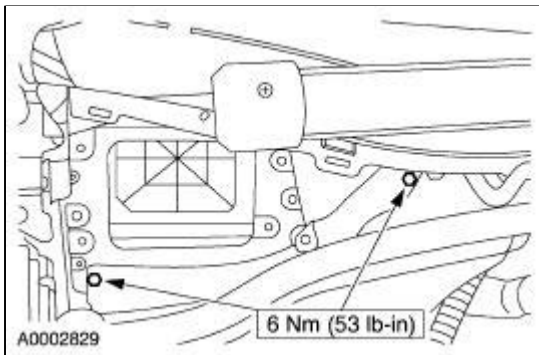
4. Remove the bolts.



5. Remove the cabin air filter housing by lifting the outboard side then removing the housing.



6. Remove the three bolts and remove the plenum panel.



7. To install, reverse the removal procedure.
-

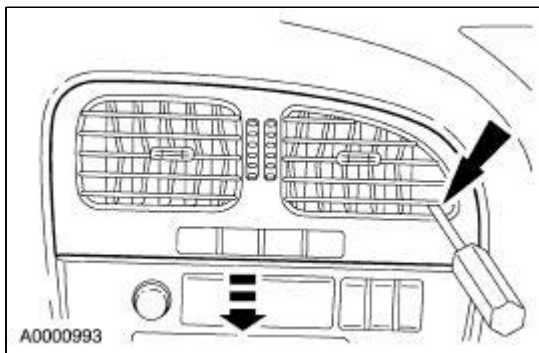
Center Registers

Removal

1. **NOTE:** The center register has pockets in the lower RH and LH corners to assist in removal.

Insert a mini-pick in the pocket and pull the register from the instrument panel.

- Disconnect the message center connector, if equipped.



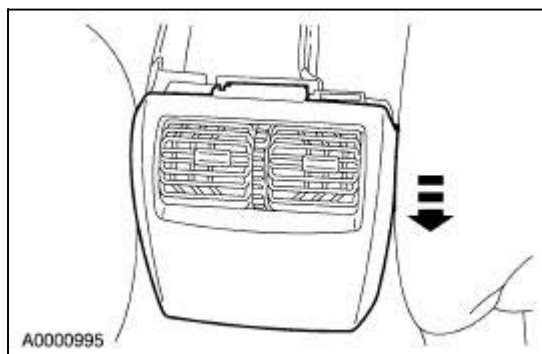
Installation

1. To install, connect the message center connector, if equipped, position the register and press into place.
-

Floor Console Register

Removal and Installation

1. Lift the center console cover and pull the register from the center console.



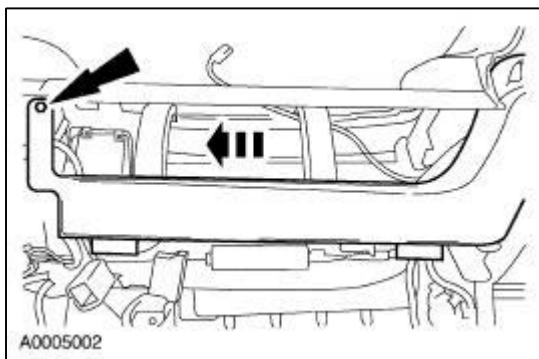
2. To install, reverse the removal procedure.
-

Footwell Duct

Removal and Installation

1. Remove the lower instrument panel insulator.
 - Disconnect the electrical connector.
2. **NOTE:** RH shown, LH similar.

Remove the screw and remove the duct.

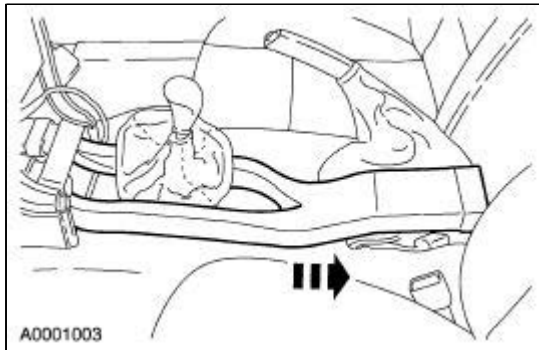


3. To install, reverse the removal procedure.
-

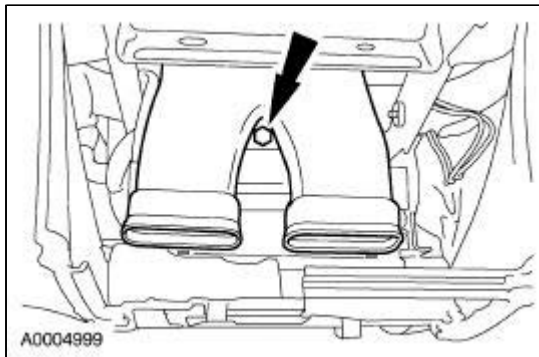
Footwell Duct —Floor Console

Removal and Installation

1. Remove the floor console. For additional information, refer to [Section 501-12](#).
2. Remove the duct.



3. Remove the screw and remove the front portion of the duct.



4. To install, reverse the removal procedure.
-

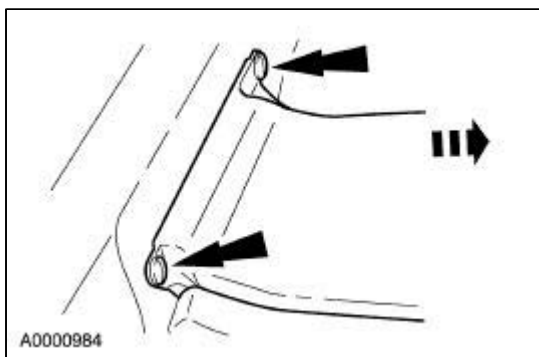
Rear Footwell Duct

Removal and Installation

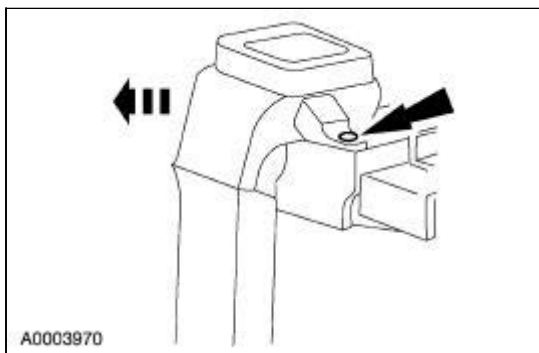
1. **NOTE:** RH shown, LH similar.

Remove the front seat. For additional information, refer to [Section 501-10](#).

2. Remove the carpet.
3. Remove the pin-type retainers.



4. Remove the pin-type retainer. Move the duct outboard and remove the duct.



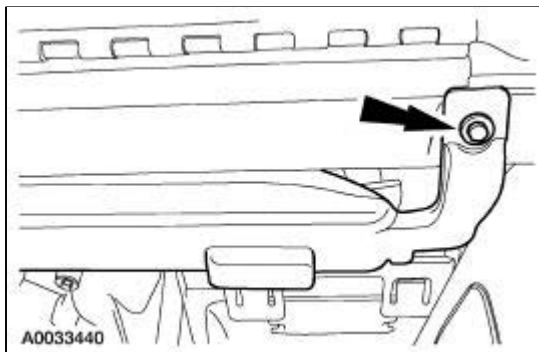
5. To install, reverse the removal procedure.
-

Plenum Chamber

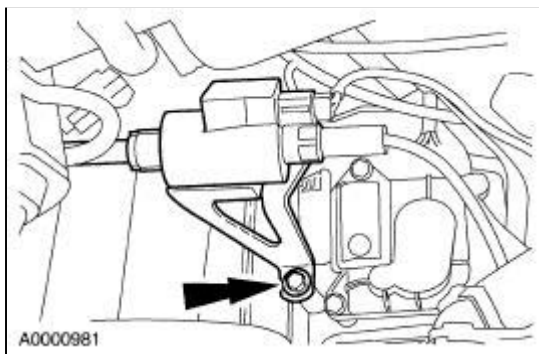
Removal and Installation

1. Remove the instrument panel. For additional information, refer to [Section 501-12](#).
2. **NOTE:** Passenger side duct shown, driver side similar.

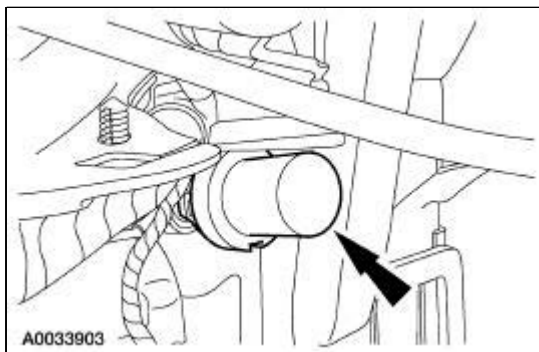
Remove the screws and remove the floor ducts.



3. Remove the screws and detach the transmission shift lockout bracket from the plenum chamber.

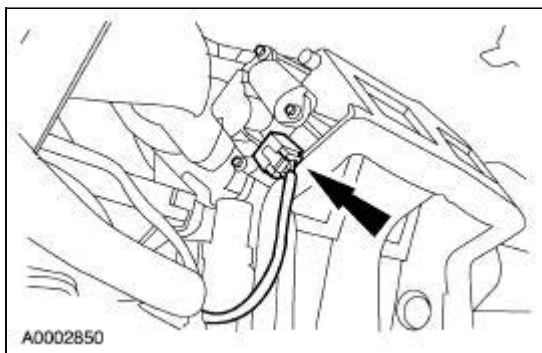


4. Detach the venturi assembly from the plenum chamber.

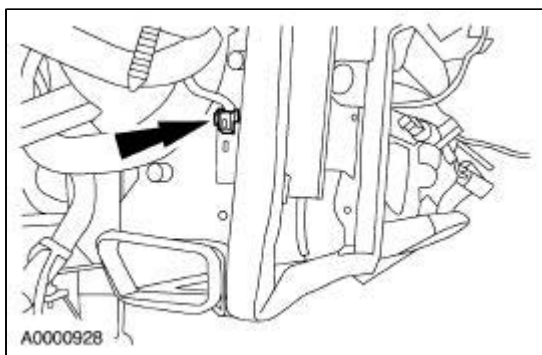


5. **NOTE:** Panel door actuator shown, defrost door and floor door actuators similar.

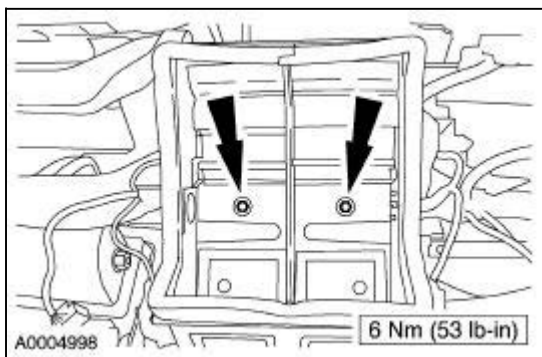
Disconnect the electrical connectors from the panel door, defrost door and floor door actuators.



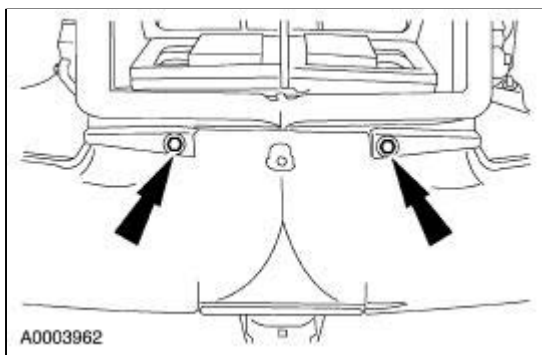
6. Disconnect the two air discharge temperature sensors from the plenum chamber.



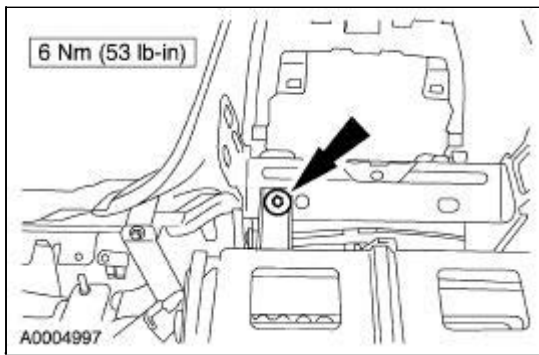
7. Remove the screws.



8. Remove the screws.



9. Remove the screw.



10. Remove the plenum chamber.
 11. If a new plenum chamber is to be installed, transfer the mode door actuators from the old unit to the new unit. For additional information, refer to [Section 412-04](#).
 12. If a new plenum chamber is to be installed, transfer the venturi cap from the old unit to the new unit.
 13. To install, reverse the removal procedure.
-

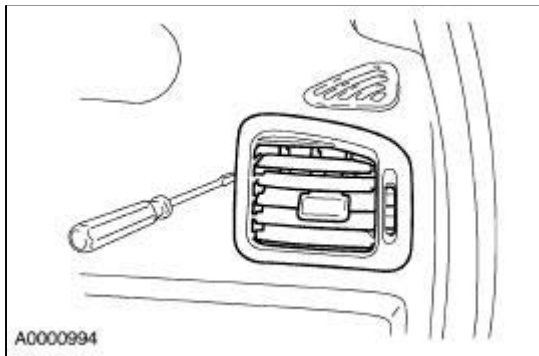
Instrument Panel Air Distribution Ducts

Disassembly and Assembly

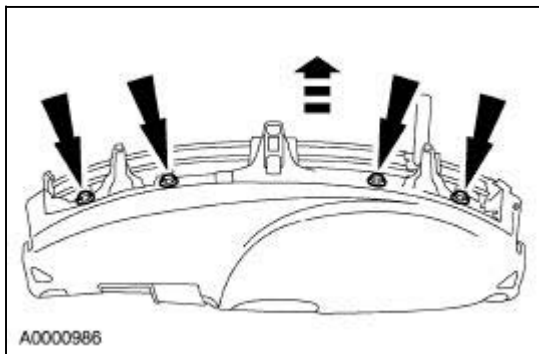
1. **NOTE:** RH register shown LH similar.

Remove the LH and RH panel registers.

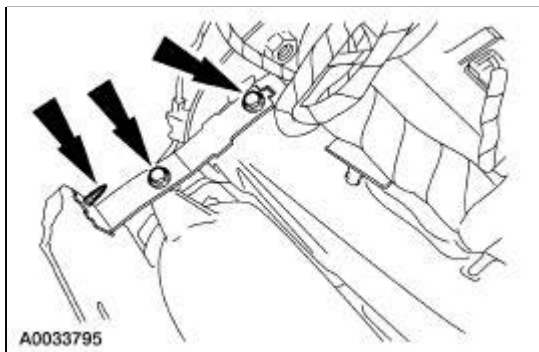
- Depress the inboard side tab with a flat blade tool. Pull the register rearward, depress the outboard tab and remove the register.



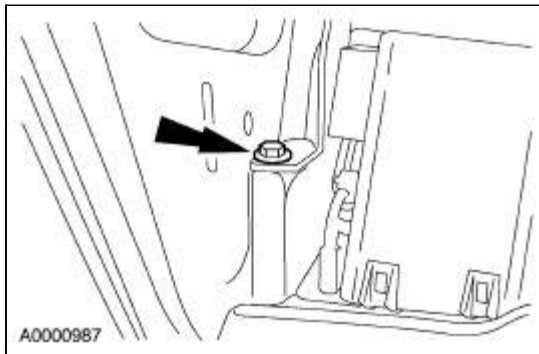
2. Remove the plenum chamber. For additional information, refer to [Plenum Chamber](#) in this section.
3. Remove the screws and remove the defroster duct.



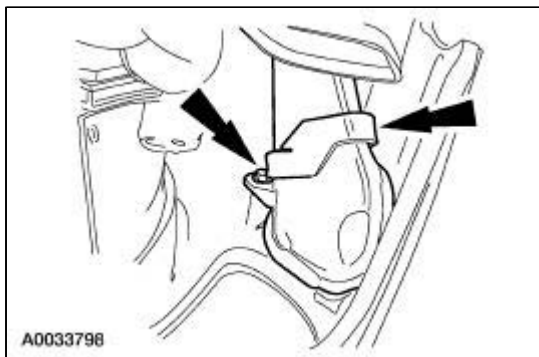
4. Remove the screws and remove the driver side support brace.



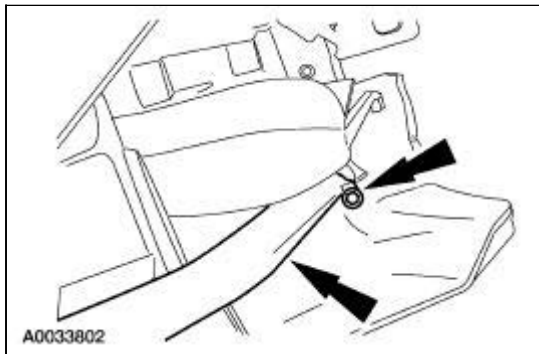
5. Remove the screw and position the driver side panel duct away from the driver side demister duct screw.



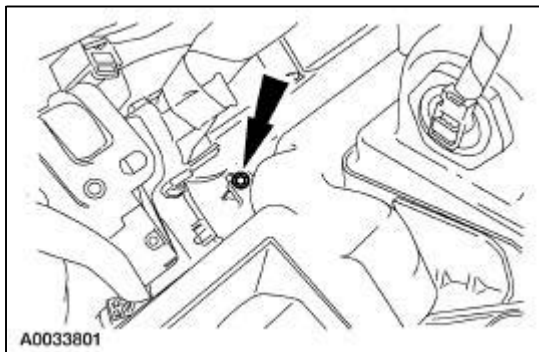
6. Remove the driver side demister duct screw and remove the driver side demister duct.



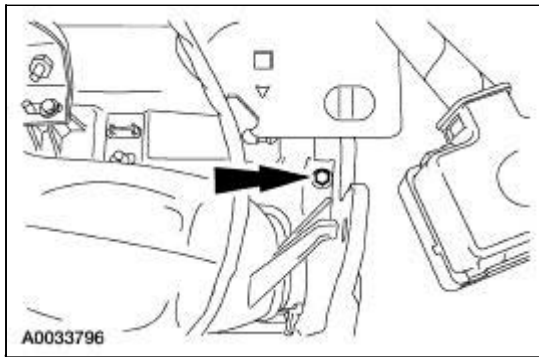
7. Remove the passenger side demister duct screw and remove the passenger side demister duct.



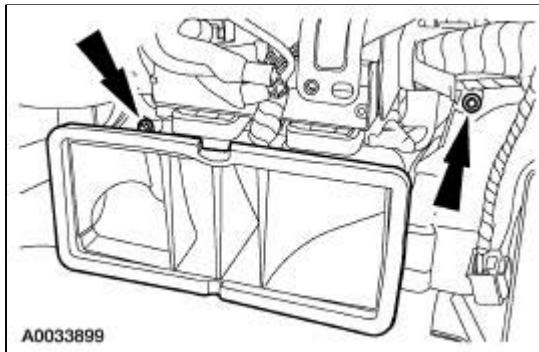
8. Remove the passenger side panel duct inner screw.



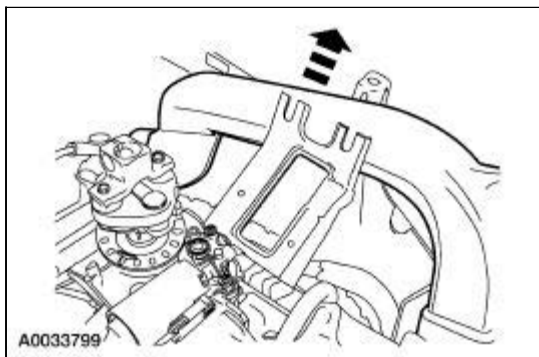
9. Remove the passenger side panel duct outer screw.



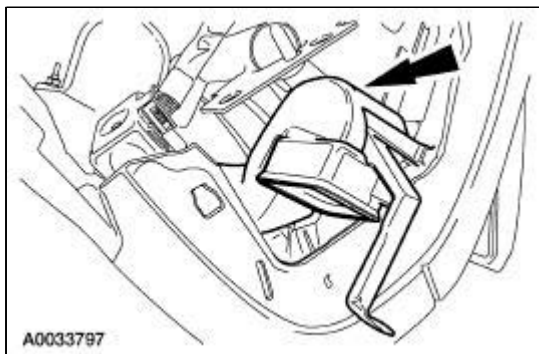
10. Remove the screws and remove the center panel duct.



11. Remove the driver side panel duct.



12. Rotate and pull the panel duct through the opening in the side of the instrument panel.



13. To assemble, reverse the disassembly procedure.
-

General Specifications

Item	Specification
Lubricants	
MERPOL®	ESE-M99B144-B
PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C)	WSH-M1C231-B
Refrigerant	
R-134a Refrigerant YN-19	WSH-M17B19-A
Capacity kg (oz)	0.79 (28)

Torque Specifications

Description	Nm	lb-in
Evaporator housing mounting nuts	7	62
Cowl top attachment bolt	7	62
Coolant valve mounting bracket bolts	9	80
Coolant valve assembly mounting bolts	9	80
Auxiliary coolant pump mounting bolts	6	53
Rear hose assembly mounting bolt	9	80
Forward heater hose mounting bolt	9	80
Evaporator housing attachment bolt	5	44

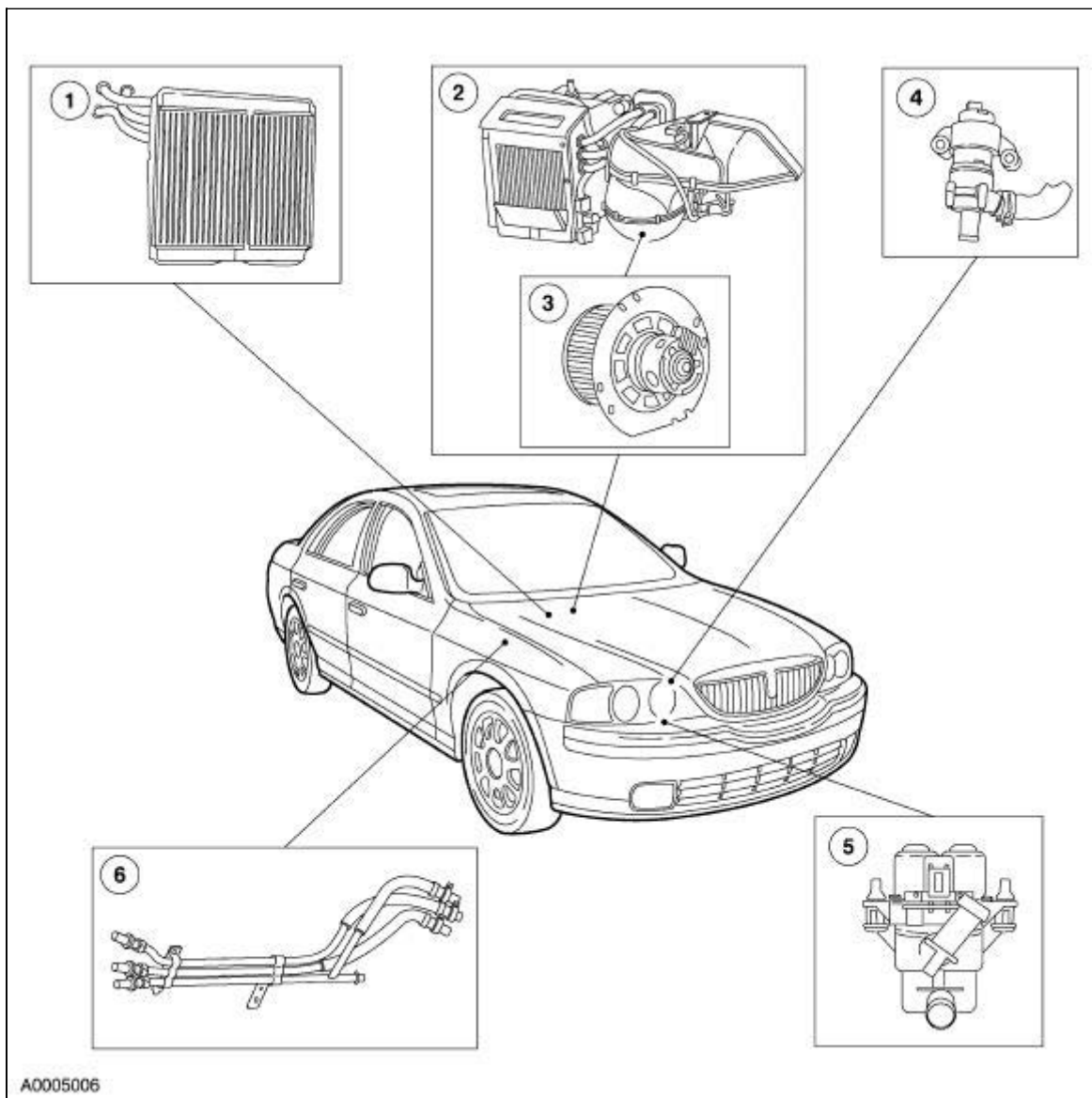
Heating and Ventilation

The heating and defrosting system:

- controls the vehicle air temperature and, during A/C operation, reduces the relative humidity of the air inside the vehicle.
- delivers heated or cooled air to maintain the vehicle interior temperature and comfort level.
- controls the A/C blower motor speed.
- allows temperature to be adjusted individually by the driver and the passenger to maintain comfort.
- uses a reheat method to provide conditioned air to the passenger compartment. All airflow from the blower motor passes through the A/C evaporator core (19860) and the heater core (18476). Temperature is regulated by reheating the air out of the evaporator core to achieve the desired temperature.
- controls the air temperature by regulating the flow of engine coolant to separate halves of the heater core. A dual solenoid actuated valve is used to control the flow of coolant.

The blower motor (19805) draws outside air through the air inlet filter and duct or draws recirculated air through the recirculated air duct.

Component Locations



A0005006

Item	Part Number	Description
1	18476	Heater core
2	19850	A/C evaporator housing
3	19805	Blower motor
4	18D473	Auxiliary coolant flow pump—3.9L only
5	18495	Dual coolant flow valve
6	18C553	Heater water hose assembly — (consists of 18663 and two 18696 hose assemblies)

Heater Core

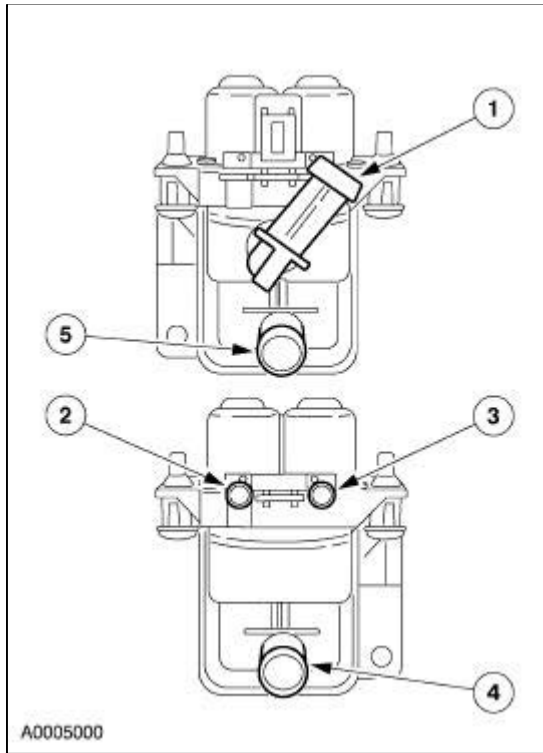
The heater core consists of fins and tubes arranged to extract heat from the engine coolant and transfer it to air passing through the heater core. The heater core is separated into two sections. Air passing through one section is directed to the driver side of the vehicle, while air passing through the other section is directed to the passenger side of the vehicle. The heater core has separate inlet ports with a common outlet port.

Blower Motor

The A/C blower motor (19805) pulls air from the air inlet and forces it into the evaporator housing and plenum assembly (which is attached to the instrument panel) where it is distributed.

Dual Coolant Control Valve

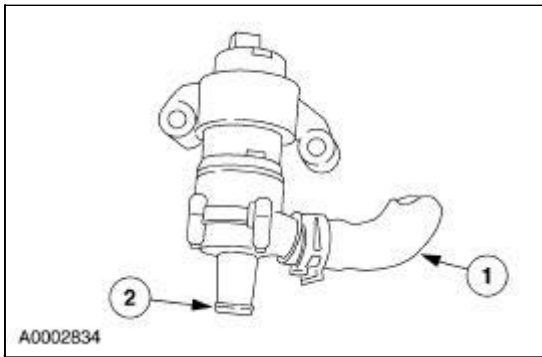
The dual coolant valves regulates the flow of engine coolant to each half of the heater core. Two electric solenoids, which are individually actuated by the DATC module, are the control elements. The valve contains five ports:



Port	Function	Location
1	Inlet—coolant from engine	front face
2	Outlet to heater core, driver side	rear face
3	Outlet to heater core, passenger side	rear face
4	Return coolant from heater core	rear face
5	Outlet—return to engine	front face

Auxiliary Water Pump—3.9L Engine

The auxiliary water pump is electrically driven and provides increased coolant flow during low engine speed operation. The pump is also used to circulate coolant after the engine is turned off under certain conditions.

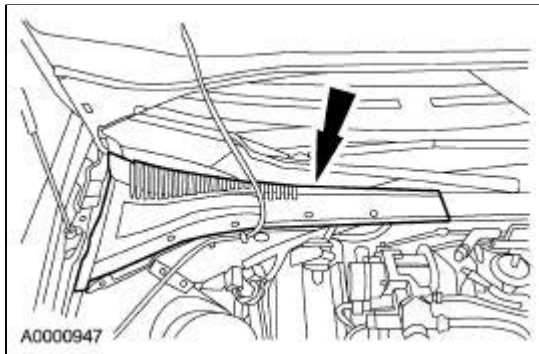


Port	Description
1	Inlet from engine
2	Outlet to coolant valve

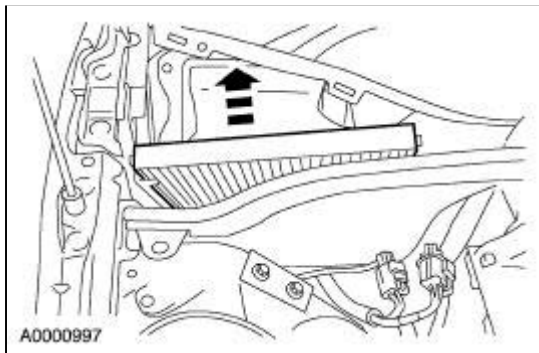
Heater Hose

Removal

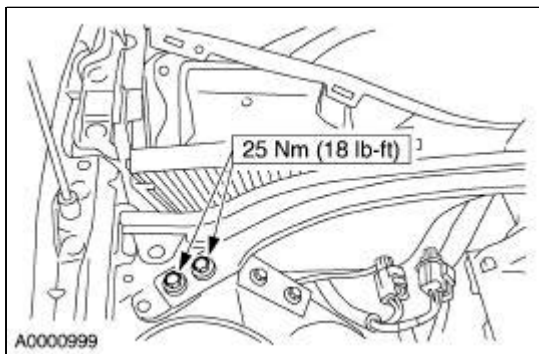
1. Drain the radiator. For additional information, refer to [Section 303-03](#).
2. Remove the throttle body air intake tube. For additional information, refer to [Section 303-12](#).
3. Remove the RH cowl cover.



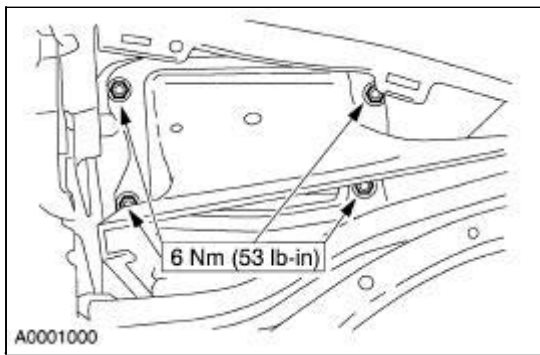
4. Push on the RH corner of the filter to release the clip. Release the LH clip and remove the cabin air filter.



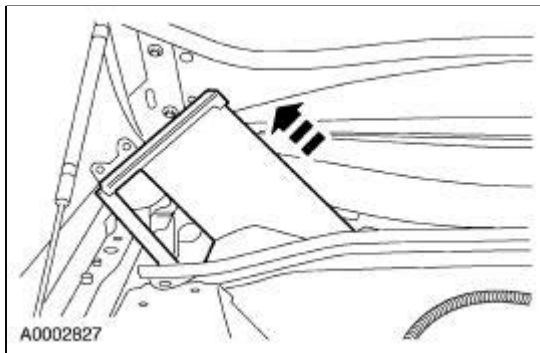
5. Remove the seven bolts and remove the cross-vehicle support.



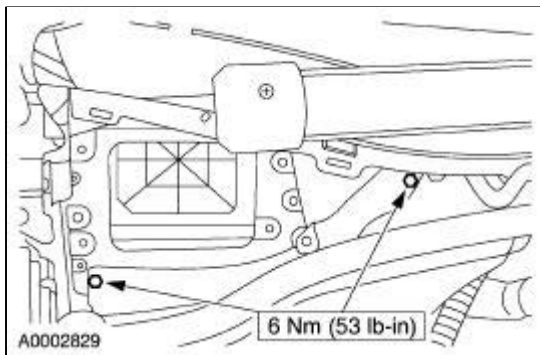
6. Remove the bolts.



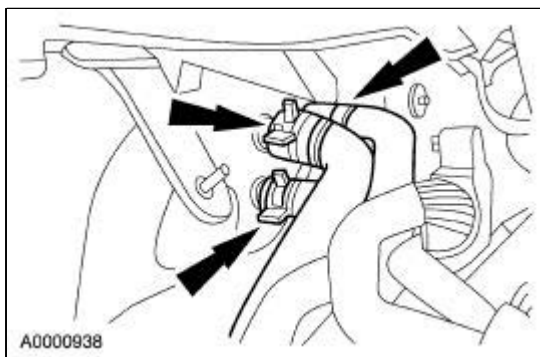
7. Remove the cabin air filter housing by lifting the outboard side then removing the housing.



8. Remove the three bolts and remove the plenum panel.



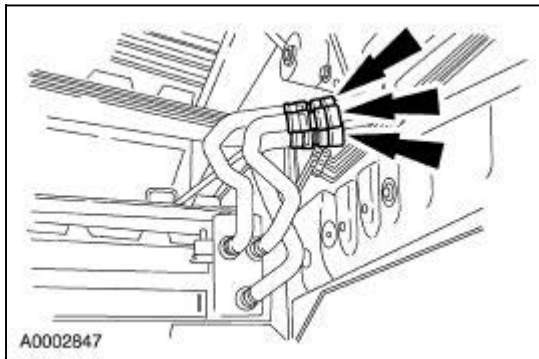
9. Disconnect the heater hoses from the heater core.



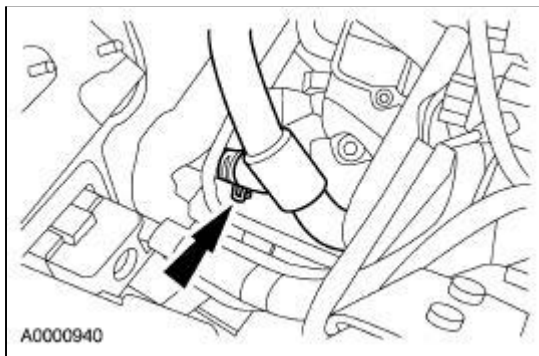
10. **NOTE:** The top heater hose has a green identifying mark to match the hose on the dual coolant flow valve. If the marking is not visible, make sure to mark the hoses for location prior to disconnecting the couplings. This will aid in the correct installation of the hose assemblies.

NOTE: Hose connections shown with components removed for clarity.

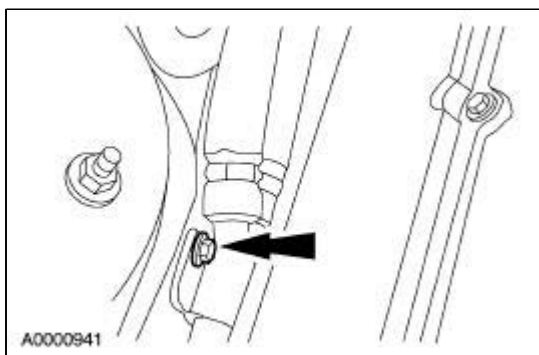
Disconnect the three quick-disconnect couplings from the coolant control valve hoses. For additional information, refer to [Section 412-00](#).



11. Disconnect the coolant recovery line.



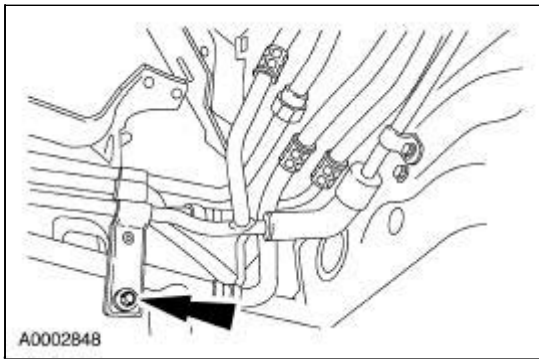
12. Remove the forward heater hose mounting bolt at the RH shock tower.



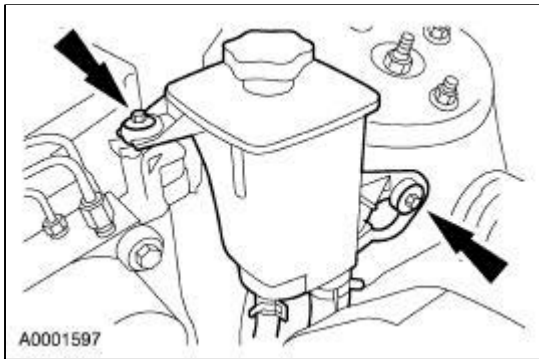
13. Raise the vehicle. For additional information, refer to [Section 100-02](#).

14. **NOTE:** View shown with components removed for clarity.

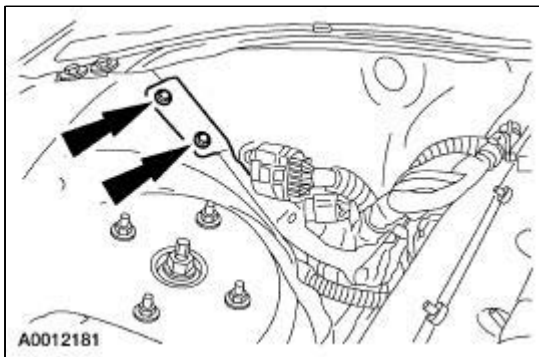
Remove the rear heater hose mounting bolt from the body side.



15. Position the hydraulic cooling fan reservoir aside.

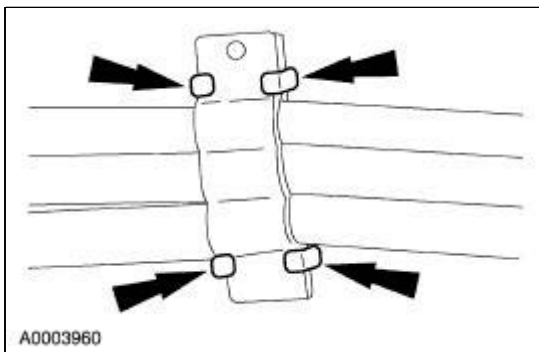


16. Position the PCM wiring harness bracket aside.

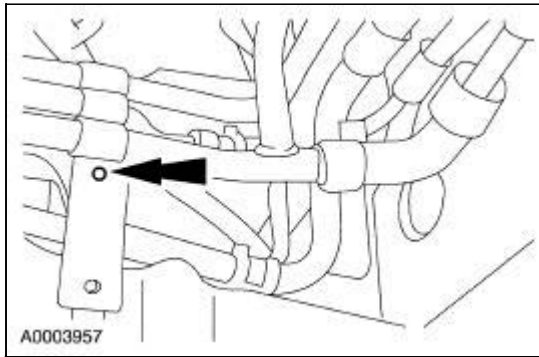


17. Lower the vehicle and remove the heater hose assembly.
18. **NOTE:** Steps 18 and 19 are required only if the heater hose assembly is being separated.

If necessary, remove the crimps and remove the bracket.

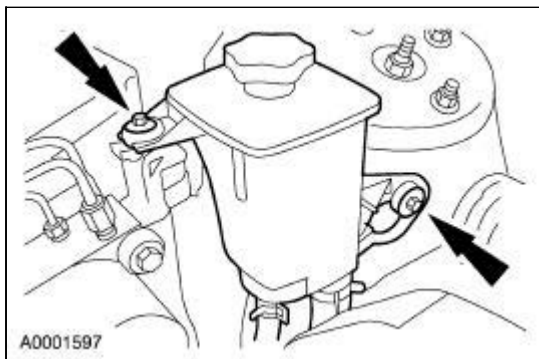


19. If necessary, remove the rivet and remove the bracket.

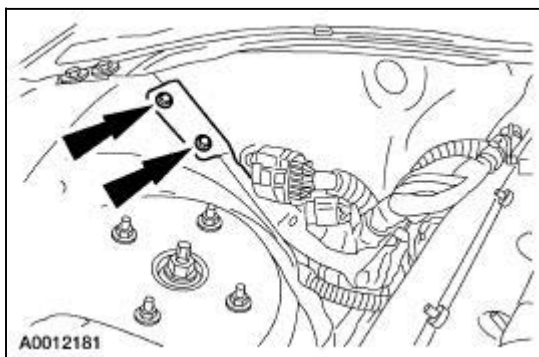


Installation

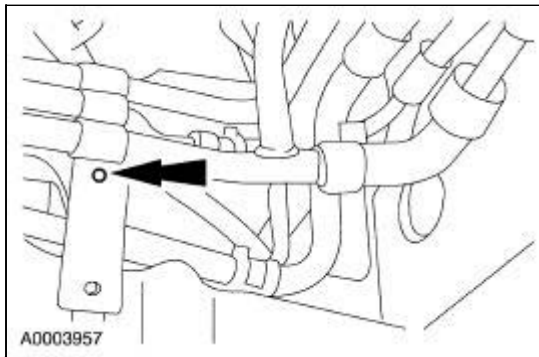
1. Install heater hose assembly.
2. Install the hydraulic cooling fan reservoir.



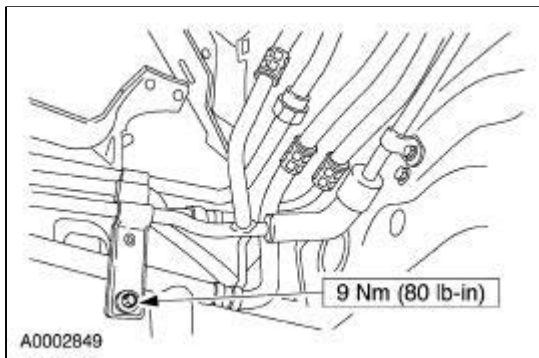
3. Install the PCM wiring harness bracket.



4. **NOTE:** If the hose assembly has been separated, install the bracket removed using a new rivet.
Install the bracket using a new rivet.

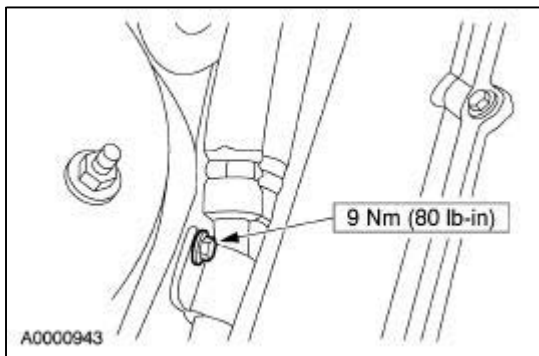


5. Install the rear heater hose mounting bolt.

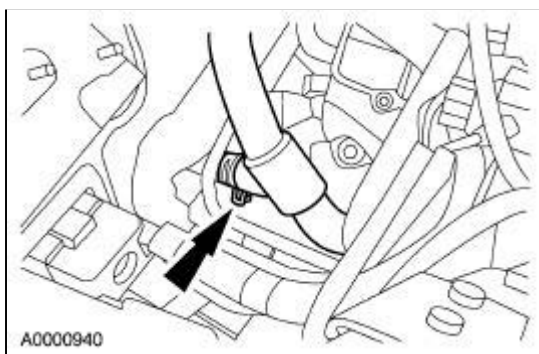


6. **NOTE:** If the hose assembly has been separated, a new bracket must be installed.

Install the forward heater hose mounting bolt.

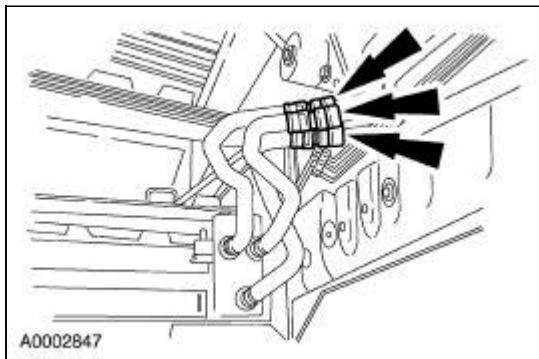


7. Connect the coolant recovery line.

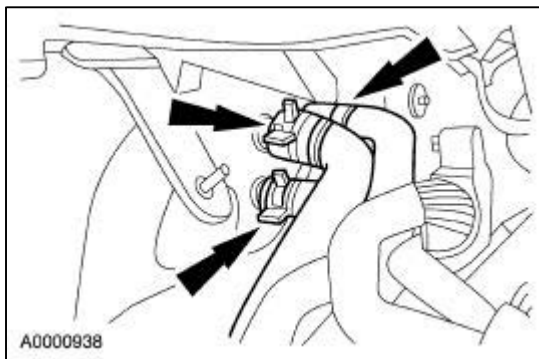


8. Install the couplings.
 - Make sure that the heater hoses are installed in the correct position.

- Lubricate the coolant hoses with MERPOL® meeting Ford specification ESE-M99B144-B or plain water only, if needed.



9. Install the heater hoses at the heater core.
 - Make sure that the heater hoses are installed in the correct position.
 - Lubricate the coolant hoses with MERPOL® meeting Ford specification ESE-M99B144-B or plain water only, if needed.
 - Check for correct hose installation by verifying DATC system operation.

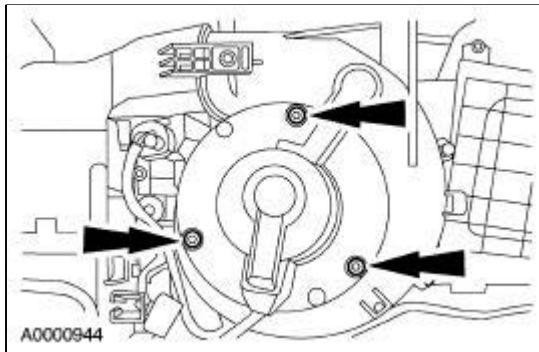


10. Install the cabin air intake plenum.
 11. Install the cabin air filter.
 12. Install the RH cowl cover.
 13. Install the throttle body intake tube.
 14. Fill the cooling system.
-

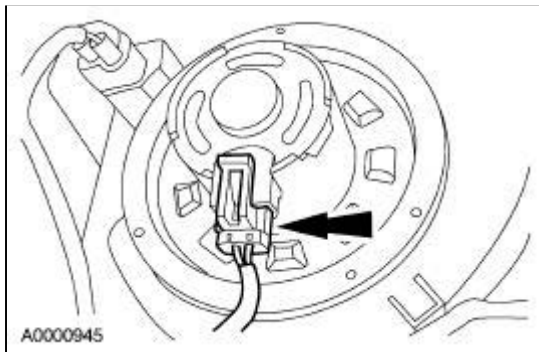
Blower Motor


Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the passenger side floor duct. For additional information, refer to [Section 412-01](#).
3. Remove the screws and remove the cover.



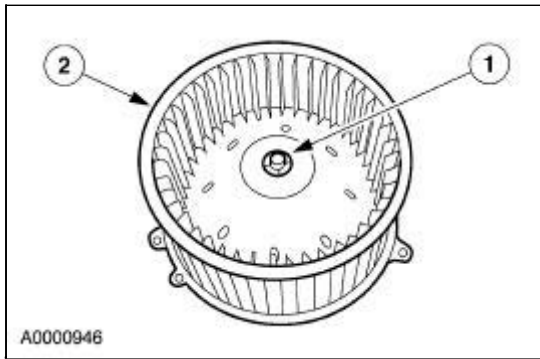
4. Disconnect the connector and remove the blower motor.



5.  **CAUTION:** Prior to removing a wheel that is to be reused, clean any corrosion from the blower motor shaft to prevent damage to the wheel mounting diameter.

Remove the wheel from the blower motor.

1. Remove the push clip.
2. Remove the wheel from the blower motor.



6. **NOTE:** Make sure to install the blower motor cover. It is necessary for correct cooling.

To install, reverse the removal procedure.

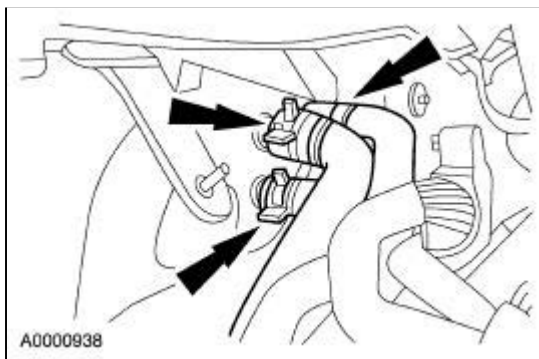
Heater Core And Evaporator Core Housing

Material

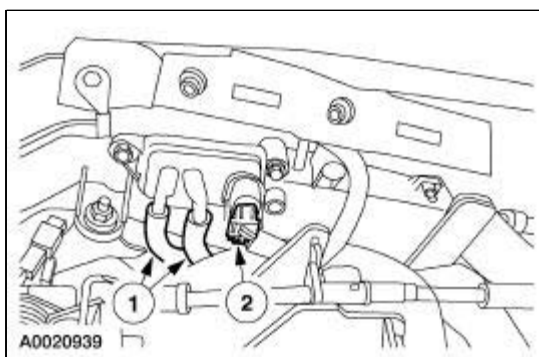
Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C)	WSH-M1C231-B
MERPOL®	ESE-M99B144-B

Removal and Installation

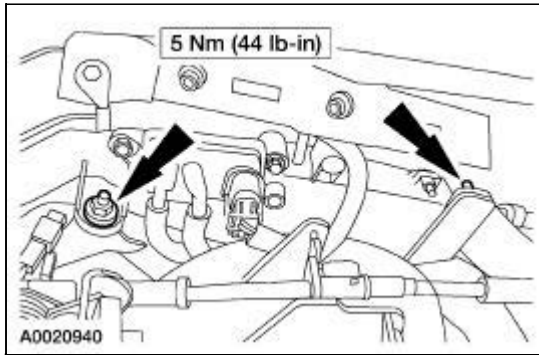
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Recover the refrigerant. For additional information, refer to [Section 412-00](#).
3. Partially drain the cooling system. For additional information, refer to [Section 303-03](#).
4. Remove the fresh air inlet duct. For additional information, refer to [Section 412-01](#).
5. Disconnect the heater hose assembly from the heater core.



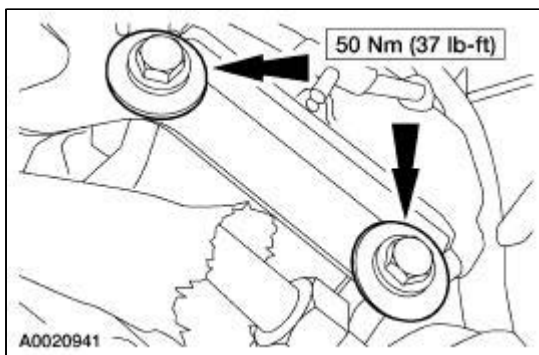
6. Disconnect the differential pressure feedback (DFPE) sensor.
 1. Disconnect the vacuum hoses.
 2. Disconnect the electrical connector.



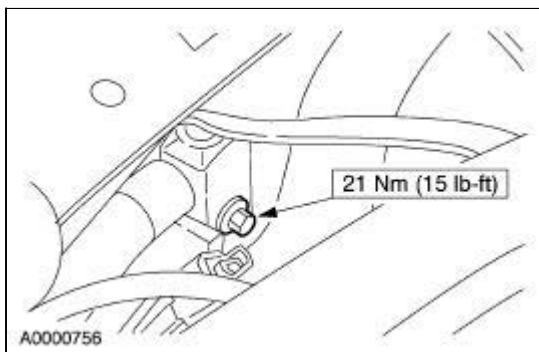
7. Remove the wire harness retaining nuts and position the wiring harness aside.



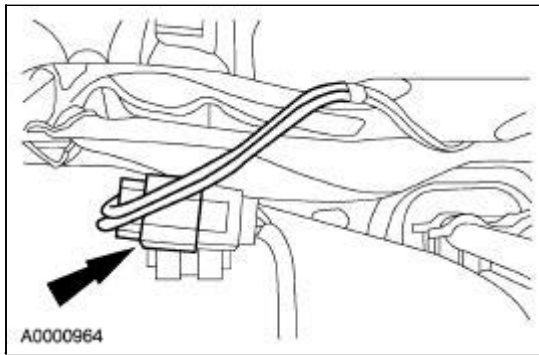
8. Remove the two harness bracket retaining bolts from the RH cylinder head and position the bracket aside.



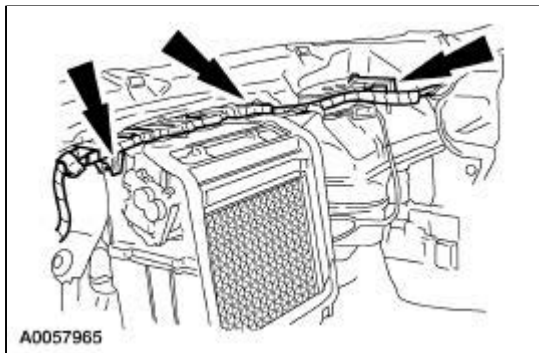
9. Remove the bolt and disconnect the manifold and tube assembly from the thermostatic expansion valve.
 - Discard the O-ring seals.



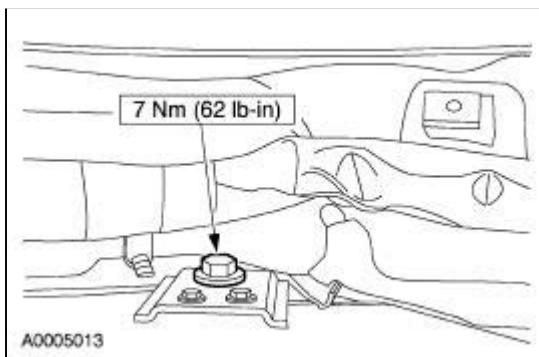
10. Remove the instrument panel. For additional information, refer to [Section 501-12](#).
11. Disconnect the connector located on the top of the evaporator core housing.



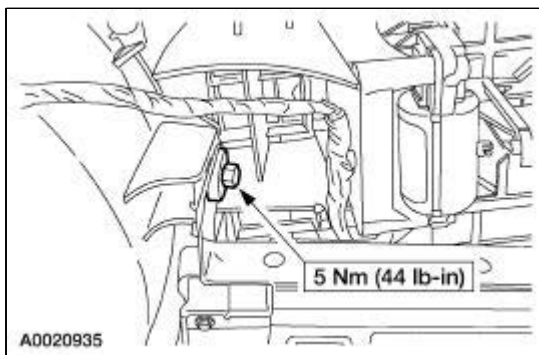
12. Detach and position the wiring harness aside.



13. Remove the cowl top attachment bolt.

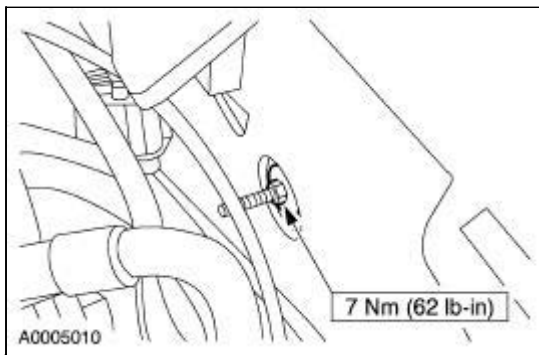


14. Remove the evaporator housing attachment bolt.

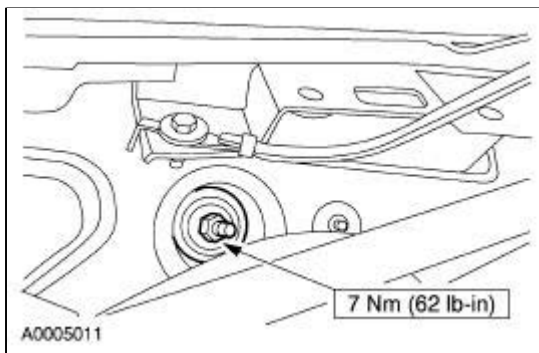


15. **NOTE:** Nut and washer assemblies removed in steps 15 and 16 are located in the engine compartment.

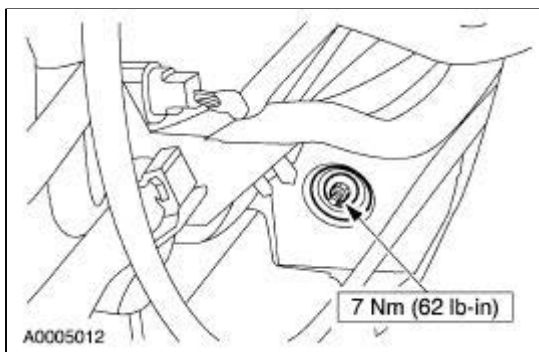
Remove the nut and washer assembly retaining the evaporator housing to the bulkhead.



16. Remove the nut and washer assembly retaining the evaporator housing to the bulkhead.



17. Remove the nut and washer assembly retaining the evaporator housing to the bulkhead.



18. Remove the evaporator core housing.
19. To install, reverse the removal procedure.
- Install new O-ring seals lubricated in clean PAG oil.
 - Clean and lubricate the coolant hoses with coolant hose lubricant or plain water only if needed.
20. Fill the engine coolant level. For additional information, refer to [Section 303-03](#).
21. Evacuate, leak test and charge the refrigerant system. For additional information, refer to [Section 412-00](#).
-

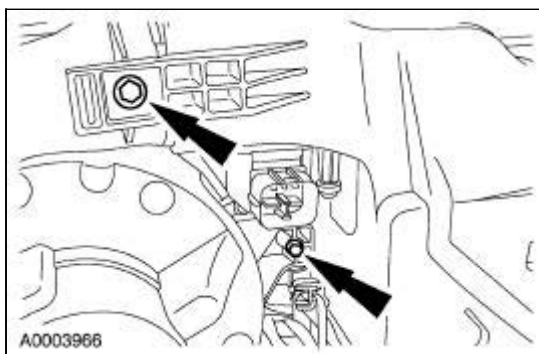
Heater Core

Removal and Installation

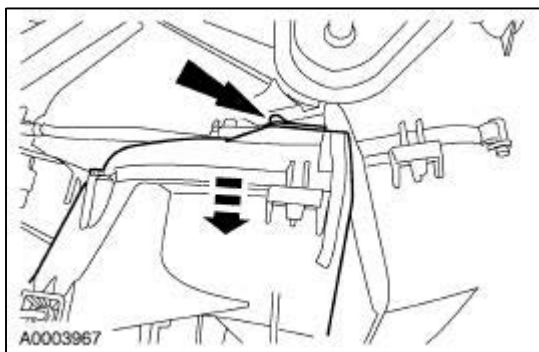
1. **NOTE:** If a leak is suspected, the heater core must be leak tested in the vehicle before removal. For additional information, refer to [Section 412-00](#).

Remove the evaporator core housing. For additional information, refer to [Heater Core And Evaporator Core Housing](#) in this section.

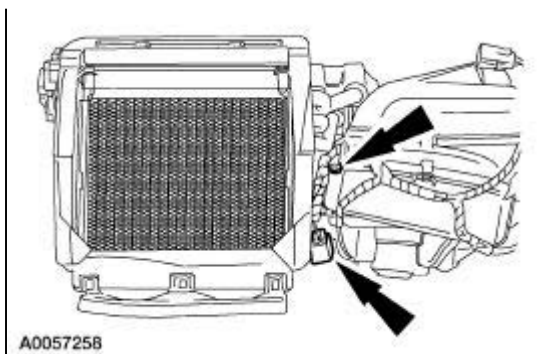
2. Remove the evaporator core housing to air inlet housing screws.



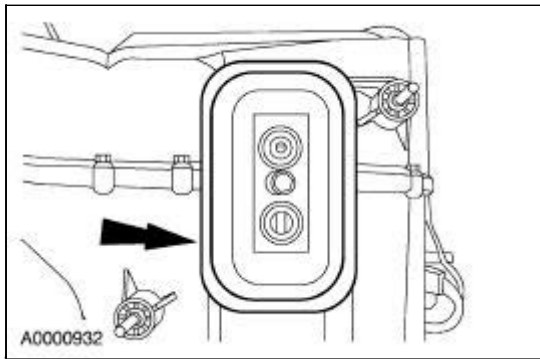
3. Disengage the clip and separate the evaporator core housing from the air inlet housing.



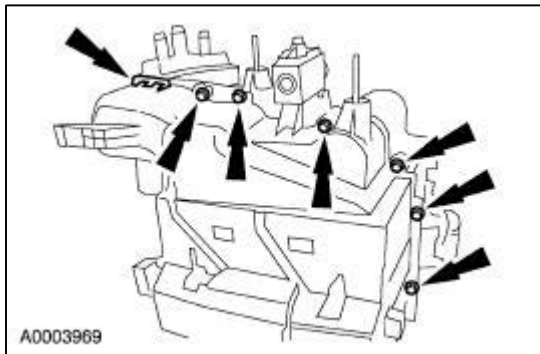
4. Disconnect the evaporator core housing electrical connectors and position the wire harness aside.



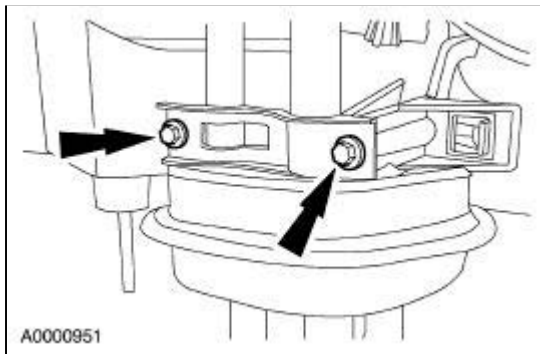
5. Remove the gasket.



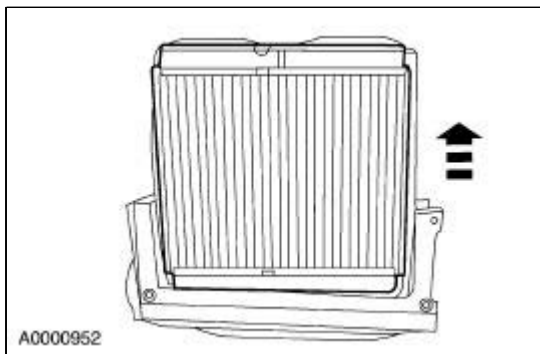
6. Remove the nine screws, disengage the clip and separate the heater core and evaporator core housing.



7. Remove the screws.



8. Remove the heater core.

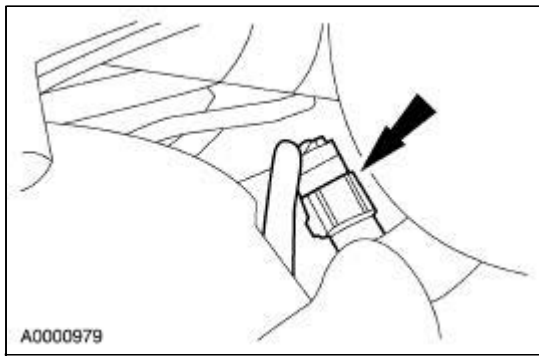


9. Remove the heater core tube gasket.
10. To install, reverse the removal procedure.

Dual Coolant Flow Valve

Removal and Installation

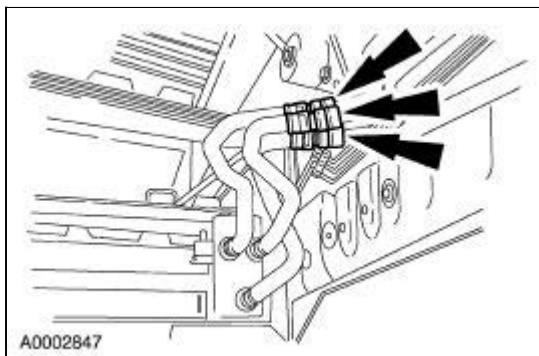
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Drain the radiator. For additional information, refer to [Section 303-03](#).
3. If equipped with 3.9L engine, remove the auxiliary coolant pump. For additional information, refer to [Auxiliary Coolant Flow Pump](#) in this section.
4. Disconnect the connector located at the end of the coolant valve harness pigtail.



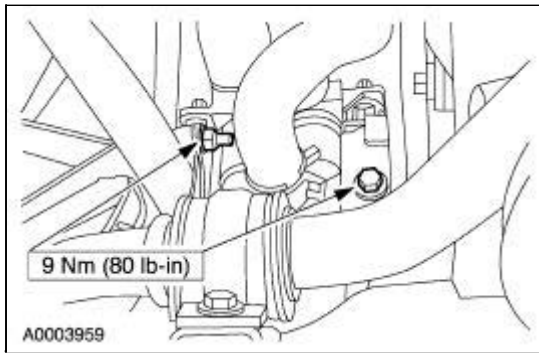
5. **NOTE:** The top heater hose has a green identifying mark to match the hose on the dual coolant flow valve. If mark is not visible, identify the hoses for location. This will aid in the correct installation of the hose assemblies.

NOTE: Hose assemblies shown with components removed for clarity.

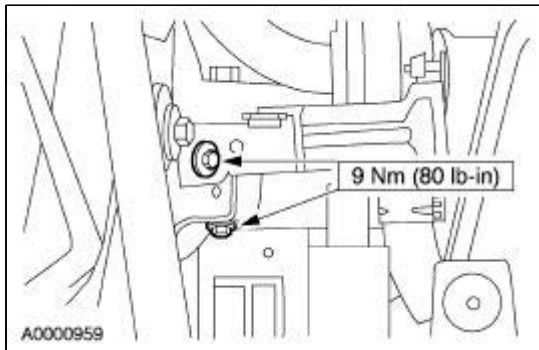
Disconnect the three quick-disconnect couplings from the coolant control valve hoses. For additional information, refer to [Section 412-00](#).



6. Raise the vehicle. For additional information, refer to [Section 100-02](#).
7. Remove the coolant valve assembly mounting bolt and the nut.



8. Raise the valve and disconnect the coolant supply and return lines.
9. Remove the bolts and remove the coolant valve mounting bracket.

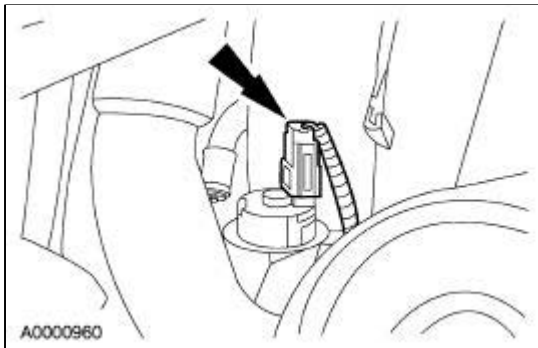


10. To install, reverse the removal procedure.
 - Make sure that the heater hoses are installed in the correct position.
 - Lubricate the coolant hoses with MERPOL® meeting Ford specification ESE-M99B144-B or plain water only, if needed.
 - Check for correct hose installation by verifying DATC system operation.
-

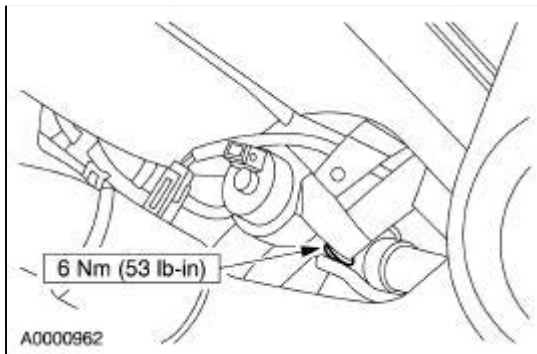
Auxiliary Coolant Flow Pump

Removal and Installation

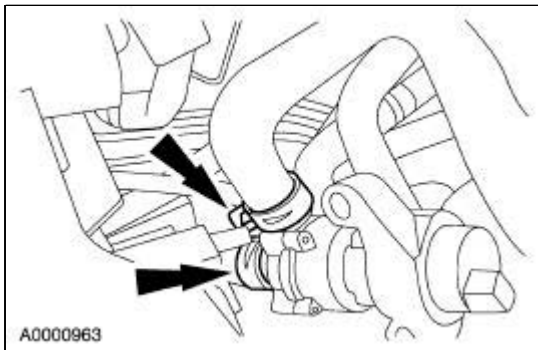
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Drain the radiator. For additional information, refer to [Section 303-03](#).
3. Disconnect the connector.



4. Remove the two auxiliary coolant pump to fan shroud bolts.



5. Disconnect the hoses and remove the pump.



6. To install, reverse the removal procedure.
 - Make sure that the heater hoses are installed in the correct position.
 - Lubricate the coolant hoses with MERPOL® meeting Ford specification ESE-M99B144-B

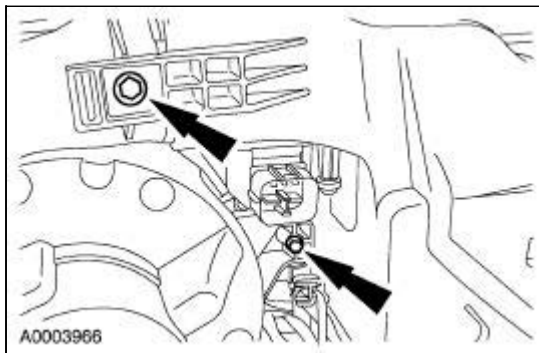
or plain water only, if needed.

- Check for correct hose installation by verifying DATC system operation.
-

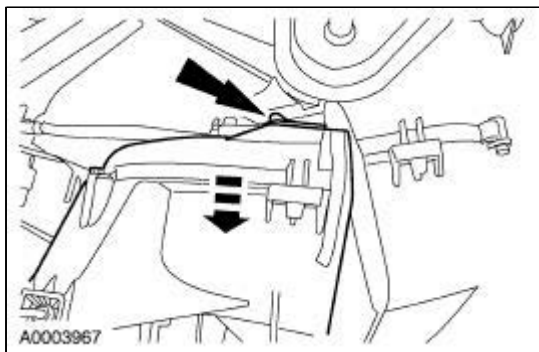
Heater Core And Evaporator Core Housing

Disassembly and Assembly

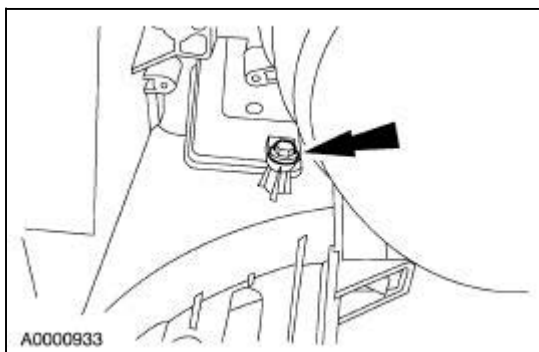
1. Remove the evaporator core housing. For additional information, refer to [Heater Core And Evaporator Core Housing](#) in this section.
2. Remove the evaporator core housing to air inlet housing screws.



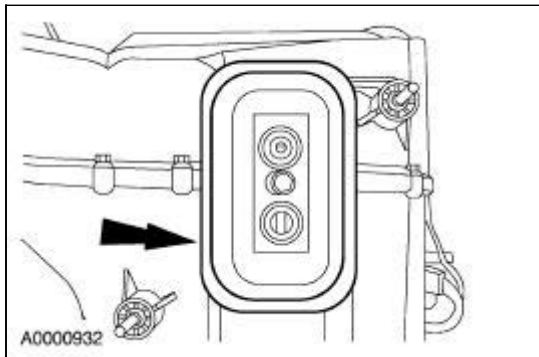
3. Disengage the clip and separate the evaporator core housing from the air inlet housing.



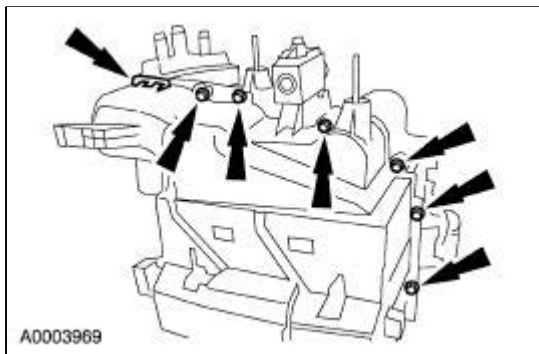
4. Remove the screw and remove the blower motor speed control.



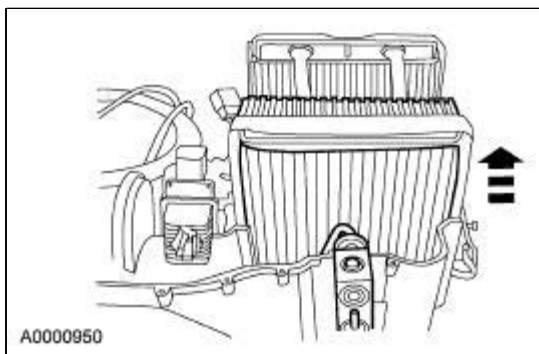
5. Remove the gasket.



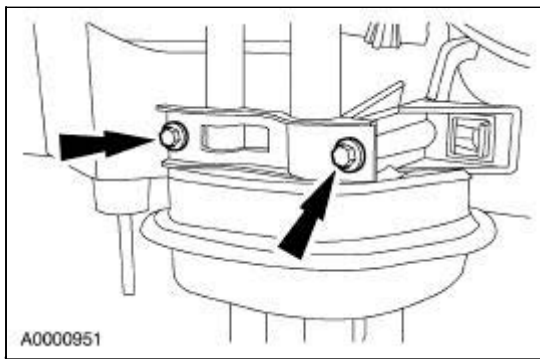
6. Remove the nine screws, disengage the clip and separate the housing.



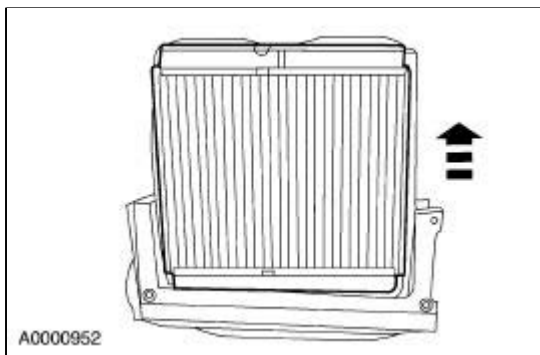
7. If necessary, remove the cold air bypass door actuator. For additional information, refer to [Section 412-04](#).
8. If necessary, remove the evaporator core air discharge temperature sensor. For additional information, refer to [Section 412-04](#).
9. Remove the evaporator core.



10. Disconnect the air bypass door actuator connector and position the harness aside.
11. Remove the screws.



12. Remove the heater core.



13. Remove the blower motor. For additional information, refer to [Blower Motor](#) in this section.
 14. If necessary, remove the air inlet door actuator. For additional information, refer to [Section 412-04](#).
 15. To assemble, reverse the disassembly procedure.
-

General Specifications

Item	Specification
Magnetic Clutch	
Air gap between pulley and clutch plate	0.35-0.75 mm (0.014-0.030 in)
Lubricants	
PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C)	WSH-M1C231-B
MERPOL®	ESE-M99B144-B

Torque Specifications

Description	Nm	lb-ft	lb-in
A/C compressor mounting bolts	25	18	—
A/C compressor manifold and tube retaining bolt	21	15	—
A/C compressor clutch retaining nut	17	13	—
A/C condenser core mounting bolts	10	—	89
Receiver drier mounting bracket clamp bolt	7	—	62
A/C pressure transducer	10	—	89
A/C pressure relief valve	9	—	80
Peanut fitting retaining nut	8	—	71
Thermostatic expansion valve fitting nut	9	—	80
Electrical harness bracket bolts	9	—	80
A/C compressor manifold and tube assembly bracket nut	12	9	—
A/C compressor mounting bracket bolts	50	37	—
TXV fittings	24	18	—
Refrigerant line bracket bolt	9	—	80
TXV mounting bolt	21	15	—
Receiver drier manifold nut	8	—	71

Air Conditioning

The A/C refrigerant system is a clutch cycling, thermostatic expansion valve type. The system components are:

- A/C compressor
- A/C clutch
- A/C condenser core
- A/C evaporator core
- thermostatic expansion valve
- receiver drier
- connecting refrigerant lines

The refrigeration system operation is controlled by the:

- thermostatic expansion valve.
- evaporator discharge temperature sensor.
- A/C compressor pressure relief valve.
- A/C pressure transducer.
- powertrain control module (PCM).
- DATC module.
- ambient temperature sensor.

The refrigerant system incorporates a variable capacity A/C compressor. The A/C compressor clutch engagement is controlled by the vehicle PCM.

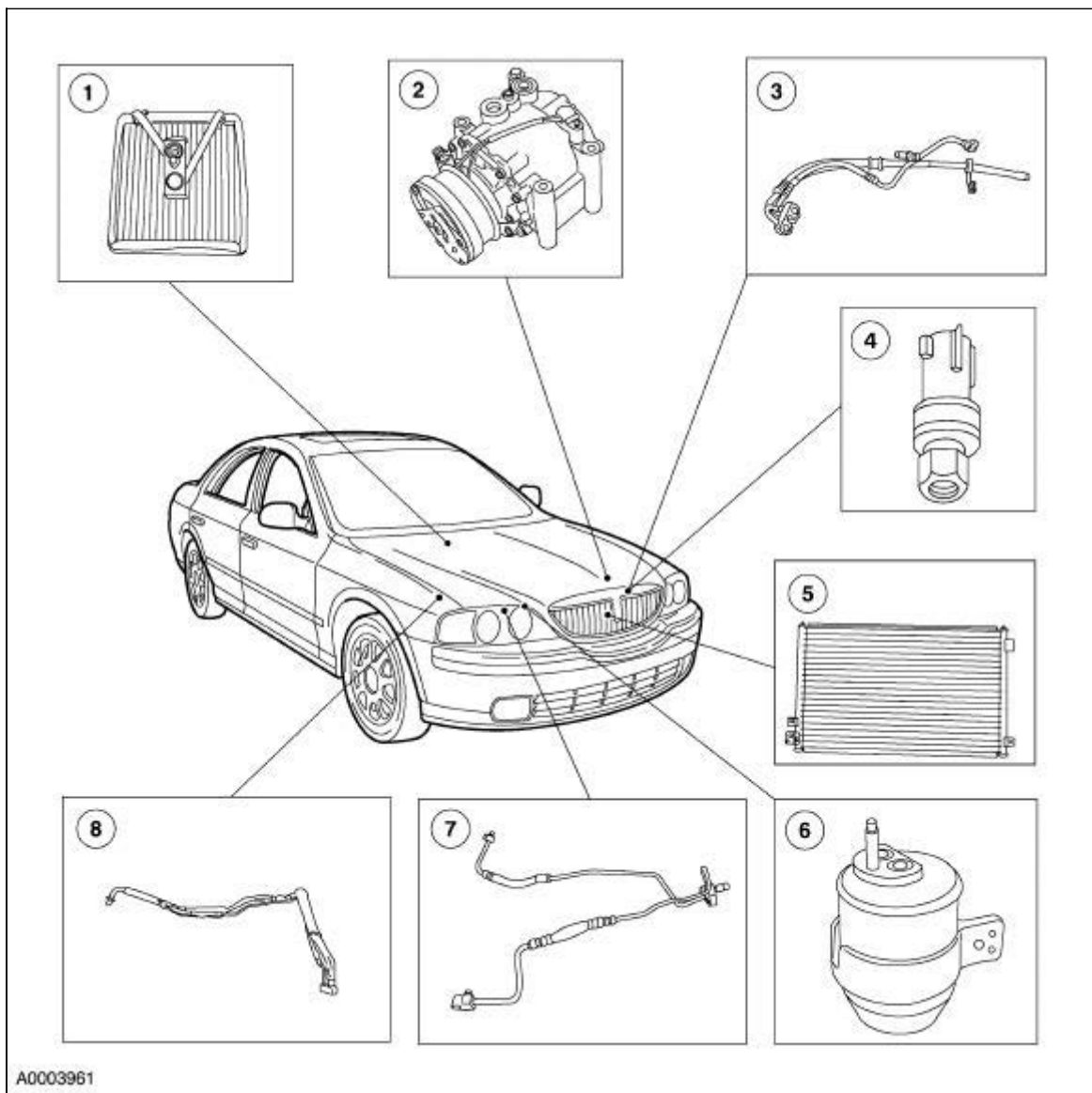
The evaporator discharge temperature sensor senses evaporator discharge temperature. The DATC module monitors the evaporator discharge temperature sensor and communicates with the PCM to control clutch cycling. The DATC also monitors the ambient air temperature sensor and disables A/C operation when the ambient air temperature is below 0°C (32°F).

The A/C pressure transducer is located in the compressor discharge line and is monitored by the PCM. If high or low refrigerant pressures are experienced, the PCM will interrupt A/C compressor operation.

The pressure relief valve is installed in the compressor manifold and tube assembly and protects the system from excessively high refrigerant pressure.

The thermostatic expansion valve, which is mounted to the evaporator core inlet and outlet tubes, contains an adjustable orifice which provides the restriction that separates the high and low pressure liquid phases in the refrigeration system.

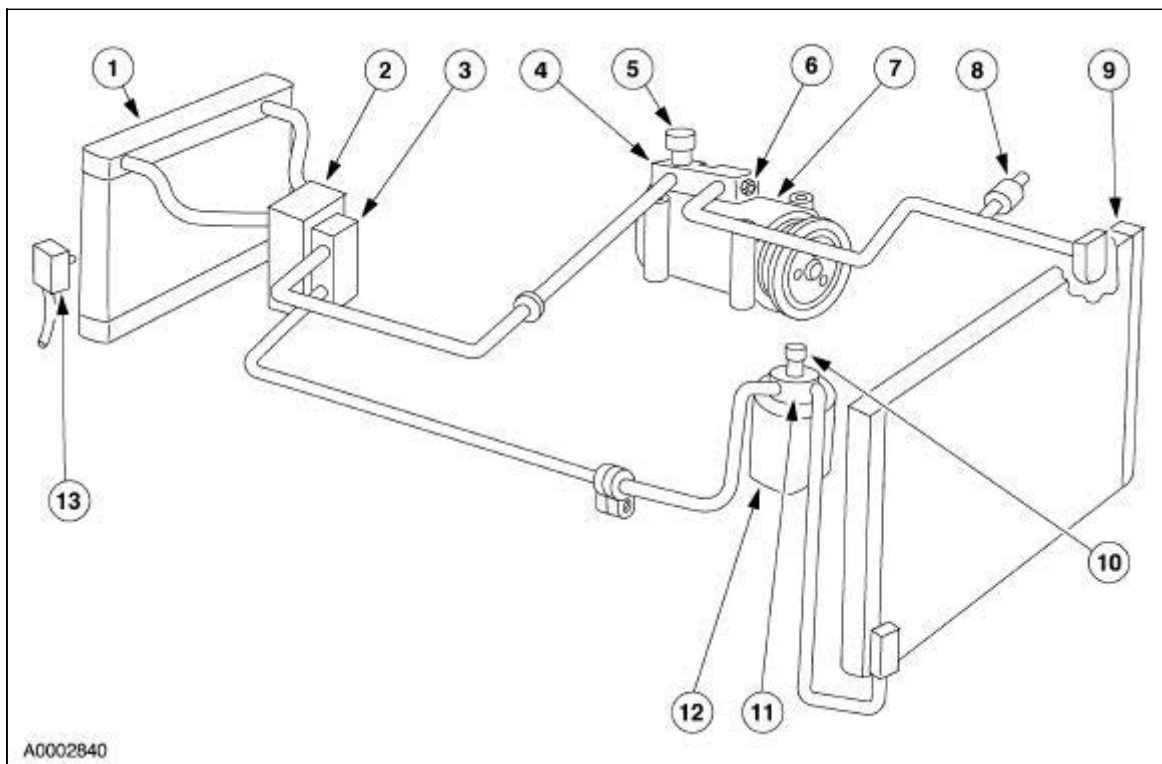
Component Locations



A0003961

Item	Part Number	Description
1	19860	A/C evaporator core
2	19D629	A/C compressor and clutch assembly
3	19D850	Manifold and tube assembly—A/C compressor
4	19D594	A/C pressure transducer
5	19712	A/C condenser core
6	19959	Receiver drier
7	19N585	Manifold and tube assembly—receiver drier
8	19A834	Manifold and tube assembly—thermal expansion valve

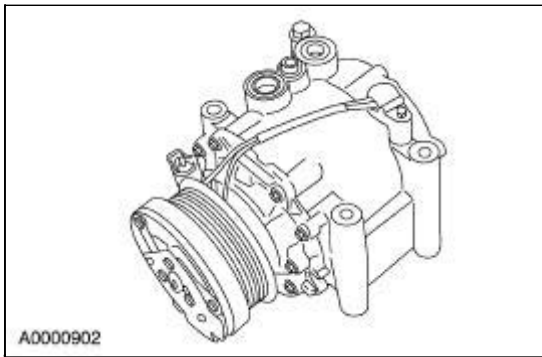
Refrigeration System Components



A0002840

Item	Part Number	Description
1	19860	A/C evaporator core
2	19849	Thermostatic expansion valve
3	19A834	Manifold and tube assembly—thermostatic expansion valve
4	19D850	Manifold and tube assembly—A/C compressor
5	19E762	A/C charge port valve (low side)
6	19E762	A/C pressure relief valve
7	19703	A/C compressor
8	19D594	A/C pressure transducer
9	19712	A/C condenser core
10	19D701	A/C charge port valve (high side)
11	19N585	Manifold and tube assembly—receiver drier
12	19959	Receiver drier
13	19C734	Sensor—evaporator air discharge temperature

A/C Compressor and Clutch Assembly



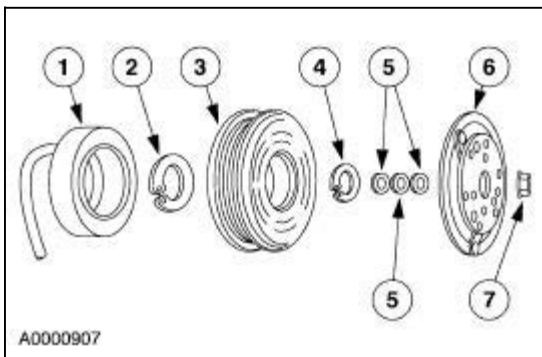
NOTE: Internal A/C compressor components are not serviced separately. The A/C scroll compressor is serviced only as an assembly. The A/C clutch, A/C clutch pulley and the A/C clutch field coil are serviceable.

The Ford Variable Scroll A/C compressor (SC90V) has the following characteristics:

- A variable capacity function controlled by a suction pressure sensing device.
- A fixed and orbiting scroll to provide refrigerant compression.
- A non-serviceable shaft seal.
- The A/C compressor uses PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B. This oil contains special additives necessary for the A/C compressor.

The A/C compressor contains a thermal cutout switch which senses the compressor housing temperature. The switch will disengage the A/C compressor clutch if the housing temperature exceeds 120°C (247°F).

SC90V A/C compressors used on the six and eight cylinder engines are not interchangeable.



Item	Part Number	Description
1	19D798	A/C clutch field coil
2	W704579-S301	Field coil snap ring
3	19D784	A/C clutch pulley
4	W701742-S301	Pulley snap ring
5	19D648	A/C clutch hub spacer
6	19D786	A/C clutch
7	W704577-S301	A/C clutch nut

The SC90V magnetic A/C clutch has the following characteristics:

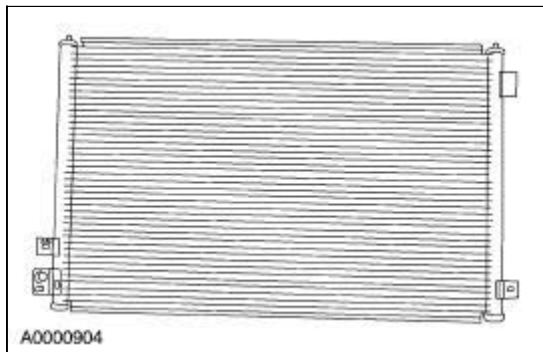
- It drives the compressor shaft.
- When battery positive voltage (B+) is applied to the A/C clutch field coil, the clutch disc and hub assembly is drawn toward the A/C clutch pulley.
- The magnetic force locks the clutch disc and hub assembly and the A/C clutch pulley together as one unit, causing the compressor shaft to rotate.
- When B+ is removed from the A/C clutch field coil, springs in the clutch disc and hub assembly move the clutch disc away from the A/C clutch pulley.

A/C Compressor Pressure Relief Valve

An A/C compressor pressure relief valve is incorporated into the compressor A/C manifold and tube to:

- relieve unusually high refrigerant system discharge pressure buildups. For specifications regarding operating pressure(s), refer to [Section 412-00](#).
- prevent damage to the A/C compressor and other system components.
- avoid total refrigerant loss by closing after the excessive pressure has been relieved.

A/C Condenser Core



The A/C condenser core has the following characteristics:

- It is an aluminum fin and tube design heat exchanger located in front of the vehicle radiator (8005).
- It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat and by condensing gas to liquid refrigerant as it is cooled.

Refrigerant Lines

The manifold and tube assembly-receiver drier carries the high pressure liquid from the condenser core to the receiver drier, and from the receiver drier to the manifold and tube assembly-thermostatic expansion valve. It attaches to the A/C receiver drier, uses O-ring seals, and also contains the high pressure service port.

The manifold and tube assembly-thermostatic expansion valve carries high pressure liquid to the thermostatic expansion valve and low pressure gas from the thermostatic expansion valve to the manifold and tube assembly-A/C compressor.

The manifold and tube assembly-A/C compressor carries the high pressure gas from the A/C compressor to the condenser core. It also carries the low pressure gas received from the manifold and tube assembly-thermostatic expansion valve to the A/C compressor. The A/C manifold and tube assembly is attached to the A/C compressor, uses O-ring seals, and has:

- a Schrader-type valve stem core fitting used to mount the A/C pressure transducer so that the A/C pressure transducer can be removed without discharging the A/C system.
- a serviceable high pressure relief valve.

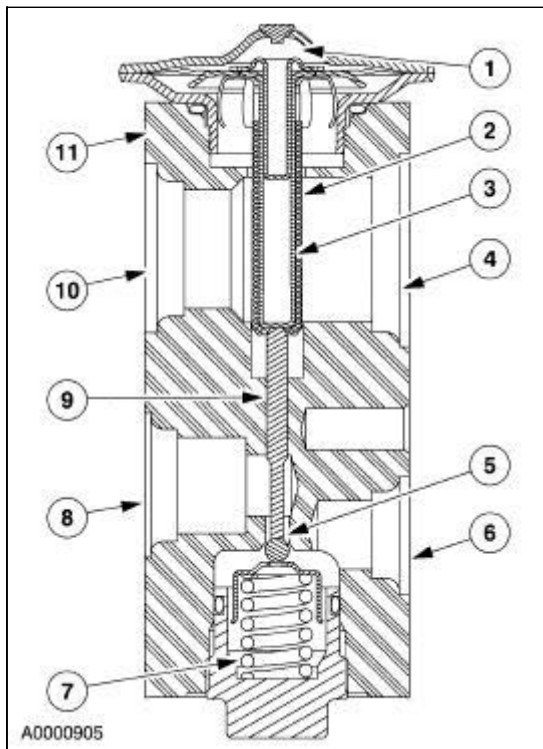
The manifold and tube assembly-A/C compressor used on the V6 and V8 engines are not interchangeable.

A/C Evaporator Core

The A/C evaporator core is the plate/fin type with a unique refrigerant flow path.

- A mixture of refrigerant and oil exits the thermostatic expansion valve (TXV) and enters the evaporator tank area through the 1/2 inch (12.7 mm) tube.
- The tank area is divided into three sections: front inlet, front outlet and rear tank.
- The refrigerant enters the evaporator core tank area at the front inlet, flows down through the core and up the back side in a "U-flow" pattern.
- The refrigerant moves into the rear tank area and across to the other half of the core. The refrigerant moves down through the core and back up the front side of the core to the front outlet tank area.
- The refrigerant at this point is in a gaseous state. It exits the evaporator through the 5/8 inch (15.9 mm) tube then passes through the TXV.

A/C Thermostatic Expansion Valve



Item	Description
1	Sensing bulb
2	Insulator
3	Hollow core pin-type retainer
4	Outlet port—low pressure liquid
5	Metering orifice
6	Inlet port—high pressure liquid
7	Spring
8	Evaporator inlet port—low pressure liquid
9	Pin
10	Evaporator outlet port—low pressure gas
11	Housing

The thermostatic expansion valve has the following characteristics:

- It is mounted on the A/C evaporator core inlet and outlet tubes.
- It is a block-type valve.
- It contains an internal sensing bulb to increase the effectiveness of temperature sensing.
- It is not serviceable. A new thermostatic expansion valve must be installed as a unit.

Receiver Drier

The receiver drier is mounted to the engine fan shroud to the right of the vehicle center. The inlet tube of the receiver drier attaches directly to the A/C condenser core and the outlet tube of the receiver drier attaches to the thermostatic expansion valve inlet line.

The receiver drier stores high pressure liquid after it leaves the condenser core. A desiccant bag mounted in the receiver drier removes any retained moisture.

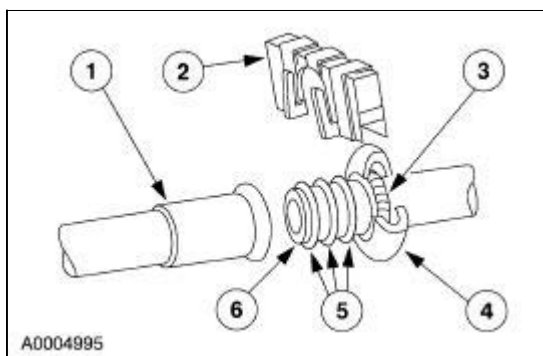
The manifold and tube assembly that mounts to the top of the receiver drier contains the high pressure service port for the refrigerant system.

A/C Pressure Transducer

The A/C pressure transducer monitors the compressor discharge pressure and communicates with the powertrain control module (PCM). The PCM will interrupt A/C compressor operation in the event that the A/C pressure transducer indicates high system discharge pressures. It is also used to sense no or low charge conditions. If the pressure is below a predetermined value for a given ambient temperature, the PCM will not allow the clutch to engage.

- The A/C pressure transducer is mounted on a Schrader valve-type fitting on the A/C compressor to condenser discharge line.
- A valve depressor, located inside the threaded end of the A/C pressure transducer, presses on the Schrader valve stem and allows the A/C pressure transducer to monitor the compressor discharge pressure.
- When the compressor discharge pressure rises, the PCM will interrupt the A/C compressor clutch coil circuit and disengage the A/C compressor. When the pressure drops, the PCM will enable the A/C compressor circuit. For specifications regarding operating pressure(s), refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
- It is not necessary to discharge the refrigerant system to remove the A/C pressure cut-off switch.

Spring Lock Coupling



Item	Part Number	Description
1	—	Female fitting
2	19E746	A/C tube lock coupling clip
3	19E576	A/C tube lock coupling spring
4	—	Cage
5	—	O-ring seals
6	—	Male fitting

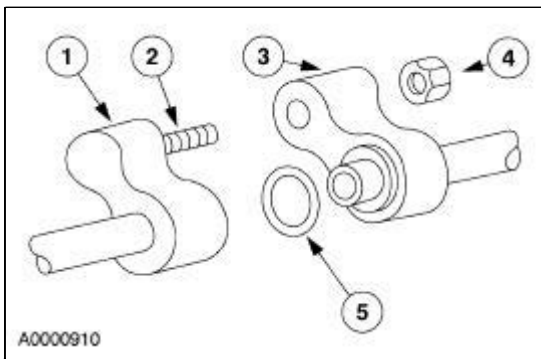
The spring lock coupling is a refrigerant line coupling held together by a garter spring inside a circular cage. The spring lock coupling is used to connect the A/C compressor manifold and tube assembly (inlet) to the TXV manifold and tube assembly (outlet).

- When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting.
- The garter spring and cage then prevent the flared end of the female fitting from pulling out of the cage.
- Three O-ring seals are used to seal between the thermostatic expansion valve outlet tube and the compressor inlet tube. All other couplings have two O-ring seals.
- Use only the O-ring seals listed in the Ford Master Parts Catalog for the spring lock coupling.
- An A/C tube lock coupling clip is used to secure the coupling.

Peanut Fitting

The A/C condenser core and the connection between the receiver drier manifold assembly (outlet) and the TXV manifold and tube assembly (inlet) use the peanut-shaped refrigerant fittings instead of spring lock couplings.

- The male and female blocks of the peanut fitting are retained with a nut.
- An O-ring seal is installed around the tube on the male block.
- When correctly assembled, the male and female fittings should be flush.
- Use only the O-ring seals listed in the Ford Master Parts Catalog for the peanut fitting.

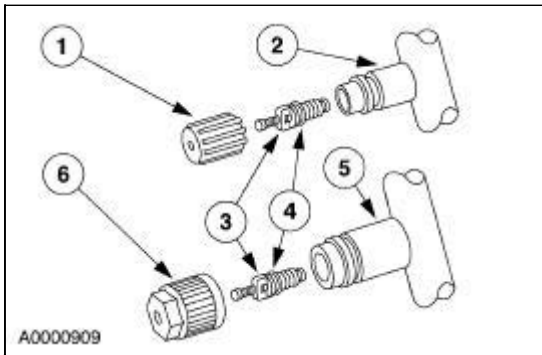


Item	Part Number	Description
1	—	Female block (part of tube assembly)
2	W701890-S426	Stud (part of female block)
3	—	Male block (part of 19712)
4	W520413-S301	Nut
5	—	O-ring seal

Service Gauge Port Valves

The high-pressure service gauge port valve is located on the A/C receiver drier manifold and tube assembly.

The low pressure service gauge port valve is located on the manifold of the A/C compressor manifold and tube assembly at the A/C compressor.



Item	Part Number	Description
1	19D702	A/C charging valve cap
2	—	Low pressure service gauge port valve
3	19D701	Schrader-type valve
4	—	O-ring seal (part of 19D701)
5	—	High pressure service gauge port valve
6	19D702	A/C charging valve cap

The fitting is an integral part of the refrigeration line or component.

- Special couplings are necessary for both the high side and low side service gauge ports.
- A new Schrader-type valve core can be installed if the seal leaks.
- Always install the A/C charging valve cap on the service gauge port valves after repairing the refrigerant system.

Air Conditioning

Refer to Section 412-00 .

Air Conditioning (A/C) Compressor —3.0L

Removal and Installation

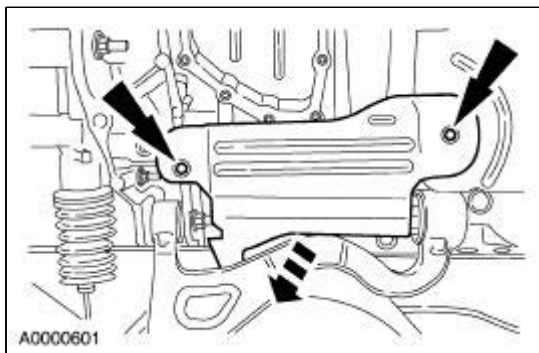


CAUTION: If installing a new air conditioning compressor due to an internal failure of the old unit, you must carry out the following procedures to remove contamination from the air conditioning system.

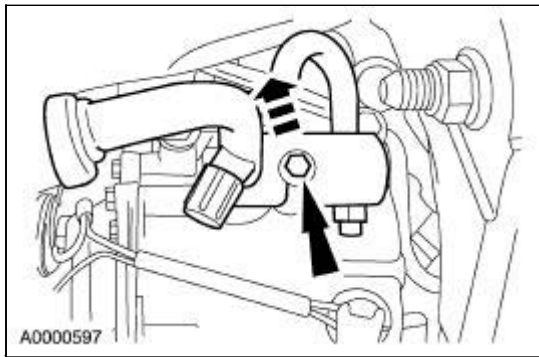
- If A/C flushing equipment is available, carry out the flushing of the air conditioning system prior to installing a new air conditioning compressor. For additional information, refer to [Section 412-00](#).
- If A/C flushing equipment is not available, carry out filtering of the air conditioning system after a new air conditioning compressor has been installed. For additional information, refer to [Section 412-00](#).
- Install a new thermostatic expansion valve, as directed by the A/C flushing or filtering procedure.
- Install a new receiver/drier, as directed by the A/C flushing or filtering procedure.

NOTE: Installation of a new receiver/drier is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

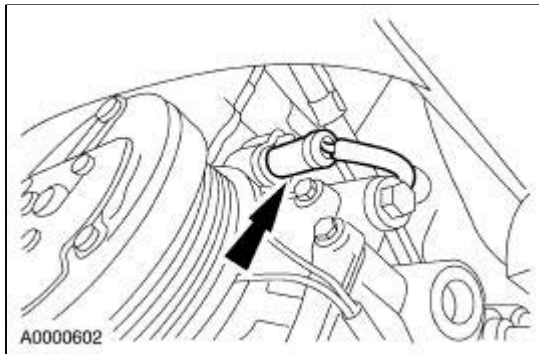
1. If flushing of the air conditioning system has not been performed, recover the refrigerant. For additional information, refer to [Section 412-00](#).
2. Remove the drive belt from the A/C clutch pulley.
3. Raise the vehicle. For additional information, refer to [Section 100-02](#).
4. Remove the screws and remove the sight shield.



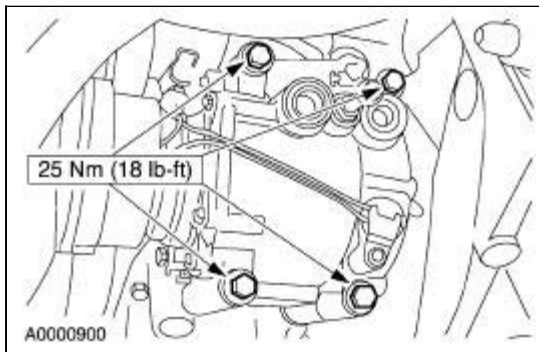
5. Remove the bolt and reposition the A/C manifold and tube assembly.



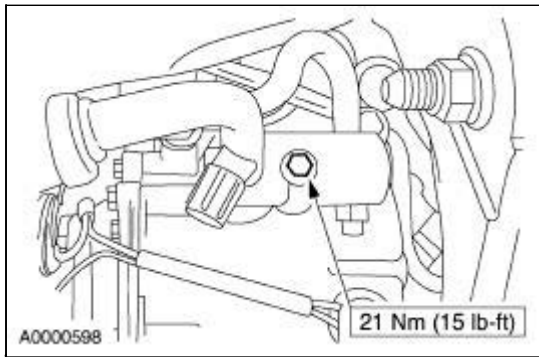
6. Disconnect the connector.



7. Remove the bolts and lower the A/C compressor.



8. To install, reverse the removal procedure.
 - If filtering of the refrigerant system is not to be performed, add the correct amount of PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B to the new A/C compressor. For additional information, refer to [Section 412-00](#).
 - Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.



9. If filtering of the refrigerant system is not to be performed, evacuate, charge and leak test the refrigerant system. For additional information, refer to [Section 412-00](#).
-

Air Conditioning (A/C) Compressor —3.9L

Removal and Installation

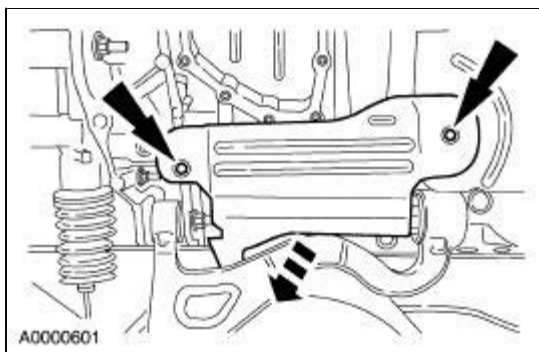


CAUTION: If installing a new air conditioning compressor due to an internal failure of the old unit, you must carry out the following procedures to remove contamination from the air conditioning system.

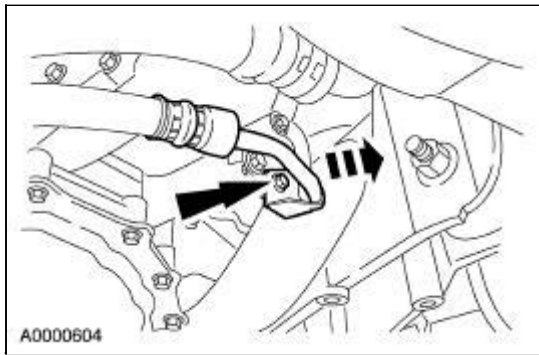
- If A/C flushing equipment is available, carry out the flushing of the air conditioning system prior to installing a new air conditioning compressor. For additional information, refer to [Section 412-00](#).
- If A/C flushing equipment is not available, carry out filtering of the air conditioning system after a new air conditioning compressor has been installed. For additional information, refer to [Section 412-00](#).
- Install a new thermostatic expansion valve, as directed by the A/C flushing or filtering procedure.
- Install a new receiver/drier, as directed by the A/C flushing or filtering procedure.

NOTE: Installation of a new receiver/drier is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

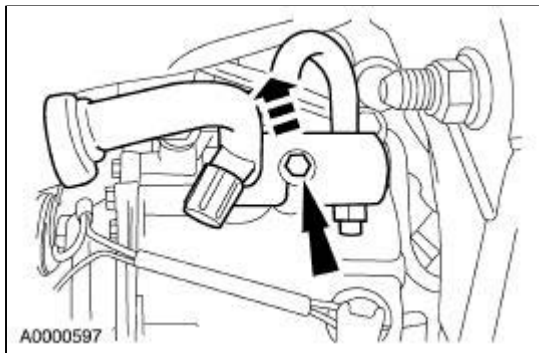
1. If flushing of the air conditioning system has not been performed, recover the refrigerant. For additional information, refer to [Section 412-00](#).
2. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
3. Remove the drive belt from the A/C clutch pulley.
4. Raise the vehicle. For additional information, refer to [Section 100-02](#).
5. Remove the screws and remove the sight shield.



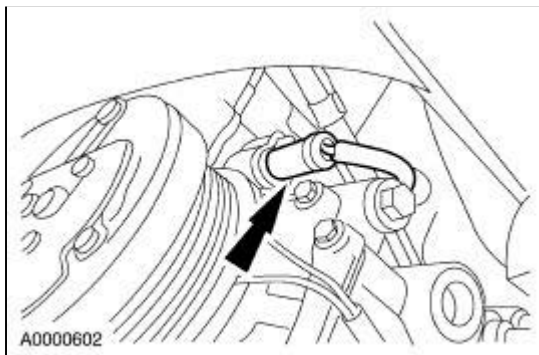
6. Remove the screw and position the power steering hose aside.



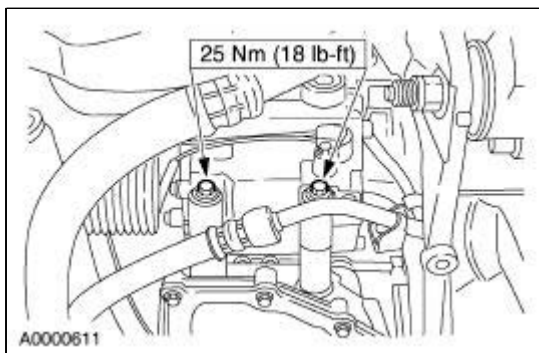
7. Remove the bolt and reposition the A/C manifold and tube assembly.



8. Disconnect the connector.



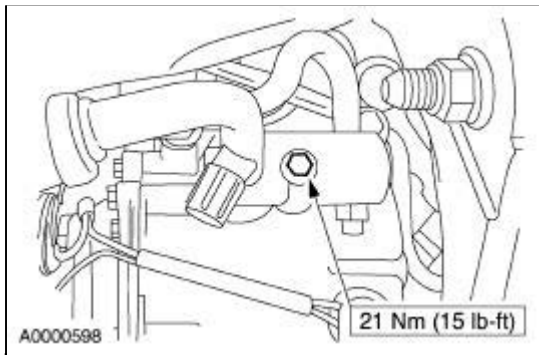
9. Remove the three bolts and lower the A/C compressor.



10. To install, reverse the removal procedure.
 - If filtering of the refrigerant system is not to be performed, add the correct amount of PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B to the new A/C compressor. For

additional information, refer to [Section 412-00](#) .

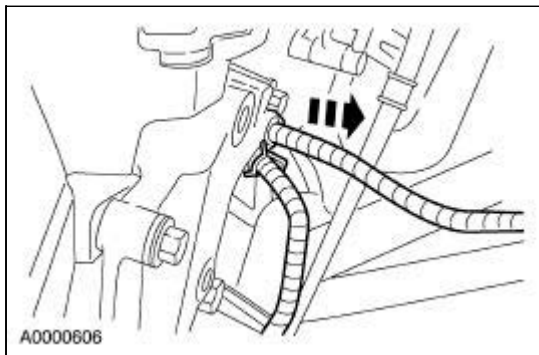
- Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.



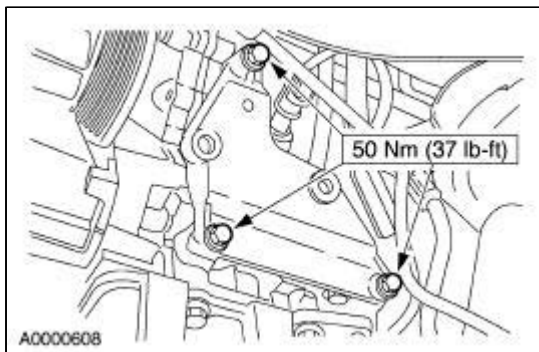
Air Conditioning (A/C) Compressor Bracket —3.0L

Removal and Installation

1. Remove the A/C compressor. For additional information, refer to [Air Conditioning \(A/C\) Compressor—3.0L](#) in this section.
2. Disengage the wire harness pin-type retainer.




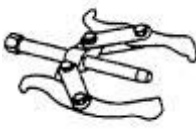
3. Remove the bolts and remove the bracket.



4. To install, reverse the removal procedure.
-

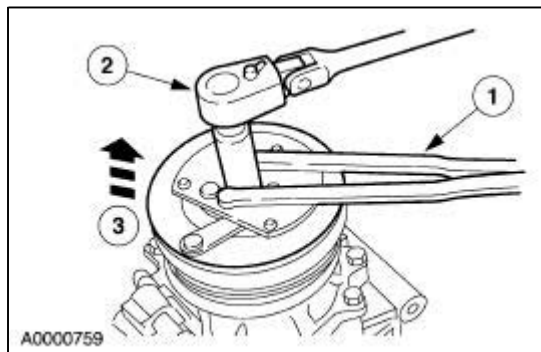
Clutch and Clutch Field Coil

Special Tool(s)

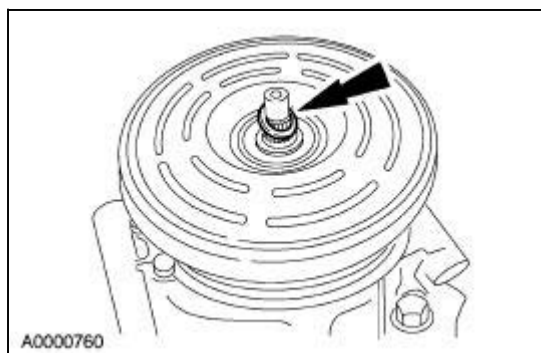
 <p>ST1233-A</p>	Installer, A/C Compressor Clutch Pulley 412-109 (T97P-19D786-A)
 <p>ST1220-A</p>	Remover, Differential Bearing 205-116 (T77F-4220-B1)

Removal

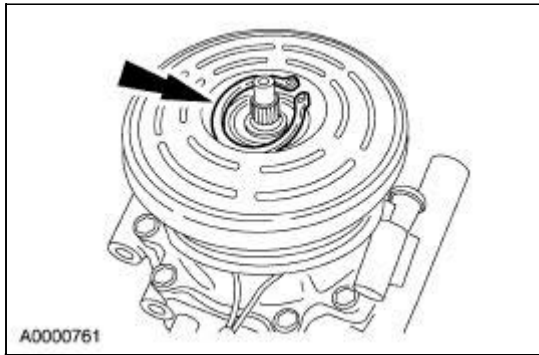
1. Remove the A/C compressor. For additional information, refer to [Air Conditioning \(A/C\) Compressor—3.0L](#) or [Air Conditioning \(A/C\) Compressor—3.9L](#) in this section.
2. Remove the A/C clutch.
 1. Hold the A/C clutch hub.
 2. Remove the nut.
 3. Remove the A/C disk and hub.



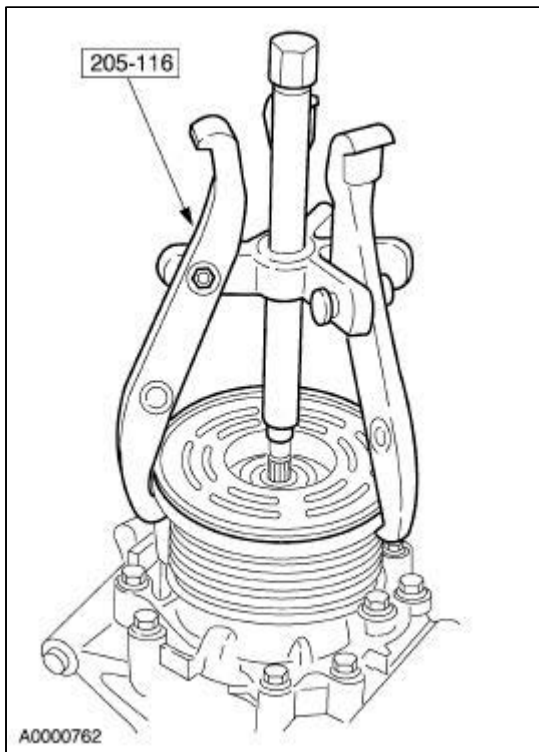
3. Remove the spacer.



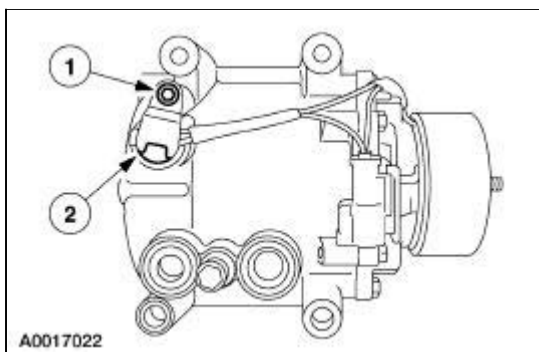
4. Remove the pulley snap ring.



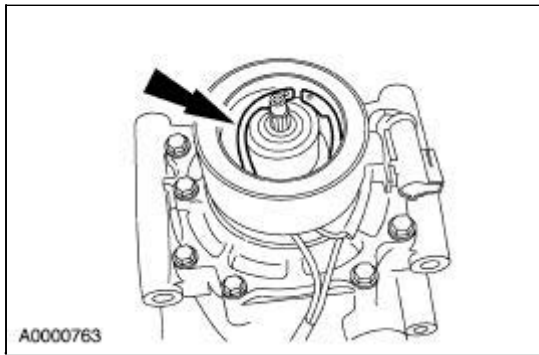
5. Using the special tool, remove the A/C clutch pulley.



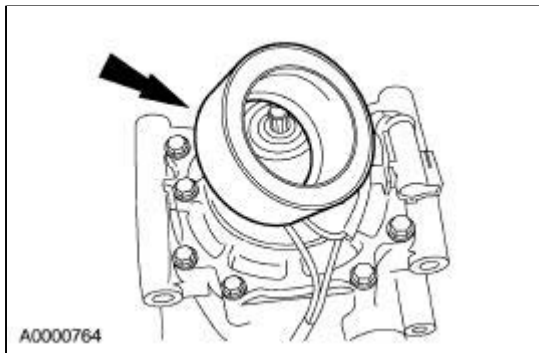
6. Remove the sensor.
 1. Remove the bolt and the hold-down bracket.
 2. Lift out the sensor while lightly twisting and pulling up on the sensor.
 - It may be necessary to pry up lightly with a small screwdriver.



7. Remove the field coil snap ring.

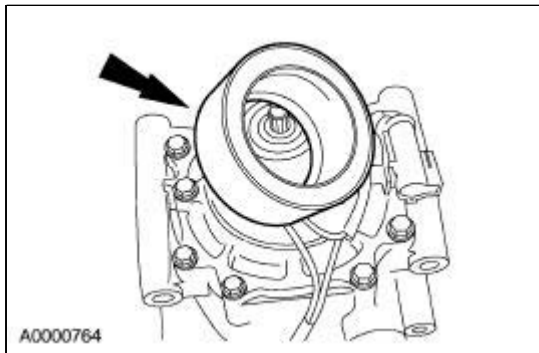


8. Remove the A/C clutch field coil.

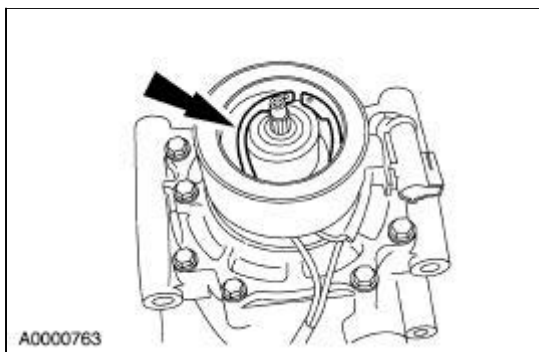


Installation

1. Clean the A/C clutch field coil and pulley mounting surfaces.
2. Install the A/C clutch field coil.



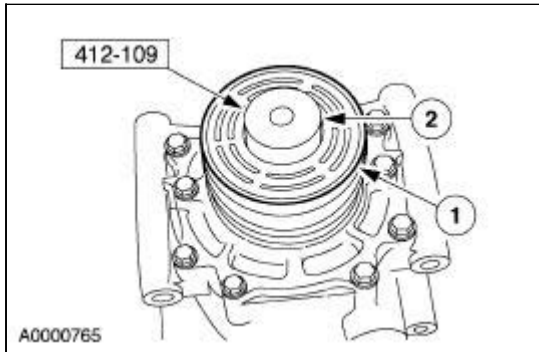
3. Install the snap ring with the bevel side out.



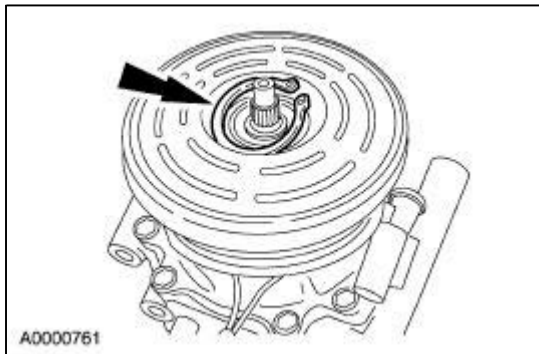
4. **NOTE:** The A/C clutch bearing and pulley is a slip fit on the compressor. If correctly aligned it should slip on easily. If difficulty is encountered, install using the special tool.

Using the special tool, install the clutch bearing and pulley.

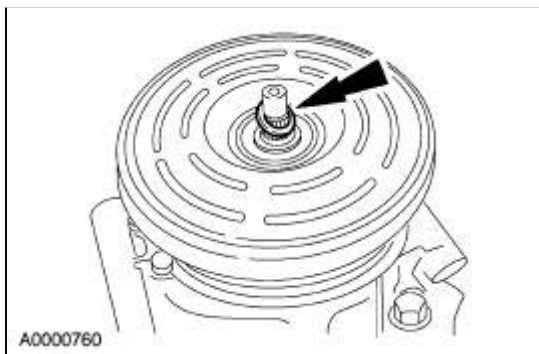
1. Position the clutch bearing and pulley.
2. Install the special tool. If required, gently tap and install the clutch bearing and pulley.



5. Install the snap ring with the bevel side out.

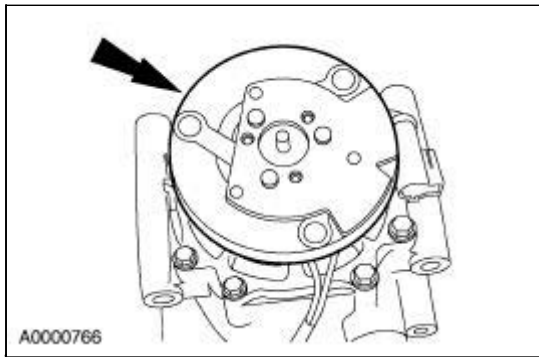


6. Install the spacer.

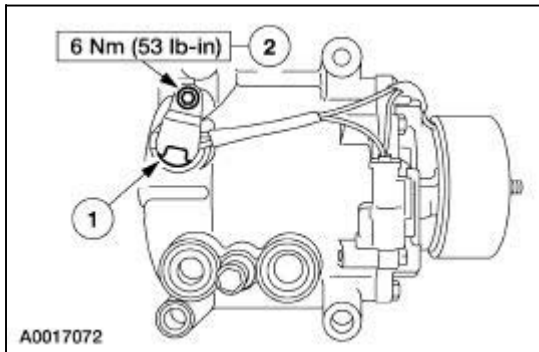


7. **NOTE:** Make sure to align the block tooth on the shaft with the missing tooth on the disc and hub.

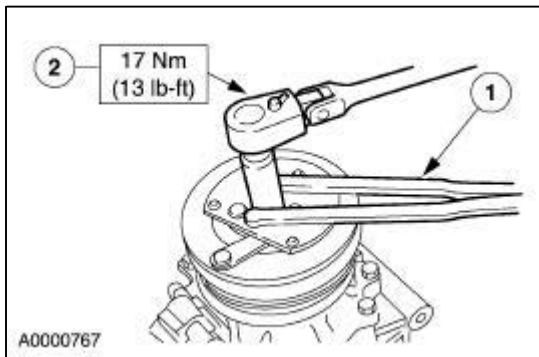
Install the A/C clutch.



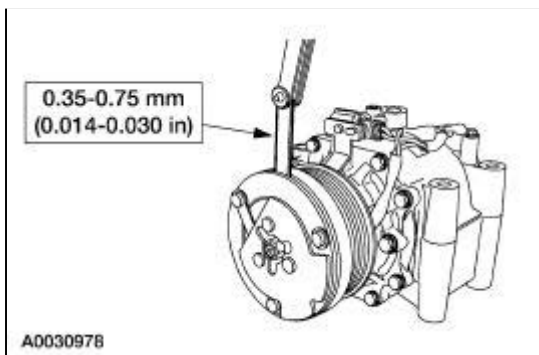
8. Install the sensor.
 1. Push the sensor into position.
 2. Install the bolt and the hold-down bracket.



9. Install the bolt.
 1. Hold the A/C clutch.
 2. Install the bolt.



10. Measure and adjust the clutch air gap by removing or adding A/C clutch hub spacers.



11. Install the A/C compressor. For additional information, refer to [Air Conditioning \(A/C\)](#)

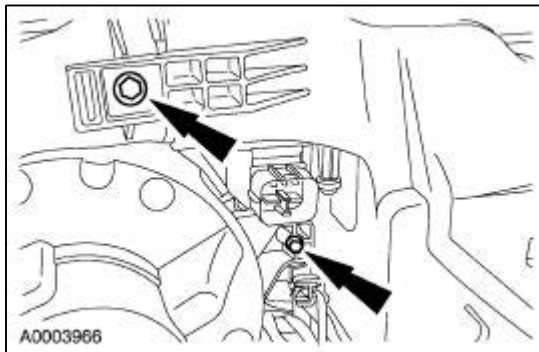
Compressor—3.0L or Air Conditioning (A/C) Compressor—3.9L in this section.

Evaporator Core

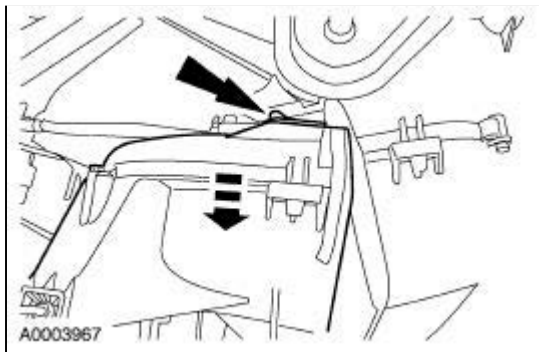
Removal and Installation

NOTE: If an A/C evaporator core leak is suspected the A/C evaporator core must be leak tested before it is removed from the vehicle. For additional information, refer to [Section 412-00](#).

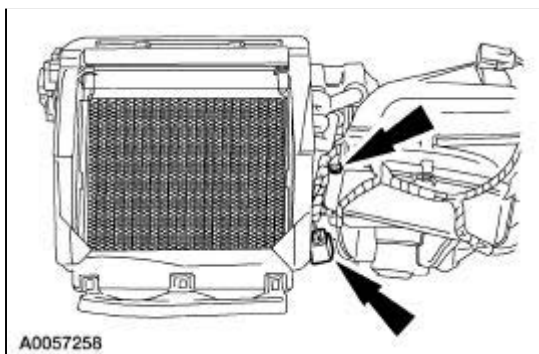
1. Remove the evaporator core housing. For additional information, refer to [Section 412-02](#).
2. Remove the screws which connect the air inlet housing to the evaporator housing.



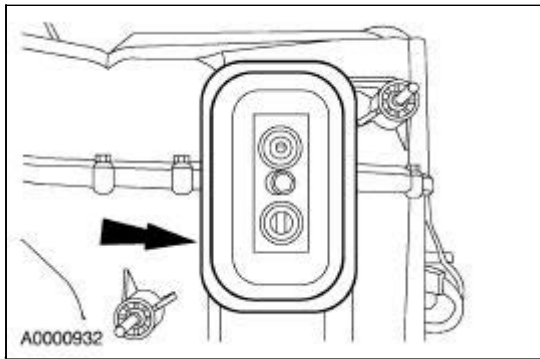
3. Disengage the clip and separate the housings.



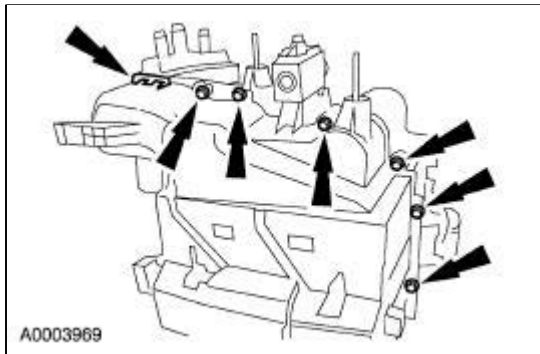
4. Disconnect the evaporator core housing wire harness connectors and position the wire harness aside.



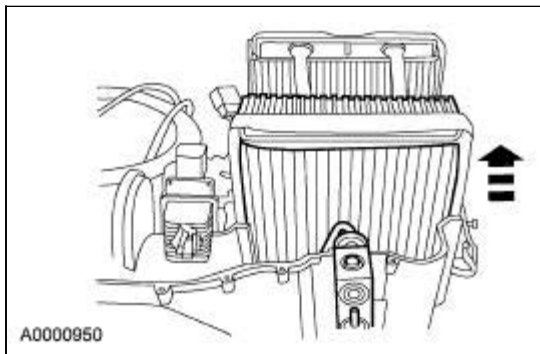
5. Remove the gasket.



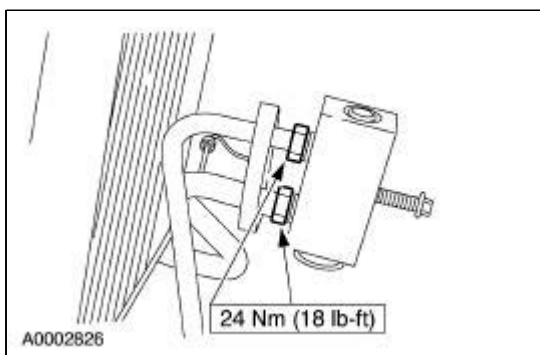
6. Remove the nine screws, disengage the clip and separate the heater/evaporator core housing.



7. Remove the evaporator core.



8. Disconnect the fittings and remove the thermostatic expansion valve.



9. To install, reverse the removal procedure.

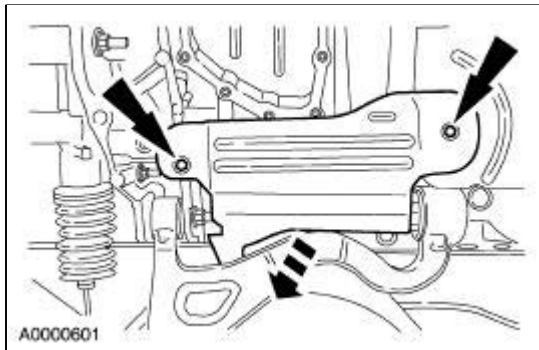
- Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.

- Add the correct amount of PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B to the new A/C evaporator core. For additional information, refer to [Section 412-00](#).
-

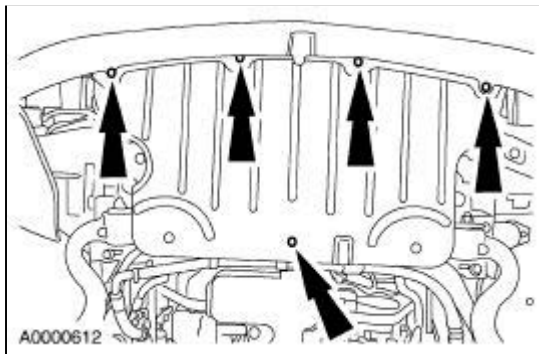
Receiver Drier

Removal and Installation

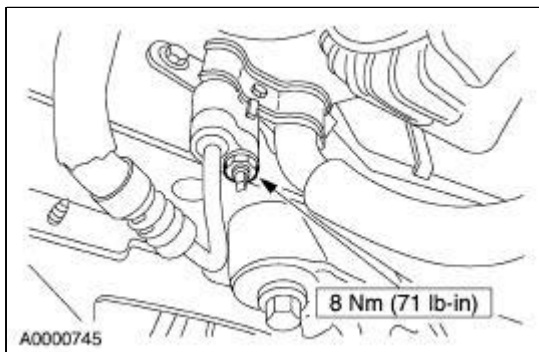
1. Recover the refrigerant. For additional information, refer to [Section 412-00](#).
2. Raise the vehicle. For additional information, refer to [Section 100-02](#).
3. Remove the screws and remove the LH sight shield.



4. Remove the screws and remove the air deflector.

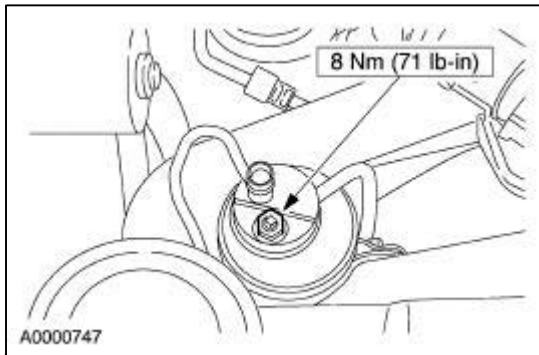


5. Remove the nut and disconnect the peanut fitting. For additional information, refer to [Section 412-00](#).

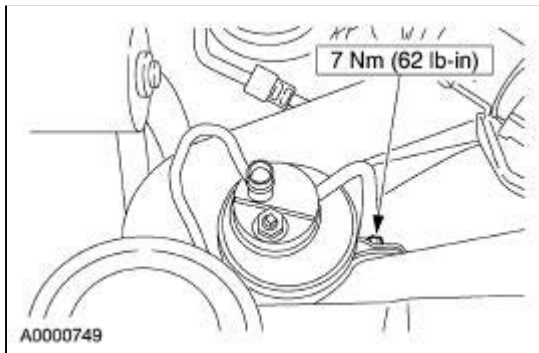


6. Lower the vehicle.

7. Disconnect the air outlet tube. For additional information, refer to [Section 303-12](#).
8. Remove the nut.



9. Remove the bolt. Position the receiver drier away from the radiator shroud and disconnect the receiver drier from the manifold.

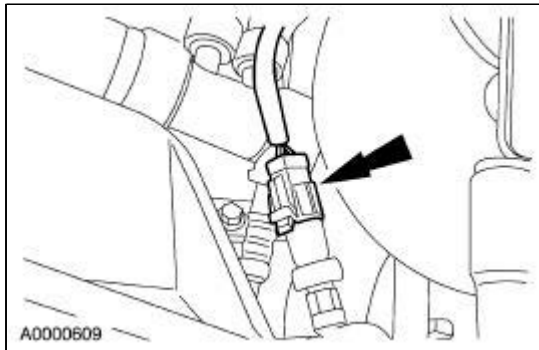


10. To install, reverse the removal procedure.
 - Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.
-

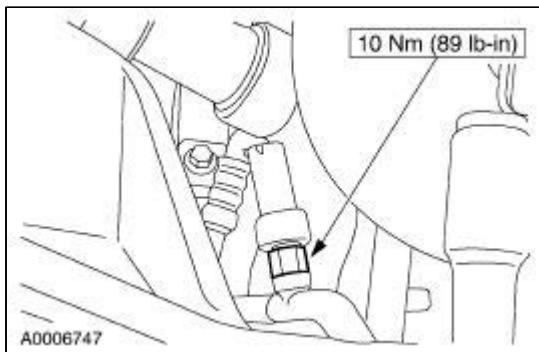
Air Conditioning (A/C) Pressure Transducer

Removal and Installation

1. Disconnect the battery. For additional information, refer to [Section 414-01](#).
2. Disconnect the connector.



3. Remove the pressure transducer.

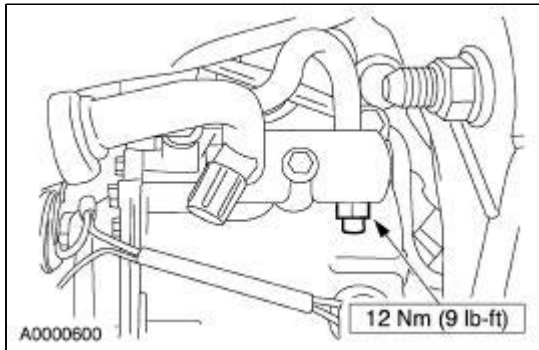


4. To install, reverse the removal procedure.
 - Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.
-

Air Conditioning (A/C) Pressure Relief Valve

Removal and Installation

1. Recover the refrigerant. For additional information, refer to [Section 412-00](#).
2. Remove the A/C compressor pressure relief valve (3.0L shown, 3.9L similar).



3. To install, reverse the removal procedure.
 - Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.
-

Condenser Core

Material

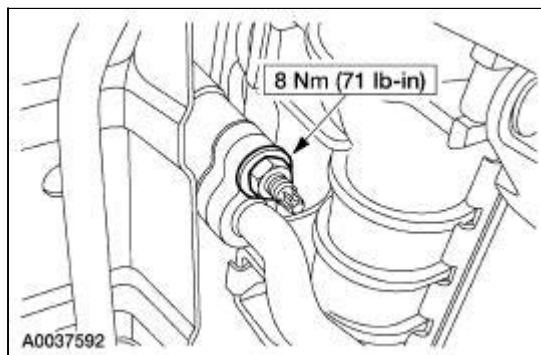
Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C)	WSH-M1C231-B

Removal and Installation

NOTE: If an A/C condenser core leak is suspected, the A/C condenser core must be leak tested before it is removed from the vehicle. For additional information, refer to [Section 412-00](#).

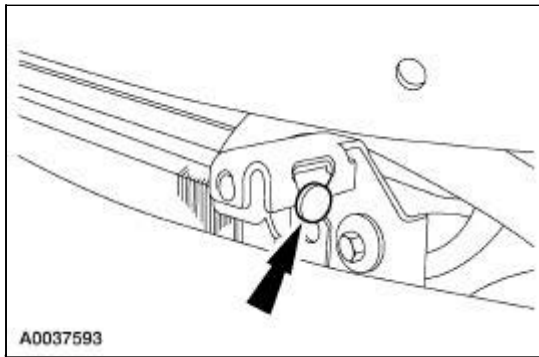
NOTE: Installation of a new receiver/drier is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver drier.

1. Recover the refrigerant. For additional information, refer to [Section 412-00](#).
2. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
3. Remove the upper radiator sight shield.
4. Remove the nut and disconnect the condenser inlet fitting.

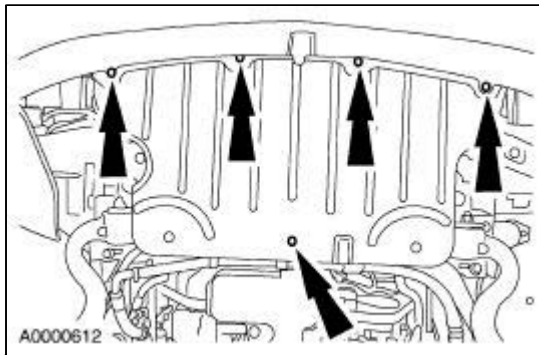


5. **NOTE:** LH condenser bracket pin-type retainer shown, RH similar.

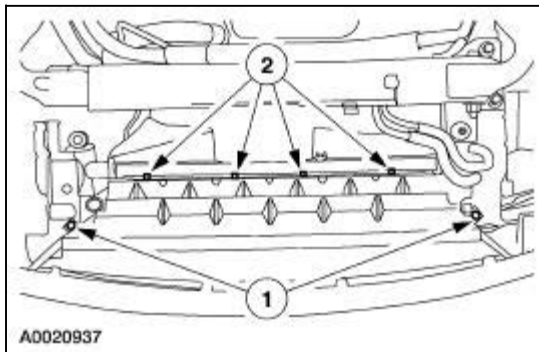
Remove the RH and LH upper condenser bracket pin-type retainers.



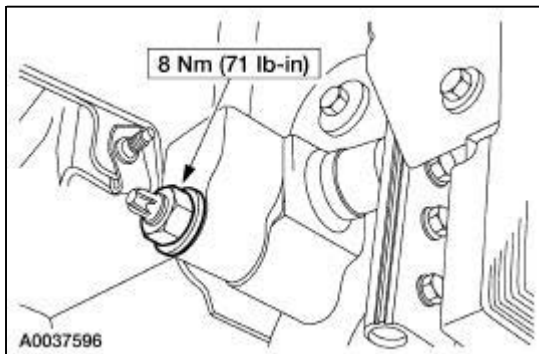
6. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
7. Remove the screws and remove the air deflector.




8. Remove the air deflector.
 1. Remove the pin-type retainers.
 2. Remove the side-clip retainers.

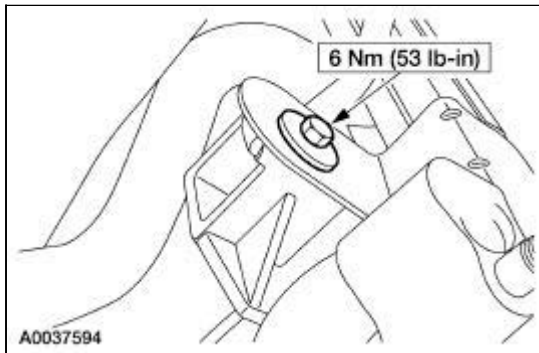


9. Remove the nut and disconnect the condenser outlet fitting.

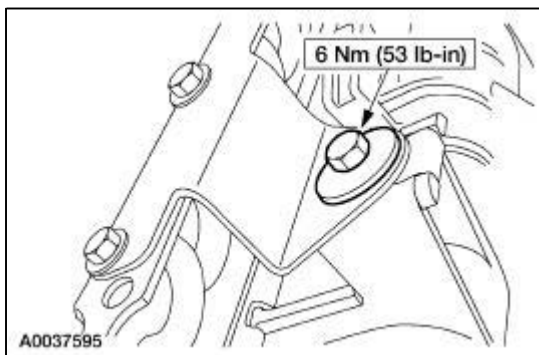


10.  **CAUTION:** To avoid damage to the condenser core, correctly support the condenser when removing the lower mounting bolts.

Remove the LH bolt.



11. Remove the RH bolt and lower the condenser core.



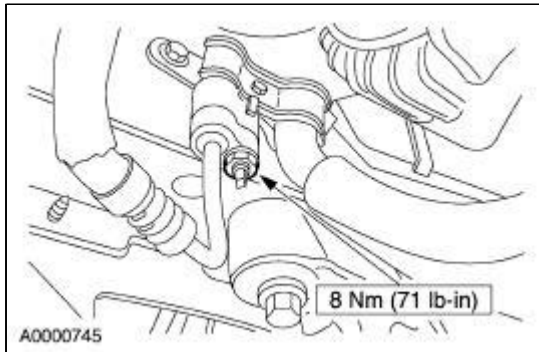
12. To install, reverse the removal procedure.

- Install new O-ring seals lubricated in clean PAG oil.
 - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to [Section 412-00](#).
-

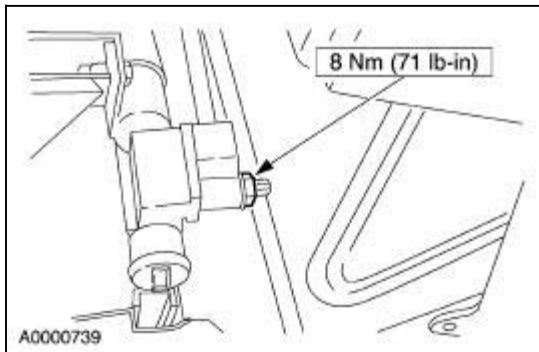
Receiver Drier Manifold and Tube Assembly —3.0L

Removal and Installation

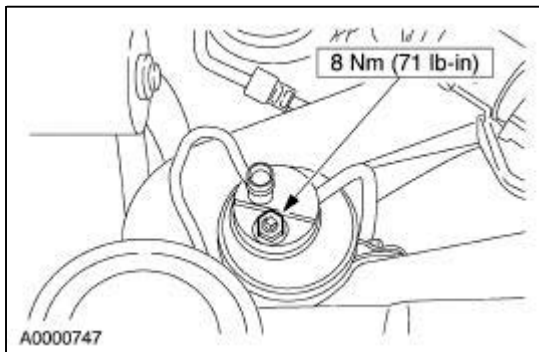
1. Recover the refrigerant. For additional information, refer to [Section 412-00](#).
2. Disconnect the peanut fitting. For additional information, refer to [Section 412-00](#).



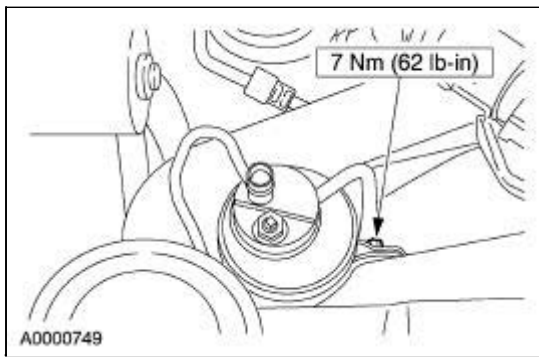
3. Disconnect the peanut fitting. For additional information, refer to [Section 412-00](#).



4. Remove the nut.



5. Remove the receiver drier mounting bracket clamp bolt. Move the receiver drier away from the fan shroud and remove the receiver drier.

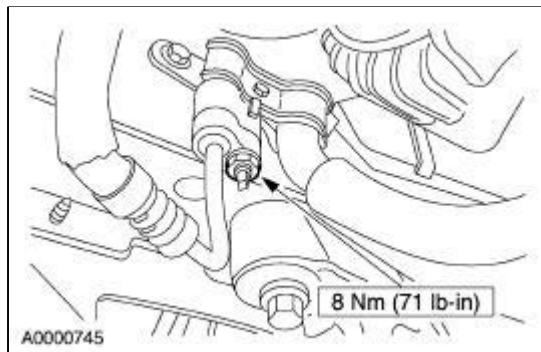


6. Remove the receiver drier manifold assembly.
 7. To install, reverse the removal procedure.
 - Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.
-

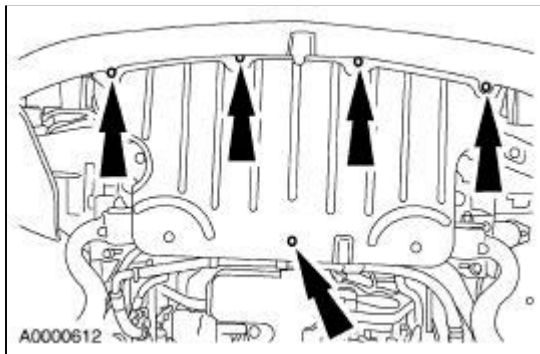
Receiver Drier Manifold and Tube Assembly —3.9L

Removal and Installation

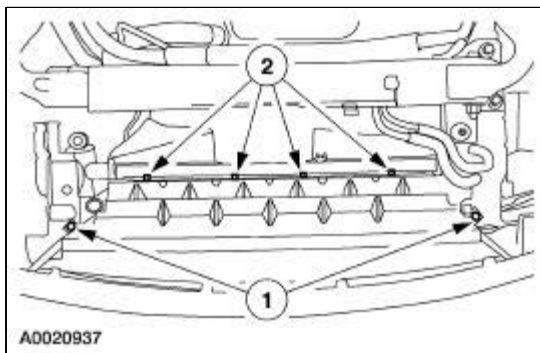
1. Recover the refrigerant. For additional information, refer to [Section 412-00](#).
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
3. Disconnect the peanut fitting. For additional information, refer to [Section 412-00](#).



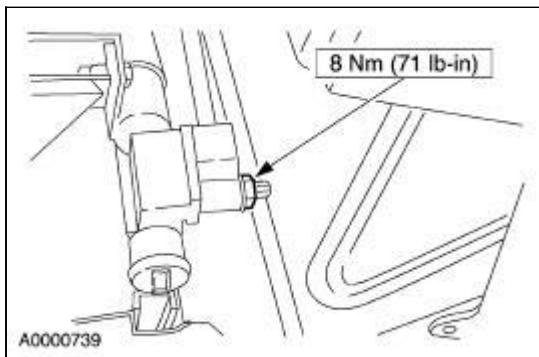
4. Remove the screws and remove the air deflector.



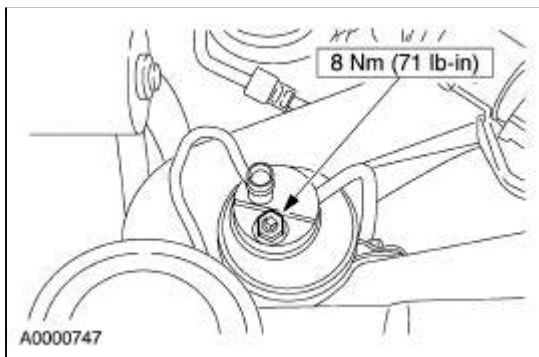
5. Remove the air deflector.
 1. Remove the push-pin retainers.
 2. Remove the side-clip retainers.



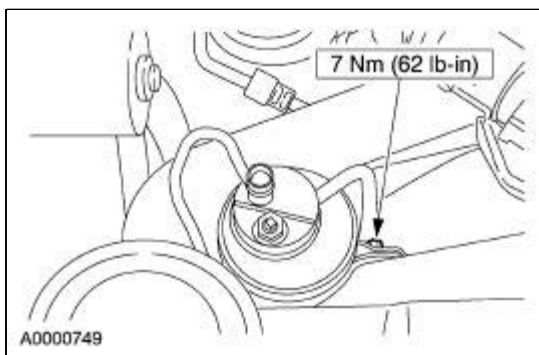
6. Disconnect the peanut fitting. For additional information, refer to [Section 412-00](#).



7. Lower the vehicle.
8. Remove the air cleaner outlet tube. For additional information, refer to [Section 303-12](#).
9. Remove the nut.



10. Remove the receiver drier mounting bracket clamp bolt. Move the receiver drier away from the fan shroud and remove the receiver drier.

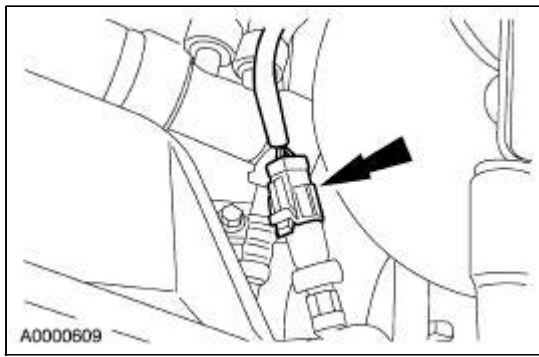


11. Remove the receiver drier manifold assembly.
 12. To install, reverse the removal procedure.
 - Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.
-

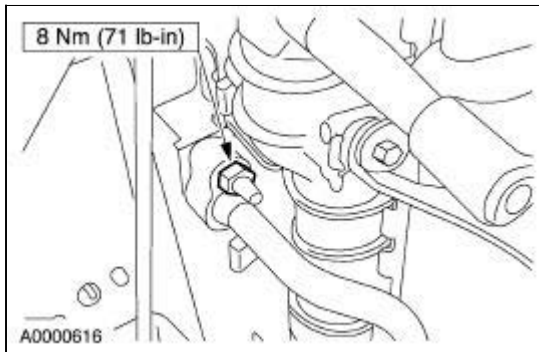
Compressor Manifold and Tube Assembly

Removal and Installation

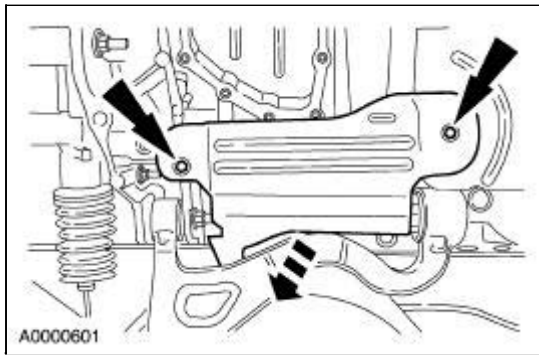
1. Disconnect the battery. For additional information, refer to [Section 414-01](#).
2. Recover the refrigerant. For additional information, refer to [Section 412-00](#).
3. Disconnect the air outlet tube and position aside. For additional information, refer to [Section 303-12](#).
4. Disconnect the connector.



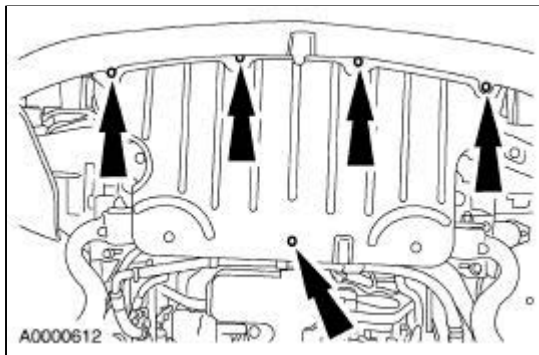
5. Remove the nut and disconnect the peanut fitting. For additional information, refer to [Section 412-00](#).



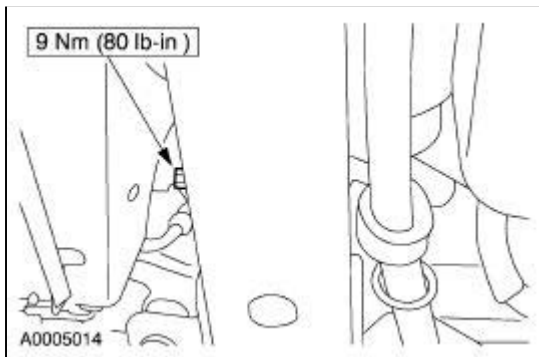
6. Raise the vehicle. For additional information, refer to [Section 100-02](#).
7. Remove the screws and remove the LH and RH sight shields (LH shown, RH similar).



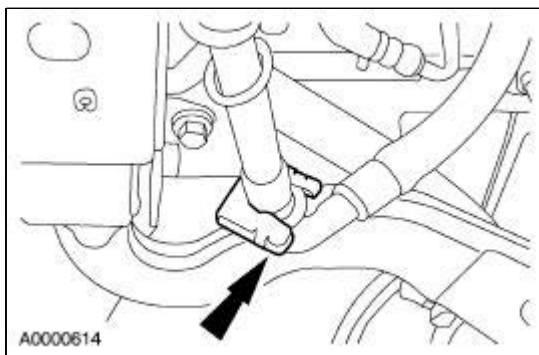
8. Remove the screws and remove the air deflector.



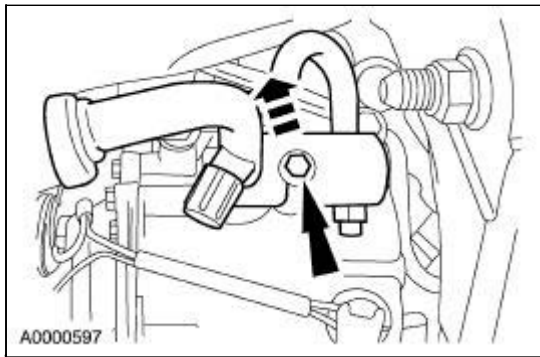
9. Remove the refrigerant line bracket bolt.



10. Disconnect the spring lock coupling. For additional information, refer to [Section 412-00](#).

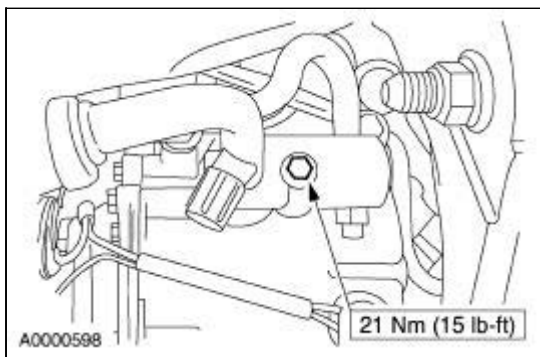


11. Loosen the bolt and remove the A/C compressor manifold and tube assembly.



12. To install, reverse the removal procedure.

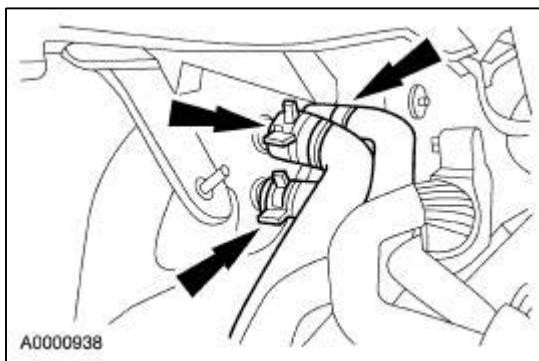
- Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.



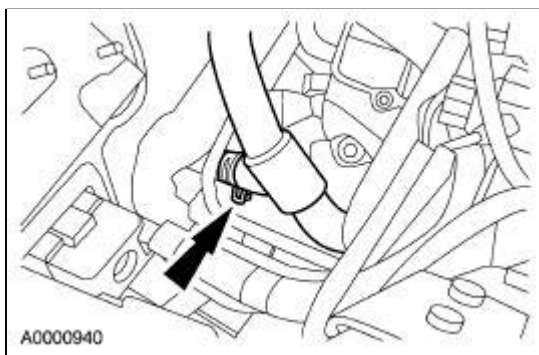
Thermostatic Expansion Valve Manifold and Tube Assembly —3.0L

Removal and Installation

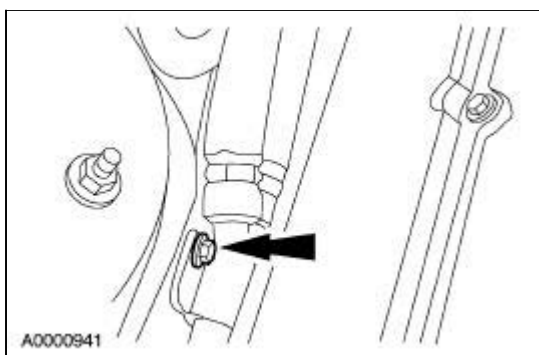
1. Recover the refrigerant. For additional information, refer to [Section 412-00](#).
2. Remove the cabin air filter plenum. For additional information refer to [Section 412-01](#).
3. Disconnect the heater hoses from the heater core.



4. Disconnect the coolant recovery line.



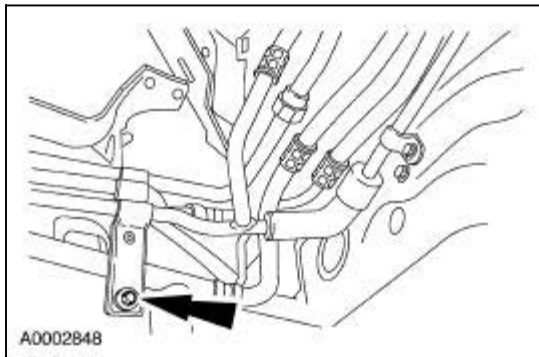
5. Remove the forward heater hose mounting bolt at the RH shock tower.



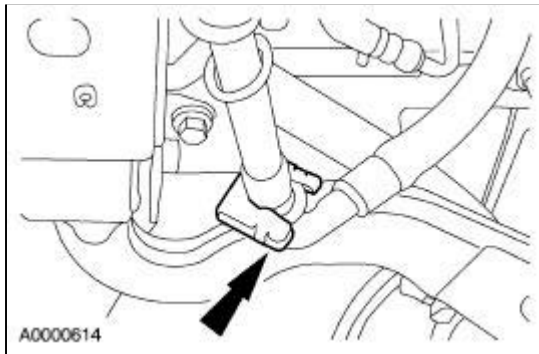
6. Raise the vehicle. For additional information refer to [Section 100-02](#).

7. **NOTE:** Shown with components removed for clarity.

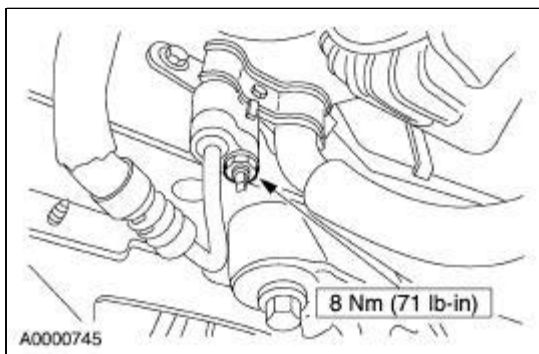
Remove the rear heater hose mounting bolt from the body side and position the heater hose assembly aside.



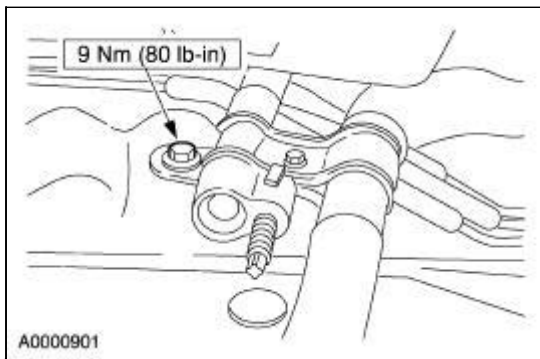
8. Disconnect the spring lock coupling. For additional information, refer to [Section 412-00](#).



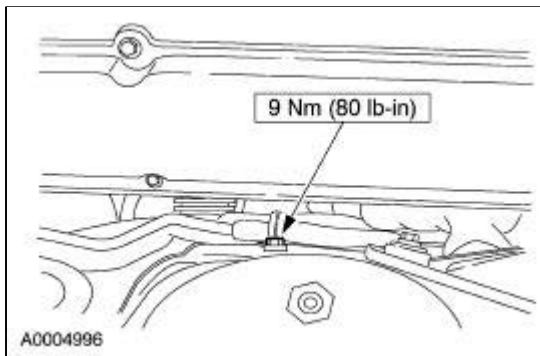
9. Remove the nut and disconnect the peanut fitting. For additional information, refer to [Section 412-00](#).



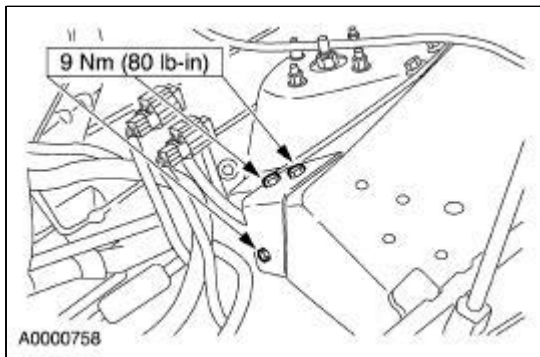
10. Remove the refrigerant line bracket bolt.



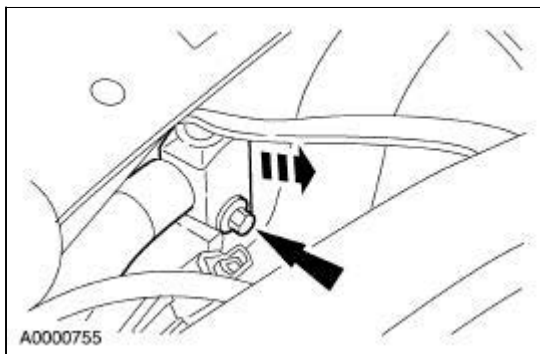
11. Remove the refrigerant line bracket bolt.



12. Remove the refrigerant line bracket bolts and position the bracket aside.



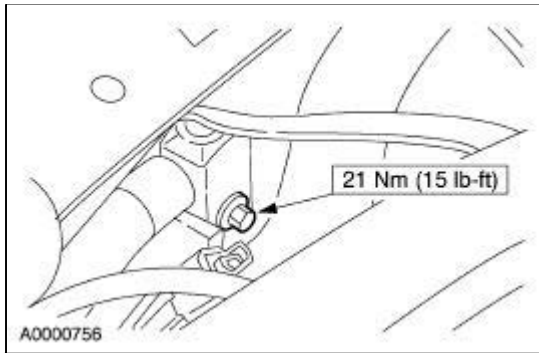
13. Loosen the bolt and remove the thermostatic expansion valve manifold and tube assembly.



14. To install, reverse the removal procedure.

- Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.

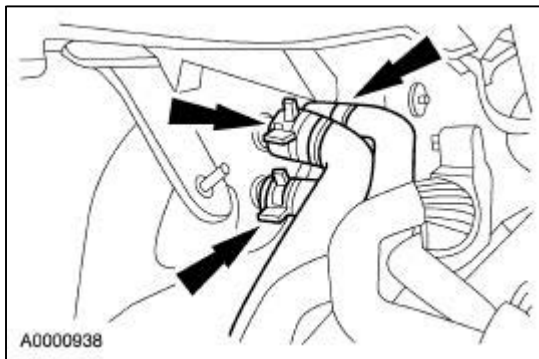
- Make sure that the heater hoses are connected correctly to the heater core. For additional information refer to [Section 412-02](#).
- Lubricate the coolant hoses with MERPOL® or plain water, if needed.



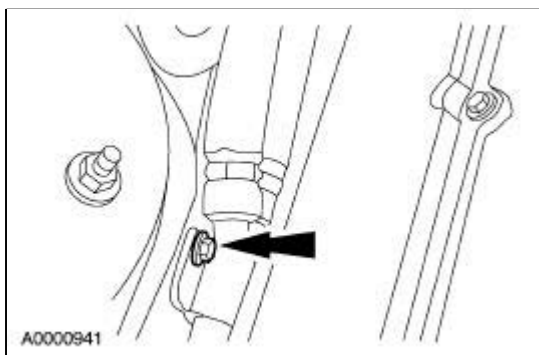
Thermostatic Expansion Valve Manifold and Tube Assembly —3.9L

Removal and Installation

1. Recover the refrigerant. For additional information, refer to [Section 412-00](#).
2. Remove the cabin air filter plenum. For additional information, refer to [Section 412-01](#).
3. Disconnect the heater hoses from the heater core.

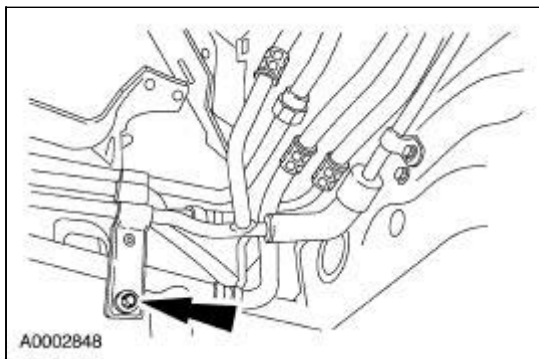


4. Remove the forward heater hose mounting bolt at the RH shock tower.

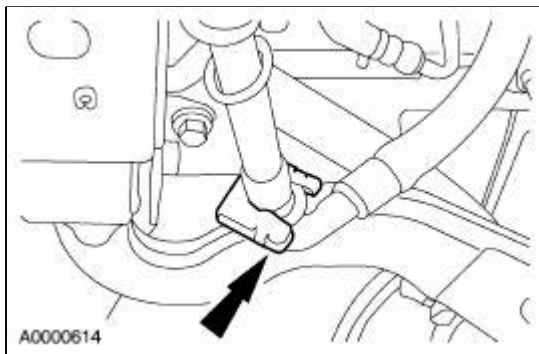


5. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
6. **NOTE:** Shown with components removed for clarity.

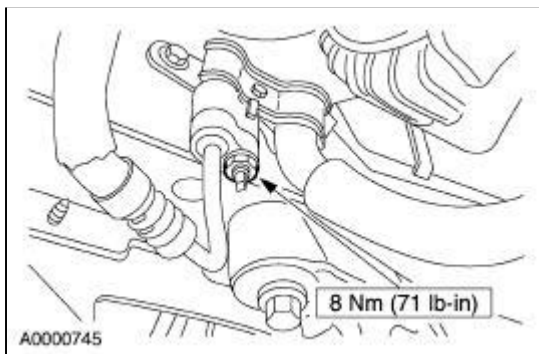
Remove the rear heater hose mounting bolt from the body side and position the heater hose assembly aside.



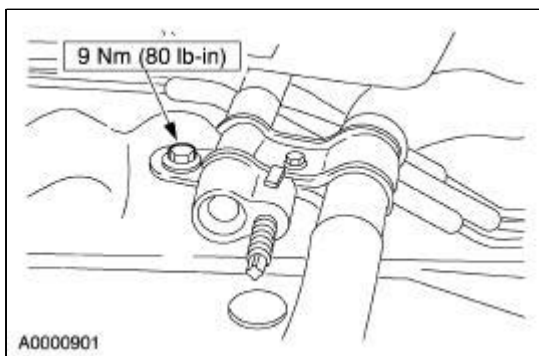
7. Disconnect the spring lock coupling. For additional information, refer to [Section 412-00](#).



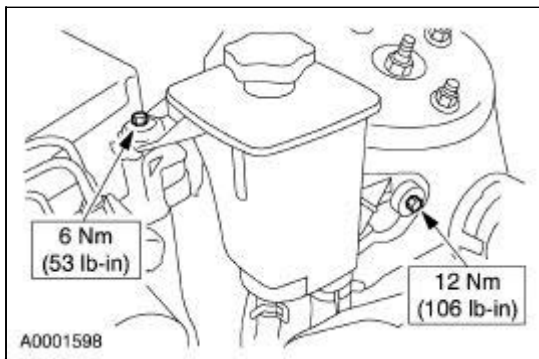
8. Remove the nut and disconnect the peanut fitting. For additional information, refer to [Section 412-00](#).



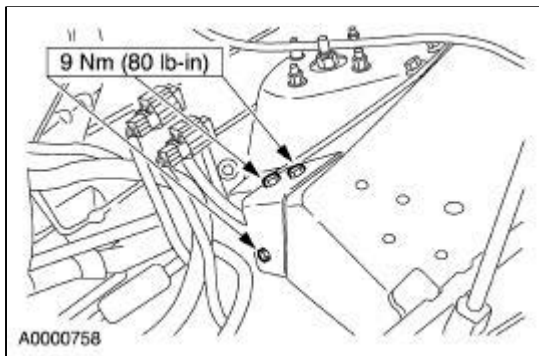
9. Remove the refrigerant line bracket bolt.



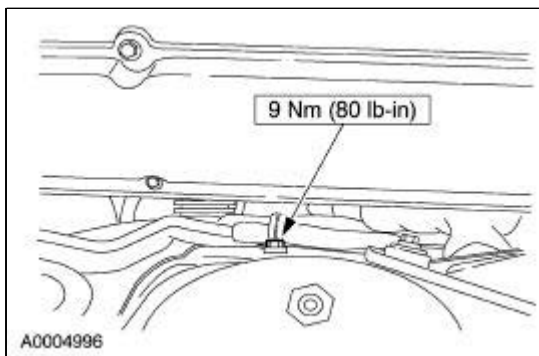
10. Lower the vehicle.
11. Loosen the two mounting bolts. Lift off and set aside the power steering reservoir.



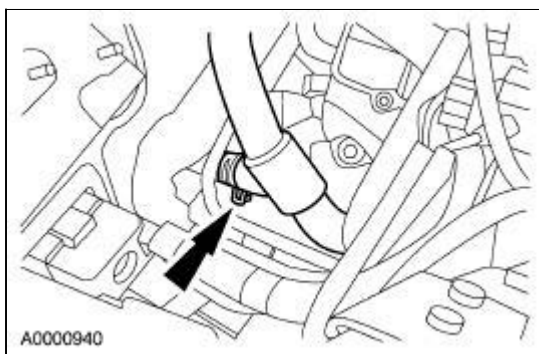
12. Remove the refrigerant line bracket bolts and position the bracket aside.



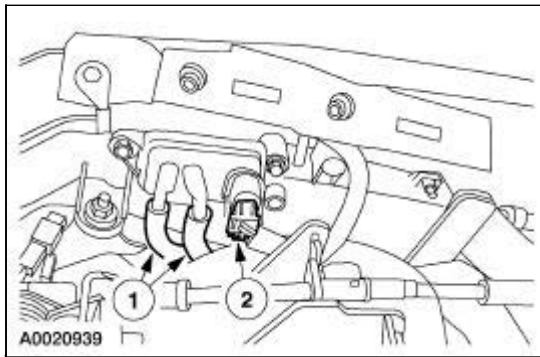
13. Remove the refrigerant line bracket bolt.



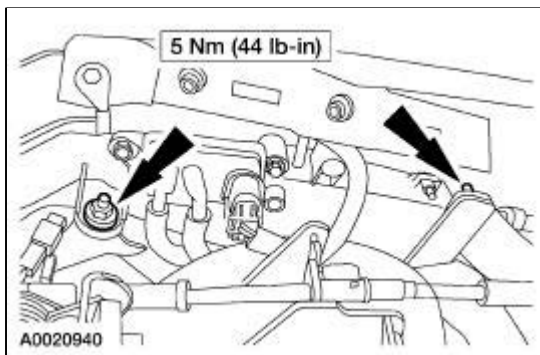
14. Disconnect the coolant recovery line.



15. Disconnect the differential pressure feedback EGR (DFPE) sensor.
 1. Disconnect vacuum hoses.
 2. Disconnect electrical connector.

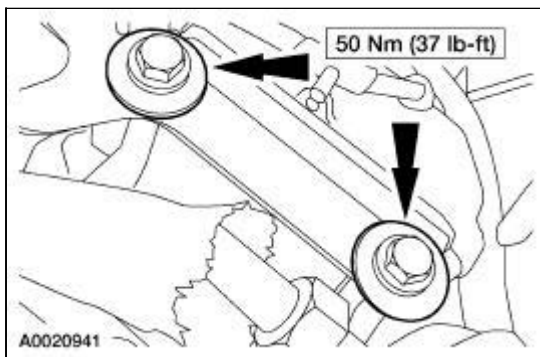


16. Remove wire harness retaining nuts and position wire harness aside.

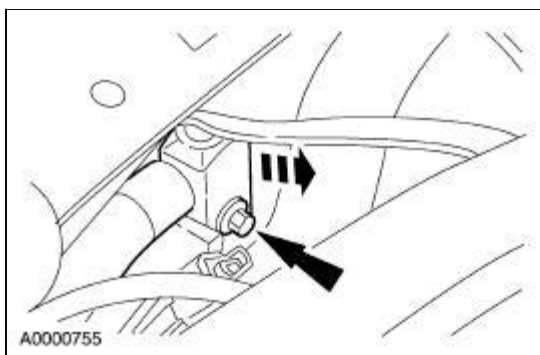


17. **NOTE:** Engine removed for clarity.

Remove the two harness bracket retaining bolts and remove the harness bracket.



18. Loosen the bolt and remove the thermostatic expansion valve manifold and tube assembly.

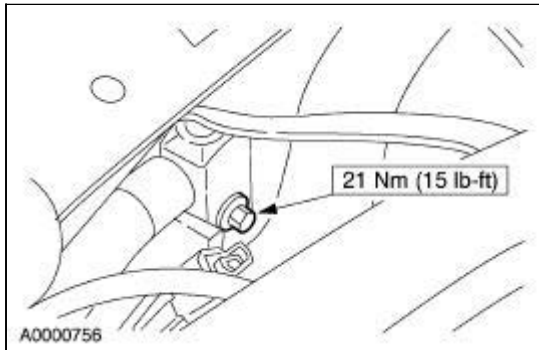


19. To install, reverse the removal procedure.

- Lubricate the O-ring seal with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-

19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.

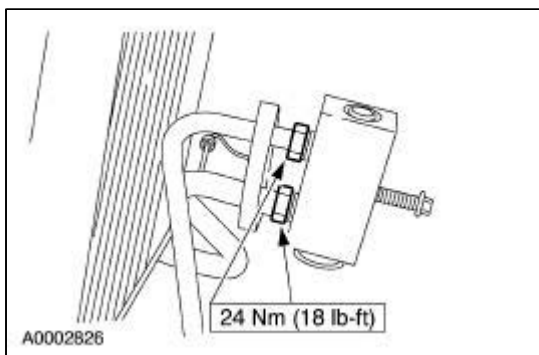
- Make sure that the heater hoses are connected correctly to the heater core. For additional information, refer to [Section 412-02](#).
- Lubricate the coolant hoses with MERPOL® or plain water, if needed.



Thermostatic Expansion Valve

Removal and Installation

1. Disconnect the battery. For additional information, refer to [Section 414-01](#).
2. Recover the refrigerant. For additional information, refer to [Section 412-00](#).
3. Remove the evaporator core. For additional information, refer to [Evaporator Core](#) in this section.
4. Disconnect the thermostatic expansion valve fittings.



5. To install, reverse the removal procedure.
 - Lubricate the O-ring seals with PAG Refrigerant Compressor Oil (R-134a Systems) F7AZ-19589-DA (Motorcraft YN-12-C) or equivalent meeting Ford specification WSH-M1C231-B.
-

Control Components

Dual Electronic Automatic Temperature Control

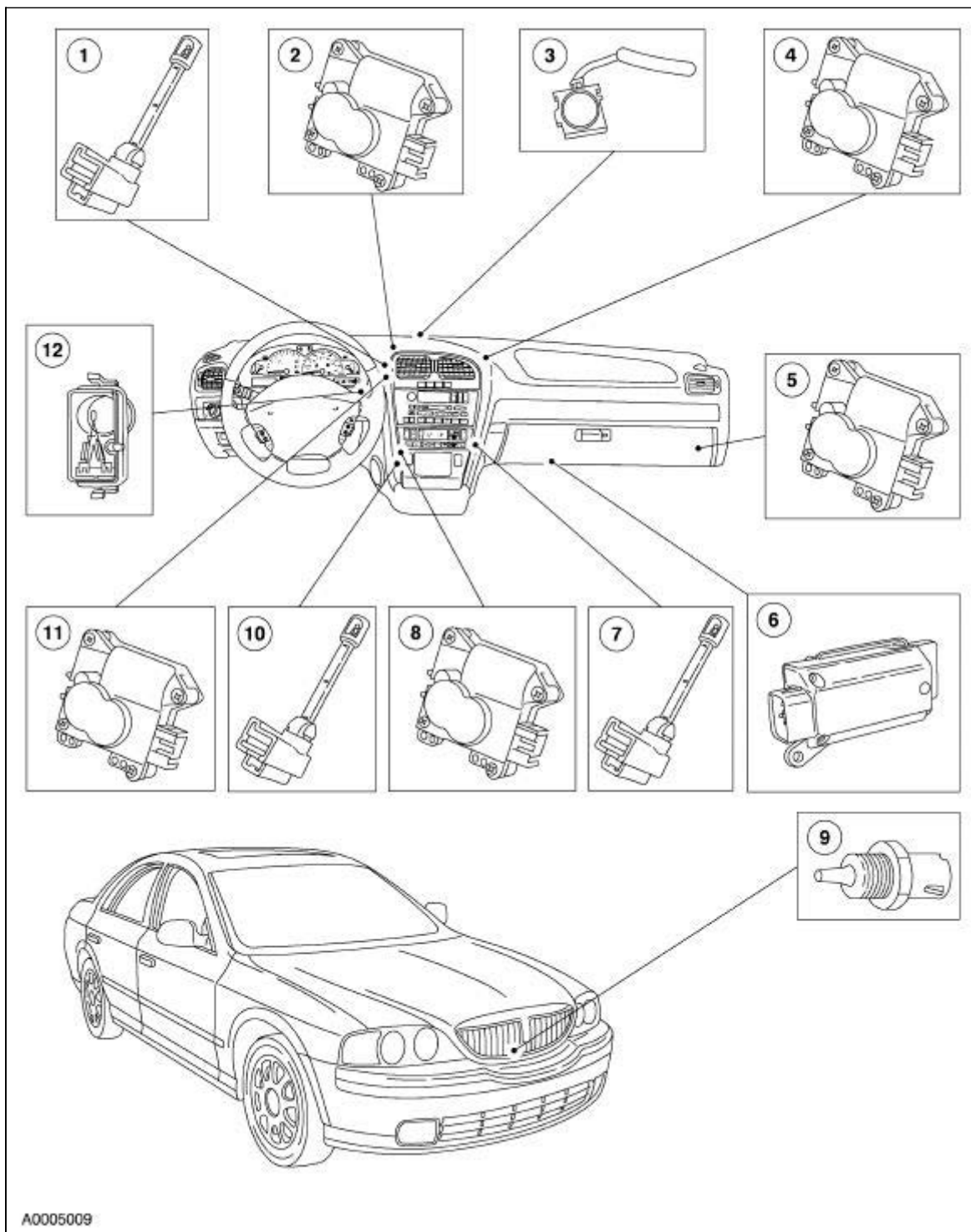
With the use of a microcontroller, the dual automatic temperature control (DATC) module analyzes input from the following major sources:

- temperature, function and blower selection (made by the vehicle occupants)
- in-vehicle temperature sensor
- ambient temperature sensor
- dual sunload sensor
- vehicle speed
- engine rpm
- engine coolant temperature
- actuator door position controls
- driver and passenger heater core air discharge temperature sensors
- evaporator discharge temperature

Using these inputs, the microcontroller determines the correct conditions for the following outputs:

- A/C clutch engagement
- blower speed
- cold air bypass door position
- panel door position
- defrost door position
- floor door position
- air inlet duct door position
- driver coolant control valve
- passenger driver coolant control valve
- electric water pump (3.9L engine)
- heater wiper rest or heated windshield
- heated rear window rear defog
- external temperature (outside temperature display)

Component Locations



A0005009

Item	Part Number	Description
1	19C734	Sensor—evaporator discharge air temperature
2	19E616	Actuator—defrost duct door
3	19E663	A/C dual sunload sensor
4	19E616	Actuator—panel, center console
5	19E616	Actuator—air inlet
6	19E624	A/C blower motor speed control
7	19C734	Sensor—passenger air discharge temperature
8	19E616	Actuator—floor duct door

9	12A648	Sensor—ambient air temperature
10	19C734	Sensor—driver air discharge temperature
11	19E616	Actuator—cold air bypass door
12	19C734	Sensor—in-vehicle temperature

Control System Inputs

Climate Control Assembly

The dual automatic temperature control (DATC) module, located in the instrument panel, has the following features:

- a blower speed override control for manual input
- individual temperature set controls for driver and passenger
- an A/C request control for manual input
- a recirculated air control for manual input
- a vacuum fluorescent display for displaying set temperatures for both the driver and passenger, external or ambient temperature, blower speed setting and diagnostic trouble codes (DTCs)
- an on-board diagnostic (OBD) feature to supply the technician with diagnostic trouble codes (DTCs). These DTCs direct the technician to the inoperative component.
- air distribution mode overrides
- rear defog control
- heated wiper rest or heated windshield
- EXT temperature control to display external or outside temperature
- F/C control to toggle between English or metric settings

A/C Ambient Air Temperature Sensor

The A/C ambient air temperature sensor:

- is located in front of the A/C condenser core near the center of the vehicle.
- contains a thermistor which measures the temperature of outside air as a resistance and sends that reading to the dual automatic temperature control assembly.

In-Vehicle Temperature Sensor

The in-vehicle temperature sensor is located in the instrument cluster finish panel. The sensor operates in the following manner:

- A thermistor in the in-vehicle temperature sensor measures air temperature inside the passenger compartment.
- An automatic temperature control sensor hose is connected between the A/C plenum housing and the in-vehicle temperature sensor.
- The automatic temperature control sensor hose and venturi takes air from the A/C plenum housing to create a suction across the in-vehicle temperature sensor.
- The suction draws in-vehicle air into the in-vehicle temperature sensor and across the thermistor.

Dual A/C Sunload Sensor

The dual A/C sunload sensor:

- is located on the top center of the instrument panel in the defroster grille.
- contains photovoltaic diodes that are sensitive to sunlight.
- generates small amounts of current across the terminals depending upon the amount of light reaching the photovoltaic diode; therefore the only test that can be carried out is for an internal short circuit, an open circuit or sensor value out-of-range.
- contains an internal diagnostic resistor to allow the DATC module to detect a difference between an open circuit and no sunlight.

Control System Outputs

A/C Blower Motor Speed Control

The A/C blower motor speed control is located on the A/C evaporator housing.

- The function of the A/C blower motor speed control is to convert low power signals from the dual electronic automatic temperature control module to a high current, variable ground feed for the blower motor.
- Blower motor speed is infinitely variable and is controlled by the dual electronic automatic temperature control module software.
- A delay function provides a gradual increase or decrease in blower motor speed under all conditions.
- Controls the integral high blower relay which is engaged when maximum fan speed is selected.

A/C Electronic Air Inlet Door Actuator

The A/C electronic air inlet door actuator is located on the evaporator housing. The air inlet door position determines whether outside or recirculated air is being used.

- The actuator positions the air inlet door on command from the control assembly.
- The air inlet door actuator contains a reversible electric motor and a potentiometer.
- A 5 volt signal and ground reference is applied to the ends of the potentiometer. The voltage available at the wiper indicates the position of the potentiometer. The target position of the actuator is calculated by the DATC module and is matched with the wiper voltage of the actuator. The control module will drive the actuator motor in the direction necessary to make the actuator wiper voltage agree with the control module target position.

Cold Air Bypass Door Actuator

The cold air bypass door actuator is located on the evaporator core housing. During automatic operation the control module can position the door fully open so that some of the airflow will not pass through the heater core. This will provide for maximum cooling. The door is closed or partially closed during modes other than maximum cooling.

- The cold air bypass door actuator positions the cold air bypass door on command from the DATC module.
- Operation of the cold air bypass door actuator is the same as the air inlet door.

Defrost Door Actuator

The defrost door actuator is located on the plenum chamber. The actuator will position the defrost door fully open during defrost operation, partially open during floor/defrost and floor mode operation and fully closed during all other operations.

- The defrost door actuator positions the defrost door on command from the DATC module.
- Operation of the defrost door actuator is the same as the air inlet door.

Panel, Floor Console Door Actuator

The panel, floor console door actuator is located on the plenum chamber. The actuator operates the panel door which is mechanically linked to the floor console door. The actuator positions the panel door and floor console door fully open during panel mode and partially open during floor/panel operation. The doors are closed during other operations.

- The panel, floor console door actuator positions the panel and floor console doors on command from the DATC module.
- Operation of the panel door actuator is the same as the air inlet door.

Floor Outlet Door Actuator

The floor outlet door actuator positions the floor outlet door fully open during floor and floor/panel and floor/defrost operations. The door is closed during other operations.

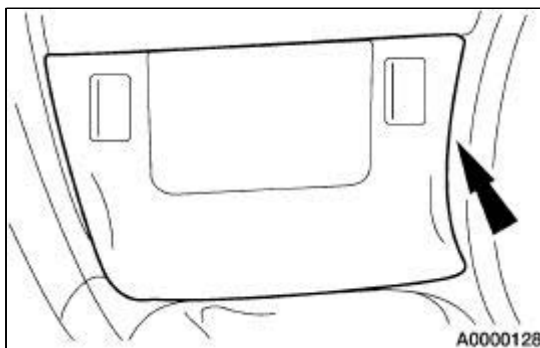
- The floor outlet door actuator positions the floor outlet door on command from the DATC module.
 - Operation of the floor door actuator is the same as the air inlet door.
 - The floor outlet door actuator is in the full open position in OFF mode.
-

Climate Control Assembly

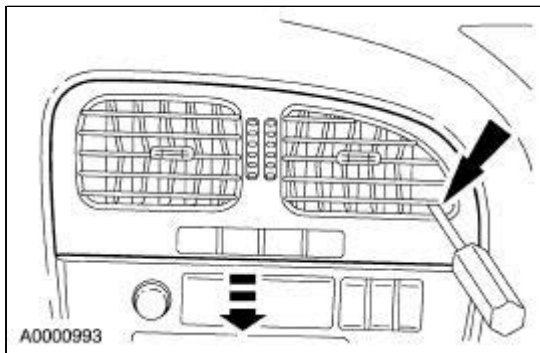
Removal and Installation

NOTE: If installing a new climate control assembly, dual automatic temperature control (DATC module), the new module must be configured. For additional information, refer to [Section 418-01](#).

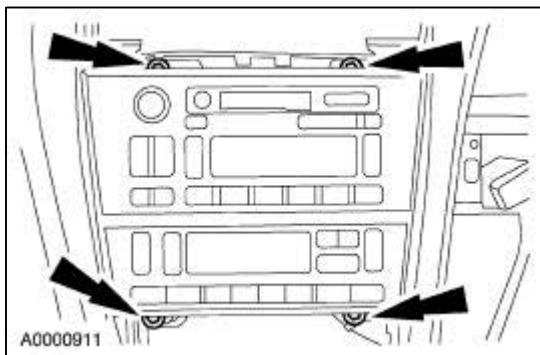
1. Disconnect the battery. For additional information, refer to [Section 414-01](#).
2. Remove the ashtray finish panel.
 - Disconnect the connector.



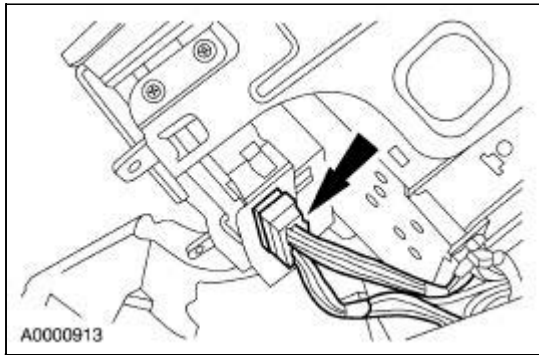
3. Insert a mini-pick in the center register and pull the center register from the instrument panel.
 - If equipped, disconnect the connector.



4. Remove the screws and pull the DATC and radio assembly away from the instrument panel.

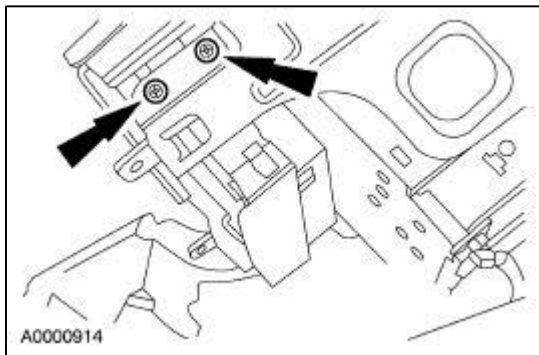


5. Disconnect the two connectors.



6. **NOTE:** The control assembly has three pins at the top of the bezel assembly which pilot in the bottom of the radio bezel. Use care when removing the control assembly.

Remove the four screws (two on each side of the control assembly) and remove the dual automatic temperature control assembly.

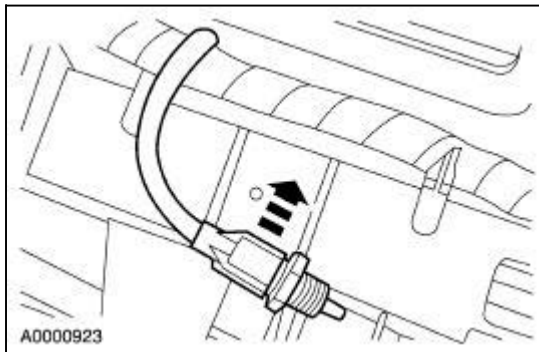


7. To install, reverse the removal procedure.
-

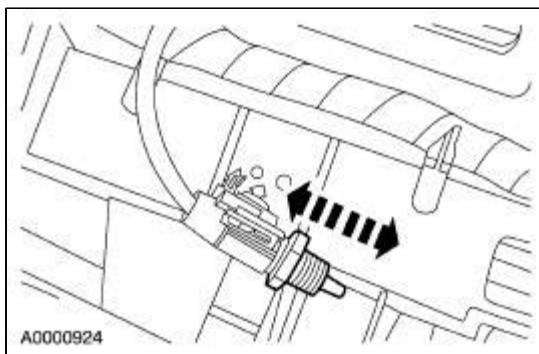
Ambient Air Temperature Sensor

Removal and Installation

1. Remove the wire harness connector and sensor.



2. Disconnect the wire harness connector.

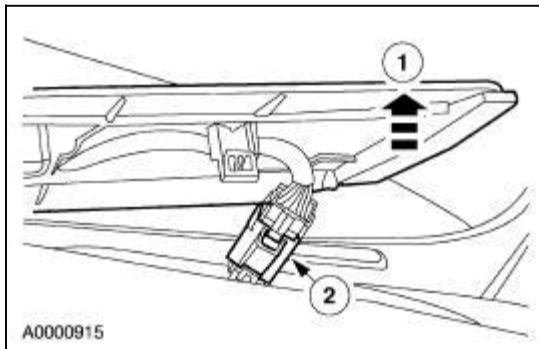


3. To install, reverse the removal procedure.
-

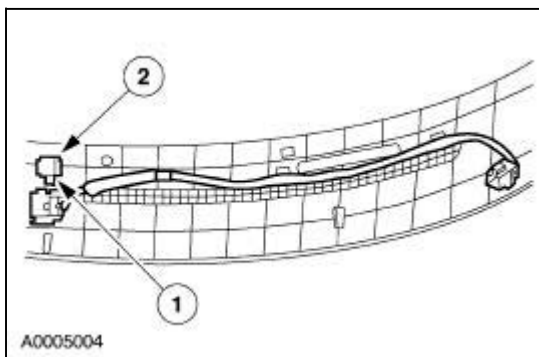
Sunload Sensor

Removal and Installation

1. Remove the instrument panel upper finish panel.
 1. Raise the upper finish panel.
 2. Disconnect the connector and remove the instrument panel finish panel.



2. Remove the dual sunload sensor.
 1. Disconnect the connector.
 2. Remove the dual sunload sensor.

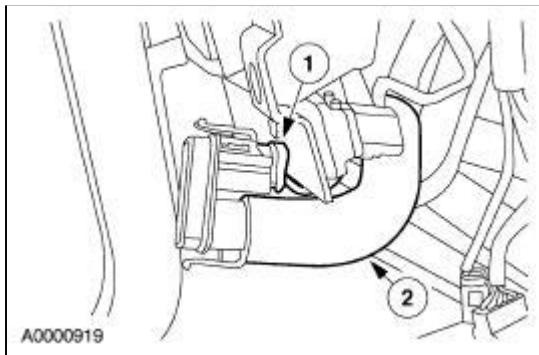


3. To install, reverse the removal procedure.

In-Vehicle Temperature Sensor

Removal and Installation

1. Remove the instrument cluster finish panel bezel. For additional information, refer to [Section 501-12](#).
2. Remove the in-car air temperature sensor.
 1. Disconnect the connector.
 2. Disconnect the aspirator hose and remove the in-car air temperature sensor.



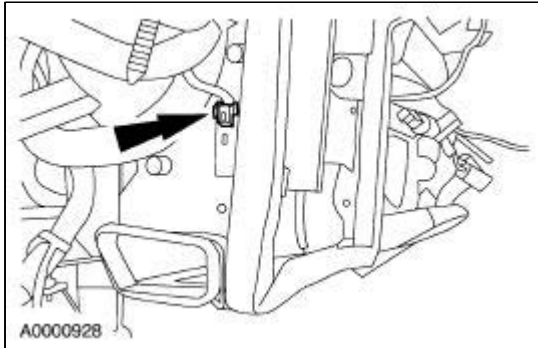
3. To install, reverse the removal procedure.
-

Air Discharge Temperature Sensor

Removal and Installation

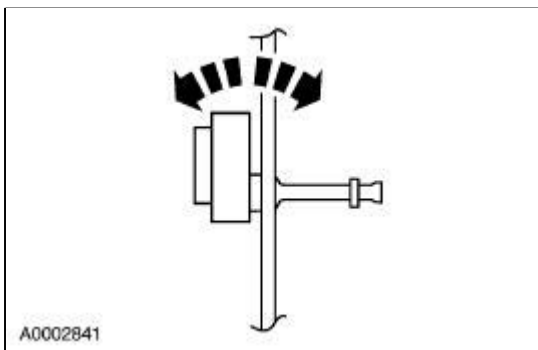
NOTE: RH shown, LH similar

1. Disconnect the connector.



2.  **CAUTION:** Do not twist the sensor during the removal process. Twisting may damage the sensor or the housing.

Remove the sensor using a rocking motion.

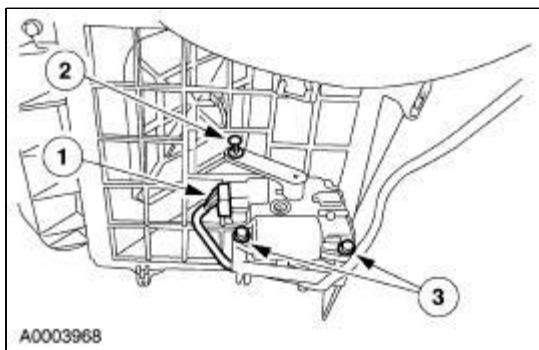


3. To install, reverse the removal procedure.

Blend Door Actuator —Air Inlet Door

Removal and Installation

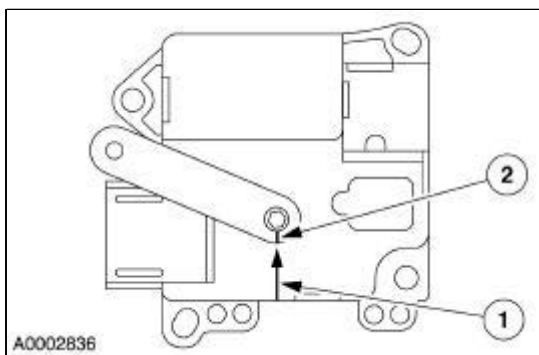
1. Disconnect the battery. Refer to [Section 414-01](#).
2. Remove the RH instrument panel insulator.
3. Remove the RH floor duct. For additional information, refer to [Section 412-01](#).
4. Remove the actuator.
 1. Disconnect the connector.
 2. Remove the coupling connector.
 3. Remove the screws and remove the actuator.



5. **NOTE:** New door actuator assemblies are shipped with the actuator in the mid-position. If reinstalling an actuator removed from the vehicle, use fused jumper wires to electrically drive the actuator to the mid-position to assist in assembly.

To install, reverse the removal procedure.

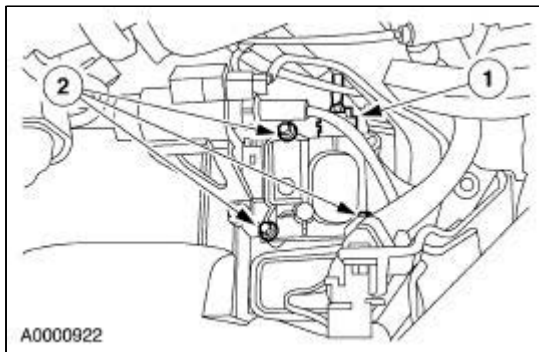
- If reinstalling an actuator removed from the vehicle, align the arrow (1) on the actuator housing with the line on the actuator coupling (2).



Blend Door Actuator —Floor Duct Door

Removal and Installation

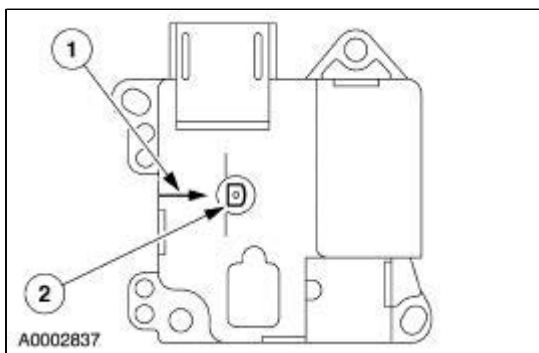
1. Disconnect the battery. For additional information, refer to [Section 414-01](#).
2. Remove the driver side instrument panel insulator.
3. Remove the LH floor duct. For additional information, refer to [Section 412-01](#).
4. Remove the actuator.
 1. Disconnect the connector.
 2. Remove the three screws and remove the actuator.



5. **NOTE:** New door actuator assemblies are shipped with the actuator in the mid-position. If reinstalling an actuator removed from the vehicle, use jumper wires to electrically drive the actuator to the mid-position to assist in assembly.

To install, reverse the removal procedure.

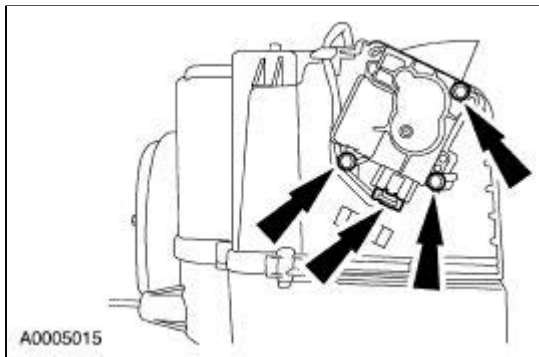
- If reinstalling an actuator removed from the vehicle, align the arrow (1) on the actuator housing with the line on the actuator coupling (2).



Blend Door Actuator —Cold Air Bypass Door

Removal and Installation

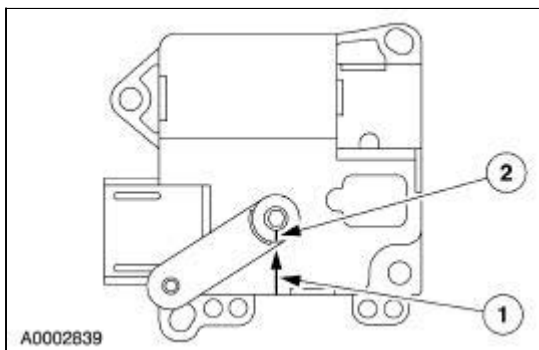
1. Disconnect the battery. For additional information, refer to [Section 414-01](#).
2. Remove the LH instrument panel insulator.
 - Disconnect the electrical connector.
3. Remove the LH floor duct. For additional information, refer to [Section 412-01](#).
4. Remove the actuator.
 - Disconnect the connector.
 - Remove the screws and remove the actuator.



5. **NOTE:** New door actuator assemblies are shipped with the actuator in the mid-position. If reinstalling an actuator removed from the vehicle, use jumper wires to electrically drive the actuator to the mid-position to assist in assembly.

To install, reverse the removal procedure.

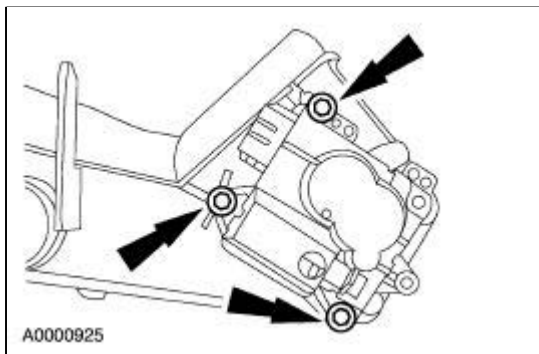
- If reinstalling an actuator removed from the vehicle, align the arrow (1) on the actuator housing with the line on the actuator coupling (2).



Blend Door Actuator —Defrost Door

Removal and Installation

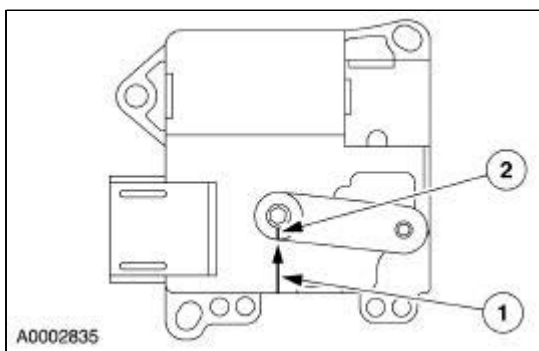
1. Remove the instrument panel. For additional information, refer to [Section 501-12](#).
2. Remove the actuator.
 - Disconnect the connector.
 - Remove the three screws and remove the actuator.



3. **NOTE:** New door actuator assemblies are shipped with the actuator in the mid-position. If reinstalling an actuator removed from the vehicle, use jumper wires to electrically drive the actuator to the mid-position to assist in assembly.

To install, reverse the removal procedure.

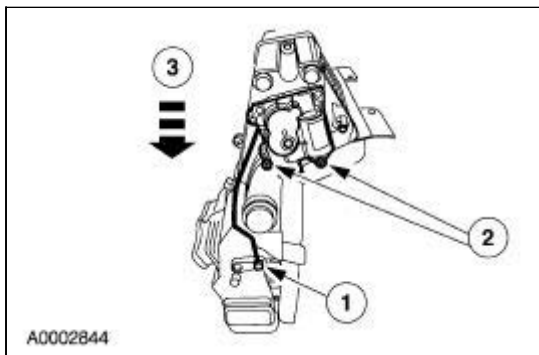
- If reinstalling an actuator removed from the vehicle, align the arrow (1) on the actuator housing with the line on the actuator coupling (2).



Blend Door Actuator —Panel, Floor Console Door

Removal and Installation

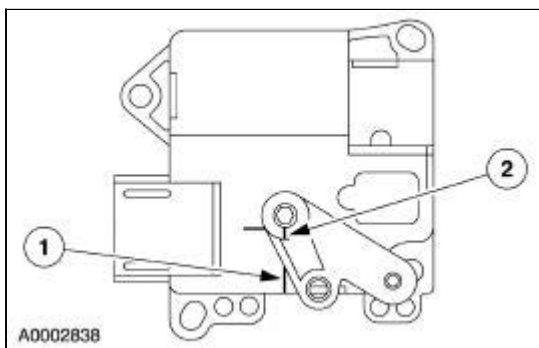
1. Disconnect the battery. For additional information, refer to [Section 414-01](#).
2. Remove the instrument panel. For additional information, refer to [Section 501-12](#).
3. Remove the panel, floor console door actuator.
 1. Disconnect the link end from the center console door.
 2. Remove the screws.
 3. Remove the panel, floor console door actuator.



4. **NOTE:** New door actuator assemblies are shipped with the actuator in mid-position. If reinstalling an actuator removed from the vehicle, use jumper wires to electrically drive the actuator to the mid-position to assist in assembly.

To install, reverse the removal procedure.

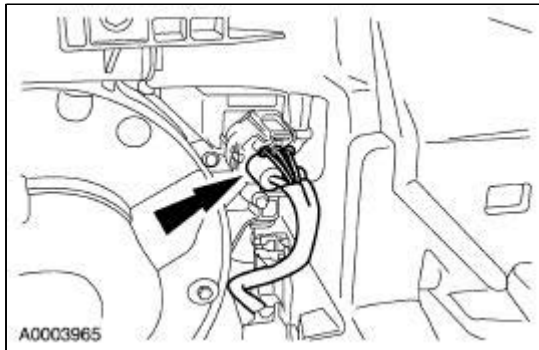
- If reinstalling an actuator removed from the vehicle, align arrow (1) on the actuator housing with the line on the actuator coupling (2).
- Position the actuator and the door fully open or fully closed.
- Manually position the floor console door fully open or fully closed and then install the link.
- Following installation, verify the door position by checking the airflow to the panel and floor console.



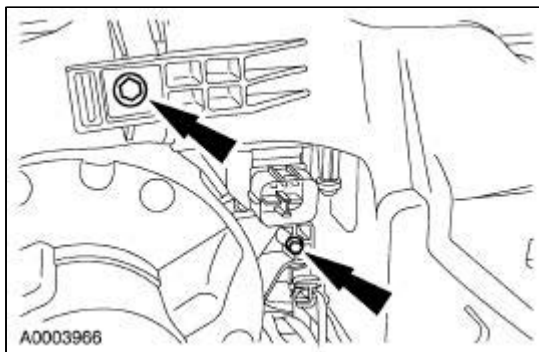
Blower Motor Speed Control

Removal and Installation

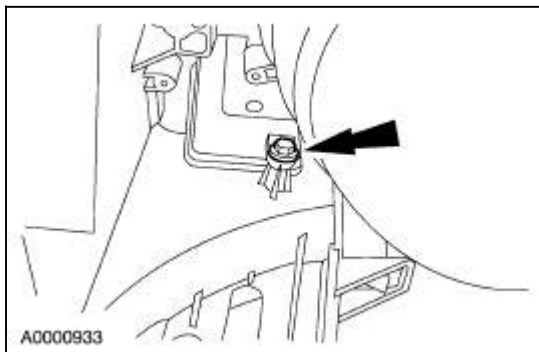
1. Remove the evaporator core housing. For additional information, refer to [Section 412-02](#).
2. Disconnect the connector.



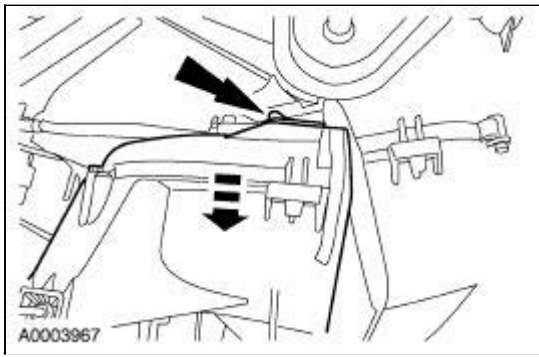
3. Remove the screws which attach the air inlet housing to the evaporator core housing.



4. Remove the blower motor speed control mounting screw.



5. Disengage the clip, separate the air inlet and evaporator housings and remove the blower motor speed control.



6. To install, reverse the removal procedure.

Instrument Cluster and Panel Illumination



The instrument cluster and panel lighting system provides dimmable backlighting to the following:

- instrument cluster (10849)
 - headlamp switch (11654)
 - panel dimmer switch
 - climate control assembly
 - audio unit
 - ash tray
 - power door lock switches
 - power window switches
 - memory set switch
 - heated seat switch
 - steering wheel switches
 - shift lever indicator bezel
 - vehicle emergency monitoring system (VEMS) switch
 - power mirror switch
 - message center
-

Instrument Cluster and Panel Illumination

Refer to Wiring Diagrams Section [413-00](#), Instrument Illumination for schematic and connector information.

Special Tool(s)

 ST1137-A	73III Automotive Meter or equivalent 105-R0051
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool

Principles of Operation

Instrument Cluster and Panel Lighting — Dimmable

The panel dimmer switch allows the brightness level of backlights and displays to be adjusted dependent upon the headlamp switch position and the dimmer switch position. The panel dimmer switch sends a signal to the instrument panel which then sends a backlighting intensity and dimming curve command over the standard corporate protocol (SCP) link to the front electronic module (FEM), the audio unit, and the dual automatic temperature control (DATC) module. The FEM then sends a pulse width modulated (PWM) dimming signal to the instrument cluster, the dimmable LEDs, and the dimmable incandescents.

When the headlamp switch is in the parking lamps ON, headlamps ON, or the autolamps ON position and the autolamp feature is active, synchronized dimming of the dimmable components can be controlled with the panel dimmer switch.

With the ignition switch in the RUN position and the headlamp switch in the OFF position, the audio unit, DATC module, tripometer, odometer, and selector lever indicator bezel will be at 100% brightness.

All backlighting will be disabled when the battery saver function has been activated.

Fault Management

The dimmable backlighting will default to 100% intensity if a panel dimmer switch failure occurs.

Inspection and Verification

NOTE: The instrument cluster and FEM must be reconfigured upon replacement. Refer to [Section 418-01](#).

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Binding or damaged panel dimmer switch 	<ul style="list-style-type: none"> ● Battery junction box (BJB) fuse(s) <ul style="list-style-type: none"> ■ 425 (40A) ■ 422 (20A) ■ 432 (30A) ● Central junction box (CJB) fuse(s) <ul style="list-style-type: none"> ■ 202 (5A) ■ 207 (5A) ■ 213 (5A) ■ 217 (5A) ■ 220 (10A) ■ 233 (10A) ● Damaged bulb(s) ● Damaged/corroded wiring harness ● Damaged interior auxiliary junction box (IAJB) ● LH instrument panel junction box ● Damaged instrument cluster ● Damaged front electronic module (FEM) ● Damaged switches

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for front electronic module (FEM), go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for instrument cluster (ICM), go to Pinpoint Test B.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the ICM or FEM.
6. If the DTCs retrieved are related to the concern, go to the Instrument Cluster or FEM Diagnostic Trouble Code (DTC) Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1342	ECU Is Defective	FEM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 .
B1438	Wiper Mode Select Switch Circuit Failure	FEM	REFER to Section 501-16 .
B1446	Wiper Park Sense Circuit Failure	FEM	REFER to Section 501-16 .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to Section 501-16 .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1567	Lamp Headlamp High Beam Circuit Failure	FEM	REFER to Section 417-01 .
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	REFER to Section 501-11 .
B2215	Window Passenger Front Down Switch Short to Battery	FEM	REFER to Section 501-11 .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2442	Intrusion Sensor Fault	FEM	REFER to Section 419-01A .
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
C1284	Oil Pressure Switch Failure	FEM	REFER to Section 413-01 .
C1446	Brake Switch Circuit Failure	FEM	REFER to Section 413-01 .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to Section 211-00 .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to Section 211-00 .

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
AL_EVT1	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT2	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT3	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT4	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT5	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT6	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT7	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT8	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR
FLUID_1	Brake Fluid Level Switch #1	OFF, ON
HOOD_SW	Hood Ajar Switch	CLOSED, AJAR
IGN_R	Ignition Switch -RUN Position	NO, YES
L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position	#####

	Sensor (Left/Right)	
PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%
R_HIGH	Right High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RADIOSW	Security Input Switch Status	OFF, ON
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-
STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	V
WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKSW	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%
BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON
FRONT WINDOW CONTROL	PR DOWN	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
POWER MIRROR CONTROL	PR DOWN	OFF, ON
POWER MIRROR CONTROL	PR LEFT	OFF, ON
POWER MIRROR CONTROL	PR RIGHT	OFF, ON
POWER MIRROR CONTROL	PR UP	OFF, ON
STEERING COLUMN CONTROL COMMAND	LOCK_GND	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	ICM	REFER to Section 413-01 .
B1205	EIC Switch-1 Assembly Circuit Failure	ICM	REFER to Section 413-01 .
B1209	EIC Switch-2 Assembly Circuit Failure	ICM	REFER to Section 413-01 .
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	ICM	REFER to Section 419-01B .
B1246	Dim Panel Potentiometer Switch Circuit Failure	ICM	GO to Pinpoint Test G .
B1342	ECU Is Defective	ICM	CLEAR and DOCUMENT the DTCs. CARRY OUT the instrument cluster self-test. INSTALL a new instrument cluster if DTC B1342 is retrieved again. REFER to Section 413-01 .
B1352	Ignition Key-In Circuit Failure	ICM	REFER to Section 211-05 .
B1470	Lamp Headlamp Input Circuit Failure	ICM	REFER to Section 417-01 .
B1492	Ignition Cylinder Sensor Open Circuit	ICM	REFER to Section 419-01B .
B1567	Lamp Headlamp High eam Circuit Failure	ICM	REFER to Section 417-01 .
B1600	PATS Ignition Key Transponder Signal Is Not Received	ICM	REFER to Section 419-01B .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	ICM	REFER to Section 419-01B .
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	ICM	REFER to Section 419-01B .
B1676	Battery Pack Voltage Out of Range	ICM	REFER to Section 413-01
B1681	PATS Transceiver Module Signal Is Not Received	ICM	REFER to Section 419-01B .
B1689	Autolamp Delay Circuit Failure	ICM	REFER to Section 417-01 .
B1875	Turn Signal / Hazard Switch Signal Circuit Failure	ICM	REFER to Section 417-01 .
B2103	Antenna Not Connected	ICM	REFER to Section 419-01B .
B2139	Data Mismatch (Receive Data Does Not Match What Was Expected)	ICM	REFER to Section 419-01A .
B2141	NVM Configuration Failure	ICM	REFER to Section 419-01B .
B2143	NVM Memory Failure	ICM	REFER to Section 419-01B .
B2162	Data Mismatch #2 (Receive Data Does Not Match What Was Expected)	ICM	REFER to Section 419-01B .
B2328	Column Reach Feedback Potentiometer Circuit Failure	ICM	REFER to Section 211-04 .
B2332	Column Tilt Feedback Potentiometer Circuit Failure	ICM	REFER to Section 211-04 .
B2351	Steering Column Switch Circuit Failure	ICM	REFER to Section 211-04 .

B2431	Transponder Programming Failed	ICM	REFER to <u>Section 419-01A</u> .
B2472	Fog Lamp Switch Failure	ICM	REFER to <u>Section 417-01</u> .
B2477	Module Configuration Failure	ICM	REFER to <u>Section 418-01</u> .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS, ABS/TC, IVD	CARRY OUT the ABS, ABS/TC, or IVD self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test.
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant Fluid Temperature	PCM	CARRY OUT the PCM self-test.
U1123	SCP (J1850) Invalid or Missing Data for Odometer Rolling Count	ABS, ABS/TC, IVD	CARRY OUT the ABS, ABS/TC, IVD self-test.
U1147	SCP (J1850) Invalid or Missing Data for Vehicle Security System	PCM	CARRY OUT the PCM self-test.

Instrument Cluster Parameter Identification (PID) Index

PID	Description	Expected Value
ABCHIME	Air Bag Chime	OFF, ON
ANTISCN	Anti-Scan Function	DISABL, ENABLE
ASWSTAT	Autolamp Switch Input Status	1 KEY, 2 KEY, 3 KEY, 4 KEY, 5 KEY, 6 KEY, 7 KEY, 8 KEY, 9 KEY, 0 KEY, NO KEY
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_SBELT	Driver Seat Belt	OUT, IN
DSWSTAT	Dimmer Switch Input Status	ON, LVL1, LVL2, LVL3, LVL4, LVL5, LVL6, LVL7, LVL8, LVL9, LVL10, LVL11, LVL12, LVL13, LVL14, LVL15, LVL16, LVL17, LVL18, LVL19, LVL20, LVL21, ?
ENABL_S	Vehicle Enable Status	DISABL, ENABLE
HEAD_L	Headlamp Switch Input Status	OFF, PARK, HEADLP, R_FOG, INVLD, ?
HIBEAM	High Beam Switch Input Status	OFF, HIGH, PASS, INVLD, ?
HORN_SW	Horn Input Switch	OFF, ON
IGN_A	Ignition Switch -ACCY Position	NO, YES
IGN_KEY	Ignition Key In / Out	OUT, IN
IGN_O/U	Ignition Switch - OFF/Unlock Position	NO, YES
IGN_R	Ignition Switch -RUN Position	NO, YES
IGN_S	Ignition Switch - START Position	NO, YES
LIGHTSN	Night(True) / Day (False)	NO, YES

M_KEY	Master Key Present	notPRE, PRESNT
NUMKEYS	Number Of Keys Stored In Module	one count per bit
PCM_ID	PCM ID Status	notSTR, STORED
PCM_VFY	PCM Verify OK	NO, YES
RESETSW	Reset Switch	OFF, ON
SELECT	Select/Mode Switch	OFF, ON
TILT	Steering Column Tilt Switch	SHORT, UP, DOWN, OFF
TELEPOS	Telescope Position Sensor	notSEN, SENSED
TELESCP	Steering Column Telescope Switch	SHORT, IN, OUT, OFF
TILTPOS	Tilt Position Sensor	notSEN, SENSED
TR_PARK	Transmission Select Lever In Park Pos	NO, YES

Instrument Cluster Active Command Index

Active Command	Display	Action
ANTI-THEFT INDICATOR LAMP	THEFT LAMP	OFF, ON
DISPLAY DIMMING CONTROL	ILLUMINAT	OFF, ON
DISPLAY SEGMENT CONTROL II	SEGMENTS	OFF, ON
ENGINE COOLANT GAUGE CONTROL	ENGCOOLNT	0%-100%
FUEL GAUGE CONTROL	FUELLEVEL	0%-100%
MEMORY SELECT CONTROL	MEMORY 1	OFF, ON
MEMORY SELECT CONTROL	MEMORY 2	OFF, ON
PRNDL DISPLAY CONTROL COMMAND	SEGMENTS	OFF, ON
RF SIGNAL	RF	OFF, ON
SPEEDOMETER CONTROL	SPDOMETER	0%-100%
TACHOMETER CONTROL	TCHOMETER	0%-100%
WARNING LAMPS AND CHIME	ALL LAMPS	OFF, ON
WARNING LAMPS AND CHIME	CHIME	OFF, ON

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the front electronic module (FEM) 	<ul style="list-style-type: none"> Battery junction box (BJB) Fuses 425 (40A), 422 (20A). Circuitry. 	<ul style="list-style-type: none"> GO to <u>Pinpoint Test A</u>.

	<ul style="list-style-type: none"> ● FEM. 	
<ul style="list-style-type: none"> ● No communication with the instrument cluster module (ICM) 	<ul style="list-style-type: none"> ● Central junction box (CJB) Fuses 202 (5A), 213 (5A), 217 (5A), 220 (10A). ● Circuitry. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B.
<ul style="list-style-type: none"> ● The instrument cluster illumination is inoperative 	<ul style="list-style-type: none"> ● Circuitry. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test C.
<ul style="list-style-type: none"> ● The climate control illumination is inoperative 	<ul style="list-style-type: none"> ● Dual automatic temperature control (DATC) module. 	<ul style="list-style-type: none"> ● INSTALL a new DATC module. REFER to Section 412-04. CLEAR the DTCs. REPEAT the self-test.
<ul style="list-style-type: none"> ● The audio system illumination is inoperative 	<ul style="list-style-type: none"> ● Audio unit. 	<ul style="list-style-type: none"> ● REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility.
<ul style="list-style-type: none"> ● The control illumination is inoperative — all LEDs and incandescents 	<ul style="list-style-type: none"> ● Circuitry. ● FEM. ● IAJB. ● LH instrument panel junction box. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D.
<ul style="list-style-type: none"> ● The control illumination is inoperative — all LEDs or incandescents 	<ul style="list-style-type: none"> ● Circuitry. ● FEM. ● IAJB. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test E.
<ul style="list-style-type: none"> ● The control illumination is always on — all LEDs or incandescents 	<ul style="list-style-type: none"> ● Circuitry. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test F.
<ul style="list-style-type: none"> ● The control illumination is always on — all LEDs and incandescents 	<ul style="list-style-type: none"> ● FEM. ● IAJB. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test G.
<ul style="list-style-type: none"> ● A single illumination source is inoperative 	<ul style="list-style-type: none"> ● Circuitry. ● Component. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test H.
<ul style="list-style-type: none"> ● The instrument panel illumination does not dim 	<ul style="list-style-type: none"> ● Circuitry. ● Panel dimmer module. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test I.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE

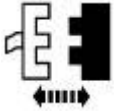
CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29SW-DK22 (OG/YE) FOR VOLTAGE	

NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.

1



2



FEM C201c

3

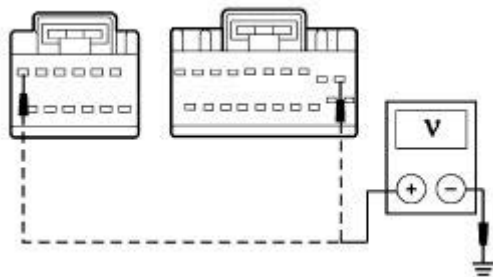


FEM C201f

4



5



A0006297

5 Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OF/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22 (OG/YE), harness side and ground.

• Are the voltages greater than 10 volts?

→ **Yes**
GO to A2.

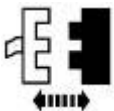
→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

A2 CHECK CIRCUITS 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS

1

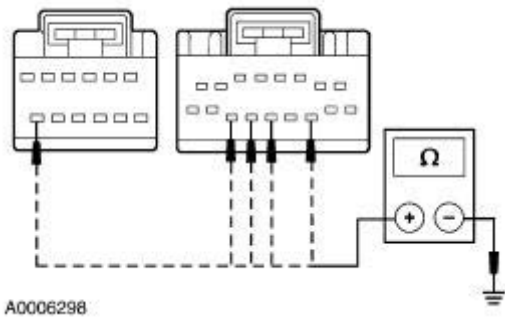


2



FEM C201a

3



3

Using the following table, measure the resistance between FEM connectors, harness side and ground:

FEM	Pin	Circuit
C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)
C201a	15	31-DK20D (BK/RD)

● Is the resistance less than 5 ohms?

→ Yes

REFER to [Section 418-00](#).

→ No

REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST B: NO COMMUNICATION WITH THE INSTRUMENT CLUSTER MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK HOT AT ALL TIMES POWER SUPPLY CIRCUIT	
<p>1</p> <p>2</p> <p>Instrument Cluster C2208</p> <p>3</p>	<p>3</p> <p>Measure the voltage between instrument cluster C220b pin 3, circuit 29-GG11 (OG/BU), harness side and ground.</p> <p>● Is the voltage greater than 10 volts?</p>

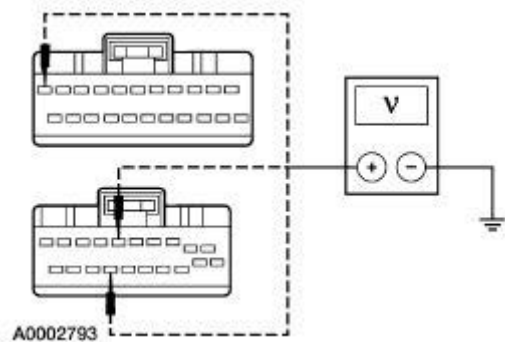
- **Yes**
GO to B2.
- **No**
REPAIR the circuit. TEST the system for normal operation.

B2 CHECK HOT IN RUN POWER SUPPLY CIRCUITS

1



2



- 2 Measure the voltage between the instrument cluster and ground as follows:

Connector Pin	Circuit
C220a pin 11	15-JA14 (GN/BK)
C220b pin 6	15-GG14 (GN/RD)
C220b pin 17	75-GG15 (YE/GN)

- Are the voltages greater than 10 volts?

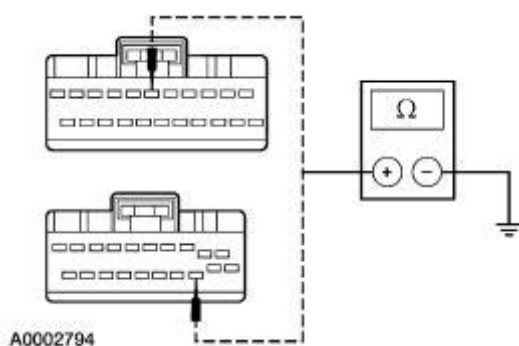
- **Yes**
GO to B3.
- **No**
REPAIR the circuit(s). TEST the system for normal operation.

B3 CHECK GROUND CIRCUITS

1



2



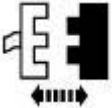

- 2 Measure the resistance between the instrument cluster and ground as follows:

Connector Pin	Circuit
C220a pin 6	31-AL11 (BK)
C220b pin 13	91-GG11 (BN/RD)

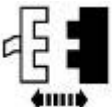
- Are the resistances less than 5 ohms?

	<p>→ Yes REFER to Section 418-00.</p> <p>→ No REPAIR the circuit(s). TEST the system for normal operation.</p>
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PINPOINT TEST C: THE INSTRUMENT CLUSTER ILLUMINATION IS INOPERATIVE

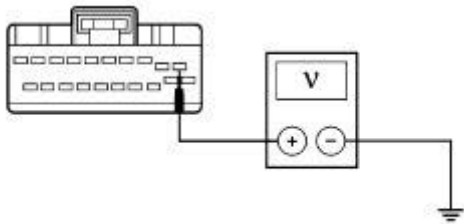
CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE ILLUMINATION FEED CIRCUIT FOR VOLTAGE	
<p>1</p>  <p>Instrument Cluster C220a</p> <p>2</p> 	<p>3 Turn the headlamps on.</p> <p>4 Turn the panel dimmer switch to the MAX position.</p> <p>5 Measure the voltage between instrument cluster C220a pin 7, circuit 64S-LK29 (BU/RD), harness side and ground.</p> <p>● Is the voltage greater than 10 volts?</p> <p>→ Yes INSTALL a new instrument cluster; REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>

PINPOINT TEST D: THE CONTROL ILLUMINATION IS INOPERATIVE — ALL LEDS AND INCANDESCENTS

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK CIRCUIT 29S-DK22 FOR VOLTAGE	
<p>1</p>  <p>FEM C201f</p> <p>2</p>	



4



A0004436

3 Turn the headlamp switch to the ON position.

4 Measure the voltage between FEM C201f pin 1, circuit 29S-DK22 (OG/YE), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to D2.

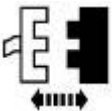
→ No
REPAIR the circuit. TEST the system for normal operation.

D2 CHECK CIRCUIT 64S-LH2 (BU/RD) FOR A SHORT TO GROUND

1

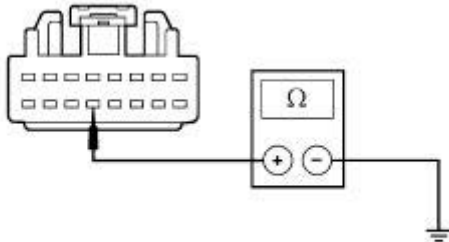


2



IAJB C283a

3



A0004437

1 Turn the headlamp switch to the OFF position.

3 Measure the resistance between IAJB C283a pin 13, circuit 64S-LH2 (BU/RD), harness side and ground.

• Is the resistance greater than 10,000 ohms?

→ Yes
GO to D3.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

D3 CHECK THE OPERATION OF THE FEM

1

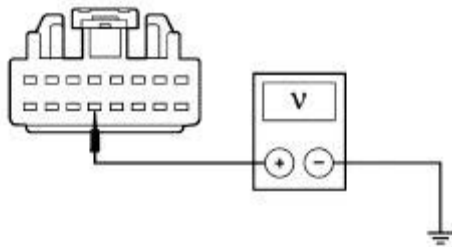


FEM C201f

2



5



A0004788

- 3 Turn the headlamps switch to the ON position.
- 4 Turn the panel dimmer switch to the MAX position.
- 5 Measure the voltage between IAJB C283a pin 13, circuit 64S-LH2 (BU/RD), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to D4.

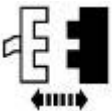
→ **No**
GO to D8.

D4 CHECK THE FEED CIRCUITS FOR A SHORT TO GROUND

1



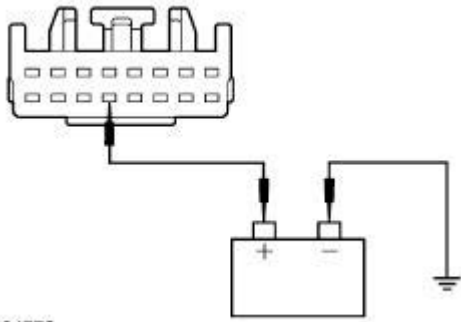
2



IAJB C283d

3

- 3 Connect a fused (5A) jumper wire between IAJB C283d pin 13, circuit 64S-LK1 (BU), harness side and the positive battery terminal.



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- Did the headlamp, panel dimmer, mirror, and steering wheel switches along with the message center and instrument cluster illuminate?

→ **Yes**
GO to D7.

→ **No**
GO to D5.

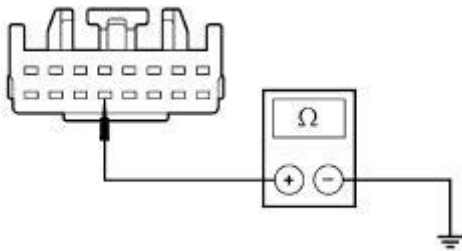
D5 CHECK CIRCUIT 64S-LK1 (BU) FOR A SHORT TO GROUND

1



LH Instrument Panel Junction Box C224

2



A0004779

- 2 Measure the resistance between IAJB C224 pin 13, circuit 64S-LK1 (BU), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to D6.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

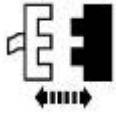
D6 CHECK THE FEED CIRCUITS FOR A SHORT TO GROUND

1



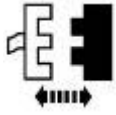
Steering Wheel Switch C217

2



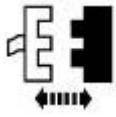
Mirror Switch C204

3



Panel Dimmer Switch C206

4



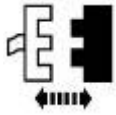
Headlamp Switch C205

5



Message Center C253

6



Instrument Cluster C220a

7 Measure the resistance between the following circuits (using the chart below) and ground:

Connector and Pin	Circuit
Steering Wheel Switch C217 pin 5	Circuit 64-LK18 (BU/RD)
Mirror Switch C204 pin 5	Circuit 64S-LH50 (BU/YE)
Panel Dimmer Switch C206 pin 1	Circuit 64S-LE10 (BU/YE)
Headlamp Switch C205 pin 5	Circuit 64S-LH26 (BU/BK)
Message Center C253 pin 1	Circuit 64S-GG25 (BU/OG)
Instrument Cluster C220a pin 7	Circuit 64S-LK29 (BU/RD)

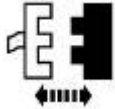
• Are the resistances greater than

10,000 ohms?

- **Yes**
REPAIR or INSTALL a new LH instrument panel junction box. CLEAR the DTCs. REPEAT the self-test.
- **No**
REPAIR the circuit in question. TEST the system for normal operation.

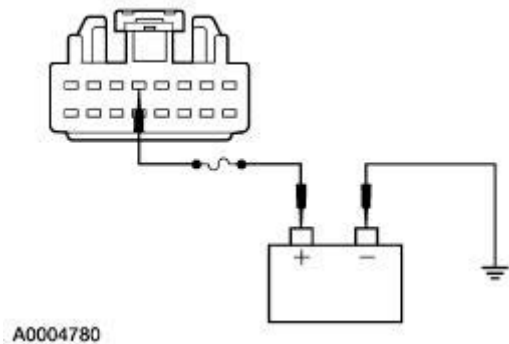
D7 CHECK THE IAJB FOR A SHORT TO GROUND

1



IAJB C283a

2



- 2 Connect a fused (5A) jumper wire between the IAJB C283a pin 5, harness side and the positive battery terminal.

- Do the selector lever indicator bezel, heated seat, TC disable, and vehicle emergency monitoring system (VEMS) switches along with the cigar lighter illuminate?

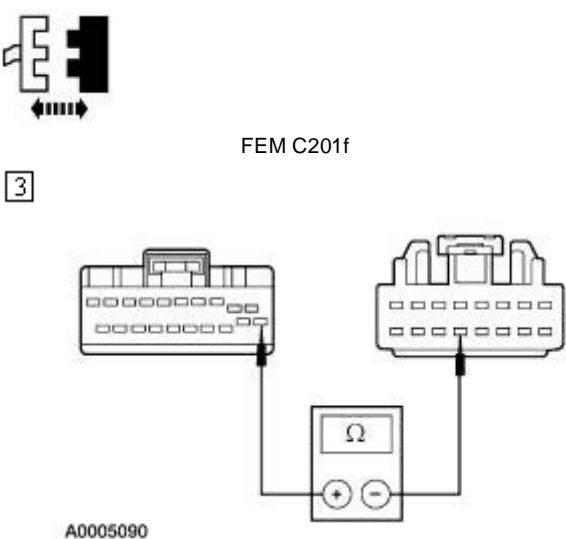
- **Yes**
REPAIR or INSTALL a new IAJB. CLEAR the DTCs. REPEAT the self-test.
- **No**
REPAIR circuit 64S-LK21 (BU/BK), circuit 64S-HC6 (BU), circuit 64S-HC9 (BU/BK), circuit 64S-LH45 (BU/OG), circuit 64S-LK11 (BU), circuit 64S-GP6 (BU/RD), or circuit 64S-LK9 (BU) for a short to ground. TEST the system for normal operation.

D8 CHECK CIRCUIT 64S-LH2 (BU/RD) FOR AN OPEN

1



2



3

FEM C201f

A0005090

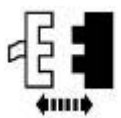
3 Measure the resistance between the FEM C201f pin 11, circuit 64S-LH2 (BU/RD), harness side and the IAJB C283a pin 13, circuit 64S-LH2 (BU/RD), harness side.

- Is the resistance less than 5 ohms?

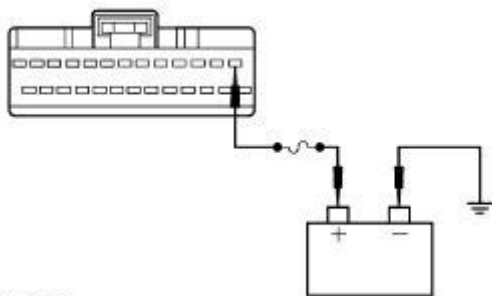
→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST E: THE CONTROL ILLUMINATION IS INOPERATIVE — ALL LEDS OR INCANDESCENTS

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 VERIFY WHICH ILLUMINATION IS INOPERATIVE	
	<p>1 Verify which switch or component illumination is inoperative.</p> <ul style="list-style-type: none"> • Are the power window, power door lock, and memory switches inoperative? <p>→ Yes GO to E2.</p> <p>→ No GO to E4.</p>
E2 CHECK THE FEM	
<p>1</p>  <p>FEM C201e</p>	

2



A0004781

2

Connect a fused (5A) jumper wire between the FEM C201e pin 1, circuit 64S-LH1 (BU), harness side and the positive battery terminal.

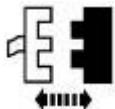
- Do the power window, power door lock, and memory switches illuminate?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to [E3](#).

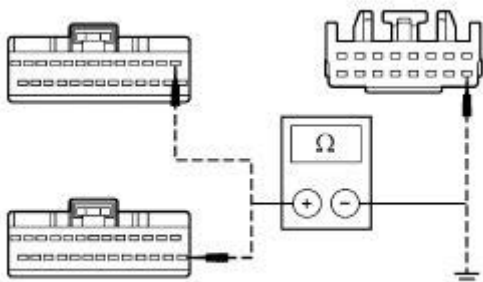
E3 CHECK THE IAJB

1



IAJB C283a

2



A0004782

2

Measure the resistance between FEM C201e pin 1, circuit 64S-LH1 (BU/RD), harness side and IAJB C283a pin 9, circuit 64S-LH1 (BU/RD), harness side; and between FEM C201e pin 1, circuit 64S-LH1 (BU/RD), harness side and ground.

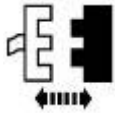
- Is the resistance between the FEM and the IAJB less than 5 ohms and the resistance between the FEM and ground greater than 10,000 ohms?

→ **Yes**
REPAIR or INSTALL a new IAJB. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

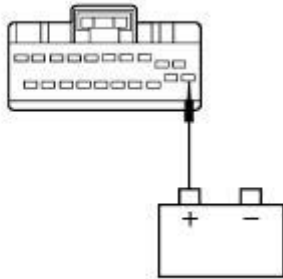
E4 CHECK THE OPERATION OF THE FEM

1



FEM C201f

2



A0005091

2

Connect a fused (5A) jumper wire between FEM C201f pin 11, circuit 64S-LH2 (BU/RD), harness side and the positive battery terminal.

- Do the selector lever indicator bezel, heated seat, TC disable, vehicle emergency monitoring system (VEMS), steering wheel, mirror, panel dimmer, and headlamp switches along with the cigar lighter, message center, and instrument cluster illuminate?

→ **Yes**

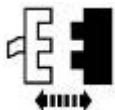
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

GO to [E5](#).

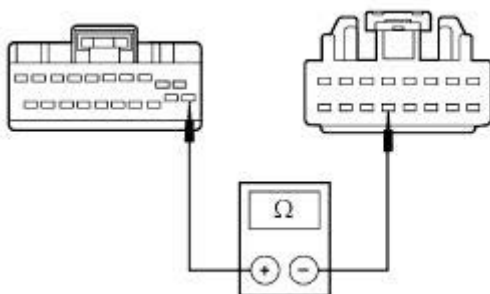
E5 CHECK CIRCUIT 64S-LH2 (BU/RD) FOR AN OPEN

1



IAJB C283a

2



A0005090



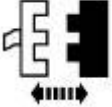

2

Measure the resistance between FEM C201f pin 11, circuit 64S-LH2 (BU/RD), harness side and the IAJB C283a pin 13, circuit 64S-LH2 (BU/RD), harness side.

- Is the resistance less than 5 ohms?

	<p>→ Yes REPAIR or INSTALL a new IAJB. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
--	--

PINPOINT TEST F: THE CONTROL ILLUMINATION IS ALWAYS ON — ALL LEDS OR INCANDESCENTS

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 ISOLATE THE SYMPTOM	
<p>1</p> 	<p>2 Identify the symptom.</p> <ul style="list-style-type: none"> ● Are only the power window, power door lock, and memory set switches always illuminated? <p>→ Yes GO to <u>F2</u>.</p> <p>→ No If both the LEDs and incandescents are always illuminated, GO to <u>Pinpoint Test G</u>. If only the selector lever indicator bezel, heated seat, TC disable, VEMS, steering wheel, mirror, panel dimmer, and headlamp switch along with the cigar lighter, message center, and instrument cluster illumination are always illuminated, GO to <u>F7</u>.</p>
F2 CHECK THE POWER SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE	
<p>1</p>  <p>2</p>  <p style="text-align: center;">FEM C201e</p> <p>3</p> 	

- Do the power window, power door lock, and memory set switch illumination turn off?

→ **Yes**
 INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
 GO to [F3](#).

F3 ISOLATE THE SHORT TO VOLTAGE

1



2



IAJB C283a

3



4 Verify if any switches are still illuminated.

- Are any switches still illuminated?

→ **Yes**
 GO to [F4](#).

→ **No**
 REPAIR circuit 64S-LH1 (BU) for a short to voltage. TEST the system for normal operation.

F4 CHECK THE IAJB FOR A SHORT TO VOLTAGE

1



2



IAJB C283b

3



4 Verify if any switches are still illuminated.

● **Are any switches still illuminated?**

→ **Yes**

If the LF power door lock, power window, and memory set switch are illuminated, REPAIR circuit 29S-LH1 (OG/YE), circuit 29S-LH28 (OG/YG), circuit 29S-AH27 (OG/YE), or circuit 29S-LH14 (OG/YE) for a short to voltage; if the LR power window switch is illuminated, REPAIR circuit 29S-LH16 (OG) for a short to voltage; if any of the RF power door lock and power window, or RR power window switches are illuminated, GO to F5.

→ **No**

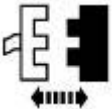
REPAIR or INSTALL a new IAJB. CLEAR the DTCs. REPEAT the self-test.

F5 CHECK THE CJB FOR A SHORT TO VOLTAGE

1



2



CJB C270d

3



4 Verify if any switches are illuminated.

● **Are any switches illuminated?**

→ **Yes**

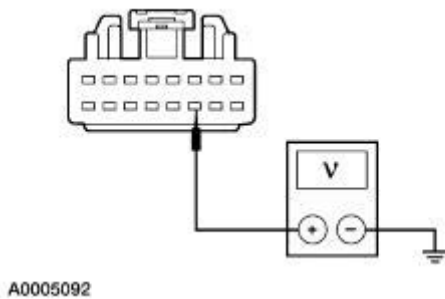
If the RF power door lock and power window switches are illuminated, REPAIR circuit 29S-LH2 (OG/BU), circuit 29S-LH42 (OG/BU), or circuit 29S-LH31 (OG/BU) for a short to power; if the RR power window switch is illuminated, REPAIR circuit 29S-LH33 (OG/BK) for a short to power. TEST the system for normal operation.

→ **No**

GO to F6.

F6 CHECK CIRCUIT 29S-AD2 (OG/BU) FOR A SHORT TO VOLTAGE

1



1 Measure the voltage between IABJ C283b pin 11, circuit 29S-AD2 (OG/BU), harness side and ground.

● Is any voltage present?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

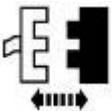
→ **No**
REPAIR or INSTALL a new CJB. CLEAR the DTCs. REPEAT the self-test.

F7 CHECK THE FEED CIRCUIT FOR A SHORT TO VOLTAGE

1



2



FEM C210f

3



● Do the selector lever indicator bezel, heated seat, TC disable, VEMS, steering wheel, mirror, panel dimmer, and headlamp switch along with the cigar lighter, message center, and instrument cluster illumination turn off?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

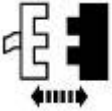
→ **No**
GO to F8.

F8 ISOLATE THE SHORT TO VOLTAGE

1



2



IAJB C283d

3



IAJB C283a

4



5 Verify if any illumination sources are illuminated.

- Are any illumination sources illuminated?

→ **Yes**

If the selector lever indicator bezel, heated seat, TC disable, and vehicle emergency monitoring system (VEMS) switches along with the cigar lighter are illuminated REPAIR circuit 64S-LK9 (BU/WH), circuit 64S-LK21 (BU/BK), circuit 64S-HC6 (BU), circuit 64S-HC9 (BU/BK), circuit 64S-LH45 (BU/OG), circuit 64S-LK11 (BU), or circuit 64S-GP6 (BU/RD) for a short to voltage. If the steering wheel, mirror, panel dimmer, headlamp switch, along with the message center, and instrument cluster illumination are illuminated GO to F10. TEST the system for normal operation.

→ **No**

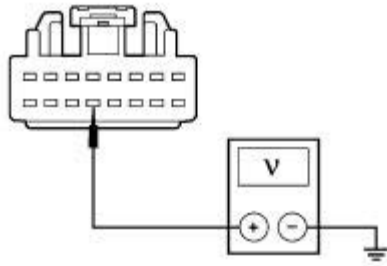
GO to F9.

F9 CHECK CIRCUIT 64S-LH2 (BU/RD) FOR A SHORT TO VOLTAGE

1

1

Measure the voltage between IAJB C283a pin 13, circuit 64S-LH2 (BU/RD), harness side and ground.



A0005093

● **Is any voltage present?**

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

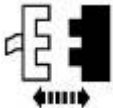
→ **No**
REPAIR or INSTALL a new IAJB. CLEAR the DTCs. REPEAT the self-test.

F10 ISOLATE THE SHORT

1



2



LH Instrument Panel Junction Box C224

3



4 Verify which illumination source is illuminated.

● **Are any illumination sources illuminated?**

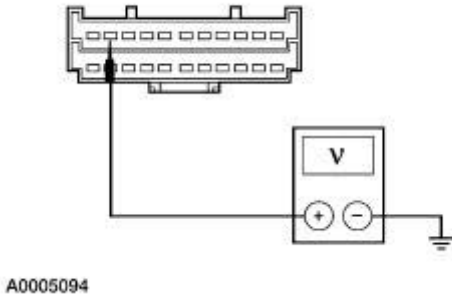
→ **Yes**
If the steering wheel switches are illuminated REPAIR circuit 64-LK18 (BU/RD) for a short to voltage; if the mirror switch is illuminated REPAIR circuit 64S-LH50 (BU/YE) for a short to voltage; if the panel dimmer switch is illuminated REPAIR circuit 64S-LE10 (BU/YE) for a short to voltage; if the headlamp switch is illuminated REPAIR circuit 64S-LH26 (BU/BK) for a short to voltage; if the message center is illuminated REPAIR circuit 64S-GG25 (BU/OG) for a short to

voltage; if the instrument cluster is illuminated REPAIR circuit 64S-LK29 (BU/RD) for a short to voltage. TEST the system for normal operation.

→ **No**
GO to F11.

F11 CHECK CIRCUIT 64S-LK1 (BU) FOR A SHORT TO VOLTAGE

1



1

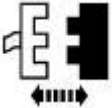
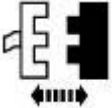

Measure the voltage between LH instrument panel junction box C224 pin 13, circuit 64S-LK1 (BU), harness side and ground.

● **Is any voltage present?**

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
REPAIR or INSTALL a new LH instrument panel junction box. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST G: THE CONTROL ILLUMINATION IS ALWAYS ON — ALL LEDS AND INCANDESCENTS

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE IAJB FOR A SHORT TO VOLTAGE	
<p>1</p>  <p>FEM C201f</p> <p>2</p>  <p>FEM C201e</p> <p>3</p> 	

- Do all the LEDs and incandescents turn off?



→ **Yes**

INSTALL a new FEM. CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR or INSTALL a new IAJB. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST H: A SINGLE ILLUMINATION SOURCE IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS																				
H1 CHECK THE POWER CIRCUIT TO THE LED OR INCANDESCENT IN QUESTION																					
<p>1</p>  <p>Inoperative Illumination Source</p> <p>2</p> 	<p>3 Turn the headlamps on.</p> <p>4 Turn the panel dimmer switch to the MAX position.</p> <p>5 Measure the voltage between the circuit in question and ground as follows.</p> <table border="1"> <thead> <tr> <th>Connector and Pin</th> <th>Circuit</th> </tr> </thead> <tbody> <tr> <td>LF Power Window Switch C504 pin 11</td> <td>circuit 29S-LH14 (OG/YE)</td> </tr> <tr> <td>RF Power Window Switch C604 pin 6</td> <td>circuit 29S-LH31 (OG/BU)</td> </tr> <tr> <td>RR Power Window Switch C801 pin 6</td> <td>circuit 29S-LH33 (OG/BK)</td> </tr> <tr> <td>LR Power Window Switch C701 pin 6</td> <td>circuit 29S-LH16 (OG)</td> </tr> <tr> <td>LF Power Door Switch C505 pin 6</td> <td>circuit 29S-LH28 (OG/YE)</td> </tr> <tr> <td>RF Power Door Switch C605 pin 6</td> <td>circuit 29S-LH42 (OG/BU)</td> </tr> <tr> <td>Memory Set Switch C503 pin 3</td> <td>circuit 29S-AH27 (OG/YE)</td> </tr> <tr> <td>Selector Lever Indicator Bezel C307 pin 1</td> <td>circuit 64S-LK21 (BU/RD)</td> </tr> <tr> <td>Left Heated Seat Switch C344 pin 6</td> <td>circuit 64S-HC6 (BU)</td> </tr> </tbody> </table>	Connector and Pin	Circuit	LF Power Window Switch C504 pin 11	circuit 29S-LH14 (OG/YE)	RF Power Window Switch C604 pin 6	circuit 29S-LH31 (OG/BU)	RR Power Window Switch C801 pin 6	circuit 29S-LH33 (OG/BK)	LR Power Window Switch C701 pin 6	circuit 29S-LH16 (OG)	LF Power Door Switch C505 pin 6	circuit 29S-LH28 (OG/YE)	RF Power Door Switch C605 pin 6	circuit 29S-LH42 (OG/BU)	Memory Set Switch C503 pin 3	circuit 29S-AH27 (OG/YE)	Selector Lever Indicator Bezel C307 pin 1	circuit 64S-LK21 (BU/RD)	Left Heated Seat Switch C344 pin 6	circuit 64S-HC6 (BU)
Connector and Pin	Circuit																				
LF Power Window Switch C504 pin 11	circuit 29S-LH14 (OG/YE)																				
RF Power Window Switch C604 pin 6	circuit 29S-LH31 (OG/BU)																				
RR Power Window Switch C801 pin 6	circuit 29S-LH33 (OG/BK)																				
LR Power Window Switch C701 pin 6	circuit 29S-LH16 (OG)																				
LF Power Door Switch C505 pin 6	circuit 29S-LH28 (OG/YE)																				
RF Power Door Switch C605 pin 6	circuit 29S-LH42 (OG/BU)																				
Memory Set Switch C503 pin 3	circuit 29S-AH27 (OG/YE)																				
Selector Lever Indicator Bezel C307 pin 1	circuit 64S-LK21 (BU/RD)																				
Left Heated Seat Switch C344 pin 6	circuit 64S-HC6 (BU)																				

Right Heated Seat Switch C342 pin 6	circuit 64S-HC9 (BU/BK)
TC Disable Switch C308 pin 6	circuit 64S-LH45 (BU/OG)
Cigar Lighter C319 pin 3	circuit 64S-LK11 (BU)
Vehicle Emergency Monitoring System (VEMS) Switch C915 pin 5	circuit 64S-GP6 (BU/RD)
Steering Wheel Switch Connector C217 pin 5	circuit 64-LK18
Mirror Switch C204 pin 5	circuit 64S-LH50 (BU/YE)
Panel Dimmer Switch C206 pin 1	circuit 64S-LE10 (BU/YE)
Headlamp Switch C205 pin 5	circuit 64S-LH26 (BU/BK)
Message Center C253 pin 1	circuit 64S-GG25 (BU/OG)

● **Is the voltage greater than 10 volts?**

→ **Yes**
GO to H2.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

H2 CHECK THE GROUND CIRCUIT TO THE LED OR INCANDESCENT IN QUESTION

1



2 Turn the headlamps off.

3 Measure the resistance between the circuit in question (using the chart below) and ground.

Connector and Pin	Circuit
LF Power Window Switch C504 pin 14	circuit 31-AJ80 (BK)
RF Power Window Switch C604 pin 4	circuit 31-LH31 (BK)
RR Power Window Switch C801 pin 4	circuit 31-LH33 (BK/GN)
LR Power Window Switch C701 pin 4	circuit 31-LH16 (BK/OG)
LF Power Door Switch C505 pin 4	circuit 31-LH28 (BK)
RF Power Door Switch C605 pin 4	circuit 31-LH42 (BK)
Memory Set Switch C503 pin 4	circuit 31-AH27 (BK)
Selector Lever Indicator Bezel C307 pin 2	circuit 31-LK21 (BK/GN)
Left Heated Seat Switch C344 pin 4	circuit 31-HC6 (BK/YE)

Right Heated Seat Switch C342 pin 4	circuit 31-HC9 (BK/GN)
TC Disable Switch C308 pin 5	circuit 31-LH45 (BK/WH)
Cigar Lighter C319 pin 4	circuit 31-LK11 (BK/YE)
VEMS Switch C915 pin 4	circuit 31-GP6 (BK)
Steering Wheel Switch Connector C217 pin 5	circuit 10-GJ9
Mirror Switch C204 pin 6	circuit 31-LH50 (BK)
Panel Dimmer Switch C206 pin 2	circuit 31-LE10 (BK)
Headlamp Switch C205 pin 4	circuit 31-LH26 (BK)
Message Center C253 pin 2	circuit 31-GG25 (BK)

● **Is the resistance greater than 10,000 ohms?**

→ **Yes**

INSTALL a new switch or illuminated component. CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST I: THE INSTRUMENT PANEL ILLUMINATION DOES NOT DIM

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 RETRIEVE DTCs FROM THE INSTRUMENT CLUSTER	
	<p>1 Use the recorded results from the instrument cluster self-test.</p> <p>● Are any DTCs retrieved?</p> <p>→ Yes If DTC B1246, GO to 3.</p> <p>If DTC B1342, CLEAR and DOCUMENT the DTCs. CARRY OUT the instrument cluster self-test. INSTALL a new instrument cluster if DTC B1342 is retrieved again. REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No GO to 2.</p>
I2 CHECK THE PANEL DIMMER SWITCH — MONITOR THE INSTRUMENT CLUSTER PID	
1	



3



2 Turn the headlamps on.

3 Select and monitor the instrument cluster PID DSWSTAT while rotating the panel dimmer switch from the lowest position to the highest position.

• Does the PID value agree with the panel dimmer switch position?

→ Yes
INSTALL a new instrument cluster.
REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.

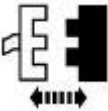
→ No
GO to I3.

I3 CHECK THE POWER CIRCUIT TO THE PANEL DIMMER SWITCH

1



2

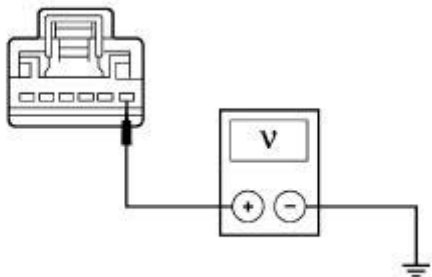


Panel Dimmer Switch C206

3



4



A0004783

4 Measure the voltage between panel dimmer switch C206 pin 1, circuit 64S-LE10 (BU/YE), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to I4.

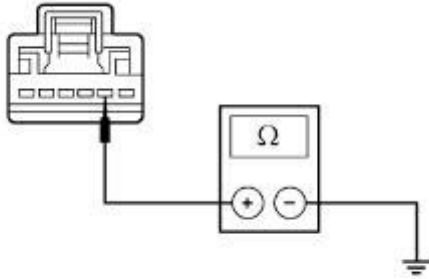
→ **No**
REPAIR the circuit. TEST the system for normal operation.

I4 CHECK THE GROUND CIRCUIT TO THE PANEL DIMMER SWITCH

1



2



A0004784

2 Measure the resistance between panel dimmer switch C206 pin 2, circuit 31-LE10 (BK), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to 15.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

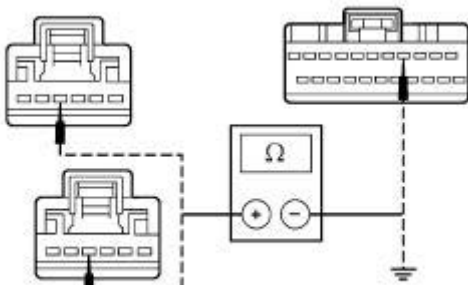
I5 CHECK CIRCUIT 9-LE10 (BN/YE) FOR AN OPEN OR SHORT TO GROUND

1



Instrument Cluster C220c

2



A0004785

2 Measure the resistance between panel dimmer switch C206 pin 4, circuit 9-LE10 (BN/YE), harness side and instrument cluster C220c pin 4, circuit 9-LE10 (BN/YE), harness side; and between panel dimmer switch C206 pin 4, circuit 9-LE10 (BN/YE), harness side and ground.

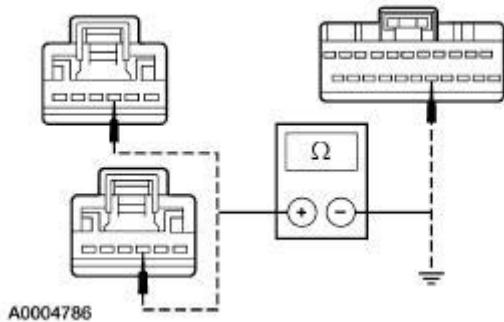
● Is the resistance less than 5 ohms between the panel dimmer switch and instrument cluster; and greater than 10,000 ohms between the panel dimmer switch and ground?

→ **Yes**
GO to 16.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

16 CHECK CIRCUIT 8-LE10 (WH/BK) FOR AN OPEN OR A SHORT TO GROUND

1



1 Measure the resistance between panel dimmer switch C206 pin 3, circuit 8-LE10 (WH/BK), harness side and instrument cluster C220c pin 16, circuit 8-LE10 (WH/BK), harness side; and between panel dimmer switch C206 pin 3, circuit 8-LE10 (WH/BK), harness side and ground.

- Is the resistance less than 5 ohms between the panel dimmer switch and instrument cluster; and greater than 10,000 ohms between the panel dimmer switch and ground?

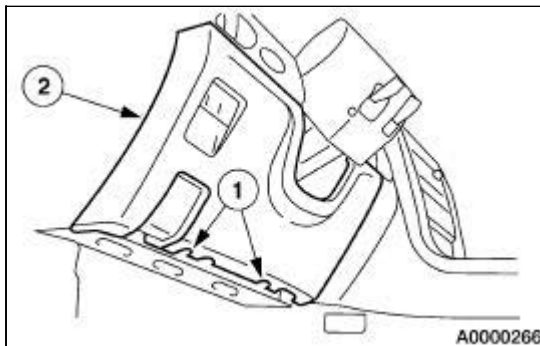
→ **Yes**
INSTALL a new panel dimmer switch.
REFER to Switch—Panel Dimmer.
CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

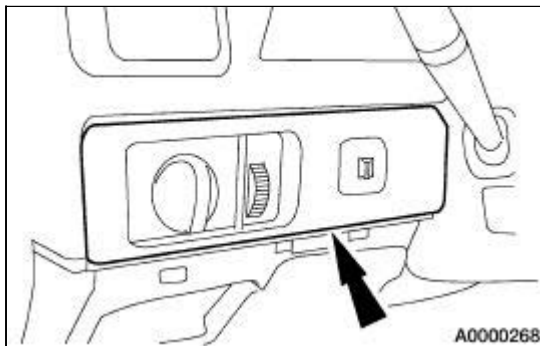
Switch —Panel Dimmer

Removal and Installation

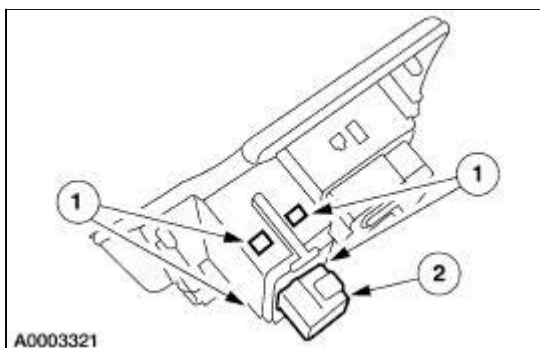
1. Disconnect the battery ground cable. Refer to [Section 414-01](#).
2. Remove the lower instrument panel finish panel.
 1. Remove the bolts.
 2. Remove the lower instrument panel finish panel.



3. Remove the instrument panel finish panel.
 - Disconnect the electrical connectors.



4. Remove the panel dimmer switch.
 1. Release the four retaining clips.
 2. Remove the panel dimmer switch.



5. **NOTE:** When the battery is disconnected and reconnected, some abnormal drive symptoms

may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 miles) or more to relearn the strategy.

To install, reverse the removal procedure.

Torque Specifications

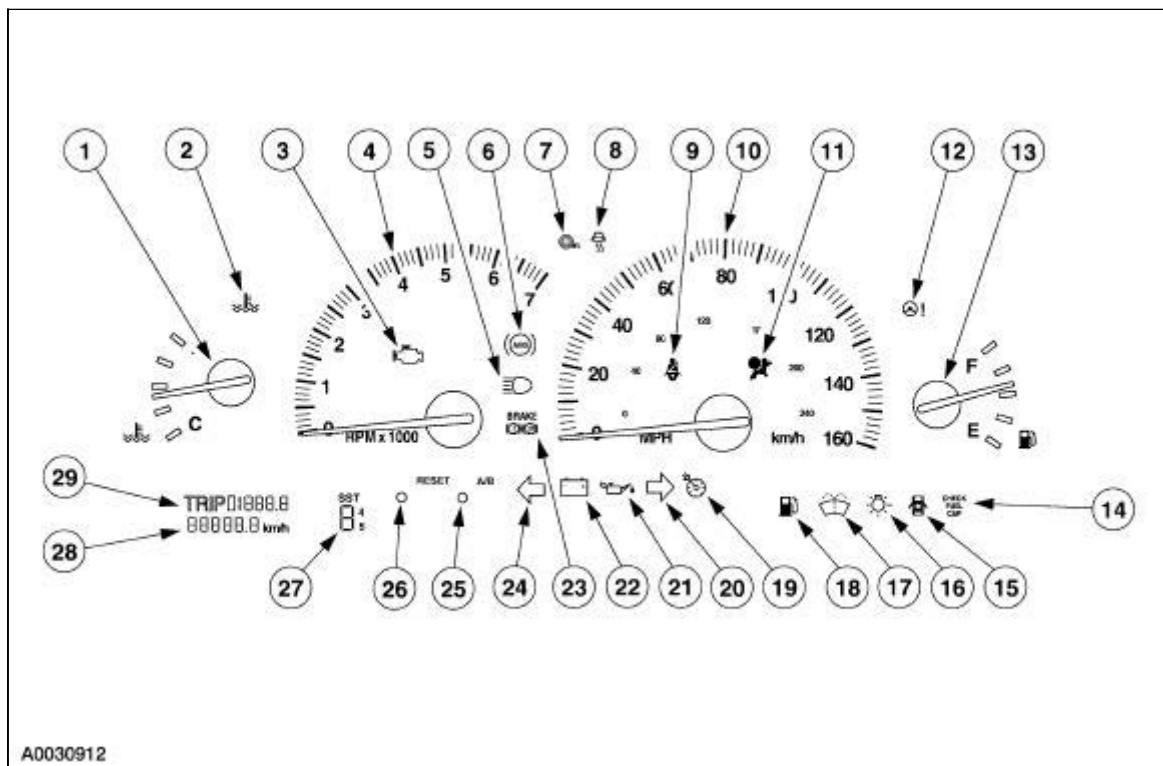
Description	Nm	lb-ft	lb-in
Battery ground cable bolt	10	—	89
Steering column reinforcement bolts	9	—	80
Instrument panel tunnel reinforcement bolts	20	15	—

Instrument Cluster

NOTE: Miles per hour (mph) instrument cluster shown, kilometers per hour (km/h) instrument cluster similar.

The standard instrument cluster consists of the following:

Instrument Cluster (Standard)



A0030912

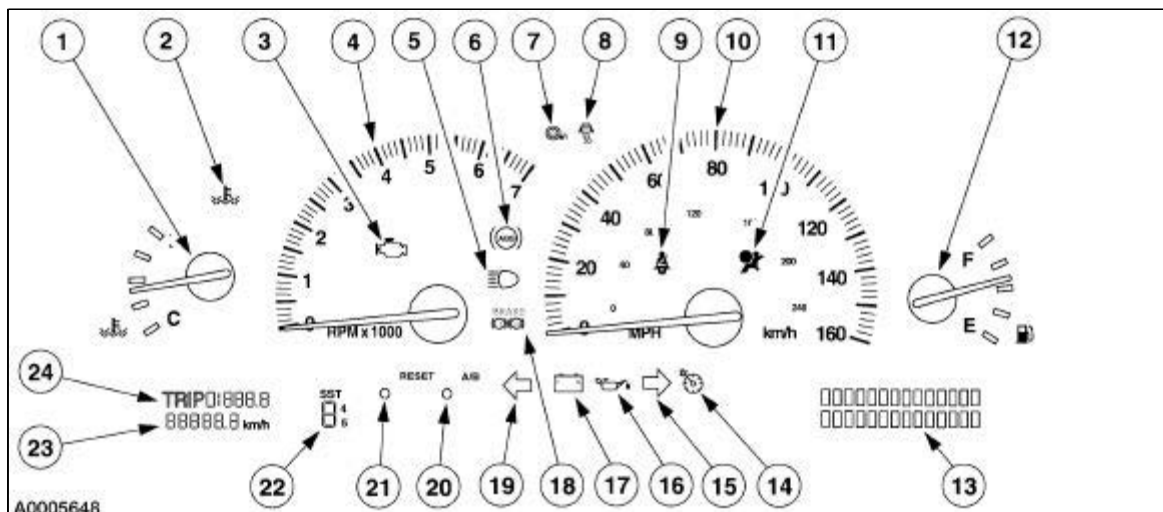
Item	Part Number	Description
1	—	Engine coolant temperature gauge
2	—	Engine over-temperature indicator
3	—	Malfunction indicator lamp (MIL) indicator
4	—	Tachometer
5	—	High beam indicator
6	—	Anti-lock brake system (ABS)
7	—	Traction control indicator
8	—	Advance traction control indicator (if equipped)
9	—	Safety belt indicator
10	—	Speedometer
11	—	Air bag indicator
12	—	Steering column lock indicator (if equipped)
13	—	Fuel gauge

14	—	CHECK FUEL CAP indicator
15	—	Door ajar indicator
16	—	Lamp outage indicator
17	—	Low washer fluid indicator
18	—	Low fuel indicator
19	—	Speed control indicator
20	—	Right turn signal indicator
21	—	Low oil pressure indicator
22	—	Charging system indicator
23	—	Brake system warning indicator (BRAKE)
24	—	Left turn signal indicator
25	—	A/B trip odometer button
26	—	Trip odometer button (reset)
27	—	Shift indicator
28	—	Odometer
29	—	Trip odometer

NOTE: Miles per hour (mph) instrument cluster shown, kilometers per hour (km/h) instrument cluster similar.

The optional instrument cluster consists of the following:

Instrument Cluster (Optional)





Item	Part Number	Description
1	—	Engine coolant temperature gauge
2	—	Engine over-temperature indicator
3	—	Malfunction indicator lamp (MIL)
4	—	Tachometer
5	—	High beam indicator
6	—	Anti-lock brake system (ABS)
7	—	Traction control indicator
8	—	Speedometer
9	—	Cruise control indicator
10	—	Shift indicator
11	—	Door ajar indicator
12	—	Fuel gauge
13	—	Trip odometer
14	—	Odometer
15	—	Low oil pressure indicator
16	—	Low fuel indicator
17	—	Low washer fluid indicator
18	—	Lamp outage indicator
19	—	Right turn signal indicator
20	—	Left turn signal indicator
21	—	Charging system indicator
22	—	Brake system warning indicator (BRAKE)
23	—	A/B trip odometer button
24	—	Engine over-temperature indicator

8	—	Advance traction control indicator
9	—	Safety belt indicator
10	—	Speedometer
11	—	Air bag indicator
12	—	Fuel gauge
13	—	Message center display
14	—	Speed control indicator
15	—	Right turn signal indicator
16	—	Low oil pressure indicator
17	—	Charging system indicator
18	—	Brake system warning indicator (BRAKE)
19	—	Left turn signal indicator
20	—	A/B trip odometer button
21	—	Trip odometer button (reset)
22	—	Shift indicator
23	—	Odometer
24	—	Trip odometer

Instrument Cluster

Refer to Wiring Diagrams Section [413-01](#), Instrument Cluster for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

NOTE: The instrument cluster, front electronic module (FEM), and the rear electronic module (REM) must be reconfigured upon replacement. Refer to [Section 418-01](#).

NOTE: The diagnostic tool may display ICM for the instrument cluster.

NOTE: For any concerns with the restraint control module (RCM), refer to [Section 501-20B](#).

The instrument cluster is a hybrid electronic instrument cluster (HEC). The vehicle electronic functions are divided into zones. The instrument cluster, FEM, and REM use the standard corporate protocol (SCP) communication network to transmit and receive information. As a technician, it is very important to understand:

- where the input (command) originates from
- all information (messages) necessary in order for a feature to operate
- which module(s) receive(s) the input or command message
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module
- which module controls the output of the feature

The instrument cluster communicates with the FEM, REM, anti-lock brake system/traction control/interactive vehicle dynamics (ABS/TC/IVD), powertrain control module (PCM), steering column lock (SCL), message center (MC) module, and the restraint control module (RCM) over the SCP to control the gauges, indicators, and chimes.

Warning Indicator Functionality

Low Oil Pressure Indication

The low oil pressure switch is hardwired to the FEM. The status of the oil pressure is sent from the FEM to the instrument cluster via the standard corporate protocol (SCP) communication network.

Safety Belt Warning Indication

The safety belt switch is hardwired directly to the instrument cluster. The instrument cluster uses the input from the switch to determine whether or not the safety belt is fastened.

Door Ajar Warning Indication (If equipped)

The door switches for the rear of the vehicle are directly hardwired to the REM. The REM uses the multiple inputs from the door switches to determine whether the doors are in the opened or closed position. This information is then relayed from the REM to the instrument cluster via the SCP communication network. The door switches for the front of the vehicle are directly hardwired to the FEM. The FEM uses the multiple inputs from the door switches to determine whether the doors are in the opened or closed position. This information is then relayed to the instrument cluster via the SCP communication network.

Charging System Warning Indication

The charging system is hardwired to the PCM. The status of the charging system is then relayed from the PCM to the instrument cluster via the SCP communication network.

Brake Warning Indication

The brake warning indicator supports three separate functions. Those functions are brake system failure, low brake fluid level, and engagement of the parking brake control. These functions are controlled by the parking brake control switch, the brake fluid level switch and the brake system itself. The brake fluid level switch and the parking brake control switch are hardwired directly to the FEM. The status of both the fluid and parking brake control switches is sent from the FEM to the instrument cluster via the SCP communication network. The brake system status is sent from the ABS/TC/IVD to the instrument cluster via the SCP communication network.

High Beam Indication

The multifunction switch is hardwired directly to the instrument cluster. The headlamp status is then sent from the instrument cluster to the FEM via the SCP communication network.

Low Washer Fluid Warning Indication (If equipped)

The low washer fluid level switch is hardwired directly to the FEM. The FEM monitors the washer fluid level status and sends it to the instrument cluster via the SCP communication network.

Air Bag Warning Indication

The AIR BAG warning indicator will be illuminated when the electronic crash sensor (ECS) sends a ground signal to the instrument cluster. The prove out of the AIR BAG warning indicator is controlled by the ECS.

ABS Warning Indication

The status of the ABS/TC/IVD system is sent to the instrument cluster via the SCP communication network. The instrument cluster uses this input to determine whether or not there is a fault with the ABS/TC/IVD system.

Traction Control Warning Indication

The status of the traction control is communicated to the instrument cluster from the TC/IVD module via the SCP communication network.

Advance Traction Warning Indication

The status of the system is communicated to the instrument cluster from the IVD module via the SCP communication network.

Lamp Outage Warning Indication (If equipped)

The FEM and REM both control the exterior illumination. If the exterior lamps are the cause of the fault, these two modules will notify the instrument cluster via the SCP communication network and cause the lamp outage warning indicator to illuminate.

Malfunction Indicator Lamp (MIL)

After the engine is started, the MIL will prove out for a duration of three seconds. If the instrument cluster does not receive a message from the PCM within five seconds, it will send two messages to the PCM and attempt to reestablish communication. If the instrument cluster is unable to reestablish communication, the instrument cluster will illuminate the MIL and log a diagnostic trouble code (DTC).

Turn/Hazard Indication

The multifunction switch is hardwired directly to the instrument cluster. The instrument cluster sends the signal from the multifunction switch to both the FEM and REM via the SCP communication network while simultaneously illuminating the turn/hazard indicators. The FEM and the REM use these inputs from the instrument cluster to illuminate the exterior lighting as necessary.

Speed Control Indication

The speed control status is monitored by the PCM and then relayed to the instrument cluster via the SCP communication network. The speed control indicator illuminates when the speed control is set.

Low Fuel Warning Indication (If equipped)

There are two fuel tank senders, and they are hardwired directly to the REM. The status of the fuel level from both senders is sent from the REM over the SCP communication network to the instrument cluster. The instrument cluster uses these inputs to determine the overall fuel level in the tank and illuminates the low fuel warning indicator if the fuel level is low.

Engine Over-Temperature Indicator

The cylinder head temperature sending unit is hardwired directly to the PCM. The status of the cylinder head temperature is sent from the PCM over the SCP communication network to the instrument cluster. The instrument cluster then determines whether or not the cylinder head temperature is above the over-temperature threshold.

Steering Column Lock Indication

The steering column lock status is monitored by the instrument cluster from the input of the steering column lock (SCL) module via the standard corporate protocol (SCP) communication network.

Gauge Functionality

Temperature Gauge

The cylinder head temperature sending unit is hardwired directly to the PCM. The status of the cylinder head temperature is sent from the PCM over the SCP communication network to the instrument cluster. Normal operating temperature is 140° F (60° C) to 248° F (120° C). Redline starts at 249.8° F (121° C).

Tachometer Gauge

The crankshaft position sensor is hardwired directly to the PCM. The status of the crankshaft position sensor is sent from the PCM to the instrument cluster via the SCP communication network.

Speedometer Gauge

The vehicle speed signal (VSS) from all four wheels are hardwired directly to the ABS/TC/IVD. The speed status is then sent to the instrument cluster by the ABS/TC/IVD via the SCP communication network.

Fuel Gauge

The fuel gauge system has a saddle-type fuel tank with two integrated fuel senders: the fuel delivery module (FDM) and the jet pump module (JPM). The FDM is located in the right side of the fuel tank and the JPM is located in the left side of the fuel tank. Fuel level status is sent directly to the rear electronic module (REM), which is hardwired to the fuel senders. The REM sends the fuel data to the instrument cluster via the standard corporate protocol (SCP) line. Normal operating range of the FDM is from 16 ± 2 ohms at empty (E) to 155 ± 4 ohms at full (F). Normal operating range of the JPM sender is from 19 ± 2 ohms at empty (E) to 160 ± 2 ohms at full (F). If either the REM or JPM fuel sender has an open or shorted signal, the instrument cluster will log diagnostic trouble code (DTC) B1201. If the JPM sender is open, the fuel gauge will default to the FDM sender value only and the fuel gauge will indicate E to 1/2 tank (depending on the fuel level on the FDM side of the tank). If the FDM is open, the fuel gauge will default to the empty position.

CHECK FUEL CAP

The CHECK FUEL CAP indicator is used to indicate significant leaks in the fuel tank evaporative system due to a loose fuel cap. Fuel tank pressure is monitored by the PCM and if a leak is detected it signals a fault to the instrument cluster via the SCP network. Once the PCM has detected a loose fuel cap and the CHECK FUEL CAP indicator is illuminated, the indicator will remain illuminated until the fuel cap is secured and the vehicle has been running for several minutes. For additional information, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Digital Segment Displays

Trip A/B And Odometer Displays

The vehicle speed signal (VSS) from all four wheels are hardwired directly to the ABS/TC/IVD. The speed status is then sent to the instrument cluster by the ABS/TC/IVD via the SCP communication network to establish a rolling count.

PRNDL Display

The digital transmission range (DTR) sensor is hardwired directly to the PCM. The status of the gear selection is sent to the instrument cluster from the PCM via the SCP communication network.

Parameter Reset and Key Programming

NOTE: The instrument cluster parameters must be reset upon installation of a new instrument cluster.

NOTE: Both passive anti-theft system (PATS) keys are needed to carry out this procedure.

To reset the instrument cluster parameters and program the keys, complete the following procedure:

1. Connect the diagnostic tool.
2. Select the instrument cluster.
3. Select ENTER SECURITY ACCESS. Wait 10 minutes for security access to be granted.
4. Select PARAMETER RESET.
5. Disconnect the diagnostic tool.
6. Place the first PATS key in the OFF position.
7. Place the key in the ON position.
8. Remove the key.
9. Place the second PATS key in the ON position.
10. Place the key in the OFF position (the programming sequence is complete).

NOTE: If the vehicle fails to start following completion of the parameter reset and key programming sequence, clear the keep alive memory (KAM) by disconnecting the battery for five minutes. For additional information about the battery disconnect procedure, refer to [Section 414-00](#).

Inspection and Verification

NOTE: The instrument cluster, REM and FEM must be reconfigured upon replacement. Refer to [Section 418-01](#).

NOTE: For any concerns with the restraint control module (RCM), refer to [Section 501-20B](#).

1. Verify the customer concern by operating the instrument cluster to duplicate the condition by observing the indicators, warning displays, and gauges to determine if they are operating correctly with the ignition switch:
 - in RUN with the engine off
 - in START before the ignition switch is released
 - in RUN with the engine running
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none">● Low washer fluid level● Damaged fuel tank● Low engine coolant level	<ul style="list-style-type: none">● Central junction box (CJB) fuse(s):<ul style="list-style-type: none">■ 204 (5A)■ 205 (5A)

<ul style="list-style-type: none"> ● Damaged accessory drive belt ● Low engine oil level ● Low brake fluid level 	<ul style="list-style-type: none"> ■ 207 (5A) ■ 213 (5A) ■ 217 (5A) ■ 219 (15A) ■ 220 (10A) ■ 224 (5A) ■ 229 (5A) ■ 230 (5A) ■ 235 (5A) ● Battery junction box (BJB) fuse(s): <ul style="list-style-type: none"> ■ 422 (20A) ■ 425 (40A) ■ 427 (30A) ■ 430 (30A) ● Damaged circuitry ● Damaged connectors ● Damaged switches or sensors
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3. If the inspection reveals obvious concern(s) that can be readily identified, repair as necessary.
4. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
6. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for instrument cluster, GO to Pinpoint Test A.
 - NO RESP/NOT EQUIP for FEM, GO to Pinpoint Test B.
 - NO RESP/NOT EQUIP for REM, GO to Pinpoint Test C.
 - NO RESP/NOT EQUIP for RCM, REFER to [Section 501-20B](#).
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the instrument cluster.
7. If the DTCs retrieved are related to the concern, go to the Instrument Cluster Diagnostic Trouble Code (DTC) Index to continue diagnostics.
8. If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue diagnostics.

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	Instrument Cluster	GO to Pinpoint Test D .

B1205	EIC Switch-1 Assembly Circuit Failure	Instrument Cluster	INSTALL a new instrument cluster; REFER to Instrument Cluster . TEST the system for normal operation.
B1209	EIC Switch-2 Assembly Circuit Failure	Instrument Cluster	INSTALL a new instrument cluster; REFER to Instrument Cluster . TEST the system for normal operation.
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	Instrument Cluster	REFER to Section 419-01B .
B1246	Dim Panel Potentiometer Switch Circuit Failure	Instrument Cluster	REFER to Section 413-00 .
B1342	ECU Is Defective	Instrument Cluster	CLEAR and DOCUMENT the DTCs. CARRY OUT the instrument cluster self-test. INSTALL a new instrument cluster if DTC B1342 is retrieved again. REFER to Instrument Cluster .
B1352	Ignition Key-In Circuit Failure	Instrument Cluster	REFER to Section 413-09 .
B1470	Lamp Headlamp Input Circuit Failure	Instrument Cluster	REFER to Section 417-01 .
B1567	Lamp Headlamp High Beam Circuit Failure	Instrument Cluster	REFER to Section 417-01 .
B1600	PATS Ignition Key Transponder Signal Is Not Received	Instrument Cluster	REFER to Section 419-01B .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	Instrument Cluster	REFER to Section 419-01B .
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	Instrument Cluster	REFER to Section 419-01B .
B1676	Battery Pack Voltage Out of Range	Instrument Cluster	GO to Pinpoint Test J .
B1681	PATS Transceiver Module Signal Is Not Received	Instrument Cluster	REFER to Section 419-01B .
B1689	Autolamp Delay Circuit Failure	Instrument Cluster	REFER to Section 417-01 .
B1875	Turn Signal / Hazard Switch Signal Circuit Failure	Instrument Cluster	REFER to Section 417-01 .
B2103	Antenna Not Connected	Instrument Cluster	REFER to Section 419-01B .
B2139	Security Data Mismatch (Receive Data Does Not Match What Was Expected)	Instrument Cluster	REFER to Section 419-01B .
B2141	NVM Configuration Failure	Instrument Cluster	REFER to Section 419-01B .
B2143	NVM Memory Failure	Instrument Cluster	GO to Pinpoint Test Z .
B2162	Security Data Mismatch #2 (Receive Data Does Not Match What Was Expected)	Instrument Cluster	REFER to Section 419-01B .
B2328	Column Reach Feedback Potentiometer Circuit Failure	Instrument Cluster	REFER to Section 211-04 .

B2332	Column Tilt Feedback Potentiometer Circuit Failure	Instrument Cluster	REFER to Section 211-04 .
B2351	Steering Column Switch Circuit Failure	Instrument Cluster	REFER to Section 211-04 .
B2431	Transponder Programming Failed	Instrument Cluster	REFER to Section 419-01B .
B2472	Fog Lamp Switch Failure	Instrument Cluster	REFER to Section 417-01 .
B2477	Module Configuration Failure	Instrument Cluster	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS/TC/IVD	CARRY OUT the ABS/TC/IVD self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test.
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant Fluid Temperature	PCM	CARRY OUT the PCM self-test.
U1123	SCP (J1850) Invalid or Missing Data for Odometer Rolling Count	ABS/TC/IVD	CARRY OUT the ABS/TC/IVD self-test.
U1131	SCP (J1850) Invalid or Missing Data for Fuel System	Instrument Cluster	GO to Pinpoint Test D .
U1147	SCP (J1850) Invalid or Missing Data for Vehicle Security System	PCM	REFER to Section 419-01B .
U1262	SCP (J1850) Communication Bus Fault	Instrument Cluster	REFER to Section 418-00 .

Instrument Cluster Parameter Identification (PID) Index

PID	Description	Expected Value
ABCHIME	Air Bag Chime	OFF, ON
ANTISCN	Anti-Scan Function	DISABL, ENABLE
ASWSTAT	Autolamp Switch Input Status	OFF, DELAY7, DELAY6, DELAY5, DELAY4, DELAY3, DELAY2, DELAY1, INVLD
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_SBELT	Driver Seat Belt	OUT, IN
DSWSTAT	Dimmer Switch Input Status	ON, LVL1, LVL2, LVL3, LVL4, LVL5, LVL6, LVL7, LVL8, LVL9, LVL10, LVL11, LVL12, LVL13, LVL14, LVL15, LVL16, LVL17, LVL18, LVL19, LVL20, LVL21, Invalid
ENABL_S	Vehicle Enable Status	DISABL, ENABLE
FOG_SW, HZ_SW	Fog Lamp Switch, Hazard Switch	OFF, ON, OFF, ON
HEAD_L	Headlamp Switch Input Status	OFF, PARK, HEADLP, R_FOG, INVLD, (OPEN/SHORT)
HIBEAM	High Beam Switch Input Status	OFF, HIGH, PASS, INVLD, (SHORT)

HORN_SW	Horn Input Switch	OFF, ON
IGN_A	Ignition Switch - ACCY Position	NO, YES
IGN_KEY	Ignition Key In / Out	OUT, IN
IGN_O/U	Ignition Switch - OFF/Unlock Position	NO, YES
IGN_R	Ignition Switch - RUN Position	NO, YES
IGN_S	Ignition Switch - START Position	NO, YES
LIGHTSN	Night (True) / Day (False)	NO, YES
LTURN	Left Turn Switch	OFF, ON
MIN#KEY	Minimum Number Of Keys Required	0-67
M_KEY	Master Key Present	notPRE, PRESENT
NUMKEYS	Number Of Keys Stored In Module	one count per bit
PCM_ID	PCM ID Status	notSTR, STORED
PCM_VFY	PCM Verify OK	NO, YES
RESETSW	Reset Switch	OFF, ON
RTURN	Right Turn Switch	OFF, ON
SELECT	Select/Mode Switch	OFF, ON
SERVMOD	Service Module	NO, YES
SPAREKY	Spare key programming: 0 = Enabled, 1 = Disabled	0-14
TILT	Steering Column Tilt Switch	SHORT, UP, DOWN, OFF
TELEPOS	Telescope Position Sensor	notSEN, SENSED
TELESCP	Steering Column Telescope Switch	SHORT, IN, OUT, OFF
TILTPOS	Tilt Position Sensor	notSEN, SENSED
TR_PARK	Transmission Select Lever In Park Pos	NO, YES

Instrument Cluster Active Command Index

Active Command	Display	Action
ANTI-THEFT INDICATOR LAMP	THEFT LAMP	OFF, ON
DISPLAY DIMMING CONTROL	ILLUMINAT	OFF, ON
DISPLAY SEGMENT CONTROL II	SEGMENTS	OFF, ON
DISPLAY SEGMENT CONTROL	SEGMENTS	OFF, ON
ENGINE COOLANT GAUGE CONTROL	ENGCOOLNT	0%-100%

FUEL GAUGE CONTROL	FUELLEVEL	0%-100%
MEMORY SELECT CONTROL	MEMORY 1	OFF, ON
MEMORY SELECT CONTROL	MEMORY 2	OFF, ON
PRNDL DISPLAY CONTROL COMMAND	SEGMENTS	OFF, ON
RF SIGNAL	RF	OFF, ON
SPEEDOMETER CONTROL	SPDOMETER	0%-100%
TACHOMETER CONTROL	TCHOMETER	0%-100%
WARNING LAMPS AND CHIME	ALL LAMPS	OFF, ON
WARNING LAMPS AND CHIME	CHIME	OFF, ON

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1342	ECU Is Defective	FEM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1438	Wiper Mode Select Switch Circuit Failure	FEM	REFER to Section 501-16 .
B1446	Wiper Park Sense Circuit Failure	FEM	REFER to Section 501-16 .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to Section 413-01 .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1567	Lamp Headlamp High Beam Circuit Failure	FEM	REFER to Section 417-01 .
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B1794	Lamp Headlamp Low Beam Circuit Failure	FEM	REFER to Section 417-01 .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	REFER to Section 501-11 .
B2215	Window Passenger Front Down Switch Short to Battery	FEM	REFER to Section 501-11 .

B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2443	Powertrain Performance Mode Switch Circuit Failure	FEM	Not Applicable
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
C1284	Oil Pressure Switch Failure	FEM	REFER to Section 413-01 .
C1446	Brake Switch Circuit Failure	FEM	REFER to Section 413-01 .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to Section 211-00 .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to Section 211-00 .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	CARRY OUT the PCM self-test.
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	Instrument Cluster	CARRY OUT the instrument cluster self-test.
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	Instrument Cluster	CARRY OUT the instrument cluster self-test.
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	Instrument Cluster	CARRY OUT the instrument cluster self-test.

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
AL_EVT1	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT2	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT3	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT4	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND

AL_EVT5	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT6	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT7	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT8	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR
FLUID_1	Brake Fluid Level Switch #1	OFF, ON
HOOD_SW	Hood Ajar Switch	CLOSED, AJAR
IGN_R	Ignition Switch -RUN Position	NO, YES
L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position Sensor (Left/Right)	#####
PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%
R_HIGH	Right High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-
STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	Volts

WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKS	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%
BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON
FRONT WINDOW CONTROL	PR DOWN	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
POWER MIRROR CONTROL	PR DOWN	OFF, ON
POWER MIRROR CONTROL	PR LEFT	OFF, ON
POWER MIRROR CONTROL	PR RIGHT	OFF, ON
POWER MIRROR CONTROL	PR UP	OFF, ON
STEERING COLUMN CONTROL COMMAND	LOCK_GND	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON
VAPS II OUTPUT PULSE CONTROL	VAPSIIOUT	%

REM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	REM	REFER to Section 413-01 .
B1300	Power Door Lock Circuit Failure	REM	REFER to Section 501-14B .
B1310	Power Door Unlock Circuit Failure	REM	REFER to Section 501-14B .
B1331	Deck Lid Ajar Rear Door Circuit Failure	REM	REFER to Section 417-02 .
B1335	Door Ajar RR Circuit Failure	REM	REFER to Section 417-02 .
B1342	ECU Is Defective	REM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new

			REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1483	Brake Pedal Input Circuit Failure	REM	REFER to Section 417-01 .
B1499	Lamp Turn Signal Left Circuit Failure	REM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	REM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	REM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	REM	REFER to Section 417-01 .
B1551	Deck Lid Release Circuit Failure	REM	REFER to Section 501-14B .
B1571	Door Ajar LR Circuit Failure	REM	REFER to Section 417-02 .
B1676	Battery Pack Voltage Out of Range	REM	REFER to Section 414-00 .
B2172	Inertia Switch Input Circuit Open	REM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	Instrument Cluster	CARRY OUT the instrument cluster self-test

REM Parameter Identification (PID) Index

PID	Description	Expected Value
BOO	Brake Switch Input	OFF, ON
DECKLID	Deck Lid Ajar Switch	CLOSED, AJAR
DL_DSARM	Deck Lid Disarm	NO, YES
DLIDOUT	Deck Lid Driver	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
DLIDRLS	Deck Lid Release	OFF, ON
L_TAIL	Left and Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG

LMRKOUT	Left Marker Lamp Driver Output State	OFF, ON
LMRKSTB	Left Marker Lamp Driver Short To Battery	NO, YES
LR_TURN	Left and Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LRDN_SW	Left Rear Window Down Switch	OFF, UP
LRDR_SW	Left Rear Door Ajar Switch	CLOSED, AJAR
LRUP_SW	Left Rear Window Up Switch	OFF, DOWN
PD_LOCK	Passenger Door Lock	NO, YES
PD_UNLK	Passenger Door Unlock	NOTLOC, LOCK
R_TAIL	Left and Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RR_TURN	Left and Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RRDN_SW	Right Rear Window Down Switch	OFF, UP
RRDR_SW	Right Rear Door Ajar Switch	CLOSED, AJAR
RRUP_SW	Right Rear Window Up Switch	OFF, DOWN

REM Active Command Index

Active Command	Display	Action
EXTERIOR LAMP CONTROL	BACKUPLMP	OFF, ON
EXTERIOR LAMP CONTROL	H MNT STP	OFF, ON
EXTERIOR LAMP CONTROL	L STOP	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
EXTERIOR LAMP CONTROL	R DEF RLY	OFF, ON
EXTERIOR LAMP CONTROL	R FOG LMP	OFF, ON
EXTERIOR LAMP CONTROL	R STOP	OFF, ON
POWER WINDOW ENABLE COMMAND	PSGR RLY	OFF, ON
REAR DOOR LOCK CONTROL	LR LOCK	OFF, ON
REAR DOOR LOCK CONTROL	LR UNLOCK	OFF, ON
REAR DOOR LOCK CONTROL	RELEASE	OFF, ON
REAR WINDOW CONTROL	LR DOWN	OFF, ON
REAR WINDOW CONTROL	LR UP	OFF, ON
REAR WINDOW CONTROL	RR DOWN	OFF, ON

REAR WINDOW CONTROL	RR UP	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

PCM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
P0457	Fuel Fill Cap Off	PCM	GO to Pinpoint Test AA .

For a complete list of PCM DTCs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom Chart


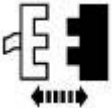
Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the instrument cluster 	<ul style="list-style-type: none"> CJB Fuse 220 (10A). BJB Fuse 425 (40A). Circuitry. J1850 Communication Network (SCP). Instrument Cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test A .
<ul style="list-style-type: none"> No communication with the front electronic module 	<ul style="list-style-type: none"> BJB Fuses 422 (20A), 425 (40A). Circuitry. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test B .
<ul style="list-style-type: none"> No communication with the rear electronic module 	<ul style="list-style-type: none"> BJB Fuse 425 (40A). CJB Mini Fuse 207 (5A). Circuitry. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test C .
<ul style="list-style-type: none"> Incorrect fuel gauge indication 	<ul style="list-style-type: none"> Fuel tank. Circuitry. REM. Fuel level sender(s). Fuel pump module. Instrument Cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test D .
<ul style="list-style-type: none"> Incorrect temperature gauge indication 	<ul style="list-style-type: none"> Circuitry. Instrument cluster. Powertrain control module (PCM). Engine coolant temperature sender. 	<ul style="list-style-type: none"> GO to Pinpoint Test E .
<ul style="list-style-type: none"> An indicator is inoperative/always on — low oil pressure 	<ul style="list-style-type: none"> Circuitry. Engine oil pressure. Engine oil pressure switch. FEM. Instrument Cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test F .
<ul style="list-style-type: none"> The speedometer is inoperative 	<ul style="list-style-type: none"> Circuitry. ABS/TC/IVD. 	<ul style="list-style-type: none"> GO to Pinpoint Test

	<ul style="list-style-type: none"> ● Instrument Cluster. 	<ul style="list-style-type: none"> ● <u>G.</u>
<ul style="list-style-type: none"> ● The safety belt warning indicator is inoperative/does not operate correctly 	<ul style="list-style-type: none"> ● Circuitry. ● Safety belt switch (part of buckle end). ● Instrument Cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test H.</u>
<ul style="list-style-type: none"> ● The door ajar indicator is inoperative/does not operate correctly 	<ul style="list-style-type: none"> ● Circuitry. ● FEM. ● REM. ● Instrument Cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test I.</u>
<ul style="list-style-type: none"> ● The charge system warning indicator is never/always on 	<ul style="list-style-type: none"> ● Circuitry. ● Generator (GEN) (10300). ● PCM. ● Instrument Cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test J.</u>
<ul style="list-style-type: none"> ● The brake warning indicator is always on 	<ul style="list-style-type: none"> ● Circuitry. ● Low brake fluid level. ● Low brake pressure. ● Parking brake switch. ● Brake fluid level switch. ● ABS/TC/IVD. ● FEM. ● Instrument Cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test K.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative/always on — high beam 	<ul style="list-style-type: none"> ● Circuitry. ● Multifunction switch. ● Instrument Cluster. ● FEM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test L.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative/always on — low washer fluid warning 	<ul style="list-style-type: none"> ● Circuitry. ● Low washer fluid switch. ● FEM. ● Instrument Cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test M.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative/always on — ABS warning 	<ul style="list-style-type: none"> ● Circuitry. ● ABS/TC/IVD. ● Instrument Cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test N.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative/always on — traction control and advance traction 	<ul style="list-style-type: none"> ● Circuitry. ● ABS/TC/IVD. ● Instrument Cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test O.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative/always on — lamp outage 	<ul style="list-style-type: none"> ● Bulb. ● Instrument cluster. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test P.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative/always on — malfunction indicator lamp (MIL) 	<ul style="list-style-type: none"> ● Circuitry. ● Instrument cluster. ● PCM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test Q.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative/always on — turn/hazard 	<ul style="list-style-type: none"> ● Circuitry. ● Multifunction switch. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test R.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative/always on — steering column lock warning 	<ul style="list-style-type: none"> ● Circuitry. ● SCL. ● Instrument Cluster. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test S.</u>
<ul style="list-style-type: none"> ● The tachometer is inoperative 	<ul style="list-style-type: none"> ● Circuitry. ● Instrument Cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test</u>

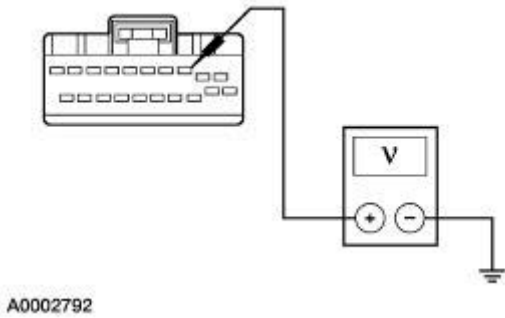
	<ul style="list-style-type: none"> ● PCM. 	<u>T.</u>
<ul style="list-style-type: none"> ● The indicator is inoperative/always on — speed control 	<ul style="list-style-type: none"> ● Circuitry. ● ABS/TC/IVD. ● Instrument Cluster. ● PCM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test U.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative/always on — PRNDL display 	<ul style="list-style-type: none"> ● Circuitry. ● Digital transmission range sensor. ● PCM. ● Instrument Cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test V.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative/always on — low fuel warning 	<ul style="list-style-type: none"> ● Circuitry. ● PCM. ● Instrument Cluster. ● REM. ● Fuel sender(s). 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test W.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative/always on — engine over-temperature 	<ul style="list-style-type: none"> ● Circuitry. ● PCM. ● Instrument Cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test X.</u>
<ul style="list-style-type: none"> ● An indicator is inoperative — air bag warning 	<ul style="list-style-type: none"> ● Circuitry. ● Instrument cluster. ● Electronic crash sensor (ECS). 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test Y.</u>
<ul style="list-style-type: none"> ● The air bag warning indicator is always on 	<ul style="list-style-type: none"> ● Circuitry. ● Restraint Control Module (RCM). ● ECS. 	<ul style="list-style-type: none"> ● REFER to <u>Section 501-20B.</u>
<ul style="list-style-type: none"> ● The odometer is inoperative 	<ul style="list-style-type: none"> ● Circuitry. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test Z.</u>
<ul style="list-style-type: none"> ● The CHECK FUEL CAP INDICATOR is inoperative/always on 	<ul style="list-style-type: none"> ● Circuitry. ● SCP network. ● PCM. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test N.</u>

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE INSTRUMENT CLUSTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK HOT AT ALL TIMES POWER SUPPLY CIRCUIT	
<p>1</p>  <p>2</p>  <p>Instrument Cluster C220b</p>	

3



3 Measure the voltage between instrument cluster C220b pin 3, circuit 29-GG11 (OG/BU), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to A2.

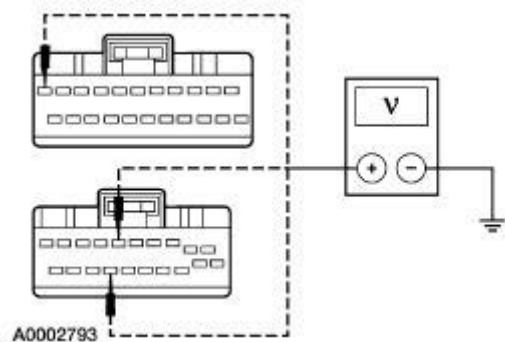
→ **No**
REPAIR the circuit. TEST the system for normal operation.

A2 CHECK HOT IN RUN POWER SUPPLY CIRCUITS

1



2



2 Measure the voltage between the instrument cluster and ground as follows:

Connector Pin	Circuit
C220a pin 11	15-JA14 (GN/BK)
C220b pin 6	15-GG14 (GN/RD)
C220b pin 17	75-GG15 (YE/GN)

• Are the voltages greater than 10 volts?

→ **Yes**
GO to A3.

→ **No**
REPAIR the circuit(s). TEST the system for normal operation.

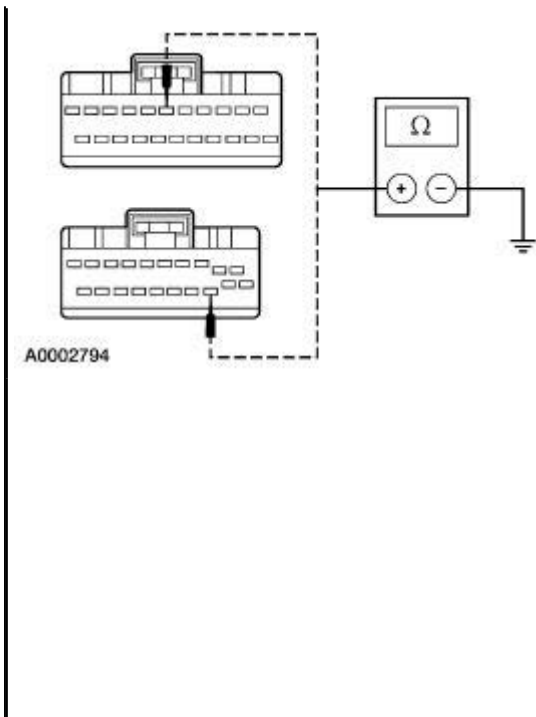
A3 CHECK GROUND CIRCUITS

1



2

2 Measure the resistance between the



instrument cluster and ground as follows:

Connector Pin	Circuit
C220a pin 6	31-AL11 (BK)
C220b pin 13	91-GG11 (BN/RD)

- Are the resistances less than 5 ohms?

→ Yes

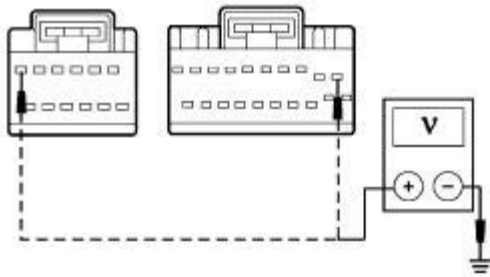
REFER to Section 418-00.

→ No

REPAIR the circuit(s). TEST the system for normal operation.

PINPOINT TEST B: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK22 (OG/YE) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p> <p>2</p> <p>FEM C201c</p> <p>3</p> <p>FEM C201f</p> <p>4</p> <p>5</p>	<p>5</p> <p>Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22</p>



A0006297

(OG/YE) harness side and ground.

- Are the voltages greater than 10 volts?

→ **Yes**
GO to B2.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

B2 CHECK CIRCUITS 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS

1

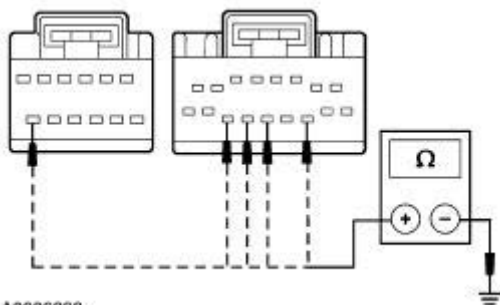


2



FEM C201a

3



A0006298

3 Measure the resistance between FEM connectors, harness side and ground as follows:


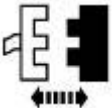
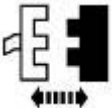

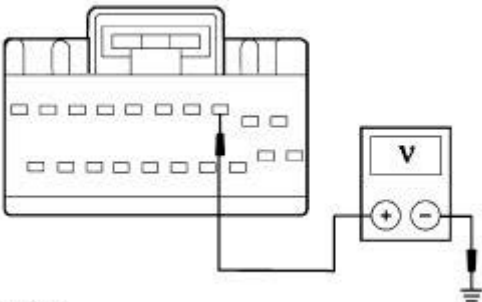
FEM	Pin	Circuit
C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)
C201a	15	31-DK20D (BK/RD)

- Are the resistances less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST C: NO COMMUNICATION WITH THE REAR ELECTRONIC MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK CIRCUIT 29-DK31 (OG/BK) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"> 1  </div> <div style="margin-bottom: 10px;"> 2  <p style="margin-left: 100px;">REM C420d</p> </div> <div style="margin-bottom: 10px;"> 3  <p style="margin-left: 100px;">REM C420c</p> </div> <div style="margin-bottom: 10px;"> 4  </div> <div style="margin-bottom: 10px;"> 5  <p style="margin-left: 20px;">A0006299</p> </div> </div>	<div style="margin-top: 20px;"> 5 Measure the voltage between REM C420d pin 3, circuit 29-DK31 (OG/BK), harness side and ground. </div> <div style="margin-top: 20px;"> <ul style="list-style-type: none"> ● Is the voltage greater than 10 volts? </div> <div style="margin-top: 10px;"> <p>→ Yes GO to <u>C2</u>.</p> </div> <div style="margin-top: 10px;"> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p> </div>
C2 CHECK CIRCUITS 29S-DK31 (OG/BK), 31-DK30D (BK), 31-DK30E (BK), 31-DK30F (BK), 31-DK30G (BK) AND 31-DK30H (BK/OG), FOR OPENS	
1	

REM C420b

A0006300

3 Measure the resistance between REM connectors, harness side and ground as follows:

REM	Pin	Circuit
C420c	13	29S-DK31 (OG/BK)
C420c	12	31-DK30E (BK)
C420c	11	31-DK30D (BK)
C420c	26	31-DK30G (BK)
C420c	25	31-DK30F (BK)
C420b	12	31-DK30H (BK/OG)

- **Are the resistances less than 5 ohms?**

→ **Yes**
REFER to [Section 418-00](#).

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST D: INCORRECT FUEL GAUGE INDICATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — REM AND INSTRUMENT CLUSTER	
NOTE: The fuel gauge does not change indication unless there has been at least eleven liters (three gallons) of fuel added or removed between ignition switch cycle.	
	<p>1 Use recorded REM and instrument cluster DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes If REM DTC B1201, or instrument cluster DTC U1131 is retrieved, GO to D7.</p> <p>→ No GO to D2.</p>

D2 CARRY OUT THE INSTRUMENT CLUSTER FUEL GAUGE ACTIVE COMMAND

1



Instrument Cluster Active Command

1

Select the instrument cluster FUEL GAUGE CONTROL active command.

2

Trigger FUELLEVEL active command. Toggle and monitor the fuel gauge while adjusting the FUELLEVEL active command to read 50% and 100%.

- **Did the fuel gauge needle start at empty (E), move to half at 50%, and full (F) at 100%?**

→ **Yes**
GO to D3.

→ **No**
INSTALL a new instrument cluster; REFER to *Instrument Cluster*. CLEAR the DTC. REPEAT the instrument cluster self-test.

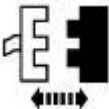
D3 CHECK THE FUEL DELIVERY MODULE (FDM) RESISTANCE READING

NOTE: The fuel delivery module (FDM) sender resistance varies from 16 ± 2 ohms when empty (E) to 155 ± 4 ohms when full (F).

1

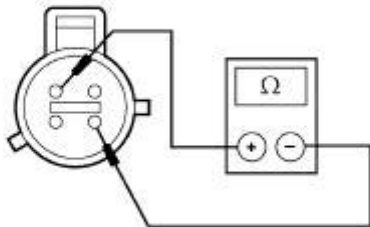


2



(RH) Fuel Delivery Module (FDM)

3



A0037799

3

Measure the resistance between the RH fuel delivery module (FDM) C433 pin 2, circuit 8-GA7 (WH/RD), component side and the FDM C433 pin 3, circuit 9-GA7 (BN/RD), component side.

- **Is the resistance within specifications?**

→ **Yes**
GO to D4.

→ **No**
INSTALL a new FDM. REFER to [Section 310-01](#). TEST the system for normal operation.GO to [D5](#).

D4 CHECK THE JET PUMP MODULE (JPM) RESISTANCE READING

NOTE: The jet pump module (JPM) sender resistance varies from 19 ± 2 ohms when empty (E) to 160 ± 4 ohms when full (F).

1

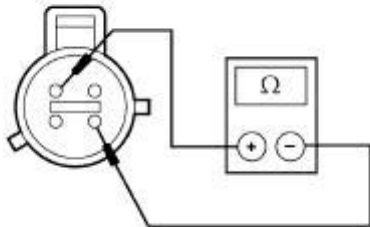


2



(LH) Jet Pump Module (JPM)

3



A0037799

3 Measure the resistance between the LH jet pump module (JPM) C434 pin 2, circuit 8-GA25 (WH/BU), component side and JPM C434 pin 3, circuit 9-GA25 (BN/WH), component side.

● **Is the resistance within specifications?**

→ **Yes**
GO to [D6](#).

→ **No**
INSTALL a new JPM. REFER to [Section 310-01](#). TEST the system for normal operation.GO to [D5](#).

D5 INSPECT THE FUEL TANK

1 Visually inspect the fuel tank for any damage or deformation.

● **Is the fuel tank OK?**

→ **Yes**
GO to [D6](#).

→ **No**
INSTALL a new fuel tank. REFER to [Section 310-01](#). TEST the system for normal operation.

D6 INSPECT THE FUEL LEVEL SENSOR AND PUMP ASSEMBLY

1 Visually inspect the float and float rod for damage or obstruction.

- Are the fuel pump and wiring OK?

→ Yes

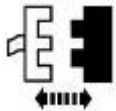
INSTALL a new fuel level sender. REFER to [Section 310-01](#). TEST the system for normal operation.

→ No

REPAIR as necessary. REFER to [Section 310-01](#). TEST the system for normal operation.

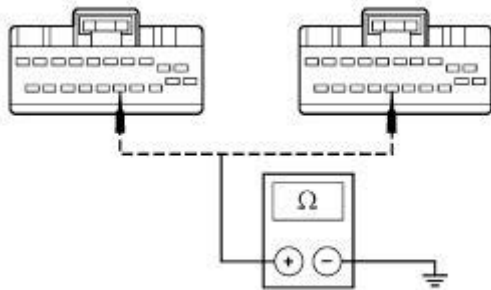
D7 CHECK CIRCUIT 8-GA7 (WH/RD), CIRCUIT 9-GA1 (BN) AND CIRCUIT 8-GA25 (WH/BU) FOR SHORT TO GROUND WITH REM DISCONNECTED

1



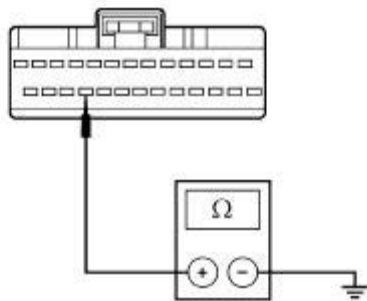
REM

2



A0004796

3



A0004797

2

Measure the resistance between REM C420d pin 15, circuit 8-GA7 (WH/RD), harness side and ground; and between REM C420d pin 16, circuit 8-GA25 (WH/BU), harness side and ground.

3

Measure the resistance between REM C420c pin 23, circuit 9-GA1 (BN), harness side and ground.

- Are the resistances greater than 10,000 ohms?

→ Yes

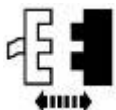
GO to [D9](#).

→ No

GO to D8.

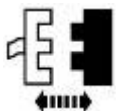
D8 CHECK CIRCUIT 8-GA7 (WH/RD), CIRCUIT 9-GA1 (BN) AND CIRCUIT 8-GA25 (WH/BU) FOR SHORT TO GROUND WITH FUEL PUMP MOTOR AND FUEL SENDER DISCONNECTED

1



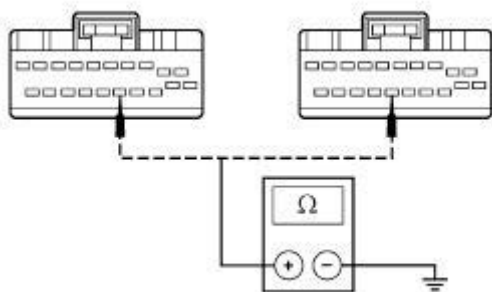
Fuel Pump Motor C433

2



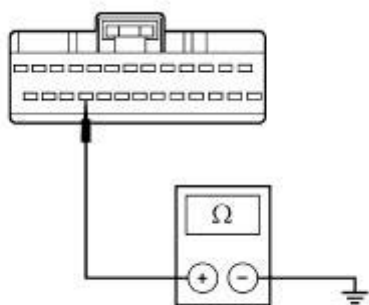
Fuel Sender C434

3



A0004796

4



A0004797

3

Measure the resistance between REM C420d pin 15, circuit 8-GA7 (WH/RD), harness side and ground; and between REM C420d pin 16, circuit 8-GA25 (WH/BU), harness side and ground.

4

Measure the resistance between REM C420c pin 23, circuit 9-GA1 (BN), harness side and ground.

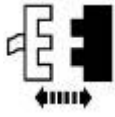
● **Are the resistances greater than 10,000 ohms?**

→ **Yes**
REPAIR the fuel sender circuit in question. TEST the system for normal operation.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

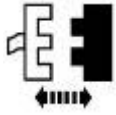
D9 CHECK CIRCUIT 8-GA7 (WH/RD), CIRCUIT 9-GA1 (BN) AND CIRCUIT 8-GA25 (WH/BU) FOR OPEN

1



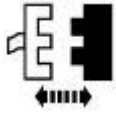
Fuel Pump Motor C433

2



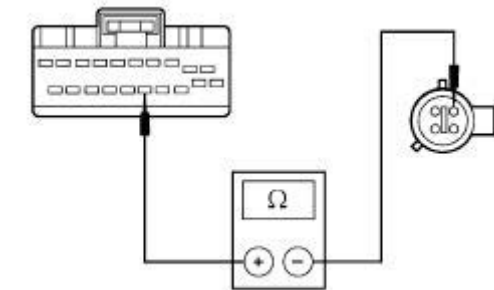
Fuel Sender C434

3



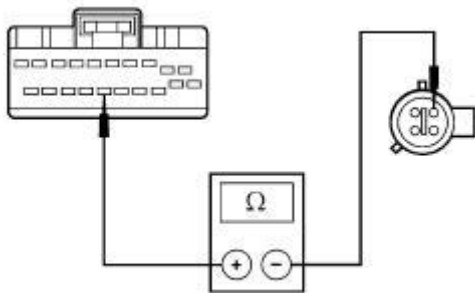
REM

4



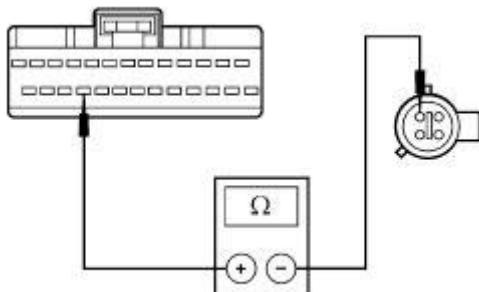
A0004800

5



A0004801

6



A0004802

4

Measure the resistance between REM C420d pin 15, circuit 8-GA7 (WH/RD), harness side and fuel pump motor C433 pin 1, circuit 8-GA7 (WH/RD), harness side.

5

Measure the resistance between REM C420d pin 16, circuit 8-GA25 (WH/BU), harness side and fuel sender C434 pin 1, circuit 8-GA25 (WH/BU), harness side.

6

Measure the resistance between REM C420c pin 23, circuit 9-GA1 (BN), harness side and fuel pump motor C433 pin 3, circuit 9-GA7 (BN/RD), harness side.

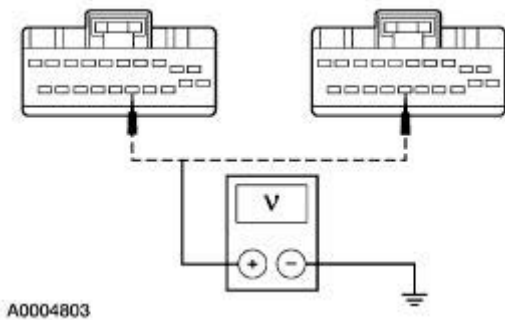
- Are the resistances less than 5 ohms?

→ **Yes**
GO to D10.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

D10 CHECK CIRCUIT 8-GA7 (WH/RD), CIRCUIT 9-GA1 (BN) AND CIRCUIT 8-GA25 (WH/BU) FOR SHORT TO BATTERY

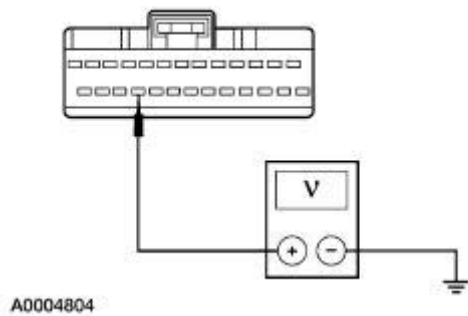
1



1

Measure the voltage between REM C420d pin 15, circuit 8-GA7 (WH/RD), harness side and REM C420d pin 16, circuit 8-GA25 (WH/BU), harness side and ground.

2



2

Measure the voltage between REM C420c pin 23, circuit 9-GA1 (BN), harness side and ground

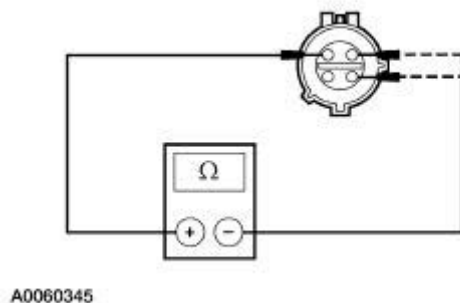
● **Is any voltage indicated?**

→ **Yes**
REPAIR the circuit in question. TEST the system for normal operation.

→ **No**
GO to D11.

D11 CHECK FUEL PUMP MOTOR CIRCUITS FOR SHORT

1




1

Measure the resistance between fuel pump motor C433 pin 1, circuit 15S-RG2A (GN/BU), component side and fuel pump motor C433 pin 2, circuit 8-GA7 (WH/RD), component side, and between fuel pump motor C433 pin 1, circuit 15S-RG2A (GN/BU), component side and fuel pump motor C433 pin 3, circuit 9-GA7 (BN/RD), component side.




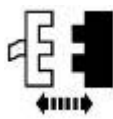
	<ul style="list-style-type: none"> ● Is the resistance greater than 10,000 ohms? <p>→ Yes REPAIR in-tank fuel pump module, and fuel sender circuit(s) as necessary. REFER to <u>Section 310-01</u>. TEST the system for normal operation.</p> <p>→ No INSTALL a new REM. REFER to <u>Section 419-10</u>. CLEAR the DTCs. REPEAT the self-test. INSTALL a new instrument cluster. If incorrect fuel gauge indication is still present REFER to <u>Instrument Cluster</u>. CLEAR the DTCs. REPEAT the self-test.</p>
--	--

PINPOINT TEST E: INCORRECT TEMPERATURE GAUGE INDICATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — INSTRUMENT CLUSTER	
	<p>1 Use recorded instrument cluster DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any instrument cluster DTCs recorded? <p>→ Yes If instrument cluster DTC U1073 is retrieved, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.</p> <p>All other DTCs, refer to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>E2</u>.</p>
E2 CARRY OUT THE INSTRUMENT CLUSTER ENGINE COOLANT TEMPERATURE GAUGE ACTIVE COMMAND	
<p>1</p>  <p>Instrument Cluster Active Command</p>	<p>1 Select the instrument cluster ENGINE COOLANT CONTROL active command.</p> <p>2 Trigger the ENGCOOLNT active command. Toggle and monitor the engine coolant temperature gauge while adjusting the ENGCOOLNT active command to read 50% and 100%.</p> <ul style="list-style-type: none"> ● Did the temperature gauge needle start at cold, move to half at 50%, and full hot at 100%?

- **Yes**
REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
- **No**
INSTALL a new instrument cluster; REFER to Instrument Cluster.
CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST F: AN INDICATOR IS INOPERATIVE/ALWAYS ON — LOW OIL PRESSURE

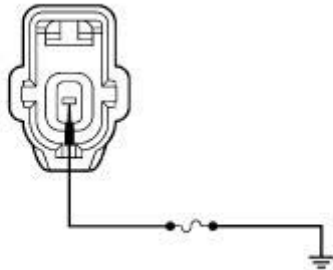
CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE INSTRUMENT CLUSTER LOW OIL PRESSURE WARNING INDICATOR ILLUMINATION	
NOTE: Verify that the oil level is at or near the FULL level.	
<p>1  Instrument Cluster Active Command</p> <p>2  Instrument Cluster Active Command</p>	<p>1 Select instrument cluster warning lamps and chime and trigger ON the active command ALL LAMPS.</p> <p>2 Trigger OFF the active command ALL LAMPS.</p> <p>● Does the low oil pressure warning indicator illuminate when triggered ON, and go off when triggered OFF?</p> <p>→ Yes GO to <u>F2</u>.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Instrument Cluster</u>. CLEAR the DTCs. REPEAT the self-test.</p>
F2 MONITOR FEM LOW OIL LEVEL PRESSURE PID OILWRN	
<p>1 </p> <p>2  Oil Pressure Switch C103</p> <p>3</p>	



4



5



A0004821

4

Monitor the FEM PID OILWRN.

5

Connect a 10A fused jumper wire between oil pressure switch C103 pin 1, circuit 8-GC21 (WH/GN), harness side and ground.

● Does the FEM PID read ON and OFF alternately?

→ Yes

INSTALL a new oil pressure switch. REFER to Section 303-01A or Section 303-01B. TEST the system for normal operation.

→ No

REMOVE the jumper wire, EXIT the FEM PID, GO to F3.

If the fused jumper wire fails, REMOVE the jumper and GO to F5.

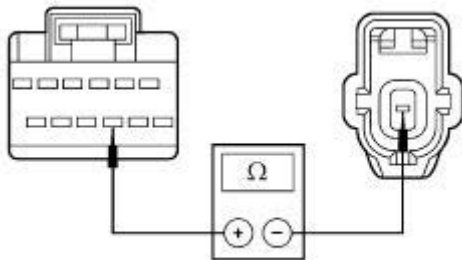
F3 CHECK CIRCUIT 8-GC21 (WH/GN) FOR OPEN

1



FEM 201c

2



A0004822

2

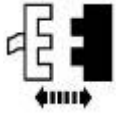
Measure the resistance between FEM C201c pin 9, circuit 8-GC21 (WH/GN), harness side and oil pressure switch C103, circuit 8-GC21 (WH/GN), harness side.

● Is the resistance less than 5 ohms?

- **Yes**
GO to F4.
- **No**
REPAIR the circuit. TEST the system for normal operation.

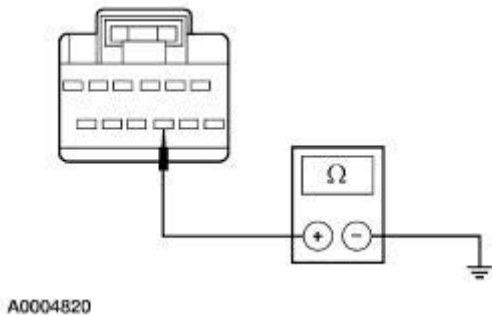
F4 CHECK CIRCUIT 8-GC21 (GN/WH) FOR SHORT TO GROUND

1



FEM C201c

2



3 Measure the resistance between FEM C201c pin 9, circuit 8-GC21 (WH/GN), harness side and ground.

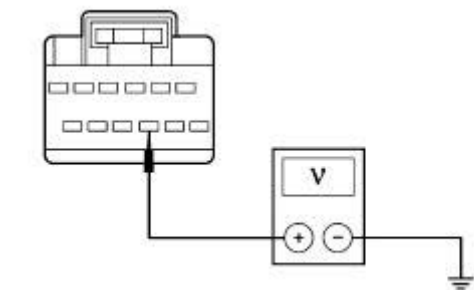
- **Is the resistance greater than 10,000 ohms?**

→ **Yes**
INSTALL a new FEM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

F5 CHECK CIRCUIT 8-GC21 (WH/GN) FOR SHORT TO BATTERY

1





1 Measure the voltage between FEM C201c pin 9, circuit 8-GC21 (WH/GN), harness side and ground.

- **Is any voltage present?**

- **Yes**
REPAIR the circuit. TEST the system for normal operation.
- **No**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.




PINPOINT TEST G: THE SPEEDOMETER IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — INSTRUMENT CLUSTER	
	<p>1 Use recorded instrument cluster DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes If instrument cluster DTC U1041 is recorded, REFER to Section 206-09A with ABS, REFER to Section 206-09B with ABS/TC, or REFER to Section 206-09C with ABS/TC/IVD.</p> <p>All other instrument cluster DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to G2.</p>
G2 CARRY OUT THE INSTRUMENT CLUSTER SPEEDOMETER AND DIGITAL SEGMENT DISPLAY ACTIVE COMMANDS	
<p>1</p>  <p>Instrument Cluster Active Command</p> <p>3</p>  <p>Instrument Cluster Active Command</p>	<p>1 Select the instrument cluster SPEEDOMETER COMMAND active command.</p> <p>2 Trigger SPDOMETER and scroll in increments of 10%. Monitor the speedometer gauge. The speedometer should be increasing in increments of 16 mph for every 10%.</p> <p>3 Select the instrument cluster DISPLAY SEGMENT CONTROL II active command.</p> <p>4 Trigger the SEGMENTS active command.</p> <ul style="list-style-type: none"> ● Does the speedometer increase within specification and do all segments illuminate?

→ **Yes**
 REFER to Section 206-09A with ABS, REFER to Section 206-09B with ABS/TC, or REFER to Section 206-09C with stability assist.

→ **No**
 INSTALL a new instrument cluster. REFER to Instrument Cluster. CLEAR the DTCs. REPEAT the instrument cluster self-test. TEST the system for normal operation.

PINPOINT TEST H: THE SAFETY BELT WARNING INDICATOR IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 MONITOR THE INSTRUMENT CLUSTER SAFETY BELT PID D_SBELT	
<p>1</p>  <p>2</p>  <p>Instrument Cluster PID</p>	<p>2</p> <p>Select and monitor the instrument cluster PID D_SBELT while fastening and unfastening the safety belt.</p> <ul style="list-style-type: none"> ● Does the PID agree with the safety belt position? <p>→ Yes GO to <u>H2</u>.</p> <p>→ No GO to <u>H3</u>.</p>
H2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND	
<p>1</p>  <p>Instrument Cluster Active Command</p>	<p>1</p> <p>Select the instrument cluster WARNING LAMPS AND CHIME active command ALL LAMPS. Trigger the ALL LAMPS active command.</p> <ul style="list-style-type: none"> ● Does the safety belt warning indicator illuminate? <p>→ Yes The system is OK. REFER to the Principles of Operation for the safety belt warning indicator.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Instrument Cluster</u>. CLEAR</p>

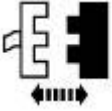
the DTCs. REPEAT the self-test.

H3 CHECK THE SAFETY BELT SWITCH

1



2

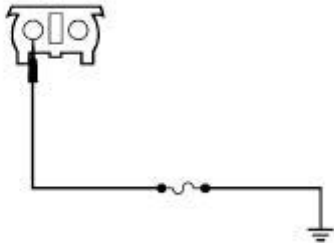


Safety Belt Switch C381

3



4



A0004824

5



Instrument Cluster PID

4 Connect a 10A fused jumper wire between safety belt switch C381, circuit 8-GE52 (WH/BK), harness side and ground.

5 Select and monitor the instrument cluster PID D_SBELT.

6 DISCONNECT the jumper wire. Monitor the instrument cluster PID D_SBELT.

- Does the PID value alternate between IN and OUT?

→ Yes
GO to H4.

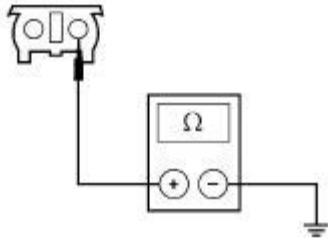
→ No
REMOVE the jumper wire and GO to H5.

If the fused jumper wire fails, REMOVE the jumper wire and GO to H6.

H4 CHECK THE SAFETY BELT SWITCH CIRCUIT 31-GE52 (BK) FOR OPEN

1

1 Measure the resistance between safety belt switch C381, circuit 31-GE52 (BK), component side and ground.



A0004835

- Is the resistance less than 5 ohms?

- **Yes**
INSTALL a new buckle end. TEST the system for normal operation.
- **No**
REPAIR the circuit. TEST the system for normal operation.

H5 CHECK SAFETY BELT WARNING INDICATOR CIRCUIT 8-GE52 (WH/BK)

1

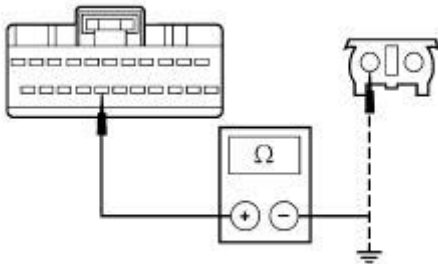


2



Instrument Cluster C220a

3



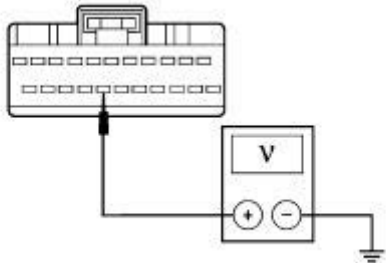
A0004836

- 3 Measure the resistance between instrument cluster C220a pin 18, circuit 8-GE52 (WH/BK), harness side and safety belt switch C381, circuit 8-GE52 (WH/BK), harness side; and between instrument cluster C220a pin 18, circuit 8-GE52 (WH/BK), harness side and ground.

- Is the resistance between the instrument cluster and the safety belt switch less than 5 ohms, and greater than 10,000 ohms between the instrument cluster and ground?

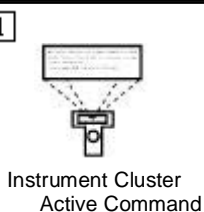
- **Yes**
GO to H6.
- **No**
REPAIR the circuit. TEST the system for normal operation.

H6 CHECK CIRCUIT 8-GE52 (WH/BK) FOR SHORT TO BATTERY

<p>1</p>  <p>A0004837</p>	<p>1 Measure the voltage between instrument cluster C220a pin 18, circuit 8-GE52 (WH/BK), harness side and ground.</p> <p>● Is any voltage present?</p> <p>→ Yes REPAIR the circuit. TEST the system for normal operation.</p> <p>→ No GO to <u>H2</u>.</p>
---	---

PINPOINT TEST I: THE DOOR AJAR INDICATOR IS INOPERATIVE/DOES NOT OPERATE CORRECTLY



CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>I1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — FEM AND REM</p>	<p>1 Use recorded FEM and REM DTCs from the continuous and on-demand self-test.</p> <p>● Are any FEM or REM DTCs recorded?</p> <p>→ Yes REFER to FEM Diagnostic Trouble Code (DTC) Index or REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>I2</u>.</p>
<p>I2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND</p>	<p>1 Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger the ALL LAMPS active command. Observe the door ajar warning indicator.</p> <p>● Does the door ajar warning indicator illuminate?</p> <p>→ Yes</p>



REFER to [Section 417-02](#).

→ **No**
 INSTALL a new instrument cluster. REFER to [Instrument Cluster](#).
 CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST J: THE CHARGE SYSTEM WARNING INDICATOR IS NEVER/ALWAYS ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 CHECK CHARGING SYSTEM	
	<p>1 Check the charging system operation. Refer to Section 414-00.</p> <ul style="list-style-type: none"> ● Is the charging system operating correctly? <p>→ Yes GO to J2.</p> <p>→ No REFER to Section 414-00.</p>
J2 CHECK THE CHARGE SYSTEM WARNING INDICATOR	
<p>1</p>  <p>Instrument Cluster Active Command</p> <p>2</p>  <p>Instrument Cluster Active Command</p>	<p>1 Select instrument cluster warning lamps and chime and trigger ON the active command ALL LAMPS.</p> <p>2 Trigger OFF the active command ALL LAMPS.</p> <ul style="list-style-type: none"> ● Does the charge system warning indicator illuminate when triggered ON, and go off when triggered OFF? <p>→ Yes REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.</p> <p>→ No INSTALL a new instrument cluster. REFER to Instrument Cluster. CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST K: THE BRAKE WARNING INDICATOR IS ALWAYS ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 CHECK THE INSTRUMENT CLUSTER BRAKE WARNING INDICATOR ILLUMINATION	

1



Instrument Cluster Active Command

2



Instrument Cluster Active Command

1

Select instrument cluster warning lamps and chime and trigger ON the activate command ALL LAMPS.

2

Select instrument cluster warning lamps and chime and trigger OFF the activate command ALL LAMPS.

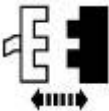
- Does the BRAKE warning indicator illuminate when triggered ON, and go off when triggered OFF?

→ Yes
GO to [K2](#).

→ No
INSTALL a new instrument cluster. REFER to [Instrument Cluster](#). CLEAR the DTCs. REPEAT the self-test.

K2 CHECK BRAKE FLUID LEVEL SWITCH

1



Brake Fluid Level Switch C124

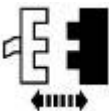
- Does the BRAKE warning indicator continue to illuminate?

→ Yes
GO to [K3](#).

→ No
INSTALL a new brake fluid level switch. REFER to [Section 206-06](#). TEST the system for normal operation.

K3 CHECK PARKING BRAKE CONTROL SWITCH

1



Parking Brake Control Switch C306

- Does the BRAKE warning indicator continue to illuminate?

→ Yes
GO to [K4](#).

→ **No**
INSTALL a new parking brake control switch. REFER to Section 206-05 . TEST the system for normal operation.

K4 CHECK BRAKE FLUID LEVEL FEM PID FLUID_1

1

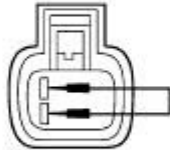


2



FEM PID

3



A0004838

2 Select and monitor FEM PID FLUID_1.

3 Connect a 10A fused jumper wire between brake fluid warning switch C124, circuit 8-GC7 (WH/RD), harness side and ground.

- Does the PID read OFF when the jumper wire is not connected and ON when the jumper wire is connected?

→ **Yes**
GO to K5 .

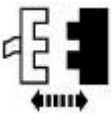
→ **No**
GO to K6 .

K5 CHECK PARKING BRAKE CONTROL SWITCH CIRCUIT 31S-RP9 (BK/GN) FOR SHORT TO GROUND

1



2

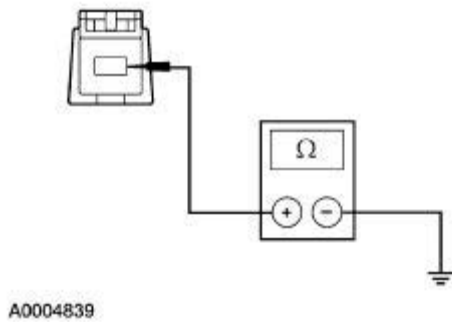


FEM C281

3



4



- 4 Measure the resistance between parking brake switch C306 pin 1, circuit 31S-RP9 (BK/GN), harness side and ground.

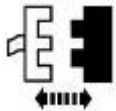
- Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

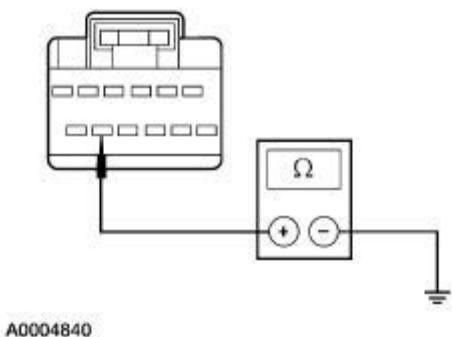
K6 CHECK BRAKE WARNING INDICATOR INPUT CIRCUIT 8-GC7 (WH/RD) FOR SHORT TO GROUND

1



FEM C201c

2






- 2 Measure the resistance between FEM C201c pin 11, circuit 8-GC7 (WH/RD), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.




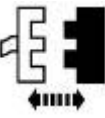
→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST L: AN INDICATOR IS INOPERATIVE/ALWAYS ON — HIGH BEAM

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — INSTRUMENT CLUSTER	
	<p>1 Use recorded instrument cluster DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any instrument cluster DTCs recorded? <p>→ Yes If DTC B1567, REFER to Section 417-01 . All other DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to L2 .</p>
L2 MONITOR THE INSTRUMENT CLUSTER PID LSWMODE	
<p>1</p>  <p>4</p>  <p>Instrument Cluster PID</p>	<p>2 Place headlamp switch in the ON position.</p> <p>3 Verify that the multifunction switch is in the high beam position.</p> <p>4 Select and monitor the instrument cluster PID HIBEAM with the multifunction switch in the high beam position.</p> <ul style="list-style-type: none"> ● Does the PID read HIGH? <p>→ Yes GO to L3 .</p> <p>→ No REFER to Section 417-01 .</p>
L3 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND	
<p>1</p>  <p>Instrument Cluster Active</p>	<p>1 Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger the ALL LAMPS active command.</p>

Command	<ul style="list-style-type: none"> ● Does the high beam indicator turn on? <p>→ Yes REFER to Section 417-01.</p> <p>→ No INSTALL a new instrument cluster. REFER to Instrument Cluster. CLEAR the DTCs. REPEAT the self-test.</p>
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PINPOINT TEST M: AN INDICATOR IS INOPERATIVE/ALWAYS ON — LOW WASHER FLUID WARNING

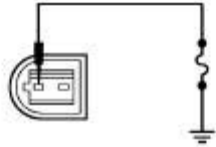
CONDITIONS	DETAILS/RESULTS/ACTIONS
M1 CHECK THE LOW WASHER FLUID WARNING INDICATOR	
<p>1</p>  <p>Instrument Cluster Active Command</p> <p>2</p>  <p>Instrument Cluster Active Command</p>	<p>1</p> <p>Select instrument cluster warning lamps and chime and trigger ON the active command ALL LAMPS.</p> <p>2</p> <p>Trigger OFF the active command ALL LAMPS.</p> <ul style="list-style-type: none"> ● Does the low washer fluid warning indicator illuminate when triggered ON, and go off when triggered OFF? <p>→ Yes GO to M2.</p> <p>→ No INSTALL a new instrument cluster. REFER to Instrument Cluster. CLEAR the DTCs. REPEAT the self-test.</p>
M2 MONITOR FEM PID WFLUID	
<p>1</p>  <p>2</p>  <p>Washer Fluid Level Switch C138</p> <p>3</p>	



4



5



A0004841

4

Monitor the FEM PID WFLUID.

5

Connect a 10A fused jumper wire between washer fluid level switch C138, circuit 8-GC8 (WH/GN), harness side and ground.

• Does the FEM PID read ON and OFF alternately?

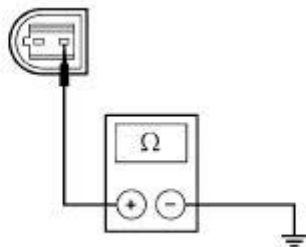
→ **Yes**
GO to M3.

→ **No**
REMOVE the jumper wire, EXIT the FEM PID, GO to M4.

If the fused jumper wire blows, REMOVE the jumper and GO to M5.

M3 CHECK WASHER FLUID LEVEL SWITCH GROUND CIRCUIT 31-GC8 (BK) FOR OPEN

1



A0004810

1

Measure the resistance between washer fluid level switch C138, circuit 31-GC8 (BK), harness side and ground.

• Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new washer fluid level switch. REFER to Section 501-16. TEST the system for normal operation.

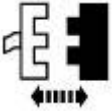
→ **No**
REPAIR the circuit. TEST the system for normal operation.

M4 CHECK CIRCUIT 8-GC8 (WH/BU) FOR SHORT TO GROUND

1

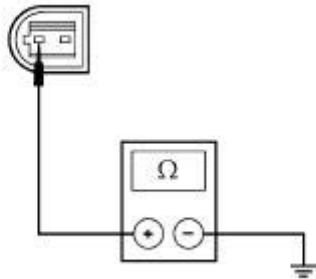


2



FEM C201b

3



A0004806

3 Measure the resistance between washer fluid level switch C138, circuit 8-GC8 (WH/BU), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

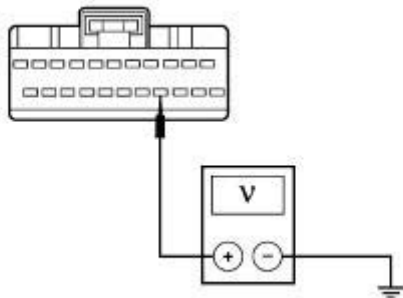
→ **No**
REPAIR the circuit. TEST the system for normal operation.

M5 CHECK THE LOW WASHER FLUID SWITCH CIRCUIT 8-GC8 (WH/BU) FOR SHORT TO BATTERY

1



2




A0004807

2 Measure the voltage between FEM C201b pin 15, circuit 8-GC8 (WH/BU), harness side and ground.

- Is any voltage present?


	<p>→ Yes REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No INSTALL a new FEM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p>
--	--

PINPOINT TEST N: AN INDICATOR IS INOPERATIVE/ALWAYS ON — ABS WARNING


CONDITIONS	DETAILS/RESULTS/ACTIONS
N1 CARRY OUT THE INSTRUMENT CLUSTER ABS WARNING INDICATOR ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
<p>1 </p> <p>Instrument Cluster Active Command</p>	<p>1 Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger the ALL LAMPS active command. Observe the ABS warning indicator.</p> <p>● Does the ABS warning indicator illuminate?</p> <p>→ Yes REFER to Section 206-09A with ABS, REFER to Section 206-09B with ABS/TC, or REFER to Section 206-09C with ABS/TC/IVD.</p> <p>→ No INSTALL a new instrument cluster. REFER to Instrument Cluster. CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST O: AN INDICATOR IS INOPERATIVE / ALWAYS ON — TRACTION CONTROL AND ADVANCE TRACTION

CONDITIONS	DETAILS/RESULTS/ACTIONS
O1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — INSTRUMENT CLUSTER	
	<p>1 Use recorded instrument cluster DTCs from the continuous and on-demand self-test.</p> <p>● Are any DTCs recorded?</p> <p>→ Yes If DTC U1041, REFER to Section 206-09A with ABS, REFER to Section 206-09B with ABS/TC, or REFER to Section 206-09C with ABS/TC/IVD.</p> <p>All other instrument cluster DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.</p>


	→ No GO to <u>O2</u> .
O2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
<p>1</p>  <p>Instrument Cluster Active Command</p>	<p>1</p> <p>Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger the ALL LAMPS active command ON and OFF. Observe the traction control and advance traction indicators.</p> <p>• Do both indicators illuminate and turn off?</p> <p>→ Yes REFER to <u>Section 206-09A</u> with ABS, REFER to <u>Section 206-09B</u> with ABS/TC, or REFER to <u>Section 206-09C</u> with ABS/TC/IVD.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Instrument Cluster</u>. CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST P: AN INDICATOR IS INOPERATIVE / ALWAYS ON — LAMP OUTAGE


CONDITIONS	DETAILS/RESULTS/ACTIONS
P1 CHECK EXTERIOR LIGHTING OPERATION	
	<p>1</p> <p>Verify that the exterior lighting operates correctly.</p> <p>• Do all of the exterior lights operate correctly?</p> <p>→ Yes GO to <u>P2</u>.</p> <p>→ No REFER to <u>Section 417-01</u>.</p>
P2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
<p>1</p>  <p>Instrument Cluster Active Command</p>	<p>1</p> <p>Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger the ALL LAMPS active command ON. Observe the lamp outage indicator.</p> <p>2</p> <p>Trigger the ALL LAMPS active command OFF. Observe the lamp outage indicator.</p> <p>• Does the lamp outage indicator illuminate, then turn off?</p> <p>→ Yes</p>


	<p>GO to <u>P3</u>.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Instrument Cluster</u> . CLEAR the DTCs. REPEAT the self-test.</p>
P3 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — FEM AND REM	
	<p>1 Use recorded REM and FEM DTCs from the continuous and on-demand self-test.</p> <p>• Are any FEM or REM DTCs recorded?</p> <p>→ Yes REFER to the FEM or REM DTC indices.</p> <p>→ No REFER to <u>Section 417-01</u>.</p>

PINPOINT TEST Q: AN INDICATOR IS INOPERATIVE/ALWAYS ON — MALFUNCTION INDICATOR LAMP (MIL)



CONDITIONS	DETAILS/RESULTS/ACTIONS
Q1 CHECK THE INSTRUMENT CLUSTER ILLUMINATION	
<p>1</p>  <p>Instrument Cluster Active Command</p>	<p>1 Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger the ALL LAMPS active command ON and OFF. Observe the MIL warning indicator.</p> <p>• Does the MIL warning indicator illuminate and turn off?</p> <p>→ Yes REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Instrument Cluster</u> . CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST R: AN INDICATOR IS INOPERATIVE/ALWAYS ON — TURN / HAZARD

CONDITIONS	DETAILS/RESULTS/ACTIONS
R1 CHECK THE TURN SIGNAL AND HAZARD LAMPS OPERATION	
<p>1</p> 	



	<p>2 Operate the turn signal on the left and right sides.</p> <p>3 Operate the hazard lamps.</p> <ul style="list-style-type: none"> ● Do the turn signals and hazard lamps operate correctly? <p>→ Yes GO to <u>R2</u>.</p> <p>→ No REFER to <u>Section 417-01</u>.</p>
<p>R2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL</p>	
<p>1</p>  <p>Instrument Cluster Active Command</p>	<p>1 Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger the ALL LAMPS active command ON and OFF. Observe the LH turn and RH turn indicators.</p> <ul style="list-style-type: none"> ● Do the indicators illuminate and turn off? <p>→ Yes REFER to <u>Section 417-01</u>.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Instrument Cluster</u>. CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST S: AN INDICATOR IS INOPERATIVE / ALWAYS ON — STEERING COLUMN LOCK WARNING

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>S1 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND</p>	
<p>1</p>  <p>Instrument Cluster Active Command</p> <p>2</p>  <p>Instrument Cluster Active Command</p>	<p>1 Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger the ALL LAMPS active command on.</p> <p>2 Trigger the ALL LAMPS active command off.</p> <ul style="list-style-type: none"> ● Did the steering column lock indicator turn on and off with the active command?

	<p>→ Yes REFER to Section 211-05.</p> <p>→ No INSTALL a new instrument cluster. REFER to Instrument Cluster. CLEAR the DTCs. REPEAT the self-test.</p>
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PINPOINT TEST T: THE TACHOMETER IS INOPERATIVE


CONDITIONS	DETAILS/RESULTS/ACTIONS
T1 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
<p>1</p>  <p>Instrument Cluster Active Command</p> <p>2</p>  <p>Instrument Cluster Active Command</p>	<p>1 Select the instrument cluster TACHOMETER CONTROL active command. Trigger the TCHOMETER active command. Adjust the scroll knob until TCHOMETER reads 50%. Note the tachometer gauge reading.</p> <p>2 Adjust the scroll knob until TCHOMETER reads 100%. Note the tachometer gauge reading.</p> <ul style="list-style-type: none"> ● Does the tachometer gauge needle start at 0 rpm, move to approximately 3500 rpm at 50% and 7000 rpm at 100%? <p>→ Yes REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.</p> <p>→ No INSTALL a new instrument cluster. REFER to Instrument Cluster. CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST U: AN INDICATOR IS INOPERATIVE/ALWAYS ON — SPEED CONTROL


CONDITIONS	DETAILS/RESULTS/ACTIONS
U1 VERIFY THAT THE SPEED CONTROL AND SPEEDOMETER OPERATE CORRECTLY	
	<p>1 Verify that the speed control and the speedometer operate correctly.</p> <ul style="list-style-type: none"> ● Do the speed control and speedometer operate correctly? <p>→ Yes GO to U2.</p> <p>→ No</p>

If the speed control does not operate correctly, REFER to [Section 310-03](#).
 If the speedometer does not operate correctly, GO to [Pinpoint Test G](#).

U2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND

<p>1</p>  <p>Instrument Cluster Active Command</p>	<p>1 Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger the ALL LAMPS active command. Observe the speed control indicator.</p> <p>● Does the speed control indicator illuminate?</p> <p>→ Yes REFER to Section 310-03.</p> <p>→ No INSTALL a new instrument cluster. REFER to Instrument Cluster. CLEAR the DTCs. REPEAT the self-test.</p>
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PINPOINT TEST V: AN INDICATOR IS INOPERATIVE/ALWAYS ON — PRNDL DISPLAY

CONDITIONS	DETAILS/RESULTS/ACTIONS
V1 VERIFY THAT THE PRNDL DISPLAY OPERATES CORRECTLY	
<p>1</p>  <p>Instrument Cluster Active Command</p>	<p>1 Select the instrument cluster DISPLAY SEGMENT CONTROL II active command.</p> <p>2 Trigger the SEGMENTS active command.</p> <p>● Do ALL of the segments illuminate?</p> <p>→ Yes REFER to Section 310-03.</p> <p>→ No INSTALL a new instrument cluster. REFER to Instrument Cluster. CLEAR the DTCs. REPEAT the instrument cluster self-test. TEST the system for normal operation.</p>


PINPOINT TEST W: AN INDICATOR IS INOPERATIVE / ALWAYS ON — LOW FUEL WARNING

CONDITIONS	DETAILS/RESULTS/ACTIONS
W1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND	

SELF-TESTS — REM AND INSTRUMENT CLUSTER

	<p>1 Use recorded REM and instrument cluster DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes If REM DTC B1201, or instrument cluster DTC U1131 is retrieved, GO to <u>Pinpoint Test D</u>.</p> <p>→ No GO to <u>W2</u>.</p>
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W2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL

<p>1</p>  <p>Instrument Cluster Active Command</p>	<p>1 Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger ALL LAMPS active command ON and OFF. Observe the low fuel warning indicator.</p> <ul style="list-style-type: none"> ● Does the low fuel indicator illuminate and turn off? <p>→ Yes GO to <u>Pinpoint Test D</u>.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Instrument Cluster</u>. CLEAR the DTCs. REPEAT the self-test.</p>
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PINPOINT TEST X: AN INDICATOR IS INOPERATIVE / ALWAYS ON — ENGINE OVER-TEMPERATURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
X1 RETRIEVE THE RECORDED DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — INSTRUMENT CLUSTER	
	<p>1 Use recorded instrument cluster DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes If instrument cluster DTC U1073 is retrieved, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.</p> <p>All other instrument cluster DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>X2</u>.</p>
X2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE	

COMMAND USING THE DIAGNOSTIC TOOL

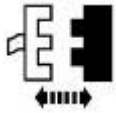
<p>1</p>  <p>Instrument Cluster Active Command</p>	<p>1</p> <p>Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger the ALL LAMPS active command ON and OFF. Observe the engine over-temperature indicator.</p> <ul style="list-style-type: none"> ● Does the engine over-temperature indicator illuminate and turn off? <p>→ Yes GO to Pinpoint Test E.</p> <p>→ No INSTALL a new instrument cluster. REFER to Instrument Cluster. CLEAR the DTCs. REPEAT the self-test.</p>
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PINPOINT TEST Y: THE AIR BAG WARNING INDICATOR IS INOPERATIVE/ALWAYS ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
Y1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — RCM	
	<p>1</p> <p>Use the recorded RCM DTCs from the continuous and on-demand self-tests.</p> <ul style="list-style-type: none"> ● Are any RCM DTCs recorded? <p>→ Yes REFER to Section 501-20B.</p> <p>→ No GO to Y2.</p>
Y2 CARRY OUT THE REM AIR BAG WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
<p>1</p>  <p>RCM Active Command</p>	<p>1</p> <p>Select the RCM WARNING LAMPS AND CHIME active command. Trigger the AIR BAG WARNING LAMP AND CHIME active command ON and OFF. Observe the air bag warning indicator.</p> <ul style="list-style-type: none"> ● Does the air bag warning indicator illuminate and turn off? <p>→ Yes REFER to Section 501-20B to continue diagnosis.</p> <p>→ No GO to Y3.</p>

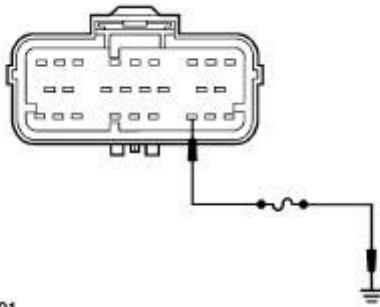
Y3 CHECK THE AIR BAG WARNING INDICATOR OPERATION

2



C310a

3



A0037801

4



1 Deactivate the supplemental restraint system. Refer to [Section 501-20B](#).

3 Connect a fused (10A) jumper wire between the restraint control module C310a pin 20, circuit 31S-JA14 (BK/GN), harness side and ground.

● Does the air bag warning indicator illuminate?

→ **Yes**
GO to [Y4](#)

→ **No**
GO to [Y5](#).

Y4 CHECK FOR CORRCET RCM OPERATION

1 Disconnect all RCM connector.

2 Check for:

- corrosion
- pushed-out pins

3 Connect all RCM connectors and make sure they seat correctly.

4 Operate the system and verify the concern is still present.

● Is the concern still present?

→ **Yes**
INSTALL a new RCM. REFER to [Section 501-20B](#). TEST the system for normal operation.

→ **No**


	<p>The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. TEST the system for normal operation.</p>
<p>Y5 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION</p>	
	<ol style="list-style-type: none"> 1 Disconnect all instrument cluster connectors. 2 Check for: <ul style="list-style-type: none"> ● corrosion ● pushed-out pins 3 Connect all instrument cluster connectors and make sure they seat correctly. 4 Operate the system and verify the concern is still present. <ul style="list-style-type: none"> ● Is the concern still present? <p>→ Yes INSTALL a new instrument cluster. REFER to Instrument Cluster in this section. TEST the system for normal operation.</p> <p>→ No The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST Z: THE ODOMETER IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>Z1 RETRIEVE THE RECORDED DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — INSTRUMENT CLUSTER</p>	
	<ol style="list-style-type: none"> 1 Use recorded instrument cluster DTCs from the continuous and on-demand self-test. <ul style="list-style-type: none"> ● Are there any DTCs recorded? <p>→ Yes If the instrument cluster DTC U1123 is recorded, REFER to Section 206-09A with ABS, Section 206-09B with ABS/TC, or Section 206-09C with ABS/TC/IVD.</p> <p>If DTC B2143, GO to Z2.</p> <p>All other instrument cluster DTCs, REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.</p> <p>→ No</p>

	GO to <u>Z3</u> .
Z2 VERIFY THE ODOMETER ILLUMINATES	
	<p>1 Verify that the odometer does illuminate with the ignition in the RUN position.</p> <ul style="list-style-type: none"> ● Does the odometer illuminate? <p>→ Yes GO to <u>Z3</u>.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Instrument Cluster</u>. TEST the system for normal operation.</p>
Z3 CHECK THE SPEEDOMETER OPERATION	
	<p>1 Operate the vehicle to verify that the speedometer operates correctly.</p> <ul style="list-style-type: none"> ● Does the speedometer operate correctly? <p>→ Yes The system is OK.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Instrument Cluster</u>. TEST the system for normal operation.</p>

PINPOINT TEST AA: THE CHECK FUEL CAP INDICATOR IS INOPERATIVE/ALWAYS ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
AA1 RETRIEVE AND RECORD DTCS FROM CONTINUOUS AND ON-DEMAND SELF-TESTS—PCM	
NOTE: Once the check fuel cap indicator does turn on, it does not turn off unless the fuel cap has been correctly secured and the vehicle has been driven for several minutes.	
	<p>1 Use recorded PCM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes If PCM DTC P0457, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.</p> <p>→ No GO to <u>AA2</u>.</p>
AA2 CARRY OUT THE INSTRUMENT CLUSTER WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE DIAGNOSTIC TOOL	
<p>1</p>  <p>Instrument Cluster</p>	

Active Command

2 Select the instrument cluster WARNING LAMPS AND CHIME active command. Trigger the ALL WARNING LAMPS active command ON. Observe the CHECK FUEL CAP indicator.

● **Does the CHECK FUEL CAP indicator illuminate?**

→ **Yes**
REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

→ **No**
GO to [AA3](#).

AA3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION

1 Disconnect all instrument cluster connectors.

2 Check for:

- corrosion
- pushed-out pins

3 Connect all instrument cluster connectors and make sure they are seated correctly.

4 Operate the system and verify the concern is still present.


● **Is the concern still present?**

→ **Yes**
INSTALL a new instrument cluster. REFER to [Instrument Cluster](#) in this section.

→ **No**
The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Instrument Cluster

Removal and Installation

1.  **CAUTION:** Prior to removal of the module, it is necessary to upload module configuration information to the diagnostic tool. This information needs to be downloaded into the new module once installed. For additional information, refer to [Section 418-01](#).

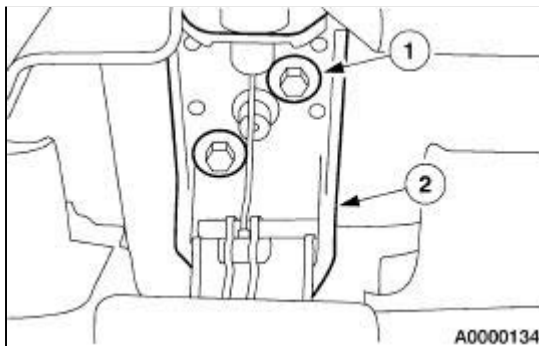
 **CAUTION:** Electronic modules are sensitive to electrical charges. If exposed to these charges, damage may result.

 **CAUTION:** To avoid damaging the instrument cluster lens, place a protective cloth over the upper steering column cover before removing the instrument cluster.

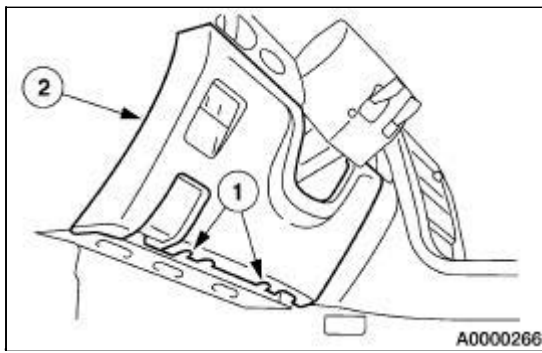
NOTE: The instrument cluster is not repairable at the dealership. Do not disassemble the instrument cluster.

Remove the instrument panel cluster finish panel. For additional information, refer to [Section 501-12](#).

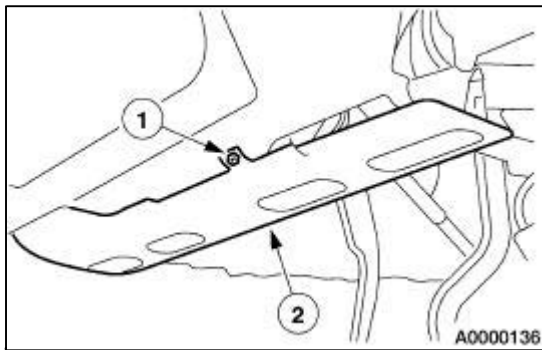
2. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
3. Remove the hood latch release handle.
 1. Remove the bolts.
 2. Remove the handle.



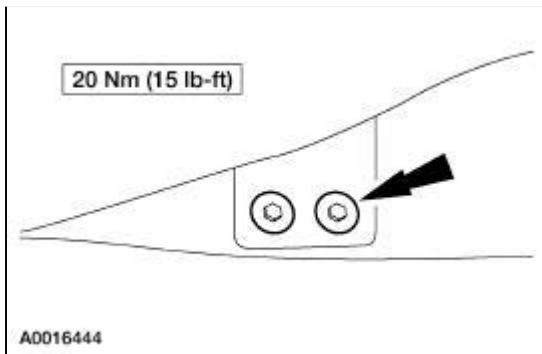
4. Remove the instrument panel steering column cover.
 1. Remove the bolts.
 2. Remove the cover.



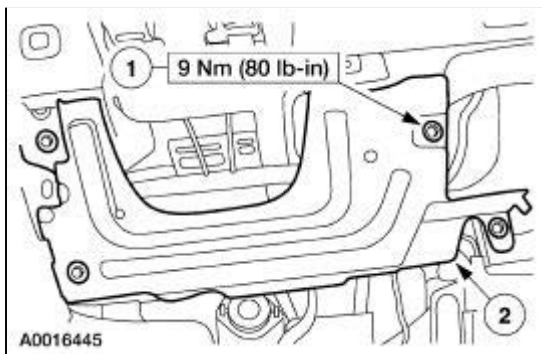
5. Remove the floor heat duct.
 1. Remove the bolt.
 2. Remove the duct.



6. Loosen the two LH instrument panel tunnel brace bolts.

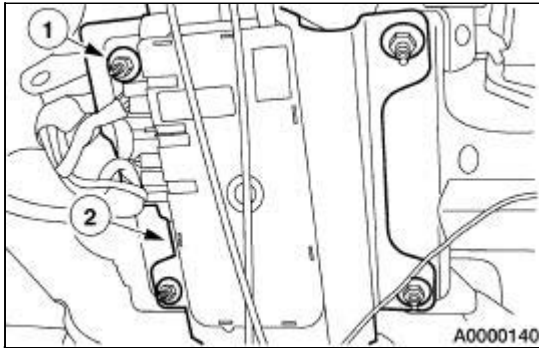


7. Remove the steering column reinforcement.
 1. Remove the bolts.
 2. Remove the reinforcement.

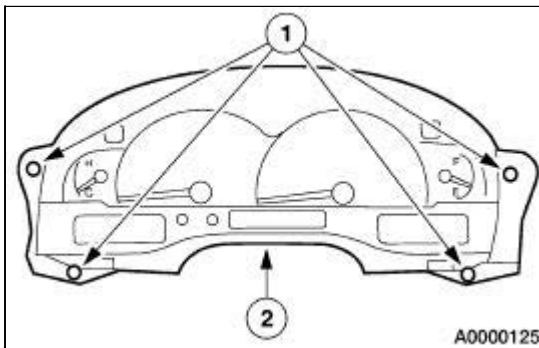



8. Lower the steering column.

1. Loosen, but do not remove, the four nuts.
2. Lower the column.



9. Disconnect the passive anti-theft system (PATS) transceiver electrical connector. For additional information, refer to [Section 419-01B](#).
10. Remove the instrument cluster.
 1. Remove the bolts.
 2. Remove the instrument cluster.
 - Disconnect the electrical connectors.



11.  **CAUTION:** Once the new module is installed, it is necessary to download the module configuration information from the diagnostic tool into the new module. For additional information, refer to [Section 418-01](#).

 **CAUTION:** To avoid damaging the instrument cluster lens, place a protective cloth over the upper steering column cover before installing the instrument cluster.

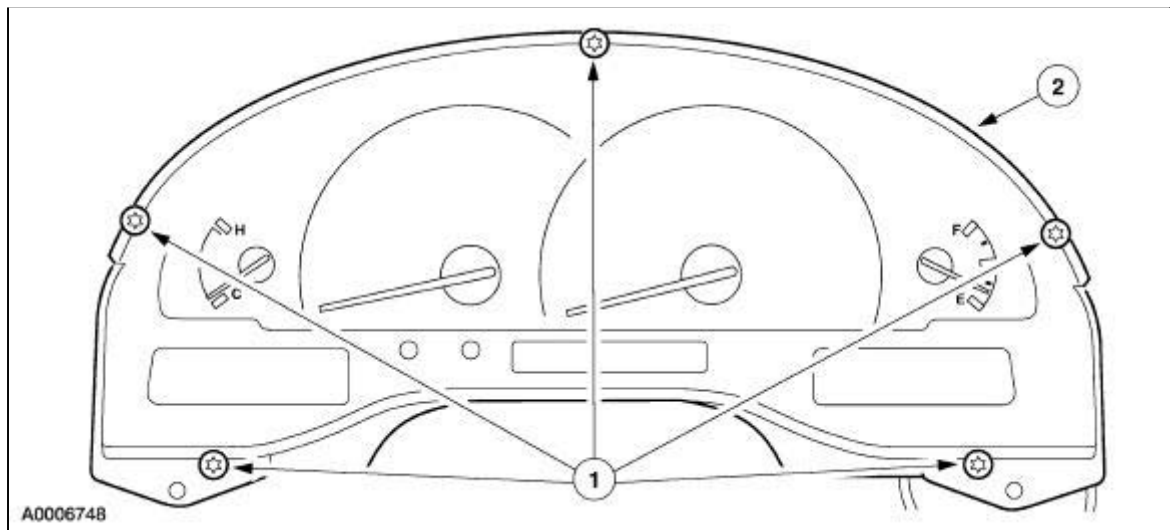
NOTE: Following the installation of a new instrument cluster, carry out the Parameter Reset and Key Programming procedure in this section.

To install, reverse the removal procedure.

Cluster Lens

Removal and Installation

1. Remove the instrument cluster. For additional information, refer to [Instrument Cluster](#) in this section.
2. Remove the cluster lens.
 1. Remove the screws.
 2. Remove the cluster lens.



3. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
Horn bolt	20	15	—
Horn switch pad bolt	6	—	53

Horn


The horn system includes the following:

- Horn relay.
 - Horn (13832).
 - Air bag sliding contact (14A664).
 - Steering wheel switch harness.
 - Horn switch.
-

Horn

Refer to Wiring Diagrams Section [413-06](#), Horn for schematic and connector information.

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool

Principles of Operation

When the horn switch is depressed, a message is sent from the instrument cluster via the network communication link to the front electronic module (FEM). The FEM acknowledges the message and energizes the horn relay by grounding the horn relay coil which allows the dual note horn to sound.

Inspection and Verification

NOTE: The FEM and instrument cluster must be reconfigured upon replacement. Refer to [Section 418-01](#).

1. Verify the customer concern by operating the horn.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Damaged horn ● Damaged horn switch ● Damaged horn relay ● Damaged air bag sliding contact (14A664) C2 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 425 (40A) ■ 422 (20A) ● Central junction box (CJB) Fuses: <ul style="list-style-type: none"> ■ 202 (5A) ■ 213 (5A) ■ 217 (5A) ■ 220 (10A)

- Auxiliary junction box (AJB) Fuse(s):
 - 104 (15A)
- Damaged circuitry
- Damaged horn relay
- Loose or corroded connections
- Damaged air bag sliding contact (14A664)

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for instrument cluster, GO to Pinpoint Test B.
 - NO RESP/NOT EQUIP for FEM, GO to Pinpoint Test A.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the instrument cluster and FEM.
6. If the DTCs retrieved are related to the concern, go to the Instrument Cluster Diagnostic Trouble Code (DTC) Index or go to the FEM Diagnostic Trouble Code (DTC) Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

FEM Diagnostic Trouble Code (DTC) Index

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1342	ECU Is Defective	FEM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 .
B1438	Wiper Mode Select Switch Circuit Failure	FEM	REFER to Section 501-16 .
B1446	Wiper Park Sense Circuit Failure	FEM	REFER to Section 501-16 .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to Section 501-16 .
B1499	Lamp Turn Signal Left Circuit	FEM	REFER to Section 417-01 .

	Failure		
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1567	Lamp Headlamp High Beam Circuit Failure	FEM	REFER to Section 417-01 .
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B1794	Lamp Headlamp Low — Beam Circuit Failure	FEM	REFER to Section 417-01 .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	REFER to Section 501-11 .
B2215	Window Passenger Front Down Switch Short to Battery	FEM	REFER to Section 501-11 .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2442	Intrusion Sensor Fault	FEM	REFER to Section 419-01A .
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
C1284	Oil Pressure Switch Failure	FEM	REFER to Section 413-01 .
C1446	Brake Switch Circuit Failure	FEM	REFER to Section 417-01 .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to Section 211-00 .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to Section 211-00 .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	CARRY OUT the PCM self-test.
U1041	SCP (J1850) Invalid or Missing Data Vehicle Speed	ABS	CARRY OUT the ABS self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/ Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test.
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	CARRY OUT the ICM self-test.
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	ICM	CARRY OUT the ICM self-test.

FEM Parameter Identification (PID) Index

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
AL_EVT1	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT2	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT3	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT4	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT5	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT6	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT7	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT8	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR
FLUID_1	Brake Fluid Level Switch #1	OFF, ON
HOOD_SW	Hood Ajar Switch	CLOSED, AJAR
IGN_R	Ignition Switch -RUN Position	NO, YES
L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position Sensor (Left/Right)	#####

PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%
R_HIGH	Right High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RADIOSW	Security Input Switch Status	OFF, ON
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-
STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	V
WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKS	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%
BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON
FRONT WINDOW CONTROL	PR DOWN	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
POWER MIRROR CONTROL	PR DOWN	OFF, ON
POWER MIRROR CONTROL	PR LEFT	OFF, ON
POWER MIRROR CONTROL	PR RIGHT	OFF, ON
POWER MIRROR CONTROL	PR UP	OFF, ON
STEERING COLUMN CONTROL COMMAND	LOCK_GND	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

Instrument Cluster Diagnostic Trouble Code (DTC) Index**Instrument Cluster Diagnostic Trouble Code (DTC) Index**

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	ICM	REFER to Section 413-01 .
B1205	EIC Switch-1 Assembly Circuit Failure	ICM	REFER to Section 413-01 .
B1209	EIC Switch-2 Assembly Circuit Failure	ICM	REFER to Section 413-01 .
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	ICM	REFER to Section 419-01B .
B1246	Dim Panel Potentiometer Switch Circuit Failure	ICM	REFER to Section 413-00 .
B1342	ECU Is Defective	ICM	CLEAR and DOCUMENT the DTCs. CARRY OUT the instrument cluster Self-Test. INSTALL a new instrument cluster if DTC B1342 is retrieved again. REFER to Section 413-01 .
B1352	Ignition Key-In Circuit Failure	ICM	REFER to Section 211-05 .
B1470	Lamp Headlamp Input Circuit Failure	ICM	REFER to Section 417-01 .
B1492	Ignition Cylinder Sensor Open Circuit	ICM	REFER to Section 419-01B .
B1567	Lamp Headlamp High Beam Circuit Failure	ICM	REFER to Section 417-01 .
B1600	PATS Ignition Key Transponder Signal Is Not Received	ICM	REFER to Section 419-01B .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	ICM	REFER to Section 419-01B .
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	ICM	REFER to Section 419-01B .
B1676	Battery Pack Voltage Out of Range	ICM	REFER to Section 413-01 .
B1681	PATS Transceiver Module Signal Is Not Received	ICM	REFER to Section 419-01B .
B1689	Autolamp Delay Circuit Failure	ICM	REFER to Section 417-01 .
B1875	Turn Signal / Hazard Switch Signal Circuit Failure	ICM	REFER to Section 417-01 .
B2103	Antenna Not Connected	ICM	REFER to Section 419-01B .
B2139	Data Mismatch (Receive Data Does Not Match What Was Expected)	ICM	REFER to Section 419-01A .
B2141	NVM Configuration Failure	ICM	REFER to Section 418-01 .

B2143	NVM Memory Failure	ICM	REFER to <u>Section 413-01</u> .
B2162	Data Mismatch #2 (receive data does not match what was expected)	ICM	REFER to <u>Section 419-01B</u> .
B2328	Column Reach Feedback Potentiometer Circuit Failure	ICM	REFER to <u>Section 211-04</u> .
B2332	Column Tilt Feedback Potentiometer Circuit Failure	ICM	REFER to <u>Section 211-04</u> .
B2351	Steering Column Switch Circuit Failure	ICM	REFER to <u>Section 211-04</u> .
B2431	Transponder Programming Failed	ICM	REFER to <u>Section 419-01A</u> .
B2472	Fog Lamp Switch Failure	ICM	REFER to <u>Section 417-01</u> .
B2477	Module Configuration Failure	ICM	REFER to <u>Section 418-01</u> .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/ Transaxle/PRNDL	PCM	CARRY out the PCM self-test.
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant Fluid Temperature	PCM	CARRY OUT the PCM self-test.
U1123	SCP (J1850) Invalid or Missing Data for Odometer Rolling Count	ABS	CARRY OUT the ABS self-test.
U1131	SCP (J1850) Invalid or Missing Data for Fuel System	ICM	REFER to <u>Section 413-01</u> .
U1147	SCP (J1850) Invalid or Missing Data for Vehicle Security System	PCM	CARRY OUT the PCM self-test.

Instrument Cluster Parameter Identification (PID) Index

Instrument Cluster Parameter Identification (PID) Index

PID	Description	Expected Value
ABCHIME	Air Bag Chime	OFF, ON
ANTISCN	Anti-Scan Function	DISABL, ENABLE
ASWSTAT	Autolamp Switch Input Status	1 KEY, 2 KEY, 3 KEY, 4 KEY, 5 KEY, 6 KEY, 7 KEY, 8 KEY, 9 KEY, 0 KEY, NO KEY
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_SBELT	Driver Seat Belt	OUT, IN
DSWSTAT	Dimmer Switch Input Status	ON, LVL1, LVL2, LVL3, LVL4, LVL5, LVL6, LVL7, LVL8, LVL9, LVL10, LVL11, LVL12, LVL13, LVL14, LVL15, LVL16, LVL17, LVL18, LVL19, LVL20, LVL21, ?
ENABL_S	Vehicle Enable Status	DISABL, ENABLE
HEAD_L	Headlamp Switch	OFF, PARK, HEADLP, R_FOG, INVLD, ?

	Input Status	
HIBEAM	High Beam Switch Input Status	OFF, HIGH, PASS, INVLD, ?
HORN_SW	Horn Input Switch	OFF, ON
IGN_A	Ignition Switch -ACCY Position	NO, YES
IGN_KEY	Ignition Key In / Out	OUT, IN
IGN_O/U	Ignition Switch - OFF/Unlock Position	NO, YES
IGN_R	Ignition Switch -RUN Position	NO, YES
IGN_S	Ignition Switch - START Position	NO, YES
LIGHTSN	Night(True) / Day (False)	NO, YES
M_KEY	Master Key Present	notPRE, PRESNT
NUMKEYS	Number Of Keys Stored In Module	one count per bit
PCM_ID	PCM ID Status	notSTR, STORED
PCM_VFY	PCM Verify OK	NO, YES
RESETSW	Reset Switch	OFF, ON
SELECT	Select/Mode Switch	OFF, ON
TILT	Steering Column Tilt Switch	SHORT, UP, DOWN, OFF
TELEPOS	Telescope Position Sensor	notSEN, SENSED
TELESCP	Steering Column Telescope Switch	SHORT, IN, OUT, OFF
TILTPOS	Tilt Position Sensor	notSEN, SENSED
TR_PARK	Transmission Select Lever In Park Pos	NO, YES

Instrument Cluster Active Command Index

Instrument Cluster Active Command Index

Active Command	Display	Action
ANTI-THEFT INDICATOR LAMP	THEFT_LAMP	OFF, ON
DISPLAY DIMMING CONTROL	ILLUMINAT	OFF, ON
DISPLAY SEGMENT CONTROL II	SEGMENTS	OFF, ON
ENGINE COOLANT GAUGE CONTROL	ENGCOOLNT	0%-100%
FUEL GAUGE CONTROL	FUELLEVEL	0%-100%
MEMORY SELECT CONTROL	MEMORY 1	OFF, ON
MEMORY SELECT CONTROL	MEMORY 2	OFF, ON
PRNDL DISPLAY CONTROL COMMAND	SEGMENTS	OFF, ON

RF_SIGNAL	RF	OFF, ON
SPEEDOMETER CONTROL	SPDOMETER	0%-100%
TACHOMETER CONTROL	TCHOMETER	0%-100%
WARNING LAMPS AND CHIME	ALL_LAMPS	OFF, ON
WARNING LAMPS AND CHIME	CHIME	OFF, ON


Symptom Chart

Symptom Chart

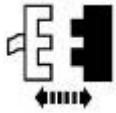
Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with front electronic module (FEM) 	<ul style="list-style-type: none"> BJB Fuses 425 (40A) and 422 (20A). Circuitry. J1850 communication network (SCP). FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> No communication with the instrument cluster module 	<ul style="list-style-type: none"> Circuitry. CJB Fuses 202 (5A), 213 (5A), 217 (5A), 220 (10A). J1850 communication network (SCP). Instrument cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
<ul style="list-style-type: none"> The horn does not sound 	<ul style="list-style-type: none"> BJB Fuse 104 (15A). Circuitry. Horn relay. Horn switch. Horn. FEM. Instrument cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> The horn sounds continuously 	<ul style="list-style-type: none"> Instrument cluster. Horn relay. Circuitry. Horn switch. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test D.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE (FEM)

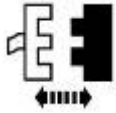
CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK22 (OG/YE) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p> 	

2



FEM C201c

3

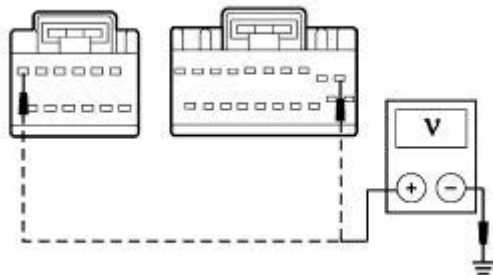


FEM C201f

4



5



A0006297

5 Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22 (OG/YE) harness side and ground.

• Are the voltages greater than 10 volts?

→ Yes
GO to A2.

→ No
REPAIR the circuit(s) in question. TEST the system for normal operation.

A2 CHECK CIRCUITS 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS

1



2

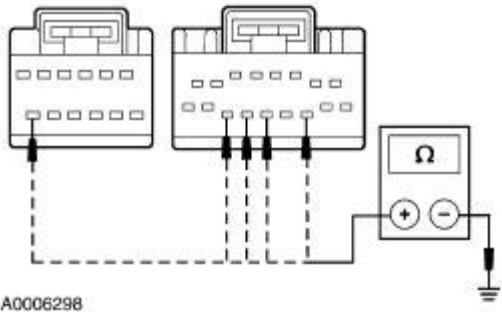


FEM C201a

3

3 Using the following table, measure the resistance between FEM connectors, harness side and ground:

FEM	Pin	Circuit
-----	-----	---------



A0006298

C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)
C201a	15	31-DK20D (BK/RD)

● Is the resistance less than 5 ohms?


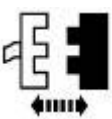
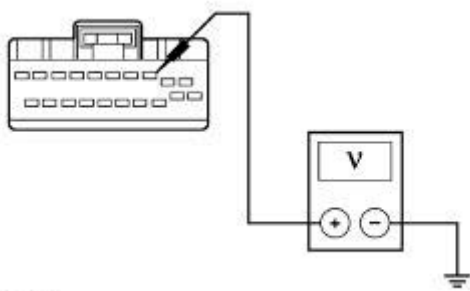
→ **Yes**

REFER to Section 418-00.

→ **No**

REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST B: NO COMMUNICATION WITH THE INSTRUMENT CLUSTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK HOT AT ALL TIMES POWER SUPPLY CIRCUIT	
<p>1</p>  <p>2</p>  <p>Instrument Cluster</p> <p>3</p>  <p>A0002792</p>	<p>3</p> <p>Measure the voltage between instrument cluster C220b pin 3, circuit 29-GG11 (OG/BU), harness side and ground.</p> <p>● Is the voltage greater than 10 volts?</p> <p>→ Yes GO to <u>B2</u>.</p>

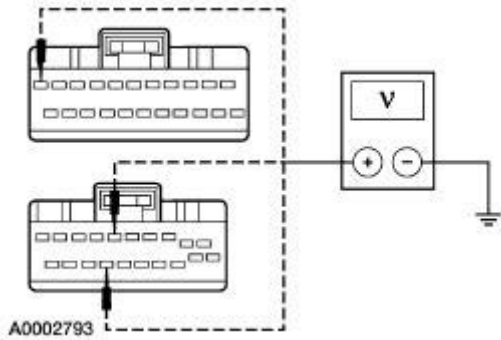
→ **No**
REPAIR the circuit. TEST the system for normal operation.

B2 CHECK HOT IN RUN POWER SUPPLY CIRCUITS

1



2



2 Measure the voltage between the instrument cluster and ground as follows:

Connector Pin	Circuit
C220a pin 11	15-JA14 (GN/BK)
C220b pin 6	15-GG14 (GN/RD)
C220b pin 17	75-GG15 (YE/GN)

• Are the voltages greater than 10 volts?

→ **Yes**
GO to B3.

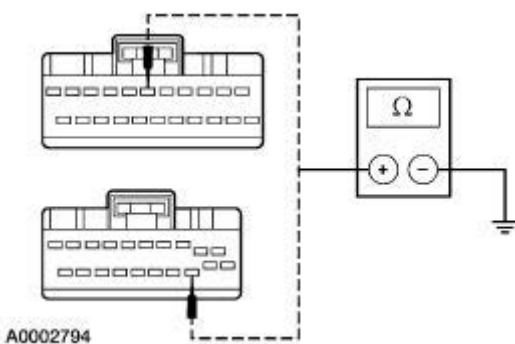
→ **No**
REPAIR the circuit(s). TEST the system for normal operation.

B3 CHECK GROUND CIRCUITS

1



2



2 Measure the resistance between the instrument cluster and ground as follows:




Connector Pin	Circuit
C220a pin 6	31-AL11 (BK)
C220b pin 13	91-GG11 (BN/RD)

• Are the resistances less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit(s). TEST the system for normal operation.

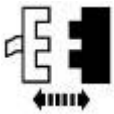
PINPOINT TEST C: THE HORN DOES NOT SOUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK HORN INPUT PID FROM THE INSTRUMENT CLUSTER	
<p>1 </p> <p>Diagnostic Tool</p> <p>2 </p> <p>3 </p>	<p>4 Monitor the ICM PID HORN_SW while depressing and releasing the horn switch.</p> <ul style="list-style-type: none"> • Does the PID indicate ON with the horn switch depressed and OFF with the horn switch released? <p>→ Yes GO to <u>C6</u>.</p> <p>→ No GO to <u>C2</u>.</p>
C2 INITIATE THE HORN CONTROL ACTIVE COMMAND	
	<p>1 Trigger the ICM active command HORN CONTROL.</p> <ul style="list-style-type: none"> • Does the horn sound? <p>→ Yes GO to <u>C3</u>.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Section 413-01</u> . CLEAR the DTCs. REPEAT the self-test.</p>
C3 CHECK THE OPERATION OF THE HORN SWITCH	

1

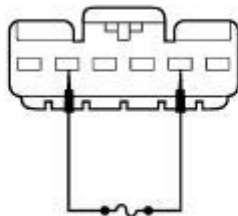


3



Horn Switch Connector

4



A0003816

2

Deactivate the air bag system; refer to [Section 501-20B](#).

4

Connect a fused (5A) jumper wire between the horn switch connector pin 2, harness side and the horn switch connector pin 5, harness side.

• Does the horn sound?

→ Yes

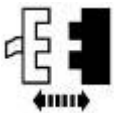
INSTALL a new horn switch. REFER to [Horn—Switch](#). CLEAR the DTCs. REPEAT the self-test.

→ No

GO to [C4](#).

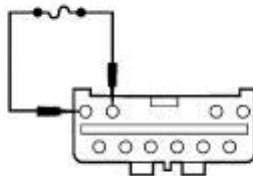
C4 CHECK THE OPERATION OF THE AIR BAG SLIDING CONTACT

1



Air Bag Sliding Contact C218

2



A0003817

2

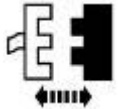
Connect a fused (5A) jumper wire between air bag sliding contact C218 pin 9, circuit 10-GJ9 (GY/OG), harness side and air bag sliding contact C218 pin 10, circuit 64-LK18 (BU/RD), harness side.

• Does the horn sound?

- **Yes**
INSTALL a new air bag sliding contact.
REFER to [Section 501-20B](#) . CLEAR the DTCs. REPEAT the self-test.
- **No**
GO to [C5](#) .

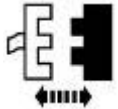
C5 CHECK CIRCUIT 10-GJ9 (GY/OG) FOR AN OPEN

1



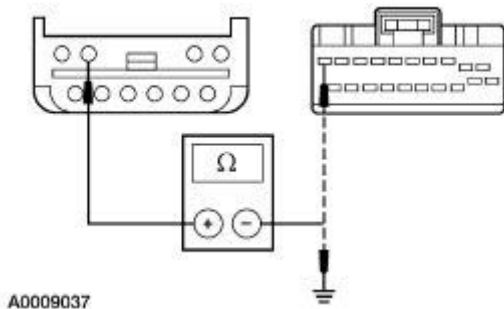
Instrument Cluster C220b

2



Air Bag Sliding Contact C218

3



- 3 Measure the resistance between instrument cluster C220b pin 10, circuit 10-GJ9 (GY/OG), harness side and air bag sliding contact C218 pin 9, circuit 10-GJ9 (GY/OG), harness side; and between air bag sliding contact C218 pin 9, circuit 10-GJ9 (GY/OG), harness side and ground.

- **Is the resistance less than 5 ohms between the instrument cluster and the air bag sliding contact; and greater than 10,000 ohms between the air bag sliding contact and ground?**

- **Yes**
REPAIR circuit 64-LK18 for a short to ground or an open. CLEAR the DTCs. REPEAT the self-test.

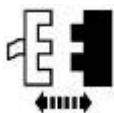
- **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C6 CHECK THE OPERATION OF THE HORN RELAY

1



2



Horn Relay C1006

3 Carry out the relay component test. Refer to Wiring Diagrams Section 700-09, Component Testing.

• Is the relay OK?

→ Yes
GO to C7.

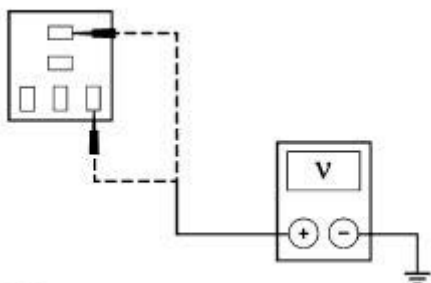
→ No
INSTALL a new horn relay. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK CIRCUITS 30-GJ7A (RD/BU) AND 30-GJ7B (RD/BU) FOR AN OPEN

1



2



A0003390

2 Measure the voltage between horn relay C1006 pin 3, circuit 30-GJ7A, harness side and ground; and between horn relay C1006 pin 2, circuit 30-GJ7B (RD/BU), harness side and ground.

• Are the voltages greater than 10 volts?

→ Yes
GO to C8.

→ No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

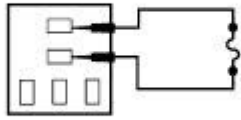
C8 CHECK THE HORN OPERATION

1



2

2 Connect a fused (5A) jumper wire between horn relay C1006 pin 5, circuit 30S-GJ6 (RD/YE), harness side and the horn relay C1006 pin 3, circuit 30-GJ7A (RD/BU), harness side.



A0003391

3



● Does the horn sound?

→ **Yes**
GO to C9.

→ **No**
GO to C10.

C9 CHECK CIRCUIT 91S-GJ7 (BN/RD) FOR AN OPEN

1

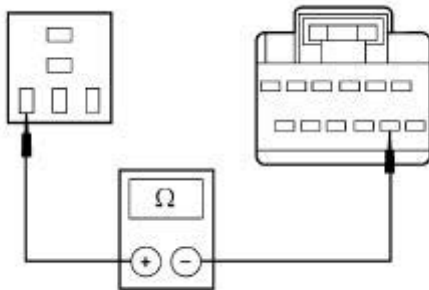


2



FEM C201c

3



A0003392

3 Measure the resistance between horn relay C1006 pin 1, circuit 91S-GJ7 (BN/RD), harness side and FEM C201c pin 8, circuit 91S-GJ7 (BN/RD), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new FEM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**

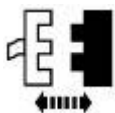
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

C10 CHECK CIRCUIT 30S-GJ6 (RD/YE) FOR AN OPEN

1

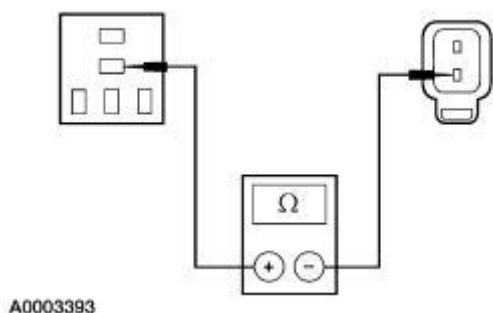


2



Horn C131

3



3

Measure the resistance between horn relay C1006 pin 5, circuit 30S-GJ6 (RD/YE), harness side and horn C131 pin 1, circuit 30S-GJ6 (RD/YE), harness side.

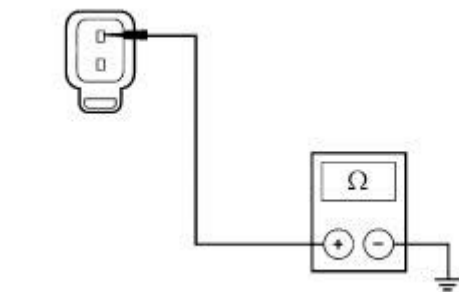
● Is the resistance less than 5 ohms?

→ **Yes**
GO to C11.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

C11 CHECK CIRCUIT 31-GJ6 (BK/YE) FOR AN OPEN

1



1

Measure the resistance between horn C131 pin 2, circuit 31-GJ6 (BK/YE), harness side and ground.





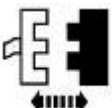
● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new horn. REFER to Horn.
CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

PINPOINT TEST D: THE HORN SOUNDS CONTINUOUSLY

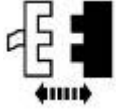
CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK HORN INPUT PID FROM THE INSTRUMENT CLUSTER	
<p>1 </p> <p>Diagnostic Tool</p> <p>2 </p> <p>3 </p> <p>PID HORN_SW</p>	<p>4 Monitor the ICM PID HORN_SW.</p> <ul style="list-style-type: none"> ● Does the PID always indicate ON? <p>→ Yes GO to <u>D2</u>.</p> <p>→ No GO to <u>D5</u>.</p>
D2 CHECK THE HORN SWITCH OPERATION	
<p>1 </p> <p>3 </p> <p>Horn Switch</p>	<p>2 Deactivate the air bag system; refer to <u>Section 501-20B</u>.</p> <ul style="list-style-type: none"> ● Does the horn stop? <p>→ Yes INSTALL a new horn switch. REFER to <u>Horn—Switch</u>. CLEAR the DTCs.</p>

REPEAT the self-test.

→ **No**
GO to D3.

D3 CHECK THE AIR BAG SLIDING CONTACT OPERATION

1



Air Bag Sliding Contact C218

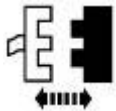
● **Does the horn stop?**

→ **Yes**
INSTALL a new air bag sliding contact.
REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to D4.

D4 CHECK THE INSTRUMENT CLUSTER OPERATION

1



Instrument Cluster C220b

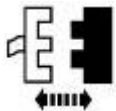
● **Does the horn stop?**

→ **Yes**
INSTALL a new instrument cluster.
REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR circuit 10-GJ9 (GY/OG) for a short to power. CLEAR the DTCs. REPEAT the self-test.

D5 CHECK CIRCUIT 30S-GJ6 (RD/YE) FOR A SHORT TO POWER

1



Horn Relay C1006

● **Does the horn stop?**

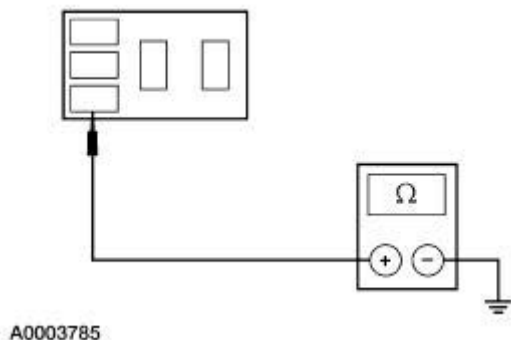
→ **Yes**
GO to D6.

→ **No**
REPAIR the circuit. CLEAR the DTCs.

REPEAT the self-test.

D6 CHECK CIRCUIT 91S-GJ7 (BK/BU) FOR A SHORT TO GROUND

1



1 Measure the resistance between horn relay C1006 pin 2, circuit 91S-GJ7 (BK/BU), harness side and ground.

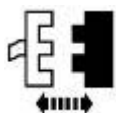
- Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new horn relay. CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to D7.

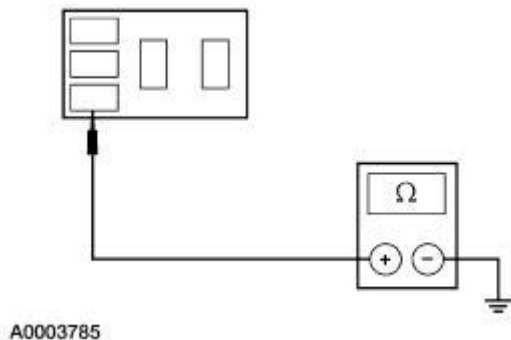
D7 CHECK CIRCUIT 91S-GJ7 (BK/BU) AND THE FEM FOR A SHORT TO GROUND

1



FEM C201c

2



2 Measure the resistance between horn relay C1006 pin 2, circuit 91S-GJ7 (BK/BU), harness side and ground.

- Is the resistance greater than 10,000 ohms?

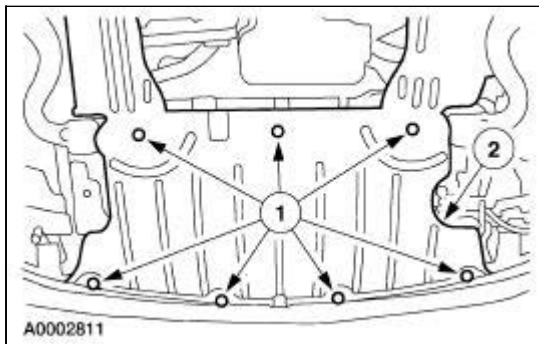
→ **Yes**
INSTALL a new FEM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

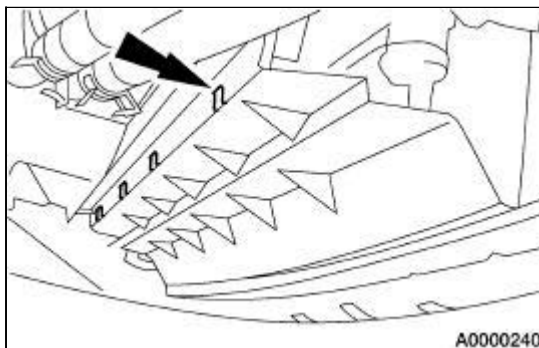
Horn

Removal and Installation

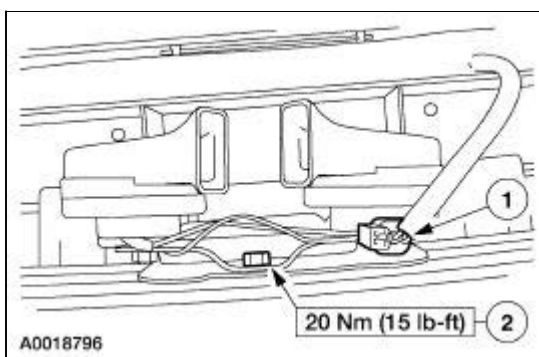
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the front splash shield.
 1. Remove the bolts.
 2. Remove the front splash shield.



3. Remove the air deflector shield.



4. Remove the horn.
 1. Disconnect the electrical connector.
 2. Remove the bolt.



5. To install, reverse the removal procedure.

Horn —Switch

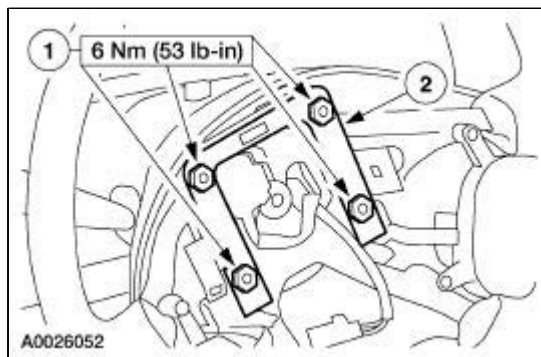
Removal and Installation

1. Remove the driver air bag module. Refer to [Section 501-20B](#).
2. **NOTE:** The diagnostic tool has been removed from the art for clarity.

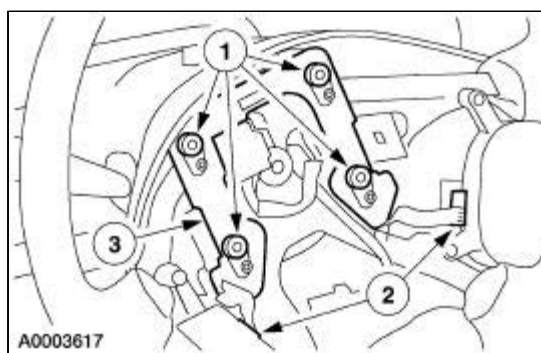
NOTE: The four horn switch springs are not attached. To avoid losing the springs use caution when removing the horn switch.

Remove the horn switch pad.

1. Remove the bolts.
2. Remove the horn switch pad.



3. Remove the horn switch.
 1. Remove the springs.
 2. Disconnect the steering wheel controls.
 3. Remove the horn switch.



4. **NOTE:** To provide correct tension between the horn pad and horn switch, install the yellow horn switch springs at the bottom and the silver horn switch springs at the top.

To install, reverse the removal procedure.


Information and Message Center

The message center display is a green vacuum fluorescent, fixed format display. The message center display is integrated within the instrument cluster (10849) and cannot be replaced separately, refer to [Section 413-01](#). The message center is controlled by the four message center switches (FUEL, RESET, STATUS, and SETUP). Refer to the owner literature for more information.

Information and Message Center

Refer to Wiring Diagrams Section [413-08](#), Message Center for schematic and connector information.

Special Tool(s)

 ST1137-A	73 III Automotive Meter or equivalent 105-R0057
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool

Principles of Operation

NOTE: The instrument cluster (IC), message center (MC), front electronic module (FEM), rear electronic module (REM), remote emergency satellite cellular unit (RESCU), anti-lock braking system/traction control/stability assist module (ABS/TC), and the driver door module (DDM) must be reconfigured upon replacement. Refer to [Section 418-01](#).

The message center is part of the instrument cluster (10849). It uses a vacuum fluorescent display. The message center communicates with the PCM, FEM, REM, IC, ABS/TC/stability assist module, DDM, and the RESCU module over the SCP network. As a technician it is important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message) control the output of the feature, or does it output a message over the SCP communication network to another module?
- which module controls the output of the feature.

Display Information

The display modes are:

- fuel (average fuel economy, distance to empty)
- setup
- system status
- warning

- temporary alert

The message center information can be selected by depressing any of the following four buttons:

- FUEL
- RESET
- SETUP
- STATUS

The setup display and the status display will time-out and default to the fuel blank display function. The temporary alert display will interrupt the current display to show the status of an event that has just happened. The warning display interrupts the current display until cleared or reset by the driver.

Status Displays

The status displays are timed modes and default back to the fuel blank display function. The status display modes are:

- oil life %
- AC air filter life %
- charging system
- engine temperature
- brake fluid level
- washer fluid level
- driver door
- passenger door
- driver rear door
- passenger rear door
- luggage compartment lid
- front turn lamps
- rear turn lamps
- stoplamps
- tail lamps
- traction control
- advance trac

Setup Displays

The setup displays are timed modes and default back to the fuel blank display function. The setup display modes are:

- language
- English/metric units
- autolocks on, autolocks off
- lock chirp on, lock chirp off

- easy entry on, easy entry off

Warning Messages

The warning messages can interrupt the display until cleared or reset by the driver. The warning messages are:

- engine temperature
- oil life
- check charging system
- transmission errors
- low washer fluid level
- low brake fluid
- low fuel
- driver door
- passenger door
- driver rear door
- passenger rear door
- luggage compartment lid
- stoplamps
- front turn lamps
- rear turn lamps
- rear tail lamps
- check fuel cap

The warning messages will display when the ignition switch is turned to ON and a fault occurs in a system. The message can be cleared by pressing the RESET button.

Temporary Alert Messages

The temporary alert display will interrupt the current display to show the status of an event that has just happened. The temporary alert messages are:

- autolamp delay
- memory recall/save
- traction control
- advance trac
- RESCU message

Inspection and Verification

NOTE: The IC, MC, REM, and FEM must be reconfigured upon replacement. Refer to [Section 418-01](#).

1. Verify the customer concern by operating the instrument cluster and message center to

duplicate the condition by observing the indicators, warning displays, and gauges to determine if they are operating correctly with the ignition switch:

- in RUN with the engine off
- in START before the ignition switch is released
- in RUN with the engine running

2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Low washer fluid level ● Damaged fuel tank ● Low engine coolant level ● Damaged accessory drive belt ● Low engine oil level ● Low brake fluid level 	<ul style="list-style-type: none"> ● Central junction box (CJB) Fuse(s): <ul style="list-style-type: none"> ■ 204 (5A) ■ 205 (5A) ■ 207 (5A) ■ 213 (5A) ■ 217 (5A) ■ 219 (15A) ■ 220 (10A) ■ 224 (5A) ■ 229 (5A) ■ 230 (5A) ● Battery junction box (BJB) Fuse(s): <ul style="list-style-type: none"> ■ 422 (20A) ■ 425 (40A) ■ 430 (30A) ● Damaged circuitry ● Damaged connectors ● Damaged switches or sensors

3. If the inspection reveals obvious concern(s) that can be readily identified, repair as necessary.

4. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:

- check that the program card is correctly installed.
- check the connections to the vehicle.
- check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the New Generation STAR Tester manual.

6. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:

- CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
- NO RESP/NOT EQUIP for instrument cluster or message center (MCM), go to Pinpoint Test A.
- NO RESP/NOT EQUIP for FEM, go to Pinpoint Test B.
- NO RESP/NOT EQUIP for REM, go to Pinpoint Test C.
- SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs),

erase the continuous DTCs and carry out self-test diagnostics for the instrument cluster.

7. If the DTCs retrieved are related to the concern, go to the Message Center Module Diagnostic Trouble Code (DTC) Index, Instrument Cluster Diagnostic Trouble Code (DTC) Index, FEM Diagnostic Trouble Code (DTC) Index, REM Diagnostic Trouble Code (DTC) Index or RESCU Diagnostic Trouble Code (DTC) Index to continue diagnostics.
8. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

Message Center Module Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1205	Message Center Switch Assembly Circuit Failure	MCM	GO to <u>Pinpoint Test D</u> .
B1342	ECU Defective	MCM	NOTE: The message center is part of the instrument cluster. CLEAR and DOCUMENT the DTCs. CARRY OUT the message center self-test. INSTALL a new instrument cluster if the DTC B1342 is retrieved again. REFER to <u>Section 413-01</u> .
B1676	Battery Voltage Out of Range	MCM	GO to <u>Pinpoint Test A</u> .
B2477	Module Configuration Failure	MCM	REFER to <u>Section 418-01</u> .
U1020	SCP (J1850) Invalid or Missing Data for Engine Air Conditioning Clutch	FEM	CARRY OUT the FEM self-test.
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	CARRY OUT the PCM self-test.
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ICM	CARRY OUT the instrument cluster self-test.
U1053	SCP (J1850) Invalid or Missing Data for Steering / Steering Wheel	PCM	CARRY OUT the PCM self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test.
U1065	SCP (J1850) Invalid or Missing Data for Primary Id \$41	ABS	CARRY OUT the ABS self-test.
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant	PCM	CARRY OUT the PCM self-test.
U1075	SCP (J1850) Invalid or Missing Data for Engine Oil	FEM	REFER to <u>Section 413-01</u> .
U1083	SCP (J1850) Invalid or Missing Data for Engine Systems Other	PCM	CARRY OUT the PCM self-test.

U1098	SCP (J1850) Invalid or Missing Data for Vehicle Speed Control	PCM	CARRY OUT the PCM self-test.
U1117	SCP (J1850) Invalid or Missing Data for Electrical Energy Management	FEM	CARRY OUT the FEM self-test.
U1123	SCP (J1850) Invalid or Missing Data for Odometer	ABS, stability assist module, TC	CARRY OUT the ABS, stability assist module, and TC self-test.
U1135	SCP (J1850) Invalid or Missing Data for Ignition Switch / Starter	ICM	CARRY OUT the instrument cluster self-test.
U1136	SCP (J1850) Invalid or Missing Data for Telltales	FEM, PCM	CARRY OUT the FEM and PCM self-test.
U1180	SCP (J1850) Invalid or Missing Data for Personalization (Memory) Features	DDM	CARRY OUT the DDM self-test.
U1181	SCP (J1850) Invalid or Missing Data for Personalization (Memory) Features	DDM	CARRY OUT the DDM self-test.
U1199	SCP (J1850) Invalid or Missing Data for External Access (Doors)	REM, FEM, DDM	CARRY OUT the REM, FEM, and DDM self-test.
U1217	SCP (J1850) Invalid or Missing Data for External Lamp Outage	FEM, REM	CARRY OUT the FEM and REM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the instrument cluster self-test.
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	CARRY OUT the instrument cluster self-test.

Message Center Module Parameter Identification (PID) Index

PID	Description	Expected Value
CCNT	Number Of Continuous DTCs In Module	one count per bit
FUELSW	Fuel Switch	OFF, ON
RESETSW	Reset Switch	OFF, ON
SETUPSW	Setup Switch	OFF, ON
STATUSSW	Status Switch	OFF, ON

Message Center Module Active Command Index

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Active Command	Display	Action
MESSAGE CENTER DISPLAY CHARACTER	SEGMENTS	OFF, ON
DISPLAY DIMMING CONTROL	ILLUMINAT	OFF, ON

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	ICM	REFER to Section 413-01 .
B1205	EIC Switch-1 Assembly Circuit Failure	ICM	REFER to Section 413-01 .
B1209	EIC Switch-2 Assembly Circuit Failure	ICM	REFER to Section 413-01 .
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	ICM	REFER to Section 419-01B .
B1246	Dim Panel Potentiometer Switch Circuit Failure	ICM	REFER to Section 413-00 .
B1342	ECU Is Defective	ICM	CLEAR and DOCUMENT the DTCs. CARRY OUT the instrument cluster Self-Test. INSTALL a new instrument cluster if DTC B1342 is retrieved again. REFER to Section 413-01 .
B1352	Ignition Key-In Circuit Failure	ICM	REFER to Section 211-05 .
B1470	Lamp Headlamp Input Circuit Failure	ICM	REFER to Section 417-01 .
B1567	Lamp Headlamp High Beam Circuit Failure	ICM	REFER to Section 417-01 .
B1600	PATS Ignition Key Transponder Signal Is Not Received	ICM	REFER to Section 419-01B .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	ICM	REFER to Section 419-01B .
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	ICM	REFER to Section 419-01B .
B1676	Battery Pack Voltage Out of Range	ICM	REFER to Section 413-01 .
B1681	PATS Transceiver Module Signal Is Not Received	ICM	REFER to Section 419-01B .
B1689	Autolamp Delay Circuit Failure	ICM	REFER to Section 417-01 .
B1875	Turn Signal / Hazard Switch Signal Circuit Failure	ICM	REFER to Section 417-01 .
B2103	Antenna Not Connected	ICM	REFER to Section 419-01B .
B2139	Data Mismatch (Received Data Does Not Match What Was Expected)	ICM	REFER to Section 419-01A .
B2141	NVM Configuration Failure	ICM	REFER to Section 419-01B .
B2143	NVM Memory Failure	ICM	REFER to Section 419-01B .
B2162	Security Data Mismatch #2 (Received Data Does Not Match What Was Expected)	ICM	REFER to Section 419-01B .
B2328	Column Reach Feedback Potentiometer Circuit Failure	ICM	REFER to Section 211-04 .
B2332	Column Tilt Feedback Potentiometer	ICM	REFER to Section 211-04 .

	Circuit Failure		
B2351	Steering Column Switch Circuit Failure	ICM	REFER to Section 211-04 .
B2431	Transponder Programming Failed	ICM	REFER to Section 419-01A .
B2472	Fog Lamp Switch Failure	ICM	REFER to Section 417-01 .
B2477	Module Configuration Failure	ICM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS, ABS/TC, stability assist module	CARRY OUT the ABS, ABS/TC, or stability assist self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test.
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant Fluid Temperature	PCM	CARRY OUT the PCM self-test.
U1123	SCP (J1850) Invalid or Missing Data for Odometer Rolling Count	ABS, ABS/TC, stability assist module	CARRY OUT the ABS, ABS/TC, stability assist module self-test.
U1147	SCP (J1850) Invalid or Missing Data for Vehicle Security System	PCM	CARRY OUT the PCM self-test.

Instrument Cluster Parameter Identification (PID) Index

PID	Description	Expected Value
ABCHIME	Air Bag Chime	OFF, ON
ANTISCN	Anti-Scan Function	DISABL, ENABLE
ASWSTAT	Autolamp Switch Input Status	OFF, DELAY7, DELAY6, DELAY5, DELAY4, DELAY3, DELAY2, DELAY1, INVLD
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_SBELT	Driver Seat Belt	OUT, IN
DSWSTAT	Dimmer Switch Input Status	ON, LVL1, LVL2, LVL3, LVL4, LVL5, LVL6, LVL7, LVL8, LVL9, LVL10, LVL11, LVL12, LVL13, LVL14, LVL15, LVL16, LVL17, LVL18, LVL19, LVL20, LVL21, INVALID
ENABL_S	Vehicle Enable Status	DISABL, ENABLE
FOG_SW HA2_SW	Fog lamp switch Hazard Switch	OFF, ON OFF, ON
HEAD_L	Headlamp Switch Input Status	OFF, PARK, HEADLP, R_FOG, INVLD, ?
HIBEAM	High Beam Switch Input Status	OFF, HIGH, PASS, INVLD, ?
HORN_SW	Horn Input Switch	OFF, ON
IGN_A	Ignition Switch - ACCY Position	NO, YES
IGN_KEY	Ignition Key In / Out	OUT, IN
IGN_O/U	Ignition Switch -	NO, YES

	OFF/Unlock Position	
IGN_R	Ignition Switch - RUN Position	NO, YES
IGN_S	Ignition Switch - START Position	NO, YES
LIGHTSN	Night (True) / Day (False)	NO, YES
LTURN	Left Turn Switch	OFF, ON
MIN#KEY	Minimum number of keys required	0-67
M_KEY	Master Key Present	notPRE, PRESNT
NUMKEYS	Number Of Keys Stored In Module	one count per bit
PCM_ID	PCM ID Status	notSTR, STORED
RESETSW	Reset Switch	OFF, ON
RTURN	Right turn switch	OFF, ON
SELECT	Select/Mode Switch	OFF, ON
SERVMOD	Service module: 0=No, Y=Yes	0-25 0-14
SPAREKY	Spare key programming: 0=enabled, 1=Disabled	
TILT	Steering Column Tilt Switch	SHORT, UP, DOWN, OFF
TELEPOS	Telescope Position Sensor	notSEN, SENSED
TELESCP	Steering Column Telescope Switch	SHORT, IN, OUT, OFF
TILTPOS	Tilt Position Sensor	notSEN, SENSED
TR_PARK	Transmission Select Lever In Park Pos	NO, YES

Instrument Cluster Active Command Index

Active Command	Display	Action
ANTI-THEFT INDICATOR LAMP	THEFT LAMP	OFF, ON
DISPLAY DIMMING CONTROL	ILLUMINAT	OFF, ON
DISPLAY SEGMENT CONTROL II	SEGMENTS	OFF, ON
ENGINE COOLANT GAUGE CONTROL	ENGCOOLNT	0%-100%
FUEL GAUGE CONTROL	FUELLEVEL	0%-100%
MEMORY SELECT CONTROL	MEMORY 1	OFF, ON
MEMORY SELECT CONTROL	MEMORY 2	OFF, ON
PRNDL DISPLAY CONTROL COMMAND	SEGMENTS	OFF, ON
RF SIGNAL	RF	OFF, ON
SPEEDOMETER CONTROL	SPDOMETER	0%-100%

TACHOMETER CONTROL	TCHOMETER	0%-100%
WARNING LAMPS AND CHIME	ALL LAMPS	OFF, ON
WARNING LAMPS AND CHIME	CHIME	OFF, ON

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1342	ECU Is Defective	FEM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1438	Wiper Mode Select Switch Circuit Failure	FEM	REFER to Section 501-16 .
B1446	Wiper Park Sense Circuit Failure	FEM	REFER to Section 501-16 .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to Section 413-01 .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1567	Lamp Headlamp High-Beam Circuit Failure	FEM	REFER to Section 417-01 .
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B1794	Lamp Headlamp Low-Beam Circuit Failure	FEM	REFER to Section 417-01 .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	REFER to Section 501-11 .
B2215	Window Passenger Front Down Switch Short to Battery	FEM	REFER to Section 501-11 .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2443	Powertrain Performance Mode Switch Circuit Failure	FEM	Not Used

B2477	Module Configuration Failure	FEM	REFER to <u>Section 418-01</u> .
C1284	Oil Pressure Switch Failure	FEM	REFER to <u>Section 413-01</u> .
C1446	Brake Switch Circuit Failure	FEM	REFER to <u>Section 413-01</u> .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to <u>Section 211-00</u> .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to <u>Section 211-00</u> .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	CARRY OUT the PCM self-test.
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test.
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	CARRY OUT the ICM self-test.
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	ICM	CARRY OUT the ICM self-test.

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
AL_EVT1	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT2	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT3	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT4	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT5	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT6	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT7	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT8	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
CCNT	Number Of Continuous	one count per bit

	DTCs In Module	
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR
FLUID_1	Brake Fluid Level Switch #1	OFF, ON
HOOD_SW	Hood Ajar Switch	CLOSED, AJAR
IGN_R	Ignition Switch -RUN Position	NO, YES
L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position Sensor (Left/Right)	#####
PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%
R_HIGH	Right High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RADIOSW	Security Input Switch Status	OFF, ON
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-
STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	Volts
WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKSW	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%
BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON
FRONT WINDOW CONTROL	PR DOWN	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
POWER MIRROR CONTROL	PR DOWN	OFF, ON
POWER MIRROR CONTROL	PR LEFT	OFF, ON
POWER MIRROR CONTROL	PR RIGHT	OFF, ON
POWER MIRROR CONTROL	PR UP	OFF, ON
STEERING COLUMN CONTROL COMMAND	LOCK_GND	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON
VAPS II OUTPUT PULSE CONTROL	VAPSIIOUT	%

REM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	REM	REFER to Section 413-01 .
B1300	Power Door Lock Circuit Failure	REM	REFER to Section 501-14B .
B1310	Power Door Unlock Circuit Failure	REM	REFER to Section 501-14B .
B1331	Deck Lid Ajar Rear Door Circuit Failure	REM	REFER to Section 417-02 .
B1335	Door Ajar RR Circuit Failure	REM	REFER to Section 417-02 .
B1342	ECU Is Defective	REM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1483	Brake Pedal Input Circuit Failure	REM	REFER to Section 417-01 .
B1499	Lamp Turn Signal Left Circuit Failure	REM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	REM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	REM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit	REM	REFER to Section 417-01 .

	Short to Battery		
B1551	Deck Lid Release Circuit Failure	REM	REFER to Section 501-14B .
B1571	Door Ajar LR Circuit Failure	REM	REFER to Section 417-02 .
B1676	Battery Pack Voltage Out of Range	REM	REFER to Section 414-00 .
B2172	Inertia Switch Input Circuit Open	REM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test.

REM Parameter Identification (PID) Index

PID	Description	Expected Value
BOO	Brake Switch Input	OFF, ON
DECKLID	Deck Lid Ajar Switch	CLOSED, AJAR
DL_DSRM	Deck Lid Disarm	NO, YES
DLIDOUT	Deck Lid Driver	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
DLIDRLS	Deck Lid Release	OFF, ON
L_TAIL	Left & Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LMRKOUT	Left Marker Lamp Driver Output State	OFF, ON
LMRKSTB	Left Marker Lamp Driver Short To Battery	NO, YES
LR_TURN	Left & Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LRDN_SW	Left Rear Window Down Switch	OFF, UP
LRDR_SW	Left Rear Door Ajar	CLOSED, AJAR

	Switch	
LRUP_SW	Left Rear Window Up Switch	OFF, DOWN
PD_LOCK	Passenger Door Lock	NO, YES
PD_UNLK	Passenger Door Unlock	NOTLOC, LOCK
R_TAIL	Left & Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RR_TURN	Left & Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RRDN_SW	Right Rear Window Down Switch	OFF, UP
RRDR_SW	Right Rear Door Ajar Switch	CLOSED, AJAR
RRUP_SW	Right Rear Window Up Switch	OFF, DOWN

REM Active Command Index

Active Command	Display	Action
EXTERIOR LAMP CONTROL	BACKUPLMP	OFF, ON
EXTERIOR LAMP CONTROL	H MNT STP	OFF, ON
EXTERIOR LAMP CONTROL	L STOP	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
EXTERIOR LAMP CONTROL	R DEF RLY	OFF, ON
EXTERIOR LAMP CONTROL	R FOG LMP	OFF, ON
EXTERIOR LAMP CONTROL	R STOP	OFF, ON
POWER WINDOW ENABLE COMMAND	PSGR RLY	OFF, ON
REAR DOOR LOCK CONTROL	LR LOCK	OFF, ON
REAR DOOR LOCK CONTROL	LR UNLOCK	OFF, ON
REAR DOOR LOCK CONTROL	RELEASE	OFF, ON
REAR WINDOW CONTROL	LR DOWN	OFF, ON
REAR WINDOW CONTROL	LR UP	OFF, ON
REAR WINDOW CONTROL	RR DOWN	OFF, ON
REAR WINDOW CONTROL	RR UP	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

RESCU Diagnostic Trouble Code (DTC) Index

DTC	Description	DTC Caused By	Action
-----	-------------	---------------	--------

B1216	Emergency Roadside Assistance Switch Circuit Short to Ground	RESCU Module	REFER to Section 419-05 .
B1342	ECU is Defective	RESCU Module	CLEAR the DTCs. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new RESCU module. For additional information, REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1871	Passenger Air Bag Disable Module Fault	RESCU Module	REFER to Section 419-05 .
B1874	Cellular Phone Handset Not Present (Phone transceiver is connected but not responding to any RESCU query)	RESCU Module	REFER to Section 419-05 .
B1893	GPS Antenna Open Circuit	RESCU Module	REFER to Section 419-05 .
B2102	Antenna Circuit Short to Ground (GPS)	RESCU Module	REFER to Section 419-05 .
B2141	NVM Configuration Failure [No/invalid telephone number (s) present]	RESCU Module	CLEAR the DTCs. CARRY OUT RESCU on-demand self-test. If DTC B2141 is retrieved, INSTALL a new RESCU module. For additional information, REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B2477	Module Configuration Failure (No/invalid VIN present or RESCU configuration error)	RESCU Module	CHECK the RESCU module configuration. For additional information, REFER to Section 418-01 .

RESCU Parameter Identification (PID) Index

PID	Description	Expected Value
AIRBAGI	Airbag Input Status	notACT, ACTIVE
ASSTREQ	Button Status Assistance Request	notACT, ACTIVE
CCNT	Number Of Continuous DTCs In Module	one count per bit
DEP_IND	Airbag Deployment Indication Input	NORMAL, OPEN, STG, STB
INFOREQ	Button Status Information Request	notACT, ACTIVE

PCM Diagnostic Trouble Code (DTC) Index

DTC	Description	DTC Caused By	Action
P0457	Fuel Fill Cap Off	PCM	GO to Pinpoint Test M.

For a complete list of PCM DTCs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom Chart


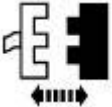
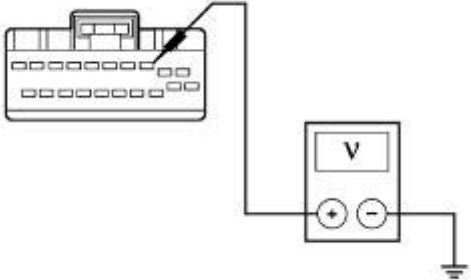
Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the instrument cluster module/message center module 	<ul style="list-style-type: none"> CJB Fuses 220 (10A), 204 (5A). BJB Fuse 425 (40A). Circuitry. J1850 communication network (SCP). Instrument cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> No communication with the front electronic module 	<ul style="list-style-type: none"> CJB Fuses 220 (10A), 229 (5A), 230 (5A) BJB Fuses 422 (20A), 425 (40A), 426 (20A). Circuitry. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
<ul style="list-style-type: none"> No communication with the rear electronic module 	<ul style="list-style-type: none"> BJB Fuses 425 (40A), 419 (15A). CJB Mini Fuses 207 (5A), 204 (5A), 220 (10A), 235 (5A). Circuitry. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> No communication with the remote emergency satellite cellular unit (RESCU) 	<ul style="list-style-type: none"> BJB Fuse 414 (5A). CJB Fuse 229 (5A). Circuitry. RESCU module. Connectors. 	<ul style="list-style-type: none"> GO to Pinpoint Test D.
<ul style="list-style-type: none"> The message center display is blank 	<ul style="list-style-type: none"> Instrument cluster. 	<ul style="list-style-type: none"> NOTE: The message center will be blank if the blank display was selected with the last ignition switch ON. <p>INSTALL a new instrument cluster. REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.</p>
<ul style="list-style-type: none"> The message center is not operating correctly 	<ul style="list-style-type: none"> Instrument cluster. Message center switch. 	<ul style="list-style-type: none"> GO to Pinpoint Test E.
<ul style="list-style-type: none"> The message center switch is not operating correctly 	<ul style="list-style-type: none"> Circuitry. Message center switch. Message center module (part of the instrument cluster). 	<ul style="list-style-type: none"> GO to Pinpoint Test F.
<ul style="list-style-type: none"> The indicator does not operate correctly — low fuel level 	<ul style="list-style-type: none"> Circuitry. Fuel level sender (s). 	<ul style="list-style-type: none"> GO to Pinpoint Test G.

display	<ul style="list-style-type: none"> ● REM. ● Instrument cluster. 	
<ul style="list-style-type: none"> ● The indicator is inoperative — oil life status, AC filter life 	<ul style="list-style-type: none"> ● Circuitry. ● ABS module. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test H.
<ul style="list-style-type: none"> ● Lamp out warning indicator is inoperative 	<ul style="list-style-type: none"> ● Circuitry. ● FEM. ● REM. ● Message center module (part of instrument cluster). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test I.
<ul style="list-style-type: none"> ● The indicator does not operate correctly — washer fluid level display 	<ul style="list-style-type: none"> ● Circuitry. ● Washer fluid level switch. ● FEM. ● Message center module (part of instrument cluster). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test J.
<ul style="list-style-type: none"> ● The indicator does not operate correctly — low brake fluid level display 	<ul style="list-style-type: none"> ● Circuitry. ● Brake fluid level switch. ● FEM. ● Message center module (part of instrument cluster). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test K.
<ul style="list-style-type: none"> ● The charging system warning is incorrect 	<ul style="list-style-type: none"> ● Circuitry. ● Generator. ● PCM. ● Instrument cluster. 	<ul style="list-style-type: none"> ● REFER to Section 413-01.
<ul style="list-style-type: none"> ● The distance to empty (DTE) / average / instantaneous fuel economy is incorrect 	<ul style="list-style-type: none"> ● Circuitry. ● Message center module (part of instrument cluster). ● PCM. ● ABS. 	<ul style="list-style-type: none"> ● CHECK the operation of the speedometer, the fuel gauge and the odometer. If inoperative, REFER to Section 413-01. ● If the speedometer, the fuel gauge and the odometer operates correctly but the distance to empty, instantaneous fuel economy, average fuel economy does not operate correctly, INSTALL a new instrument cluster. REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.
<ul style="list-style-type: none"> ● Data status message is displayed — door ajar display 	<ul style="list-style-type: none"> ● Circuitry. ● Door ajar switch (es). ● FEM. ● REM. ● Message center module (part of 	<ul style="list-style-type: none"> ● GO to Pinpoint Test L.

	instrument cluster).	
<ul style="list-style-type: none"> ● Data status message is displayed — RESCU message display 	<ul style="list-style-type: none"> ● Overhead switches. ● RESCU module. ● Circuitry. ● Connectors. 	<ul style="list-style-type: none"> ● REFER to <u>Section 419-05</u>.
<ul style="list-style-type: none"> ● Data status message is displayed — traction control and advance traction display 	<ul style="list-style-type: none"> ● Circuitry. ● ABS/TC/stability assist module. ● Message center module (part of instrument cluster). 	<ul style="list-style-type: none"> ● REFER to <u>Section 413-01</u>.
<ul style="list-style-type: none"> ● Data status message is displayed—check fuel cap 	<ul style="list-style-type: none"> ● Message center module (part of instrument cluster). ● PCM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test M</u>.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE INSTRUMENT CLUSTER MODULE/MESSAGE CENTER MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK HOT AT ALL TIMES POWER SUPPLY CIRCUIT	
<p>1</p>  <p>2</p>  <p>Instrument Cluster C220b</p> <p>3</p>  <p>A0002792</p>	<p>3</p> <p>Measure the voltage between instrument cluster C220b pin 3, circuit 29-GG11 (OG/BU), harness side and ground.</p> <p>● Is the voltage greater than 10 volts?</p>

- **Yes**
GO to A2.
- **No**
REPAIR the circuit. TEST the system for normal operation.

A2 CHECK HOT IN RUN POWER SUPPLY CIRCUITS

1

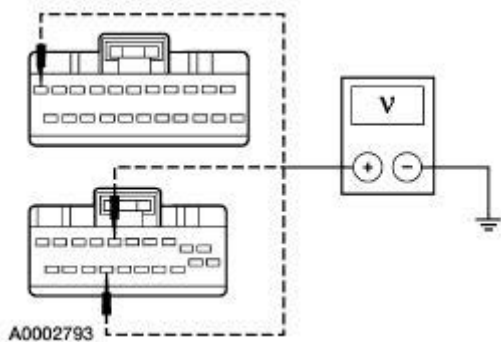


Instrument Cluster C220a

2



3



- 3 Measure the voltage between the instrument cluster connectors, harness side and ground as follows:

Connector Pin	Circuit
C220a pin 11	15-JA14 (GN/BK)
C220b pin 6	15-GG14 (GN/RD)
C220b pin 17	75-GG15 (YE/GN)

- Are the voltages greater than 10 volts?

- **Yes**
GO to A3.
- **No**
REPAIR the circuit(s). TEST the system for normal operation.

A3 CHECK GROUND CIRCUITS

1



2

- 2 Measure the resistance between the instrument cluster and ground as follows:

Connector Pin	Circuit
C220a pin 6	31-AL11 (BK)
C220b pin 13	91-GG11 (BN/RD)


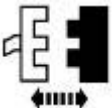
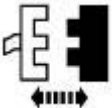

A0002794

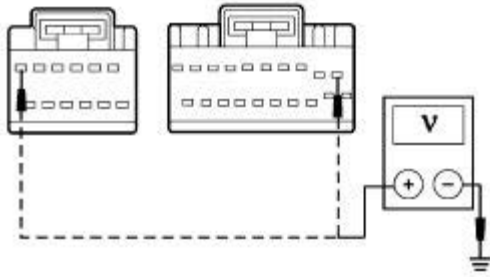
- Are the resistances less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit(s). TEST the system for normal operation.

PINPOINT TEST B: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK22 (OG/YE) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>2</p>  <p>FEM C201c</p> <p>3</p>  <p>FEM C201f</p> <p>4</p>  <p>5</p>	<p>5</p> <p>Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22</p>



A0006297

(OG/YE) harness side and ground.

- Are the voltages greater than 10 volts?

→ **Yes**
GO to B2.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

B2 CHECK CIRCUIT S 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS

1

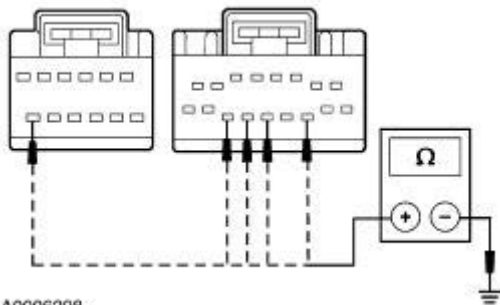


2



FEM C201a

3



A0006298

3 Measure the resistance between FEM connectors, harness side and ground as follows:


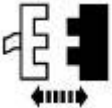
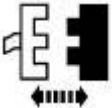

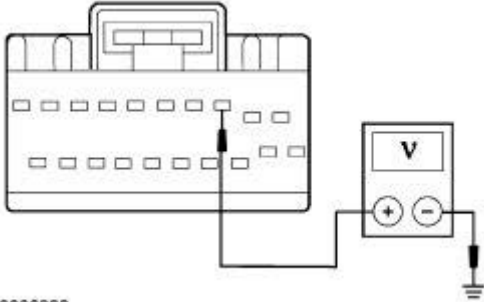
FEM	Pin	Circuit
C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)
C201a	15	31-DK20D (BK/RD)

- Are the resistances less than 5 ohms?

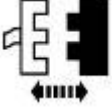
→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST C: NO COMMUNICATION WITH REAR ELECTRONIC MODULE

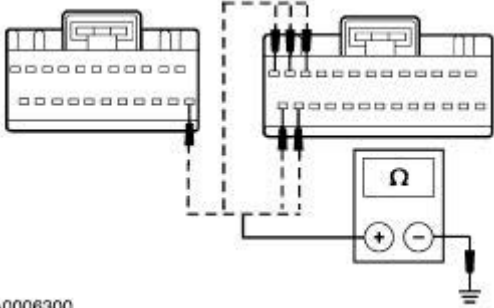
CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK CIRCUIT 29–DK31 (OG/BK) FOR VOLTAGE	
<p>1 </p> <p>2  REM C420d</p> <p>3  REM C420c</p> <p>4 </p> <p>5  A0006299</p>	<p>5 Measure the voltage between REM C420d pin 3, circuit 29–DK31 (OG/BK), harness side and ground.</p> <p>● Is the voltage greater than 10 volts?</p> <p>→ Yes GO to <u>C2</u>.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
C2 CHECK CIRCUITS 29S-DK31 (OG/BK), 31–DK30D (BK), 31–DK30E (BK), 31–DK30F (BK), 31–DK30G (BK) AND 31–DK30H (BK/OG) FOR OPENS	
1	

2



REM C420b

3



A0006300

3 Measure the resistance between REM connectors, harness side and ground as follows:


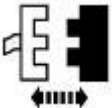
REM	Pin	Circuit
C420c	13	29-DK31 (OG/BK)
C420c	12	31-DK30E (BK)
C420c	11	31-DK30D (BK)
C420c	26	31-DK30G (BK)
C420c	25	31-DK30F (BK)
C420b	12	31-DK30H (BK/OG)

- **Are the resistances less than 5 ohms?**

→ **Yes**
REFER to [Section 418-00](#).

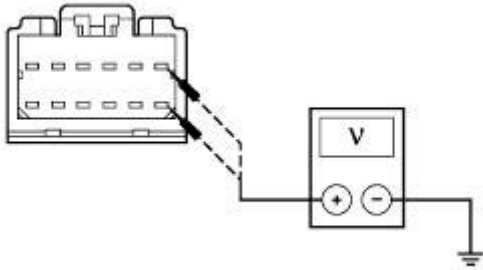
→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST D: NO COMMUNICATION WITH THE REMOTE EMERGENCY SATELLITE CELLULAR UNIT (RESCU)

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>D1 CHECK THE RESCU MODULE FOR VOLTAGE — CIRCUITS 30-GP8 (RD/BK) AND 20-GP8 (PK/OG)</p>	
<p>1</p>  <p>2</p>  <p>RESCU Module C401a</p> <p>3</p>	



4



A0004042

4

Measure the voltage between RESCU Module C401a pin 1, circuit 30-GP8 (RD/BK), harness side and ground; and between RESCU Module C401a pin 7, circuit 20-GP8 (PK/OG), harness side and ground.

- Are the voltages greater than 10 volts?

→ **Yes**
GO to D2.

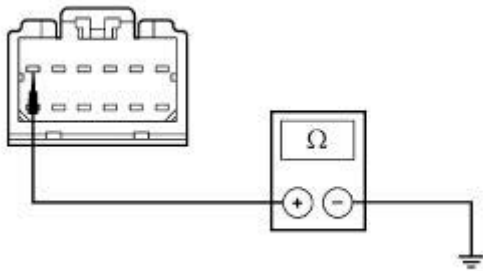
→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

D2 CHECK THE RESCU MODULE GROUND — CIRCUIT 31-GP8 (BK/RD)

1



2



A0004043

2

Measure the resistance between RESCU module C401a pin 6, circuit 31-GP8 (BK/RD), harness side and ground.



- Is the resistance less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST E: THE MESSAGE CENTER IS NOT OPERATING

CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK THE MESSAGE CENTER DISPLAY OPERATION	
<p>1</p>  <p>2</p>  <p>MCM Active Command</p>	<p>2</p> <p>Select the MCM MESSAGE CENTER DISPLAY CHARACTER active command. Trigger SEGMENTS active command ON.</p> <p>3</p> <p>Observe the message center display.</p> <ul style="list-style-type: none"> <li>● Does the message center display illuminate all segments? <p>→ Yes The system is OK. If the FUEL, RESET, SETUP or STATUS buttons are inoperative, GO to <u>Pinpoint Test F</u>.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Section 413-01</u>. TEST the system for normal operation.</p>

PINPOINT TEST F: THE MESSAGE CENTER SWITCH IS NOT OPERATING CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 RETRIEVE THE RECORDED DTC FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — MESSAGE CENTER MODULE (MCM)	
	<p>1</p> <p>Use recorded message center DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> <li>● Are any message center DTCs recorded? <p>→ Yes If message center DTC B1205, GO to <u>F3</u>.</p> <p>All other message center DTCs, REFER to the Message Center Module Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>F2</u>.</p>
F2 CHECK THE MCM PID FOR THE MESSAGE CENTER SWITCH	

1



MCM PID

1

Select and monitor the MCM PIDs FUELSW, RESETSW, SETUPSW and STATUSSW while pressing each message center button (FUEL, RESET, SETUP and STATUS).

- Does each PID agree with each button position?

→ Yes

INSTALL a new instrument cluster. REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.

→ No

GO to F3.

F3 CHECK THE MESSAGE CENTER SWITCH CIRCUIT 9-GG25 (BN/WH) FOR OPEN AND SHORT TO GROUND

1

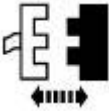


2



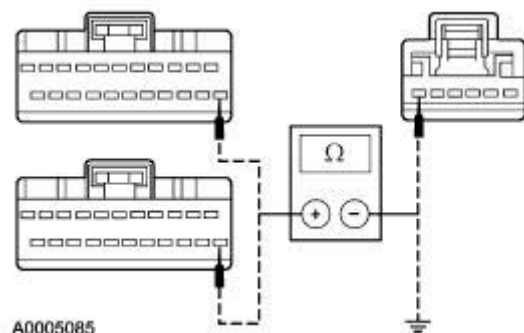
Instrument Cluster C220a

3



Message Center Switch C253

4



4

Measure the resistance between instrument cluster C220a pin 12, circuit 9-GG25 (BN/WH), harness side and message center switch C253 pin 6, circuit 9-GG25 (BN/WH), harness side; and between instrument cluster C220a pin 12, circuit 9-GG25 (BN/WH), harness side and ground.

- Is the resistance less than 5 ohms between the instrument cluster and the message center switch; and greater than 10,000 ohms between the instrument cluster and ground?

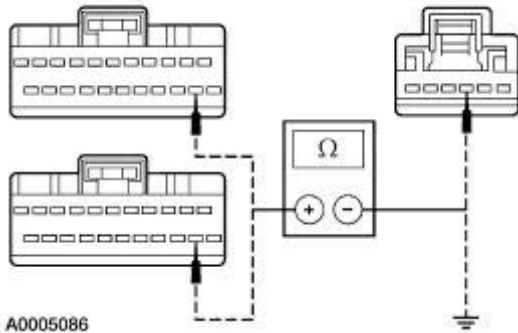
→ Yes

GO to F4.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

F4 CHECK THE MESSAGE CENTER SWITCH CIRCUIT 7-GG25 (YE/VT)

1



1

Measure the resistance between instrument cluster C220a pin 13, circuit 7-GG25 (YE/VT), harness side and message center switch C253 pin 3, circuit 7-GG25 (YE/VT), harness side; and between instrument cluster C220a pin 13, circuit 7-GG25 (YE/VT), harness side and ground.


- Is the resistance less than 5 ohms between the instrument cluster and the message center switch; and greater than 10,000 ohms between the instrument cluster and ground?

→ **Yes**
INSTALL a new message center switch. REFER to Switch—Message Center. TEST the system for normal operation.



→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST G: THE INDICATOR DOES NOT OPERATE CORRECTLY — LOW FUEL LEVEL DISPLAY

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 RETRIEVE THE RECORDED DTC FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — REM AND INSTRUMENT CLUSTER	
NOTE: The fuel gauge does not change indication unless there have been at least 11 liters (three gallons) of fuel added or removed between ignition switch cycles.	
	<p>1 Use recorded REM and instrument cluster DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes If REM DTC B1201, or instrument cluster DTC U1131 is retrieved, REFER to <u>Section 413-01</u>.</p> <p>→ No GO to <u>G2</u>.</p>
G2 CHECK THE FUEL GAUGE OPERATION	



<p>1</p> 	<p>2 NOTE: The fuel gauge does not change indication unless there have been at least 11 liters (three gallons) of fuel added or removed between ignition switch cycles.</p> <p>Observe the fuel gauge operation.</p> <ul style="list-style-type: none"> ● Does the fuel gauge operate correctly? <p>→ Yes GO to <u>G3</u>.</p> <p>→ No REFER to <u>Section 413-01</u>.</p>
--	---

G3 CHECK THE MESSAGE CENTER DISPLAY ILLUMINATION

<p>1</p>  <p>MCM Active Command</p> <p>2</p>  <p>MCM Active Command</p>	<p>1 Select MCM MESSAGE CENTER DISPLAY CHARACTER and trigger ON the active command SEGMENTS.</p> <p>2 Trigger OFF the active command SEGMENTS.</p> <ul style="list-style-type: none"> ● Does the message center display illuminate when triggered ON, and go off when triggered OFF? <p>→ Yes REFER to the Symptom Chart.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Section 413-01</u>. CLEAR the DTCs. REPEAT the self-test.</p>
---	---

PINPOINT TEST H: THE INDICATOR IS INOPERATIVE — OIL LIFE STATUS, AC FILTER LIFE

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK THE ODOMETER OPERATION	
	<p>1 Observe the odometer operation.</p> <ul style="list-style-type: none"> ● Does the odometer operate correctly?




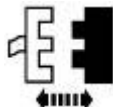


	<p>→ Yes GO to <u>H2</u>.</p> <p>→ No REFER to <u>Section 413-01</u>.</p>
H2 CHECK THE LOW OIL PRESSURE INDICATOR	
<p>1</p>  <p>3</p> 	<p>2 Observe the low oil pressure indicator.</p> <p>4 Observe the low oil pressure indicator.</p> <ul style="list-style-type: none"> ● Does the low oil pressure indicator operate correctly? <p>→ Yes INSTALL a new instrument cluster. REFER to <u>Section 413-01</u>. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REFER to <u>Section 413-01</u>.</p>

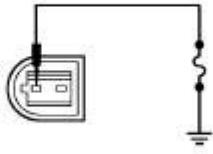
PINPOINT TEST I: LAMPOUT WARNING INDICATOR IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Verify that the FEM and REM operate correctly and communicate with the instrument cluster and message center.	
I1 CHECK THE EXTERIOR LIGHTS OPERATION	
	<p>1 Operate each exterior light. Observe the operation.</p> <ul style="list-style-type: none"> ● Do all exterior lights operate correctly? <p>→ Yes INSTALL a new instrument cluster. REFER to <u>Section 413-01</u>. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REFER to <u>Section 417-01</u>.</p>

PINPOINT TEST J: THE INDICATOR DOES NOT OPERATE CORRECTLY — WASHER FLUID LEVEL DISPLAY

--	--

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 CHECK THE MESSAGE CENTER DISPLAY ILLUMINATION	
<p>1  MCM Active Command</p> <p>2  MCM Active Command</p>	<p>1 Select MCM MESSAGE CENTER DISPLAY CHARACTER and trigger ON the active command SEGMENTS.</p> <p>2 Trigger OFF the active command SEGMENTS.</p> <ul style="list-style-type: none"> ● Does the message center display illuminate when triggered ON, and go off when triggered OFF? <p>→ Yes GO to <u>J2</u>.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Section 413-01</u>. CLEAR the DTCs. REPEAT the self-test.</p>
J2 MONITOR FEM PID WFLUID	
<p>1 </p> <p>2  Washer Fluid Level Switch C138</p> <p>3 </p> <p>4 </p> <p>5</p>	<p>4 Monitor the FEM PID WFLUID.</p> <p>5 Connect a 10A fused jumper wire between washer fluid level switch C138, circuit 8-GC8 (WH/GN), harness side and ground.</p>



A0004841

- Does the FEM PID read ON and OFF alternately?

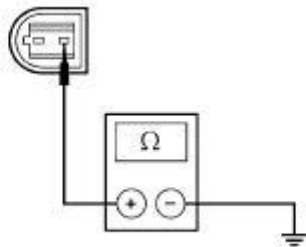
→ **Yes**
GO to J3.

→ **No**
REMOVE the jumper wire, EXIT the FEM PID, and GO to J4.

If the fused jumper wire fails, REMOVE the jumper and GO to J5.

J3 CHECK WASHER FLUID LEVEL SWITCH GROUND CIRCUIT 31-GC8 (BK) FOR OPEN

1



A0004810

1

Measure the resistance between washer fluid level switch C138, circuit 31-GC8 (BK), harness side and ground.

- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new washer fluid level switch. REFER to Section 501-16. TEST the system for normal operation.

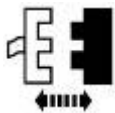
→ **No**
REPAIR the circuit. TEST the system for normal operation.

J4 CHECK CIRCUIT 8-GC8 (WH/BU) FOR SHORT TO GROUND

1

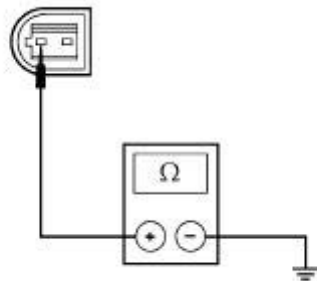


2



FEM C201b

3



A0004806

3

Measure the resistance between washer fluid level switch C138, circuit 8-GC8 (WH/BU), harness side and ground.

● Is the resistance less greater than 10,000 ohms?

→ Yes

INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ No

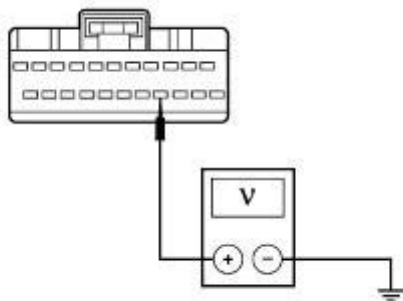
REPAIR the circuit. TEST the system for normal operation.

J5 CHECK THE LOW WASHER FLUID SWITCH CIRCUIT 8-GC8 (WH/BU) FOR SHORT TO BATTERY

1



2



A0004807

2

Measure the voltage between FEM C201b pin 15, circuit 8-GC8 (WH/BU), harness side and ground.

● Is any voltage present?

→ Yes



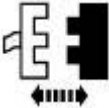
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

→ No

INSTALL a new FEM. REFER to [Section](#)

419-10. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST K: THE INDICATOR DOES NOT OPERATE CORRECTLY — LOW BRAKE FLUID LEVEL DISPLAY

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 CHECK THE INSTRUMENT CLUSTER BRAKE WARNING INDICATOR ILLUMINATION	
<p>1  ICM Active Command</p> <p>2  ICM Active Command</p>	<p>1 Select ICM warning lamps and chime and trigger ON the active command ALL LAMPS.</p> <p>2 Select ICM warning lamps and chime and trigger OFF the activate command ALL LAMPS.</p> <ul style="list-style-type: none"> ● Does the BRAKE warning indicator illuminate when triggered ON, and go off when triggered OFF? <p>→ Yes GO to <u>K2</u>.</p> <p>→ No INSTALL a new instrument cluster. REFER to <u>Section 413-01</u>. CLEAR the DTCs. REPEAT the self-test.</p>
K2 CHECK BRAKE FLUID LEVEL SWITCH	
<p>1  Brake Fluid Level Switch C124</p>	<ul style="list-style-type: none"> ● Does the BRAKE warning indicator continue to illuminate? <p>→ Yes GO to <u>K3</u>.</p> <p>→ No INSTALL a new brake fluid level switch. REFER to <u>Section 206-06</u>. TEST the system for normal operation.</p>
K3 CHECK BRAKE FLUID LEVEL FEM PID FLUID_1	
<p>1</p>	

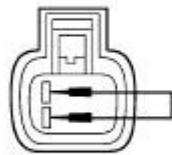


2



FEM PID

3



A0004838

2

Select and monitor FEM PID FLUID_1.

3

Connect a 10A fused jumper wire between brake fluid warning switch C124, circuit 8-GC7 (WH/RD), harness side and ground.

- Does the PID read OFF when the jumper wire is not connected and ON when the jumper wire is connected?

→ Yes

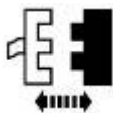
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ No

GO to [K4](#).

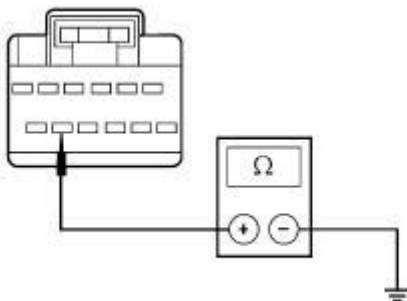
K4 CHECK BRAKE WARNING INDICATOR INPUT CIRCUIT 8-GC7 (WH/RD) FOR SHORT TO GROUND

1



FEM C201c

2





A0004840

2


Measure the resistance between FEM C201c pin 11, circuit 8-GC7 (WH/RD), harness side and ground.

	<ul style="list-style-type: none"> ● Is the resistance greater than 10,000 ohms? <p>→ Yes INSTALL a new FEM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
--	--

PINPOINT TEST L: DATA STATUS MESSAGE IS DISPLAYED — DOOR AJAR DISPLAY

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — FEM AND REM	
	<p>1 Use recorded FEM and REM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any FEM or REM DTCs recorded? <p>→ Yes REFER to FEM Diagnostic Trouble Code (DTC) Index or REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to L2.</p>
L2 CHECK THE MESSAGE CENTER DISPLAY ILLUMINATION	
<p>1</p>  <p>MCM Active Command</p> <p>2</p>  <p>MCM Active Command</p>	<p>1 Select MCM MESSAGE CENTER DISPLAY CHARACTER and trigger ON the active command SEGMENTS.</p> <p>2 Trigger OFF the active command SEGMENTS.</p> <ul style="list-style-type: none"> ● Does the message center display illuminate when triggered ON, and go off when triggered OFF? <p>→ Yes REFER to Section 417-02.</p> <p>→ No INSTALL a new instrument cluster. REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST M: DATA STATUS MESSAGE IS DISPLAYED— CHECK FUEL CAP

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1 RETRIEVE AND RECORD DTCS FROM CONTINUOUS AND ON-DEMAND SELF-TESTS—PCM	
	<p>1 Use recorded PCM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue diagnosis.</p> <p>→ No GO to <u>M2</u>.</p>
M2 CHECK THE MESSAGE CENTER DISPLAY ILLUMINATION	
<p>1</p>  <p style="text-align: center;">MCM Active Command</p>	<p>2 Select the MCM MESSAGE CENTER DISPLAY CHARACTER and trigger ON the active command segments.</p> <ul style="list-style-type: none"> ● Do all segments of the message center display illuminate? <p>→ Yes REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue diagnosis.</p> <p>→ No GO to <u>M3</u></p>
M3 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
	<p>1 Disconnect all instrument cluster connectors.</p> <p>2 Check for:</p> <ul style="list-style-type: none"> ● corrosion ● pushed-out pins <p>3 Connect all instrument connectors and make sure they are seated correctly.</p> <p>4 Operate the system and verify the concern is still present.</p> <ul style="list-style-type: none"> ● Is the concern still present? <p>→ Yes INSTALL a new instrument cluster. REFER to <u>Section 413-01</u> .</p>

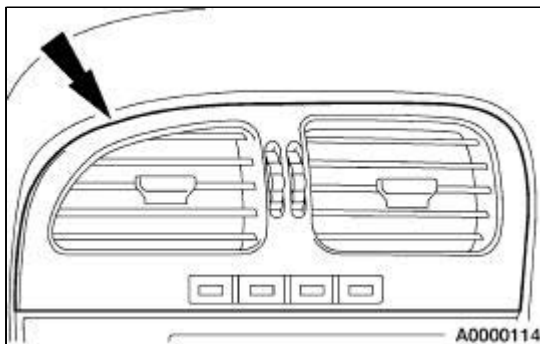
→ **No**

The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

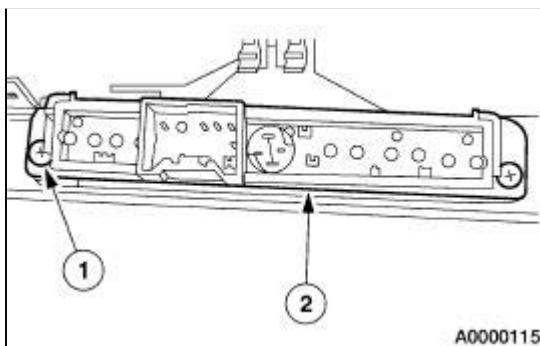
Switch —Message Center

Removal and Installation

1. Disconnect the battery ground cable. Refer to [Section 414-01](#)
2. Remove the center A/C register finish panel.
 - Disconnect the electrical connector.



3. Remove the message center switch.
 1. Remove the screws.
 2. Remove the message center switch.
 - Install a new bulb if necessary.



4. **NOTE:** When the battery is disconnected and then reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 miles) or more to relearn the strategy.

To install, reverse the removal procedure.

Warning Devices

NOTE: The key-in-ignition switch is an integral part of the ignition switch. For additional information, refer to [Section 211-04](#).



The warning device system consists of the following:

- key-in-ignition switch
 - door ajar switch
 - instrument cluster
 - front electronic module (FEM)
 - rear electronic module (REM)
 - safety belt switch
 - headlamp switch
-

Warning Devices

Refer to Wiring Diagrams Section [413-09](#), Warning Devices for schematic and connector information.

Special Tool(s)

 <p>ST2332-A</p>	<p>Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool</p>
 <p>ST1137-A</p>	<p>73III Automotive Meter 105-R0057 or equivalent</p>

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Door ajar switches ● Key-in-ignition switch ● Headlamp switch 	<ul style="list-style-type: none"> ● Central junction box (CJB) Fuses: <ul style="list-style-type: none"> ■ 204 (5A) ■ 213 (5A) ■ 217 (5A) ■ 219 (20A) ■ 220 (10A) ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 422 (20A) ■ 425 (40A) ● Circuitry. ● Instrument cluster.

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.

4. If the diagnostic tool does not power up, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTICS test. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for instrument cluster (IC), go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for restraint control module (RCM), refer to [Section 501-20B](#).
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the IC and RCM.
6. If the DTCs retrieved from the RCM are related to the concern, refer to [Section 501-20B](#). If the DTCs retrieved from the IC are related to the concern, go to the Instrument Cluster Diagnostic Trouble Code (DTC) Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue diagnostics.

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1352	Ignition Key-In Circuit Failure	ICM	GO to Pinpoint Test D .

NOTE: For a complete master list of all instrument cluster DTCs refer to [Section 419-10](#).

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● No communication with the instrument cluster 	<ul style="list-style-type: none"> ● Battery junction box (BJB) fuses: <ul style="list-style-type: none"> ■ 422 (20A). ■ 425 (40A). ● Central junction box (CJB) fuses: <ul style="list-style-type: none"> ■ 204 (5A). ■ 213 (5A). ■ 217 (5A). ■ 219 (20A). ■ 220 (10A). ● Circuitry. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.
<ul style="list-style-type: none"> ● All the chimes are inoperative 	<ul style="list-style-type: none"> ● Instrument cluster. 	<ul style="list-style-type: none"> ● INSTALL a new instrument cluster. REFER to Section 413-01 CLEAR the DTCs. REPEAT the self-test.
<ul style="list-style-type: none"> ● The chime sounds when the driver door is ajar (no 	<ul style="list-style-type: none"> ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B.

key in ignition and headlamps OFF)	<ul style="list-style-type: none"> ● Key-in-ignition switch. ● Circuitry. ● Headlamp switch. 	
<ul style="list-style-type: none"> ● The safety belt warning chime does not operate correctly 	<ul style="list-style-type: none"> ● Driver safety belt switch. ● Instrument cluster. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test C.
<ul style="list-style-type: none"> ● The belt minder feature does not operate correctly 	<ul style="list-style-type: none"> ● Driver safety belt switch. ● Instrument cluster. ● Circuitry. 	<ul style="list-style-type: none"> ● Go to Pinpoint Test C.
<ul style="list-style-type: none"> ● The key-in-ignition chime does not operate correctly 	<ul style="list-style-type: none"> ● Key-in-ignition switch. ● Driver door ajar switch. ● Circuitry. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D.
<ul style="list-style-type: none"> ● The headlamp on reminder chime does not operate correctly 	<ul style="list-style-type: none"> ● Instrument cluster. ● Headlamp switch. ● Circuitry. ● Driver door ajar switch. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test E.
<ul style="list-style-type: none"> ● A chime does not operate correctly — air bag warning chime 	<ul style="list-style-type: none"> ● Instrument cluster. ● Circuitry. ● Restraint control module (RCM). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test F.
<ul style="list-style-type: none"> ● A chime does not operate correctly — fail safe cooling chime 	<ul style="list-style-type: none"> ● Instrument cluster. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test G.
<ul style="list-style-type: none"> ● A chime does not operate correctly — turn signal warning tone 	<ul style="list-style-type: none"> ● Instrument cluster. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test H.

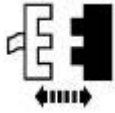
Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE INSTRUMENT CLUSTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK CONSTANT POWER SUPPLY CIRCUIT	
1	

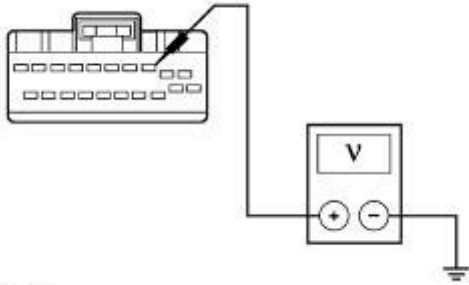


2



Instrument Cluster C220b

3



A0002792

3

Measure the voltage between the instrument cluster C220b pin 3, circuit 29-GG11 (OG/BU), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to A2.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

A2 CHECK IGNITION POWER SUPPLY CIRCUITS

1



2



Instrument Cluster C220a

3

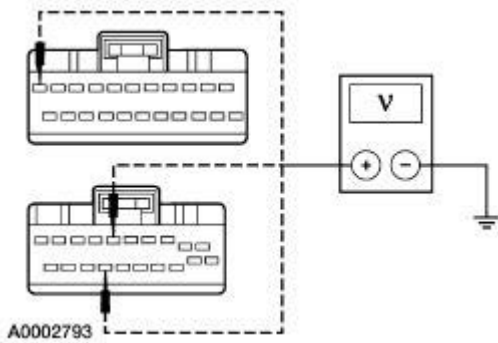


4

4

Using the following table, measure the voltage between the instrument cluster connectors, harness side and ground.

Connector Pin	Circuit
C220a pin 11	15-JA14 (GN/BK)
C220b pin 6	15-GG14 (GN/RD)



C220b pin 17 | 75-GG15 (YE/GN)

- Are the voltages greater than 10 volts?

→ **Yes**
GO to A3.

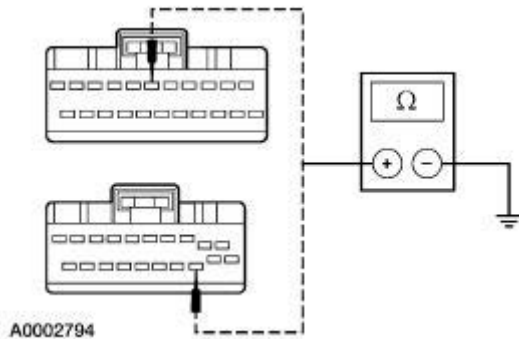
→ **No**
REPAIR the circuit(s). CLEAR the DTCs.
REPEAT the self-test.

A3 CHECK GROUND CIRCUITS

1



2



- 2 Using the following table, measure the resistance between the instrument cluster connectors, harness side and ground.

Connector Pin	Circuit
C220a pin 6	31-AL11 (BK)
C220b pin 13	91-GG11 (BN/RD)

- Are the resistances less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit(s). CLEAR the DTCs.
REPEAT the self-test.

PINPOINT TEST B: THE CHIME SOUNDS WHEN THE DRIVER DOOR IS AJAR (NO KEY IN IGNITION AND HEADLAMPS OFF)

CONDITIONS	DETAILS/RESULTS/ACTIONS
------------	-------------------------

B1 MONITOR ICM PID IGN_KEY

1



3



Diagnostic Tool

4



2 Remove the ignition key.

4 Monitor ICM PID IGN_KEY.

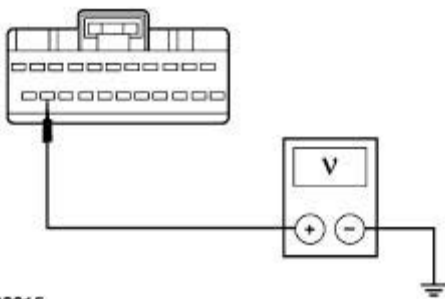
• Does the ICM PID indicate IN?

→ **Yes**
GO to B2.

→ **No**
INSTALL a new instrument cluster.
REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.

B2 CHECK CIRCUIT 30S-GM7 (RD/WH) FOR A SHORT TO VOLTAGE

1








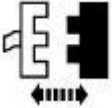

1 Measure the voltage between the instrument cluster C220a, pin 21, circuit 30S-GM7 (RD/WH), harness side and ground.

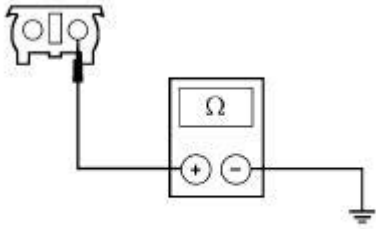
• Is any voltage present?

→ **Yes**
INSTALL a new ignition switch. REFER to Section 211-04. CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to Pinpoint Test D.

PINPOINT TEST C: THE SAFETY BELT WARNING CHIME DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: Verify the belt minder is activated before diagnosing the belt minder.</p>	
<p>C1 CHECK THE SEAT BELT WARNING SWITCH — MONITOR THE ICM PID D_SBELT</p>	
<p>1 </p> <p>2  Diagnostic Tool</p> <p>3 </p> <p>4 </p>	<p>4 Monitor the ICM PID D_SBELT , while inserting and removing the safety belt.</p> <ul style="list-style-type: none"> ● Does the ICM PID D_SBELT indicate IN with the safety belt inserted and OUT with the safety belt out? <p>→ Yes INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No If the ICM PID D_SBELT indicates IN, GO to C5 . If the ICM PID D_SBELT indicates OUT, GO to C2 .</p>
<p>C2 CHECK CIRCUIT 31-GE52 (BK) FOR OPEN</p>	
<p>1 </p> <p>2  Safety Belt Switch C381</p> <p>3 </p>	<p>3 Measure the resistance between the safety belt switch C381, circuit 31-GE52 (BK), harness side and ground.</p>



A0003906

● Is the resistance less than 5 ohms?

→ **Yes**
GO to C3.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

C3 CHECK SAFETY BELT SWITCH FOR SOURCE OF CONCERN

1 Connect a jumper wire between the safety belt switch C381, circuit 8-GE52, harness side and ground.

2 Monitor the ICM PID D_SBELT.

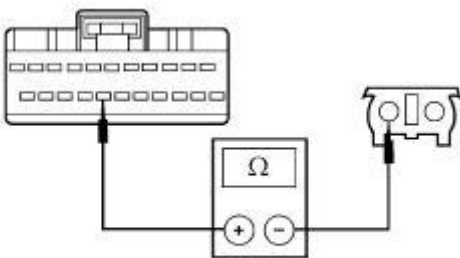
● Does the ICM PID indicate IN?

→ **Yes**
INSTALL a new safety belt buckle.
REFER to Section 501-20A.

→ **No**
GO to C4.

C4 CHECK CIRCUIT 8-GE52 (WH/BK) FOR OPEN

1



A0003907

1 Measure the resistance between the instrument cluster C220a pin 18, circuit 8-GE52 (WH/BK), harness side and the safety belt switch C381, circuit 8-GE52 (WH/BK), harness side.

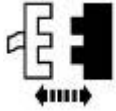
● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new instrument cluster.
REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

C5 MONITOR THE PID D_SBELT

1



Safety Belt Switch C381

2 Monitor the ICM PID D_SBELT.

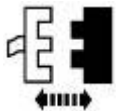
● **Does the PID say OUT?**

→ **Yes**
INSTALL a new safety belt buckle.
REFER to [Section 501-20A](#).

→ **No**
GO to [C6](#).

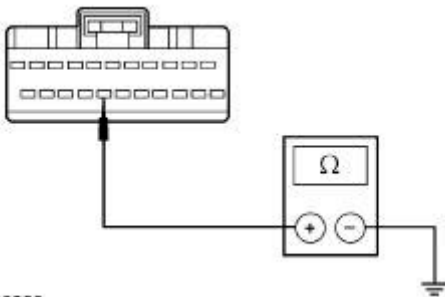
C6 CHECK CIRCUIT 8-GE52 (WH/BK) FOR SHORT TO GROUND

1



Instrument Cluster C220a

2



A0003908




2 Measure the resistance between the instrument cluster C220a pin 18, circuit 8-GE52 (WH/BK), harness side and ground.

● **Is the resistance greater than 10,000 ohms?**

→ **Yes**
INSTALL a new instrument cluster.
REFER to [Section 413-01](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

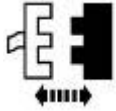
PINPOINT TEST D: THE KEY-IN-IGNITION CHIME DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 RETRIEVE THE RECORDED DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST—ICM	
	<p>1 Use the recorded ICM DTCs from the continuous and on-demand self-tests.</p> <ul style="list-style-type: none"> ● Are there any DTCs recorded? <p>→ Yes If DTC B1352, GO to <u>D3</u>.</p> <p>→ No GO to <u>D2</u>.</p>
D2 CHECK THE COURTESY LAMPS	
	<p>1 Open the driver front door.</p> <ul style="list-style-type: none"> ● Do the courtesy lamps illuminate? <p>→ Yes GO to <u>D3</u>.</p> <p>→ No REFER to <u>Section 417-02</u>.</p>
D3 MONITOR THE ICM PID IGN_KEY	
<p>1 </p> <p>2 </p> <p>Diagnostic Tool</p> <p>3 </p>	<p>4 Monitor the ICM PID IGN_KEY.</p> <p>5 With the key in the ignition, the ICM PID IGN_KEY should indicate IN. With the key out of the ignition, the ICM PID IGN_KEY should indicate OUT.</p> <ul style="list-style-type: none"> ● Does the ICM PID IGN_KEY indicate correctly? <p>→ Yes INSTALL a new instrument cluster. REFER to <u>Section 413-01</u> . CLEAR the DTCs. REPEAT the self-test.</p>

→ **No**
GO to D4.

D4 CHECK THE KEY-IN-IGNITION WARNING SWITCH—MONITOR THE PID IGN_KEY

1



Ignition Switch C250

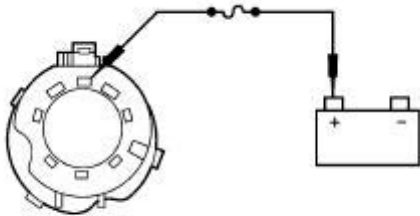
2



3



4



A0003909

3 Monitor the PID IGN_KEY.

4 Connect a 10A fused jumper wire between the ignition switch C250 pin 8, circuit 30S-GM7 (RD/WH), harness side and battery positive.

- Does the ICM PID IGN_KEY indicate **IN** with the jumper wire connected and **OUT** with the jumper wire removed?

→ **Yes**
INSTALL a new ignition switch. REFER to Section 211-04. CLEAR the DTCs. REPEAT the self-test.

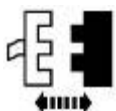
→ **No**
GO to D5.

D5 CHECK CIRCUIT 30S-GM7 (RD/WH) FOR OPEN

1

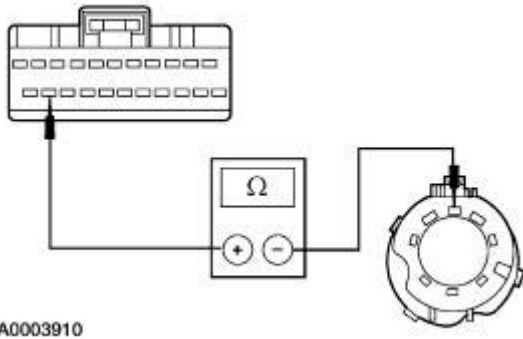


2



Instrument Cluster C220a

3



3

Measure the resistance between the instrument cluster C220a pin 21, circuit 30S-GM7 (RD/WH), harness side and the ignition switch C250 pin 8, circuit 30S-GM7 (RD/WH), harness side.

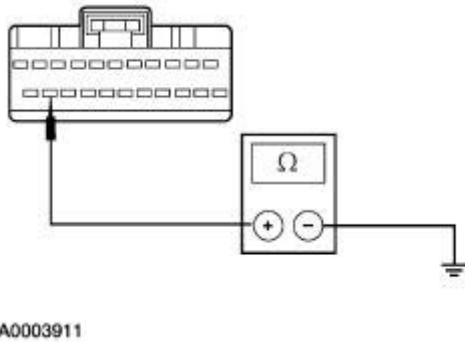
● Is the resistance less than 5 ohms?

→ **Yes**
GO to D6.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D6 CHECK CIRCUIT 30S-GM7 (RD/WH) FOR SHORT TO GROUND

1



1

Measure the resistance between the instrument cluster C220a pin 21, circuit 30S-GM7 (RD/WH), harness side and ground.




● Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new instrument cluster, REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST E: THE HEADLAMP ON REMINDER CHIME DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — ICM	
	<p>1 Use the recorded ICM DTCs from the continuous and on-demand self-tests.</p>

	<ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes For DTC B1470, REFER to Section 417-01.</p> <p>→ No GO to E2.</p>
E2 MONITOR THE ICM PID IGN_KEY	
<p>1</p>  <p>2</p>  <p>Diagnostic Tool</p> <p>3</p> 	<p>3 Monitor the ICM PID IGN_KEY.</p> <ul style="list-style-type: none"> ● Does the ICM PID IGN_KEY indicate IN with the key in the ignition and indicate OUT with the key out of the ignition? <p>→ Yes GO to E3.</p> <p>→ No GO to Pinpoint Test D.</p>
E3 CHECK FOR COURTESY LAMP OPERATION	
	<p>1 Monitor the courtesy lamps while opening and closing the driver door.</p> <ul style="list-style-type: none"> ● Do the courtesy lamps illuminate with the driver door open, and go out with the driver door closed after a 20 second delay? <p>→ Yes INSTALL a new instrument cluster, REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REFER to Section 417-02 .</p>

PINPOINT TEST F: A CHIME DOES NOT OPERATE CORRECTLY — AIR BAG WARNING CHIME

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 RETRIEVE THE RECORDED DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — RCM	

1 Use the recorded RCM DTCs from the continuous and on-demand self-tests.

● Are any RCM DTCs recorded?

→ **Yes**
REFER to Section 501-20B.

→ **No**
GO to F2.

F2 CHECK CIRCUIT 8-JA13 (BK/WH) FOR SHORT TO GROUND

1

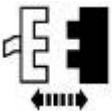


3



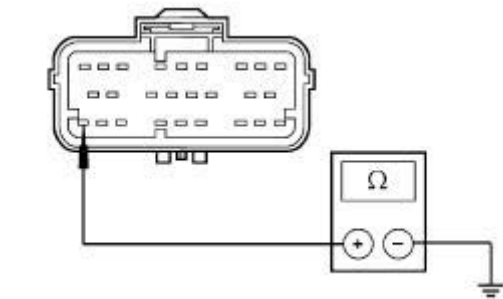
RCM C310a

4



Instrument Cluster C220b

5



A0003912

2 Deactivate the air bag system. Refer to Section 501-20B.

5 Measure the resistance between the RCM C310a pin 26, circuit 8-JA13 (WH/BK), harness side and ground.

● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to F3.

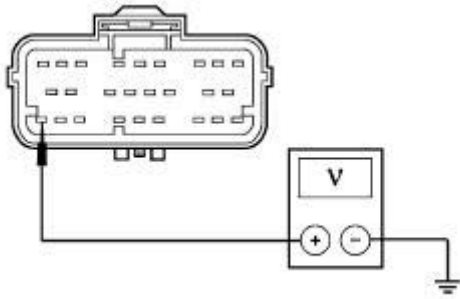
→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

F3 CHECK CIRCUIT 8-JA13 (WH/BK) FOR SHORT TO VOLTAGE

1



2



A0003913

2 Measure the voltage between the RCM C310a pin 26, circuit 8-JA13 (WH/BK), harness side and ground.

● Is any voltage indicated?

→ **Yes**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

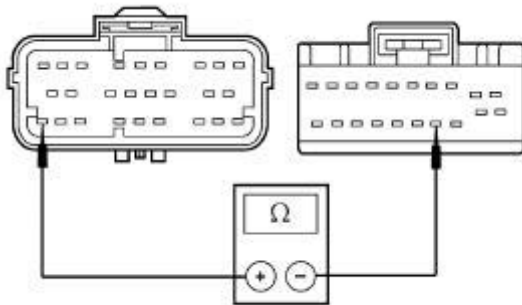
→ **No**
GO to F4.

F4 CHECK CIRCUIT 8-JA13 (WH/BK) FOR OPEN

1



2



A0003914

2 Measure the resistance between the RCM C310a pin 26, circuit 8-JA13 (WH/BK), harness side and the instrument cluster C220b pin 14, circuit 8-JA13 (WH/BK), harness side.

● Is the resistance less than 5 ohms?


→ **Yes**
INSTALL a new instrument cluster,
REFER to Section 413-01. CLEAR the
DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

FAIL SAFE COOLING CHIME IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF TESTS—ICM	
	<p>1 Use the recorded ICM DTCs from the continuous and on-demand self-tests.</p> <ul style="list-style-type: none"> ● Are there any DTCs recorded? <p>→ Yes For DTC U1073, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.</p> <p>→ No INSTALL a new instrument cluster, REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.</p>

PINPOINT TEST H: A CHIME DOES NOT OPERATE CORRECTLY — TURN SIGNAL WARNING TONE

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS — ICM	
	<p>1 Use the recorded ICM DTCs from the continuous and on-demand self-tests.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes For ICM DTC U1123, REFER to Section 206-09A, Section 206-09B, or Section 206-09C.</p> <p>→ No GO to H2.</p>
H2 CHECK OPERATION OF THE TURN SIGNALS	
<p>1</p> 	<p>2 Operate the turn signals.</p> <ul style="list-style-type: none"> ● Do the turn signal lamps operate? <p>→ Yes INSTALL a new instrument cluster, REFER to Section 413-01. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REFER to Section 417-01.</p>

Belt Minder Deactivating/Activating

Preparation

1. Before deactivating/activating the belt minder, set the parking brake.
2. Place the transmission range selector lever in P (PARK) (automatic transmission) or the NEUTRAL position (manual transmission).
3. Place the ignition switch in the OFF position.
4. Close all the vehicle doors.
5. Unbuckle the driver safety belt.
6. Place the parking lamps/headlamps switch in the OFF position.

Deactivating/Activating

1. Start with the ignition OFF and the driver and passenger safety belts unbuckled.
2. Turn the ignition to RUN (it is not required to start the vehicle.)
3. Wait until the seatbelt warning lamp turns off (approximately one minute.)
4. Buckle then unbuckle the driver or passenger seatbelt three times, ending in the unbuckled state. Step 4 must be completed within 60 seconds.
5. After Step 4 is complete the airbag warning lamp will be turned on for three seconds.
6. After the airbag warning lamp turns off, buckle/then unbuckle the safety belt again. This will enable the belt minder if it is currently disabled, or will disable the belt minder if it is currently enabled.
7. Confirmation of enabling the belt minder is provided to the customer by the airbag warning lamp flashing four times per second for three seconds, followed by three seconds again.
8. Confirmation of disabling the belt minder is provided to the customer by the airbag warning lamp flashing four times per second for three seconds.
9. Customer programming of the belt minder is automatically exited after completion of the customer confirmation.
10. The belt minder will automatically exit the programming mode without changing its enable status if Step 6 does not occur within 10 seconds of the end of Step 4.
11. Performing Steps 1-12 using only the driver safety belt will permanently enable/ disable the driver belt minder feature.

12. Performing Steps 1-12 using only the passenger safety belt will permanently enable/disable the passenger belminder feature.
 13. Only one side (driver or passenger) can be enabled/disabled per key cycle. While programming the driver side, any activity on the passenger safety belt will abort the programming sequence. While programming the passenger side, any activity on the driver safety belt will terminate the programming sequence.
 14. The programming sequence will abort if a system fault occurs that requires the illumination of the restraints indicator lamp (RIL) at any time during programming or confirmation.
-

General Specifications

Item	Specification
Battery	
Manufacturer	Motorcraft
Voltage	12 volts
Amps at -17.7°C (0°F) cold crank	650
Minutes-reserve capacity	130
Amps/hrs. -20 hour rate	72
Generator	
Current output	105 amps @ 6,000 gen rpm
Type	6G with internal voltage regulator
Pulley ratio	2.65:1 (3.0L); 2.78:1 (3.9L)

Charging System

This vehicle is equipped with a powertrain control module (PCM) controlled charging system. The PCM-controlled charging system is a system whereby the PCM determines the optimal voltage setpoint for the charging system and communicates this information to the voltage regulator. The PCM-controlled charging system is unique in that it has two unidirectional communication lines between the PCM and the generator/regulator. Both of these communication lines are pulse-width modulated. The generator communication (GEN COM) line communicates the desired setpoint from the PCM to the voltage regulator and the generator monitor (GEN MON) line communicates the generator load and error conditions to the PCM. The third pin on the voltage regulator, the A circuit pin, is a dedicated battery voltage sense line.

Circuit Description

B+ Output Terminal Circuit 30-BA6 (RD)

Generator output voltage is supplied through the battery positive (B+) output terminal on the rear of the generator to the battery and the electrical system.

Circuit 30-BA25 (RD)

This is the A terminal battery voltage sense circuit and is used to sense battery voltage. The circuit is used to supply current to the generator field (rotor) and to turn on the voltage regulator which determines generator output. This circuit is also used to turn the charging system warning indicator on if there is a fault in the charging system operation.

Circuit 10-BA25 (GY/RD)

This is the generator communication (GEN COM) circuit. The PCM determines the optimal voltage setpoint for the charging system and communicates this information to the voltage regulator via the GEN COM circuit.




Circuit 8-BA25 (WH/RD)

The generator monitor (GEN MON) circuit communicates the generator load and error conditions to the PCM.


Charging System


Refer to Wiring Diagrams Section [414-00](#) for schematic and connector information.


Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2173-A	SABRE Premium Electrical System Tester 010-00736 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool

Inspection and Verification

 **WARNING:** Batteries normally produce explosive gases. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation. Failure to follow these instructions may result in personal injury.

 **WARNING:** When lifting a plastic-cased battery, excessive pressure on the end walls could cause acid to spew through the vent caps, resulting in personal injury, damage to the vehicle or battery. Lift with a battery carrier or with your hands on opposite corners. Failure to follow these instructions may result in personal injury.

 **WARNING:** Keep batteries out of the reach of children. Batteries contain sulfuric acid. Avoid contact with skin, eyes, or clothing. Also, shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

1. Verify the customer concern by operating the engine to duplicate the concern.
2. Inspect to determine if one of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Battery ● Generator drive belt ● Generator pulley 	<ul style="list-style-type: none"> ● Battery junction box (BJB) fuse: <ul style="list-style-type: none"> ■ F415 (5A) ● Central junction box (CJB) fuse: <ul style="list-style-type: none"> ■ F217 (5A) ● Circuitry ● Charging warning indicator ● Cables

3. If the inspection reveals obvious concerns that can be readily identified, repair as necessary. Check the generator sense Fuse F415 located in the battery junction box.
4. Measure the open circuit battery voltage. (Battery is located in the luggage compartment on the RH side). If the battery voltage is less than 12.0 volts, test and recharge the battery before continuing with diagnosis. Refer to [Section 414-01](#).
5. Check the operation of the charging system warning indicator lamp (instrument cluster). Normal operation is as follows:
 - With the ignition switch OFF, the charging system warning indicator should be OFF.
 - With the ignition switch in RUN and the engine off, the charging system warning indicator light should be on.
 - With the engine running, the charging system warning indicator light should be off.
6. Check the battery voltage before and after starting the engine to determine if the battery voltage increases. Refer to the Normal Charging System Voltages chart.

Normal Charging System Voltages and Charging System Warning Indicator Operation

Key Position	30-BA25 (RD)	10-BA25 (GY/RD)	Generator B+ 30-BA6 (RD)	Battery	Engine to Battery Ground	Charging System Warning Indicator Operation
Key OFF	12 volts	0 volts	12 volts	12 volts	0 volts	Off
RUN-engine OFF	12 volts	1-3 volts	12 volts	12 volts	0 volts	Illuminated
RUN-engine running	13- 15V	13- 15V	13- 15V	13- 15V	0V	Off

7. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located under the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the vehicle selection cannot be entered:
 - check that the program card is correctly installed.
 - Check the connections to the vehicle.
 - check the ignition switch position. If the diagnostic tool still does not allow the vehicle selection to be entered, refer to the diagnostic tool manual.
8. If any PCM DTCs are retrieved, go to the PCM Index below to check if the codes retrieved are related to the charging system and continue diagnosis.
9. If no DTCs related to the charging system are retrieved, go to the Symptom Chart to continue

diagnosis.

NOTE: DTC P1246 can be set by the loss of the communication lines, GEN COM Circuit 8-BA25 (WH/RD) and/or GEN MON Circuit 10-BA25 (GY/RD). However, the generator warning indicator lamp will not illuminate since the generator is self-regulating and will function normally.

Powertrain Control Module Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
P1246	System voltage failure	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> Battery is discharged or voltage is low 	<ul style="list-style-type: none"> Circuitry. High key-off current drain(s). Battery. Generator. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> The charging system warning indicator is on with the engine running (the system voltage does not increase) 	<ul style="list-style-type: none"> Generator. Battery junction box (BJB) fuse F415 (5A) Circuitry. 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
<ul style="list-style-type: none"> The system overcharges (battery voltage greater than 15 volts) 	<ul style="list-style-type: none"> Battery junction box (BJB) fuse F415 (5A). Circuitry. Generator. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> The charging system warning indicator is on with the engine running (the system increases voltage) 	<ul style="list-style-type: none"> Battery junction box (BJB) fuse F415 (5A). Generator. Instrument cluster. PCM. Circuitry. 	<ul style="list-style-type: none"> GO to Pinpoint Test D.
<ul style="list-style-type: none"> The charging system warning indicator is off with the ignition switch in the RUN position and the engine off 	<ul style="list-style-type: none"> Generator connector unplugged C102a. Battery. Circuitry. Instrument cluster. PCM. 	<ul style="list-style-type: none"> GO to Pinpoint Test E.
<ul style="list-style-type: none"> The charging system warning indicator flickers or is intermittent 	<ul style="list-style-type: none"> Battery junction box (BJB) fuse F415 (5A). Generator connector unplugged (C102a). Circuitry. Generator. 	<ul style="list-style-type: none"> GO to Pinpoint Test F.
<ul style="list-style-type: none"> The generator is noisy 	<ul style="list-style-type: none"> Loose bolts/brackets. Drive belt. Generator/pulley. 	<ul style="list-style-type: none"> GO to Pinpoint Test G.
<ul style="list-style-type: none"> Radio interference 	<ul style="list-style-type: none"> Generator. 	<ul style="list-style-type: none"> GO to

- Wiring/routing.
- In-vehicle entertainment system.

Pinpoint Test H.

Pinpoint Tests



CAUTION: Do not make jumper connections except as directed. Incorrect connections may damage the voltage regulator test terminals, fuses or fuse links.



CAUTION: Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins.

NOTE: While carrying out any pinpoint test, disregard any DTCs set while following any specific pinpoint test. After the completion of any test, be sure to clear all codes in the PCM.

NOTE: All voltage measurements are referenced to the negative (-) battery post unless otherwise specified.

NOTE: When the battery has been disconnected and reconnected, some abnormal drive symptoms may occur while the powertrain control module (PCM) relearns its fuel trim. The vehicle may need to be driven to relearn the strategy.





PINPOINT TEST A: BATTERY IS DISCHARGED OR VOLTAGE IS LOW

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK THE GENERATOR OUTPUT	
	<p>1 Carry out the On-Vehicle Generator Load/No Load Tests. Refer to Component Tests in this section.</p> <ul style="list-style-type: none"> ● Is the generator OK? <p>→ Yes GO to <u>A2</u>.</p> <p>→ No GO to <u>Pinpoint Test B</u>.</p>
A2 CHECK FOR CURRENT DRAINS	
	<p>1 Carry out the Battery — Drain Test. Refer to Component Tests in this section.</p> <ul style="list-style-type: none"> ● Are there any excessive current drains? <p>→ Yes REPAIR as necessary. TEST the system for normal operation.</p> <p>→ No GO to <u>A3</u>.</p>
A3 CHECK FOR CURRENT DRAINS WHICH SHUT OFF WHEN THE BATTERY IS	

DISCONNECTED

	<p>1 Carry out the Battery — Electronic Drains Which Shut Off When the Battery Cable is Disconnected Test. Refer to Component Tests in this section.</p> <ul style="list-style-type: none"> ● Are there any current drains which shut off when the battery is disconnected? <p>→ Yes REPAIR as necessary. TEST the system for normal operation.</p> <p>→ No GO to <u>Pinpoint Test B</u>.</p>
--	--

PINPOINT TEST B: CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING (THE SYSTEM VOLTAGE DOES NOT INCREASE)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK THE FAULT CODES IN THE PCM	
<p>1</p>  <p>2</p>  <p>3</p> 	<p>3 Use the recorded PCM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes REFER to PCM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>B2</u>.</p>
B2 CHECK CIRCUIT 10-BA25 (GY/RD)	
<p>1</p>  <p>2</p>	



3



Generator C175c

4



5 Measure the voltage between the generator C175c pin 2, circuit 10-BA25 (GY/RD), harness side and ground.

• Is the voltage 0 volts?

→ Yes
GO to B4.

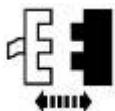
→ No
GO to B3.

B3 CHECK CIRCUIT 10-BA25 (GY/RD) FOR AN OPEN

1

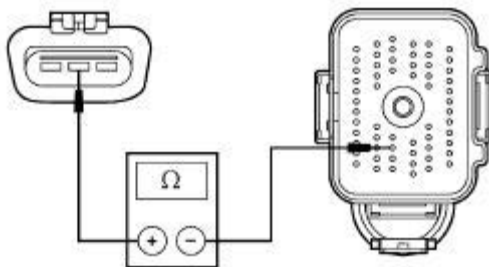


2



PCM C175c

3



A0016592

3 Measure the resistance between the PCM C175c pin 28, circuit 10-BA25 (GY/RD), harness side and the generator C102a pin 2, circuit 10-BA25 (GY/RD), harness side.

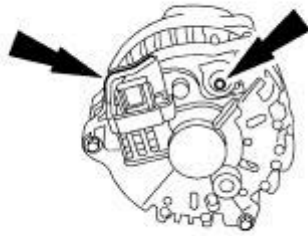
• Is the resistance less than 5 ohms?

→ Yes
GO to B4.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

B4 CHECK THE GENERATOR OUTPUT

1



A0005524

2



PCM C175c

3 Carry out the generator load test. Refer to Component Tests, Generator On-Vehicle Tests in this section.

● **Is the generator OK?**

→ **Yes**
GO to B5.

→ **No**
INSTALL a new generator. REFER to Section 414-02. TEST the system for normal operation.

B5 CHECK FOR CORRECT MODULE OPERATION

1 Check:

- for corrosion
- for pushed-out pins
- connector seated correctly

2 Connect any disconnected connectors.

3 Make sure all other system connectors are fully seated.








4 Operate the system and verify the concern is still present.

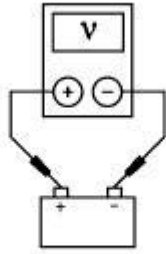
● **Is the concern still present?**

→ **Yes**
INSTALL a new PCM. REFER to Section 303-14. CLEAR the DTCs. REPEAT the PCM self-test.

→ **No**
 The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST C: THE SYSTEM OVERCHARGES (BATTERY VOLTAGE GREATER THAN 15 VOLTS)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE FAULT CODES IN THE PCM	
<p>1 </p> <p>2 </p> <p>3 </p>	<p>3 Use the recorded PCM DTCs from the continuous and on-demand self-test.</p> <p>● Are any DTCs recorded?</p> <p>→ Yes REFER to PCM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>C2</u>.</p>
C2 CHECK THE BATTERY VOLTAGE	
<p>1 </p> <p>2 </p> <p>3 </p> <p>4 </p>	<p>4 With the engine running and all accessories turned off, measure the</p>



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voltage at the battery while varying the engine rpm.

- **Is the voltage greater than 15 volts?**

→ **Yes**
GO to C4.

→ **No**
GO to C3.

C3 CHECK THE VOLTAGE GAUGE OPERATION

1 Vary the engine rpm and monitor the voltage gauge operation.

- **Does the voltage gauge read above 15 volts?**

→ **Yes**
The voltage gauge is inaccurate. REFER to Section 413-01 to continue gauge diagnostics.

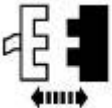
→ **No**
GO to C4.

C4 CHECK THE GENERATOR OUTPUT

1



2



Generator C102a

3

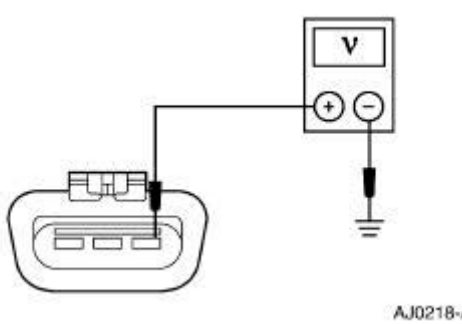


4 Check the generator output. Refer to Component Tests, Generator On-Vehicle Tests in this section.



- **Is the generator OK?**

	<p>→ Yes GO to <u>C5</u>.</p> <p>→ No INSTALL a new generator. REFER to Section. CLEAR the codes and TEST the system for normal operation.</p>
--	--

C5 CHECK CIRCUIT 30-BA25 (RD)

<p>1</p> 	<p>1 Measure the voltage between the generator C102a pin 3, circuit 30-BA25 (RD), harness side and ground.</p> <ul style="list-style-type: none"> ● Is the voltage less than 0.5 volt from battery voltage. <p>→ Yes INSTALL a new generator. REFER to Section 414-02 . CLEAR codes and test the system for normal operation.</p> <p>→ No REPAIR circuit 30-BA25 (RD) for high resistance. CLEAR codes and TEST the system for normal operation.</p>
--	---

PINPOINT TEST D: CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING THE SYSTEM INCREASES VOLTAGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>D1 CHECK THE FAULT CODES IN THE PCM</p>	
<p>1</p>  <p>2</p>  <p>3</p>	<p>3 Use the recorded PCM DTCs from the continuous and on-demand self-test.</p>



● Are any DTCs recorded?

→ **Yes**
REFER to PCM Diagnostic Trouble Code (DTC) Index.

→ **No**
GO to D2.

D2 CHECK THE SYSTEM FOR OVER CHARGING

1



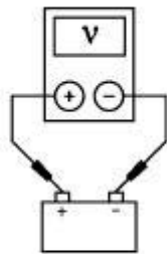
2



3



4



AJ0210-A

4 With the engine running and all accessories off measure the voltage at the battery terminals while varying the engine rpm.

● Is the voltage greater than 15 volts?

→ **Yes**
GO to Pinpoint Test C.

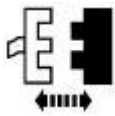
→ **No**
GO to D3.

D3 CHECK CIRCUIT 30-BA25 (RD)

1



2

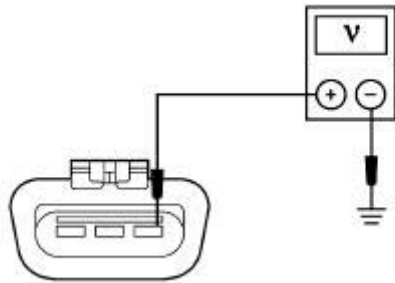


Generator C102a

3



4



AJ0218-A

4 Measure the voltage between generator C102a pin 3, circuit 30-BA25 (RD), harness side, and ground.

• Is the voltage equal to battery voltage?

→ Yes
GO to D4.

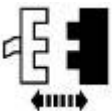
→ No
REPAIR the circuit. TEST the system for normal operation.

D4 CHECK THE CHARGING SYSTEM WARNING INDICATOR OPERATION

1



2



PCM C175c

3



3 Monitor the charging system warning indicator.

• Is the indicator illuminated?

→ Yes
REPAIR circuit 10-BA25 (GY/RD) for a short to ground. TEST the system for normal operation.

→ **No**
GO to D5.

D5 CHECK THE GENERATOR OUTPUT

1

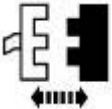


2



PCM C175c

3



Generator C102a

4 Verify the generator output. Refer to Component Tests, Generator On-Vehicle Test — Load Test in this section.

● **Is the generator OK?**

→ **Yes**
GO to D6.

→ **No**
INSTALL a new generator. REFER to Section 414-02. Clear codes and TEST the system for normal operation.

D6 CHECK FOR CORRECT MODULE OPERATION

1 Check:

- for corrosion
- for pushed-out pins
- connector seated correctly

2 Connect any disconnected connectors.

3 Make sure all other system connectors are fully seated.

4 Operate the system and verify the concern is still present.






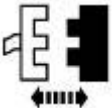
● **Is the concern still present?**

→ **Yes**
INSTALL a new PCM. REFER to Section 303-14. CLEAR the DTCs. REPEAT the PCM self-test.

→ **No**

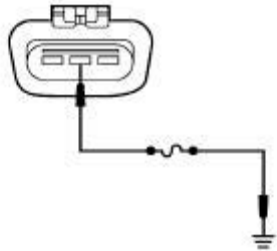
The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST E: THE CHARGING SYSTEM WARNING INDICATOR IS OFF WITH THE IGNITION SWITCH IN THE RUN POSITION AND THE ENGINE IS OFF

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK THE FAULT CODES IN THE PCM	
<p>1 </p> <p>2 </p> <p>3 </p>	<p>3 Use the recorded PCM DTCs from the continuous and on-demand self-test.</p> <p>● Are any DTCs recorded?</p> <p>→ Yes REFER to PCM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>E2</u>.</p>
E2 CHECK THE CHARGING SYSTEM WARNING INDICATOR OPERATION	
<p>1 </p> <p>2 </p> <p>3 </p> <p>Generator C102a</p> <p>4</p>	



5



A0016591

- 5 With the engine off, connect a fused (15A), jumper wire between the generator C102a pin 2, circuit 10-BA25 (GY/RD), harness side and ground.

- Does the charging system warning indicator illuminate?

→ **Yes**
INSTALL a new generator. REFER to [Section 414-02](#). TEST the system for normal operation.

→ **No**
GO to [E3](#).

E3 CHECK FOR CORRECT MODULE OPERATION

1 Check:

- for corrosion
- for pushed-out pins
- connector seated correctly

2 Connect any disconnected connectors.

3 Make sure all other system connectors are fully seated.

4 Operate the system and verify the concern is still present.




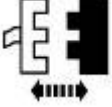

- Is the concern still present?

→ **Yes**
INSTALL a new PCM. REFER to [Section 303-14](#). CLEAR the DTCs. REPEAT the PCM self-test.

→ **No**
The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST F: THE CHARGING SYSTEM WARNING INDICATOR

LAMP FLICKERS OR IS INTERMITTENT

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE FAULT CODES IN THE PCM	
<p>1 </p> <p>2 </p> <p>3 </p>	<p>3 Use the recorded PCM DTCs from the continuous and on-demand self-test.</p> <p>● Are any DTCs recorded?</p> <p>→ Yes REFER to PCM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>F2</u>.</p>
F2 CHECK FOR LOOSE CONNECTIONS	
<p>1  Generator C102a</p> <p>3  Generator C102a</p>	<p>2 Check all generator, battery, and power distribution connections for looseness, corrosion, loose or bent terminals, or loose eyelets.</p> <p>● Are all connections clean and tight?</p> <p>→ Yes GO to <u>F3</u>.</p> <p>→ No REPAIR as necessary. TEST the system for normal operation.</p>

F3 CHECK FUSE CONNECTION

1



2 With the engine running, check BJB fuse F415 (5A) in circuit 30-BA25 (RD) for looseness by wiggling the fuse and noting the charging system warning indicator lamp operation.

● **Does the charging system warning indicator lamp flicker?**

→ **Yes**
REPAIR loose fuse connections as necessary. TEST the system for normal operation.

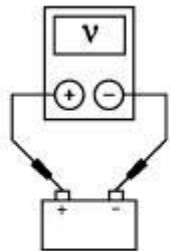
→ **No**
GO to F4.

F4 CHECK THE BATTERY VOLTAGE

1



2



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2 With the engine running, and all accessories turned off, measure the voltage at the battery while varying the engine rpm.

● **Is the voltage greater than 15 volts?**

→ **Yes**
GO to Pinpoint Test G.

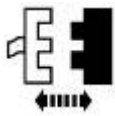
→ **No**
GO to F5.

F5 CHECK THE WARNING SYSTEM INDICATOR OPERATION

1



2



Generator C102a

3



4 Connect a fused jumper wire between generator C102a pin 2, circuit 10-BA25 (GY/RD), harness side and ground.

- Does the charging system warning indicator illuminate?

→ **Yes**
GO to F6.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

F6 CHECK THE PCM OPERATION

1



2



Generator C102a

3



3 Monitor the charging system warning indicator operation.

- Is the charging system warning indicator illuminated?

→ **Yes**
The PCM is operating correctly. RECHECK the generator circuits (including the generator) for intermittent shorts or opens. TEST the system for normal operation.

→ **No**
GO to F7.

F7 CHECK FOR CORRECT MODULE OPERATION

1 Check:

	<ul style="list-style-type: none"> ● for corrosion ● for pushed-out pins ● connector seated correctly <p>2 Connect any disconnected connectors.</p> <p>3 Make sure all other system connectors are fully seated.</p> <p>4 Operate the system and verify the concern is still present.</p> <p>● Is the concern still present?</p> <p>→ Yes INSTALL a new PCM. REFER to Section 303-14. CLEAR the DTCs. REPEAT the PCM self-test.</p> <p>→ No The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.</p>
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PINPOINT TEST G: THE GENERATOR IS NOISY

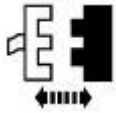
CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK FOR ACCESSORY DRIVE NOISE AND MOUNTING BRACKETS	
	<p>1 Check the accessory drive belt for damage and correct installation; refer to Section 303-05.</p> <p>2 Check the accessory mounting brackets and generator pulley for looseness or misalignment.</p> <p>● Is the accessory drive OK?</p> <p>→ Yes If equipped with a one-way clutch (OWC) pulley, GO to G2.</p> <p>If not equipped with an OWC pulley, GO to G3.</p> <p>→ No REPAIR as necessary. TEST the system for normal operation.</p>
G2 CHECK ONE-WAY CLUTCH (OWC) PULLEY	
	<p>1 With the front end accessory drive (FEAD) belt removed, spin the OWC pulley in a clockwise direction, then reverse the direction of the pulley by spinning it in a counterclockwise direction. If necessary, refer to Section 303-05 for belt removal.</p> <p>● Does the OWC pulley engage with the rotor when spun in a clockwise direction and free-wheel when spun in a counterclockwise direction with minimal noise as compared to a known good vehicle?</p> <p>→ Yes</p>

GO to G3.

→ **No**
INSTALL a new generator assembly with OWC pulley. REFER to Section 414-02. TEST the system for normal operation.

G3 CHECK GENERATOR FOR ELECTRICAL NOISE

1



Generator C102a

2



3 With the engine running, turn the headlights on, rear defroster on, and the blower motor to HI.

● **Is the noise still present?**

→ **Yes**
GO to G4.

→ **No**
INSTALL a new generator. REFER to Section 414-02. TEST the system for normal operation.

G4 CHECK GENERATOR FOR MECHANICAL NOISE

1



2



Generator C102a

3





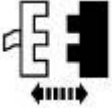

4 Turn all accessories off. With the engine running, use a stethoscope or equivalent listening device to probe the generator for unusual mechanical noise.

● **Is the generator the noise source?**

→ **Yes**
INSTALL a new generator. REFER to Section 414-02. TEST the system for normal operation.

→ **No**
 REFER to [Section 303-00](#) to diagnose the source of the engine noise.


PINPOINT TEST H: RADIO INTERFERENCE

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 VERIFY GENERATOR IS SOURCE OF RADIO INTERFERENCE	
<p>1 </p> <p>3 </p> <p>4  Generator C102a</p> <p>5 </p>	<p>1 Start and run the engine.</p> <p>2 Tune the radio to a station where the interference is present.</p> <p>● Is the interference present with the generator disconnected?</p> <p>→ Yes REFER to Section 415-00 for diagnosis and testing of the in-vehicle entertainment system.</p> <p>→ No INSTALL a new generator. REFER to Section 414-02 . TEST the system for normal operation.</p>

Component Tests

Battery — Drain Testing

Check for current drains on the battery in excess of 30 milliamps (0.030 amp) with all the electrical accessories off and the vehicle at rest for at least 40 minutes. Current drains can be tested with the following procedure:

 **WARNING:** Do not attempt this test on a lead-acid battery that has recently been recharged. Explosive gases can cause personal injury.

 **CAUTION:** To prevent damage to the meter, do not crank the engine or operate accessories that draw more than 10A.

NOTE: Many electronic modules draw 5 mA or more continuously.

NOTE: Use an in-line digital ammeter between the battery negative post and its respective cable.

1. Make sure the engine/luggage compartments and interior fuse panels are accessible without turning on interior, underhood, or luggage compartment lights.
2. Drive the vehicle at least five minutes and over 48 km/h (30 mph) to turn on and activate vehicle systems.
3. Allow the vehicle to sit with the key off for at least 40 minutes to allow modules to time out/power down.
4. Connect a jumper wire between the negative battery cable and the negative battery post to prevent modules from resetting and to catch capacitive drains.
5. Disconnect the negative battery cable from the negative battery post without breaking the connection of the jumper wire.
6. Connect the battery tester between the negative battery cable and post. The meter must be capable of reading milliamps and should have a 10 amp capacity.

NOTE: It is very important that continuity is not broken between the battery post and the negative cable when connecting the meter. If this happens, the entire procedure must be repeated.

7. Remove the jumper wire.

NOTE: If the meter settings need to be switched or the test leads need to be moved to another jack, the jumper wire must be reinstalled to avoid breaking continuity.

8. Note the amperage draw. Draw will vary from vehicle to vehicle depending on the equipment package. Compare to a comparable vehicle for reference. No factory equipped vehicle should have more than a 30 mA draw (0.030 amp).
9. If the draw is found to be excessive, pull fuses from the central, auxiliary, and battery junction boxes one at a time and note the current reading. Do not reinstall fuses until you have finished testing.
10. If the current draw is still excessive, remove the remaining fuses from all three junction boxes one at a time and note the current drop. Do not reinstall fuses until you have finished testing. When the current level drops after pulling a fuse, the circuit containing the excessive draw has been located.
11. Check the Wiring Diagrams for any circuits that run from the battery without passing through either junction box. If the current draw is still excessive, disconnect these circuits until the draw is found. Also disconnect the generator electrical connections if the draw cannot be located. The generator may be internally shorted, causing current drain.

Generator On-Vehicle Tests



CAUTION: To prevent damage to the generator (10346), do not make jumper wire connections except as directed.



CAUTION: Do not allow any metal object to come in contact with the housing and the internal diode cooling fins with key on or off. A short circuit will result and burn out the diodes.

NOTE: Battery posts and cable clamps must be clean and tight for accurate meter indications.

1. Turn off all lamps and electrical components.
2. Place the vehicle in transmission range NEUTRAL and apply the parking brake.
3. Carry out the Load Test and No-Load Test according to the following component tests:

Generator On-Vehicle Tests — Load Test

1. Switch the tester to the ammeter function.
2. Connect the positive and negative leads of the tester to the corresponding battery terminals.
3. Connect the current probe to the generator B+ output terminal, circuit 38 (BK/OG).
4. With the engine running at 2,000 rpm, adjust the tester load bank to determine the output of the generator.
5. With the engine running, turn the A/C on, the blower motor on high speed and the headlamps on high beam.
6. Increase the engine speed to approximately 2,000 rpm. The voltage should increase a minimum of 0.5 volt above the base voltage.
 - If the voltage does not increase as specified, carry out the Generator On-Vehicle Tests in this section.
 - If the voltage increases as specified, the charging system is operating normally.

Generator On-Vehicle Tests — No Load Test

1. Switch the tester to the voltmeter function.
 2. Connect the voltmeter positive lead to the generator B+ terminal and the negative lead to ground.
 3. Turn all electrical accessories off.
 4. With the engine running at 2,000 rpm, check the generator output voltage. The voltage should be between 13.0 and 15.0 volts. If not, refer to the Symptom Chart.
 5. Turn the A/C on, the blower motor on high speed and the headlamps on high beam.
 6. The voltage should increase a minimum of 0.5 volt above the base voltage.
 - If the voltage does not increase as specified, carry out the Generator On-Vehicle Tests. For additional information, refer to Generator On-Vehicle Tests in this section.
 - If the voltage increases as specified, the charging system is operating normally.
-

General Specifications

Item	Specification
Manufacturer	Motorcraft
Voltage	12 volt
Amps at -17.7°C (0°F) cold crank	650
Minutes-reserve capacity	130
Amps/hrs.-20 hour rate	72
Amps at -17.7°C (0°F) cold crank	750 (Europe only)
Minutes-reserve capacity	140 (Europe only)
Amps/hrs.-20 hour rate	78 (Europe only)
Battery location	Right rear of the luggage compartment
Lubricant	
Premium Long Life Grease XG-1-C or XG-1-K	ESA-M1C75-B

Torque Specifications

Description	Nm	lb-ft	lb-in
Battery ground cable	7	—	62
Battery positive cable	7	—	62
Battery hold-down clamp bolt at battery	8	—	71
Battery positive cable bolt at the power distribution box	12	9	—
Battery negative cable bolt at the body (trunk)	12	9	—
Battery tray bolts	30	22	—
Battery positive cable nut at dash (interior/exterior)	12	9	—
Battery positive cable nut at the starter solenoid	12	9	—
Battery (ignition/start) wire nut at the starter solenoid	6	—	53
Battery positive cable nut at the power distribution box	12	9	—
Battery cable protective tube bolts	6	—	53
Battery hold-down bolt at body	12	9	—

Battery and Cables

Vehicles are equipped with a 12 volt maintenance-free battery (10655) which is located in the luggage compartment, next to the spare tire. The battery purges any battery gases to the outside of the vehicle by means of a vent hose. This vent hose must be attached at all times. New batteries must be of the same vented design.

The battery contains a built-in hydrometer. The hydrometer eye indication is as follows:

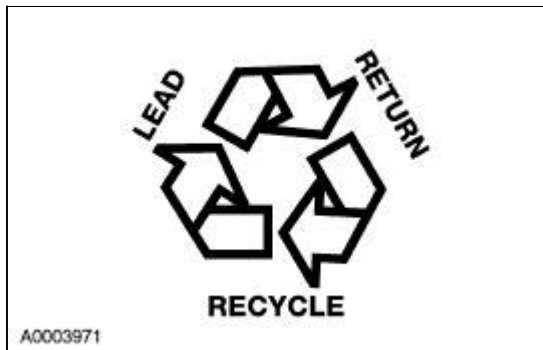
- A green dot means the battery is OK.
- A yellow dot, or a red dot, or when the green dot is not visible, means the battery needs to be charged.

If the battery has a cover/shield, make sure it is reinstalled after the battery has been cleaned or after a new battery has been installed.

The battery normally does not require additional water during its useful life. For longer, trouble-free operation, the top of battery should be clean and dry. Also, make certain the battery cables (14300, 14301) are always tightly fastened to the battery terminals.


If any terminal corrosion is detected, remove the cables from the terminals and clean with a wire brush. Battery acid can be neutralized with a solution of baking soda and water.

Always dispose of automotive batteries in a responsible manner. Follow your local authorized standards for disposal. Call your local authorized recycling center to find out more about recycling automotive batteries.



Battery

Special Tool(s)

 <p>ST2442-A</p>	<p>Micro 490 Digital Battery Analyzer 162-00004</p>
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Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Battery ● Battery mounting 	<ul style="list-style-type: none"> ● Battery cables ● Battery posts

3. If an obvious cause for a concern is found, correct the cause before proceeding to the next step.
4. If the fault is not visually evident, proceed to the pinpoint test.

Pinpoint Tests

PINPOINT TEST A: BATTERY CONDITION TEST

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 TEST BATTERY CONDITION	
	<p>NOTE: No battery with a red test-eye should be replaced. The red eye only means the battery is discharged, not necessarily defective.</p> <p>NOTE: Failure to fully charge the battery before retesting may cause false readings.</p>
	<p>1 Verify the battery condition using the Battery Analyzer.</p> <ul style="list-style-type: none"> ● Is the battery OK? <p>→ Yes Does the meter read, GOOD BATTERY? RETURN the battery to service. REFER to Section 414-00.</p> <p>Does the meter read, GOOD-RECHARGE? CHARGE the battery and</p>

RETURN to service. REFER to Section 414-00.

Does the meter read, CHARGE & RETEST? Fully CHARGE the battery and RETEST.

→ **No**

Does the meter read, REPLACE BATTERY? INSTALL a new battery.

Does the meter read, BAD CELL-REPLACE? INSTALL a new battery.

Battery Disconnect



WARNING: Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery, always shield your face and protect your eyes. Always provide ventilation.



WARNING: To avoid accidental deployment and possible injury, the backup power supply must be depleted before repairing or installing any front or side air bag supplemental restraint system (SRS) components and before repairing, installing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).



WARNING: When lifting a battery, excessive pressure on the end walls could cause acid to spew through the vent caps, resulting in personal injury. Lift with a battery carrier or with your hands on opposite corners.



WARNING: Keep out of the reach of children. Batteries contain sulfuric acid. Avoid contact with skin, eyes or clothing. Also, shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately.


1. **NOTE:** When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven to relearn its strategy.


Disconnect the battery ground cable.

2. Disconnect the positive battery cable.
 3. To install, reverse the removal procedure.
-

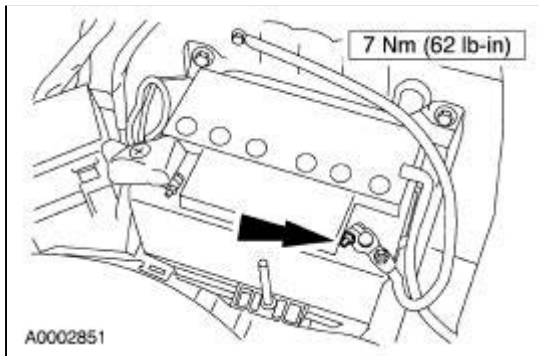
Battery

Removal and Installation

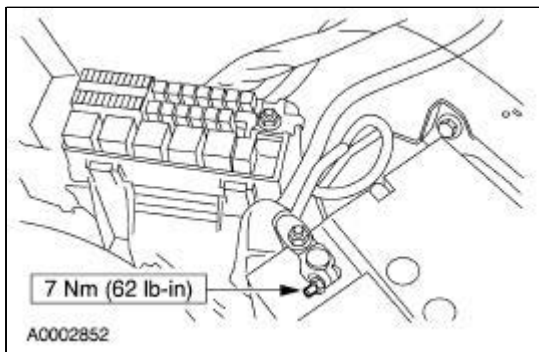
 **WARNING:** Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation.

 **WARNING:** Keep out of the reach of children. Batteries contain sulfuric acid. Avoid contact with skin, eyes or clothing. Also, shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately.

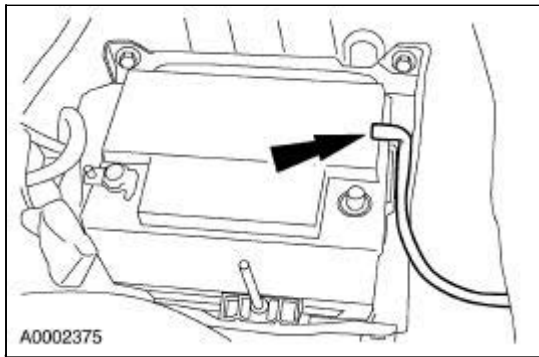
1. Disconnect the battery ground cable (14301).



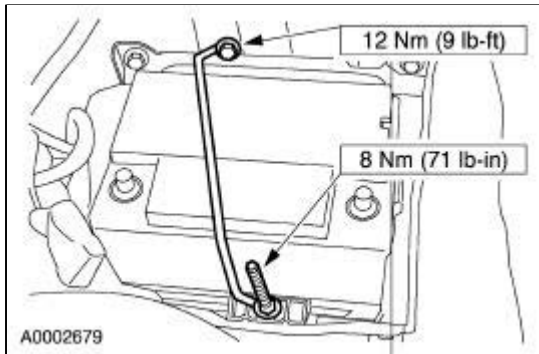
2. Disconnect the battery positive cable (14300).




3. Disconnect the battery vent tube.



4. Remove the bolt and spacer clamp (10B684).



5.  **WARNING:** When lifting a battery, excessive pressure on the end walls could cause acid to spew through the vent caps, resulting in personal injury. Lift with a battery carrier or with your hands on opposite corners.


Remove the battery (10655).


6. **NOTE:** Because the vehicle's engine is electronically controlled by a computer, some control conditions are maintained by power from the battery. When the battery is disconnected or a new battery is installed, the engine must relearn its idle and fuel trim strategy for optimum driveability and performance. Let the engine idle for one minute. The relearning process will automatically complete itself as the vehicle is driven. The vehicle may need to be driven 16 km (10 miles). If the engine is not allowed to relearn its idle trim, the idle quality may be adversely affected until the idle trim is eventually relearned. Additionally, to account for customer driving habits and conditions, the automatic transmission must relearn its adaptive strategy. Optimal shifting will resume within a few hundred kilometers (miles) of operation. The clock and the preset radio stations must be reset once the battery is reconnected.

To install, reverse the removal procedure.

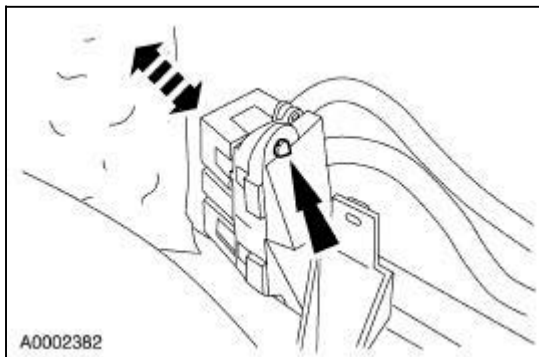
Battery Tray

Removal and Installation

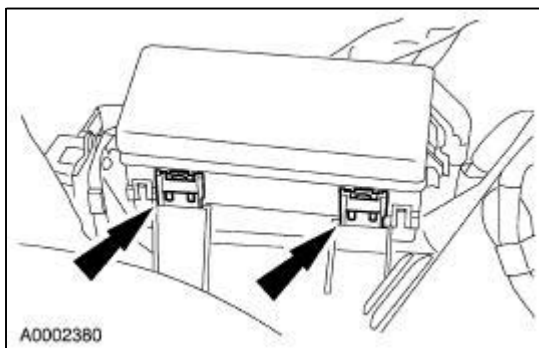
 **WARNING:** Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation.

 **WARNING:** Keep out of the reach of children. Batteries contain sulfuric acid. Avoid contact with skin, eyes or clothing. Also, shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately.

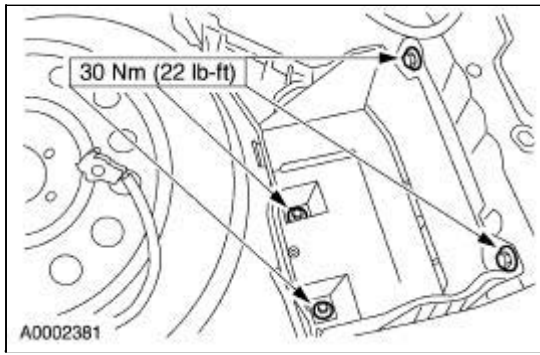
1. Remove the battery (10655). For additional information, refer to [Battery](#).
2. Remove the pin type retainer and position the fuse holder aside.



3. Remove the battery junction box (BJB) cover and remove the BJB from the battery tray (10764) and position it aside.




4. Remove the battery tray bolts and washers and the battery tray.




5. To install, reverse the removal procedure.
-

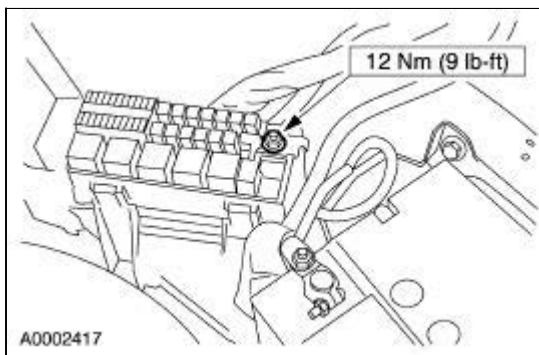
Battery Cables

Removal and Installation

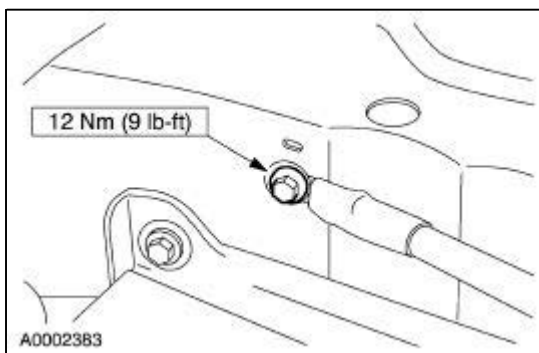
 **WARNING:** Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation.

 **WARNING:** Keep out of the reach of children. Batteries contain sulfuric acid. Avoid contact with skin, eyes or clothing. Also, shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately.

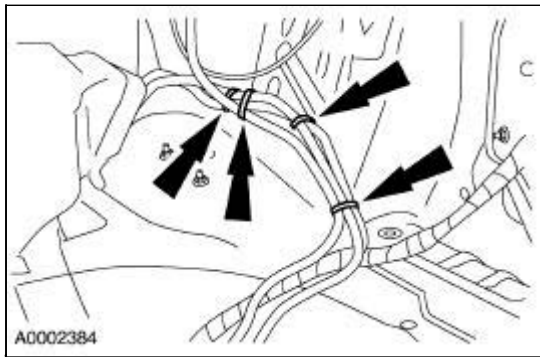
1. Remove the battery (10655). For additional information, refer to [Battery](#).
2. Remove the battery junction box (BJB) cover and remove the attachment nut securing the positive cable.



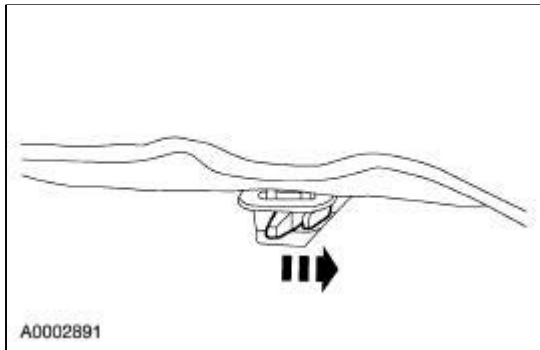
3. Remove the negative cable bolt.



4. Remove the harness clips from the cable in the luggage compartment.



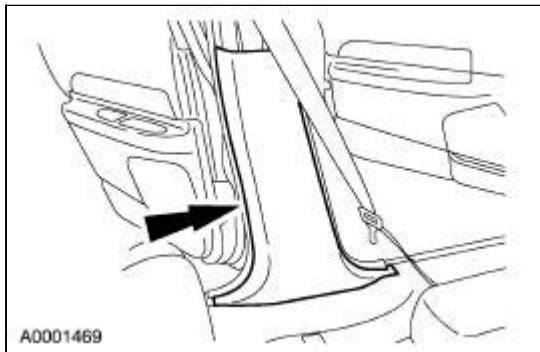
5. Remove the rear seat cushion.



6. Remove the upper RH B-pillar trim panel. For additional information, refer to [Section 501-05](#).

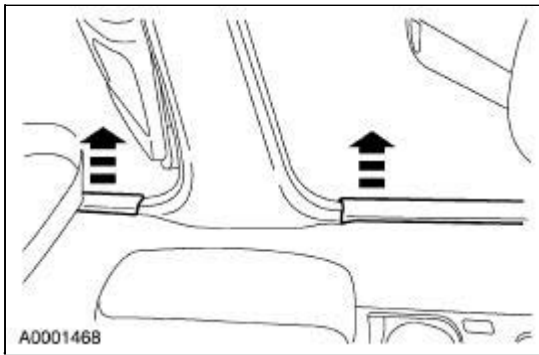
7. **NOTE:** LH shown, RH similar

Remove the lower RH B-pillar trim cover and scuff plate screws .



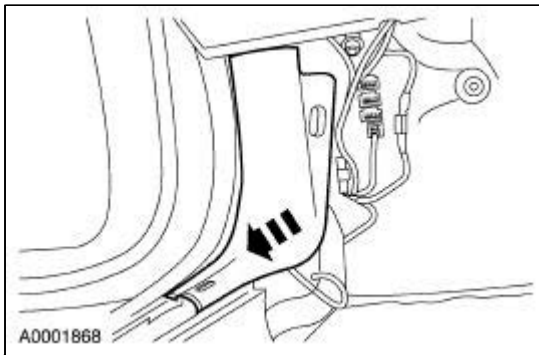
8. **NOTE:** LH shown, RH similar

Remove the RH front and rear scuff plates.

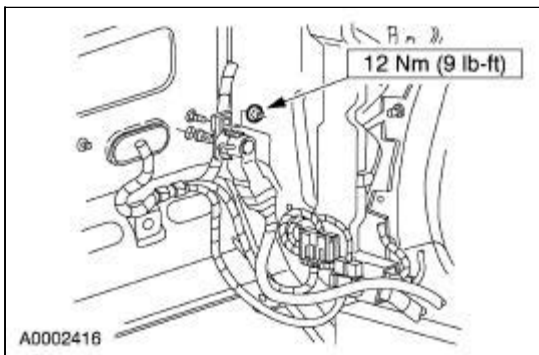


9. **NOTE:** LH shown, RH similar

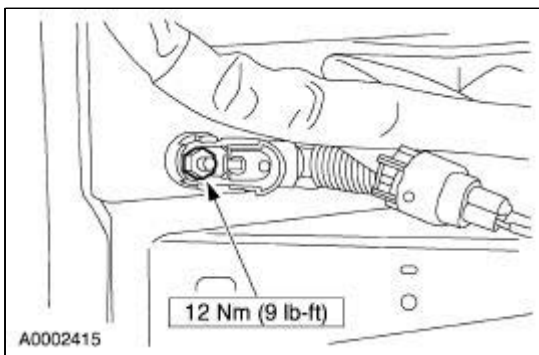
Remove the RH A-pillar lower trim panel and position aside the carpet to expose battery cable.



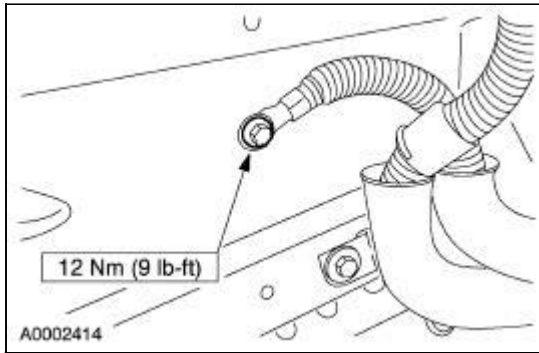
10. Remove the retaining tie straps and detach the cable forward past the rear seatback into the passenger compartment.
11. Remove the cable attachment cover and the nut at the dash through-bolt and remove the cable.



12. In the engine compartment at the dash panel, remove the protective cover and the nut.

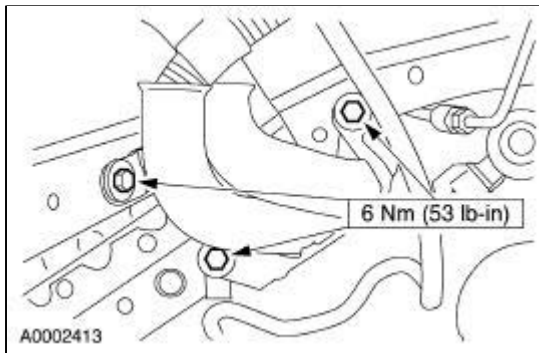


13. Remove the bolt at the body.



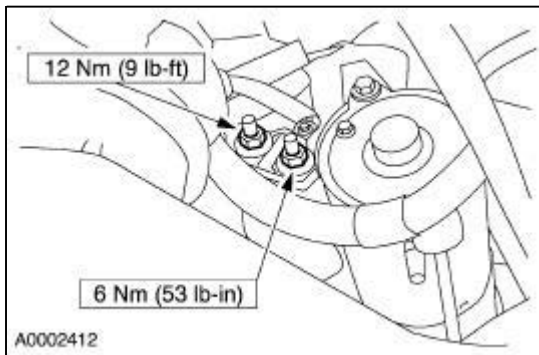
14. Remove the right front wheel well splash shield. For additional information, refer to [Section 501-02](#).

15. Remove the bolts at the harness protective tubes.



16. **NOTE:** 3.0L shown, 3.9L similar.

Remove the cable protective cover at the starter solenoid and remove the nuts and the cable.



17. To install, reverse the removal procedure.
-

General Specifications

Item	Specification
Generator (10300) 3.0L	XR8U-AC
Generator (10300) 3.9L	XR8U-CD
Rating (gen. crank/rev.) 3.0/3.9L	(105 AMP/MAX)
Generator ratio, 3.0L	2.65:1
Generator ratio, 3.9L	2.78:1
Voltage regulator type (10316)	Electronic integral with generator

Torque Specifications

Description	Nm	lb-ft	lb-in
Generator positive cable nut	8	—	71
Generator mounting bolts, 3.0L	45	33	—
Generator mounting bolts, 3.9L	48	35	—
Generator expanding bushing and bolt assembly	20 + 90°	15 + 90°	—

Generator

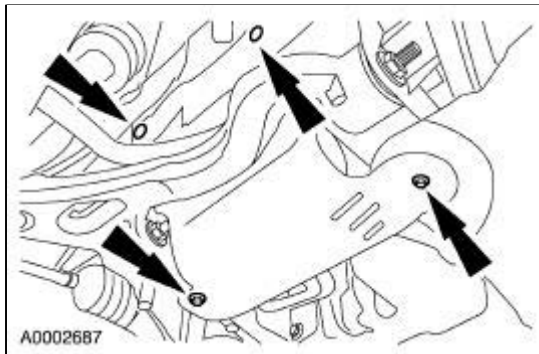
The generator has an internal voltage regulator that is not repaired separately. The generator and voltage regulator must be replaced as an assembly.

All 3.0L V6 manual transmission applications are equipped with a one-way clutch (OWC) in the generator pulley. The OWC pulley temporarily disengages the generator rotor from the front end accessory drive (FEAD) system during high acceleration/deceleration rates on the engine, which may increase belt life and decrease belt chirp. A new OWC pulley and generator/voltage regulator must be installed as an assembly.

Generator —3.0L

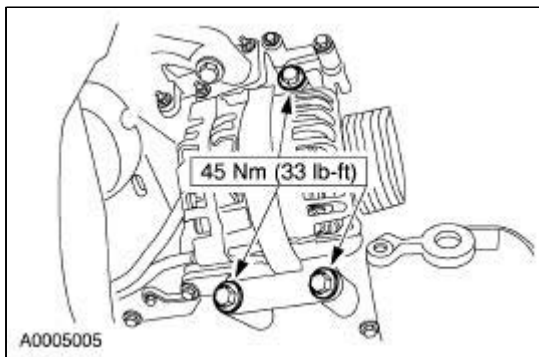
Removal and Installation

1. Disconnect the battery ground cable. Refer to [Section 414-01](#).
2. Relieve the accessory drive belt tension and move the belt off of the generator pulley. For additional information, refer to [Section 303-05](#).
3. Raise the vehicle. For additional information, refer to [Section 100-02](#).
4. Remove the lower splash shield.
 - Remove the bolts.
 - Remove the pin-type retainers.

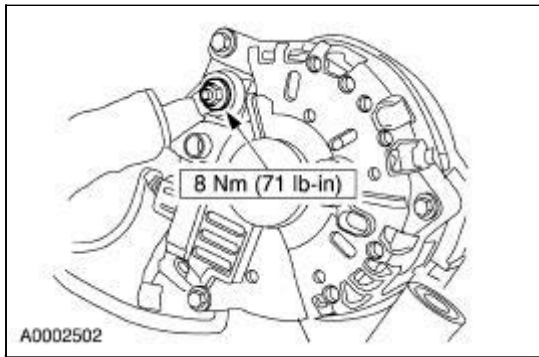


5.  **CAUTION:** The generator must be supported by hand after removing the bolts and prior to disconnecting the electrical connectors or damage to the connectors or wiring could result.

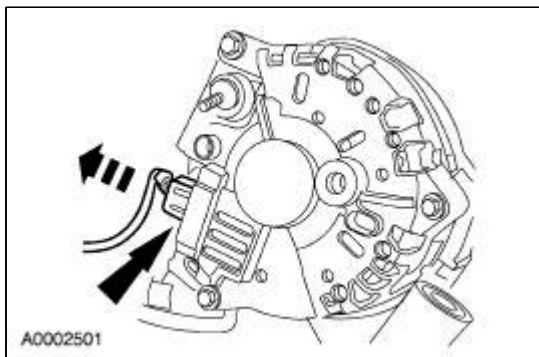
Remove the bolts.



6. Disconnect the generator positive cable.
 - Carefully lower the generator to gain access to the battery generator cable nut.
 - Remove the nut and detach the cable.



7. Remove the generator.
 - Disconnect the electrical connector.
 - Remove the generator.

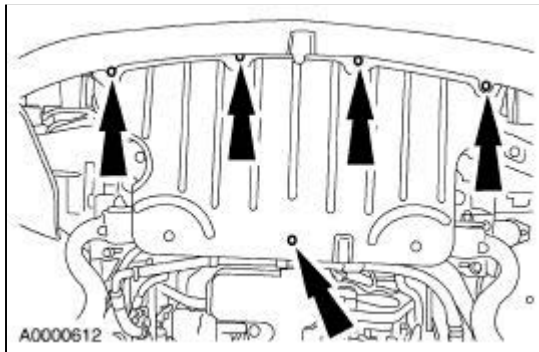


8. To install, reverse the removal procedure.
-

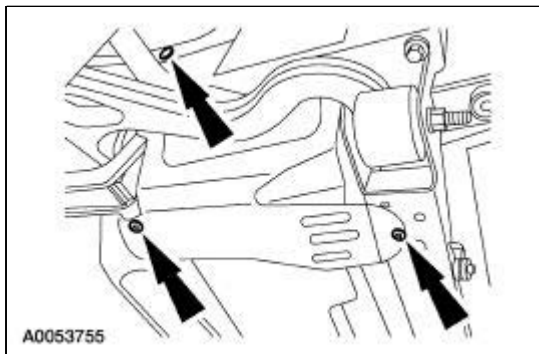
Generator —3.9L

Removal

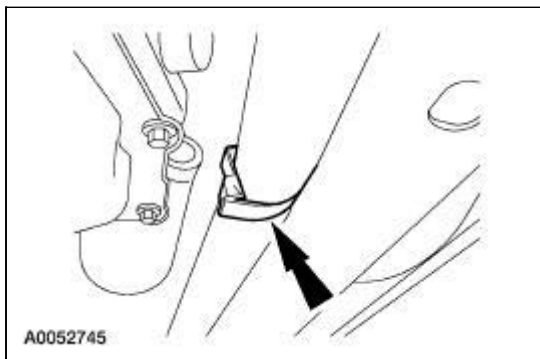
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the air intake tube. For additional information, refer to [Section 303-12](#).
3. Relieve the accessory drive belt tension and move the belt off the generator pulley. For additional information, refer to [Section 303-05](#).
4. Raise the vehicle. For additional information, refer to [Section 100-02](#).
5. Remove the front lower splash shield.



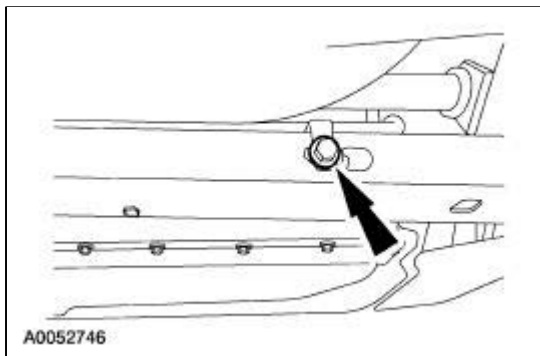
6. Remove the lower RH splash shield.



7. Remove the A/C suction line clip from the radiator core support.

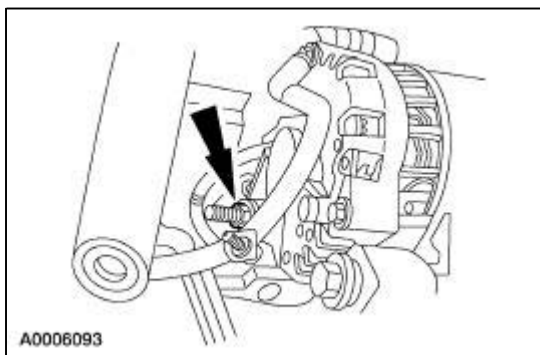


8. Remove the LH A/C suction line lower bracket bolt and position the bracket rearward.

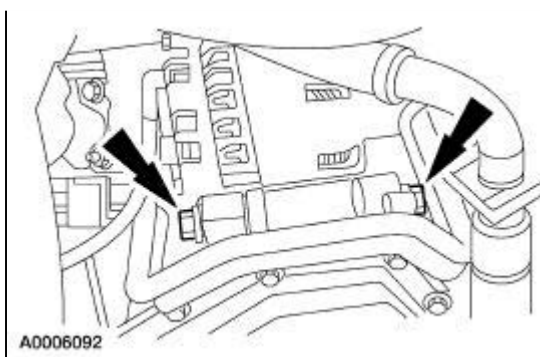


9. **NOTE:** The A/C suction line may need to be positioned rearward to ease generator removal.

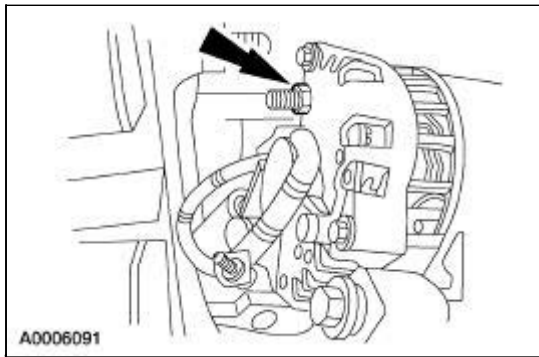
Remove the top nut and through bolt.



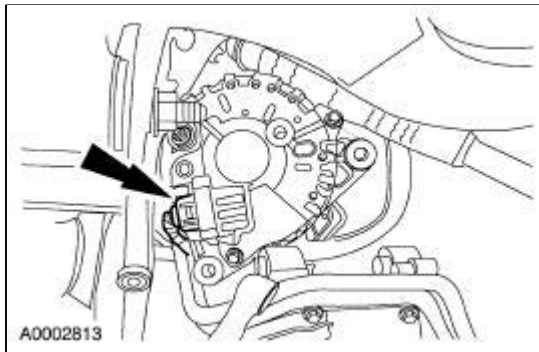
10. Remove the lower bolts.



11. Turn the generator slightly to access the generator positive cable nut and remove the nut.



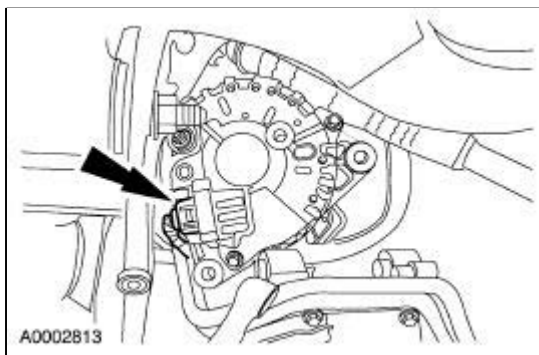
12. Lower the generator slightly and disconnect the electrical connector.



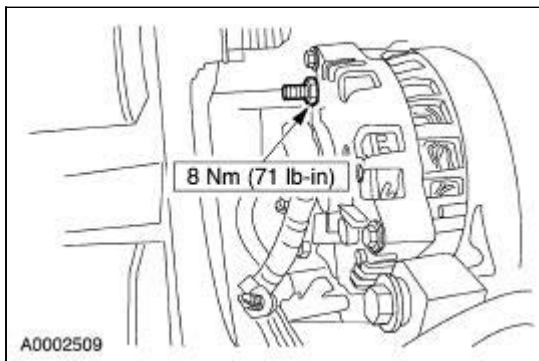
13. Remove the generator.
 - Rotate the generator to gain access for removal.
 - Remove the generator.

Installation

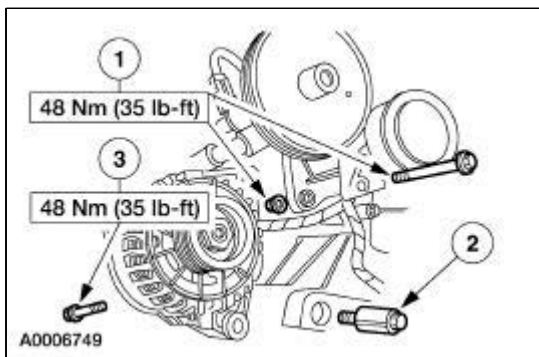
1. Position the generator and connect the electrical connector.



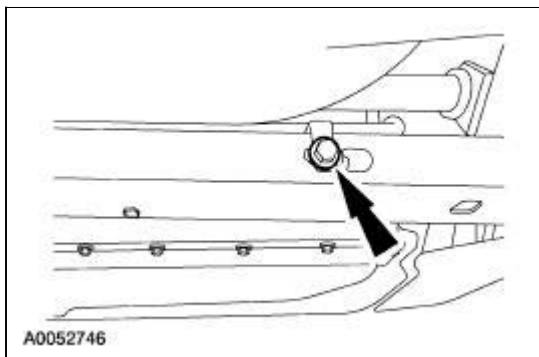
2. Rotate generator to gain access to the generator positive terminal and install cable and nut.



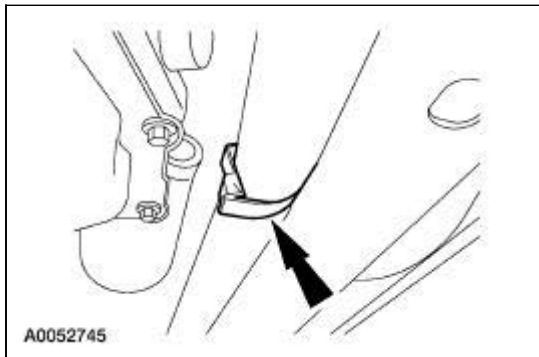
3. Install the generator and tighten in the sequence shown.
 1. Loosely assemble the pivot bolt and nut.
 2. Install the expanding bushing and bolt assembly in two stages.
 - Stage 1: Tighten the bolt to 20 Nm (15 lb-ft).
 - Stage 2: Tighten the bolt an additional 90 degrees.
 3. Install the bolt.



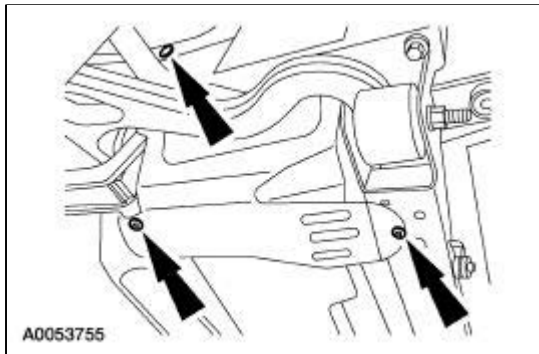
4. Install the LH A/C section line lower bracket and bolt.



5. Install the A/C suction line clip into the radiator core support.



6. Install the lower RH splash shield.




7. Install the front lower splash shield.
 8. Lower the vehicle. For additional information, refer to [Section 100-02](#).
 9. Install the accessory drive belt. For additional information, refer to [Section 303-05](#).
 10. Install the air intake tube. For additional information, refer to [Section 303-12](#).
 11. Connect the battery cable ground cable. For additional information, refer to [Section 414-01](#).
-

Audio System

Refer to Wiring Diagrams Section [415-00](#), Audio System--General Information for schematic and connector information.

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224 New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool

Inspection and Verification

1. **NOTE:** The audio control module (ACM) is also referred to as the audio unit.

Verify the customer concern by operating the electronic audio system with the engine running and the vehicle in motion.

2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Audio unit ● Digital audio compact disc player ● Antenna or antenna cable ● Antenna isolator module ● Audio speakers, mounting/speaker cones ● Radio ignition interference capacitors, radio frequency interference suppression bond, and radio receiver hood bonding strap 	<ul style="list-style-type: none"> ● Central junction box (CJB) fuse: <ul style="list-style-type: none"> ■ 202 (5A) ■ 227 (10A) ● Battery junction box (BJB) fuse: <ul style="list-style-type: none"> ■ 414 (5A) ■ 418 (20A) ■ 429 (30A) ● Ignition switch ● Circuitry

3. If the fault is not visually evident, proceed to speaker walk-around test, audio unit self-diagnostic mode (P100i only) and the diagnostic tool.

Audio Unit Self-Diagnostic Mode

NOTE: To enter the speaker walk-around test or the audio unit self-diagnostic mode, must be ON and in radio tuner mode (AM/FM). The audio unit self-diagnostic mode can only be entered while in the speaker walk-around test.

4. To enter the speaker walk-around test, simultaneously press the audio unit preset buttons 3 and 6.
5. The speaker walk-around test stops at each speaker and applies a different tone to each speaker for about 1-2 seconds. Each speaker is tested and displayed on the audio unit in the following sequence: RF, LF, LR, RR, Subwoofer I, Subwoofer II except for premium P100i and Premium CDx6 no Subwoofer I, Subwoofer II will display.
6. The speaker walk-around test automatically continues and tests:
 - for speaker short. If a short is present, SPKR SHORT will be displayed.
 - for CD/DJ. The audio unit display will show NO DJ if not present.

The speaker walk-around test will end and the audio unit will return to its previous setting.

To enter the following audio unit self-diagnostic modes, press the preset button desired while in the speaker walk-around test. This will abort the speaker walk-around test and start the selected test.

7. The audio unit self-diagnostic mode has five tests available:
 - Preset button 1 = Audio internal/external SELF TEST. If SELF FAIL is displayed, press TUNE > to scroll view the DTCs stored. Refer to the audio unit Diagnostic Trouble Code (DTC) Index. If the system is OK, SELF PASS is displayed.
 - Preset button 2 = View/Clear continuous diagnostic trouble codes (DTCs). NO DTCs is displayed if no DTCs are retrieved. If DTCs FOUND is displayed, press TUNE > button to view the DTCs retrieved. Refer to the audio unit Diagnostic Trouble Code (DTC) Index. To clear all DTCs press the EJECT button. DTCs CLEAR will be displayed.
 - Preset button 3 = SIGNAL TEST. This test measures the average strength at the current tuner setting.
 - Preset button 4 = Software configuration level. This test queries each audio system controller for its software configuration level. SOFT LEVELS will be displayed upon completion of the query. Press TUNE > to scroll view the software configuration version level.

Controller	Description	Audio Unit Display Example
Main	Main Micro Software Version	MAIN ##.##.##
CDSP	CDSP Micro Software Version	CDSP ##.##.##
ADSP	ADSP Micro Software Version	ADSP ##.##.##
Auxiliary	Auxiliary Software Version	AUX ##.##.##
CD/DJ	CDDJ Software Version	DJ ##.##.##
CD Changer	CDR Software Version	CD ##.##.##
Tape Deck	Tape Deck Software Version	TAP ##.##.##
RSC	Rear Seat Controller Software Version	RCP ##.##.##

- Preset button 5 = DISPLAY TEST. This test will light all the audio unit display segments for five seconds and then turn all segments off. When the test is complete, DISPLAY TEST is displayed

on the bezel.

- Preset button 6 = CONFIG LEVELS. This will show the software configuration for the audio unit.
8. To exit audio unit self-diagnostic mode, turn the ignition switch or the audio unit OFF.
 9. If the concern remains and the fault is not detected, proceed to Diagnostic Tool.

Diagnostic Tool

1. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.

2. **NOTE:** The audio unit must be in AM, FM1 or FM2 mode to enter diagnostic tool tester diagnostics.

If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.

3. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for audio unit, go to Pinpoint Test A.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the audio unit.
4. If the DTCs retrieved are related to the concern, go to the audio unit Diagnostic Trouble Code (DTC) Index to continue diagnostics.
5. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

Audio Unit Diagnostic Trouble Code (DTC) Index

NOTE: The audio unit and the diagnostic tool use the same diagnostic trouble codes.

DTC	Description	Source	Action
B1342	ECU is Defective	ACM	CLEAR and DOCUMENT the DTCs. CARRY OUT the audio unit On-Demand Self-Test. REMOVE the audio unit and SEND it to an authorized Ford Audio System repair facility if DTC B1342 is retrieved again. TEST the system for normal operation.
B2401	Audio Tape Deck Mechanism Fault	ACM	VERIFY that no tape is inserted in the audio unit. CLEAR and DOCUMENT the DTCs. CARRY OUT the ACM On-Demand self-test. If DTC B2401 is retrieved again, REMOVE the audio unit and SEND it to an authorized Ford

			Audio System repair facility.
B2402	Audio CD/DJ Thermal Shutdown Fault	ACM	Not applicable for CDX6. GO to Pinpoint Test C .
B2403	Audio CD/DJ Internal Fault	ACM	Not applicable for CDX6. GO to Pinpoint Test C .
B2404	Audio Steering Wheel Switch Circuit Fault	ACM	GO to Pinpoint Test M .
B2405	Audio Single-Disc CD Player Thermal Shutdown Fault	ACM	Not applicable.
B2406	Audio Single-Disc CD Player Internal Fault	ACM	Not applicable.
B2477	Module Configuration Fault	ACM	REFER to Section 418-01 .
U2003	Audio CD/D Jockey is Not Responding	ACM	NOTE: U2003 is retrieved if CDDJ is not present, disconnected, or inoperative. Not applicable for CDX6. GO to Pinpoint Test C .
U2005	Audio Rear Integrated Control Panel Unit is Not Responding	ACM	NOTE: U2005 is retrieved if RICP is not present, disconnected, or inoperative. Not applicable.
U2008	Audio Phone is Not Responding	ACM	REFER to Section 419-08 .
U2014	Audio Subwoofer Unit is Not Responding	ACM	NOTE: U2014 is retrieved if subwoofer is not present, disconnected, or inoperative. GO to Pinpoint Test L .
U2020	Center Image Amplifier is Not Responding	ACM	NOTE: U2020 is retrieved if center image amplifier is not present, disconnected, or inoperative. GO to Pinpoint Test I .

Symptom Chart

Symptom Chart


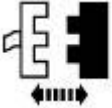

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the audio unit 	<ul style="list-style-type: none"> Central junction box (CJB) fuse: <ul style="list-style-type: none"> 202 (5A). 227 (10A). Battery junction box (BJB) fuse: <ul style="list-style-type: none"> 414 (5A). 429 (30A). J1850 communication network. Circuitry. Audio unit. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> The audio unit is 	<ul style="list-style-type: none"> CJB fuse: 	<ul style="list-style-type: none"> GO to Pinpoint Test B.

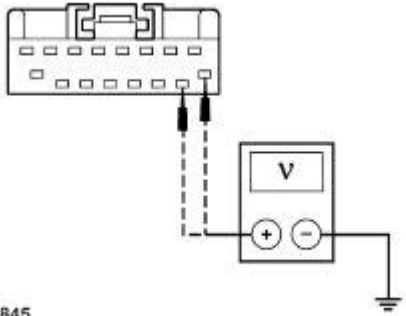
inoperative/does not operate correctly	<ul style="list-style-type: none"> ■ 202 (5A). ■ 227 (10A). ● BJB fuse: <ul style="list-style-type: none"> ■ 414 (5A). ■ 429 (30A). ● Circuitry. ● Audio unit. 	
● The cassette player is inoperative/does not operate correctly	● Audio unit.	● REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.
● The radio does not operate correctly — display is blank	● Audio unit.	● REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.
● The CD changer is inoperative/does not operate correctly	<ul style="list-style-type: none"> ● BJB fuse 414 (5A). ● Circuitry. ● Audio unit. ● CD changer. 	● GO to Pinpoint Test C.
● The audio unit does not display CD changer information	<ul style="list-style-type: none"> ● Circuitry. ● Audio unit. ● CD changer. 	● GO to Pinpoint Test D.
● Poor reception	<ul style="list-style-type: none"> ● Antenna. ● Antenna connections. ● Noise suppression equipment. ● Antenna isolator module. ● Audio unit. 	● GO to Pinpoint Test E.
● Continuous SEEK/SCAN in AM/FM	<ul style="list-style-type: none"> ● Antenna. ● Antenna connections. ● Antenna isolator module. ● Audio unit. 	● GO to Pinpoint Test F.
● Poor quality/distorted sound from one or more speakers (not all speakers)	<ul style="list-style-type: none"> ● Speaker(s). ● Circuitry. ● Audio cable. ● Audio unit. 	● GO to Pinpoint Test G.
● Poor quality/distorted sound from all speakers	● Audio unit.	● REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.
● No sound from one or more speakers (not all speakers)	<ul style="list-style-type: none"> ● Speaker(s). ● Circuitry. ● Audio unit. 	● GO to Pinpoint Test H.
● No sound from one or more speakers (not all speakers) — center	<ul style="list-style-type: none"> ● Speaker(s). ● Circuitry. ● Audio unit. 	● GO to Pinpoint Test I.

imaging	<ul style="list-style-type: none"> Center imaging speaker amplifier. 	
<ul style="list-style-type: none"> No sound from all speakers 	<ul style="list-style-type: none"> Speaker(s). Circuitry. Audio unit. Audio cable. 	<ul style="list-style-type: none"> GO to Pinpoint Test J.
<ul style="list-style-type: none"> Loud pops when cycling the ignition switch 	<ul style="list-style-type: none"> Subwoofer. Circuitry. 	<ul style="list-style-type: none"> GO to Pinpoint Test K.
<ul style="list-style-type: none"> The subwoofer is inoperative 	<ul style="list-style-type: none"> BJB fuse 418 (20A). Circuitry. Subwoofer. 	<ul style="list-style-type: none"> GO to Pinpoint Test L.
<ul style="list-style-type: none"> No radio illumination 	<ul style="list-style-type: none"> Circuitry. Audio unit. 	<ul style="list-style-type: none"> REFER to Section 413-00.
<ul style="list-style-type: none"> The auxiliary audio control is inoperative/does not operate correctly — steering wheel control switches 	<ul style="list-style-type: none"> Circuitry. Audio unit. Steering wheel control switches. Horn switch. Clockspring. 	<ul style="list-style-type: none"> GO to Pinpoint Test M.
<ul style="list-style-type: none"> The speed sensitive volume function is inoperative/does not operate correctly 	<ul style="list-style-type: none"> Audio unit. 	<ul style="list-style-type: none"> REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE AUDIO UNIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK THE VOLTAGE TO THE AUDIO UNIT	
<p>1</p>  <p>2</p>  <p>Audio Unit C240c</p> <p>3</p>  <p>4</p>	<p>4 Measure the voltage between the audio unit C240c pin 9, circuit 29-MD15</p>



A0004845

(OG/BK), harness side and ground; and between the audio unit C240c pin 10, circuit 75-MD15 (YE/GN), harness side and ground.

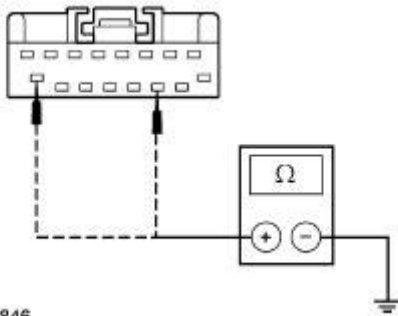
- Are the voltages greater than 10 volts?

→ **Yes**
GO to A2.

→ **No**
REPAIR the circuit in question. REPEAT the data link diagnostic test.

A2 CHECK THE GROUND TO THE AUDIO UNIT

1



A0004846

1

Measure the resistance between the audio unit C240c pin 11, circuit 31-MD15 (BK/GN), harness side and ground; and between the audio unit C240c pin 16, circuit 31-MD15 (BK/GN), harness side and ground.

- Are the resistances less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit in question. REPEAT the data link diagnostic test.

PINPOINT TEST B: THE AUDIO UNIT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK OPERATION OF THE AUDIO UNIT	
1	



2 Turn on the audio unit.

● **Is the audio unit display illuminated?**

→ **Yes**
GO to B2.

→ **No**
GO to B4.

B2 CHECK FOR SOUND COMING FROM THE AUDIO SPEAKERS

1 Carry out the speaker walk-around test by pressing preset buttons 3 and 6 simultaneously.

2 Check for sound from the audio speakers.

● **Is sound coming from the speakers?**

→ **Yes**
GO to B3.

→ **No**
GO to Pinpoint Test J.

B3 CARRY OUT CONTROLS AND FEATURES TEST

1 Verify that all the audio system controls and features operate correctly; refer to the owner literature.

● **Do all the controls and features operate correctly?**

→ **Yes**
The system is OK.

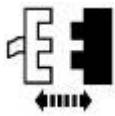
→ **No**
REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

B4 CHECK THE VOLTAGE TO THE AUDIO UNIT

1



2

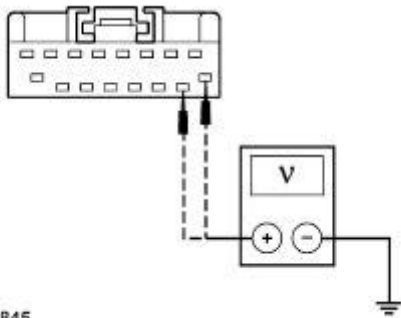


Audio Unit C240c

3



4



A0004845

- 4 Measure the voltage between the audio unit C240c pin 10, circuit 75-MD15 (YE/GN), harness side and ground; and between the audio unit C240c pin 9, circuit 29-MD15 (OG/BK), harness side and ground.

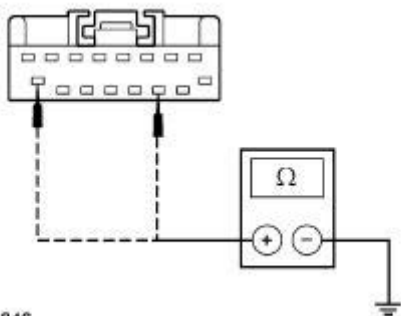
- Are the voltages greater than 10 volts?

→ **Yes**
GO to B5.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

B5 CHECK THE GROUND TO THE AUDIO UNIT

1



A0004846

- 1 Measure the resistance between the audio unit C240c pin 11, circuit 31-MD15 (BK/GN), harness side and ground; and between the audio unit C240c pin 16, circuit 31-MD15 (BK/GN) harness side and ground.


- Are the resistances less than 5 ohms?

→ **Yes**
REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

→ **No**
REPAIR the circuit in question. TEST the

system for normal operation.

PINPOINT TEST C: THE CD CHANGER IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 RETRIEVE THE RECORDED AUDIO UNIT DTCS FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	<p>1 Use the recorded results from the continuous and on-demand self-tests.</p> <ul style="list-style-type: none">● Are any DTCs retrieved? <p>→ Yes If B2402, B2403, or U2003 is retrieved, GO to <u>C5</u>.</p> <p>→ No GO to <u>C2</u>.</p> <p>All other DTCs, GO to Audio Unit Diagnostic Trouble Code (DTC) Index.</p>
C2 CHECK OPERATION OF THE CD CHANGER	
<p>1</p> 	<p>2 Turn on the audio unit.</p> <p>3 Verify that the audio unit is operating correctly. Refer to the owner literature.</p> <p>4 Verify that the CD changer power loading function is operating correctly. Refer to the owner literature.</p> <ul style="list-style-type: none">● Is the CD player information displayed on the audio unit display? <p>→ Yes GO to <u>C3</u>.</p> <p>→ No GO to <u>Pinpoint Test D</u>.</p>
C3 CHECK FOR SOUND COMING FROM THE AUDIO SPEAKERS	
	<p>1 Insert a known good CD and press the CD button.</p> <p>2 Check for sound from the audio speakers.</p> <ul style="list-style-type: none">● Is sound coming from the speakers?

→ **Yes**
GO to C4.

→ **No**
GO to Pinpoint Test J.

C4 CD CHANGER PLAY/STOP TEST

1 Verify that all CD changer controls and features operate correctly. Refer to the owner literature.

- **Do all controls and features operate correctly?**

→ **Yes**
The system is OK.

→ **No**
GO to C5.

C5 CHECK THE CIRCUITS BETWEEN THE COMPONENTS FOR OPEN

1



2



CD Changer C243

3



Audio Unit C240a

4 Measure the resistances between the CD changer C243 and the audio unit C240a as follows:

CD Changer C243 pin	circuit	Audio Unit C240a pin	circuit
6	1-MD50 (WH/BK)	17	1-MD50 (WH/BK)
5	1-MD49 (WH/GN)	19	1-MD49 (WH/GN)
1	4-EA6 (GY)	6	4-EA8 (GY/VT)
12	2-MD50 (GY/BK)	18	2-MD50 (GY/BK)
11	2-MD49	20	2-MD49

	(GY/OG)		(GY/OG)
8	8-MD51 (WH/BU)	5	8-MD51 (WH/BU)
7	5-EA6 (BU)	7	5-EA8 (BU/WH)

- Are the resistances less than 5 ohms?

→ **Yes**
GO to C6.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

C6 CHECK THE CIRCUITS BETWEEN THE COMPONENTS FOR SHORT

- 1 Measure the resistance between the CD changer C243, harness side and ground as follows:

Pin	Circuit
6	1-MD50 (WH/BK)
5	1-MD49 (WH/GN)
1	4-EA6 (GY)
12	2-MD50 (GY/BK)
11	2-MD49 (GY/OG)
8	8-MD51 (WH/BU)
7	5-EA6 (BU)

- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to C7.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

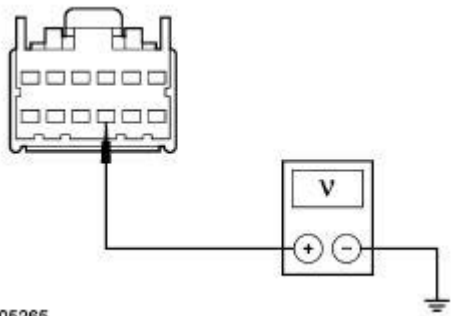
C7 CHECK VOLTAGE TO THE CD CHANGER

1



2

- 2 Measure the voltage between the CD changer C243 pin 9, circuit 29-MD41 (OG), harness side and ground.



A0005265

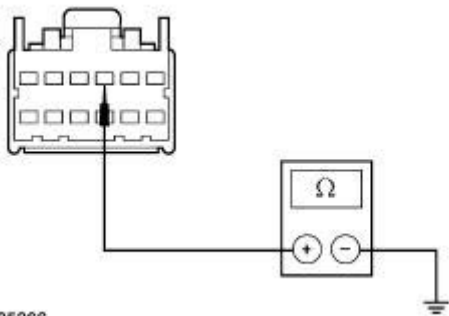
- Is the voltage greater than 10 volts?

→ **Yes**
GO to C8.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

C8 CHECK CIRCUIT 31-MD41 (BK/OG) FOR OPEN

1



A0005266

1

Measure the resistance between the CD changer C243 pin 3, circuit 31-MD41 (BK/OG), harness side and ground.

- Is the resistance less than 5 ohms?

→ **Yes**
REMOVE the CD changer and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST D: THE AUDIO UNIT DOES NOT DISPLAY CD CHANGER INFORMATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK OPERATION OF THE CD CHANGER	
1	



- 2 Turn on the audio unit.
- 3 Verify that the audio unit is operating correctly. Refer to the owner literature.
- 4 Verify that the CD changer power loading function is operating correctly. Refer to the owner literature.

● **Is the CD changer information displayed on the audio unit display?**

→ **Yes**
GO to Pinpoint Test C.

→ **No**
GO to D2.

D2 CARRY OUT THE BEZEL DISPLAY TEST

- 1 Carry out the bezel display test. Press preset buttons 3 and 6 simultaneously. Within the first five seconds, while in the speaker walk-around test, press preset button 5. All segments of the bezel display should illuminate for approximately five seconds and DISPLAY TEST will be shown on the display.

● **Does the display test illuminate all segments?**

→ **Yes**
GO to D3.

→ **No**
REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

D3 CHECK FOR SOUND COMING FROM THE AUDIO SPEAKERS

- 1 Insert a known good CD and press the CD button.
- 2 Carry out the speaker walk-around test by pressing preset buttons 3 and 6 simultaneously.

● **Is sound coming from the speakers?**

→ **Yes**
REMOVE the CD changer and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

→ **No**
GO to Pinpoint Test C.

PINPOINT TEST E: POOR RECEPTION

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK THE RADIO SIGNAL RECEPTION	

1 Check the audio unit signal reception with the engine running and with the engine off.

- **Is the audio unit signal reception noisy only with the engine running?**

→ **Yes**
GO to E2.

→ **No**
If FM only, GO to E8.

If AM only, GO to E10.

If both FM and AM, GO to E12.

E2 CHECK SUPPRESSION EQUIPMENT

1 Check all required suppression equipment, radio frequency interference suppression bond, and the hood bonding strap for security, cleanliness, and metal-to-metal contact. Refer to Section 415-01.

- **Are the contacts clean, secure, and in metal-to-metal contact?**

→ **Yes**
GO to E3.

→ **No**
INSTALL new radio frequency interference suppression bonds or related equipment CLEAN or SECURE the connections as necessary. TEST the system for normal operation.

E3 CHECK THE CAPACITOR MOUNTING AND CONNECTING CIRCUITS

NOTE: The capacitor mounting points are used to complete the electrical circuit and must be mounted securely to clean surfaces.

1 Check the mounting and connecting circuits of the radio ignition interference capacitor(s) for security, cleanliness, and metal-to-metal contact. Refer to Section 415-01.

- **Are the contacts clean, secure, and in metal-to-metal contact?**

→ **Yes**
GO to E4.

→ **No**
CLEAN or SECURE the connections as necessary. TEST the system for normal operation.

E4 CHECK RADIO IGNITION INTERFERENCE CAPACITOR(S) AND THE GENERATOR

1 Check the operation of the radio ignition interference capacitor(s) by installing known good component(s).

2 Check the generator by disconnecting the wiring harness from the voltage regulator.

3



4 Check the operation of the audio unit.

● **Is the noise eliminated?**

→ **Yes**
REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

→ **No**
GO to E5.

E5 CHECK IGNITION CIRCUITS

1



2 Check the ignition circuits for correct routing, grounding, and security of connections.

● **Are the circuits OK?**

→ **Yes**
GO to E6.

→ **No**
REPAIR the circuit as necessary. TEST the system for normal operation.

E6 CHECK THE IGNITION SYSTEM

1 Test the ignition system; refer to Section 303-07A or Section 303-07B.

● **Is the ignition system OK?**

→ **Yes**
GO to E7.

→ **No**
REPAIR the ignition system. REFER to Section 303-07A or Section 303-07B. TEST the system for normal operation.

E7 SUBSTITUTE THE AUDIO UNIT

1



2 Substitute a known good audio unit.

3



4 Check the operation of the audio unit.

● **Is the noise eliminated?**

→ **Yes**

REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

→ **No**

REINSTALL the original audio unit. USE a jumper cable to GROUND various parts of the vehicle to the frame (for example: engine, fenders, quarter panels, stone deflectors, air cleaner, body sheet metal). When the noise is eliminated, PROVIDE a permanent ground where necessary. TEST the system for normal operation.

E8 CHECK FM ANTENNA FOR DAMAGE

1



2



FM Antenna Lead Terminal

3 Measure the resistance between the FM antenna cable lead terminal and the end of the FM antenna grid wire.

● **Is the resistance less than 8 ohms?**

→ **Yes**

GO to E9.

→ **No**

REPAIR the antenna; REFER to Section 415-02.

E9 SUBSTITUTE FM ANTENNA EXTENSION CABLE

1



2 Substitute a known good antenna cable between the antenna isolator module and the FM antenna.

3



4 Check the operation of the audio unit.

● **Is the noise eliminated?**

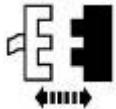
- **Yes**
INSTALL a new antenna cable; REFER to Section 415-02. TEST the system for normal operation.
- **No**
REINSTALL the original antenna cable. GO to E13.

E10 CHECK AM ANTENNA FOR DAMAGE

1



2



Rear Window Defroster Grid

- 3 Measure the resistance between the left side rear window defroster terminal and the right side rear window defroster terminal.

- **Is the resistance less than 1 ohm?**

- **Yes**
GO to E11.

- **No**
REPAIR the antenna; REFER to Section 415-02.

E11 SUBSTITUTE AM ANTENNA EXTENSION CABLE

1



- 2 Substitute a known good antenna cable between the antenna isolator module and the AM antenna (rear window defroster).

3





- 4 Check the operation of the audio unit.

- **Is the noise eliminated?**



- **Yes**
INSTALL a new antenna cable; REFER to Section 415-02. TEST the system for normal operation.

- **No**
REINSTALL the original antenna cable. GO to E13.

E12 SUBSTITUTE ANTENNA EXTENSION CABLE(S)

<p>1</p> 	<p>2</p> <p>Substitute a known good antenna cable(s) between the antenna isolator module and the audio unit.</p>
<p>3</p> 	<p>4</p> <p>Check the operation of the audio unit.</p> <p>● Is the noise eliminated?</p> <p>→ Yes INSTALL a new antenna cable; REFER to <u>Section 415-02</u>. TEST the system for normal operation.</p> <p>→ No REINSTALL the original antenna cable. GO to <u>E13</u>.</p>

E13 SUBSTITUTE ANTENNA ISOLATOR MODULE

<p>1</p> 	<p>2</p> <p>Substitute a known good antenna isolator module.</p>
<p>3</p> 	<p>4</p> <p>Check the operation of the audio unit.</p> <p>● Is the noise eliminated?</p> <p>→ Yes INSTALL a new antenna isolator module; REFER to <u>Section 415-02</u>. TEST the system for normal operation.</p> <p>→ No REINSTALL the original antenna isolator module. REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.</p>

PINPOINT TEST F: CONTINUOUS SEEK/SCAN IN AM/FM

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK OPERATION OF THE SEEK/SCAN FUNCTIONS	
<p>1</p>	



2 Operate the SEEK/SCAN functions with the audio unit in both AM and FM tuner modes.

- Do the SEEK/SCAN functions search continuously in both AM and FM tuner modes?

→ **Yes**
GO to F6.

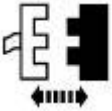
→ **No**
If FM only, GO to F2.
If AM only, GO to F4.

F2 CHECK FM ANTENNA FOR DAMAGE

1



2



FM Antenna Lead Terminal

3 Measure the resistance between the FM antenna cable lead terminal and the end of the FM antenna grid wire.

- Is the resistance less than 8 ohms?

→ **Yes**
GO to F3.

→ **No**
REPAIR the antenna; REFER to Section 415-02.

F3 SUBSTITUTE FM ANTENNA EXTENSION CABLE

2



1 Substitute a known good antenna cable between the antenna isolator module and the FM antenna.

3 Check the operation of the audio unit.

- Is the noise eliminated?

→ **Yes**
INSTALL a new antenna cable; REFER to Section 415-02. TEST the

system for normal operation.

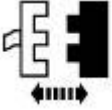
→ **No**
REINSTALL the original antenna cable. GO to F7.

F4 CHECK AM ANTENNA FOR DAMAGE

1



2



Rear Window Defroster Grid

3 Measure the resistance between the left side rear window defroster terminal and the right side rear window defroster terminal.

● **Is the resistance less than 1 ohm?**

→ **Yes**
GO to F5.

→ **No**
REPAIR the antenna; REFER to Section 415-02.

F5 SUBSTITUTE AM ANTENNA EXTENSION CABLE

1



2 Substitute a known good antenna cable between the antenna isolator module and the AM antenna (rear window defroster).

3



4 Check the operation of the audio unit.

● **Is the noise eliminated?**

→ **Yes**
INSTALL a new antenna cable; REFER to Section 415-02. TEST the system for normal operation.

→ **No**
REINSTALL the original antenna cable. GO to F7.

F6 SUBSTITUTE ANTENNA EXTENSION CABLE

1



2 Substitute a known good antenna cable between the antenna isolator module and the audio unit.

3



4 Check the operation of the audio unit.

● **Is the noise eliminated?**

→ **Yes**

INSTALL a new antenna cable; REFER to [Section 415-02](#). TEST the system for normal operation.

→ **No**

REINSTALL the original antenna cable. GO to [F7](#).

F7 SUBSTITUTE ANTENNA ISOLATOR MODULE

1



2 Substitute a known good antenna isolator module.

3



4 Check the operation of the audio unit.

● **Do the SEEK/SCAN functions operate correctly?**

→ **Yes**

INSTALL a new antenna isolator module; REFER to [Section 415-02](#). TEST the system for normal operation.

→ **No**

REINSTALL the original antenna isolator module. REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

PINPOINT TEST G: POOR QUALITY/DISTORTED SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS)

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK FOR POOR SOUND	
1	



- 2 Turn on the audio unit.
- 3 Carry out the speaker walk-around test by pressing preset buttons 3 and 6 simultaneously.

• **Do all the audio speakers have poor sound quality?**

→ **Yes**
 REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

→ **No**
 GO to G2.

G2 CHECK THE CIRCUITS TO THE SPEAKER(S)

1



2



Audio Unit C240c

3





Poor Sounding
 Audio Speaker
 (s)

- 4 Measure the resistances between the distorted audio speaker connector and the audio unit C240c; and between the following distorted audio speaker connector pins, harness side and ground as follows:

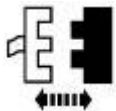
Speaker	Speaker Connector	Audio Unit C240c Pin	Circuit
LR	C702	13	10-MD11 (GY/WH)
LR	C702	12	8-MD11 (WH/VT)
LF	C523	15	10-MD10 (GY/BK)
LF	C523	14	8-MD10 (WH/BK)
RR	C802	6	10-MD18 (GY)
RR	C802	5	8-MD18 (WH)
RF	C612	8	10-MD17 (GY/RD)
RF	C612	7	8-MD17

	(WH/RD)
	<ul style="list-style-type: none"> ● Are the resistance(s) less than 5 ohms between the distorted audio speaker connector(s) and the audio unit, and greater than 10,000 ohms between the audio speaker connector(s) and ground? <p>→ Yes GO to <u>G3</u>.</p> <p>→ No REPAIR the circuit in question. TEST the system for normal operation.</p>
G3 CHECK THE SPEAKER	
	<p>1 Substitute the poor quality speaker with a known good component.</p> <ul style="list-style-type: none"> ● Is the sound quality OK? <p>→ Yes INSTALL a new audio speaker(s). TEST the system for normal operation.</p> <p>→ No REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.</p>

PINPOINT TEST H: NO SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS)

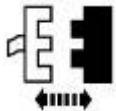
CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK FOR SOUND	
<p>1</p> 	<p>2 Turn on the audio unit.</p> <p>3 Carry out the speaker walk-around test by pressing preset buttons 3 and 6 simultaneously.</p> <ul style="list-style-type: none"> ● Are all the audio speakers without sound? <p>→ Yes GO to <u>Pinpoint Test J</u>.</p> <p>→ No GO to <u>H2</u>.</p>
H2 CHECK THE CIRCUITS BETWEEN THE SPEAKER(S) AND THE AUDIO UNIT	
<p>1</p> 	

2



Audio Unit C240c

3



Silent Audio Speaker(s)

4 Measure the resistance between the silent audio speaker connector and the audio unit C240c; and between the silent audio speaker connector, harness side and ground as follows:

Speaker	Speaker Connector	Audio Unit C240c Pin	Circuit
LR	C702	13	10-MD11 (GY/WH)
LR	C702	12	8-MD11 (WH/VT)
LF	C523	15	10-MD10 (GY/BK)
LF	C523	14	8-MD10 (WH/BK)
RR	C802	6	10-MD18 (GY)
RR	C802	5	8-MD18 (WH)
RF	C612	8	10-MD17 (GY/RD)
RF	C612	7	8-MD17 (WH/RD)

- Are the resistance(s) less than 5 ohms between the audio speaker connector(s) and the audio unit, and greater than 10,000 ohms between the audio speaker connector(s) and ground?

→ **Yes**
GO to H3.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

H3 SUBSTITUTE SPEAKER

2



1 Substitute a known good audio speaker for each silent audio speaker.

3 Turn on the audio unit.



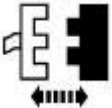

- Are the known good audio speaker(s) silent?

→ **Yes**

REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

→ **No**
 INSTALL a new audio speaker(s) in question. TEST the system for normal operation.

PINPOINT TEST I: NO SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS) — CENTER IMAGING

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 CHECK FOR SOUND	
<p>1</p> 	<p>2 Turn on the audio unit.</p> <p>3 Carry out the speaker walk-around test by pressing preset buttons 3 and 6 simultaneously.</p> <ul style="list-style-type: none"> ● Are all the audio speakers without sound? <p>→ Yes GO to Pinpoint Test J.</p> <p>→ No If one center imaging speaker is inoperative, GO to I2.</p> <p>If both center imaging speakers are inoperative, GO to I4.</p>
I2 CHECK THE CIRCUITS BETWEEN THE SPEAKER(S) AND THE CENTER IMAGING AMPLIFIER	
<p>1</p>  <p>2</p>  <p>Center Imaging Amplifier C225</p> <p>3</p>  <p>Silent Audio Speaker(s)</p>	

- 4 Measure the resistance between the silent audio speaker connector and center imaging amplifier C225; and between the silent audio speaker connector and ground as follows:

Speaker	Speaker Connector	C225 Pin	Circuit
LH	C230	7	8-MD30 (WH/BU)
LH	C230	8	10-MD30 (GY/VT)
RH	C231	5	8-MD31 (WH/GN)
RH	C231	6	10-MD31 (GY/OG)

- Are the resistance(s) less than 5 ohms between the audio speaker connector(s) and the audio unit, and greater than 10,000 ohms between the audio speaker connector(s) and ground?

→ **Yes**
GO to I3.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

I3 SUBSTITUTE SPEAKER

2



- 1 Substitute a known good audio speaker for each silent audio speaker.

- 3 Turn on the audio unit.

- Are the known good audio speaker(s) silent?

→ **Yes**
REMOVE the center imaging amplifier and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

→ **No**
INSTALL a new audio speaker(s) in question. TEST the system for normal

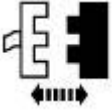
operation.

14 CHECK CENTER IMAGING AMPLIFIER ENABLE CIRCUIT FOR POWER

1



2

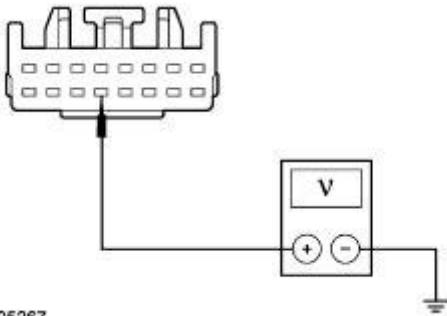


Center Imaging Amplifier C225

3



5



A0005267

4 Turn on the audio unit.

5 Measure the voltage between the center imaging amplifier C225 pin 13, circuit 7-MD12 (YE), harness side and ground.

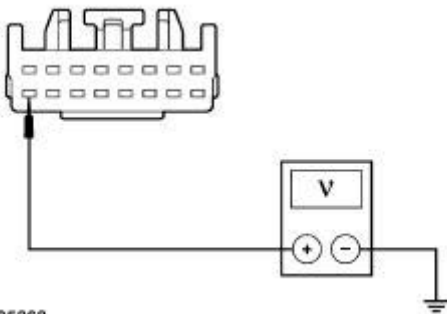
• Is voltage present?

→ **Yes**
GO to 15.

→ **No**
GO to 19.

15 CHECK POWER TO THE CENTER IMAGING AMPLIFIER

1



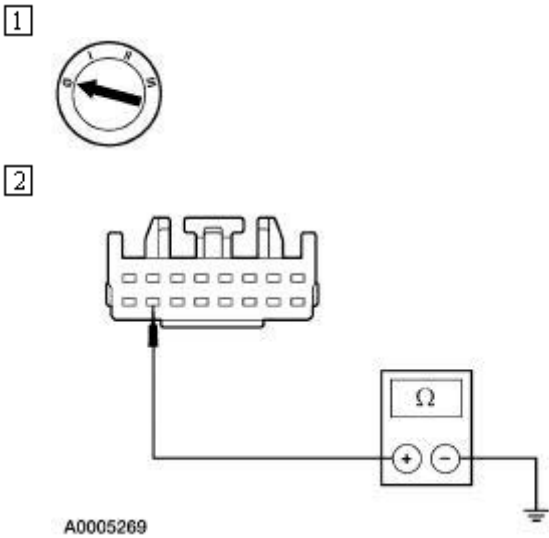
A0005268

1 Measure the voltage between the center imaging amplifier C225 pin 16, circuit 29-MD12 (OG/YE), harness side and ground.

• Is the voltage greater than 10 volts?

- **Yes**
GO to 16.
- **No**
REPAIR the circuit. TEST the system for normal operation.

16 CHECK GROUND TO THE CENTER IMAGING AMPLIFIER

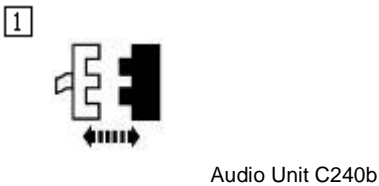


- 2** Measure the resistance between the center imaging amplifier C225 pin 15, circuit 31-MD12 (BK/YE), harness side and ground.

● **Is the resistance less than 5 ohms?**

- **Yes**
GO to 17.
- **No**
REPAIR the circuit. TEST the system for normal operation.

17 CHECK THE CIRCUITS BETWEEN THE AUDIO UNIT AND THE CENTER IMAGING AMPLIFIER



- 2** Measure the resistance between the audio unit C240b and the center imaging amplifier C225; and between the audio unit C240b and ground as follows:

Audio Unit 240b Pin	Center Imaging Amplifier C225 Pin	Circuit
5	2	2-MD12 (GY)
6	1	1-MD12 (WH)

● **Are the resistance(s) less than 5**

ohms between the audio unit and the center imaging amplifier, and greater than 10,000 ohms between the audio unit and ground?

→ **Yes**
GO to 18.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

18 CHECK THE AUDIO UNIT

1 Substitute the audio unit with a known good component.

● **Do the center imaging speakers operate?**

→ **Yes**
REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

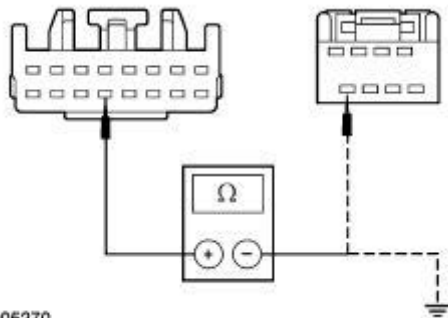
→ **No**
REMOVE the center imaging amplifier and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

19 CHECK THE ENABLE CIRCUIT TO THE CENTER IMAGING AMPLIFIER

1



2




2 Measure the resistance between the center imaging amplifier C225 pin 13, circuit 7-MD12 (YE), harness side and the audio unit C240b pin 8, circuit 7-MD12 (YE), harness side; and between the center imaging amplifier C225 pin 13, circuit 7-MD12 (YE), harness side and ground.

● **Is the resistance less than 5 ohms between the center imaging amplifier and the audio unit and greater than 10,000 ohms between the center imaging amplifier and ground?**


→ **Yes**
REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility.

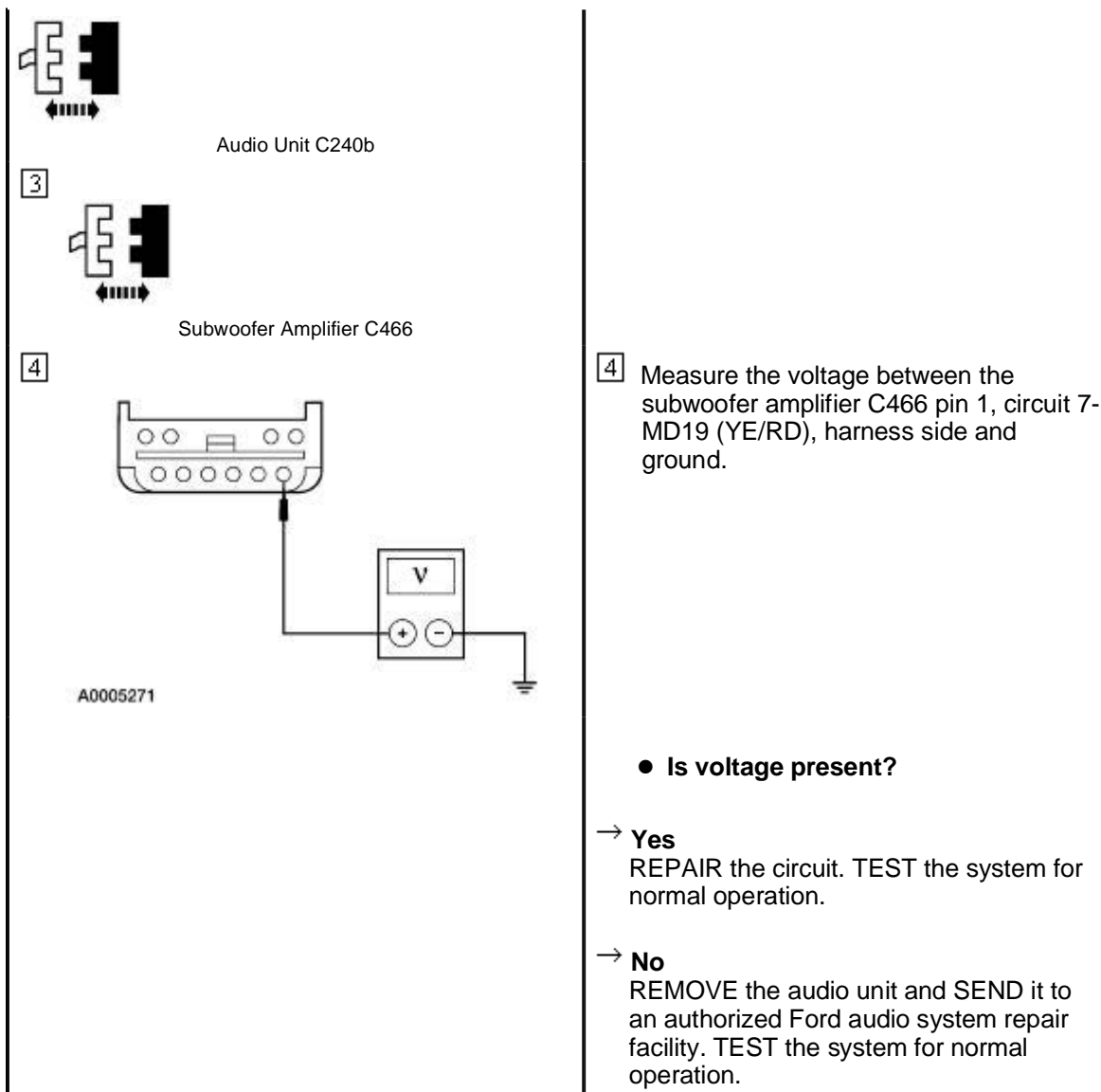
	<p>TEST the system for normal operation.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
--	---

PINPOINT TEST J: NO SOUND FROM ALL SPEAKERS


CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 CHECK FOR AUDIO UNIT POWER	
<p>1</p> 	<p>2 Turn on the audio unit.</p> <ul style="list-style-type: none"> ● Does the display on the audio unit illuminate? <p>→ Yes GO to <u>J2</u>.</p> <p>→ No GO to <u>Pinpoint Test B</u>.</p>
J2 CHECK FOR SOUND	
	<p>1 Carry out the speaker walk-around test by pressing preset buttons 3 and 6 simultaneously.</p> <ul style="list-style-type: none"> ● Are all the audio speakers without sound? <p>→ Yes REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.</p> <p>→ No GO to <u>Pinpoint Test H</u>.</p>

PINPOINT TEST K: LOUD POPS WHEN CYCLING THE IGNITION SWITCH

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 CHECK CIRCUIT 7-MD19 (YE/RD) FOR POWER	
<p>1</p>  <p>2</p>	



PINPOINT TEST L: THE SUBWOOFER IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1 CHECK THE SUBWOOFER OPERATION	
<p>1</p> 	<p>2 Turn the audio unit on.</p> <p>3 Check the operation of the subwoofer speakers.</p> <ul style="list-style-type: none"> • Are both subwoofer speakers inoperative? <p>→ Yes GO to <u>L2</u>.</p>

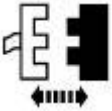
→ **No**
GO to L8.

L2 CHECK THE AUDIO UNIT OUTPUT TO THE SUBWOOFER AMPLIFIER

1



2

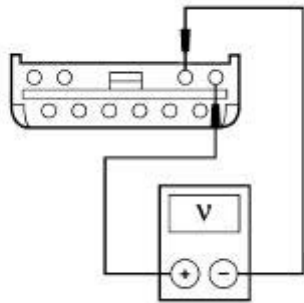


Subwoofer Amplifier C466

3



4



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4 While adjusting the volume control, measure the voltage between the subwoofer amplifier C466 pin 7, circuit 1-MD19 (WH/RD) harness side and C466 pin 8, circuit 2-MD19 (GY/RD) harness side.

- Does the voltage vary between 0 and 1.5 A/C volts?

→ **Yes**
GO to L3.

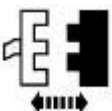
→ **No**
Go To Pinpoint Test B.

L3 CHECK CIRCUIT 7-MD19 (YE/RD) FOR POWER

1



2

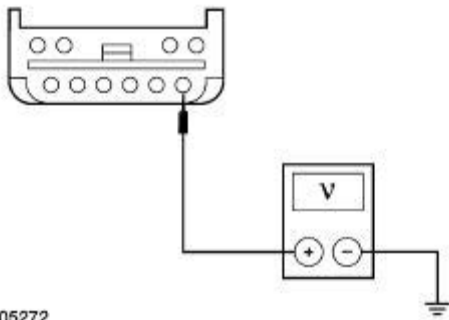


Subwoofer Amplifier C466

3



4



A0005272

4 Measure the voltage between the subwoofer amplifier C466 pin 1, circuit 7-MD19 (YE/RD), harness side and ground.

● Is voltage present?

→ **Yes**
GO to L4.

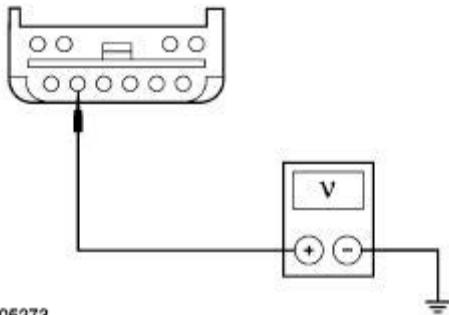
→ **No**
GO to L9.

L4 CHECK CIRCUIT 30-MD19 (RD) FOR VOLTAGE

1



2



A0005273

2 Measure the voltage between the subwoofer amplifier C466 pin 5, circuit 30-MD19 (RD), harness side and ground.

● Is the voltage greater than 10 volts?

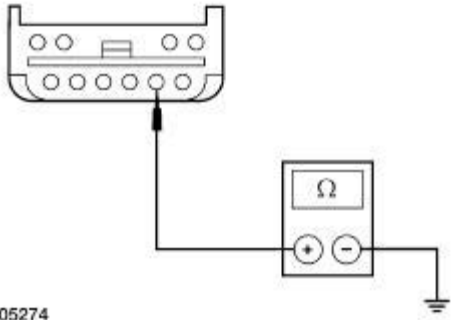
→ **Yes**
GO to L5.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

L5 CHECK GROUND CIRCUIT 31-MD19 (BK)

1

1 Measure the resistance between the subwoofer amplifier C466 pin 2, circuit 31-MD19 (BK), harness side and ground.



A0005274

- Is the resistance less than 5 ohms?

→ **Yes**
GO to L6.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

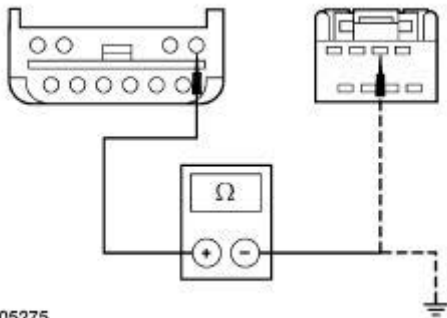
L6 CHECK CIRCUIT 1-MD19 (WH/RD)

1



Audio Unit C240b

2



A0005275

- 2 Measure the resistance between the subwoofer amplifier C466 pin 7, circuit 1-MD19 (WH/RD), harness side and the audio unit C240b pin 2, circuit 1-MD19 (WH/RD), harness side; and between the subwoofer amplifier C466 pin 7, circuit 1-MD19 (WH/RD), harness side and ground.

- Is the resistance less than 5 ohms between the subwoofer amplifier and the audio unit, and greater than 10,000 ohms between the subwoofer amplifier and ground?

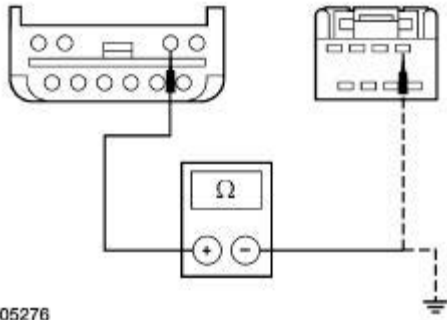
→ **Yes**
GO to L7.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

L7 CHECK CIRCUIT 2-MD19 (GY/RD)

1

- 1 Measure the resistance between the subwoofer amplifier C466 pin 8, circuit 2-MD19 (GY/RD), harness side and the



A0005276

audio unit C240b pin 1, circuit 2-MD19 (GY/RD), harness side; and between the subwoofer amplifier C466 pin 8, circuit 2-MD19 (GY/RD), harness side and ground.

- **Is the resistance less than 5 ohms between the subwoofer amplifier and the audio unit, and greater than 10,000 ohms between the subwoofer amplifier and ground?**

→ **Yes**

REMOVE the subwoofer amplifier and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

→ **No**

REPAIR the circuit. TEST the system for normal operation.

L8 CHECK SUBWOOFER SPEAKER

1



3



2

Substitute the inoperative subwoofer speaker with a known good subwoofer speaker.

4

Check the operation of the subwoofer speakers.

- **Does the known good subwoofer speaker operate correctly?**

→ **Yes**

INSTALL a new subwoofer speaker; REFER to [Section 415-03](#). TEST the system for normal operation.

→ **No**

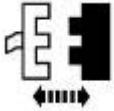
REPAIR the circuit between the subwoofer amplifier and the inoperative subwoofer speaker. TEST the system for normal operation.

L9 CHECK CIRCUIT 7-MD19 (YE/RD) FOR OPEN

1

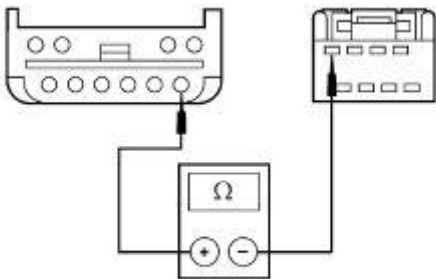


2



Audio Unit C240b

3



A0005277

3

Measure the resistance between the subwoofer amplifier C466 pin 1, circuit 7-MD19 (YE/RD), harness side and the audio unit C240b pin 4, circuit 7-MD19 (YE/RD), harness side.

● **Is the resistance less than 5 ohms?**


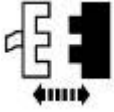
→ **Yes**

REMOVE the subwoofer amplifier and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

→ **No**

REPAIR the circuit. TEST the system for normal operation.

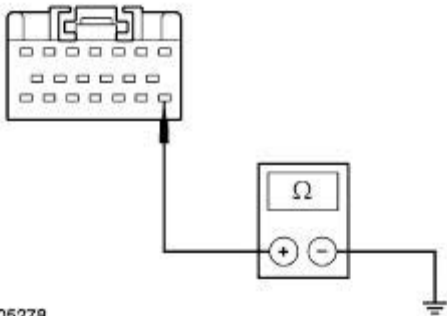
PINPOINT TEST M: THE AUXILIARY AUDIO CONTROL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY — STEERING WHEEL CONTROL SWITCHES

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1 CHECK THE STEERING WHEEL CONTROL SWITCH RESISTANCES	
<p>1</p>  <p>2</p>  <p>Audio Unit C240a</p>	

3



4



A0005278

4

Measure the resistance between the audio unit C240a pin 14, circuit 8-MD26 (WH/BK), harness side and ground while depressing the steering wheel control switches as follows:

Switch	Resistance range
VOL Down	53.1-54.1 ohms
VOL Up	145.3-148.1 ohms
SEEK Up	297.7-303.7 ohms
SEEK Down	556.1-567.3 ohms
MEDIA	1026.4-1047.0 ohms
Phone/Mute	2016.4-2057.0 ohms
None	greater than 10,000 ohms

● Are the resistances within specification?

→ Yes

REMOVE the audio unit and SEND it to an authorized Ford audio system repair facility. TEST the system for normal operation.

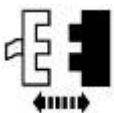
→ No

GO to M2.

M2 CHECK CIRCUIT 8-MD26 (WH/BK)

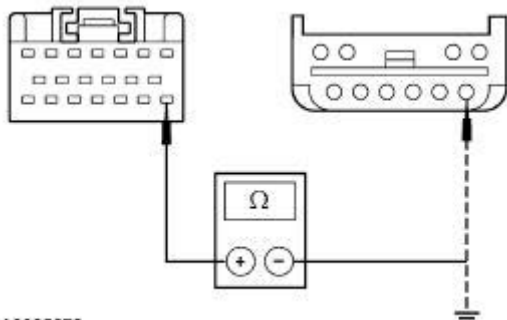
NOTE: Before disconnecting the clockspring deactivate the air bags. REFER to Section 501-20B.

1



Clockspring C218a

2



A0005279

2

Measure the resistance between the audio unit C240a pin 14, circuit 8-MD26 (WH/BK), harness side and the clockspring C218a pin 1, circuit 8-MD26 (WH/BK), harness side; and between the audio unit C240a pin 14, circuit 8-MD26 (WH/BK), harness side and ground.

- Is the resistance less than 5 ohms between the audio unit and the clockspring, and greater than 10,000 ohms between the audio unit and ground?

→ **Yes**
GO to M3.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

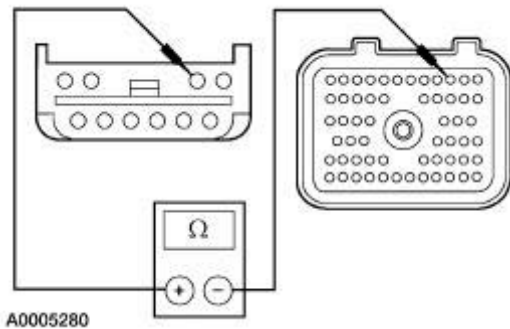
M3 CHECK CIRCUIT 31S-PG24 (BK/OG)

1



PCM 175a

2



2

Measure the resistance between the clockspring C218a pin 8, circuit 31S-PG24 (BK/OG), harness side and the PCM C175a pin 56, circuit 31S-PG24 (BK/OG), harness side; and between the clockspring C218a pin 8, circuit 31S-PG24 (BK/OG), harness side and ground.

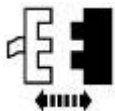
- Is the resistance less than 5 ohms?

→ **Yes**
GO to M4.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

M4 CHECK THE CLOCKSPRING

1

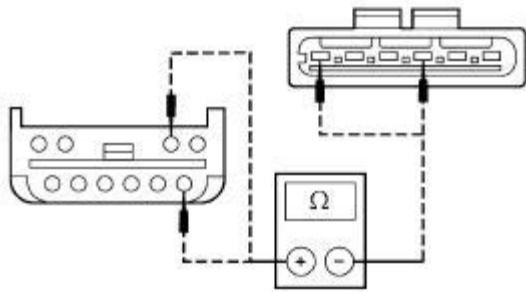


Clockspring C217

2

2

Measure the resistance between the clockspring C218a pin 1, component side and horn switch C217 pin 6, component side; and between the clockspring C218a pin 8, component side and the horn switch C217 pin 3, component side.



A0005281

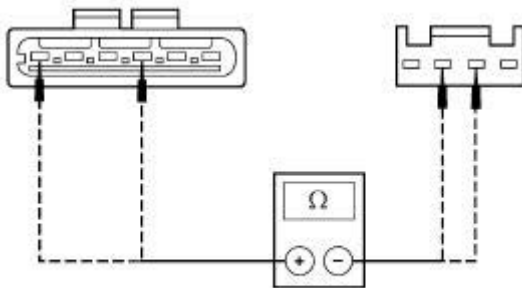
- Are the resistances less than 5 ohms?

→ **Yes**
GO to M5.

→ **No**
INSTALL a new clockspring; REFER to Section 501-20B. TEST the system for normal operation.

M5 CHECK THE HORN SWITCH

1



A0005282

1

Measure the resistance between the horn switch C217 pin 6, component side and steering wheel control switch C208 pin 3, component side; and between the horn switch C217 pin 3, component side and the steering wheel control switch C208 pin 2, component side.

- Are the resistances less than 5 ohms?

→ **Yes**
INSTALL new steering wheel control switches. TEST the system for normal operation.

→ **No**
INSTALL a new horn switch; REFER to Section 413-06. TEST the system for normal operation.

Torque Specifications

Description	Nm	lb-in
Battery ground cable	10	89
CD changer bolts	5	44
CD changer nut	5	44
Center imaging amplifier nuts	5	44

Audio System

The audio system consists of the following:

- P100i audio unit
 - CDX6 audio unit
 - four premium speakers (audiophile)
 - two subwoofer speakers (audiophile)
 - two center imaging speakers (audiophile)
 - center imaging amplifier (audiophile)(located in the left side of instrument panel)
 - CD changer (located in the glove compartment)(if equipped)
 - antenna isolator module (AIM)(located in the rear package tray)
 - steering wheel controls
-

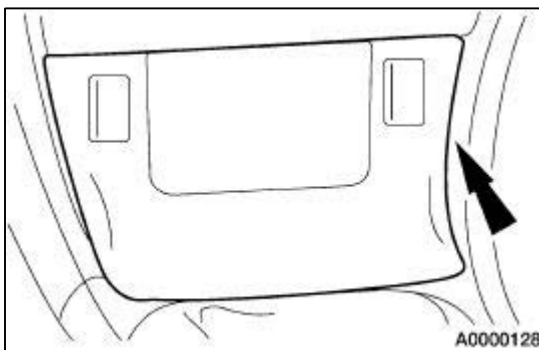
Audio System

Refer to Section 415-00 .

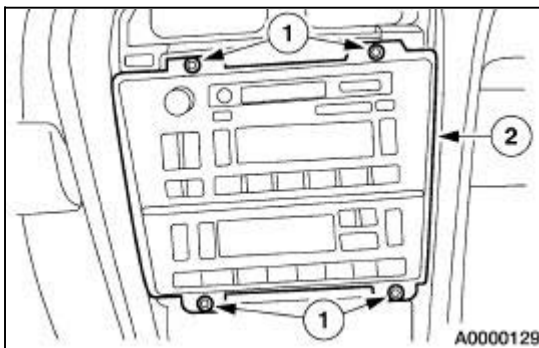
Audio Unit

Removal and Installation

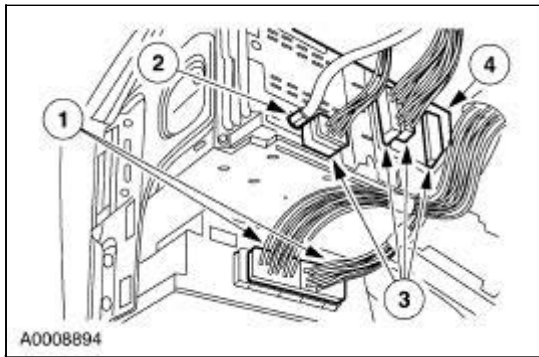
1. Disconnect the battery ground cable. Refer to [Section 414-01](#).
2. Remove the center A/C register finish panel. For additional information, refer to [Section 412-01](#).
3. Remove the ashtray finish panel.
 - Disconnect the electrical connectors.



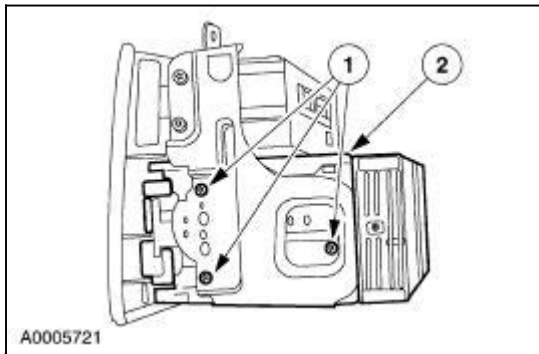
4. Position the audio/DATC assembly.
 1. Remove the bolts.
 2. Position the audio unit.



5. Remove the audio/DATC assembly.
 1. Disconnect the DATC electrical connectors.
 2. Disconnect the antenna lead-in cable.
 3. Disconnect the audio unit electrical connectors.
 4. Remove the audio unit.



6. Separate the audio unit from the audio/DATC assembly.
 1. Remove the six screws.
 2. Separate the audio unit.



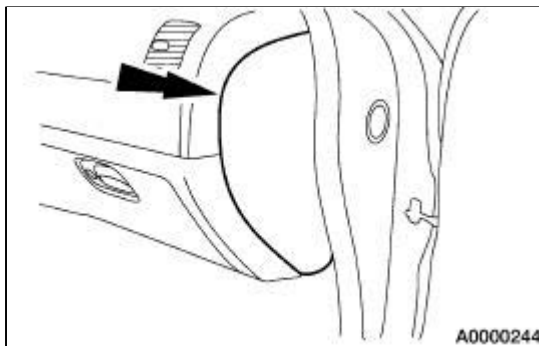
7. To install, reverse the removal procedure.
-

Compact Disc (CD) Changer

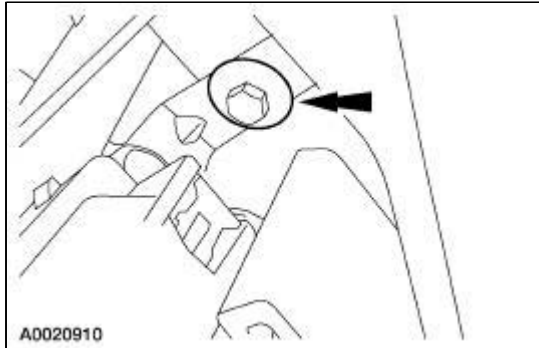
Removal and Installation

NOTE: Prior to the removal of the CD changer, it is necessary to remove the magazine.

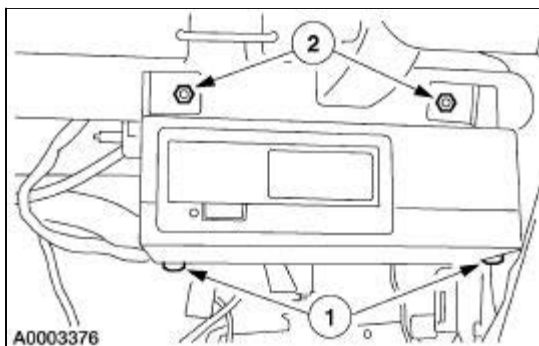
1. Remove the glove compartment. For additional information, refer to [Section 501-12](#).
2. Remove the RH end panel.



3. Remove the CD changer bracket bolt.



4. Remove the CD changer.
 1. Remove the two bolts.
 2. Remove the nuts.
 - Disconnect the electrical connector.



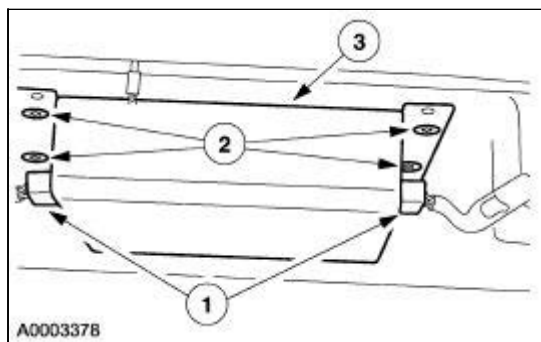
5. Remove the brackets from the CD changer.

6. To install, reverse the removal procedure.

Amplifier —Subwoofer

Removal and Installation

1. Disconnect the battery. For additional information, refer to [Section 414-01](#).
2. Open the luggage compartment lid.
3. Remove the subwoofer amplifier.
 1. Disconnect the electrical connectors.
 2. Remove the bolts.
 3. Remove the subwoofer amplifier.

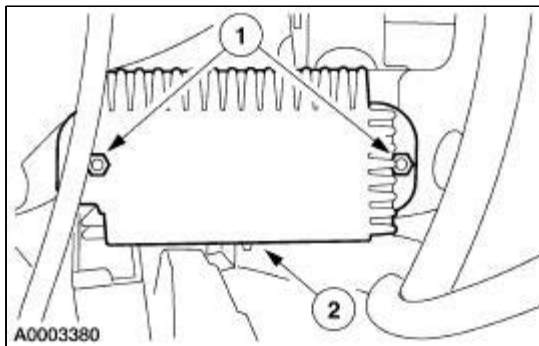


4. To install, reverse the removal procedure.
-

Amplifier —Center Imaging

Removal and Installation

1. Disconnect the battery. For additional information, refer to [Section 414-01](#).
2. Remove the driver side instrument panel insulator.
3. Remove the driver side lower heat duct.
4. Remove the center imaging amplifier.
 1. Remove the nuts.
 2. Disconnect the electrical connector.

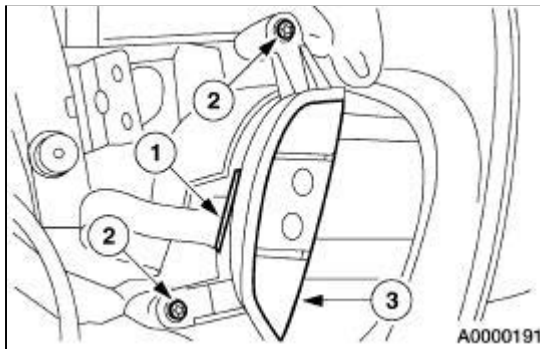


5. To install, reverse the removal procedure.
-

Auxiliary Control —Steering Wheel Switch

Removal and Installation

1. Remove the driver side air bag module. For additional information, refer to [Section 501-20B](#).
2. Remove the auxiliary control.
 1. Disconnect the electrical connector.
 2. Remove the screws.
 3. Remove the auxiliary control.



3. To install, reverse the removal procedure.
-

General Specifications

Item	Specification
Grid wire repair kit	ESB-M4J58-A
D8AZ-19562-AA	

Torque Specifications

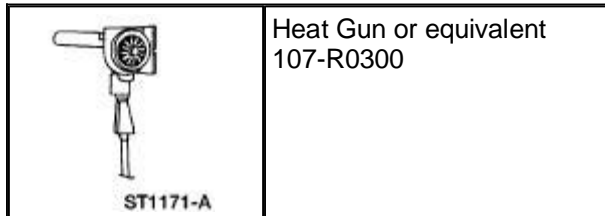
Description	Nm	lb-in
Antenna isolator module bolts	9	80
Battery ground cable bolt	10	89

Antenna

The radio antenna is concealed on the inside of the rear window glass. The AM antenna consists of the rear window defroster grid and the FM antenna is the conductive tracing above the rear window defroster grid. The radio antenna uses an antenna isolator module mounted under the rear package tray trim panel to separate the AM signals, FM signals, and rear defroster power.

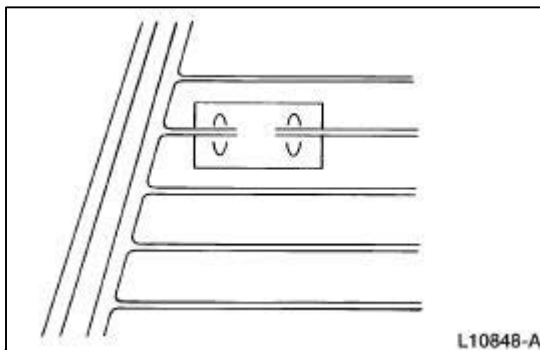
Antenna Grid Wire Repair

Special Tool(s)



NOTE: Any breaks longer than 25.4 mm (1 in) in one grid cannot be repaired. The back window glass must be replaced. Breaks equal to or shorter than 25.4 mm (1 in) in the heated back window grid wire can be successfully repaired by using the following procedure:

1. Obtain a grid wire repair repair kit meeting Ford specification ESB-M4J58-A.
2. The vehicle should be brought inside and allowed to reach 16°C (60°F) or above.
3. Clean the repair area with denatured alcohol.
4. Place the grid line mask over the break aligning the cut out slots on either side of the repair area.



5. Apply the epoxy to the repair area.
6. Remove the mask without disturbing the epoxy.
7. Use Heat Gun to heat the repair area for one to two minutes at a distance of about 25-50 mm (1-2 in). This procedure should heat the repair area to approximately 149°C (300°F).
8. The heated back window may be energized immediately after the repair. Optimum hardness and adhesion will occur after 24 hours. Do not disturb the repaired area until that time.


Antenna

Removal

1. The antenna is integral to the back window glass and can be repaired, but not replaced separately. For removal and installation of the back window glass, refer to [Section 501-11](#) . For repair procedures, refer to [Antenna Grid Wire Repair](#) .
-

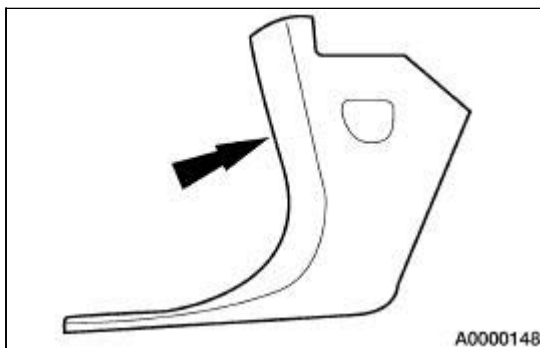
Cable

Removal and Installation

1.  **CAUTION:** The antenna lead-in cable is not removable from the rear lamp wiring harness. If the cable needs to be replaced, leave it in the rear lamp wiring harness, install a new cable on top and secure it with ties.

Disconnect the battery ground cable. Refer to [Section 414-01](#).

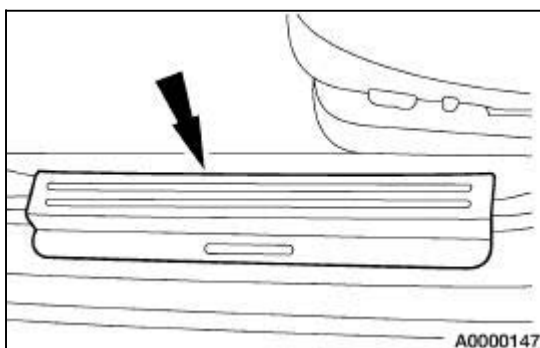
2. Remove the instrument panel. Refer to [Section 501-12](#).
3. Remove the LH A-pillar lower trim panel.



4. **NOTE:** Front LH scuff plate shown. Rear LH scuff plate similar.

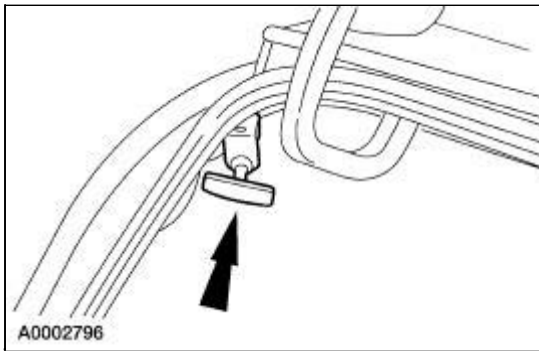
Remove the front and rear LH scuff plates.

- Remove the protective covers to expose the wiring harness.

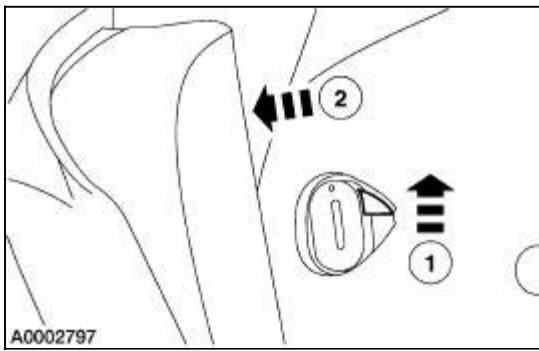


5. Remove the rear seat. For additional information, refer to [Section 501-10](#)
6. **NOTE:** The rear seat back release handles are located in the luggage compartment.

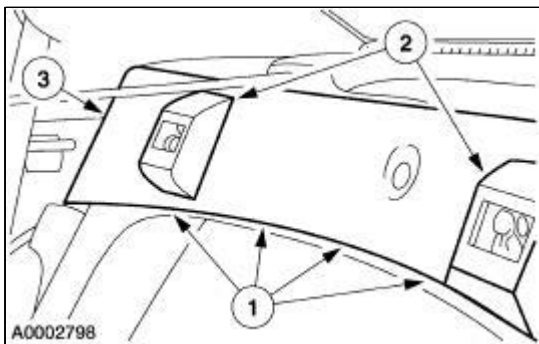
Lower the LH and RH rear seat backrests.



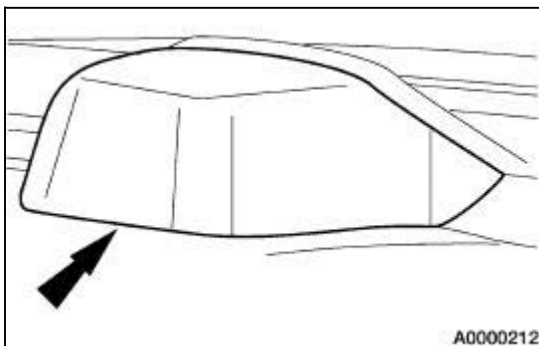
7. Position the LH and RH rear seat side bolsters aside.
 1. Release the upper retaining latches.
 2. Position the rear seat side bolsters aside.



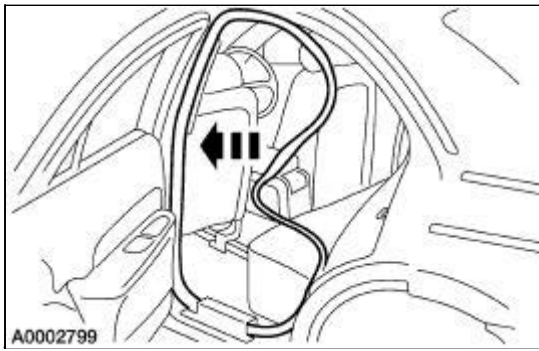
8. Remove the upper pass-through trim panel.
 1. Remove the five pin-type retainers.
 2. Release the latch covers.
 3. Remove the upper pass-through trim panel.



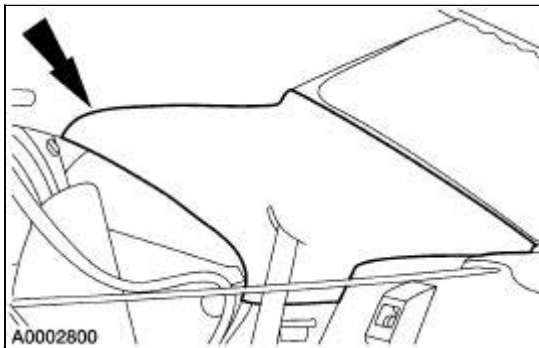
9. Remove the high mounted stoplamp cover.



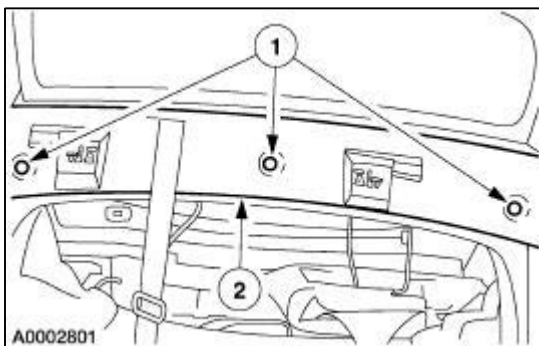
10. Position the LH and RH rear door opening sealing strips aside.



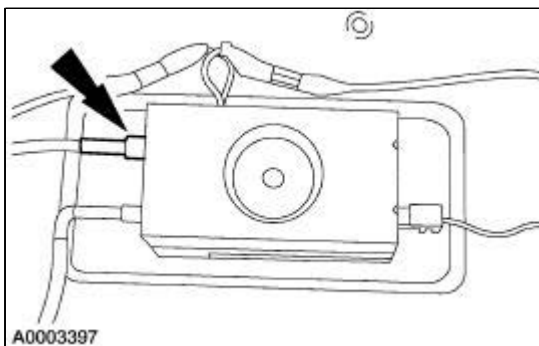
11. Position the LH and RH rear quarter panel trim panels aside.
 - Grasp trim panels at the top and gently pull outward to release the clips.



12. Remove the package tray.
 1. Remove the pin-type retainers.
 2. Remove the package tray.



13. Disconnect the antenna lead-in cable from the antenna isolator module.



14.  **CAUTION:** The antenna lead-in cable is not removable from the rear lamp wiring

harness. If the cable needs to be replaced, leave it in the rear lamp wiring harness, install a new cable on top and secure it with ties.

NOTE: To avoid noise after the new antenna lead-in cable has been installed, cut both ends of the old antenna lead-in cable to remove the metal connectors.

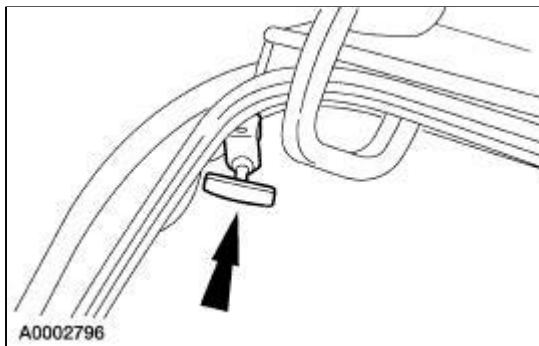
To install, reverse the removal procedure.

Module —Isolator

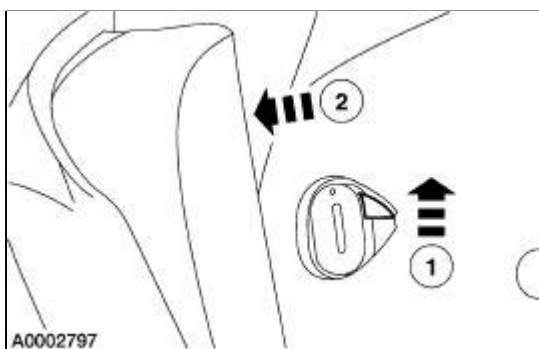
Removal and Installation

1. Disconnect the battery ground cable. Refer to [Section 414-01](#).
2. **NOTE:** The rear seat back release handles are located in the luggage compartment.

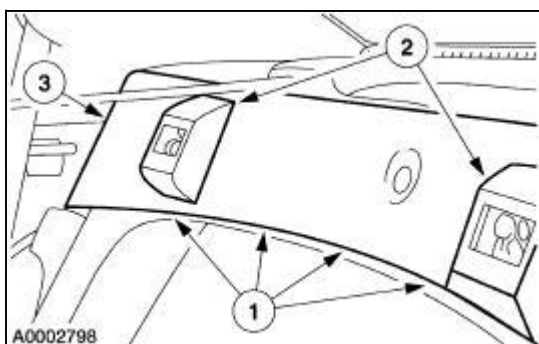
Lower the LH and RH rear seat backrests.



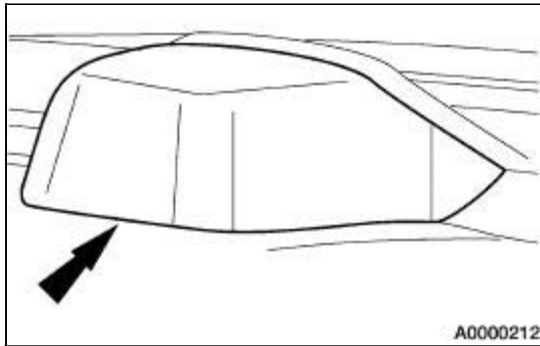
3. Position the LH and RH rear seat side bolsters aside.
 1. Release the upper retaining latches.
 2. Position the rear seat side bolsters aside.



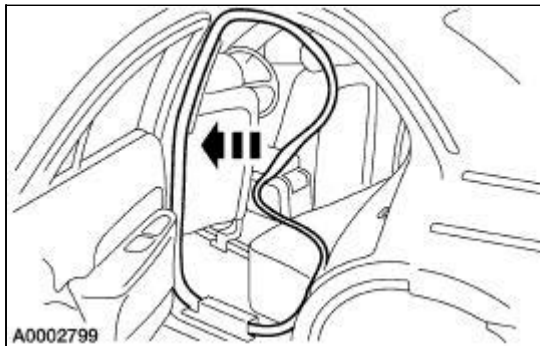
4. Remove the upper pass-through trim panel.
 1. Remove the five pin-type retainers.
 2. Release the latch covers.
 3. Remove the upper pass-through trim panel.



5. Remove the high mounted stoplamp cover.

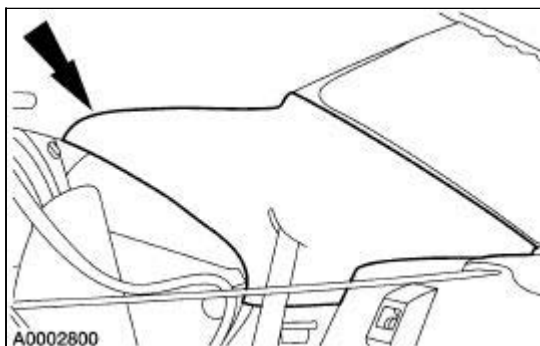


6. Position the LH and RH rear door opening sealing strips aside.



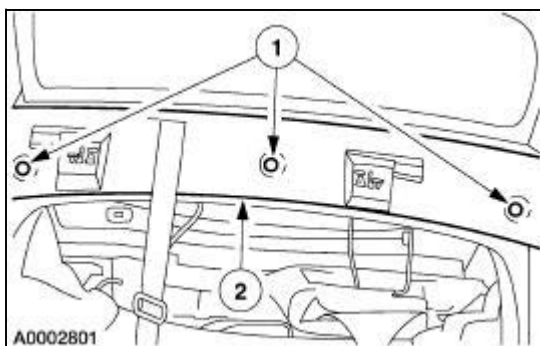
7. Position the LH and RH rear quarter panel trim panels aside.

- Grasp trim panels at the top and gently pull outward to release the clips.



8. Remove the package tray.

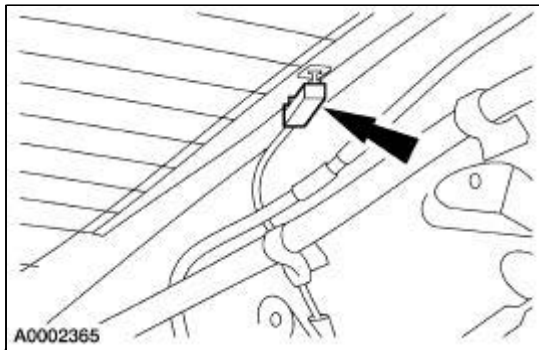
1. Remove the pin-type retainers.
2. Remove the package tray.



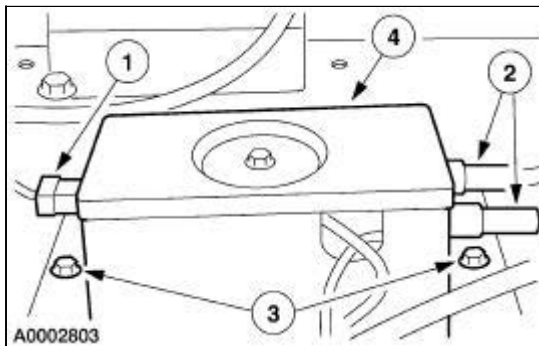
9. **NOTE:** RH rear defroster grid wiring harness shown, LH similar.

Disconnect the LH and RH rear defroster grid wiring harness.

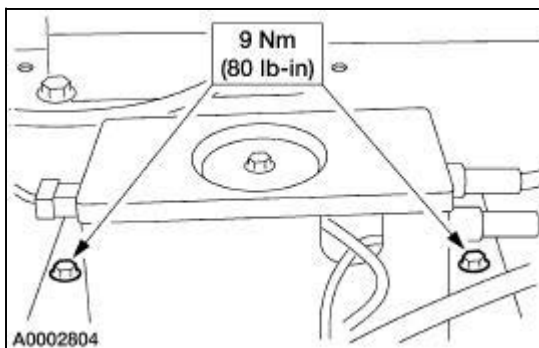
- Release the harness retainers.



10. Remove the isolator module.
1. Disconnect the electrical connector.
 2. Disconnect the antenna lead-in cables.
 3. Remove the bolts.
 4. Remove the isolator module.



11. To install, reverse the removal procedure.



Speakers

There are two speaker systems available:

- The premium sound speaker system.
- The optional audiophile speaker system.

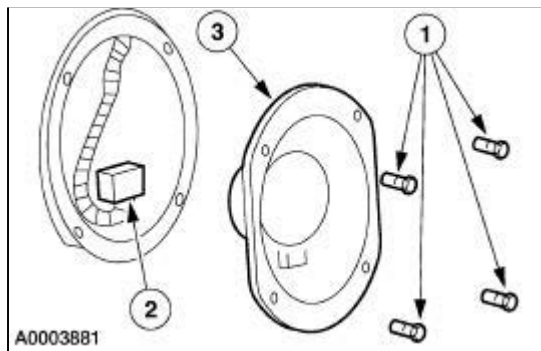
The premium sound system has one speaker mounted in each door.

The optional audiophile system has one two-way speaker mounted in each door, two subwoofer speakers in an enclosure mounted to the package tray, and two center imaging speakers mounted in the center stack area of the instrument panel.

Speaker —Door Mounted

Removal and Installation

1. Remove the door trim panel. Refer to [Section 501-05](#).
2. Remove the speakers.
 1. Remove the screws.
 2. Disconnect the electrical connector.
 3. Remove the speakers.

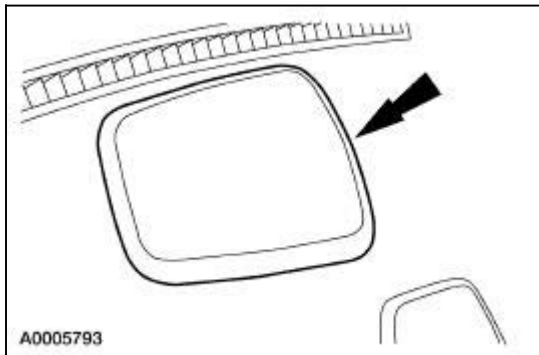


3. To install, reverse the removal procedure.
-

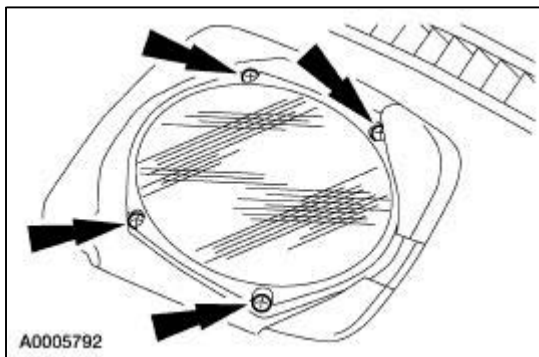
Subwoofer Speaker

Removal and Installation

1. Remove the subwoofer speaker grille.



2. Remove the screws and the speaker.
 - Disconnect the electrical connector.

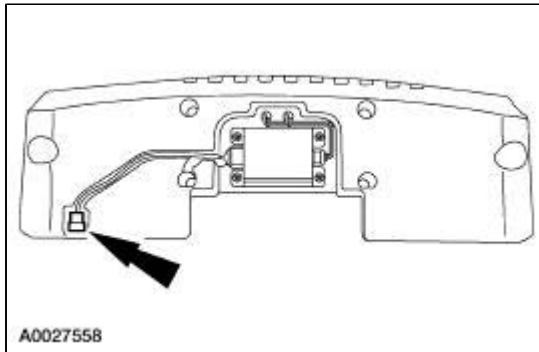


3. To install, reverse the removal procedure.
-

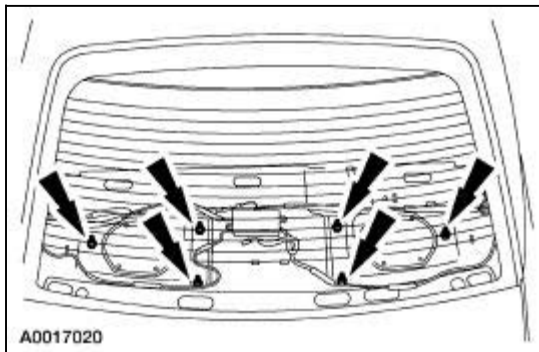
Speaker Enclosure —Subwoofer

Removal and Installation

1. Remove the package tray trim panel. For additional information, refer to [Section 501-05](#).
2. Disconnect the electrical connector.



3. Support the housing and remove the nuts.



4. Transfer all the components to the new housing as necessary.
5. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
Battery ground cable bolt	10	—	89
Fog lamp assembly nuts	5	—	44
Headlamp assembly bolts	6	—	53
Stoplamp assembly nuts	5	—	44

Exterior Lighting

The exterior lighting system consists of:

- headlamps
 - autolamps
 - parking lamps
 - front marker lamps
 - fog lamps
 - rear lamps
 - stoplamps
 - high mounted stoplamp
 - license plate lamps
 - turn signals
 - reversing lamps
 - headlamp switch
 - brake pedal position (BPP) switch
-

Headlamps

Refer to Wiring Diagrams Section [417-01](#), Exterior Lighting for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

NOTE: The front electronic module (FEM), the rear electronic module (REM) and the instrument cluster module (ICM) must be reconfigured before installing a new module. Refer to [Section 418-01](#).

The vehicle electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely on the standard corporate protocol (SCP) communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message) control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Exterior Lighting

The exterior lighting outputs are zone controlled by the FEM and REM. The front exterior lights are controlled by the FEM and the rear exterior lights are controlled by the REM. An additional function of the lighting system is a lamp outage function which indicates to the driver if certain exterior bulbs are not functioning. With a bulb inoperative, the FEM or REM will send a message to the instrument cluster and message center (if equipped with the message center), which will indicate to the driver that the lamp is inoperative with a lamp out indicator (with the message center a message will be displayed). To provide complete input and output functionality, each exterior lamp feature will be described individually. All exterior lighting is powered by the switched system power (SSP) feature (refer to Switched System Power [SSP]). A failure of all or any of the SSP features will cause inoperative

exterior lighting. When diagnosing exterior lighting, it is essential to determine if all related symptoms and DTCs are controlled by the SSP feature.

Headlamps

The headlamps are controlled by the FEM and instrument cluster module. The headlamp and multifunction switches are hardwired to the instrument cluster. When the headlamp switch is in any position, the instrument cluster module will send a command to the FEM through the SCP communication network. The FEM will process this information and output the appropriate command to the headlamps, which are hardwired to the FEM. This is the same for the low and high beams and flash-to-pass position. Daytime running lamps (DRL) is an additional feature which the FEM may be configured to include. Left and right low, as well as high beams will provide a lamp outage indication. Fault management of the headlamps will provide some headlamp functionality. In the event of all multifunction switch, all headlamp switch or ignition switch invalid or missing data failures, the low beams will be illuminated. There is also a headlamp battery saver feature. This feature turns off the headlamps in ten minutes after the ignition is turned off.

The vehicle electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the SCP communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message) control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Switched System Power (SSP)

The SSP is invoked by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps, and power door locks. This is only accomplished when both the FEM and the REM are in sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (input) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3, and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. When energized, each relay will supply power to multiple features/functions. For additional information, refer to the SSP Index for diagnosis and testing of SSP related issues.

Inspection and Verification

1. Verify the customer concern by operating the headlamps following these steps:
 1. Place the ignition switch in the ON position.
 2. Place the headlamp switch in the ON position.
 3. **NOTE:** For autolamp concerns, refer to [Autolamps](#).

Verify the low and high beam operation.

 4. Place the headlamps in the OFF position.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Damaged FEM ● Damaged instrument cluster 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 423 (30A) ■ 424 (30A) ■ 427 (30A) ■ 432 (30A) ■ 425 (40A) ■ 422 (20A) ● Central junction box (CJB) Fuses: <ul style="list-style-type: none"> ■ 204 (5A) ■ 208 (5A) ■ 209 (10A) ■ 210 (5A) ■ 211 (10A) ■ 213 (5A) ■ 217 (5A) ■ 223 (10A) ■ 225 (10A) ■ 235 (5A) ■ 205 (5A) ■ 220 (10A) ■ 207 (5A) ● Damaged wiring harness ● Loose or corroded connections ● Damaged headlamp switch

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 =ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for FEM, go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for REM, go to Pinpoint Test B.
 - NO RESP/NOT EQUIP for instrument cluster, go to Pinpoint Test C.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the FEM.
6. If the DTCs retrieved are related to the concern, go to FEM Diagnostic Trouble Code (DTC) Index, and Instrument Cluster Module (ICM) Diagnostic Trouble Code (DTC) Index, or SSP Relay Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

FEM Diagnostic Trouble Code (DTC) Index

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1342	ECU Is Defective	FEM	CLEAR the DTCs. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 .
B1438	Wiper Mode Select Switch Circuit Failure	FEM	REFER to Section 501-16 .
B1446	Wiper Park Sense Circuit Failure	FEM	REFER to Section 501-16 .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to Section 413-01 .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	GO to Pinpoint Test AD .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	GO to Pinpoint Test AD .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	GO to Pinpoint Test AD .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	GO to Pinpoint Test AD .
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1567	Lamp Headlamp High-Beam Circuit Failure	FEM	GO to Pinpoint Test E .
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B1794	Lamp Headlamp Low-Beam Circuit Failure	FEM	GO to Pinpoint Test D .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	REFER to Section 501-11 .
B2215	Window Passenger Front Down Switch Short to Battery	FEM	REFER to Section 501-11 .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2442	Intrusion Sensor Fault	FEM	REFER to Section 419-01A .
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
C1284	Oil Pressure Switch Failure	FEM	REFER to Section 413-01 .
C1446	Brake Switch Circuit Failure	FEM	REFER to Section 413-01 .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to Section 211-00 .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to Section 211-00 .
U1027	SCP (J1850) Invalid or Missing	PCM	CARRY OUT the PCM self-test.

	Data for Engine RPM		
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS, ABS/TC, IVD	CARRY OUT the ABS, ABS/TC, or IVD self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test.
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	CARRY OUT the ICM self-test.
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	ICM	CARRY OUT the ICM self-test.

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
AL_EVT1	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT2	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT3	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT4	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT5	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT6	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT7	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT8	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR
FLUID_1	Brake Fluid Level Switch #1	OFF, ON
HOOD_SW	Hood Ajar Switch	CLOSED, AJAR
IGN_R	Ignition Switch -RUN Position	NO, YES

L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position Sensor (Left/Right)	#####
PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%
R_HIGH	Right High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RADIOSW	Security Input Switch Status	OFF, ON
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-
STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	V
WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKSW	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%
BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON
FRONT WINDOW CONTROL	PR DOWN	OFF, ON

FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
POWER MIRROR CONTROL	PR DOWN	OFF, ON
POWER MIRROR CONTROL	PR LEFT	OFF, ON
POWER MIRROR CONTROL	PR RIGHT	OFF, ON
POWER MIRROR CONTROL	PR UP	OFF, ON
STEERING COLUMN CONTROL COMMAND	LOCK_GND	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON
VAPS II OUTPUT PULSE CONTROL	VAPSIIOUT	%

REM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	REM	REFER to Section 413-01 .
B1300	Power Door Lock Circuit Failure	REM	REFER to Section 501-14B .
B1310	Power Door Unlock Circuit Failure	REM	REFER to Section 501-14B .
B1331	Decklid Ajar Rear Door Circuit Failure	REM	REFER to Section 417-02 .
B1335	Door Ajar RR Circuit Failure	REM	REFER to Section 417-02 .
B1342	ECU Is Defective	REM	CLEAR and DOCUMENT the DTCs. CARRY OUT the instrument cluster self-test. INSTALL a new REM if DTC B1342 is retrieved again. REFER to Section 419-10 .
B1483	Brake Pedal Input Circuit Failure	REM	GO to Pinpoint Test P .
B1499	Lamp Turn Signal Left Circuit Failure	REM	GO to Pinpoint Test AA .
B1501	Lamp Turn Signal Left Circuit Short to Battery	REM	GO to Pinpoint Test AB .
B1503	Lamp Turn Signal Right Circuit Failure	REM	GO to Pinpoint Test Z .
B1505	Lamp Turn Signal Right Circuit Short to Battery	REM	GO to Pinpoint Test AC .
B1551	Decklid Release Circuit Failure	REM	REFER to Section 501-14B .
B1571	Door Ajar LR Circuit Failure	REM	REFER to Section 417-02 .
B1676	Battery Pack Voltage Out of Range	REM	REFER to Section 414-00 .
B2172	Inertia Switch Input Circuit Open	REM	REFER to Powertrain Control/Emissions

			Diagnosis (PC/ED) manual.
B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-16 .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-16 .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-16 .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-16 .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS,ABS/TC, or IVD	CARRY OUT the ABS, ABS/TC, or IVD self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test

REM Parameter Identification (PID) Index

PID	Description	Expected Value
BOO	Brake Switch Input	OFF, ON
DECKLID	Decklid Ajar Switch	CLOSED, AJAR
DL_DSRM	Decklid Disarm	NO, YES
DLIDOUT	Decklid Driver	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
DLIDRLS	Deck Lid Release	OFF, ON
L_TAIL	Left & Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LMRKOUT	Left Marker Lamp Driver Output State	OFF, ON
LMRKSTB	Left Marker Lamp Driver Short To Battery	NO, YES
LR_TURN	Left & Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LRDN_SW	Left Rear Window Down Switch	OFF, UP
LRDR_SW	Left Rear Door Ajar Switch	CLOSED, AJAR
LRUP_SW	Left Rear Window UP Switch	OFF, DOWN
PD_LOCK	Passenger Door Lock	NO, YES

PD_UNLK	Passenger Door Unlock	NOTLOC, LOCK
R_TAIL	Left & Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RR_TURN	Left & Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RRDN_SW	Right Rear Window Down Switch	OFF, UP
RRDR_SW	Right Rear Door Ajar Switch	CLOSED, AJAR
RRUP_SW	Right Rear Window UP Switch	OFF, DOWN

REM Active Command Index

Active Command	Display	Action
EXTERIOR LAMP CONTROL	BACKUPLMP	OFF, ON
EXTERIOR LAMP CONTROL	H MNT STP	OFF, ON
EXTERIOR LAMP CONTROL	L STOP	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
EXTERIOR LAMP CONTROL	R DEF RLY	OFF, ON
EXTERIOR LAMP CONTROL	R STOP	OFF, ON
POWER WINDOW ENABLE COMMAND	PSGR RLY	OFF, ON
REAR DOOR LOCK CONTROL	LR LOCK	OFF, ON
REAR DOOR LOCK CONTROL	LR UNLOCK	OFF, ON
REAR DOOR LOCK CONTROL	RELEASE	OFF, ON
REAR WINDOW CONTROL	LR DOWN	OFF, ON
REAR WINDOW CONTROL	RR DOWN	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	ICM	REFER to Section 413-01 .
B1205	EIC Switch-1 Assembly Circuit Failure	ICM	INSTALL a new instrument cluster; REFER to Section 413-01 . TEST the system for normal operation.
B1209	EIC Switch-2 Assembly Circuit Failure	ICM	INSTALL a new instrument cluster; REFER to Section 413-01 . TEST the system for normal operation.
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	ICM	REFER to Section 419-01B .

B1246	Dim Panel Potentiometer Switch Circuit Failure	ICM	REFER to Section 413-00 .
B1342	ECU Is Defective	ICM	CLEAR and DOCUMENT the DTCs. CARRY OUT the instrument cluster Self-Test. INSTALL a new instrument cluster if DTC B1342 is retrieved again. REFER to Section 413-01 .
B1352	Ignition Key-In Circuit Failure	ICM	REFER to Section 211-05 .
B1470	Lamp Headlamp Input Circuit Failure	ICM	GO to Pinpoint Test D .
B1492	Ignition Cylinder Sensor Open Circuit	ICM	REFER to Section 419-01B .
B1567	Lamp Headlamp High-Beam Circuit Failure	ICM	GO to Pinpoint Test E .
B1600	PATS Ignition Key Transponder Signal Is Not Received	ICM	REFER to Section 419-01B .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	ICM	REFER to Section 419-01B .
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	ICM	REFER to Section 419-01B .
B1676	Battery Pack Voltage Out of Range	ICM	GO to Pinpoint Test J .
B1681	PATS Transceiver Module Signal Is Not Received	ICM	REFER to Section 419-01B .
B1689	Autolamp Delay Circuit Failure	ICM	GO to Pinpoint Test N .
B1875	Turn Signal / Hazard Switch Signal Circuit Failure	ICM	GO to Pinpoint Test AE .
B2103	Antenna Not Connected	ICM	REFER to Section 419-01B .
B2139	Data Mismatch (Receive Data Does Not Match What Was Expected)	ICM	REFER to Section 419-01A .
B2141	NVM Configuration Failure	ICM	REFER to Section 419-01B .
B2143	NVM Memory Failure	ICM	REFER to Section 419-01B .
B2162	Data Mismatch #2 (receive data does not match what was expected)	ICM	REFER to Section 419-01B .
B2328	Column Reach Feedback Potentiometer Circuit Failure	ICM	REFER to Section 211-04 .
B2332	Column Tilt Feedback Potentiometer Circuit Failure	ICM	REFER to Section 211-04 .
B2351	Steering Column Switch Circuit Failure	ICM	REFER to Section 211-04 .
B2431	Transponder Programming Failed	ICM	REFER to Section 419-01A .
B2472	Fog Lamp Switch Failure	ICM	GO to Pinpoint Test AS .
B2477	Module Configuration Failure	ICM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS/TC/IVD	CARRY OUT the ABS/TC/IVD self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test.
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant Fluid Temperature	PCM	CARRY OUT the PCM self-test.
U1123	SCP (J1850) Invalid or Missing Data for Odometer Rolling Count	ABS/TC/IVD	CARRY OUT the ABS/TC/IVD self-test.
U1131	SCP (J1850) Invalid or Missing Data	ICM	GO to Pinpoint Test D .

	for Fuel System		
U1147	SCP (J1850) Invalid or Missing Data for Vehicle Security System	PCM	CARRY OUT the PCM self-test.

Instrument Cluster Parameter Identification (PID) Index

PID	Description	Expected Value
ABCHIME	Air Bag Chime	OFF, ON
ANTISCN	Anti-Scan Function	DISABL, ENABLE
ASWSTAT	Autolamp Switch Input Status	1 KEY, 2 KEY, 3 KEY, 4 KEY, 5 KEY, 6 KEY, 7 KEY, 8 KEY, 9 KEY, 0 KEY, NO KEY
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_SBELT	Driver Seat Belt	OUT, IN
DSWSTAT	Dimmer Switch Input Status	ON, LVL1, LVL2, LVL3, LVL4, LVL5, LVL6, LVL7, LVL8, LVL9, LVL10, LVL11, LVL12, LVL13, LVL14, LVL15, LVL16, LVL17, LVL18, LVL19, LVL20, LVL21,
ENABL_S	Vehicle Enable Status	DISABL, ENABLE
HEAD_L	Headlamp Switch Input Status	OFF, PARK, HEADLP, R_FOG, INVLD,
HIBEAM	High Beam Switch Input Status	OFF, HIGH, PASS, INVLD,
HORN_SW	Horn Input Switch	OFF, ON
IGN_A	Ignition Switch -ACCY Position	NO, YES
IGN_KEY	Ignition Key In / Out	OUT, IN
IGN_O/U	Ignition Switch - OFF/Unlock Position	NO, YES
IGN_R	Ignition Switch -RUN Position	NO, YES
IGN_S	Ignition Switch - START Position	NO, YES
LIGHTSN	Night(True) / Day (False)	NO, YES
M_KEY	Master Key Present	notPRE, PRESNT
NUMKEYS	Number Of Keys Stored In Module	one count per bit
PCM_ID	PCM ID Status	notSTR, STORED
PCM_VFY	PCM Verify OK	NO, YES
RESETSW	Reset Switch	OFF, ON
SELECT	Select/Mode Switch	OFF, ON
TILT	Steering Column Tilt Switch	SHORT, UP, DOWN, OFF
TELEPOS	Telescope Position Sensor	notSEN, SENSED

TELESCP	Steering Column Telescope Switch	SHORT, IN, OUT, OFF
TILTPOS	Tilt Position Sensor	notSEN, SENSED
TR_PARK	Transmission Select Lever In Park Pos	NO, YES

Instrument Cluster Active Command Index

Active Command	Display	Action
ANTI-THEFT INDICATOR LAMP	THEFT LAMP	OFF, ON
DISPLAY DIMMING CONTROL	ILLUMINAT	OFF, ON
DISPLAY SEGMENT CONTROL II	SEGMENTS	OFF, ON
ENGINE COOLANT GAUGE CONTROL	ENGCOOLNT	0%-100%
FUEL GAUGE CONTROL	FUELLEVEL	0%-100%
MEMORY SELECT CONTROL	MEMORY 1	OFF, ON
MEMORY SELECT CONTROL	MEMORY 2	OFF, ON
PRNDL DISPLAY CONTROL COMMAND	SEGMENTS	OFF, ON
RF SIGNAL	RF	OFF, ON
SPEEDOMETER CONTROL	SPDOMETER	0%-100%
TACHOMETER CONTROL	TCHOMETER	0%-100%
WARNING LAMPS AND CHIME	ALL LAMPS	OFF, ON
WARNING LAMPS AND CHIME	CHIME	OFF, ON

SSP Relay Index

Relay	Fuse	Controlled System(s)
SSP1	BJB Fuse 427 (30A)	<ul style="list-style-type: none"> ● Driver power door lock (FEM) ● LH/RH high beam headlamps (FEM) ● RF park/turn/side marker lamps (FEM) ● RH low beam headlamp ● Driver power mirror
SSP2	BJB Fuse 432 (30A)	<ul style="list-style-type: none"> ● LH low beam headlamp (FEM) ● LF park/turn/side marker lamps (FEM) ● Interior courtesy/ demand lighting ● Windshield wiper washer pump ● Switch illumination backlighting
SSP3	BJB Fuse 424 (30A)	<ul style="list-style-type: none"> ● High mounted stoplamp (REM) ● RR park/stoplamps (REM) ● Reversing lamps (REM) ● LR turn signal (REM) ● Passenger power mirror ● Trailer stoplamps/turn signals (if equipped with trailer tow)
SSP4	BJB Fuse 423 (30A)	<ul style="list-style-type: none"> ● LR park/stoplamps (REM) ● RR turn signal (REM) ● Passenger door/side locks (REM)

	<ul style="list-style-type: none"> ● License lamps ● Luggage compartment lid release solenoid/switch ● Fuel door release solenoid/switch ● Luggage compartment lamp ● Trailer park lamps (if equipped with trailer tow)
--	--

When diagnosing an SSP relay, check that all systems for that relay are inoperative. Refer to Symptom Chart if:

- all systems for one SSP relay are inoperative.
- all systems for all SSP relays are inoperative.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● No communication with the front electronic module 	<ul style="list-style-type: none"> ● Fuses 425 (40A), 422 (20A). ● Circuitry. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.
<ul style="list-style-type: none"> ● No communication with the rear electronic module 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuse 425 (40A). ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B.
<ul style="list-style-type: none"> ● No communication with the instrument cluster module 	<ul style="list-style-type: none"> ● CJB Fuses 204 (5A), 213 (5A), 220 (5A). ● Circuitry. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test C.
<ul style="list-style-type: none"> ● The high beams are inoperative — both 	<ul style="list-style-type: none"> ● FEM. 	<ul style="list-style-type: none"> ● INSTALL a new FEM; REFER to Section 419-10. TEST the system for normal operation.
<ul style="list-style-type: none"> ● One low beam headlamp is inoperative 	<ul style="list-style-type: none"> ● BJB Fuses 427 (30A), 432 (30A). ● CJB Fuses 225 (10A), 209 (10A). ● Bulb. ● Circuitry. ● FEM. ● Instrument cluster. ● Multifunction switch. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D.
<ul style="list-style-type: none"> ● One high beam headlamp is inoperative 	<ul style="list-style-type: none"> ● BJB Fuses 427 (30A), 432 (30A). ● CJB Fuses 211 (10A), 223 (10A). ● Bulb. ● Circuitry. ● FEM. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test E.

	<ul style="list-style-type: none"> ● Multifunction switch. 	
<ul style="list-style-type: none"> ● Exterior lamps are inoperative — RF park, RF turn, RF side marker lamps, RF low beam, LF high beam, LF park, LF turn and LF side marker 	<ul style="list-style-type: none"> ● CJB Fuses 208 (5A), 209 (10A), 210 (5A), 223 (10A), 211 (10A). ● Bulbs. ● Circuitry. ● SSP relay. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test F.</u>
<ul style="list-style-type: none"> ● The headlamps are on continuously — both low beams 	<ul style="list-style-type: none"> ● Circuitry. ● FEM. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test G.</u>
<ul style="list-style-type: none"> ● The headlamps are on continuously — single low/high beams 	<ul style="list-style-type: none"> ● Circuitry. ● FEM. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test H.</u>
<ul style="list-style-type: none"> ● The power supply relay is inoperative — all SSP features 	<ul style="list-style-type: none"> ● Circuitry. ● Relay. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test I.</u>
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP1 	<ul style="list-style-type: none"> ● BJB Fuse 427 (30A). ● Circuitry. ● Relay. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test J.</u>
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP2 	<ul style="list-style-type: none"> ● BJB Fuse 432 (30A). ● Circuitry. ● Relay. ● REM. ● FEM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test K.</u>
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP3 	<ul style="list-style-type: none"> ● BJB Fuse 424 (30A). ● Circuitry. ● Relay. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test L.</u>
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP4 	<ul style="list-style-type: none"> ● BJB Fuse 423 (30A). ● Circuitry. ● Relay. ● REM. ● FEM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test M.</u>

Pinpoint Tests



CAUTION: Electronic modules are sensitive to electrical charges. If exposed to these charges, damage may result.

PINPOINT TEST A: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
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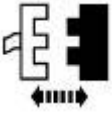
A1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK22 (OG/YE) FOR VOLTAGE

NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.

1

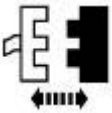


2



FEM C201c

3

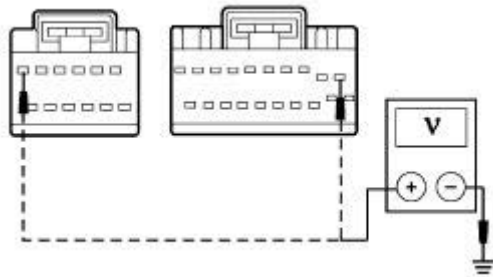


FEM C201f

4



5



A0006297

5 Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22 (OG/YE), harness side and ground.

- Are the voltages greater than 10 volts?

→ **Yes**
GO to A2.

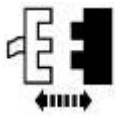
→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

A2 CHECK CIRCUITS 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS

1

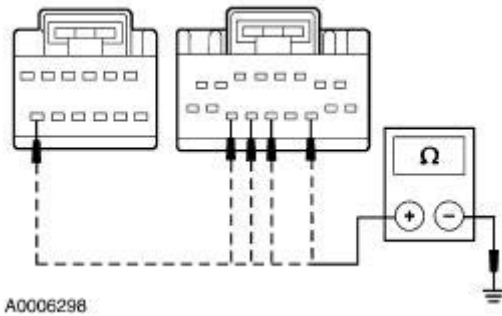


2



FEM C201a

3



3

Measure the resistance between FEM connectors, harness side and ground:

FEM	Pin	Circuit
C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)
C201a	15	31-DK20D (BK/RD)

● Is the resistance less than 5 ohms?

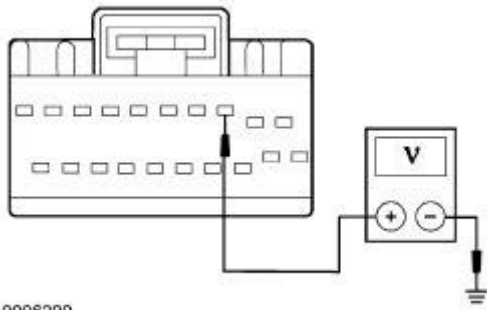
→ **Yes**
REFER to Section 418-00 .

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST B: NO COMMUNICATION WITH THE REAR ELECTRONIC MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CIRCUIT 29-DK31 (OG/BK) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>	
<p>2</p> <p>REM C420d</p>	
<p>3</p> <p>REM C420c</p>	
<p>4</p>	

5



A0006299

5

Measure the voltage between REM C420d pin 3, circuit 29-DK31 (OG/BK), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to B2.

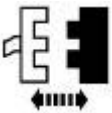
→ **No**
REPAIR the circuit. TEST the system for normal operation.

B2 CHECK CIRCUITS 29S-DK31 (OG/BK), 31-DK30D (BK), 31-DK30E (BK), 31-DK30F (BK), 31-DK30G (BK) AND 31-DK30H (BK), FOR OPENS

1

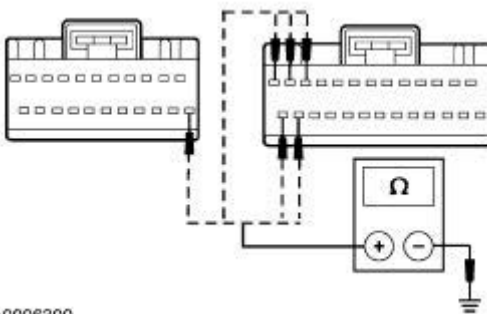


2



REM C420b

3



A0006300

3

Measure the resistance between REM connectors, harness side and ground:


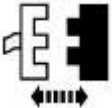
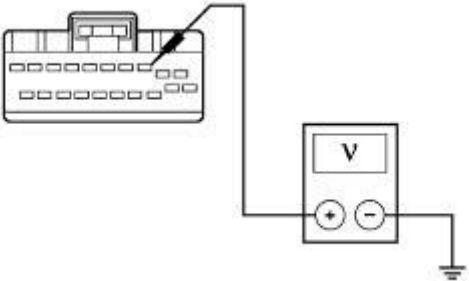


REM	Pin	Circuit
C420c	13	29S-DK31 (OG/BK)
C420c	12	31-DK30E (BK)
C420c	11	31-DK30D (BK)
C420c	26	31-DK30G (BK)
C420c	25	31-DK30F (BK)
C420b	12	31-DK30H (BK)

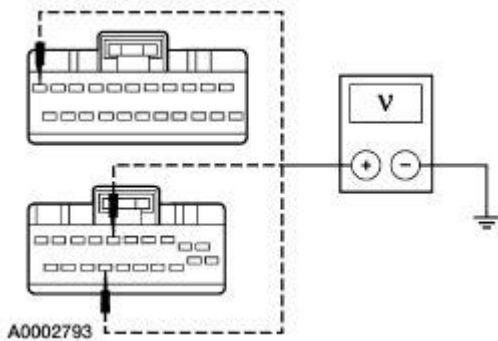
● Is the resistance less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST C: NO COMMUNICATION WITH THE INSTRUMENT CLUSTER MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS								
C1 CHECK HOT AT ALL TIMES POWER SUPPLY CIRCUIT									
<p>1 </p> <p>2 </p> <p>3 </p>	<p>3 Measure the voltage between instrument cluster C220b pin 3, circuit 29-GG11 (OG/BU), harness side and ground.</p> <p>● Is the voltage greater than 10 volts?</p> <p>→ Yes GO to <u>C2</u>.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>								
C2 CHECK HOT IN RUN POWER SUPPLY CIRCUITS									
<p>1 </p> <p>2 </p>	<p>2 Measure the voltage between the instrument cluster and ground as follows:</p> <table border="1"> <thead> <tr> <th>Connector pin</th> <th>Circuit</th> </tr> </thead> <tbody> <tr> <td>C220a pin 11</td> <td>15-JA14 (GN/BK)</td> </tr> <tr> <td>C220b pin 6</td> <td>15-GG14 (GN/RD)</td> </tr> <tr> <td>C220b pin 17</td> <td>75-GG15 (YE/GN)</td> </tr> </tbody> </table>	Connector pin	Circuit	C220a pin 11	15-JA14 (GN/BK)	C220b pin 6	15-GG14 (GN/RD)	C220b pin 17	75-GG15 (YE/GN)
Connector pin	Circuit								
C220a pin 11	15-JA14 (GN/BK)								
C220b pin 6	15-GG14 (GN/RD)								
C220b pin 17	75-GG15 (YE/GN)								



A0002793

- Are the voltages greater than 10 volts?

→ **Yes**
GO to C3.

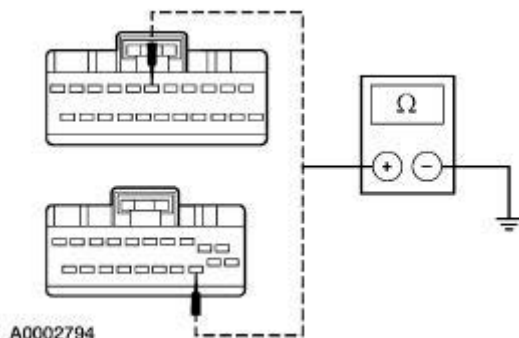
→ **No**
REPAIR the circuit(s). TEST the system for normal operation.

C3 CHECK GROUND CIRCUITS

1



2



A0002794

2 Measure the resistance between the instrument cluster and ground as follows:

Connector pin	Circuit
C220a pin 6	31-AL11 (BK)
C220b pin 13	91-GG11 (BN/RD)

- Are the resistances less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit(s). TEST the system for normal operation.

PINPOINT TEST D: ONE LOW BEAM HEADLAMP IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	

D1 CHECK OPERATION OF THE HEADLAMPS

1



2 Place the headlamp switch in the ON position.

- **Do the low beams operate correctly?**

→ **Yes**
The system is working correctly.

→ **No**
If the left low beam is inoperative, GO to D2.

If the right low beam is inoperative, GO to D7.

D2 CHECK THE FEM OUTPUT

1



2



Diagnostic Tool

3



4



5 While observing the left low beam lamp trigger the FEM active command LEFT LOW ON and then OFF.

- **Does the left low beam turn ON?**

→ **Yes**
INSTALL a new FEM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to D3.

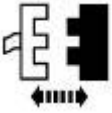
D3 CHECK CJB FUSE 225 (10A) FOR POWER

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1



2

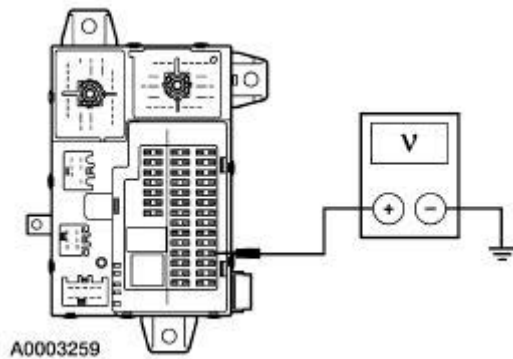


CJB 225 (10A)

3



4



4

Measure the voltage between CJB Fuse 225 (10A), input side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to D4.

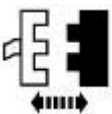
→ **No**
REFER to the SSP Relay Index in this section.

D4 CHECK CIRCUIT 29S-LE16 (OG/GN) FOR AN OPEN

1



2

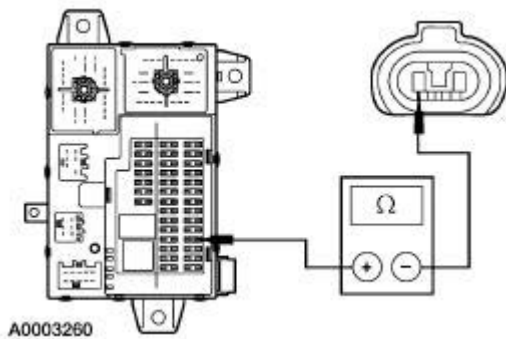


LH Low Beam Headlamp C1021

3

3

Measure the resistance between CJB Fuse 225 (10A) output side, circuit 29S-LE16 (OG/GN) and LH low beam headlamp C1021 pin 2, circuit 29S-LE16



(OG/GN), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
REINSTALL CJB Fuse 225 (10A).GO to D5.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

D5 CHECK CIRCUIT 31S-LE16 (BK/RD) FOR AN OPEN

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1

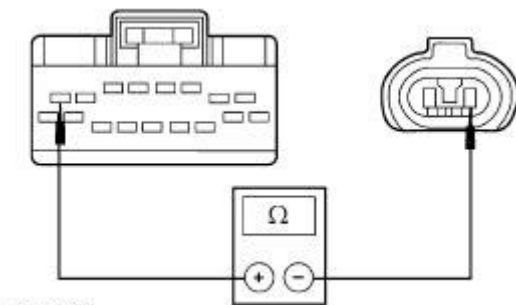


2



FEM C201a

3



- 3 Measure the resistance between FEM C201a pin 8, circuit 31S-LE16 (BK/RD), harness side and LH low beam headlamp C1021 pin 1, circuit 31S-LE16 (BK/RD), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to D6.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

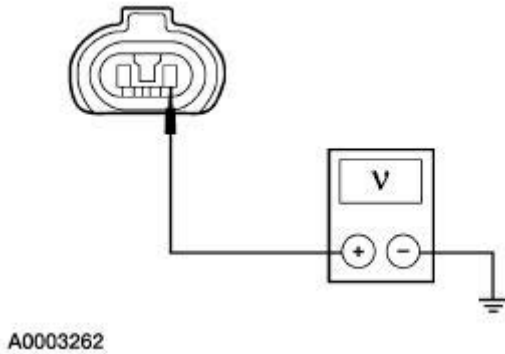
D6 CHECK CIRCUIT 31S-LE16 (BK/RD) FOR A SHORT TO POWER

NOTE: Cycle the ignition switch from OFF to RUN to enable SSP feature.

1



2



2

Measure the voltage between LH low beam headlamp C1021 pin 1, circuit 31S-LE16 (BK/RD), harness side and ground.

● **Is any voltage indicated?**

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

D7 CHECK RIGHT LOW BEAM ACTIVE COMMANDS

1



Diagnostic Tool

2



3



3

Trigger the FEM active commands RIGHT LOW ON then RIGHT HIGH ON.

● **Do the low beams operate correctly?**

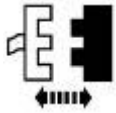
→ **Yes**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

TRIGGER the FEM active commands RIGHT LOW and RIGHT HIGH OFF. GO to D8.

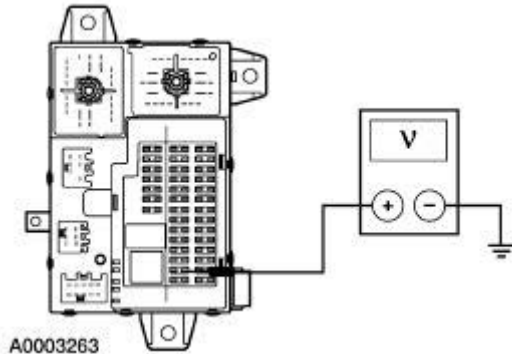
D8 CHECK CJB FUSE 209 (10A) FOR POWER

1



CJB Fuse 209 (10A)

2



2

Measure the voltage between CJB Fuse 209 (10A), input side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to D9.

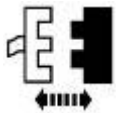
→ **No**
REFER to the SSP Relay Index in this section.

D9 CHECK CIRCUIT 29S-LE16 (OG/GN) FOR AN OPEN

1

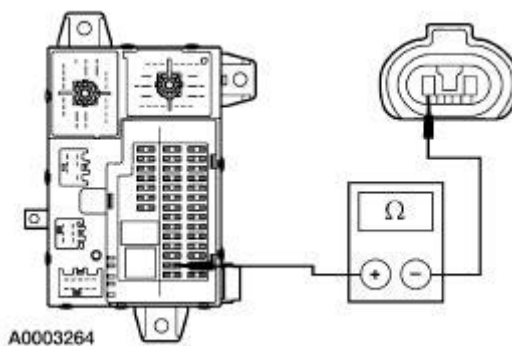


2



RH Low Beam Headlamp C1041

3



3

Measure the resistance between RH low beam headlamp C1041 pin 2, circuit 29S-LE16 (OG/GN), harness side and CJB Fuse 209 (10A), output side circuit 29S-LE23 (OG/WH).

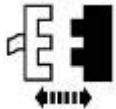
● Is the resistance less than 5 ohms?

→ **Yes**
REINSTALL CJB Fuse 209 (10A), GO to D10.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

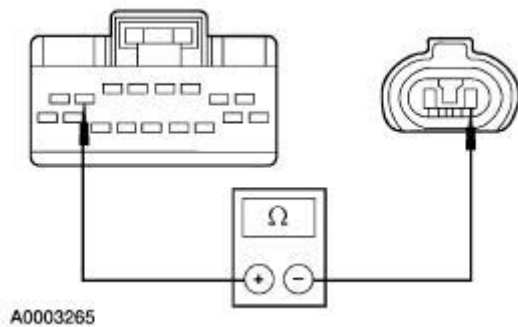
D10 CHECK CIRCUIT 31S-LE23 (BK/WH) FOR AN OPEN

1



FEM C201a

2



2

Measure the resistance between headlamp C1041 pin 1, circuit 31S-LE16 (BK/RD), harness side, and FEM C201a pin 7, circuit 31S-LE23 (BK/WH), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to D11.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

D11 CHECK CIRCUIT 31S-LE16 (BK/RD) FOR A SHORT TO POWER

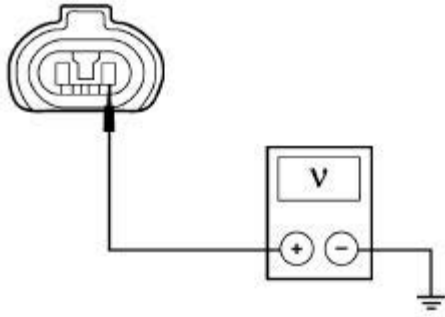
1



2

2

Measure the voltage between RH low beam headlamp C1041 pin 1, circuit 31S-LE16 (BK/RD), harness side and ground.




A0003262

- Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST E: ONE HIGH BEAM HEADLAMP IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
E1 CHECK OPERATION OF THE HEADLAMP	
<p>1</p> 	<p>2</p> <p>Place the headlamp switch in the ON position.</p> <ul style="list-style-type: none"> ● Do the high beams operate correctly? <p>→ Yes The system is working correctly.</p> <p>→ No If the left high beam is inoperative, GO to E2. If the right high beam is inoperative, GO to E6.</p>
E2 CHECK THE FEM OUTPUT	
NOTE: Cycle the ignition switch from OFF to RUN to enable the SSP feature.	
<p>1</p>	



2



Diagnostic Tool

3



4



5 While observing the left high beam lamp, trigger the FEM active command LEFT HIGH ON and then OFF.

• Do the high beams illuminate?

→ Yes
INSTALL a new FEM; REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.

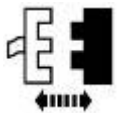
→ No
GO to E3 .

E3 CHECK CIRCUIT 29S-LE15 (OG/BK) FOR AN OPEN

1



2



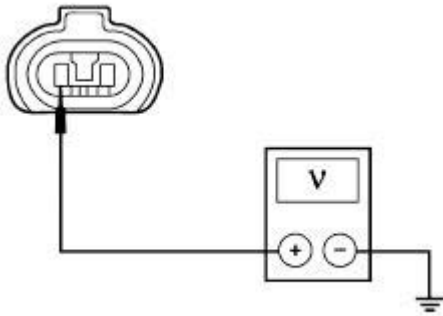
LH High Beam headlamp C1020

3



4

4 Measure the voltage between LH high beam headlamp C1020 pin 2, circuit 29S-LE15 (OG/BK), harness side and ground.



A0003266

● Is the voltage greater than 10 volts?

→ **Yes**
GO to E4.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

E4 CHECK CIRCUIT 31S-LE15 (BK/GN) FOR AN OPEN

1

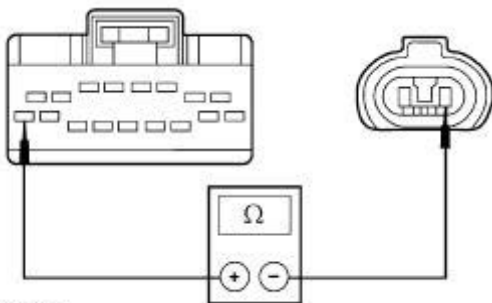


2



FEM C201a

3



A0003267

3 Measure the resistance between FEM C201a pin 17, circuit 31S-LE15 (BK/GN), harness side and LH headlamp C1020 pin 1, circuit 31S-LE15 (BK/GN), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to E5.

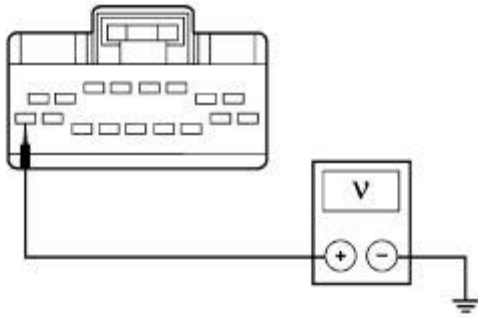
→ **No**
REPAIR the circuit. TEST the system for normal operation.

E5 CHECK CIRCUIT 31S-LE15 (BK/GN) FOR A SHORT TO POWER

1



2



A0003268

2 Measure the voltage between C201a pin 17, circuit 31S-LE15 (BK/GN), harness side and ground.

• Is any voltage indicated?

→ Yes
REPAIR the circuit. TEST the system for normal operation.

→ No
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

E6 CHECK THE FEM OUTPUT

1



2



Diagnostic Tool

3



4



5 While observing the left high beam lamp trigger the FEM active command RIGHT HIGH ON and then OFF.

• Do the high beams illuminate?

→ Yes

INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

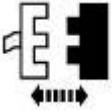
→ **No**
GO to [E7](#).

E7 CHECK CIRCUIT 29S-LE15 (OG/BK) FOR AN OPEN

1

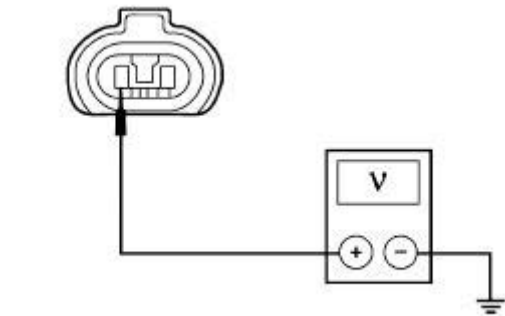


2



RH High Beam Headlamp C1040

3



A0003266

3 Measure the voltage between RH high beam headlamp C1040 pin 2, circuit 29S-LE15 (OG/BK), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to [E8](#).

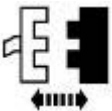
→ **No**
REPAIR the circuit. TEST the system for normal operation.

E8 CHECK CIRCUIT 31S-LE22 (BK/RD) FOR AN OPEN

1



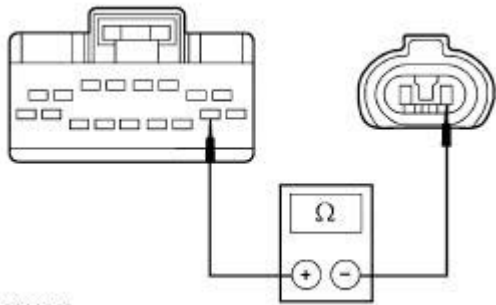
2



FEM C201a

3

3 Measure the resistance between FEM C201a pin 10, circuit 31S-LE22 (BK/RD), harness side and headlamp C1040 pin 1, circuit 31S-LE15 (BK/GN), harness side.



A0003269

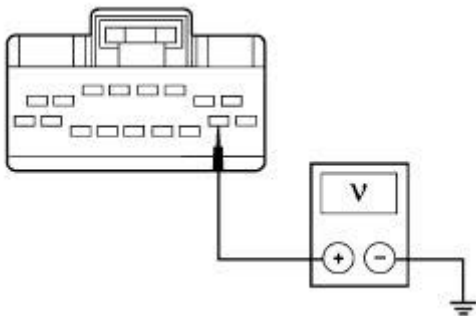
- Is the resistance less than 5 ohms?

→ **Yes**
GO to E9.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

E9 CHECK CIRCUIT 31S-LE22 (BK/RD) FOR A SHORT TO POWER

1



A0003270

1

Measure the voltage between FEM C201a pin 10, circuit 31S-LE22 (BK/RD), harness side and ground.

- Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new FEM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST F: EXTERIOR LAMPS ARE INOPERATIVE — RF PARK, RF TURN, RF SIDE MARKER LAMPS, RF LOW BEAM, LF HIGH BEAM, LF PARK, LF TURN, AND LF SIDE MARKER

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK CIRCUIT 30-DD3 (RD) FOR AN OPEN	
1	

SSP1 relay

2

CJB Fuse 209 (10A)

3

A0003271

3 Measure the resistance between SSP1 relay pin 87, circuit 30-DD3 (RD), harness side, and CJB Fuse 209 (10A) input side.

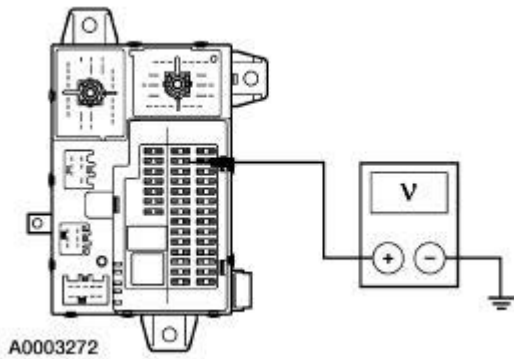
- Is the resistance less than 5 ohms?

→ **Yes**
REFER to SSP Relay Index in this section.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST G: THE HEADLAMPS ARE ON CONTINUOUSLY — BOTH LOW BEAMS

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
G1 CHECK CJB FUSE 220 (5A) FOR POWER	
<p>1</p> <p>CJB Fuse 220 (5A)</p> <p>2</p> <p>3</p>	<p>3 Measure the voltage between CJB Fuse 220 (5A) input side, circuit 30-DD1</p>



A0003272

(RD/YE), and ground.

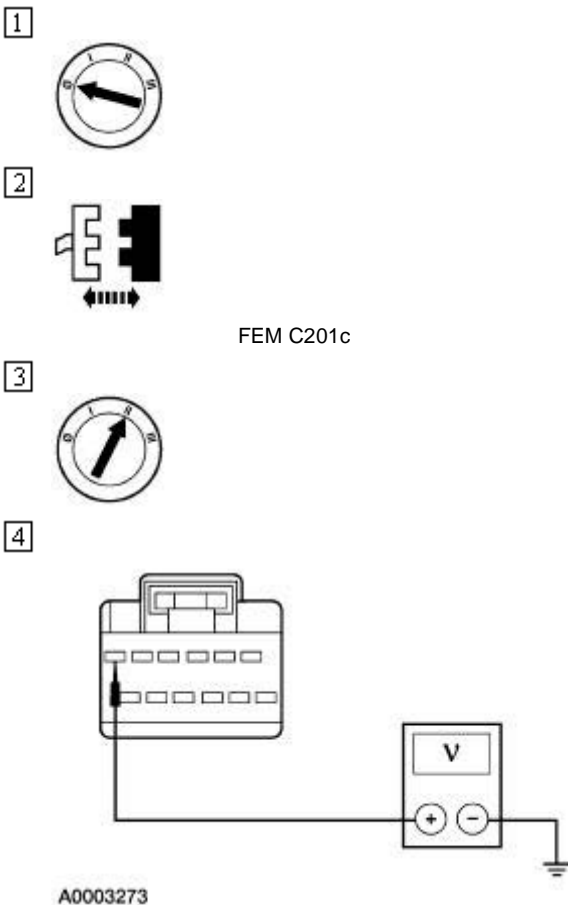
● Is the voltage greater than 10 volts?

→ **Yes**
REINSTALL CJB Fuse 220 (5A).GO to G2.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

G2 CHECK CIRCUIT 29-DK20 (OG/GN) FOR AN OPEN

NOTE: Cycle the ignition switch from OFF to RUN to enable the SSP feature.



A0003273

4 Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground.



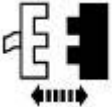
● Is the voltage greater than 10 volts?

→ **Yes**

INSTALL a new FEM; REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST H: THE HEADLAMPS ARE ON CONTINUOUSLY — SINGLE LOW/HIGH BEAMS

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.</p>	
<p>H1 CHECK OPERATION OF THE HEADLAMP</p>	
<p>1</p> 	<p>2 Place the headlamp switch in the ON position.</p> <p>3 Using the multifunction switch, place the high beams in the ON, and then OFF position.</p> <ul style="list-style-type: none"> ● Do the headlamps operate correctly? <p>→ Yes The system is working correctly.</p> <p>→ No If the left low beam operates correctly, GO to H2. If the right low beam operates correctly, GO to H3. If the left high beam operates correctly, GO to H4. If the right high beam operates correctly, GO to H5.</p>
<p>H2 CHECK LH LOW BEAM FOR A SHORT TO GROUND</p>	
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.</p>	
<p>1</p>  <p>2</p>  <p>FEM C201a</p> <p>3</p>	



● Does the LH low beam turn OFF?

- **Yes**
INSTALL a new FEM; REFER to [Section 419-10](#). TEST the system for normal operation.
- **No**
REPAIR circuit 31S-LE16 (BK/RD). TEST the system for normal operation.

H3 CHECK THE RH LOW BEAM FOR A SHORT TO GROUND

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1



2



FEM C201a

3



● Does the RH low beam turn OFF?

- **Yes**
INSTALL a new FEM; REFER to [Section 419-10](#). TEST the system for normal operation.
- **No**
REPAIR circuit 31S-LE23 (BK/WH). TEST the system for normal operation.

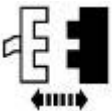
H4 CHECK THE LH HIGH BEAM FOR A SHORT TO GROUND

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1



2



FEM C201a

3



● Does the LH high beam turn OFF?

- **Yes**
INSTALL a new FEM; REFER to [Section 419-10](#). TEST the system for normal operation.
- **No**
REPAIR circuit 31S-LE15 (BK/GN). TEST the system for normal operation.

H5 CHECK THE RH HIGH BEAM FOR A SHORT TO GROUND

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1



2



FEM C201a

3

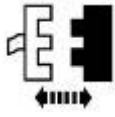


● Does the RH high beam turn OFF?

- **Yes**
INSTALL a new FEM; REFER to [Section 419-10](#). TEST the system for normal operation.
- **No**
REPAIR circuit 31S-LE22 (BK/RD). TEST the system for normal operation.

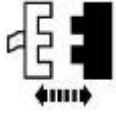
PINPOINT TEST I: THE POWER SUPPLY RELAY IS INOPERATIVE — ALL SSP FEATURES

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.</p>	
<p>NOTE: Refer to Principles of Operation and SSP Relay Index for complete detail of SSP powered features.</p>	
<p>I1 CHECK THE BJB FUSES FOR POWER</p>	
<p>1</p>	



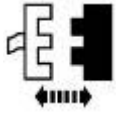
BJB Fuse 427 (30A)

2



BJB Fuse 432 (30A)

3



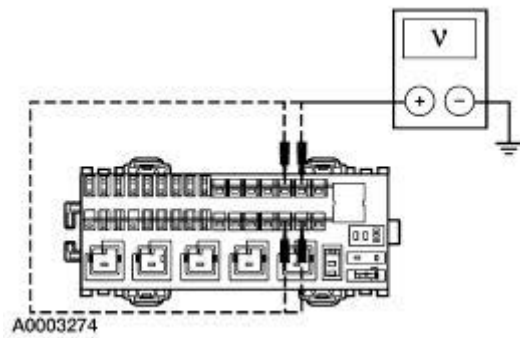
BJB Fuse 424 (30A)

4



BJB Fuse 423 (30A)

5



5 Measure the voltage between the BJB Fuses, input side and ground as follows:

BJB Fuse
423 (30A)
424 (30A)
427 (30A)
432 (30A)

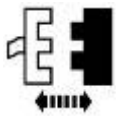
• Are the voltages greater than 10 volts?

→ Yes REINSTALL all the fuses.GO to I2.

→ No REPAIR the power supply circuit. TEST the system for normal operation.

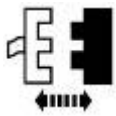
I2 CHECK BJB RELAYS FOR POWER

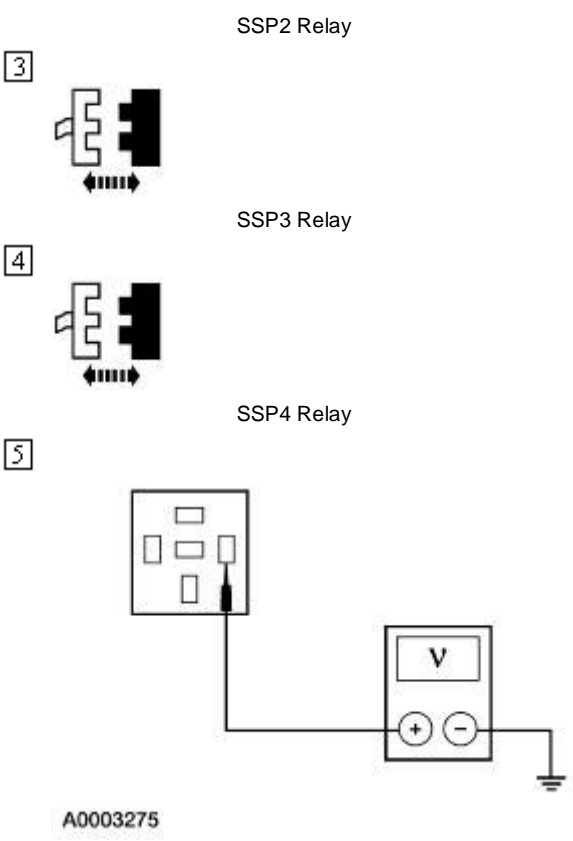
1



SSP1 Relay

2





5 Measure the voltage between BJB relay pin 86, harness side and ground as follows:

BJB Relay	Circuit
SSP1	30-DG51 (BK/YE)
SSP2	30-DG53 (RD/OG)
SSP3	30-DG55 (RD/BK)
SSP4	30-DG57 (RD/YE)

• Are the voltages greater than 10 volts?

→ Yes
GO to 13.

→ No
REPAIR or INSTALL a new BJB. TEST the system for normal operation.

13 CHECK SSP RELAY(S)

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1 Carry out the relay component test on each SSP relay; refer to Wiring Diagrams Section 700-09, Component Testing.

• Does each relay pass the component test?

→ Yes
GO to 14.

→ No
INSTALL a new SSP relay(s). TEST the system for normal operation.

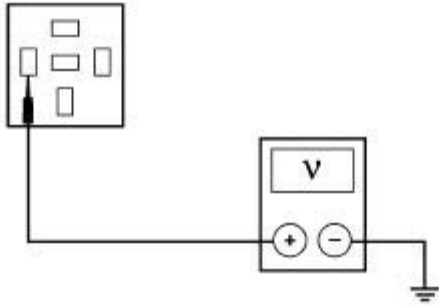
14 CHECK CIRCUIT(S) FOR A SHORT TO POWER

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1



2



A0003276

2

Measure the voltage between SSP relay BJB pin 85, harness side and ground as follows:

Relay	Circuit
SSP1	31S-DG51 (BK/YE)
SSP2	31S-DG53 (BK/OG)
SSP3	31S-DG55 (BK/RD)
SSP4	31S-DG57 (BK/YE)

● Is any voltage indicated?

→ **Yes**
GO to 15.

→ **No**
INSTALL a new FEM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

15 CHECK THE FEM FOR A SHORT TO POWER

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1

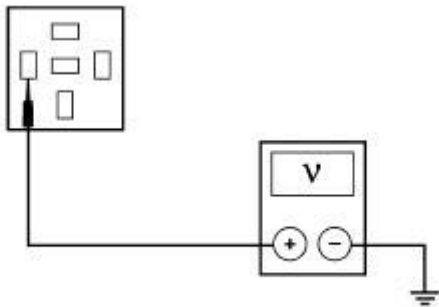


2



FEM C201c

3



A0003276

3

Measure the voltage between SSP relay pin 85, harness side and ground as follows:

Relay	Circuit
SSP1	31S-DG51 (BK/YE)
SSP2	31S-DG53 (BK/OG)
SSP3	31S-DG55 (BK/RD)
SSP4	31S-DG57 (BK/YE)

● Is any voltage indicated?

→ **Yes**

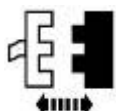
GO to I6.

→ **No**
 INSTALL a new FEM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

I6 CHECK THE REM FOR A SHORT TO POWER

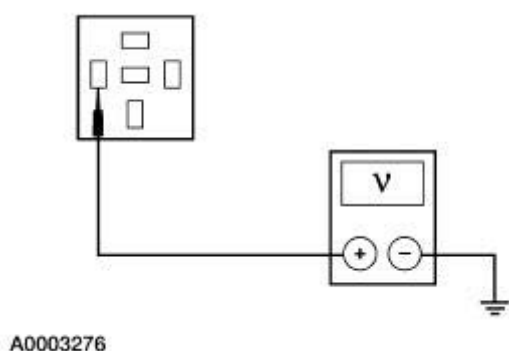
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1



REM C420d

2



2 Measure the voltage between SSP relay pin 85, harness side and ground as follows:

Relay	Circuit
SSP1	31S-DG51 (BK/YE)
SSP2	31S-DG53 (BK/OG)
SSP3	31S-DG55 (BK/RD)
SSP4	31S-DG57 (BK/YE)

● **Is any voltage indicated?**

→ **Yes**
 REPAIR the circuit. TEST the system for normal operation.

→ **No**
 INSTALL a new REM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

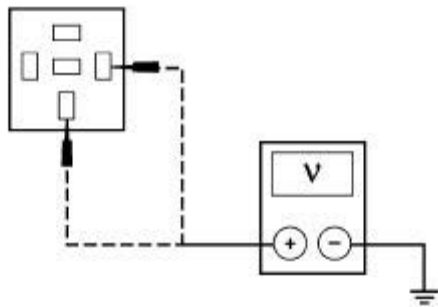
PINPOINT TEST J: THE POWER SUPPLY RELAY IS INOPERATIVE — SSP1

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.</p> <p>NOTE: Refer to Principles of Operation and SSP Relay Index for complete details of SSP1 powered features.</p>	
<p>J1 CHECK THE BJB FOR POWER</p>	
<p>1</p> <p>SSP1 Relay</p>	

2



3



A0003277

3

Measure the voltage between SSP1 relay BJB pin 86, circuit 30-DG51 (BK/YE), harness side and ground; and between SSP1 relay BJB pin 30, circuit 30-DG52 (RD/BU), harness side and ground.

- Are the voltages greater than 10 volts?

→ **Yes**
GO to J2.

→ **No**
REPAIR the power supply circuit. TEST the system for normal operation.

J2 CHECK SSP1 RELAY

1

Carry out the relay component test; refer to Wiring Diagrams Section 700-09, Component Testing.

- Does the relay pass the component test?

→ **Yes**
GO to J3.

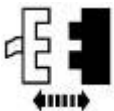
→ **No**
INSTALL a new relay. TEST the system for normal operation.

J3 CHECK CIRCUIT 31S-DG51 (BK/YE) FOR AN OPEN

1



2

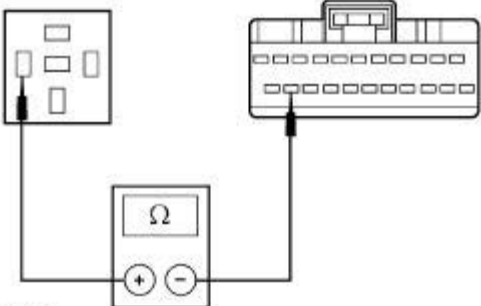


FEM C201b

3

3

Measure the resistance between SSP1 relay BJB pin 85, circuit 31S-DG51



A0003278

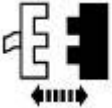

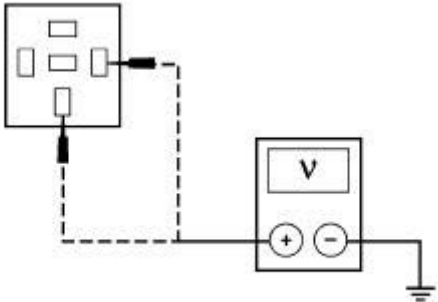
(BK/YE), harness side and FEM C201b pin 21, circuit 31S-DK21 (BK/WH), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
REPAIR circuit 30-DD3 (RD). TEST the system for normal operation.

→ **No**
REPAIR circuit 31S-DG51 (BK/YE). TEST the system for normal operation.

PINPOINT TEST K: THE POWER SUPPLY RELAY IS INOPERATIVE — SSP2

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.</p> <p>NOTE: Refer to Principles of Operation and SSP Relay Index for complete details of SSP2 powered features.</p>	
<p>K1 CHECK THE BJB FOR POWER</p>	
<p>1</p>  <p>SSP2 Relay</p> <p>2</p>  <p>3</p>  <p>A0003277</p>	<p>3 Measure the voltage between SSP2 relay BJB pin 86, circuit 30-DG53 (RD/OG), harness side and ground; and between SSP2 relay BJB pin 30, circuit 30-DG54 (RD/GN), harness side and ground.</p>

- Are the voltages greater than 10 volts?

→ **Yes**
GO to K2.

→ **No**
REPAIR the power supply circuit. TEST the system for normal operation.

K2 CHECK SSP2 RELAY

1 Carry out the relay component test; refer to Wiring Diagrams Section 700-09, Component Testing.

- Does the relay pass the component test?

→ **Yes**
GO to K3.

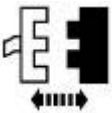
→ **No**
INSTALL a new relay. TEST the system for normal operation.

K3 CHECK CIRCUIT 31S-DG53 (BK/OG) FOR AN OPEN

1

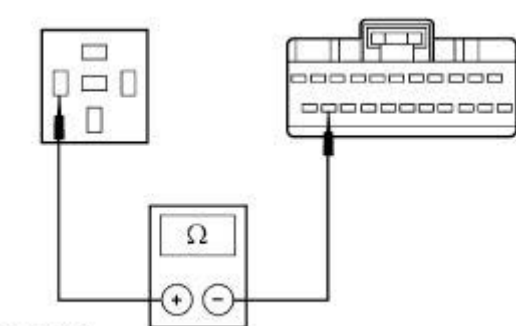


2



FEM C201b

3



A0003278

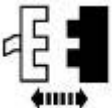

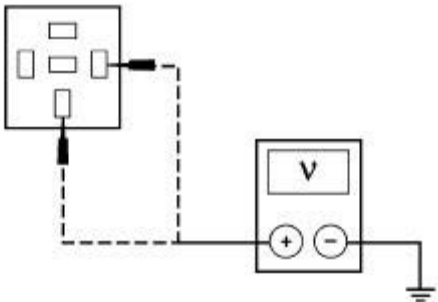
3 Measure the resistance between SSP2 relay BJB pin 85, circuit 31S-DG53 (BK/OG), harness side and FEM C201b pin 21, circuit 31S-DK21 (BK/WH), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
REPAIR or INSTALL a new BJB. TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST L: THE POWER SUPPLY RELAY IS INOPERATIVE — SSP3

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.</p> <p>NOTE: Refer to Principles of Operation and SSP Relay Index for complete details of SSP3 powered features.</p>	
<p>L1 CHECK THE BJB FOR POWER</p>	
<p>1</p>  <p>SSP3 Relay</p> <p>2</p>  <p>3</p>  <p>A0003277</p>	<p>3 Measure the voltage between SSP3 relay BJB pin 86, circuit 30-DG55 (BK/RD), harness side and ground; and between SSP3 relay BJB pin 30 circuit 30-DG56 (RD/WH), harness side and ground.</p> <ul style="list-style-type: none"> • Are the voltages greater than 10 volts? <p>→ Yes GO to <u>L2</u>.</p> <p>→ No REPAIR the power supply circuit. TEST the system for normal operation.</p>
<p>L2 CHECK SSP3 RELAY</p>	
	<p>1 Carry out the relay component test; refer to Wiring Diagrams Section 700-09.</p> <ul style="list-style-type: none"> • Does the relay pass the component test?

- **Yes**
GO to L3.
- **No**
INSTALL a new relay. TEST the system for normal operation.

L3 CHECK CIRCUIT 31S-DG55 (BK/RD) FOR AN OPEN

1

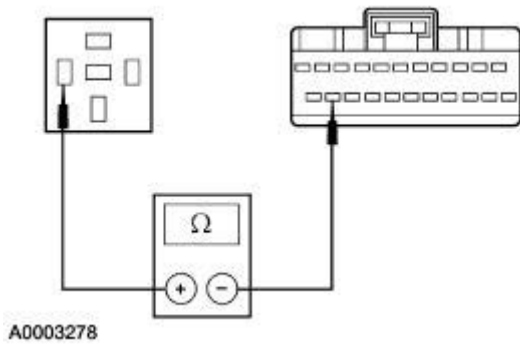


2



FEM C201b

3



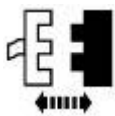
- 3 Measure the resistance between SSP3 relay BJB pin 85, circuit 31S-DG55 (BK/RD), harness side and FEM C201b pin 21, circuit 31S-DK21 (BK/WH), harness side.

● **Is the resistance less than 5 ohms?**

- **Yes**
REPAIR or INSTALL a new BJB. TEST the system for normal operation.
- **No**
REPAIR circuit. TEST the system for normal operation.

PINPOINT TEST M: THE POWER SUPPLY RELAY IS INOPERATIVE — SSP4

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.</p> <p>NOTE: Refer to Principles of Operation and SSP Relay Index for complete details of SSP4 powered features.</p>	
<p>M1 CHECK THE BJB FOR POWER</p>	
<p>1</p>	

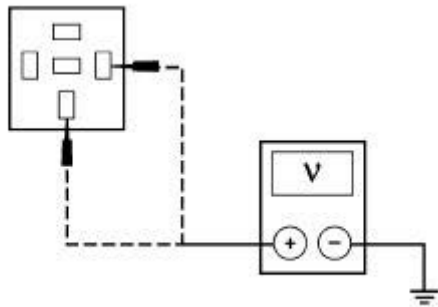


SSP4 Relay

2



3



A0003277

3 Measure the voltage between SSP4 relay BJB pin 86, circuit 31S-DG57 (BK/YE), harness side and ground; and between SSP4 relay BJB pin 30, circuit 30-DG58 (RD/BU), harness side and ground.

• Are the voltages greater than 10 volts?

→ Yes
GO to M2.

→ No
REPAIR the power supply circuit. TEST the system for normal operation.

M2 CHECK SSP4 RELAY

1 Carry out the relay component test; refer to Wiring Diagrams Section 700-09, Component Testing.

• Does the relay pass the component test?

→ Yes
GO to M3.

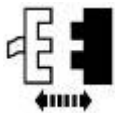
→ No
INSTALL a new relay. TEST the system for normal operation.

M3 CHECK CIRCUIT 31S-DG57 (BK/YE) FOR AN OPEN

1

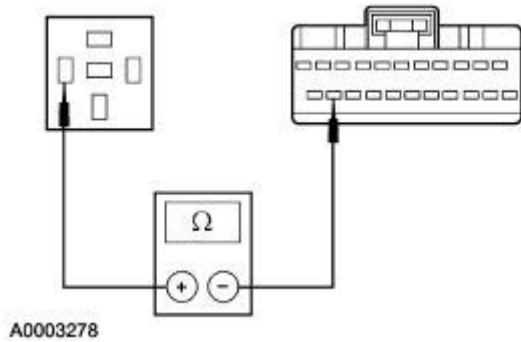


2



FEM C201b

3



3

Measure the resistance between SSP4 relay BJB pin 85, circuit 31S-DG57 (BK/YE), harness side and FEM C201b pin 21, circuit 31S-DK21 (BK/WH), harness side.

● **Is the resistance less than 5 ohms?**

→ **Yes**

REPAIR or INSTALL a new BJB. TEST the system for normal operation.



→ **No**

REPAIR the circuit. TEST the system for normal operation.

Autolamps

Refer to Wiring Diagrams Section [417-01](#), Exterior Lighting for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

NOTE: The front electronic module (FEM), the rear electronic module (REM) and the instrument cluster module (ICM) must be reconfigured before installing a new module. Refer to [Section 418-01](#).

The vehicle's electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the standard corporate protocol (SCP) communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message) control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Exterior lighting

The exterior lighting outputs are zone controlled by the front electronic module (FEM) and rear electronic module (REM). The FEM and REM. An additional function of the lighting system is a lamp outage function which indicates to the driver if certain exterior bulbs are not functioning. With a bulb inoperative, the FEM or REM will send a message to the instrument cluster and message center (if equipped with the message center) which will in turn indicate to the driver that the lamp is inoperative with a lamp out indicator (with the message center a message will be displayed). To provide complete input and output functionality, each exterior lamp feature will be described individually. All exterior lighting is powered by the switched system power (SSP) feature (refer to Switched System Power [SSP]). A failure of all or any of the SSP features will cause inoperative exterior lighting. When

diagnosing exterior lighting, it is essential to determine if all related symptoms and DTCs are controlled by the SSP feature.

Autolamps

The autolamps are controlled by the headlamp switch, autolamp sensor, instrument cluster module and the FEM. The headlamps may be in the high or low beam position depending on the multifunction switch position. When the headlamp switch is in the autolamp position, the instrument cluster module will send an ON or OFF command to the FEM, depending on the signal from the autolamp sensor. The FEM will process this information and output the appropriate command to the headlamps, which are hardwired to the FEM. The autolamps will remain ON for approximately 20 seconds after the ignition switch is changed from the RUN position to the ACC or OFF position.

Autolamps and daytime running lamps (DRL) are two functions which the FEM may be configured to include.

Left and right low, as well as high beams will provide a lamp outage indication. Fault management of the headlamps will provide some headlamp functionality. In the event of all multifunction switch, all headlamp switch or ignition switch invalid or missing data failures, the low beams will be illuminated.

The vehicle's electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the SCP communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Switched System Power (SSP)

The SSP is invoked by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps, and power door locks. This is only accomplished when both the FEM and the REM are in sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (input) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3, and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. When energized, each relay will supply power to multiple features/functions. For additional information, go to the SSP Index for diagnosis and testing of SSP related issues. Refer to [Headlamps](#).

Inspection and Verification

1. Verify the customer concern by operating the autolamps following these steps:
 1. Place the ignition switch (11572) in the ON position.
 2. Place the headlamp switch (11654) in the ON position.
 3. **NOTE:** For headlamp concerns, refer to [Headlamps](#).
- Verify the low beam operation.
4. Place the headlamps in the autolamp position.
5. **NOTE:** When aiming light and covering the light sensor amplifier, there may be a one minute delay for the autolamps to change conditions.

Verify the autolamp operation by aiming a light at the light sensor amplifier and removing the light source and covering the light sensor amplifier. The headlamps should turn OFF with the light and illuminate with the light sensor amplifier covered.

2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Damaged FEM ● Damaged instrument cluster (10849) 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 427 (30A) ■ 432 (30A) ■ 422 (20A) ■ 423 (30A) ■ 424 (30A) ■ 425 (40A) ● Central junction box (CJB) Fuses: <ul style="list-style-type: none"> ■ 204 (5A) ■ 205 (5A) ■ 213 (5A) ■ 220 (5A) ● Damaged wiring harness ● Loose or corroded connections ● Damaged headlamp switch

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT 914, CKT 915 or CKT 70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for FEM, go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for instrument cluster, go to Pinpoint Test C.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the FEM.
6. If the DTCs retrieved are related to the concern, go to FEM Diagnostic Trouble Code (DTC) Index, REM Diagnostic Trouble Code (DTC) Index, Instrument Cluster Diagnostic Trouble Code (DTC) Index, or SSP Relay Index to continue diagnostics. Refer to [Headlamps](#).
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.




Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the front electronic module 	<ul style="list-style-type: none"> Battery junction box (BJB) Fuses 425 (40A), 422 (20A). Circuitry. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> No communication with the instrument cluster module 	<ul style="list-style-type: none"> CJB Fuses 204 (5A), 213 (5A), 220 (5A). Circuitry. Instrument cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> The power supply relay is inoperative — all SSP features 	<ul style="list-style-type: none"> Circuitry. Relay. FEM. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test I.
<ul style="list-style-type: none"> The power supply relay is inoperative — SSP1 	<ul style="list-style-type: none"> BJB Fuse 427 (30A). Circuitry. Relay. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test J.
<ul style="list-style-type: none"> The power supply relay is inoperative — SSP2 	<ul style="list-style-type: none"> BJB Fuse 432 (30A). Circuitry. Relay. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test K.
<ul style="list-style-type: none"> The power supply relay is inoperative — SSP3 	<ul style="list-style-type: none"> BJB Fuse 424 (30A). Circuitry. Relay. FEM. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test L.
<ul style="list-style-type: none"> The power supply relay is inoperative — SSP4 	<ul style="list-style-type: none"> BJB Fuse 423 (30A). Circuitry. Relay. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test M.
<ul style="list-style-type: none"> The autolamps are inoperative 	<ul style="list-style-type: none"> CJB Fuse 205 (5A). Circuitry. Headlamp switch. Autolamp sensor. Instrument cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test N.
<ul style="list-style-type: none"> The autolamps are ON continuously 	<ul style="list-style-type: none"> Circuitry. Autolamp sensor. Instrument cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test O.
<ul style="list-style-type: none"> The autolamp time delay is inoperative 	<ul style="list-style-type: none"> FEM. 	<ul style="list-style-type: none"> INSTALL a new FEM; REFER to Section 419-10. TEST the system for normal operation.

Pinpoint Tests

PINPOINT TEST N: THE AUTOLAMPS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.</p>	
<p>N1 CHECK HEADLAMPS</p>	
	<p>1 Place the headlamp switch in the ON position.</p> <ul style="list-style-type: none"> ● Do the low beams illuminate? <p>→ Yes GO to <u>N2</u>.</p> <p>→ No GO to <u>Pinpoint Test D</u>.</p>
<p>N2 CHECK HEADLAMP SWITCH</p>	
	<p>1 Carry out the Headlamp Switch Component Test; refer to Wiring Diagrams, Section 700-09.</p> <ul style="list-style-type: none"> ● Is the headlamp switch OK? <p>→ Yes GO to <u>N3</u>.</p> <p>→ No INSTALL a new headlamp switch; REFER to <u>Lamp Switch—Headlamp</u> in this section. TEST the system for normal operation.</p>
<p>N3 CHECK LIGHT SENSOR AMPLIFIER INPUT</p>	
<p>1  Diagnostic Tool</p> <p>2 </p> <p>4 </p>	<p>3 Place the headlamp switch in the autolamps position.</p> <p>4 Monitor instrument cluster PID LIGHTSN while illuminating the light sensor amplifier, then remove the light source.</p> <ul style="list-style-type: none"> ● Does the PID indicate NO with the light applied and YES with the light removed?

→ **Yes**
GO to N4.

→ **No**
GO to N8.

N4 CHECK CIRCUIT 15-LE42 (GN/RD) FOR POWER

1



2

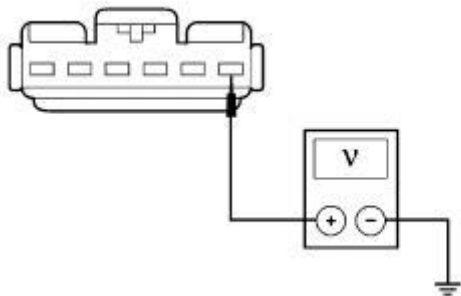


Autolamp Sensor C287

3



4



A0003279

4 Measure the voltage between autolamp sensor C287 pin 6, circuit 15-LE42 (GN/RD), harness side and ground.

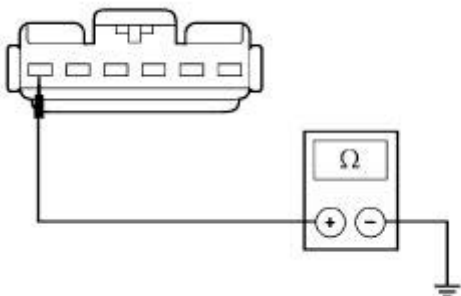
• Is the voltage greater than 10 volts?

→ **Yes**
GO to N5.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

N5 CHECK CIRCUIT 31-LE42 (BK) FOR OPEN

1



A0003280

1 Measure the resistance between autolamp sensor C287 pin 1, circuit 31-LE42 (BK), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to N6.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

N6 CHECK CIRCUIT 8-LE42 (WH/BU) FOR SHORT TO POWER

1



2

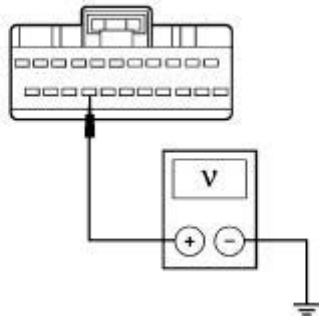


Instrument Cluster C220a

3



4



A0003281

4 Measure the voltage between instrument cluster C220a pin 19, circuit 8-LE42 (WH/BU), harness side and ground.

● Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
GO to N7.

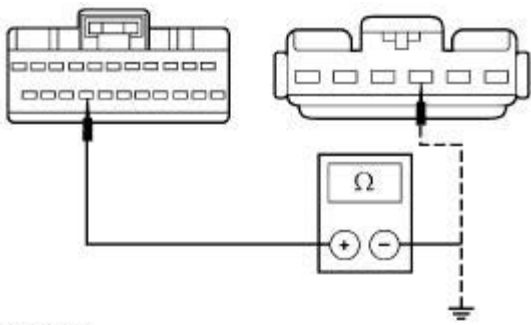
N7 CHECK CIRCUIT 8-LE42 (WH/BU) FOR OPEN OR SHORT TO GROUND

1



2

2 Measure the resistance between instrument cluster C220a pin 19, circuit 8-LE42 (WH/BU), harness side and



A0003282

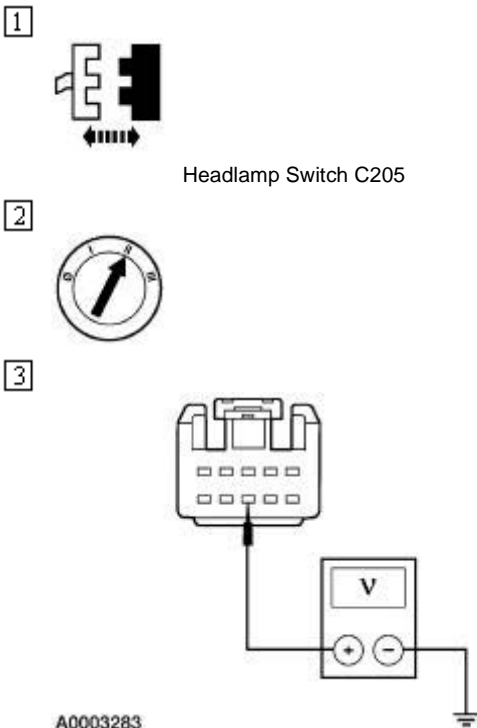
ground; and between instrument cluster C220a pin 19, circuit 8-LE42 (WH/BU), harness side and autolamp sensor C278 pin 4, circuit 8-LE42 (WH/BU), harness side.

- Is the resistance greater than 10,000 ohms between instrument cluster C220a and ground and less than 5 ohms between instrument cluster C220a and autolamp sensor C278?

→ **Yes**
 INSTALL a new autolamp sensor; REFER to Photocell and Amplifier—Light Sensor in this section. TEST the system for normal operation.

→ **No**
 REPAIR the circuit. TEST the system for normal operation.

N8 CHECK CIRCUIT 10-LE47 (GY/OG) FOR SHORT TO POWER



A0003283

- 3 Measure the voltage between headlamp switch C205 pin 8, circuit 10-LE47 (GY/OG), harness side and ground.

- Is any voltage indicated?

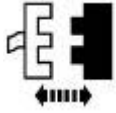
→ **Yes**
 REPAIR the circuit. TEST the system for

normal operation.

→ **No**
GO to N9.

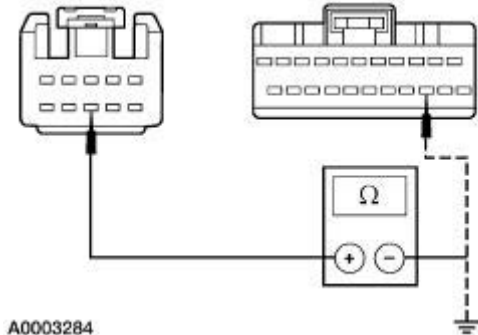
N9 CHECK CIRCUIT 10-LE47 (GY/OG) FOR OPEN OR SHORT TO GROUND

1



Instrument Cluster C220c

2



2


Measure the resistance between headlamp switch C205 pin 8, circuit 10-LE47 (GY/OG), harness side and ground; and between headlamp switch C205 pin 8, circuit 10-LE47 (GY/OG), harness side and instrument cluster C220c pin 14, circuit 10-LE47 (GY/OG), harness side.

- Is the resistance greater than 10,000 ohms between headlamp C205 and ground and less than 5 ohms between headlamp C205 and instrument cluster C220c?

→ **Yes**
INSTALL a new instrument cluster;
REFER to Section 413-01. TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST O: THE AUTO LAMPS ARE ON CONTINUOUSLY

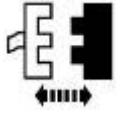
CONDITIONS	DETAILS/RESULTS/ACTIONS
O1 CHECK THE OPERATION OF THE AUTOLAMPS	
<p>1</p> 	<p>2</p> <p>Place the autolamp switch in the OFF position.</p> <ul style="list-style-type: none">● Do the headlamps turn off? <p>→ Yes</p>

The system is operating correctly.

→ **No**
GO to O2.

O2 CHECK THE OPERATION OF THE AUTOLAMP SENSOR

1



Autolamp sensor C287

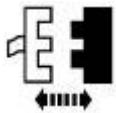
- **Do the headlamps turn off?**

→ **Yes**
INSTALL a new autolamp sensor; REFER to Photocell and Amplifier—Light Sensor in this section. TEST the system for normal operation.

→ **No**
GO to O3.

O3 CHECK INSTRUMENT CLUSTER OUTPUT

1



Instrument Cluster C220c

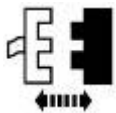
- **Do the headlamps turn off?**

→ **Yes**
INSTALL a new instrument cluster; REFER to Section 413-01. TEST the system for normal operation.

→ **No**
GO to O4.

O4 CHECK CIRCUIT 10-LE47 FOR A SHORT TO POWER

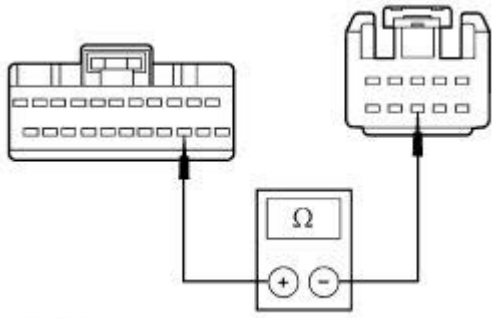
1



Headlamp Switch C205

2

2 Measure the resistance between headlamp switch C205 pin 8 circuit 10-LE47 (GY/OG), harness side and instrument cluster C220c pin 14 circuit 10-LE47 (GY/OG), harness side.



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- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new headlamp switch;
REFER to Lamp Switch—Headlamp in
this section. TEST the system for normal
operation.

→ **No**
REPAIR the circuit. TEST the system for
normal operation.

Stoplamps

Refer to Wiring Diagrams Section [417-01](#), Exterior Lighting for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

NOTE: The front electronic module (FEM), the rear electronic module (REM) and the instrument cluster module (ICM) must be reconfigured before installing a new module. Refer to [Section 418-01](#).

The vehicle's electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the standard corporate protocol (SCP) communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Exterior Lighting

The exterior lighting outputs are zone controlled by the FEM and REM. The front exterior lights are controlled by the FEM and the rear exterior lights are controlled by the REM. An additional function of the lighting system is a lamp outage function which indicates to the driver if certain exterior bulbs are not functioning. With a bulb inoperative, the FEM or REM will send a message to the instrument cluster and message center (if equipped with the message center) which will in turn indicate to the driver that the lamp is inoperative with a lamp out indicator (with the message center a message will be displayed). To provide complete input and output functionality, each exterior lamp feature will be described individually. All exterior lighting is powered by the switched system power (SSP) feature (refer to Switched System Power [SSP]). A failure of all or any of the SSP features will cause

inoperative exterior lighting. When diagnosing exterior lighting, it is essential to determine if all related symptoms and DTCs are controlled by the SSP feature.

Stoplamps

Brake lighting is controlled by the REM. The brake pedal position (BPP) switch is hardwired to the REM. When the brake pedal is depressed, the BPP switch will input information to the REM. Then, the REM will process the information and output to the left, right, and high mounted stoplamps. Only the left and right stoplamps will provide lamp outage indication.

The vehicle's electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the SCP communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Switched System Power (SSP)

The SSP is invoked by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps, and power door locks. This is only accomplished when both the FEM and the REM are in sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (input) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3, and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. When energized, each relay will supply power to multiple features/functions. For additional information, go to the SSP Index for diagnosis and testing of SSP related issues. Refer to [Headlamps](#)

Inspection and Verification

1. Verify the customer concern by operating the stoplamps.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Damaged REM 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 403 (5A) ■ 407 (5A) ■ 423 (30A) ■ 424 (30A) ■ 430 (30A) ■ 431 (30A) ● Central junction box (CJB) Fuses: <ul style="list-style-type: none"> ■ 204 (5A) ■ 220 (10A) ■ 235 (5A)

- Damaged wiring harness
- Loose or corroded connections
- Damaged BPP switch

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 =ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for REM, go to Pinpoint Test B.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the FEM.
6. If the DTCs retrieved are related to the concern, go to FEM Diagnostic Trouble Code (DTC) Index, and Instrument Cluster Diagnostic Trouble Code (DTC) Index, or SSP Relay Index to continue diagnostics. Refer to [Headlamps](#).
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● No communication with the rear electronic module 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuse 425 (40A). ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B.
<ul style="list-style-type: none"> ● The power supply relay is inoperative — all SSP features 	<ul style="list-style-type: none"> ● Circuitry. ● Relay. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test L.
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP1 	<ul style="list-style-type: none"> ● BJB Fuse 4271 (30A). ● Circuitry. ● Relay. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test J.
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP2 	<ul style="list-style-type: none"> ● BJB Fuse 432 (30A). ● Circuitry. ● Relay. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test K.
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP3 	<ul style="list-style-type: none"> ● BJB Fuse 424 (30A). ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test L.

	<ul style="list-style-type: none"> ● Relay. ● REM. 	
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP4 	<ul style="list-style-type: none"> ● BJB Fuse 423 (30A). ● Circuitry. ● Relay. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test M.
<ul style="list-style-type: none"> ● The stoplamps are inoperative 	<ul style="list-style-type: none"> ● Brake pedal position (BPP) switch. ● Bulb. ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test P.
<ul style="list-style-type: none"> ● One or more stoplamps are inoperative — RR stoplamp 	<ul style="list-style-type: none"> ● Bulb. ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test Q.
<ul style="list-style-type: none"> ● One or more stoplamps are inoperative — LR stoplamp 	<ul style="list-style-type: none"> ● Bulb. ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test R.
<ul style="list-style-type: none"> ● One or more stoplamps are inoperative — high mounted stoplamp 	<ul style="list-style-type: none"> ● Bulb. ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test S.
<ul style="list-style-type: none"> ● The exterior lamp(s) are inoperative — LR stop and rear lamps 	<ul style="list-style-type: none"> ● BJB 403 (5A). ● Bulb. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test T.
<ul style="list-style-type: none"> ● The exterior lamp(s) are inoperative — RR stop and park lamps 	<ul style="list-style-type: none"> ● BJB 407 (5A). ● Bulb. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test U.
<ul style="list-style-type: none"> ● The stoplamps are on continuously — all stoplamps 	<ul style="list-style-type: none"> ● Circuitry. ● BPP switch. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test V.
<ul style="list-style-type: none"> ● The stoplamps are on continuously — RR stoplamp only 	<ul style="list-style-type: none"> ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test W.
<ul style="list-style-type: none"> ● The stoplamps are on continuously — LR stoplamp only 	<ul style="list-style-type: none"> ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test X.
<ul style="list-style-type: none"> ● The stoplamps are on continuously — high mounted stoplamp only 	<ul style="list-style-type: none"> ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test Y.

Pinpoint Tests

PINPOINT TEST P: THE STOPLAMPS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
P1 CHECK FOR DTCs	
	<ol style="list-style-type: none"> Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.

● Are any DTCs recorded?

- **Yes**
If DTC B1483, GO to P2. For all other DTCs, GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps.
- **No**
GO to P2.

P2 CHECK THE REM INPUT

1



1

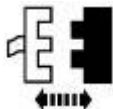
Monitor the REM PID BOO while pressing and releasing the brake pedal.

● Does the PID change states?

- **Yes**
INSTALL a new REM; REFER to Section 419-10. TEST the system for normal operation.
- **No**
GO to P3.

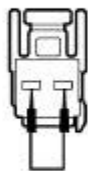
P3 CHECK BPP SWITCH OPERATION

1



BPP Switch C278

2



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2

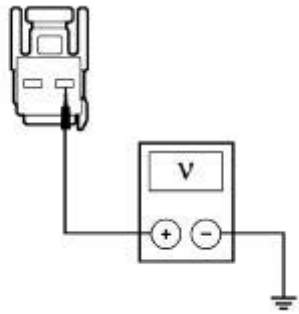
Connect a 10A fused jumper wire between BPP switch C278 pin 1, circuit 29-CF58 (OG/GN), harness side and BPP switch C278 pin 2, circuit 29S-CF1 (OG/YE), harness side.

● Do the stoplamps illuminate?

- **Yes**
INSTALL a new BPP switch; REFER to Lamp Switch—Brake Pedal Position (BPP) in this section. TEST the system for normal operation.
- **No**
GO to P4.

P4 CHECK POWER TO BPP SWITCH

1



A0003287

1

Measure the voltage between BPP switch C278 pin 1, circuit 29-CF58 (OG/GN), harness side and ground.

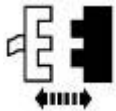
● Is the voltage greater than 10 volts?

→ **Yes**
GO to P5.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

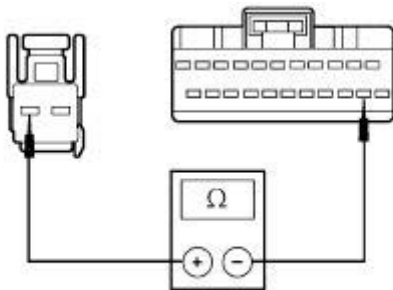
P5 CHECK CIRCUIT 29S-CF1 (OG/BU) FOR AN OPEN

1



REM C420b

2



A0003288

2


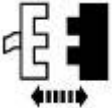

Measure the resistance between BPP switch C278 pin 2, circuit 29S-CF1 (OG/YE), harness side and REM C420b pin 13, circuit 29S-DK30 (OG), harness side.

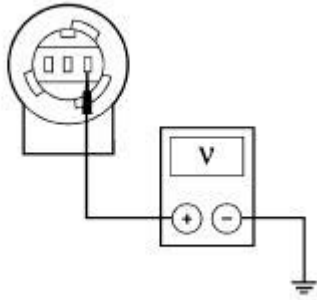
● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new REM; REFER to Section 419-10. TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

**PINPOINT TEST Q: ONE OR MORE STOPLAMPS ARE INOPERATIVE
— RR STOPLAMP**

CONDITIONS	DETAILS/RESULTS/ACTIONS
Q1 CHECK FOR DTCs	
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes GO to REM Diagnostic Trouble Code (DTC) Index. REFER to <u>Headlamps</u> in this section.</p> <p>→ No GO to <u>Q2</u>.</p>
Q2 CHECK INPUT TO REM	
	<p>1 While observing the RR stoplamp, trigger the active command R STOP ON and then OFF.</p> <ul style="list-style-type: none"> ● Does RR stoplamp operate correctly? <p>→ Yes INSTALL a new REM; REFER to <u>Section 419-10</u>. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No GO to <u>Q3</u>.</p>
Q3 CHECK CIRCUIT 29S-LF23 (OG) FOR POWER	
<p>1</p>  <p>2</p>  <p>RR Combination Lamp C417</p> <p>3</p>  <p>4</p>	<p>4 Measure the voltage between RR combination lamp C417 pin 1, circuit 29S-LF23 (OG), harness side and ground.</p>



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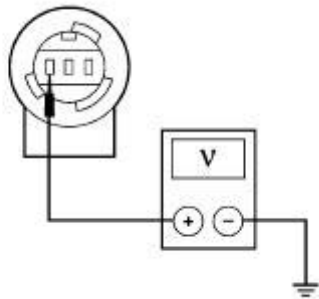
● Is the voltage greater than 10 volts?

→ **Yes**
GO to Q4.

→ **No**
REPAIR the circuit. TEST the system for normal operation

Q4 CHECK CIRCUIT 31S-LG14 (BK/OG) FOR SHORT TO POWER

1



A0003290

1 Measure the voltage between RR combination lamp C417 pin 3, circuit 31S-LG14 (BK/OG), harness side and ground.

● Is any voltage indicated?

→ **Yes**
GO to Q5.

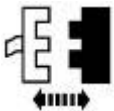
→ **No**
GO to Q6.

Q5 CHECK REM FOR SHORT TO POWER

1



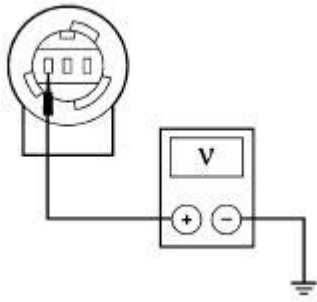
2



REM C420e

3

3 Measure the voltage between RR combination lamp C417 pin 3, circuit 31S-LG14 (BK/OG), harness side and



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ground.

- Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

Q6 CHECK CIRCUIT 31S-LG14 (BK/OG) FOR AN OPEN

1

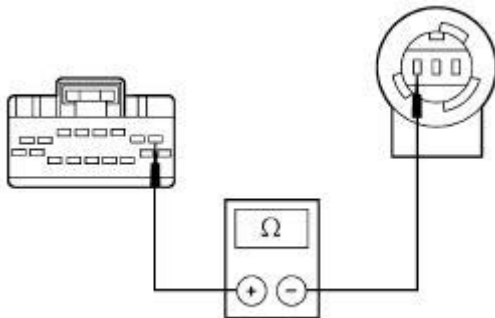


2



REM C420e

3



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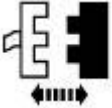

3 Measure the resistance between REM C420e pin 1, circuit 31S-LG21 (BK/GN), harness side and RR combination lamp C417 pin 3, circuit 31S-LG14 (BK/OG), harness side.

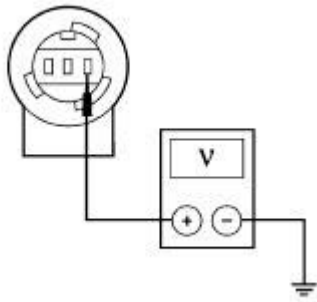
- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST R: ONE OR MORE STOPLAMPS ARE INOPERATIVE — LR STOPLAMP

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.</p>	
<p>R1 CHECK FOR DTCs</p>	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps.</p> <p>→ No GO to R2.</p>
<p>R2 CHECK REM OUTPUT</p>	
	<p>1 While observing the LR stoplamp, trigger the active command L STOP ON and then OFF.</p> <ul style="list-style-type: none"> ● Does LR stoplamp operate correctly? <p>→ Yes INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No GO to R3.</p>
<p>R3 CHECK POWER TO THE LR STOP LAMP</p>	
<p>NOTE: Cycle ignition switch from OFF to RUN to enable the SSP feature.</p>	
<p>1</p>  <p>LR Combination Lamp C414</p> <p>2</p>  <p>3</p>	<p>3 Measure the voltage between LR stop lamp C414 pin 1, circuit 29S-LF23 (OG), harness side and ground.</p>



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● Is the voltage greater than 10 volts?

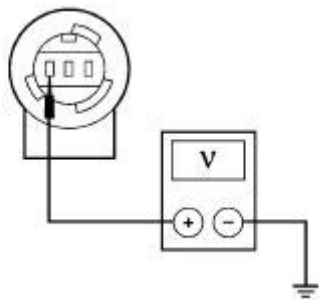
→ **Yes**
GO to R4.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

R4 CHECK CIRCUIT 31S-LG14 (BK/OG) FOR A SHORT TO POWER

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1



A0003290

1 Measure the voltage between LR combination lamp C414 pin 3, circuit 31S-LG14 (BK/OG), harness side and ground.

● Is any voltage indicated?

→ **Yes**
GO to R5.

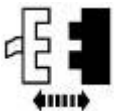
→ **No**
GO to R6.

R5 CHECK REM FOR A SHORT TO POWER

1



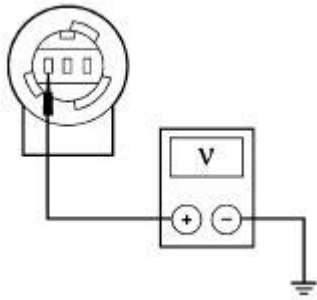
2



REM C420e

3

3 Measure the voltage between LR combination lamp C414 pin 3, circuit



A0003290

31S-LG14 (BK/OG), harness side and ground.

- Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

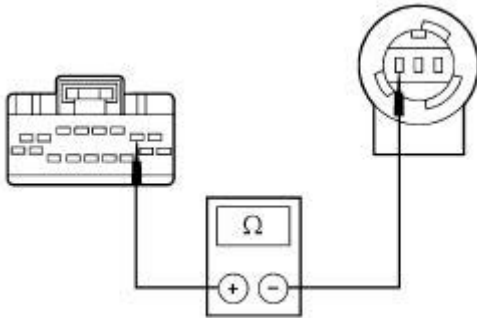
R6 CHECK CIRCUIT 31S-LG14 (BK/OG) FOR AN OPEN

1



REM C420e

2



A0003292




2 Measure the resistance between LR combination lamp C414 pin 3, circuit 31S-LG14 (BK/OG), harness side and REM C420e pin 2, circuit 31S-LG14 (BK/OG), harness side.

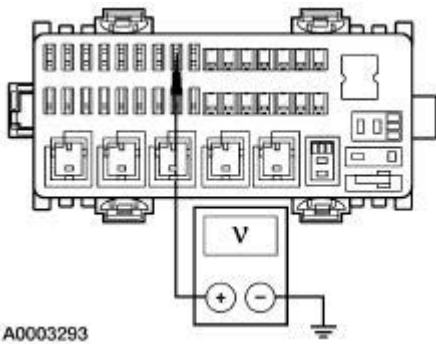
- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST S: ONE OR MORE STOPLAMPS ARE INOPERATIVE — HIGH MOUNTED STOPLAMP

CONDITIONS	DETAILS/RESULTS/ACTIONS
S1 CHECK FOR DTCs	
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes GO to REM Diagnostic Trouble Code (DTC) Index. REFER to <u>Headlamps</u> in this section.</p> <p>→ No GO to <u>S2</u>.</p>
S2 CHECK REM OUTPUT	
<p>1</p>  <p>2</p> 	<p>2 While observing the high mounted stoplamp, trigger the active command H MNT STP ON and then OFF.</p> <ul style="list-style-type: none"> ● Does the high mounted stoplamp operate correctly? <p>→ Yes INSTALL a new REM; REFER to <u>Section 419-10</u>. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No GO to <u>S3</u>.</p>
S3 CHECK POWER TO BJB 408 (10A)	
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
<p>1</p>  <p>2</p>	<p>2 Measure the voltage between BJB Fuse 408 (10A), input terminal and ground.</p>



A0003293

● Is the voltage greater than 10 volts?

→ **Yes**
REINSTALL the fuse.GO to S4.

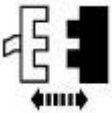
→ **No**
INSTALL a new or REPAIR the BJB.
TEST the system for normal operation.

S4 CHECK CIRCUIT 29S-LG6 (OG/YE) FOR AN OPEN

1

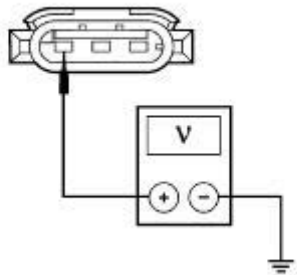


2



High Mounted Stoplamp C302

3



A0003294

3 Measure the voltage between high mounted stoplamp C302 pin 1, circuit 29S-LG6 (OG/YE), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to S5.

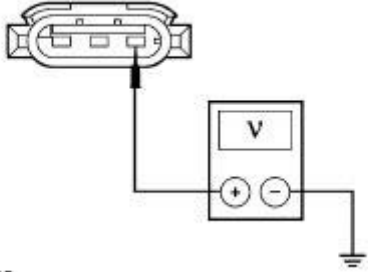
→ **No**
REPAIR the circuit. TEST the system for normal operation.

S5 CHECK CIRCUIT 31S-LG6 (BK/YE) FOR A SHORT TO POWER

1



2



A0003295

2

Measure the voltage between high mounted stoplamp C302 pin 3, circuit 31S-LG6 (BK/YE), harness side and ground.

● Is any voltage indicated?

→ Yes
GO to S6.

→ No
GO to S7.

S6 CHECK REM FOR A SHORT TO POWER

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1



2

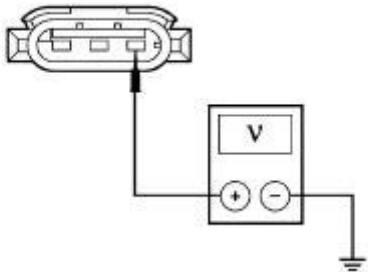


REM C420e

3



4



A0003295

4

Measure the voltage between high mounted stoplamp C302 pin 3, circuit 31S-LG6 (BK/YE), harness side and ground.

● Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

S7 CHECK CIRCUIT 31S-LG6 (BK/YE) FOR AN OPEN

1

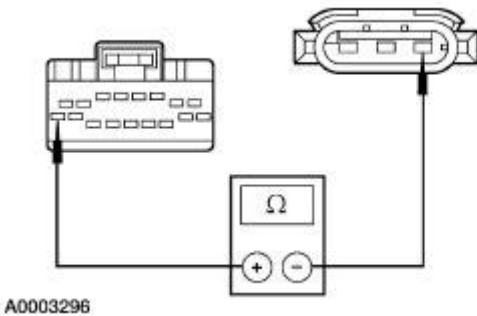


2



REM C420e

3



3 Measure the resistance between high mounted stoplamp C302 pin 3, circuit 31S-LG6 (BK/YE), harness side and REM C420e pin 17, circuit 31S-LG6 (BK/YE), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

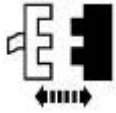
PINPOINT TEST T: THE EXTERIOR LAMP(S) ARE INOPERATIVE — LR STOP AND PARK LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
T1 CHECK FOR DTCs	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <p>● Are any DTCs recorded?</p>

- **Yes**
GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps.
- **No**
GO to T2.

T2 CHECK POWER TO BJB FUSE 403 (5A)

1

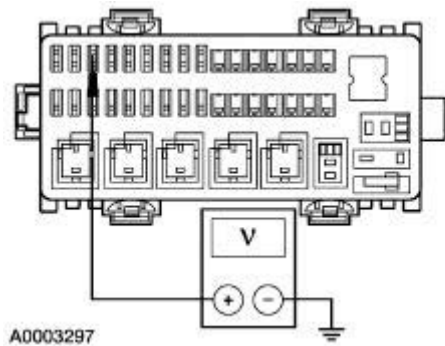


BJB Fuse 403 (5A)

2



3



- 3 Measure the voltage between BJB Fuse 403 (5A), circuit 30S-DB16 (RD/GN), input side and ground.

● **Is the voltage greater than 10 volts?**

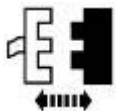
- **Yes**
GO to T3.
- **No**
REPAIR or INSTALL a new BJB. TEST the system for normal operation.

T3 CHECK POWER TO LR STOP AND PARK LAMPS

1

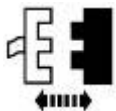


2



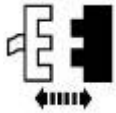
LR Combination Lamp C414

3



Park Lamp C412

4

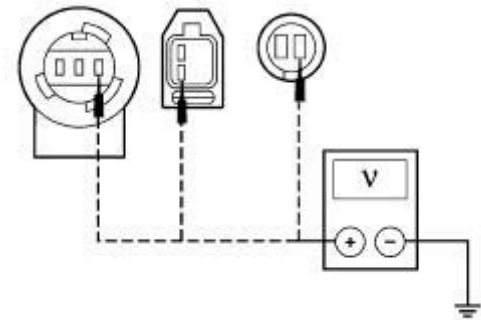


Park Lamp C419

5



6



A0003298

6

Measure the voltage between the LR combination lamp C414 pin 1, circuit 29S-LF23 (OG), harness side and ground; between LR park lamp C412 pin 1, circuit 29S-LF11 (OG/WH), harness side and ground; and between LR park lamp C419 pin 1, circuit 29S-LF11 (OG/WH), harness side and ground.

● Is the voltage greater than 10 volts?

→ Yes
GO to T4.

→ No
REPAIR the circuit. TEST the system for normal operation.

T4 CHECK REM OUTPUT

1



2



Diagnostic Tool

3



4



4



While observing the LR park lamps, trigger the REM active command PARKLAMPS ON and then OFF.

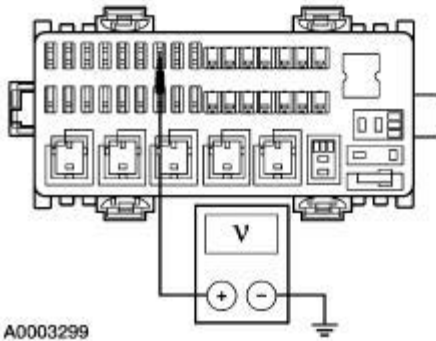
5

While observing the LR stop and park lamps, trigger the REM active command

	<p>L STOP ON and then OFF.</p> <ul style="list-style-type: none"> ● Do all the LR stop and park lamps illuminate? <p>→ Yes INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REFER to Symptom Chart to REPAIR individual lighting concerns.</p>
--	---

PINPOINT TEST U: THE EXTERIOR LAMP(S) ARE INOPERATIVE — RR STOP AND PARK LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
U1 CHECK FOR DTCs	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps in this section.</p> <p>→ No GO to U2.</p>
U2 CHECK POWER TO THE BJB FUSE 407 (5A)	
<p>1</p>  <p>BJB Fuse 407 (5A)</p> <p>2</p>  <p>3</p>	<p>3 Measure the voltage between BJB Fuse 407, circuit 30S-DB16 (RD/GN), input side and ground.</p>



A0003299

- Is the voltage greater than 10 volts?

→ **Yes**

GO to U3.

→ **No**

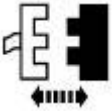
REPAIR or INSTALL a new BJB. TEST the system for normal operation.

U3 CHECK POWER TO RR STOP AND PARK LAMPS

1

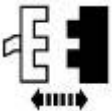


2



RR Combination Lamp C417

3



RR Park Lamp C418

4



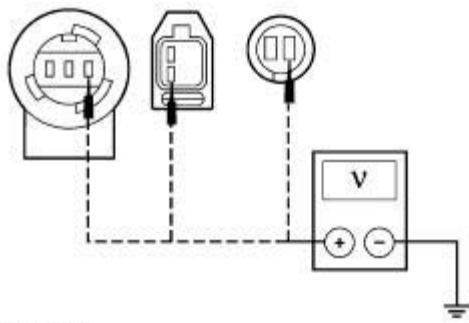
RR Park Lamp C415

5



6

- 6 Measure the voltage between RR combination lamp C417 pin 1, circuit 29S-LF23 (OG), harness side and ground; between RR park lamp C418 pin 1, circuit 29S-LF20 (OG), harness side and ground; and between RR park lamp C415 pin 1, circuit 29S-LF11 (OG/WH), harness side and ground.



A0003298

● Is the voltage greater than 10 volts?

→ **Yes**
GO to U4.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

U4 CHECK REM OUTPUT

1



2



Diagnostic Tool

3



4



4 While observing the RR park lamps, trigger the REM active command PARKLAMPS ON and then OFF.




5 While observing the RR stop and park lamps, trigger the REM active command R STOP ON and then OFF.

● Did all the RR stop and park lamps illuminate?

→ **Yes**
INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

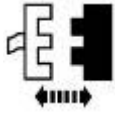
→ **No**
REFER to Symptom Chart to REPAIR individual lighting concerns.

PINPOINT TEST V: THE STOPLAMPS ARE ON CONTINUOUSLY — ALL STOPLAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.</p>	
<p>V1 CHECK FOR DTCs</p>	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps in this section.</p> <p>→ No GO to V2.</p>
<p>V2 CHECK INPUT TO REM</p>	
<p>1  Diagnostic Tool</p> <p>2 </p> <p>3 </p>	<p>3 Monitor the REM PID BOO.</p> <p>4 Depress and release the brake pedal.</p> <ul style="list-style-type: none"> ● Does the PID change value when the brake pedal is depressed and released? <p>→ Yes INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No GO to V3.</p>
<p>V3 CHECK BPP SWITCH OPERATION</p>	
<p>1</p>	



2



BPP Switch C278

● Do the stoplamps turn off?

→ Yes

INSTALL a new BPP switch; REFER to Lamp Switch—Brake Pedal Position (BPP) in this section. CLEAR the DTCs. REPEAT the self-test.

→ No

GO to V4.

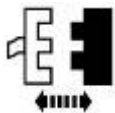
V4 CHECK CIRCUIT 29S-CF1 (OG/YE) FOR A SHORT TO POWER

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1

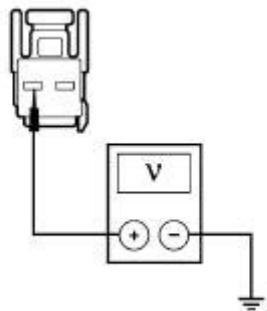


2



REM C420b

3



A0003300

3 Measure the voltage between BPP C278 pin 2, circuit 29S-CF1 (OG/YE), harness side and ground.

● Is any voltage indicated?


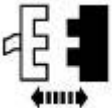

→ Yes

REPAIR the circuit. TEST the system for normal operation.

→ No


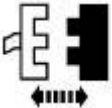

INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST W: THE STOPLAMPS ARE ON CONTINUOUSLY — RR STOPLAMP ONLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
W1 CHECK FOR DTCs	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes GO to REM Diagnostic Trouble Code (DTC) Index. REFER to <u>Headlamps</u> in this section.</p> <p>→ No GO to <u>W2</u>.</p>
W2 CHECK CIRCUIT 31S-LG14 (BK/OG) FOR A SHORT TO GROUND	
<p>1 </p> <p>2  REM C420e</p> <p>3 </p>	<ul style="list-style-type: none"> ● Does the RR stoplamp turn off? <p>→ Yes INSTALL a new REM; REFER to <u>Section 419-10</u>. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>

PINPOINT TEST X: THE STOPLAMPS ARE ON CONTINUOUSLY — LR STOPLAMP ONLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	

X1 CHECK FOR DTCs	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes</p> <p>GO to REM Diagnostic Trouble Code (DTC) Index. REFER to <u>Headlamps</u> .</p> <p>→ No</p> <p>GO to <u>X2</u> .</p>
X2 CHECK CIRCUIT 31S-LG14 (BK/OG) FOR A SHORT TO GROUND	
<p>1 </p> <p>2 </p> <p>3 </p>	<ul style="list-style-type: none"> ● Does the LR stoplamp turn off? <p>→ Yes</p> <p>INSTALL a new REM; REFER to <u>Section 419-10</u> . CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No</p> <p>REPAIR the circuit. TEST the system for normal operation.</p>

PINPOINT TEST Y: THE STOPLAMPS ARE ON CONTINUOUSLY — HIGH MOUNTED STOPLAMP ONLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
Y1 CHECK FOR DTCs	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes</p>

GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps.

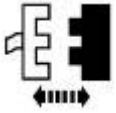
→ **No**
GO to Y2.

Y2 CHECK CIRCUIT 31S-LG6 (BK/YE) FOR A SHORT TO GROUND

1



2



REM C420e

3



● **Does the high mounted stoplamp turn off?**

→ **Yes**
INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs.
REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

Turn Signal and Hazard Lamps

Refer to Wiring Diagrams Section [417-01](#), Exterior Lighting for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

NOTE: The front electronic module (FEM), the rear electronic module (REM), and the instrument cluster module (ICM) must all be reconfigured before installing a new module. Refer to [Section 418-01](#).

The vehicle electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the standard corporate protocol (SCP) communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Exterior Lighting

The exterior lighting outputs are zone controlled by the FEM and REM. The front exterior lights are controlled by the FEM and the rear exterior lights are controlled by the REM. An additional function of the lighting system is a lamp outage function which indicates to the driver if certain exterior bulbs are not functioning. With a bulb inoperative, the FEM or REM will send a message to the instrument cluster and message center (if equipped with the message center) which will in turn indicate to the driver that the lamp is inoperative with a lamp out indicator (with the message center a message will be displayed). To provide complete input and output functionality, each exterior lamp feature will be described individually. All exterior lighting is powered by the switched system power (SSP) feature

(refer to Switched System Power [SSP]). A failure of all or any of the SSP features will cause inoperative exterior lighting. When diagnosing exterior lighting, it is essential to determine if all related symptoms and DTCs are controlled by the SSP feature.

Turn Signal, Cornering and Hazard Lamps

The LF and RF turn signal, LR and RR turn signal outputs, front and rear hazard lamp outputs, and the cornering lamp outputs are controlled by the FEM and REM. The multifunction switch and the hazard switch are hardwired to the instrument cluster. When the switch is in the left or right turn position, or the hazard switch is placed in the ON position, the instrument cluster will send a command through the standard corporate protocol (SCP) network to the FEM and REM, which will process this information and output the appropriate command to the front and rear turn, and hazard lamps. When the instrument cluster commands a turn signal ON, the FEM and REM additionally command the appropriate cornering lamp, which is hard-wired to the FEM. All turn lamps will provide lamp outage indication.

The vehicle's electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the SCP communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Switched System Power (SSP)

The SSP is invoked by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps, and power door locks. This is only accomplished when both the FEM and the REM are in sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (input) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3, and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. When energized, each relay will supply power to multiple features/functions. For additional information, go to the SSP Index for diagnosis and testing of SSP related issues. Refer to [Headlamps](#).

Inspection and Verification

1. Verify the customer concern by operating the turn signal, and hazard lamps.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Damaged FEM ● Damaged REM 	<ul style="list-style-type: none"> ● Battery junction box (BJB) fuses: <ul style="list-style-type: none"> ■ 402 (10A)

<ul style="list-style-type: none"> ● Damaged instrument cluster ● Damaged multifunction switch 	<ul style="list-style-type: none"> ■ 406 (10A) ■ 412 (5A) ■ 422 (20A) ■ 423 (30A) ■ 424 (30A) ■ 425 (40A) ■ 427 (30A) ■ 432 (30A) ● Central junction box (CJB) fuses: <ul style="list-style-type: none"> ■ 208 (5A) ■ 210 (5A) ■ 213 (5A) ■ 220 (5A) ● Damaged wiring harness ● Loose or corroded connections ● Damaged bulbs
--	--

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.

4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.

5. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 =ALL ECUS NO RESP/NOT EQUIP, REFER to [Section 418-00](#).
 - NO RESP/NOT EQUIP for FEM, go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for REM, go to Pinpoint Test B.
 - NO RESP/NOT EQUIP for instrument cluster, go to Pinpoint Test C.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the FEM.

6. If the DTCs retrieved are related to the concern, go to FEM Diagnostic Trouble Code (DTC) Index, REM Diagnostic Trouble Code (DTC) Index, Instrument Cluster Diagnostic Trouble Code (DTC) Index, or SSP Relay Index to continue diagnostics. Refer to [Headlamps](#).

7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

Symptom Chart

Symptom Chart



Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● No communication with the front electronic module 	<ul style="list-style-type: none"> ● BJB Fuses 425 (40A), 422 (20A). ● Circuitry. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.
<ul style="list-style-type: none"> ● No communication with 	<ul style="list-style-type: none"> ● Battery junction box 	<ul style="list-style-type: none"> ● GO to Pinpoint Test

the rear electronic module	(BJB) Fuse 425 (40A). ● Circuitry. ● REM.	<u>B.</u>
● No communication with the instrument cluster module	● CJB Fuses 204 (5A), 213 (5A), 220 (5A). ● Circuitry. ● Instrument cluster.	● GO to <u>Pinpoint Test C.</u>
● The power supply relay is inoperative — all SSP features	● Circuitry. ● Relay. ● FEM. ● REM.	● GO to <u>Pinpoint Test L.</u>
● The power supply relay is inoperative — SSP1	● BJB Fuse 427 (30A). ● Circuitry. ● Relay. ● FEM.	● GO to <u>Pinpoint Test J.</u>
● The power supply relay is inoperative — SSP2	● BJB Fuse 432 (30A). ● Circuitry. ● Relay. ● FEM.	● GO to <u>Pinpoint Test K.</u>
● The power supply relay is inoperative — SSP3	● BJB Fuse 424 (30A). ● Circuitry. ● Relay. ● REM.	● GO to <u>Pinpoint Test L.</u>
● The power supply relay is inoperative — SSP4	● BJB Fuse 423 (30A). ● Circuitry. ● Relay. ● REM.	● GO to <u>Pinpoint Test M.</u>
● One turn signal lamp is never on — RR turn lamp	● Bulb. ● Circuitry. ● REM.	● GO to <u>Pinpoint Test Z.</u>
● One turn signal lamp is never on — LR turn lamp	● Bulb. ● Circuitry. ● REM.	● GO to <u>Pinpoint Test AA.</u>
● The exterior lamp(s) are inoperative — LR turn, LR and RR reverse lamps	● BJB Fuses , 406 (10A), 423 (30A), 424 (30A). ● BJB.	● REPAIR or INSTALL a new BJB. TEST the system for normal operation.
● The exterior lamp(s) are inoperative — RR turn and license lamps	● BJB Fuses 402 (10A), 423 (30A). ● BJB.	● REPAIR or INSTALL a new BJB. TEST the system for normal operation.
● One turn signal lamp is always on — LR turn lamp	● Bulb. ● Circuitry. ● FEM.	● GO to <u>Pinpoint Test AB.</u>
● One turn signal lamp is always on — RR turn lamp	● Bulb. ● Circuitry. ● FEM.	● GO to <u>Pinpoint Test AC.</u>
● One turn signal lamp is never on — front	● BJB Fuses 270 (30A), 432 (30A). ● CJB Fuses 208 (5A), 210 (5A). ● Bulb. ● Circuitry.	● GO to <u>Pinpoint Test AD.</u>

<ul style="list-style-type: none"> ● The hazard flasher lamps are never/always on 	<ul style="list-style-type: none"> ● FEM. ● BJB Fuses 402 (10A), 406 (10A), 423 (30A), 424 (30A), 427 (30A), 432 (30A). ● CJB Fuses 208 (5A), 210 (5A). ● Bulbs. ● Circuitry. ● REM. ● FEM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test AE</u>.
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Pinpoint Tests

PINPOINT TEST Z: ONE TURN SIGNAL LAMP IS NEVER ON — RR TURN LAMP

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.</p>	
<p>Z1 CHECK FOR DTCs</p>	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes If REM DTC B1505, GO to <u>Z4</u>. If REM DTC B1503, GO to <u>Z3</u>. All other DTCs, GO to REM Diagnostic Trouble Code (DTC) Index. REFER to <u>Headlamps</u> in this section.</p> <p>→ No GO to <u>Z2</u>.</p>
<p>Z2 CHECK REM OUTPUT</p>	
<p>1</p>  <p>Diagnostic Tool</p> <p>2</p>  <p>3</p>	<p>3 While observing the RR turn signal lamp, trigger the REM active command RR TURN ON and then OFF.</p>



- Do the RR turn signal operate correctly?

→ **Yes**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to [Z3](#).

Z3 CHECK POWER TO THE RR TURN LAMP

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1



2

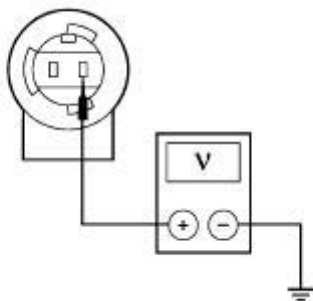


RR Turn Lamp C416

3



4



A0003347

4 Measure the voltage between RR turn lamp C416 pin 2, circuit 29S-LG12 (OG/YE), harness side and ground.

- Is the voltage greater than 10 volts?

→ **Yes**
GO to [Z5](#).

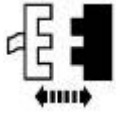
→ **No**
REPAIR the circuit. TEST the system for normal operation.

Z4 CHECK REM FOR A SHORT TO POWER

1

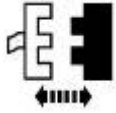


2



REM C420e

3

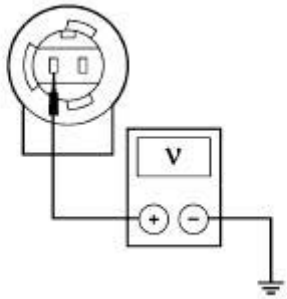


RR Turn Lamp C416

4



5



A0003348

5 Measure the voltage between RR turn lamp C416 pin 2, circuit 31S-LG12 (BK/YE), harness side and ground.

• Is any voltage indicated?

→ **Yes**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

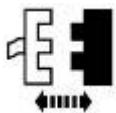
→ **No**
REPAIR the circuit. TEST the system for normal operation.

Z5 CHECK CIRCUIT 31S-LG12 (BK/YE) FOR AN OPEN

1



2



REM C420e

3

4

4 Measure the resistance between RR turn lamp C416 pin 2, circuit 31S-LG12 (BK/YE), harness side and REM C420e pin 4, circuit 31S-LG19 (BK/BU), harness side.

● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new REM; REFER to [Section 419-10](#) . CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST AA: ONE TURN SIGNAL LAMP IS NEVER ON — LR TURN LAMP

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
AA1 CHECK FOR DTCs	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <p>● Are any DTCs recorded?</p> <p>→ Yes If REM DTC B1501, GO to AA4 . If REM DTC B1499, GO to AA5 . All other DTCs, GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps in this section.</p> <p>→ No GO to AA2 .</p>
AA2 CHECK REM OUTPUT	
1	



Diagnostic Tool

2



3



3 While observing the LR turn lamp, trigger the REM active command LR TURN ON and then OFF.

• Does the LR turn signal operate correctly?

→ Yes
INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ No
GO to AA3.

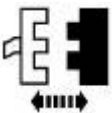
AA3 CHECK POWER TO THE LR TURN LAMP

NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.

1



2

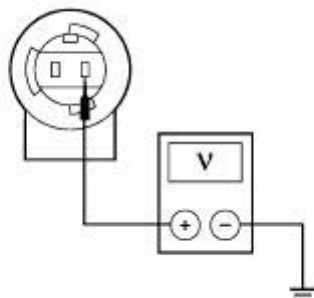


LR Turn Lamp C413

3



4



4 Measure the voltage between LR turn lamp C413 pin 1, circuit 29S-LG12 (OG/YE), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to [AA4](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation.

AA4 CHECK REM FOR A SHORT TO POWER

1



2



REM C420e

3

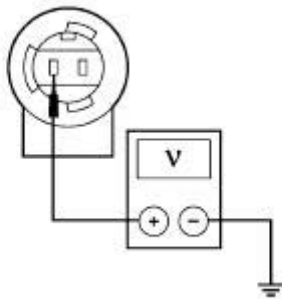


LR Turn Lamp C413

4



5



A0003348

5 Measure the voltage between LR turn lamp C413 pin 2, circuit 31S-LG12 (BK/YE), harness side and ground.

● Is any voltage indicated?

→ **Yes**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

AA5 CHECK CIRCUIT 31S-LG12 (BK/YE) FOR AN OPEN

1

2

REM C420e

3

4

A0003350

4 Measure the resistance between LR turn lamp C413 pin 2, circuit 31S-LG12 (BK/YE), harness side and REM C420e pin 3, circuit 31S-LG12 (BK/BU), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

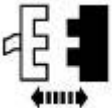
→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST AB: ONE TURN SIGNAL LAMP IS ALWAYS ON — LR TURN LAMP

CONDITIONS	DETAILS/RESULTS/ACTIONS
AB1 CHECK CIRCUIT 31S-LG12 (BK/YE) FOR SHORT TO GROUND	
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
<p>1</p> <p>REM C420e</p>	<ul style="list-style-type: none"> • Does the LR turn lamp turn off?

	<p>→ Yes INSTALL a new REM; REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
--	---

PINPOINT TEST AC: ONE TURN SIGNAL LAMP IS ALWAYS ON — RR TURN LAMP

CONDITIONS	DETAILS/RESULTS/ACTIONS
	AC1 CHECK CIRCUIT 31S-LG19 (BK/BU) FOR SHORT TO GROUND
	NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.
<p>1</p>  <p>REM C420e</p>	<ul style="list-style-type: none"> • Does the RR turn/hazard lamp turn OFF? <p>→ Yes INSTALL a new REM; REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>

PINPOINT TEST AD: ONE TURN SIGNAL/HAZARD LAMP IS NEVER/ALWAYS ON — FRONT

CONDITIONS	DETAILS/RESULTS/ACTIONS
	NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.
	AD1 CHECK FOR DTCs
	<p>1 Retrieve the recorded DTC results from the FEM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> • Are any DTCs recorded? <p>→ Yes IF DTC B1499, GO to AD2 . If DTC B1501, GO to AD5 . If DTC B1503, GO to AD6 . If DTC B1505, GO to AD9 .</p> <p>All other DTCs, GO to FEM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps in this section.</p>

→ **No**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

AD2 CHECK OPERATION OF LF TURN SIGNAL LAMP

1



2 Place the multifunction switch in the LH turn signal ON position.

- Does the LF turn signal lamp operate correctly?

→ **Yes**
GO to [AD6](#).

→ **No**
For continuously on, GO to [AD3](#).

For inoperative, GO to [AD4](#).

AD3 CHECK CIRCUIT 31S-LG11 (BK/WH) FOR A SHORT TO GROUND

1



2



FEM C201a

3



- Does the LF turn signal lamp turn off?

→ **Yes**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

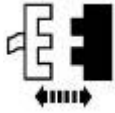
→ **No**
REPAIR the circuit. TEST the system for normal operation.

AD4 CHECK CIRCUIT 31S-LG11 (BK/WH) FOR AN OPEN

1

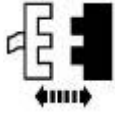


2



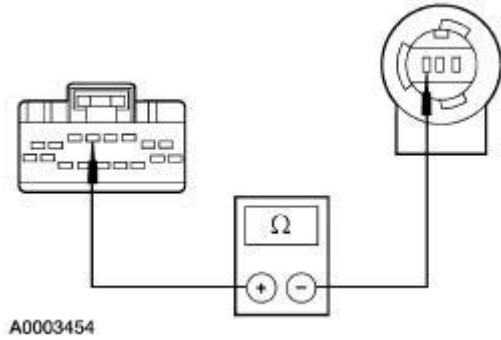
LF Turn Lamp C1022

3



FEM C201a

4



4

Measure the resistance between FEM C201a pin 5, circuit 31S-LG11 (BK/WH), harness side and LF turn lamp C1022 pin 3 circuit 31S-LG11 (BK/WH), harness side.

• Is the resistance less than 5 ohms?

→ **Yes**

INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

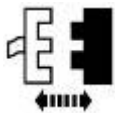
REPAIR the circuit. TEST the system for normal operation.

AD5 CHECK CIRCUIT 31S-LG11 (BK/WH) FOR A SHORT TO POWER

1

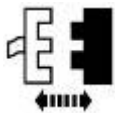


2



LF Turn Lamp C1022

3

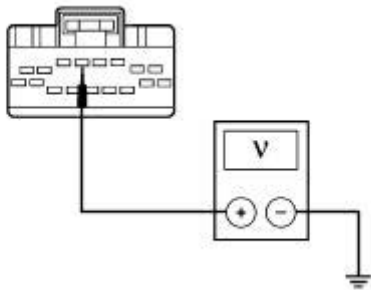


FEM C201a

4



5



5

Measure the voltage between FEM C201a pin 5, circuit 31S-LG11 (BK/WH), harness side and ground.

● **Is any voltage indicated?**

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

AD6 CHECK OPERATION OF RF TURN SIGNAL LAMP

1



2

Place the multifunction switch in the RH turn signal ON position.

● **Does the RF turn signal lamp operate correctly?**

→ **Yes**
System is operating correctly.

→ **No**
For continuously on, GO to [AD7](#).

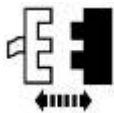
For inoperative, GO to [AD8](#).

AD7 CHECK 31S-LG18 (BK/YE) FOR A SHORT TO GROUND

1



2



FEM C201a

- Does the RF turn signal lamp turn off?

→ **Yes**
 INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

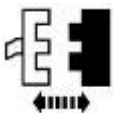
→ **No**
 REPAIR the circuit. TEST the system for normal operation.

AD8 CHECK CIRCUIT 31S-LG18 (BK/YE) FOR AN OPEN

1

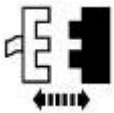


2



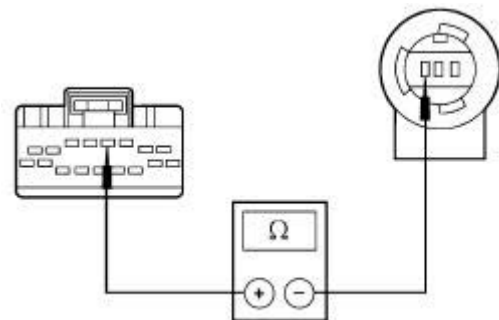
RF Turn Lamp C1042

3



FEM C201a

4



4 Measure the resistance between FEM C201a pin 4, circuit 31S-LG18 (BK/YE), harness side and RF park/turn lamp C1042 pin 3, circuit 31S-LG11 (BK/WH), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
 INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
 REPAIR the circuit. TEST the system for

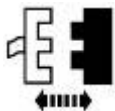
normal operation.

AD9 CHECK CIRCUIT 31S-LG18 (BK/YE) FOR A SHORT TO POWER

1

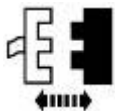


2



RF Parking/Turn Lamp C1042

3

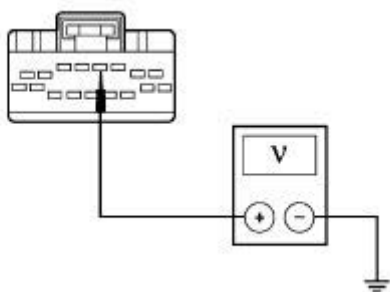


FEM C201a

4



5



A0003416

5 Measure the voltage between FEM C201a pin 4, circuit 31S-LG18 (BK/YE), harness side and ground.

● Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new FEM; REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST AE: THE HAZARD FLASHER LAMPS ARE NEVER/ALWAYS ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
	NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.
	AE1 CHECK FOR DTCs FROM FEM

1 Retrieve the recorded DTC results from the FEM for the continuous and on-demand self-test.

● **Are any DTCs recorded?**

→ **Yes**
GO to FEM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps in this section.

→ **No**
GO to AE2.

AE2 CHECK FOR DTCs FROM REM

1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.

● **Are any DTCs recorded?**

→ **Yes**
GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps .

→ **No**
GO to AE3.

AE3 CHECK TURN SIGNAL OPERATION

1 Check the turn signal operation.

● **Do the turn signal lamps operate correctly?**


→ **Yes**
INSTALL a new multifunction switch; REFER to Section 211-05 . TEST the system for normal operation.

→ **No**
REFER to Symptom Chart for inoperative turn signals.

Parking, Rear and License Lamps

Refer to Wiring Diagrams Section [417-01](#), Exterior Lighting for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

NOTE: The front electronic module (FEM), the rear electronic module (REM), and the instrument cluster module (ICM) must be reconfigured before installing a new module. Refer to [Section 418-01](#).

The vehicle electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the standard corporate protocol (SCP) communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Exterior Lighting

The exterior lighting outputs are zone controlled by the FEM and REM. The front exterior lights are controlled by the FEM and the rear exterior lights are controlled by the REM. An additional function of the lighting system is a lamp outage function which indicates to the driver if certain exterior bulbs are not functioning. With a bulb inoperative, the FEM or REM will send a message to the instrument cluster and message center (if equipped with the message center), which will indicate to the driver that the lamp is inoperative with a lamp out indicator (with the message center a message will be displayed). To provide complete input and output functionality, each exterior lamp feature will be described individually. All exterior lighting is powered by the switched system power (SSP) feature (refer to Switched System Power [SSP]). A failure of all or any of the SSP features will cause inoperative

exterior lighting. When diagnosing exterior lighting, it is essential to determine if all related symptoms and DTCs are controlled by the SSP feature.

Parking, Rear or License Lamps

For the LH and RH rear park, license, and LH and RH front park lamps, outputs are controlled by the REM and FEM. The headlamp switch is hardwired to the ICM. When the switch is in the headlamp or park position, the ICM will send a command via the network link to the FEM and REM. The REM and FEM will process this information and output the appropriate command to the rear park, license, and front park lamps, which are hardwired to the REM and FEM. Only the left and right rear lamps will provide lamp outage indication. Fault management of the park lamps will provide rear park lamp functionality in the event of certain multifunction switch, headlamp switch, ignition switch, REM or FEM failures. The park lamps are also part of the daytime running lamps (DRL) feature.

The vehicle's electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the SCP communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Switched System Power (SSP)

The SSP is invoked by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps, and power door locks. This is only accomplished when both the FEM and the REM are in sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (input) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3, and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. When energized, each relay will supply power to multiple features/functions. For additional information, go to the SSP Index for diagnosis and testing of SSP related issues. Refer to [Headlamps](#).

Inspection and Verification

1. Verify the customer concern by operating the turn signal, cornering and hazard lamps.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Damaged FEM ● Damaged REM ● Damaged instrument cluster 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 402 (10A) ■ 403 (5A) ■ 407 (5A)

	<ul style="list-style-type: none"> ■ 412 (5A) ■ 423 (30A) ■ 424 (30A) ■ 425 (40A) ■ 427 (30A) ■ 432 (30A) ● Central junction box (CJB) Fuses: <ul style="list-style-type: none"> ■ 204 (5A) ■ 208 (5A) ■ 210 (5A) ■ 213 (5A) ■ 220 (10A) ● Damaged wiring harness ● Loose or corroded connections ● Damaged bulbs
--	---

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 =ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for FEM, go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for REM, go to Pinpoint Test B.
 - NO RESP/NOT EQUIP for instrument cluster, go to Pinpoint Test C.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the REM .
6. If the DTCs retrieved are related to the concern, go to the FEM Diagnostic Trouble Code (DTC) Index, REM Diagnostic Trouble Code (DTC) Index, Instrument Cluster Diagnostic Trouble Code (DTC) Index, or SSP Relay Index to continue diagnostics. Refer to [Headlamps](#).
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● No communication with the front electronic module 	<ul style="list-style-type: none"> ● BJB Fuses 425 (40A), 422 (20A). ● Circuitry. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.
<ul style="list-style-type: none"> ● No communication with the rear electronic module 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuse 425 	<ul style="list-style-type: none"> ● GO to Pinpoint

	<ul style="list-style-type: none"> (40A). ● Circuitry. ● REM. 	<u>Test B .</u>
<ul style="list-style-type: none"> ● No communication with the instrument cluster module 	<ul style="list-style-type: none"> ● CJB Fuses 204 (5A), 213 (5A), 220 (5A). ● Circuitry. ● Instrument cluster. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test C .</u>
<ul style="list-style-type: none"> ● The power supply relay is inoperative — all SSP features 	<ul style="list-style-type: none"> ● Circuitry. ● Relay. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test I .</u>
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP1 	<ul style="list-style-type: none"> ● BJB Fuse 427 (30A). ● Circuitry. ● Relay. ● FEM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test J .</u>
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP2 	<ul style="list-style-type: none"> ● BJB Fuse 432 (30A). ● Circuitry. ● Relay. ● FEM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test K .</u>
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP3 	<ul style="list-style-type: none"> ● BJB Fuse 424 (30A). ● Circuitry. ● Relay. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test L .</u>
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP4 	<ul style="list-style-type: none"> ● BJB Fuse 423 (30A). ● Circuitry. ● Relay. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test M .</u>
<ul style="list-style-type: none"> ● The parking, rear or license lamps are inoperative — front parking and side marker lamps 	<ul style="list-style-type: none"> ● BJB Fuses 427 (30A), 210 (5A), 208 (5A), 220 (10A). ● Bulb. ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test AF .</u>
<ul style="list-style-type: none"> ● One or more parking, rear, or license lamp is inoperative — LR parking lamps 	<ul style="list-style-type: none"> ● BJB Fuses 423 (30A), 403 (5A). ● Bulb. ● Circuitry. ● FEM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test AG .</u>
<ul style="list-style-type: none"> ● One or more parking, rear, or license lamp is inoperative — RR parking lamps 	<ul style="list-style-type: none"> ● BJB Fuses 424 (30A), 407 (5A). ● Bulb. ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test AH .</u>
<ul style="list-style-type: none"> ● The parking, rear, or license lamps are inoperative — license lamps 	<ul style="list-style-type: none"> ● BJB Fuses 423 (30A), 402 (10A). ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test AI .</u>
<ul style="list-style-type: none"> ● The exterior lamp(s) are inoperative — LF or RF park and turn lamps 	<ul style="list-style-type: none"> ● CJB Fuses 208 (5A), 210 (5A). ● Circuitry. ● FEM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test AJ .</u>
<ul style="list-style-type: none"> ● The exterior lamp(s) are inoperative — LF or RF park, turn and side marker lamps 	<ul style="list-style-type: none"> ● CJB Fuses 208 (5A), 210 (5A). ● CJB. ● Circuitry. ● FEM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test AK .</u>

<ul style="list-style-type: none"> ● The exterior lamp(s) are inoperative — LF park, turn, side marker, and low beam lamps 	<ul style="list-style-type: none"> ● BJB Fuse 427 (30A). ● CJB Fuses 210 (5A), 225 (10A). ● SSP2. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test AL.
<ul style="list-style-type: none"> ● The parking, rear or license lamps are on continuously — front parking and marker lamps 	<ul style="list-style-type: none"> ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test AM.
<ul style="list-style-type: none"> ● The parking, rear or license lamps are on continuously — license lamps 	<ul style="list-style-type: none"> ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test AN.
<ul style="list-style-type: none"> ● The parking, rear or license lamps are on continuously — LR parking lamps 	<ul style="list-style-type: none"> ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test AO.
<ul style="list-style-type: none"> ● The parking, rear or license lamps are on continuously — RR parking lamps 	<ul style="list-style-type: none"> ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test AP.

Pinpoint Tests

PINPOINT TEST AF: ONE OR MORE PARKING, REAR, OR LICENSE LAMP IS INOPERATIVE — FRONT PARKING AND MARKER LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
AF1 CHECK OPERATION OF FRONT PARKING AND SIDE MARKER LAMP	
	<p>1 Place the headlamp switch in the parking lamps ON position.</p> <ul style="list-style-type: none"> ● Do the front parking and marker lamps illuminate? <p>→ Yes The system is operating correctly.</p> <p>→ No If the LF parking lamp is inoperative, GO to AF2.</p> <p>If the LF side marker lamp is inoperative, GO to AF5.</p> <p>If the RF parking lamp is inoperative, GO to AF9.</p> <p>If the RF side marker lamp is inoperative, GO to AF12.</p>
AF2 CHECK THE OPERATION OF THE LF PARKING LAMP	
1	



Diagnostic Tool

2



3



3 While observing the left parking lamp trigger the FEM active command PARKLAMPS ON and then OFF.

• Does the LF parking lamp illuminate?

→ Yes
INSTALL a new FEM; REFER to Section 419-10. TEST the system for normal operation.

→ No
GO to AF3.

AF3 CHECK CIRCUIT 31S-LF7 (BK/BU) FOR AN OPEN

1

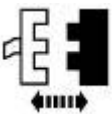


2



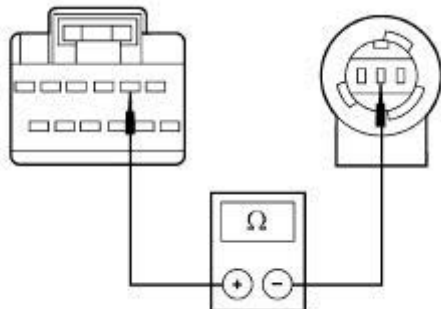
LF Parking Lamp C1022

3



FEM C201c

4



A0003301

4 Measure the resistance between LF parking lamp C1022 pin 2 circuit 31S-LF7 (BK/BU), harness side and FEM C201c pin 2 circuit 31S-LF7 (BK/BU), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to AF4.

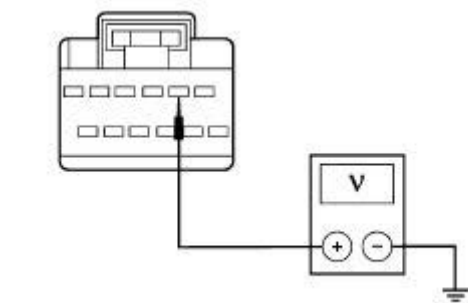
→ **No**
REPAIR the circuit. TEST the system for normal operation.

AF4 CHECK CIRCUIT 31S-LF7 (BK/BU) FOR SHORT TO POWER

1



2



A0003302

2 Measure the voltage between FEM C201c pin 2, circuit 31S-LF7 (BK/BU), harness side and ground.

● Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new FEM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

AF5 CHECK THE OPERATION OF THE LF MARKER LAMP

1



Diagnostic Tool

2



3



4 While observing the LF side marker lamp trigger the FEM active command

PARKLAMP ON and then OFF.

- Does the LF side marker lamp turn ON?

→ **Yes**

INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

GO to [AF6](#).

AF6 CHECK CIRCUIT 29S-LF8 (OG) FOR AN OPEN

NOTE: Cycle ignition switch from OFF to RUN to enable the SSP feature.

1



2

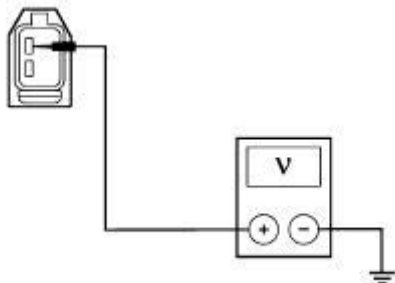


LF Side Marker C151

3



4



A0003303

4

Measure the voltage between LF side marker C151 pin 1, circuit 29S-LF8 (OG), harness side and ground.

- Is the voltage greater than 10 volts?

→ **Yes**

GO to [AF7](#).

→ **No**

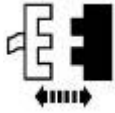
REPAIR the circuit. TEST the system for normal operation.

AF7 CHECK CIRCUIT 31S-LF8 (BK/OG) FOR AN OPEN

1

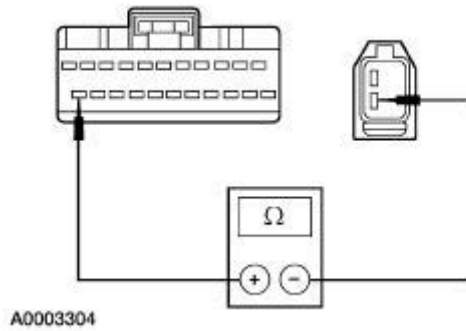


2



FEM C201b

3



3

Measure the resistance between FEM C201b pin 22, circuit 31S-LF8 (BK/OG), harness side, and LF side marker C151 pin 2, circuit 31S-LF8 (BK/OG), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to AF8.

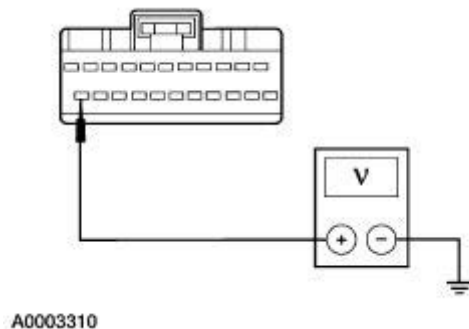
→ **No**
REPAIR the circuit. TEST the system for normal operation.

AF8 CHECK CIRCUIT 31S-LF8 (BK/OG) FOR A SHORT TO POWER

1



2



2

Measure the voltage between FEM C201b pin 22, circuit 31S-LF8 (BK/OG), harness side and ground.

● Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**

INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

AF9 CHECK THE OPERATION OF THE RF PARKING LAMP

1



Diagnostic Tool

2



3



4 While observing the RF parking lamp trigger the FEM active command PARKLAMP ON and then OFF.

• Does the RF parking lamp illuminate?

→ **Yes**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

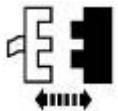
→ **No**
GO to [AF10](#).

AF10 CHECK CIRCUIT 31S-LF16 (BK/RD) FOR AN OPEN

1

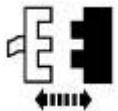


2



FEM C201c

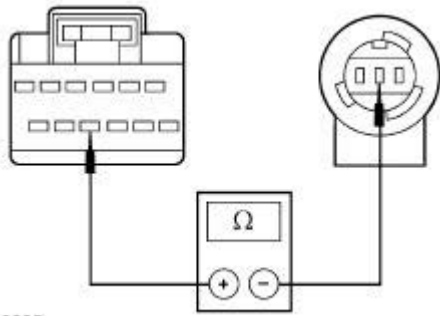
3



LF Parking/Turn Lamp C1042

4

4 Measure the resistance between FEM C201c pin 10, circuit 31S-LF16 (BK/RD), harness side and RF parking/turn lamp C1042 pin 2, circuit 31S-LF7 (BK/BU),



A0003305

harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to [AF11](#).

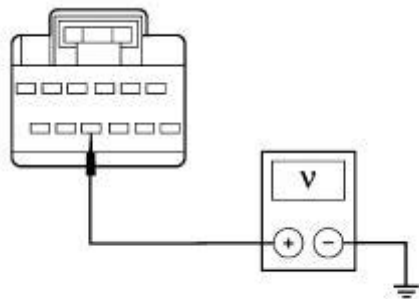
→ **No**
REPAIR the circuit. TEST the system for normal operation.

AF11 CHECK CIRCUIT 31S-LF16 (BK/RD) FOR SHORT TO POWER

1



2



A0003306

- 2 Measure the voltage between FEM C201c pin 10, circuit 31S-LF16 (BK/RD), harness side and ground.

- Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

AF12 CHECK THE OPERATION OF THE RF SIDE MARKER LAMP

NOTE: Cycle ignition switch from OFF to RUN to enable the SSP feature.

1



Diagnostic Tool

2



3



4 While observing the RF side marker lamp trigger the FEM active command PARKLAMP ON and then OFF.

• Does the right marker lamp illuminate?

→ **Yes**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to [AF13](#).

AF13 CHECK CIRCUIT 29S-LF17 (OG/WH) FOR AN OPEN

1



2

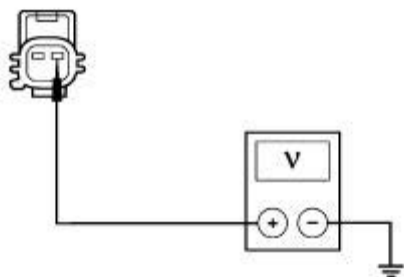


RF Side Marker C161

3



4



A0003307

4 Measure the voltage between RF side marker C161 pin 2, circuit 29S-LF17 (OG/WH), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to [AF14](#).

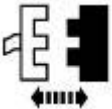
→ **No**
REPAIR the circuit. TEST the system for normal operation.

AF14 CHECK CIRCUIT 31S-LF17 (BK/WH) FOR AN OPEN

1

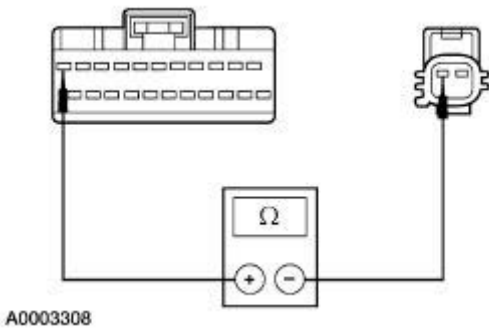


2



FEM C201b

3



A0003308

3 Measure the resistance between FEM C201b pin 11, circuit 31S-LF17 (BK/WH), harness side and RF side marker C161 pin 1, circuit 31S-LF17 (BK/WH), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to [AF15](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation.

AF15 CHECK CIRCUIT 31S-LF17 FOR SHORT TO POWER

1



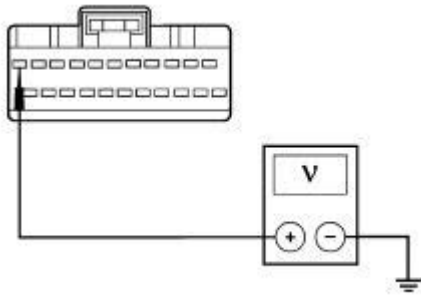
RF Side Marker C161

2



3

3 Measure the voltage between FEM C201b pin 11, circuit 31S-LF17 (BK/WH), harness side and ground.






A0003309

- Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST AG: ONE OR MORE PARKING, REAR OR LICENSE LAMPS ARE INOPERATIVE—LEFT REAR LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
AG1 CHECK REM OPERATION	
<p>1 </p> <p>Diagnostic Tool</p> <p>2 </p> <p>3 </p>	<p>3 Monitor REM PID L_TAIL.</p> <p>4 Place the headlamp switch in the parking lamp ON position.</p> <ul style="list-style-type: none"> ● Does the PID change when the headlamp switch is placed in the parking lamp position? <p>→ Yes GO to AG5.</p>

→ **No**
GO to AG2.

AG2 CHECK REM OUTPUT

1



1

While observing the LR parking lamp, trigger the REM active command PARKLAMPS ON and then OFF.

● **Did the LR parking lamp illuminate?**

→ **Yes**

INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**

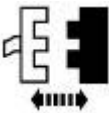
GO to AG3.

AG3 CHECK POWER TO LR LAMP

1



2



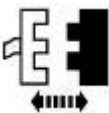
LR Rear Lamp C412

3



LR Rear Lamp C419

4



LR Combination Lamp C414

5

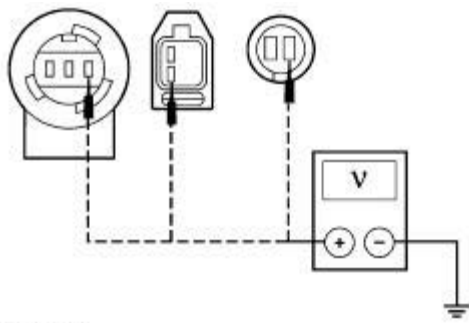


6

6

Measure the voltage between the following connector pins, harness side and ground:

Connector	Pin	Circuit
LR Combination Lamp C414	1	29S-LF23 (OG)



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LR Rear Lamp C412	1	29S-LF11 (OG/WH)
LR Rear Lamp C419	1	29S-LF11 (OG/WH)

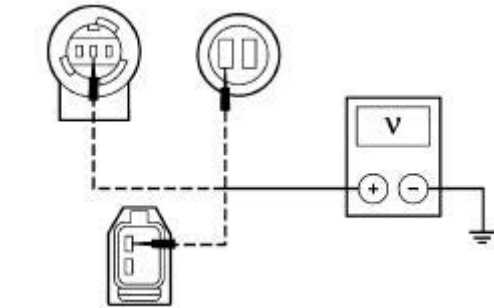
• Are the voltages greater than 10 volts?

→ **Yes**
GO to AG4.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

AG4 CHECK CIRCUIT(S) 31S-LF11 (BK/WH) FOR A SHORT TO POWER

1



A0003311

1

Measure the voltage between the following connector pins, harness side and ground:

Connector	Pin	Circuit
LR Combination Lamp C414	2	31S-LF11A (BK/WH)
LR Rear Lamp C412	2	31S-LF11 (BK/WH)
LR Rear Lamp C419	2	31S-LF11 (BK/WH)

• Is any voltage indicated?

→ **Yes**
GO to AG5.

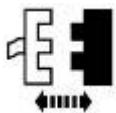
→ **No**
GO to AG6.

AG5 CHECK REM FOR SHORT TO POWER

1



2

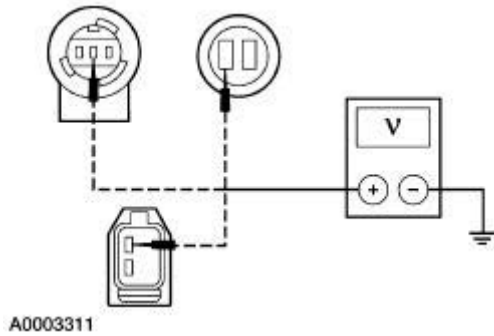


REM C420e

3



4



4 Measure the voltage between the following connector pins harness side and ground:

Connector	Pin	Circuit
LR Combination Lamp C414	2	31S-LF11A (BK/WH)
LR Rear Lamp C412	2	31S-LF11 (BK/WH)
LR Rear Lamp C419	2	31S-LF11 (BK/WH)

• Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

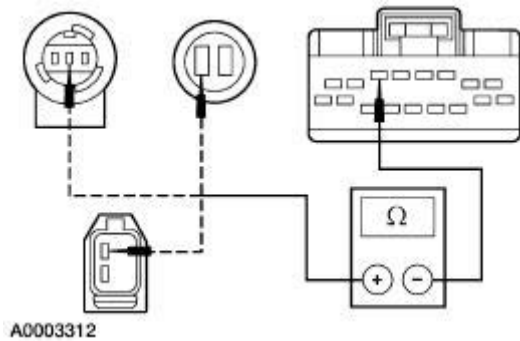
→ **No**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

AG6 CHECK LH REAR LAMP CIRCUITS AN FOR OPEN

1



2



2 Measure the resistance between C420e pin 6, circuit 31S-LF2 (BK/BU), harness side and the following connector pins:

Connector	Pin	Circuit
LR Combination Lamp C414	2	31S-LF11A (BK/WH)
LR Rear Lamp C412	2	31S-LF11 (BK/WH)
LR Rear Lamp C419	2	31S-LF11 (BK/WH)





• Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST AH: ONE OR MORE PARKING, REAR OR LICENSE LAMP IS INOPERATIVE —RIGHT REAR LAMP

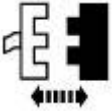
CONDITIONS	DETAILS/RESULTS/ACTIONS
AH1 CHECK REM OPERATION	
<p>1</p>  <p>Diagnostic Tool</p> <p>2</p>  <p>3</p> 	<p>3</p> Monitor the REM PID R_TAIL. <p>4</p> Turn the parking lamps on. <ul style="list-style-type: none">● Does the PID change when the parking lamps are turned on? <p>→ Yes GO to <u>AH4</u>.</p> <p>→ No GO to <u>AH2</u>.</p>
AH2 CHECK REM OUTPUT	
<p>1</p> 	<p>2</p> While observing the RR parking lamp, trigger the REM active command PARKLAMPS ON and then OFF. <ul style="list-style-type: none">● Does the RR lamp illuminate? <p>→ Yes INSTALL a new REM; REFER to <u>Section 419-10</u>. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No GO to <u>AH3</u>.</p>

AH3 CHECK POWER TO RR LAMPS

1



2



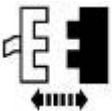
RH Combination Lamp C417

3



RH Rear Lamp C415

4

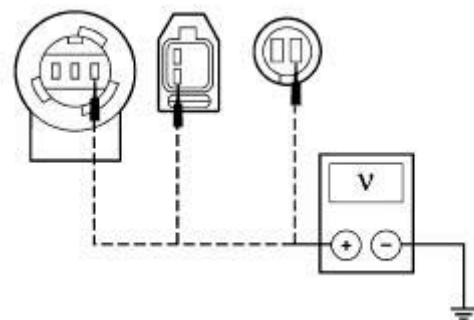


RH Rear Lamp C418

5



6



A0003298

6

Measure the voltage between the following connector pins, harness side and ground:

Connector	Pin	Circuit
RR Combination Lamp C417	1	29S-LF23 (OG)
RR Rear Lamp C415	1	29S-LF20 (OG)
RR Rear Lamp C418	1	29S-LF11 (OG/WH)

• Are the voltages greater than 10 volts?

→ **Yes**
GO to AH4.

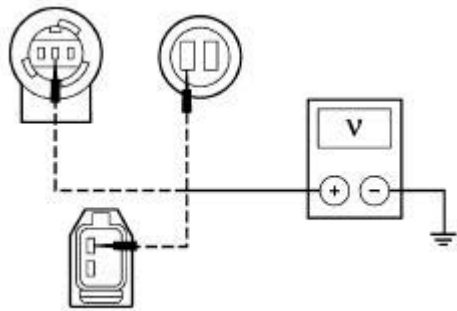
→ **No**
REPAIR the circuit. TEST the system for normal operation.

AH4 CHECK CIRCUIT(S) FOR SHORT TO POWER

1

1

Measure the voltage between the following connector pins, harness side and ground:



A0003311

Connector	Pin	Circuit
RR Combination Lamp C417	2	31S-LF11A (BK/WH)
RR Rear Lamp C415	1	31S-LF20 (BK/OG)
RR Rear Lamp C418	2	31S-LF11 (BK/WH)

● Is any voltage indicated?

→ **Yes**
GO to AH5.

→ **No**
GO to AH6.

AH5 CHECK REM FOR SHORT TO POWER

1



2

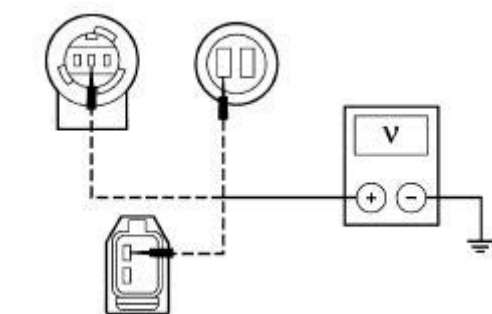


REM C420e

3



4



A0003311

4 Measure the voltage between the following connector pins, harness side and ground:

Connector	Pin	Circuit
RR Combination Lamp C417	2	31S-LF11A (BK/WH)
RR Rear Lamp C415	1	31S-LF20 (BK/OG)
RR Rear Lamp C418	2	31S-LF11 (BK/WH)

● Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**

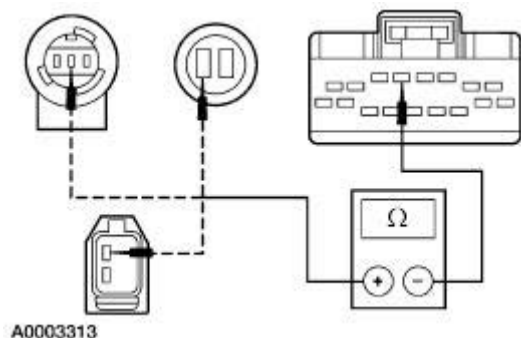
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

AH6 CHECK CIRCUIT(S) FOR OPEN

1



2



2

Measure the resistance between REM C420e pin 5, circuit 31S-LF4 (BK/BU), harness side and the following connector pins:

Connector	Pin	Circuit
RR Combination Lamp C417	2	31S-LF11A (BK/WH)
RR Rear Lamp C415	2	31S-LF20 (BK/OG)
RR Rear Lamp C418	2	31S-LF11 (BK/WH)

● Is the resistance less than 5 ohms?

→ **Yes**

INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

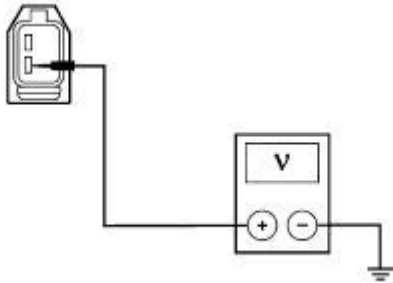
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST AI: ONE OR MORE PARKING, REAR OR LICENSE LAMP IS INOPERATIVE — LICENSE LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
AI1 CHECK POWER TO LICENSE LAMPS	
1	<p>LH License Lamp C452</p>
2	<p>RH License Lamps C462</p>
3	



4



A0003314

4

Measure the voltage between LH license lamp C452 pin 1, circuit 29S-LF21 (OG/BK), harness side and ground; and between RH license lamp C462 pin 1, circuit 29S-LF22 (OG/BK), harness side and ground.

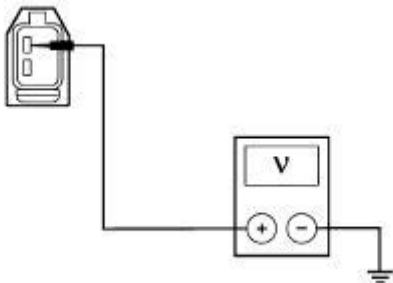
- Are the voltages greater than 10 volts?

→ **Yes**
GO to [AI2](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation.

AI2 CHECK CIRCUITS 31S-LF21 (BK/GN) AND 31S-LF22 (BK/GN) FOR SHORT TO POWER

1



A0003303

1

Measure the voltage between LH license lamp C452 pin 2, circuit 31S-LF21 (BK/GN), harness side and ground; and between RH license lamp C462 pin 2, circuit 31S-LF22 (BK/GN), harness side and ground.

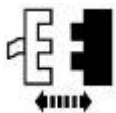
- Are any voltages indicated?

→ **Yes**
GO to [AI3](#).

→ **No**
GO to [AI4](#).

AI3 CHECK REM FOR A SHORT TO POWER

1

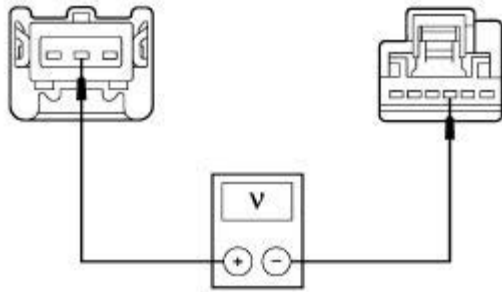


REM C420a

2

2

Measure the voltage between LH license lamp C452 pin 2, circuit 31S-LF21



A0030338

(BK/GN), harness side and ground; and between RH license lamp C462 pin 2, circuit 31S-LF22 (BK/GN), harness side and ground.

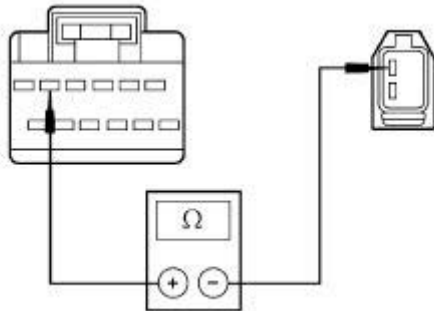
● **Is any voltage indicated?**

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

AI4 CHECK CIRCUITS 31S-LF21 (BK/GN) AND 31S-LF22 (BK/GN) FOR OPEN

1



A0003316

1

Measure the resistance between REM C420a pin 5, circuit 31S-LF12 (BK/GN), harness side and LH license lamp C452 pin 2, circuit 31S-LF21 (BK/GN), harness side; REM C420a pin 5, circuit 31S-LF12 (BK/GN), harness side and RH license lamp C462 pin 2, circuit 31S-LF22 (BK/GN), harness side.

● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST AJ: THE EXTERIOR LAMP(S) ARE INOPERATIVE — LF OR RF PARKING AND TURN LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
AJ1 CHECK OPERATION OF FRONT PARKING AND TURN LAMPS	
1	



2 Turn the parking lamps on.

- **Do the front parking and turn lamps illuminate?**

→ **Yes**
The system is operating correctly.

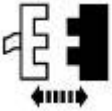
→ **No**
If the left side is inoperative, GO to [AJ2](#).
If the right side is inoperative, GO to [AJ3](#).

AJ2 CHECK CIRCUIT 29S-LF7 (OG/BU) FOR AN OPEN

1



2

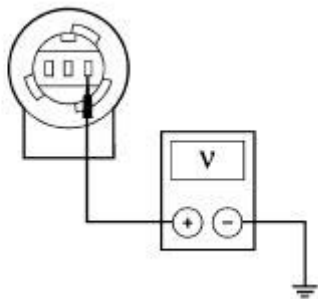


LF Parking/Turn Lamp C1022

3



4



A0003289


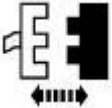

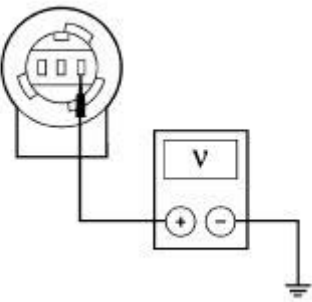
4 Measure the voltage between the left parking/turn lamp C1022 pin 1, circuit 29S-LF7 (OG/BU), harness side and ground.

- **Is the voltage greater than 10 volts?**


→ **Yes**
INSTALL a new parking/turn lamp unit.
TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

AJ3 CHECK CIRCUIT 29S-LF7 (OG/BU) FOR AN OPEN

<p>1 </p> <p>2  LF Parking/Turn Lamp C1022</p> <p>3 </p> <p>4  A0003289</p>	<p>4 Measure the voltage between the right parking/turn lamp C1042 pin 1, circuit 29S-LF7 (OG/BU), harness side and ground.</p> <ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes INSTALL a new parking/turn lamp unit. TEST the system for normal operation.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
--	--

PINPOINT TEST AK: THE EXTERIOR LAMP(S) ARE INOPERATIVE — FRONT PARKING/TURN AND SIDE MARKER LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
AK1 CHECK OPERATION OF FRONT PARKING/TURN AND SIDE MARKER LAMPS	
<p>1 </p>	<p>2 Turn the parking lamps on.</p> <ul style="list-style-type: none"> • Do the front parking/turn and side marker lamps illuminate?

- **Yes**
The system is operating correctly.
- **No**
If the left side is inoperative, GO to AK2.
- If the right side is inoperative, GO to AK3.

AK2 CHECK CJB FUSE 210 (5A) FOR POWER

1

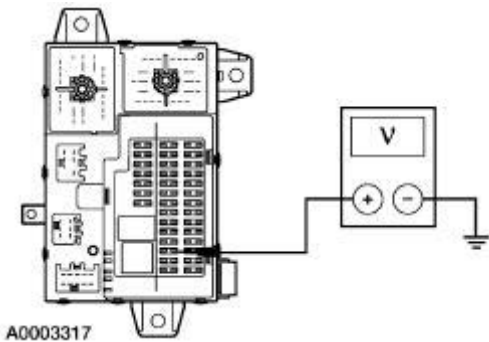


2



CJB Fuse 210 (5A)

3



3 Measure the voltage between CJB Fuse 210 (5A), input side and ground.

● **Is the voltage greater than 10 volts?**

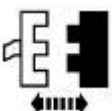
- **Yes**
REPAIR circuit 29S-LF3 (OG/YE). TEST the system for normal operation.
- **No**
REPAIR the CJB. TEST the system for normal operation.

AK3 CHECK CJB FUSE 208 (5A) FOR POWER

1



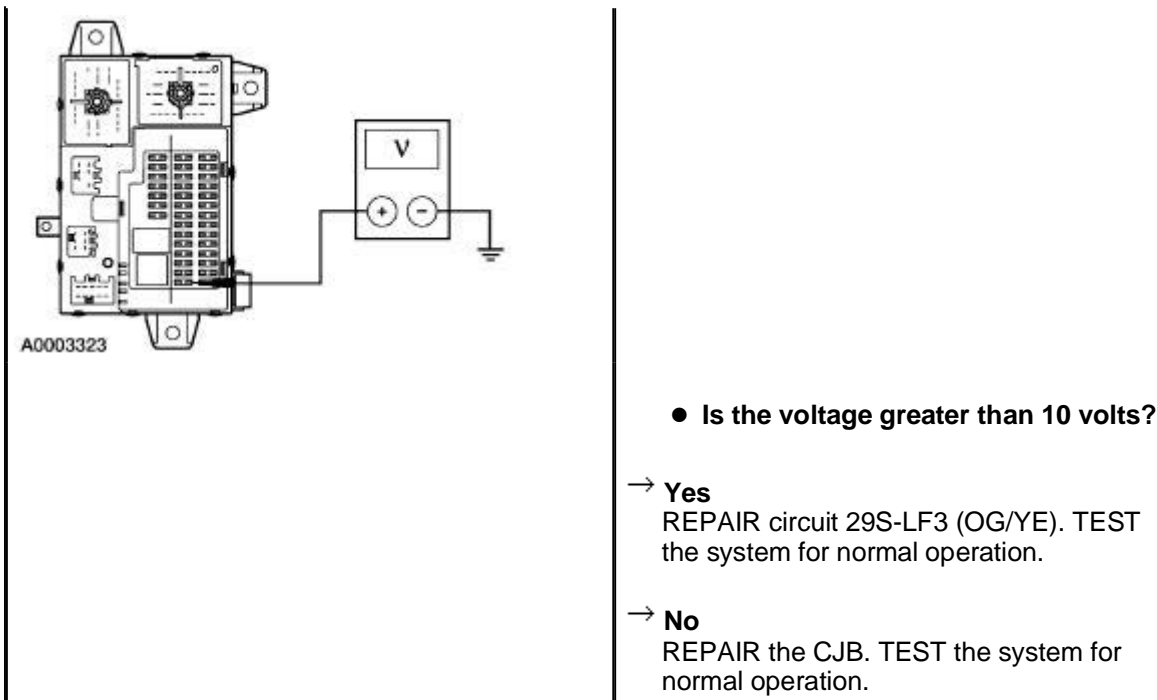
2



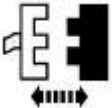
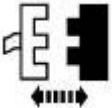
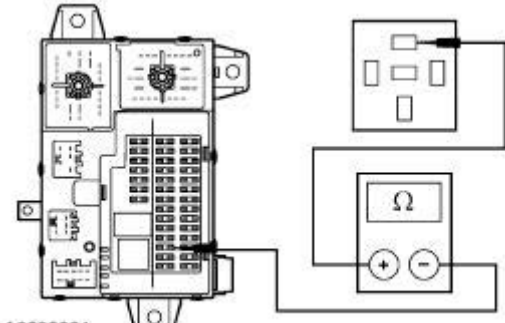
CJB Fuse 208 (5A)

3

3 Measure the voltage between CJB Fuse 208 (5A), input side and ground.



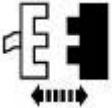

PINPOINT TEST AL: THE EXTERIOR LAMP(S) ARE INOPERATIVE — FRONT PARKING/TURN, SIDE MARKER, AND LOW BEAM LAMPS

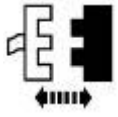
CONDITIONS	DETAILS/RESULTS/ACTIONS
AL1 CHECK CIRCUIT 30-DD2 (RD) FOR AN OPEN	
<p>1</p>  <p>SSP2 relay</p> <p>2</p>  <p>CJB Fuse 210 (5A)</p> <p>3</p>  <p>A0003324</p>	<p>3 Measure the resistance between SSP2 relay pin 87, circuit 30-DD2 (RD), harness side and CJB Fuse 210 (5A), input side.</p> <ul style="list-style-type: none"> ● Is the resistance less than 5 ohms? <p>→ Yes</p>

REPAIR the CJB. TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST AM: THE PARKING, REAR OR LICENSE LAMP IS ON CONTINUOUSLY — FRONT PARKING AND MARKER LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
AM1 CHECK OPERATION OF FRONT PARKING AND MARKER LAMP	
	<p>1 Turn the parking lamps off.</p> <ul style="list-style-type: none"> ● Are the front parking and marker lamps still illuminated? <p>→ Yes If the LF parking lamp is illuminated, GO to AM2. If the RF parking lamp is illuminated, GO to AM3. If the LF marker lamp is illuminated, GO to AM4. If the RF marker lamp is illuminated, GO to AM5.</p> <p>→ No The system is working correctly.</p>
AM2 CHECK CIRCUIT 31S-LF7 (BK/BU) FOR SHORT TO GROUND	
<p>1</p>  <p>FEM C201c</p> <p>2</p> 	<ul style="list-style-type: none"> ● Does the LF parking lamp turn off? <p>→ Yes INSTALL a new FEM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
AM3 CHECK CIRCUIT 31S-LF16 (BK/RD) FOR SHORT TO GROUND	
<p>1</p>	



FEM C201c

2



● Does the RF parking lamp turn off?

→ Yes

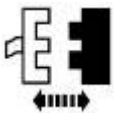
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ No

REPAIR the circuit. TEST the system for normal operation.

AM4 CHECK CIRCUIT 31S-LF8 (BK/OG) FOR SHORT TO GROUND

1



FEM C201b

2



● Does the LF marker lamp turn off?

→ Yes

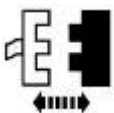
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ No

REPAIR the circuit. TEST the system for normal operation.

AM5 CHECK CIRCUIT 31S-LF17 (BK/WH) FOR SHORT TO GROUND

1



FEM C201b

2




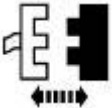

● Does the RF marker lamp turn off?

→ Yes


INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs.
REPEAT the self-test.

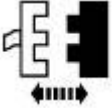

→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST AN: ONE OR MORE PARKING, REAR, OR LICENSE LAMP IS ON CONTINUOUSLY— LICENSE LAMPS


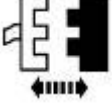

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
AN1 CHECK CIRCUIT(S) FOR SHORT TO GROUND	
<p>1 Turn the parking lamps off.</p> <p>2 </p> <p>3  REM C420a</p> <p>4 </p>	<p>● Do the license lamps turn off?</p> <p>→ Yes INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR circuit 31S-LF12 (BK/GN), 31S-LF21 (BK/GN), and 31S-LF22 (BK/GN). TEST the system for normal operation.</p>

PINPOINT TEST AO: ONE OR MORE PARKING, REAR, OR LICENSE LAMP IS ON CONTINUOUSLY — LR PARKING LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
AO1 CHECK CIRCUIT(S) FOR SHORT TO GROUND	
<p>1 Turn the parking lamps off.</p> <p>2 </p>	

<p>3</p>  <p>REM C420e</p>	
<p>4</p> 	
	<ul style="list-style-type: none"> ● Does the LR parking lamp turn off? <p>→ Yes INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR circuit 31S-LF (BK/WH) and 31S-LF11A (BK/WH). TEST the system for normal operation.</p>


PINPOINT TEST AP: ONE OR MORE PARKING, REAR, OR LICENSE LAMP IS ON CONTINUOUSLY — RR PARKING LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>AP1 CHECK CIRCUIT(S) FOR SHORT TO GROUND</p>	
<p>1</p> <p>2</p>  <p>3</p>  <p>REM C420e</p> <p>4</p> 	<p>1 Turn the parking lamps off.</p> <ul style="list-style-type: none"> ● Does the RR parking lamp turn off? <p>→ Yes INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR circuit 31S-LF (BK/WH) and 31S-LF11A (BK/WH). TEST the system for normal operation.</p>

Fog Lamps

Refer to Wiring Diagrams Section [417-01](#), Exterior Lighting for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

NOTE: The front electronic module (FEM), the rear electronic module (REM), and the instrument cluster module (ICM) must be reconfigured before installing a new module. Refer to [Section 418-01](#).

The vehicle electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the standard corporate protocol (SCP) communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message) control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Exterior Lighting

The exterior lighting outputs are zone controlled by the FEM and REM. The front exterior lights are controlled by the FEM and the rear exterior lights are controlled by the REM. An additional function of the lighting system is a lamp outage function which indicates to the driver if certain exterior bulbs are not functioning. With a bulb inoperative, the FEM or REM will send a message to the instrument cluster and message center (if equipped with the message center), which will indicate to the driver that the lamp is inoperative with a lamp out indicator (with the message center a message will be displayed). To provide complete input and output functionality, each exterior lamp feature will be described individually. All exterior lighting is powered by the switched system power (SSP) feature (refer to Switched System Power [SSP]). A failure of all or any of the SSP features will cause inoperative

exterior lighting. When diagnosing exterior lighting, it is essential to determine if all related symptoms and DTCs are controlled by the SSP feature.

The vehicle's electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the SCP communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Fog Lamps

The fog lamps are controlled by the headlamp switch. The switch toggles the fog lamps between on and off. When activated, the switch sends voltage to the instrument cluster. The instrument cluster sends a signal to the FEM which activates the fog lamp.

The vehicles electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the SCP communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- whether module which received the input (message) controls the output of the feature, or whether it outputs a message over the SCP communication network to another module.
- which module controls the output of the feature.

Switched System Power (SSP)

The SSP is invoked by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps, and power door locks. This is only accomplished when both the FEM and the REM are in sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (input) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3, and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. When energized, each relay will supply power to multiple features/functions. For additional information, go to the SSP Index for diagnosis and testing of SSP related issues. Refer to [Headlamps](#).

Inspection and Verification

1. Verify the customer concern by operating the fog lamps following these steps:
 1. Place the ignition switch (11572) in the ON position.
 2. Place the headlamp switch (11564) in the ON position.
 3. Place the fog lamp switch in the ON position.
 4. Verify the fog lamp operation.

5. Place the headlamps in the OFF position.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Damaged FEM ● Damaged instrument cluster (10849) 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 422 (20A) ■ 423 (30A) ■ 424 (30A) ■ 425 (40A) ■ 427 (30A) ■ 432 (30A) ● Central junction box (CJB) Fuse: <ul style="list-style-type: none"> ■ 213 (5A) ■ 220 (5A) ● Underhood auxiliary junction box UAJB Fuses: <ul style="list-style-type: none"> ■ 103 (15A) ● Damaged wiring harness ● Loose or corroded connections ● Damaged headlamp switch

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 =ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for FEM, go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for instrument cluster, go to Pinpoint Test C.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the FEM.
6. If the DTCs retrieved are related to the concern, go to FEM Diagnostic Trouble Code (DTC) Index, and Instrument Cluster Diagnostic Trouble Code (DTC) Index, or SSP Relay Index to continue diagnostics. Refer to [Headlamps](#).
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

Symptom Chart

Symptom Chart

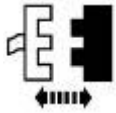
Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the front electronic module 	<ul style="list-style-type: none"> BJB Fuses 425 (40A), 422 (20A). Circuitry. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> No communication with the instrument cluster module 	<ul style="list-style-type: none"> CJB Fuses 213 (5A), 220 (5A). Circuitry. Instrument cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> The power supply relay is inoperative — all SSP features 	<ul style="list-style-type: none"> Circuitry. Relay. FEM. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test I.
<ul style="list-style-type: none"> The power supply relay is inoperative —SSP1 	<ul style="list-style-type: none"> BJB Fuse 427 (30A). Circuitry. Relay. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test J.
<ul style="list-style-type: none"> The power supply relay is inoperative —SSP2 	<ul style="list-style-type: none"> BJB Fuse 432 (30A). Circuitry. Relay. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test K.
<ul style="list-style-type: none"> The power supply relay is inoperative —SSP3 	<ul style="list-style-type: none"> BJB Fuse 424 (30A). Circuitry. Relay. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test L.
<ul style="list-style-type: none"> The power supply relay is inoperative —SSP4 	<ul style="list-style-type: none"> BJB Fuse 423 (30A). Circuitry. Relay. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test M.
<ul style="list-style-type: none"> The fog lamps are inoperative 	<ul style="list-style-type: none"> UAJB Fuse 103 (15A). Fog lamp relay. Circuitry. FEM. 	<ul style="list-style-type: none"> GO to pinpoint Test AQ.
<ul style="list-style-type: none"> The individual fog lamp is inoperative 	<ul style="list-style-type: none"> Bulb. Circuitry. 	<ul style="list-style-type: none"> GO to Pinpoint Test AR.
<ul style="list-style-type: none"> The fog lamps are on continuously 	<ul style="list-style-type: none"> Fog lamp relay. Bulbs. Circuitry. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test AS.

Pinpoint Test

PINPOINT TEST AQ: THE FOG LAMPS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
AQ1 CHECK UAJB FUSE 103 (15A) FOR POWER	

1

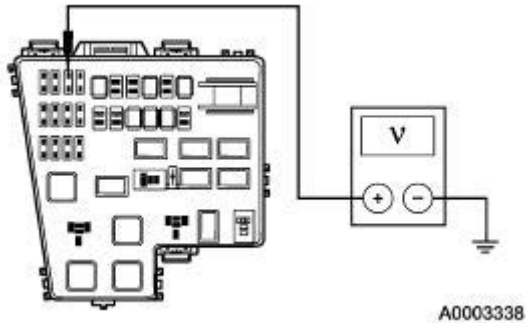


UAJB Fuse 103 (15A)

2



3



3

Measure the voltage between UAJB Fuse 103 (15A), input side and ground.

● Is the voltage greater than 10 volts?

→ Yes

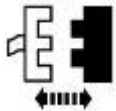
REINSTALL the fuse;GO to [AQ2](#).

→ No

REPAIR the power source. TEST the system for normal operation.

AQ2 CHECK FRONT FOG LAMPS RELAY

1



Fog Lamp Relay C1007

2

Carry out the relay component test. Refer to Wiring Diagrams Section 700-09.

● Does the relay pass the component test?

→ Yes

GO to [AQ3](#).

→ No

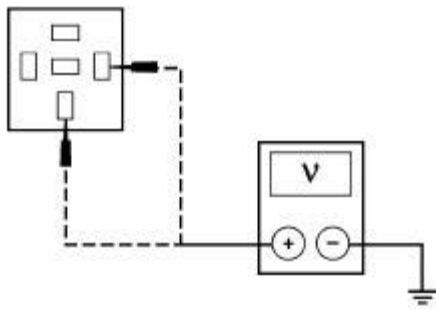
INSTALL a new relay. TEST the system for normal operation.

AQ3 CHECK CIRCUITS 30-LD8A (RD) AND 30-LD8 (RD) FOR AN OPEN

1

1

Measure the voltage between fog lamp relay C1007 pin 86, circuit 30-LD8A (RD), harness side and ground; and



A0003277

between fog lamp relay C1007 pin 30, circuit 30-LD8 (RD), harness side and ground.

- Are the voltages greater than 10 volts?

→ **Yes**
GO to AQ4.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

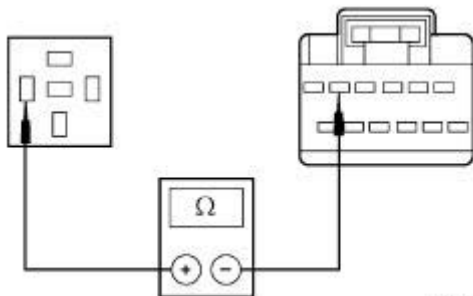
AQ4 CHECK CIRCUITS 31S-LD9 (BK/GN) FOR AN OPEN

1



FEM C201c

2



A0003339

2

Measure the resistance between fog lamp relay C1007 pin 85, circuit 31S-LD9 (BK/GN), harness side and FEM C201c pin 5, circuit 31S-LD9 (BK/GN), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to AQ5.

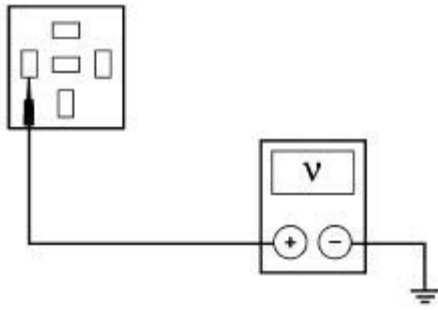
→ **No**
REPAIR the circuit. TEST the system for normal operation.

AQ5 CHECK CIRCUITS 31S-LD9 (BK/GN) FOR AN OPEN

1



2



A0003276

- 2 Measure the voltage between fog lamp relay C1007 pin 85, circuit 31S-LD9 (BK/GN), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
REINSTALL the fog lamp relay; GO to [AQ6](#).

AQ6 CHECK CIRCUITS 30S-LD11 (RD/WH) AND 30S-LD17 (RD/WH) FOR AN OPEN

1

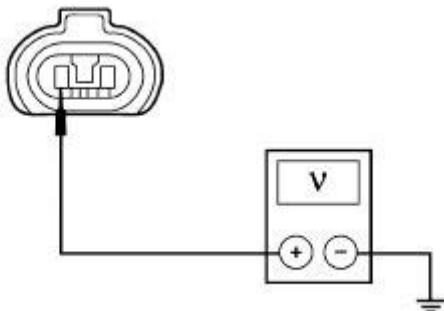


LF Fog Lamp C152

2



5



A0003266



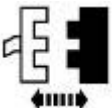
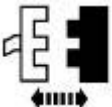
- 3 Turn the headlamps on.
4 Turn the fog lamps on.
5 Measure the voltage between LF fog lamp C152 pin 2, circuit 30S-LD11 (RD/WH), harness side and ground.

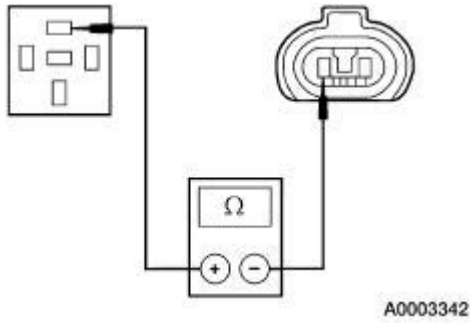
● Is the voltage greater than 10 volts?

→ **Yes**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation

PINPOINT TEST AR: THE INDIVIDUAL FOG LAMP IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
AR1 CHECK THE FRONT FOG LAMP OPERATION	
<p>1</p> 	<p>2 Turn headlamps on.</p> <p>3 Turn fog lamps on.</p> <ul style="list-style-type: none"> • Do the fog lamps illuminate? <p>→ Yes The system is operating correctly.</p> <p>→ No If the left side is inoperative, GO to <u>AR5</u>. If the right side is inoperative, GO to <u>AR2</u>.</p>
AR2 CHECK CIRCUIT 30S-LD11 (RD/WH) FOR AN OPEN	
<p>1</p>  <p>2</p>  <p>LF Fog Lamp C152</p> <p>3</p>  <p>Fog Lamp Relay C1007</p> <p>4</p>	<p>4 Measure the resistance between LF fog lamp C152 pin 2, circuit 30S-LD11 (RD/WH), harness side and front fog lamp relay C1007 pin 87, circuit 30S-LD11 (RD/WH), harness side.</p>



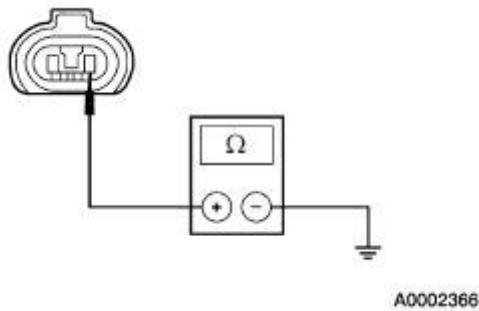
● Is the resistance less than 5 ohms?

→ **Yes**
REINSTALL the fog lamp relay;GO to AR3 .

→ **No**
REPAIR the circuit. TEST the system for normal operation.

AR3 CHECK CIRCUIT 31-LD11 (BK) FOR AN OPEN

1



1 Measure the resistance between LF fog lamp C152 pin 1, circuit 31-LD11 (BK), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to AR4 .

→ **No**
REPAIR the circuit. TEST the system for normal operation.

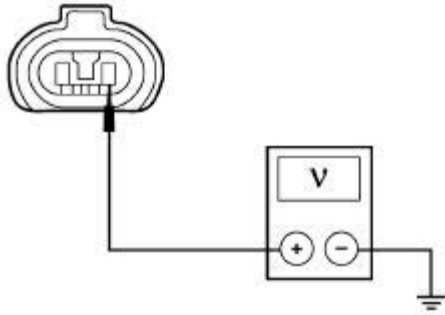
AR4 CHECK CIRCUIT 31-LD11 (BK) FOR A SHORT TO POWER

1



2

2 Measure the voltage between LF fog lamp C152 pin 1, circuit 31-LD11 (BK), harness side and ground.



A0003262

● Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

AR5 CHECK CIRCUIT 30S-LD17 (RD/WH) FOR AN OPEN

1



2



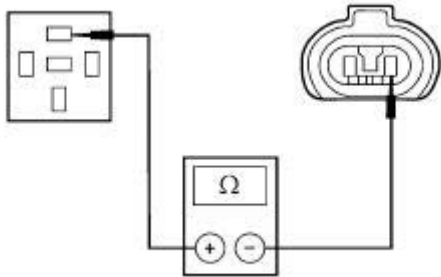
RF Fog Lamp C162

3



Fog Lamp Relay C1007

4



A0003340

4 Measure the resistance between RF fog lamp C162 pin 1, circuit 30S-LD17 (RD/WH), harness side and front fog lamp relay C1007 pin 87, circuit 30S-LD17 (RD/WH), harness side.

● Is the resistance less than 5 ohms?

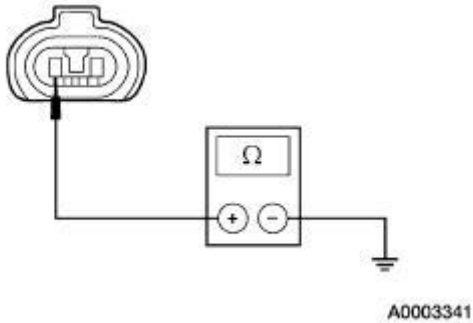
→ **Yes**

REINSTALL the front fog lamp relay. GO to [AR6](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation.

AR6 CHECK CIRCUIT 31-LD17 (BK) FOR AN OPEN

1



1 Measure the resistance between RF fog lamp C162 pin 2, circuit 31-LD17 (BK), harness side and ground.

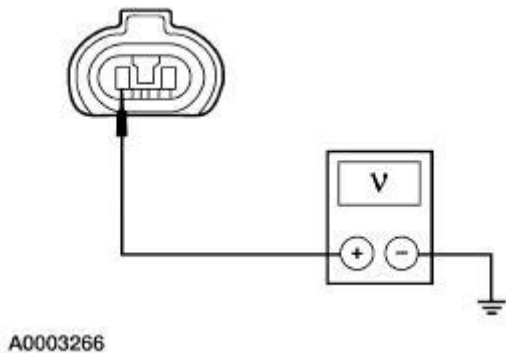
● Is the resistance less than 5 ohms?

→ **Yes**
GO to [AR7](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation.

AR7 CHECK CIRCUIT 31-LD17 (BK) FOR A SHORT TO POWER

1





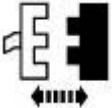
1 Measure the voltage between RF fog lamp C162 pin 2, circuit 31-LD17 (BK), harness side and ground.

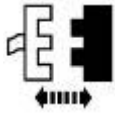
● Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new FEM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

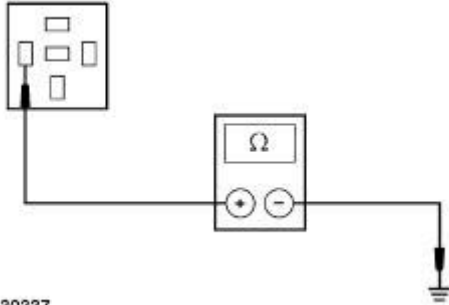
PINPOINT TEST AS: THE FOG LAMPS ARE ON CONTINUOUSLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
AS1 CHECK THE OPERATION OF THE FRONT FOG LAMPS	
<p>1</p> 	<p>2 Turn the fog lamps off.</p> <ul style="list-style-type: none"> ● Do the fog lamps turn off? <p>→ Yes The system is operating correctly.</p> <p>→ No If both lamps are on continuously, GO to <u>AS2</u>.</p> <p>If the LF fog lamp is on continuously, REPAIR circuit 30S-LD11 (RD/WH) for a short to power. TEST the system for normal operation.</p> <p>If the RF fog lamp is on continuously, REPAIR circuit 30S-LD17 (RD/WH) for a short to power. TEST the system for normal operation.</p>
AS2 CHECK FRONT FOG LAMP RELAY	
<p>1</p>  <p>2</p>  <p>Front Fog Lamp Relay C1007</p>	<p>3 Carry out the relay component test. Refer to Wiring Diagrams Section 700-09.</p> <ul style="list-style-type: none"> ● Does the relay pass the component test? <p>→ Yes GO to <u>AS3</u>.</p> <p>→ No INSTALL a new relay. TEST the system for normal operation.</p>
AS3 CHECK CIRCUIT 31S-LD9 (BK/GN) FOR A SHORT TO GROUND	
<p>1</p>	



FEM C201c

2



A0030337

2

Measure the resistance between fog lamp relay C1007 pin 85, circuit 31S-LD9 (BK/GN), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

Reversing Lamps

Refer to Wiring Diagrams Section [417-01](#), Exterior Lighting for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

NOTE: The front electronic module (FEM), the rear electronic module (REM) and the instrument cluster module (ICM) must be reconfigured before installing a new module. Refer to [Section 418-01](#).

The vehicle's electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the standard corporate protocol (SCP) communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Exterior Lighting

The exterior lighting outputs are zone controlled by the FEM and REM. The front exterior lights are controlled by the FEM and the rear exterior lights are controlled by the REM. An additional function of the lighting system is a lamp outage function which indicates to the driver if certain exterior bulbs are not functioning. With a bulb inoperative, the FEM or REM will send a message to the instrument cluster and message center (if equipped with the message center), which will indicate to the driver that the lamp is inoperative with a lamp out indicator (with the message center a message will be displayed). To provide complete input and output functionality, each exterior lamp feature will be described individually. All exterior lighting is powered by the switched system power (SSP) feature (refer to Switched System Power [SSP]). A failure of all or any of the SSP features will cause inoperative

exterior lighting. When diagnosing exterior lighting, it is essential to determine if all related symptoms and DTCs are controlled by the SSP feature.

Reversing Lamps

The reversing lamps are controlled by the REM and PCM. The PCM sends a message through the SCP communication network to the REM indicating the transmission has been placed in REVERSE. The REM will process this information and output the command to the reversing lamps which are hardwired to the REM. Fault management of the reversing lamps will provide limited reversing lamp functionality. In the event of a transmission missing or invalid data, the reversing lamps will remain in the last state of operation prior to the failure for one key cycle. In the event of invalid or missing data for the ignition switch, the lamps will work in relation to PRNDL messages.

The vehicle's electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the SCP communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Switched System Power (SSP)

The SSP is invoked by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps, and power door locks. This is only accomplished when both the FEM and the REM are in sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (input) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3, and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. When energized, each relay will supply power to multiple features/functions. For additional information, go to the SSP Index for diagnosis and testing of SSP related issues. Refer to [Headlamps](#).

Inspection and Verification

1. Verify the customer concern by operating the turn signal, cornering, and hazard lamps.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Damaged REM 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 406 (10A) ■ 423 (30A) ■ 424 (30A) ■ 425 (40A)

- 427 (30A)
- 432 (30A)
- Damaged wiring harness
- Loose or corroded connections
- Damaged bulbs

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 =ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for REM, go to Pinpoint Test B.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the REM.
6. If the DTCs retrieved are related to the concern, go to REM Diagnostic Trouble Code (DTC) Index, or SSP Relay Index to continue diagnostics. Refer to [Headlamps](#).
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

Symptom Chart


Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● No communication with the rear electronic module 	<ul style="list-style-type: none"> ● BJB Fuse 425 (40A). ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B.
<ul style="list-style-type: none"> ● The power supply relay is inoperative — all SSP features 	<ul style="list-style-type: none"> ● Circuitry. ● Relay. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test L.
<ul style="list-style-type: none"> ● The power supply relay is inoperative —SSP1 	<ul style="list-style-type: none"> ● BJB Fuse 427 (30A). ● Circuitry. ● Relay. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test J.
<ul style="list-style-type: none"> ● The power supply relay is inoperative —SSP2 	<ul style="list-style-type: none"> ● BJB Fuse 432 (30A). ● Circuitry. ● Relay. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test K.
<ul style="list-style-type: none"> ● The power supply relay is inoperative —SSP3 	<ul style="list-style-type: none"> ● BJB Fuse 424 (30A). ● Circuitry. ● Relay. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test L.

	<ul style="list-style-type: none"> ● FEM. ● REM. 	
<ul style="list-style-type: none"> ● The power supply relay is inoperative —SSP4 	<ul style="list-style-type: none"> ● BJB Fuse 423 (30A). ● Circuitry. ● Relay. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test M.
<ul style="list-style-type: none"> ● The reversing lamps are inoperative 	<ul style="list-style-type: none"> ● BJB Fuse 406 (10A). ● Bulbs. ● Circuitry. ● REM. ● Digital Transmission Range (TR) sensor. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test AT.
<ul style="list-style-type: none"> ● The individual reversing lamp is inoperative — LH reversing lamp 	<ul style="list-style-type: none"> ● Circuitry. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test AU.
<ul style="list-style-type: none"> ● The individual reversing lamp is inoperative — RH reversing lamp 	<ul style="list-style-type: none"> ● Bulb. ● Circuitry. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test AV.
<ul style="list-style-type: none"> ● The reversing lamps are on continuously 	<ul style="list-style-type: none"> ● Circuitry. ● REM. ● Digital TR Sensor. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test AW.

Pinpoint Tests

PINPOINT TEST AT: THE REVERSING LAMPS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
AT1 CHECK THE DTCs	
	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes</p> <p>GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps .</p> <p>→ No</p> <p>GO to AT2 .</p>
AT2 CHECK REM OUTPUT	
<p>1</p>  <p>Diagnostic Tool</p> <p>2</p>	



3



3

While observing the reversing lamps, trigger REM active command BACKUPLMP ON and then OFF.

• Do the reversing lamps operate correctly?

→ Yes

Check for digital transmission ranger (TR) sensor concerns. If no concerns exist INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ No

GO to [AT3](#).

AT3 CHECK POWER TO THE REVERSING LAMPS

1



2



LH Reversing Lamp C451

3

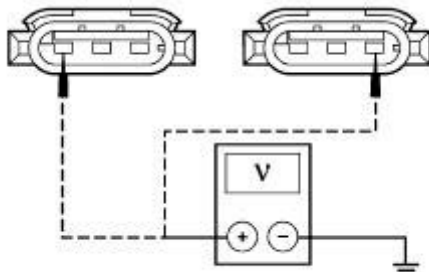


RH Reversing Lamp C461

4



5



5

Measure the voltage between LH reversing lamp C451 pin 1, circuit 29S-LG9 (OG/BK), harness side and ground; and between RH reversing lamp C461 pin 3, circuit 29S-LG16 (OG/GN), harness side and ground.

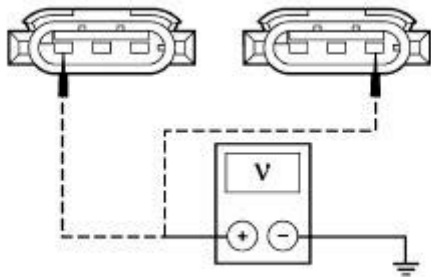
- Are the voltages greater than 10 volts?

→ **Yes**
GO to AT4.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

AT4 CHECK CIRCUIT 31S-LG16 (BK/RD) AND CIRCUIT 31S-LG9 (BK/GN) FOR A SHORT TO POWER

1



A0005097

1

Measure the voltage between LH reversing lamp C451 pin 3, circuit 31S-LG9 (BK/GN), harness side and ground; and between RH reversing lamp C461 pin 1, circuit 31S-LG16 (BK/RD), harness side and ground.

- Is any voltage indicated?

→ **Yes**
GO to AT5.

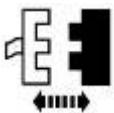
→ **No**
INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

AT5 CHECK THE REM FOR A SHORT TO POWER

1



2



REM C420e

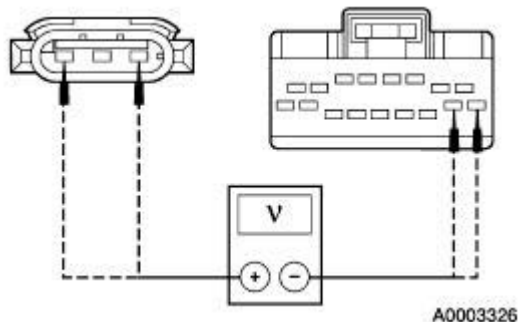
3



4

4

Measure the voltage between REM C420e pin 9, circuit 31S-LG9 (BK/GN), harness side and LH reversing lamp C451 pin 3, circuit 31S-LG9 (BK/GN), harness side; and between REM C420e pin 10, circuit 31S-LG16 (BK/RD), harness side and RH reversing lamp





C461 pin 1, circuit 31S-LG16 (BK/RD), harness side.

● **Is any voltage indicated?**

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST AU: THE INDIVIDUAL REVERSING LAMP IS INOPERATIVE — LH REVERSING LAMP

CONDITIONS	DETAILS/RESULTS/ACTIONS
AU1 CHECK THE DTCs	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <p>● Are any DTCs recorded?</p> <p>→ Yes GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps in this section.</p> <p>→ No GO to AU2.</p>
AU2 CHECK REM OUTPUT	
<p>1</p>  <p>Diagnostic Tool</p> <p>2</p>  <p>3</p>	



3 While observing the reversing lamps, trigger REM active command BACKUPLMP ON and then OFF.

• Do the reversing lamps operate correctly?

→ Yes
INSTALL a new REM; REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ No
GO to [AU3](#).

AU3 CHECK POWER TO THE LH REVERSING LAMPS

1



2

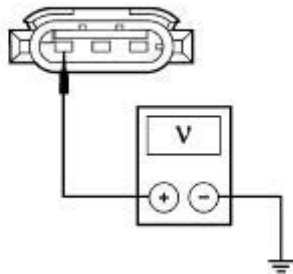


LH Reversing Lamp C451

3



4



A0003294

4 Measure the voltage between LH reversing lamp C451 pin 1, circuit 29S-LG9 (OG/BK), harness side and ground.

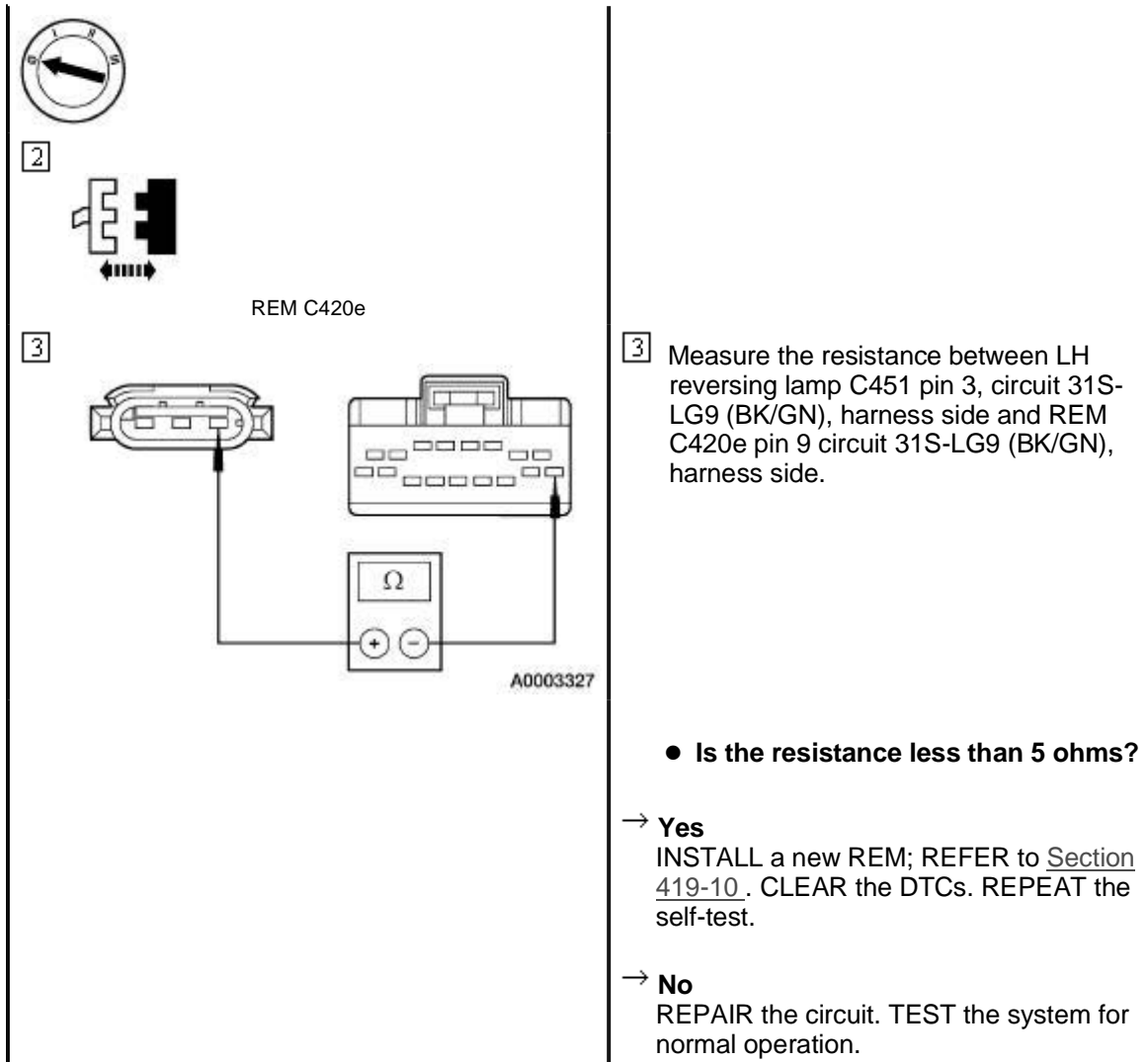
• Is the voltage greater than 10 volts?

→ Yes
GO to [AU4](#).

→ No
REPAIR the circuit. TEST the system for normal operation.

AU4 CHECK CIRCUIT 31S-LG9 (BK/GN) FOR AN OPEN

1



PINPOINT TEST AV: THE INDIVIDUAL REVERSING LAMP IS INOPERATIVE — RH REVERSING LAMP

CONDITIONS	DETAILS/RESULTS/ACTIONS
AV1 CHECK THE DTCs	<p>1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> • Are any DTCs recorded? <p>→ Yes GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps in this section.</p> <p>→ No GO to AV2.</p>
AV2 CHECK REM OUTPUT	
1	



Diagnostic Tool

2



3



3 While observing the reversing lamps, trigger REM active command BACKUPLMP ON and then OFF.

• Do the reversing lamps operate correctly?

→ Yes
INSTALL a new REM; REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.

→ No
GO to AV3 .

AV3 CHECK POWER TO THE RH REVERSING LAMPS

1



2

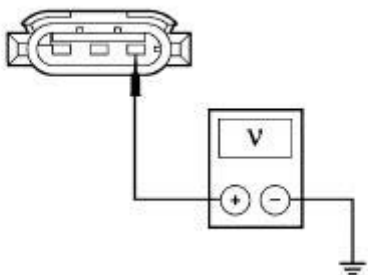


RH Reversing Lamp C461

3



4



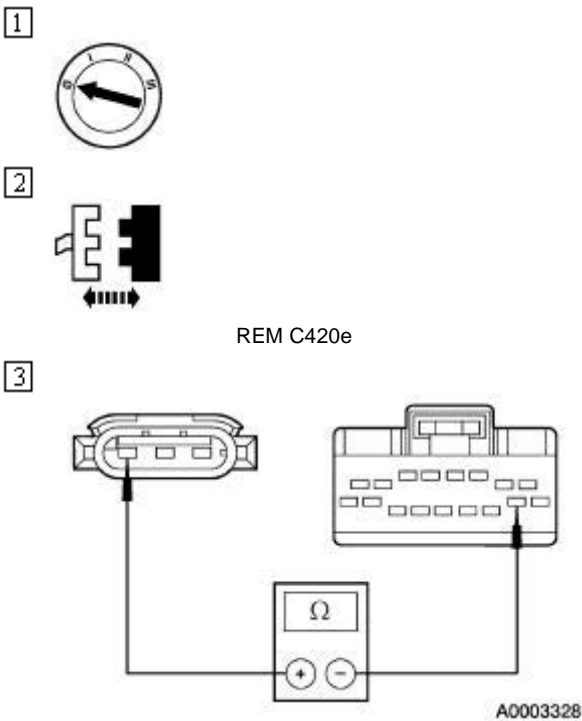
A0003295

4 Measure the voltage between RH reversing lamp C461 pin 3, circuit 29S-LG16 (OG/GN), harness side and ground.

• Is the voltage greater than 10 volts?

- **Yes**
GO to AV4.
- **No**
REPAIR the circuit. TEST the system for normal operation.

AV4 CHECK CIRCUIT 31S-LG16 (BK/RD) FOR AN OPEN



- 3** Measure the resistance between RH reverse lamp C461 pin 1, circuit 31S-LG16 (BK/RD), harness side and REM C420e pin 10, circuit 31S-LG16 (BK/RD), harness side.

● **Is the resistance less than 5 ohms?**

- **Yes**
INSTALL a new REM; REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.
- **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST AW: THE REVERSING LAMPS ARE ON CONTINUOUSLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: The ignition switch must be cycled from OFF to RUN to enable the SSP feature.	
AW1 CHECK THE DTCs	
	<ul style="list-style-type: none"> 1 Retrieve the recorded DTC results from the REM for the continuous and on-demand self-test. ● Are any DTCs recorded?

→ **Yes**

GO to REM Diagnostic Trouble Code (DTC) Index. REFER to Headlamps .

→ **No**

GO to AW2 .

AW2 CHECK CIRCUIT 31S-LG9 (BK/GN) AND CIRCUIT 31S-LG16 (BK/RD) FOR A SHORT TO GROUND

1



2



REM C420e

3



● **Do the reversing lamps turn off?**

→ **Yes**

Check for digital transmission range (TR) sensor concerns. If no concerns exist, **INSTALL** a new REM; REFER to Section 419-10 . **CLEAR** the DTCs. **REPEAT** the self-test.


→ **Yes**

REPAIR the circuit in question. Clear the DTCs. **REPEAT** the self-test.

Trailer Lamps

Refer to Wiring Diagrams Section [417-01](#), Exterior Lighting for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

NOTE: The front electronic module (FEM), the rear electronic module (REM), and the instrument cluster module (ICM) must be reconfigured before installing a new module. Refer to [Section 418-01](#).

The vehicle electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the standard corporate protocol (SCP) communication network in order to transmit and receive signals. As a technician it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input (message), control the output of the feature, or does it output a message over the SCP communication network to another module.
- which module controls the output of the feature.

Trailer Tow

The trailer lighting is controlled by the trailer tow module (TTM) (if equipped). The architecture of the vehicle lighting system requires the TTM to be used for correct trailer lighting operation. The TTM controls the park, turn, and stoplamps of the trailer lighting when connected. Trailer lighting is powered through the trailer tow relay and trailer tow auxiliary junction box (TTAJB). The TTM, which is hardwired to the rear electronics module (REM), senses the vehicle's rear exterior park, turn, and stoplamps. For turn lamp operation, when either turn lamp is activated, the TTM will apply power to the appropriate trailer turn lamp(s). For stoplamps operation, the TTM senses the vehicle right rear stoplamps only, and when activated, the TTM will apply power to both trailer stoplamps. For tail lamp operation, the TTM senses the vehicle right rear lamp only, and when activated, the TTM will apply

power to the trailer tail lamps.

Switched System Power (SSP)

The SSP is invoked by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps, and power door locks. This is only accomplished when both the FEM and the REM are in sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (input) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3, and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. When energized, each relay will supply power to multiple features/functions. For additional information, go to the SSP Index for diagnosis and testing of SSP related concerns. Refer to [Headlamps](#).

Inspection and Verification

1. Verify the customer concern by operating the vehicle stoplamps, turn signals and rear lamps. If the vehicle exterior lamps do not operate correctly, refer to [Stoplamps](#), [Turn Signal and Hazard Lamps](#), or [Parking, Rear and License Lamps](#) in this section.
2. Visually inspect for obvious signs of mechanical and electrical damage.
3. If the vehicle exterior lamps operate correctly, verify the operation of the trailer stoplamps, turn signals and tail lamps.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Damaged TTM ● Damaged bulbs ● Damaged trailer tow (TT) relay ● Damaged or corroded wiring 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 423 (30A) ■ 424 (30A) ■ 427 (30A) ■ 432 (30A) ● TTAJB fuses 433 (15A), 434 (15A)

4. If the concern remains after the inspection, proceed to Symptom Chart to continue diagnostics.

Symptom Chart


Symptom Chart

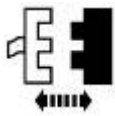
Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● The power supply relay is inoperative — all SSP features 	<ul style="list-style-type: none"> ● Circuitry. ● Relay. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test I.
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP1 	<ul style="list-style-type: none"> ● BJB Fuse 432 (30A). ● Circuitry. ● Relay. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test J.

<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP2 	<ul style="list-style-type: none"> ● BJB Fuse 427 (30A). ● Circuitry. ● Relay. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test K</u>.
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP3 	<ul style="list-style-type: none"> ● BJB Fuse 424 (30A). ● Circuitry. ● Relay. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test L</u>.
<ul style="list-style-type: none"> ● The power supply relay is inoperative — SSP4 	<ul style="list-style-type: none"> ● BJB Fuse 423 (30A). ● Circuitry. ● Relay. ● REM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test M</u>.
<ul style="list-style-type: none"> ● The trailer lamps are inoperative—all 	<ul style="list-style-type: none"> ● TTAJB Fuses 433 (15A), 434 (15A). ● Bulbs. ● TT relay. ● Circuitry. ● TTM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test AX</u>.
<ul style="list-style-type: none"> ● The trailer lamps are inoperative—rear lamps 	<ul style="list-style-type: none"> ● TTAJB Fuses 433 (15A), 434 (15A). ● Bulbs. ● Circuitry. ● TTM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test AY</u>.
<ul style="list-style-type: none"> ● The trailer lamps are inoperative—any stop or turn lamp 	<ul style="list-style-type: none"> ● TTAJB Fuses 433 (15A), 434 (15A). ● Bulbs. ● Circuitry. ● TTM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test AZ</u>.
<ul style="list-style-type: none"> ● The trailer lamps are always on—all 	<ul style="list-style-type: none"> ● Circuitry. ● TTM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test BA</u>.

Pinpoint Tests

PINPOINT TEST AX: THE TRAILER LAMPS ARE INOPERATIVE — ALL

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: It is necessary for the vehicle exterior lighting to be operating correctly. Repair any concerns with the vehicle rear exterior lighting before the diagnosis of the trailer tow module (TTM) and wiring is attempted.</p>	
<p>AX1 CHECK POWER TO THE TRAILER TOW RELAY</p>	
<p>1</p>  <p>2</p>	

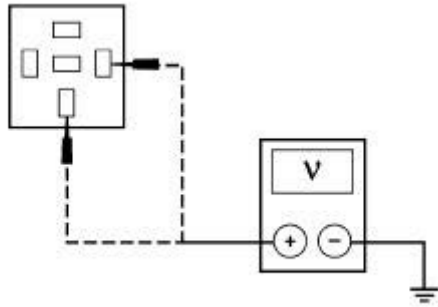


TT Relay C424

3



4



A0003277

4 Measure the voltage between TT relay C424 pin 86, circuit 29S-LF5A (OG/BU), harness side and ground; and between TT relay C424 pin 30, circuit 30-ND3 (RD), harness side and ground.

- Are the voltages greater than 10 volts?

→ **Yes**
GO to AX2.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

AX2 CHECK TRAILER TOW RELAY

1 Carry out the component test for TT relay. Refer to Wiring Diagrams Section 700-09.

- Does the relay pass the component test?

→ **Yes**
GO to AX3.

→ **No**
INSTALL a new TT relay. TEST the system for normal operation.

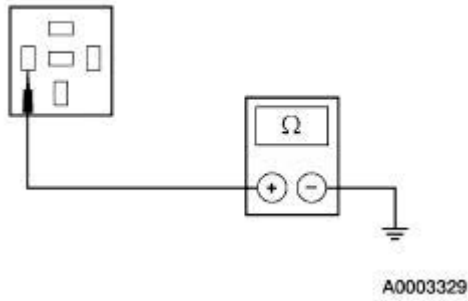
AX3 CHECK CIRCUIT 31-ND3 (BK)

1



2

2 Measure the resistance between TT relay C424 pin 85, circuit 31-ND3 (BK), harness side and ground.



● **Is the resistance less than 5 ohms?**

→ **Yes**
REINSTALL the TT relay.GO to AX4.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

AX4 CHECK CIRCUIT 30S-DC1 (RD/BU) AND 30S-DC4 (RD/BU) FOR AN OPEN

1



TTAJB Fuse 433 (15A)

2



TTAJB Fuse 434 (15A)

3



4 Measure the voltage between TTAJB Fuse 433 (15A), circuit 30S-DC1 (RD/BU), input side and ground; and between TTAJB Fuse 434 (15A), circuit 30S-DC4 (RD/BU), input side and ground.

● **Are the voltages greater than 10 volts?**

→ **Yes**
REINSTALL the fuses.GO to AX5.

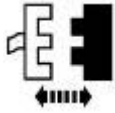
→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

AX5 CHECK POWER TO THE TTM

1



2

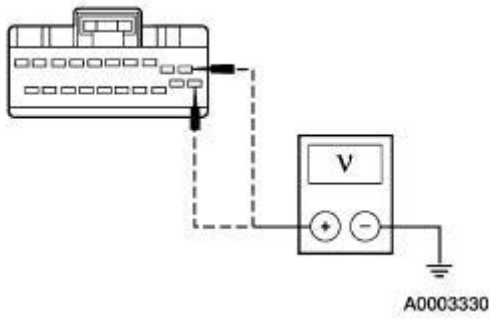


TTM C425

3



4



4 Measure the voltage between trailer tow module (TTM) C425 pin 11, circuit 30S-ND16B (RD/BU), harness side and ground; and between TTM C425 pin 1, circuit 30S-ND16A (RD/BU), harness side and ground.

• Are the voltages greater than 10 volts?

→ **Yes**
GO to AX6.

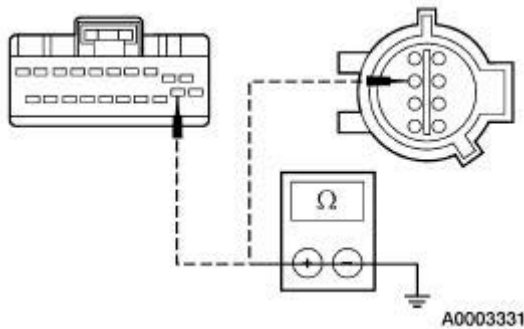
→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

AX6 CHECK CIRCUIT 31-ND16 (BK) AND 99-ND9 (WH/BU) FOR AN OPEN

1



2


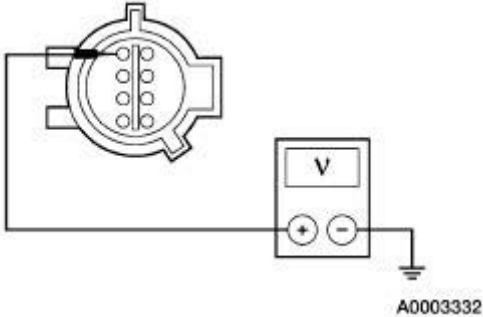



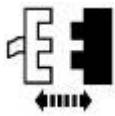
2 Measure the resistance between TTM C425 pin 12, circuit 31-ND16 (BK), harness side and ground; and between trailer harness C422 pin 7, circuit 99-ND9 (WH/BU), harness side and ground.

• Are the resistances less than 5 ohms?

	<p>→ Yes INSTALL a new TTM. TEST the system for normal operation.</p> <p>→ No REPAIR the circuit in question. TEST the system for normal operation.</p>
--	---

PINPOINT TEST AY: THE TRAILER LAMPS ARE INOPERATIVE — REAR LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: It is necessary for the vehicle exterior lighting to be operating correctly. Repair any concerns with the vehicle rear exterior lighting before the diagnosis of the trailer tow module (TTM) and wiring is attempted.</p>	
<p>AY1 CHECK TTM OUTPUT</p>	
<p>1</p>  <p>3</p> 	<p>2 Turn the parking lamps on.</p> <p>3 Measure the voltage between trailer harness C422 pin 8, circuit 87-ND29 (BN/BU), harness side and ground.</p> <p>● Is the voltage greater than 10 volts?</p> <p>→ Yes The system is OK. REPAIR the trailer harness. TEST the system for normal operation.</p> <p>→ No GO to <u>AY2</u>.</p>
<p>AY2 CHECK POWER TO TRAILER TOW MODULE</p>	
<p>1</p>  <p>2</p>	



TTAJB Fuse 434 (15A)

3



4 Measure the voltage between TTAJB Fuse 434 (15A), circuit 30S-DC4 (RD/BU), input side and ground.

• Is the voltage greater than 10 volts?

→ Yes
REINSTALL the fuse.GO to [AY3](#).

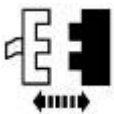
→ No
REPAIR the circuit. TEST the system for normal operation.

AY3 CHECK POWER TO TTM

1



2

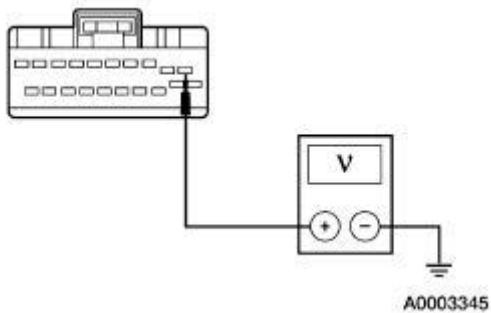


TTM C425

3



4



4 Measure the voltage between TTM C425 pin 1, circuit 30S-ND16A (RD/BU), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to [AY4](#).

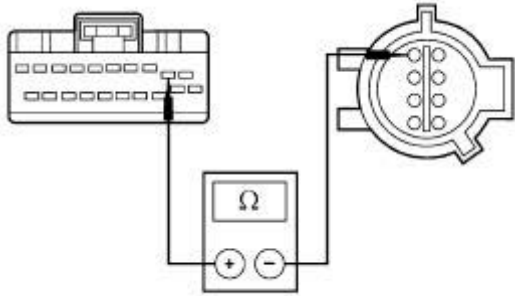
→ **No**
REPAIR the circuit. TEST the system for normal operation.

AY4 CHECK CIRCUIT 87-ND29 (BN/BU) FOR AN OPEN

1



2



A0003333

2 Measure the resistance between TTM C425 pin 2, circuit 87-ND29 (BN/BU), harness side and trailer harness C422 pin 8, circuit 87-ND29 (BN/BU), harness side.

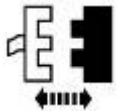
● Is the resistance less than 5 ohms?

→ **Yes**
GO to [AY5](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation.

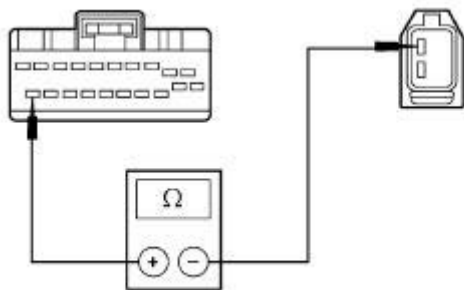
AY5 CHECK CIRCUIT 31S-ND22 (BK/WH) FOR AN OPEN

1



RR Lamp C415

2



A0003334


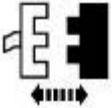


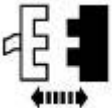
2 Measure the resistance between TTM C425 pin 19, circuit 31S-ND22 (BK/WH), harness side and RR lamp C415 pin 2, circuit 31S-LF20 (BK/OG), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new TTM. TEST the system for normal operation.

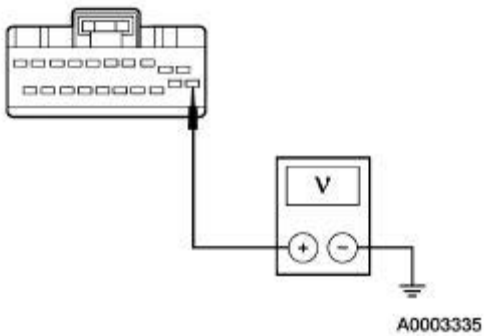
→ **No**
REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST AZ: THE TRAILER LAMPS ARE INOPERATIVE — ANY STOP OR TURN LAMP

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: It is necessary for the vehicle exterior lighting to be operating correctly. Repair any concerns with the vehicle rear exterior lighting before the diagnosis of the trailer tow module (TTM) and wiring is attempted.</p>	
<p>AZ1 CHECK POWER TO TTAJB</p>	
<p>1 </p> <p>2  TTAJB Fuse 433 (15A)</p> <p>3 </p>	<p>4 Measure the voltage between TTAJB Fuse 433 (15A), circuit 30S-ND16B (RD/BU), input side and ground.</p> <ul style="list-style-type: none"> ● Is the voltage greater than 10 volts? <p>→ Yes REINSTALL the fuse.GO to AZ2.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
<p>AZ2 CHECK POWER TO TTM</p>	
<p>1 </p> <p>2  TTM C425</p> <p>3</p>	



4



4 Measure the voltage between TTM C425 pin 11, circuit 30S-ND16B (RD/BU), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to [AZ3](#).

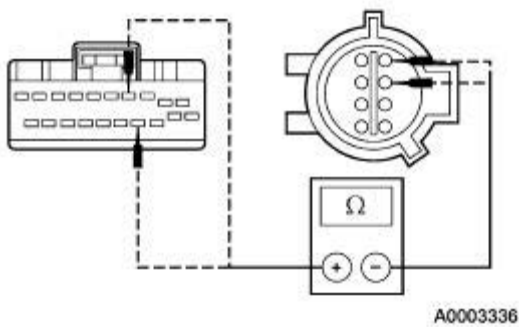
→ **No**
REPAIR the circuit. TEST the system for normal operation.

AZ3 CHECK CIRCUITS 96-ND31 (GN/BU) AND 88-ND28 (YE) FOR AN OPEN

1



2



2 Measure the resistance between TTM C425 pin 14, circuit 96-ND31 (GN/BU), harness side; and trailer harness C422 pin 4, circuit 96-ND31 (GN/BU), harness side and between TTM C425 pin 4, circuit 88-ND28 (YE), harness side and trailer harness C422 pin 3, circuit 88-ND28 (YE), harness side.

• Are the resistances less than 5 ohms?

→ **Yes**
GO to [AZ4](#).

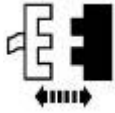
→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

AZ4 CHECK CIRCUIT 31S-ND19 (BK/BU), 31S-ND18 (BK/YE), AND 31S-ND21 (BK/OG)

1

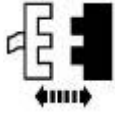


2



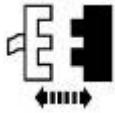
RR Turn Lamp C416

3



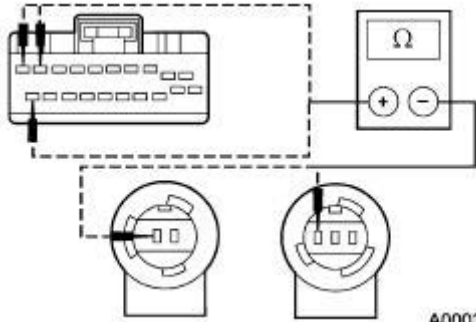
LR Turn Lamp C413

4



RR Stop/Rear Lamp C414

5



A0003337

5

Measure the resistance between TTM C425 pin 10, circuit 31S-ND19 (BK/BU), harness side and RR turn lamp C416 pin 1, circuit 31S-LG12 (BK/YE), harness side and between TTM C425 pin 9, circuit 31S-ND18 (BK/YE), harness side and LR turn lamp C413 pin 1, circuit 31S-LG12 (BK/YE), harness side and between TTM C425 pin 20, circuit 31S-ND21 (BK/OG), harness side and RR stop/rear lamp C414 pin 1, circuit 31S-LG14 (BK/OG), harness side.

- Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new TTM. TEST the system for normal operation.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

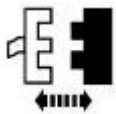
PINPOINT TEST BA: THE TRAILER LAMPS ARE ALWAYS ON — ALL

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: It is necessary for the vehicle exterior lighting to be operating correctly. Repair any concerns with the vehicle rear exterior lighting before the diagnosis of the trailer tow module (TTM) and wiring is attempted.</p>	
<p>BA1 CHECK POWER TO TTM</p>	

1



2



TTM C425

● **Do the trailer lamps turn off?**

→ **Yes**

INSTALL a new TTM. TEST the system for normal operation.

→ **No**

The system is OK. REPAIR the trailer wiring harness. TEST the system for normal operation.

Headlamp Adjustment

Headlamp Aiming

1. The headlamp aiming procedure depends on the type of beam pattern the headlamp is equipped with. Vehicles may come equipped with visual optical right (VOR), visual optical left (VOL), or SAE only (includes sealed beam type) headlamps. To identify the headlamp beam pattern, look on the headlamp lens. Molded in small letters on the headlamp lens is one of the following:
 - SAE
 - VOR or SAE
 - VOL or SAE
2. Once the headlamp beam pattern is identified, aim the headlamps using one of the following methods as applicable.
 - Photometric aimers can aim SAE, VOR and VOL type headlamps. This is the preferred method of headlamp aiming.
 - Visual or screen method aiming can be used to aim SAE, VOR and VOL type headlamps.
 - Mechanical aimers can be used only with SAE type headlamps. Lamps that can be aimed mechanically will have three nibs molded into the lens of the lamp.

Photometric Aiming

1. For the photometric aiming procedure, refer to the appropriate photometric headlamp aimer instruction manual.

Screen Method Aiming

All headlamp types

NOTE: Horizontal aim is not necessary for VOR or VOL headlamps.

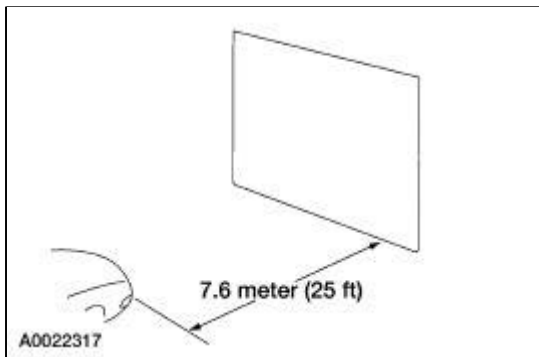
NOTE: Consult your state vehicle inspection manual for recommended tolerance ranges for visual aiming.

NOTE: The sight shield may need to be positioned or removed for access to the adjusters.

1. Before starting headlamp adjustment:
 - Check the tire inflation.
 - Check that no other load is in the vehicle other than a half tank of fuel.
 - Check that the headlamps are clean.
 - Check for correct headlamp operation.

- Check that the vehicle is on level ground.
 - If the vehicle is equipped with air suspension, make sure that the switch is on.
2. **NOTE:** The vertical wall or screen must be a minimum of 2.4 meters (8 feet) wide.

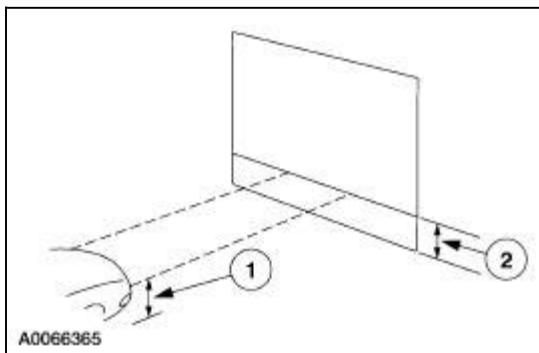
Park the vehicle on a level surface approximately 7.6 meters (25 feet) from the vertical wall or screen directly in front of it.



3. **NOTE:** The center of the lamp is marked by a 3 mm (0.12 in) circle on the headlamp lens.

Mark a horizontal reference line on the vertical wall or screen.

1. Measure the center of the headlamp height to ground and record.
2. Make a 2.4 meter (8 foot) horizontal mark (masking tape) on the vertical wall or screen at the same distance from the ground as previously recorded.



4. **NOTE:** This procedure should be done in a dark environment to effectively see the headlamp beam pattern.

Turn on the low beam headlamps to illuminate the wall or screen and open the hood.

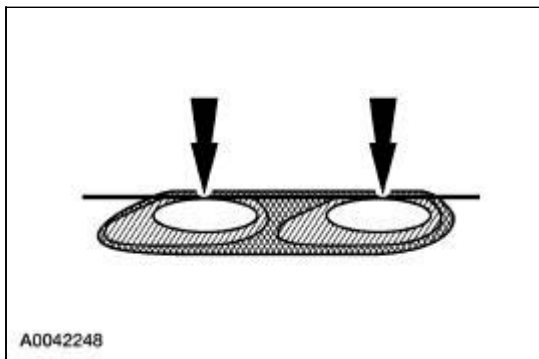
5. **NOTE:** For SAE type headlamps, the appearance of the beam pattern may vary between vehicles.

On the wall or screen, locate the high intensity area of the beam pattern. Place the top edge of the high intensity zone even with the horizontal reference line.

VOR type headlamps

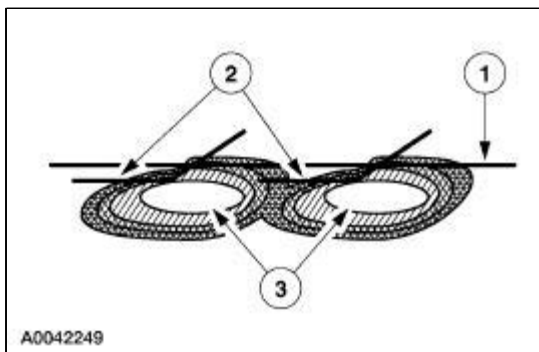
6. **NOTE:** The appearance of the VOR beam pattern may vary between vehicles.

Identify at the top edge of this high intensity area a distinct horizontal cutoff in the beam pattern. If the top edge of this cutoff is not even with the horizontal reference line, the headlamp beam will need to be adjusted.



VOL type headlamps

7. For VOL type headlamps, there will be a distinct cutoff in the left portion of the beam pattern. The edge of this cutoff should be positioned 50.2 mm (2 in) below the horizontal reference line.
 1. Horizontal reference line.
 2. Top edge of the beam pattern.
 3. High intensity zone.




Mechanical Aiming

1. For the mechanical aiming procedure, refer to the appropriate mechanical headlamp aimer instruction manual.
-

Bulb —Headlamp

Removal and Installation

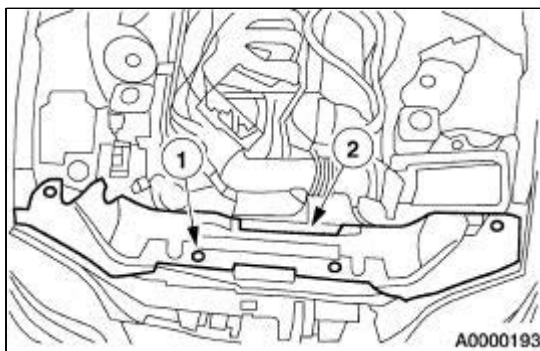
1.  **WARNING:** The halogen bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope.

NOTE: The headlamp bulb should not be removed from the headlamp assembly until just before a replacement bulb is installed. Removing the bulb for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp assembly where they can settle on the lens and reflector. Never turn on the headlamps with the bulb removed.

NOTE: Make sure that the headlamp switch and the ignition switch are in the OFF position.

Remove the radiator upper sight shield.

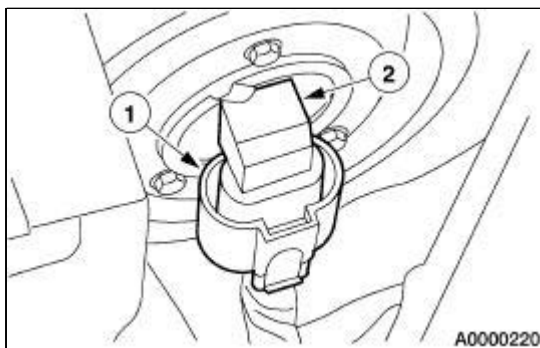
1. Remove the pin-type retainers.
2. Remove the radiator upper sight shield.



2. **NOTE:** Remove both the high and low beam headlamp bulbs in the same way.

Remove the headlamp bulb.


1. Disconnect the electrical connector.
2. Remove the headlamp bulb.



3. To install, reverse the removal procedure.

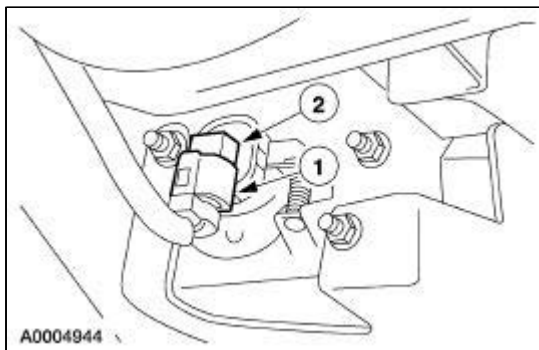
Bulb —Fog Lamp

Removal and Installation

1.  **WARNING:** The halogen fog lamp bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope.

Raise and support the vehicle. For additional information, refer to [Section 100-02](#).


2. Remove the fog lamp bulb.
 1. Disconnect the electrical connector.
 2. Remove the fog lamp bulb.



3. To install, reverse the removal procedure.
-

Lamp Assembly —Headlamp

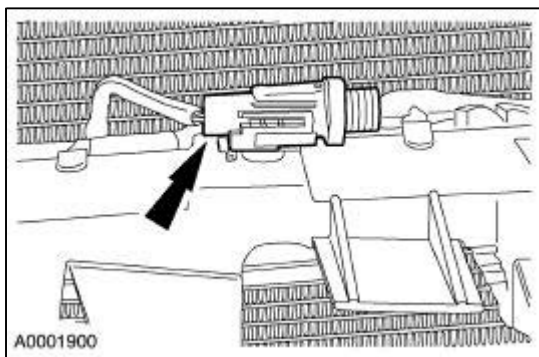
Removal and Installation

 **WARNING:** The halogen fog lamp bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope.

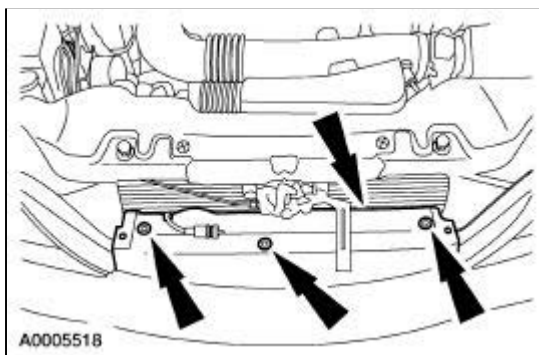
NOTE: The headlamp bulb should not be removed from the headlamp assembly until just before a replacement bulb is installed. Removing the bolt for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp assembly where they can settle on the lens and reflector. Never turn on the headlamps with the bulb removed.

1. **NOTE:** Make sure that the headlamp switch and the ignition switch are in the OFF position.

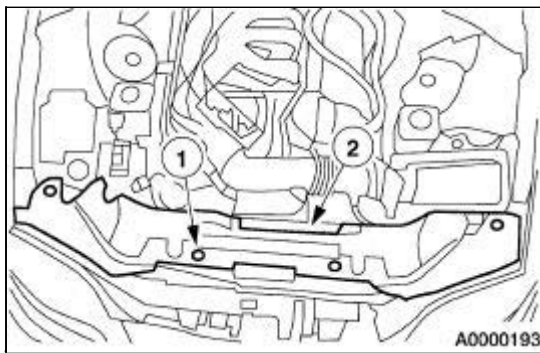
Release the ambient air temperature sensor.



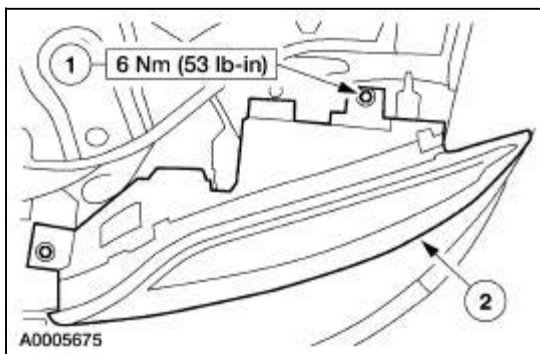
2. Remove the radiator grille opening cover at the top shelf of the bumper.



3. Remove the radiator upper sight shield.
 1. Remove the pin-type retainers.
 2. Remove the radiator upper sight shield.




4. Position the headlamp assembly for removal.
 1. Remove the three bolts.
 2. Position the headlamp assembly for removal.
 - Disconnect the electrical connectors and remove the headlamp assembly.



5. To install, reverse the removal procedure.
 - If necessary, install new bulbs.
 - If necessary, adjust the headlamps. For additional information, refer to [Headlamp Adjustment](#) in this section.
-

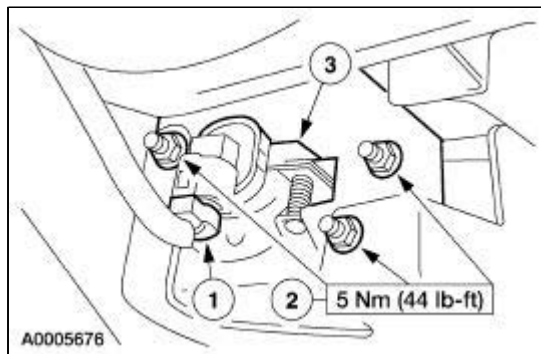
Lamp Assembly —Fog Lamp

Removal and Installation

1.  **WARNING:** The halogen fog lamp bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope.

Raise and support the vehicle. For additional information, refer to [Section 100-02](#).

2. Remove the fog lamp assembly.
 1. Disconnect the electrical connector.
 2. Remove the nuts.
 3. Remove the fog lamp assembly.
 - If necessary, install a new bulb.

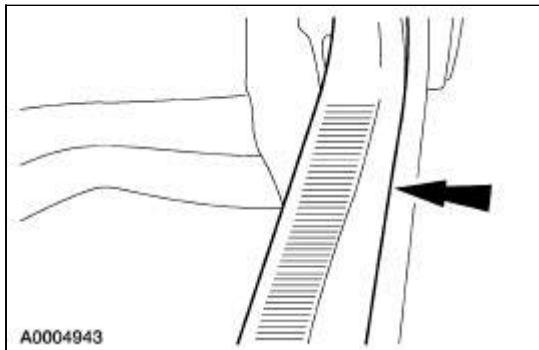


3. To install, reverse the removal procedure.

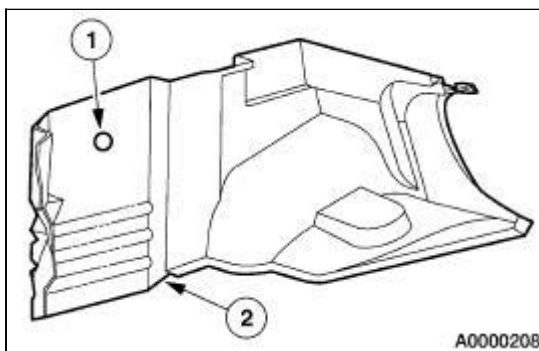
Lamp Assembly —Stoplamp

Removal and Installation

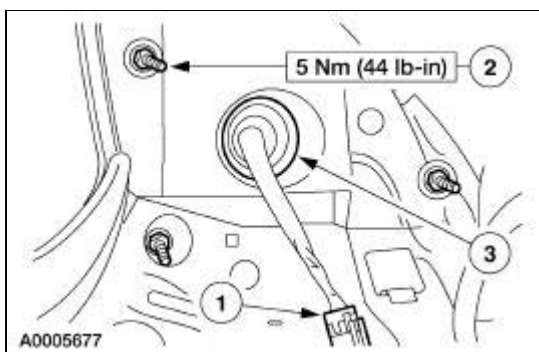
1. Remove the luggage compartment scuff plate.
 - Pull to unsnap.



2. Position the luggage compartment side trim panel aside.
 1. Remove the pin-type retainers.
 2. Position the luggage compartment side trim panel aside.



3. Remove the stoplamp assembly.
 1. Disconnect the electrical connector.
 2. Remove the three nuts.
 3. Push the rubber grommet through the sheet metal and remove the stoplamp assembly.
 - If necessary, install new bulbs.

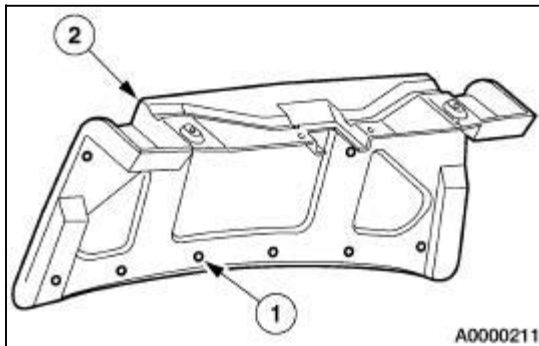


4. To install, reverse the removal procedure.

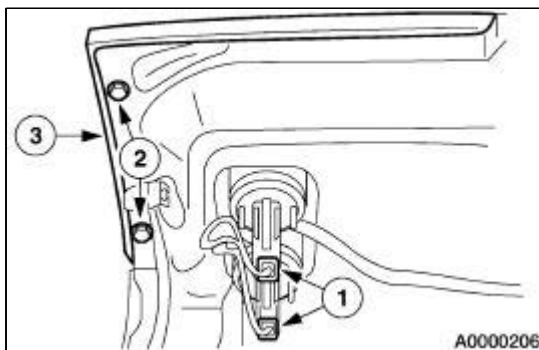
Lamp Assembly —Rear

Removal and Installation

1. Remove the luggage compartment door trim panel.
 1. Remove the 13 pin-type retainers.
 2. Remove the luggage compartment door trim panel.




2. Remove the rear lamp assembly.
 1. Disconnect the electrical connectors.
 2. Remove the nuts.
 3. Remove the rear lamp assembly.
 - If necessary, install new bulbs.



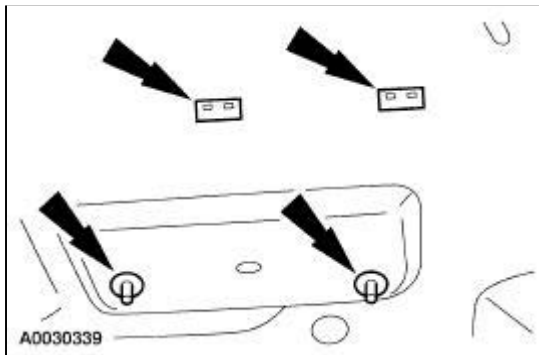
3. To install, reverse the removal procedure.

Lamp Assembly —High Mounted Stoplamp

Removal and Installation

1. Remove the carpeted package tray trim panel. For additional information, refer to [Section 501-05](#).
2. If equipped, remove the subwoofer enclosure. For additional information, refer to [Section 415-03](#).
3.  **CAUTION: Exercise care not to break the locator pins, which are positioned on the high mounted stoplamp assembly at the rear of the vehicle.**

Depress the two retaining tabs from the inside of the luggage compartment.

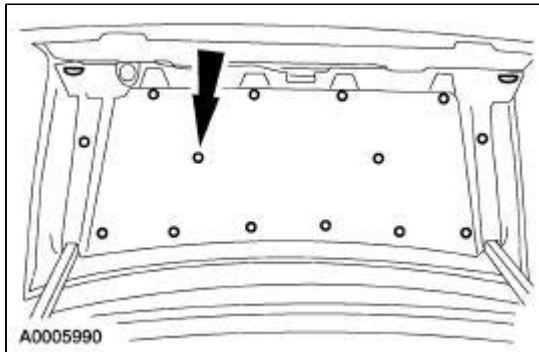


4. Lift the high mounted stoplamp up to clear the locator pins and remove the stoplamp assembly.
5. To install, reverse the removal procedure.

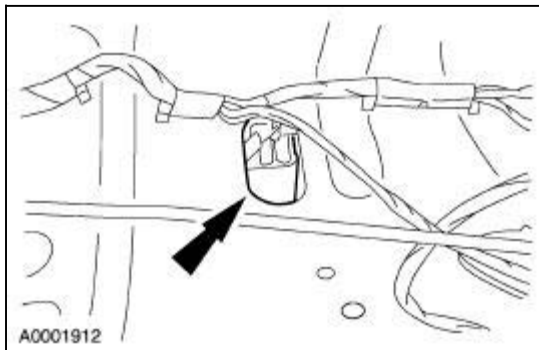
License Plate Lamp

Removal and Installation

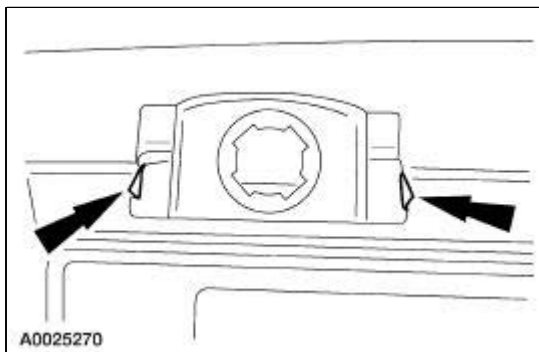
1. If necessary, remove the license plate.
2. Remove the pin-type retainers and the luggage compartment lid trim panel.



3. Disconnect the license plate lamp electrical connector.



4. Remove the lamp socket from the license plate lamp.
5. Using a suitable tool, through the access hole, release the clips and remove the license plate lamp.

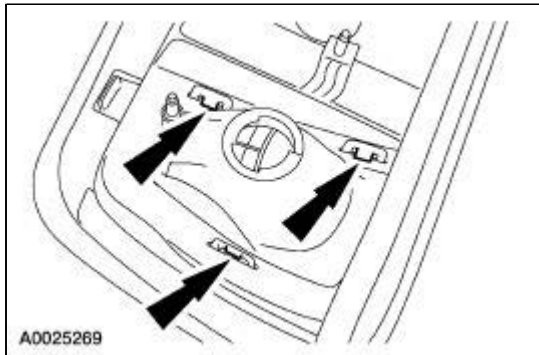


6. To install, reverse the removal procedure.

Reversing Lamp

Removal and Installation

1. Remove the license plate housing. For additional information, refer to section [Section 501-08](#).
2. Release the clips and remove the reversing lamp.

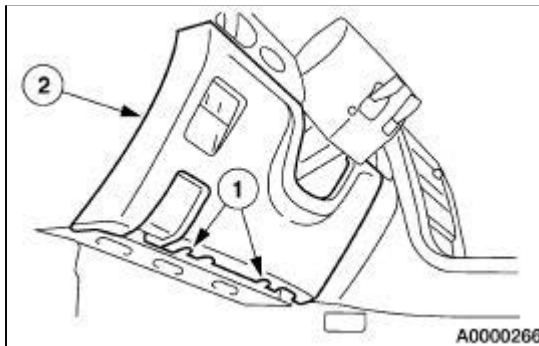


3. To install, reverse the removal procedure.
-

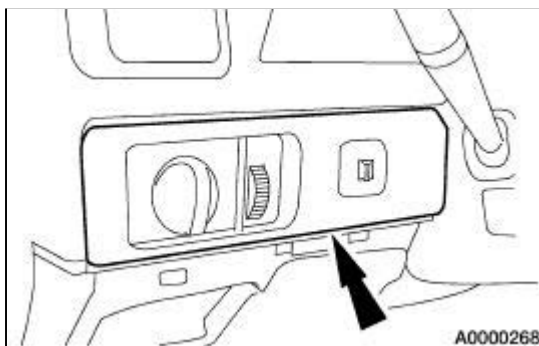
Lamp Switch —Headlamp

Removal and Installation

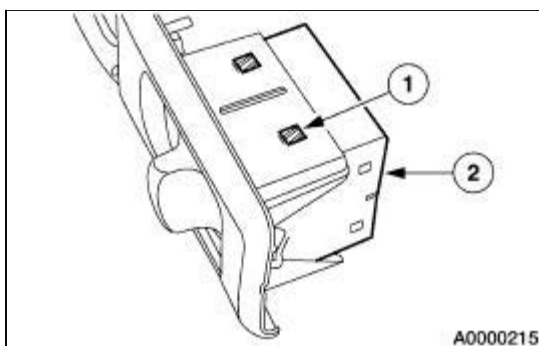
1. Disconnect the battery ground cable. Refer to [Section 414-01](#).
2. Remove the instrument panel steering column cover.
 1. Remove the screws.
 2. Remove the instrument panel steering column cover.
 - Disconnect the electrical connectors.



3. Remove the outer instrument panel finish panel.
 - Disconnect the electrical connector.



4. Remove the headlamp switch.
 1. Release the four retaining clips.
 2. Remove the headlamp switch.

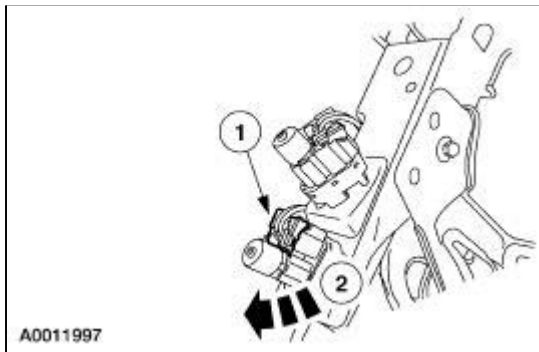


5. To install, reverse the removal procedure.

Lamp Switch —Brake Pedal Position (BPP)

Removal

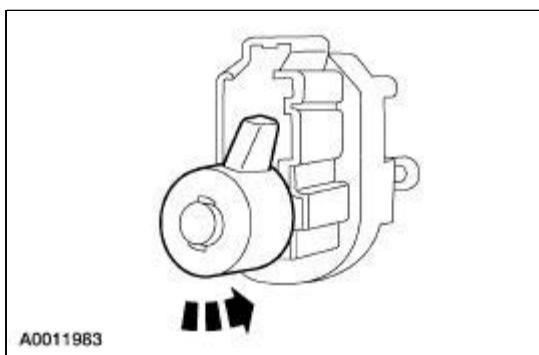
1. Remove the instrument panel insulator.
 - Disconnect electrical connector.
2. Remove the brake pedal position (BPP) switch.
 1. Disconnect the electrical connector.
 2. Remove the BPP switch.



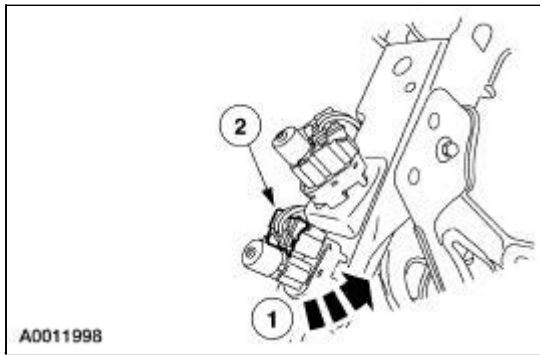
Installation

⚠ CAUTION: Initial installation of a brake pedal position (BPP) switch allows for one adjustment. If additional adjustments are required, install a new switch.

1. Rotate the lock knob counterclockwise to the stop to unlock.



2. With the engine running, fully depress and hold the brake pedal.
3. Install the BPP switch.
 1. Position the BPP switch in the bracket and rotate counterclockwise.
 2. Connect the electrical connector.

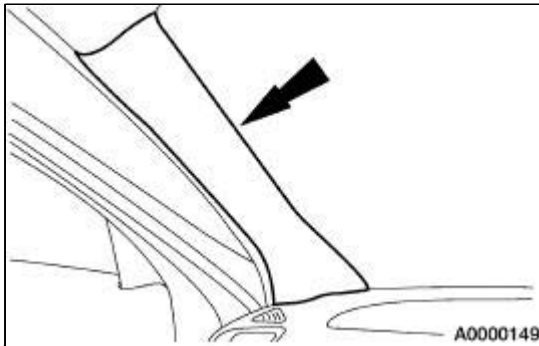


4. Slowly release the brake pedal.
-

Photocell and Amplifier —Light Sensor

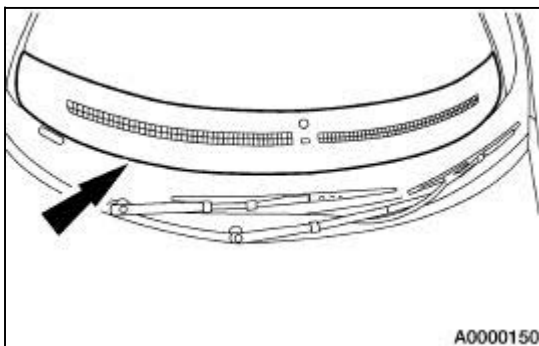
Removal and Installation

1. Disconnect the battery ground cable. Refer to [Section 414-01](#).
2. Remove the RH and LH windshield side garnish mouldings.

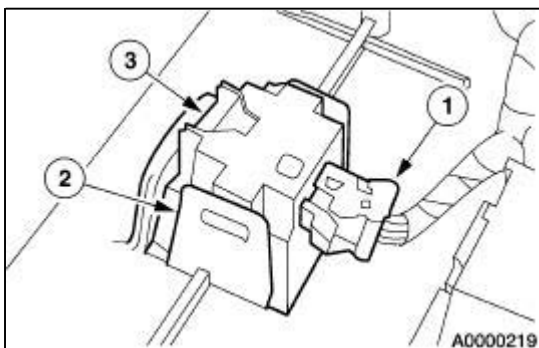


3.  **CAUTION:** To avoid damaging the photocell and amplifier electrical connector, lift the instrument panel defroster opening grille assembly only enough to expose the connector.

Remove the instrument panel defroster opening grille assembly.



4. Remove the photocell and amplifier.
 1. Disconnect the electrical connector.
 2. Release the two retaining clips.
 3. Remove the photocell and amplifier.



5. To install, reverse the removal procedure.

Interior Lighting

The interior lighting system consists of:

- driver and passenger front door lamp (integral to the door trim panel)
 - left and right instrument panel lamps
 - rear dome lamp (integral to the headliner)
 - left and right front map lamps (integral to the headliner)
 - rear map lamps
 - deck lid lamp
 - glove box lamp
 - inside console lamp
 - driver and passenger vanity lamp
-

Interior Lighting

Refer to Wiring Diagrams Section [417-02](#) for schematic and connector information.

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool

Principles of Operation

NOTE: The front electronic module (FEM), rear electronic module (REM), and driver door module (DDM) must all be reconfigured before installing a new module. REFER to [Section 418-01](#).

The vehicle's electronic functions are divided into zones. The FEM controls the front portion of the vehicle and the REM controls the rear portion of the vehicle. These systems rely heavily on the standard corporate protocol (SCP) communication network in order to transmit and receive signals. As a technician, it is very important to understand:

- where the input (command) originates from.
- all information (messages) necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- whether the module which received the input (message) controls the output of the feature, or whether it outputs a message over the SCP communication network to another module.
- which module controls the output of the feature.

FEM Operation

This system is unique in that many of the inputs the FEM receives are delivered via the SCP communication network. These input messages come from other modules connected to the network, such as the REM, DDM, and instrument cluster. The FEM will interpret the inputs and, in turn, command the correct output. The FEM also receives inputs which come directly from components which are hardwired to the module, such as the passenger door ajar switch.

Interior Lighting

The FEM controls the outputs to all interior lighting. The interior lamps include: courtesy lamps, dome lamps, and map lamps. The lamps will be illuminated if the driver or front passenger door is ajar. The switches are hardwired to the FEM. When any of the two doors are opened, the FEM will command the interior lamps through the SCP network to the FEM. The right and left rear ajar switches are hardwired to the REM. When any of these doors are ajar, the REM will send a command through the SCP network, to the FEM. The FEM will command the appropriate interior lamps on.

The FEM also handles the grounds for the glove box and the visor lamps. Fault management of the interior lamps will provide limited functionality in the event of certain dome or lighting mode inputs, vehicle speed or ignition switch failures. All interior lighting is powered by the switched system power (SSP) feature (refer to Switched System Power). A failure of any or all of the SSP feature(s) could cause inoperative interior lighting. When diagnosing the interior lighting, it is essential to determine if all relative symptoms and DTCs are controlled by the SSP feature.

Switched System Power (SSP)

The SSP is invoked by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps, and power door locks. This is only accomplished when both the FEM and the REM are in sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (inputs) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3, and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. Each relay, when energized, will supply power to multiple features/functions. For additional information, refer to the SSP Relay Index for diagnosis and testing of SSP-related issues.

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Electrical
<ul style="list-style-type: none"> ● Wiring harness ● Loose or corroded connections ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 404 (10A) ■ 405 (10A) ■ 422 (20A) ■ 425 (40A) ■ 423 (30A) ■ 424 (30A) ■ 430 (30A) ■ 431 (30A) ● Central junction box (CJB) Fuses: <ul style="list-style-type: none"> ■ 207 (5A) ■ 220 (10A) ■ 222 (10A) ■ 235 (5A) ● Lamp(s) ● Relay(s) ● Headlamp switch ● Instrument cluster ● Dimmer switch ● FEM ● REM

- DDM

- If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - Check that the program card is correctly installed.
 - Check the connections to the vehicle.
 - Check the ignition switch position.
- If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
- Carry out the DATA LINK DIAGNOSTICS test. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 =ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for FEM, go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for REM, go to Pinpoint Test B.
 - NO RESP/NOT EQUIP for DDM, go to Pinpoint Test C.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the FEM.
- If the DTCs retrieved are related to the concern, go to FEM Diagnostic Trouble Code (DTC) Index or REM Diagnostic Trouble Code (DTC) Index.
- If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	GO to Pinpoint Test F .
B1327	Passenger Door Ajar Circuit Failure	FEM	GO to Pinpoint Test F .
B1342	ECU Is Defective	FEM	CLEAR the DTC. REPEAT the FEM self-test. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 .
B1438	Wiper Mode Select Switch Circuit Failure	FEM	REFER to Section 501-16 .
B1446	Wiper Park Sense Circuit Failure	FEM	REFER to Section 501-16 .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to Section 413-01 .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit	FEM	REFER to Section 417-01 .

	Short to Battery		
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1567	Lamp Headlamp High Beam Circuit Failure	FEM	REFER to Section 417-01 .
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B1794	Lamp Headlamp Low Beam Circuit Failure	FEM	REFER to Section 417-01 .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	REFER to Section 501-11 .
B2215	Window Passenger Front Down Switch Short to Battery	FEM	REFER to Section 501-11 .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
C1284	Oil Pressure Switch Failure	FEM	REFER to Section 413-01 .
C1446	Brake Switch Circuit Failure	FEM	REFER to Section 413-01 .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to Section 211-00 .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to Section 211-00 .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	CARRY OUT the PCM self-test. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test. REFER to Section 206-09A , Section 206-09B , or Section 206-09C .
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual..
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
AL_EVT1	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT2	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD,

		LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT3	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT4	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT5	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT6	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT7	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT8	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR
FLUID_1	Brake Fluid Level Switch #1	OFF, ON
HOOD_SW	Hood Ajar Switch	CLOSED, AJAR
IGN_R	Ignition Switch -RUN Position	NO, YES
L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position Sensor (Left/Right)	#####
PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%
R_HIGH	Right High Beam Lamp	Off---, Off-B-, On---, On-B-

	Driver	
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RADIOSW	Security Input Switch Status	OFF, ON
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-
STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	Volts
WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKSW	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%
BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON
FRONT WINDOW CONTROL	PR DOWN	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
POWER MIRROR CONTROL	PR DOWN	OFF, ON
POWER MIRROR CONTROL	PR LEFT	OFF, ON
POWER MIRROR CONTROL	PR RIGHT	OFF, ON
POWER MIRROR CONTROL	PR UP	OFF, ON
STEERING COLUMN CONTROL COMMAND	LOCK_GND	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON
VAPS II OUTPUT PULSE CONTROL	VAPSIIOUT	%

REM Diagnostic Trouble Code (DTC) Index

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DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	REM	REFER to Section 413-01 .
B1300	Power Door Lock Circuit Failure	REM	REFER to Section 501-14B .
B1310	Power Door Unlock Circuit Failure	REM	REFER to Section 501-14B .
B1331	Decklid Ajar Rear Door Circuit Failure	REM	GO to Pinpoint Test J .
B1335	Door Ajar RR Circuit Failure	REM	GO to Pinpoint Test F .
B1342	ECU Is Defective	REM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new REM. REFER to Section 419-10 .
B1483	Brake Pedal Input Circuit Failure	REM	REFER to Section 417-01 .
B1499	Lamp Turn Signal Left Circuit Failure	REM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	REM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	REM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	REM	REFER to Section 417-01 .
B1551	Decklid Release Circuit Failure	REM	REFER to Section 501-14B .
B1571	Door Ajar LR Circuit Failure	REM	GO to Pinpoint Test F .
B1676	Battery Pack Voltage Out of Range	REM	REFER to Section 414-00 .
B2172	Inertia Switch input Circuit Open	REM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-16 .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-16 .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-16 .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-16 .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
U1059	SCP (J1850) Invalid or missing Data for Transmission/Transaxle/ PRNDL	PCM	CARRY OUT the PCM self-test. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test.

REM Parameter Identification (PID) Index

PID	Description	Expected Value
BOO	Brake Switch Input	OFF, ON
DECKLID	Decklid/Hatch Ajar	CLOSED, AJAR
DL_DSRRM	Decklid/Hatch Unlock	NO, YES

	Disarm Switch	
DLIDOUT	Decklid Driver	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
DLIDRLS	Deck Lid Release	OFF, ON
L_TAIL	Left and Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LMRKOUT	Left Marker Lamp Driver Output State	OFF, ON
LMRKSTB	Left Marker Lamp Driver Short To Battery	NO, YES
LR_TURN	Left and Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LRDN_SW	Left Rear Down Activated	OFF, UP
LRDR_SW	Left Rear Door Ajar Switch	CLOSED, AJAR
LRUP_SW	Left Rear Up Activated	OFF, DOWN
PD_LOCK	Passenger Door Lock	NO, YES
PD_UNLK	Passenger Door Unlock	NOTLOC, LOCK
R_TAIL	Left and Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RR_TURN	Left and Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RRDN_SW	Right Rear Down Activated	OFF, UP
RRDR_SW	Right Rear Door Ajar Switch	CLOSED, AJAR
RRUP_SW	Right Rear Up Activated	OFF, DOWN

REM Active Command Index

Active Command	Display	Action
EXTERIOR LAMP CONTROL	BACKUPLMP	OFF, ON
EXTERIOR LAMP CONTROL	H MNT STP	OFF, ON
EXTERIOR LAMP CONTROL	L STOP	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
EXTERIOR LAMP CONTROL	R DEF RLY	OFF, ON
EXTERIOR LAMP CONTROL	R FOG LMP	OFF, ON
EXTERIOR LAMP CONTROL	R STOP	OFF, ON
POWER WINDOW ENABLE COMMAND	PSGR RLY	OFF, ON
REAR DOOR LOCK CONTROL	LR LOCK	OFF, ON

REAR DOOR LOCK CONTROL	LR UNLOCK	OFF, ON
REAR DOOR LOCK CONTROL	RELEASE	OFF, ON
REAR WINDOW CONTROL	LR DOWN	OFF, ON
REAR WINDOW CONTROL	RR DOWN	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

DDM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1309	Power Door Lock Circuit Short to Ground	DDM	REFER to Section 501-14B .
B1341	Power Door Unlock Circuit Short to Ground	DDM	REFER to Section 501-14B .
B1342	ECU Is Defective	DDM	CLEAR the DTC. REPEAT the DDM self-test. If DTC B1342 is retrieved, INSTALL a new DDM. REFER to Section 419-10 .
B1400	Driver Power Window One Touch Window Relay Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1405	Driver Power Window Down Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1408	Driver Power Window Up Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1416	Power Window LR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1420	Passenger Power Window Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1424	Power Window RR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1530	Memory Set Switch Circuit Short to Ground	DDM	REFER to Section 501-10 .
B1534	Memory 1 Switch Circuit Short to Ground	DDM	REFER to Section 501-10 .
B1538	Memory 2 Switch Circuit Short to Ground	DDM	REFER to Section 501-10 .
B1676	Battery Pack Voltage Out of Range	DDM	REFER to Section 414-00 .
B2112	Door Driver Set Switch Stuck Failure	DDM	REFER to Section 501-14B .
B2116	Door Driver Reset Switch Stuck Failure	DDM	REFER to Section 501-14B .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2336	Mirror Switch Assembly Circuit Failure	DDM	REFER to Section 501-09 .

B2425	Remote Keyless Entry Out of Synchronization	DDM	REFER to <u>Section 501-14B</u> .
B2477	Module Configuration Failure	DDM	REFER to <u>Section 418-01</u> .

DDM Parameter Identification (PID) Index

PID	Description	Expected Value
D_DN_SW	Driver Window Down Switch	OFF, DOWN
D_PWPK	Driver Power Window Peak Current	AMP
D_UP_SW	Driver Window Up Switch	OFF, UP
DMIR_H	Driver Side Mirror Horizontal Motor	notSEN, SENSED
DMIR_V	Driver Mirror Vertical	notSEN, SENSED
DR_LOCK	Driver Door Lock Output State	NO, YES
DR_UNLK	All Doors Unlock Output State	NO, YES
DRLKCYL	Door Lock Cylinder	notACT, ACTIVE
MEM1_SW	Memory Recall Switch #1	notACT, ACTIVE
MEM2_SW	Memory Recall Switch #2	notACT, ACTIVE
MEMS_SW	Memory Set Switch	notACT, ACTIVE
MIR_SEL	Power Mirror Select Switch	DRVMIR, PSGMIR, OFF
MIRH_SW	Pow Mir Position Switch - Horizontal	SHORT, RIGHT, LEFT, OFF
OTD_SW	One Touch Down Switch	OFF, DOWN
VBAT	Battery Voltage	Volts

DDM Active Command Index

Active Command	Display	Action
DOOR LOCK CONTROL	DD LOCK	OFF, ON
DOOR LOCK CONTROL	DD UNLOCK	OFF, ON
DOUBLE LOCK COMMAND	DOUBLE LK	UNLOCK, LOCK
FRONT WINDOW CONTROL	DR DOWN	OFF, ON
FRONT WINDOW CONTROL	DR UP	OFF, ON
ONE TOUCH WINDOW DOWN & ACCY DELAY	ONE TOUCH	OFF, ON
POWER MIRROR CONTROL	DR DOWN	OFF, ON
POWER MIRROR CONTROL	DR LEFT	OFF, ON
POWER MIRROR CONTROL	DR RIGHT	OFF, ON
POWER MIRROR CONTROL	DR UP	OFF, ON

SSP Relay Index

Relay	Fuse	Controlled System(s)
SSP1	BJB Fuse 427 (30A)	<ul style="list-style-type: none"> • Driver power door lock (FEM) • LH high beam headlamps (FEM) • RF park/turn/side marker lamps (FEM) • RH low beam headlamp • Driver exterior rear view mirror • LF park/turn/side marker lamps (FEM)
SSP2	BJB Fuse 432 (30A)	<ul style="list-style-type: none"> • LH low beam headlamp (FEM) • RH high beam headlamps (FEM) • Passenger exterior rear view mirror (FEM) • Switch illumination backlighting
SSP3	BJB Fuse 424 (30A)	<ul style="list-style-type: none"> • High mounted stoplamp (REM) • RR park/stoplamps (REM) • Reversing lamps (REM) • LR turn signals (REM) • Interior courtesy and demand lighting (FEM)
SSP4	BJB Fuse 423 (30A)	<ul style="list-style-type: none"> • LR park/stoplamps (REM) • RR turn signals (REM) • All passenger door locks (REM) • License lamps • Luggage compartment release solenoid/switch • Fuel door release solenoid/switch • Luggage compartment lamp

When diagnosing an SSP relay, check that all systems for that relay are inoperative. Refer to [Section 417-01](#).

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> • No communication with the front electronic module (FEM) 	<ul style="list-style-type: none"> • BJB Fuses: <ul style="list-style-type: none"> ■ 425 (40A). ■ 422 (20A). • Circuitry. • FEM. 	<ul style="list-style-type: none"> • GO to Pinpoint Test A.
<ul style="list-style-type: none"> • No communication with the rear electronic module (REM) 	<ul style="list-style-type: none"> • CJB Fuse: <ul style="list-style-type: none"> ■ 235 (5A). • Circuitry. • REM. 	<ul style="list-style-type: none"> • GO to Pinpoint Test B.
<ul style="list-style-type: none"> • No communication with the driver door module (DDM) 	<ul style="list-style-type: none"> • CJB Fuse: <ul style="list-style-type: none"> ■ 207 (5A). ■ 222 (10A). • Circuitry. • DDM. 	<ul style="list-style-type: none"> • GO to Pinpoint Test C.

<ul style="list-style-type: none"> ● The courtesy lamps are inoperative — all courtesy and interior lamps 	<ul style="list-style-type: none"> ● BJB Fuse 405 (10A). ● CJB. ● Circuits. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D.
<ul style="list-style-type: none"> ● An individual courtesy lamp is inoperative — individual and multiple lamps 	<ul style="list-style-type: none"> ● BJB. ● Interior AJB. ● Lamps. ● Switch(es). ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test E.
<ul style="list-style-type: none"> ● The courtesy lamps stay on continuously — all courtesy and interior lamps 	<ul style="list-style-type: none"> ● Door ajar switches. ● Interior AJB. ● Circuits. ● Map/rear dome lamp switches. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test F.
<ul style="list-style-type: none"> ● The demand lamps stay on continuously — left map, right map or rear dome lamp 	<ul style="list-style-type: none"> ● Switches. ● Circuits. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test G.
<ul style="list-style-type: none"> ● The courtesy lamps do not turn on with one door open 	<ul style="list-style-type: none"> ● Door ajar switches. ● Circuits. ● FEM. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test H.
<ul style="list-style-type: none"> ● Individual demand lamp is inoperative — glove compartment, vanity mirror (s), map or rear dome lamp 	<ul style="list-style-type: none"> ● Circuitry. ● Lamps. ● Switches. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test I.
<ul style="list-style-type: none"> ● The courtesy lamp stays on continuously — luggage compartment lid lamp only 	<ul style="list-style-type: none"> ● Circuitry. ● Luggage compartment lid ajar switch. ● Circuitry. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test J.
<ul style="list-style-type: none"> ● The courtesy lamps do not turn on with one door open — luggage compartment lid lamp inoperative with luggage compartment open 	<ul style="list-style-type: none"> ● Circuitry. ● Lamp. ● Luggage compartment lid ajar switch. ● REM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test K.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE (FEM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK22 (OG/YE) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
1	



2



FEM C201c

3

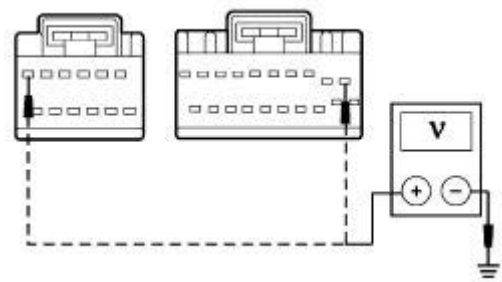


FEM C201f

4



5



A0006297

5 Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22 (OG/YE) harness side and ground.

• Are the voltages greater than 10 volts?

→ Yes
GO to A2.

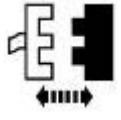
→ No
REPAIR the circuit(s) in question. TEST the system for normal operation.

A2 CHECK CIRCUITS 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS

1



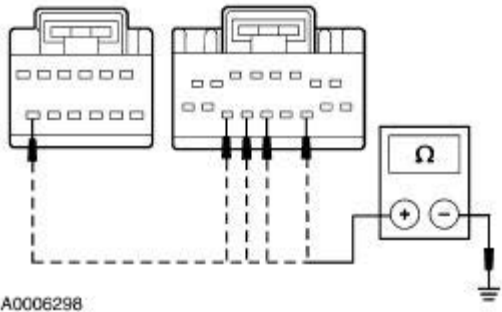
2



FEM C201a

3

3 Using the following table, measure the



resistance between FEM connectors, harness side and ground:

FEM	Pin	Circuit
C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)
C201a	15	31-DK20D (BK/RD)

- Are the resistances less than 5 ohms?

→ **Yes**

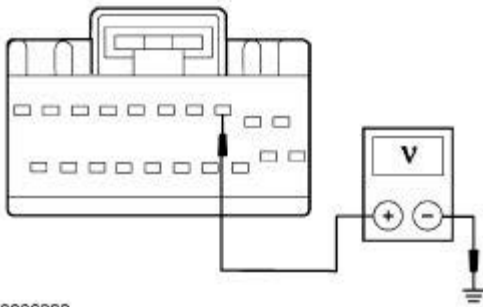
REFER to [Section 418-00](#).

→ **No**

REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST B: NO COMMUNICATION WITH THE REAR ELECTRONIC MODULE (REM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CIRCUIT 29-DK31 (OG/BK) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p> <p>2</p> <p>REM C420d</p> <p>3</p> <p>REM C420c</p> <p>4</p> <p>5</p>	<p>5</p> <p>Measure the voltage between REM C420d pin 3, circuit 29-DK31 (OG/BK), harness side and ground.</p>



A0006299

- Is the voltage greater than 10 volts?

→ **Yes**

GO to B2.

→ **No**

REPAIR the circuit. TEST the system for normal operation.

B2 CHECK CIRCUITS 29S-DK31 (OG), 31-DK30D (BK), 31-DK30E (BK), 31-DK30F (BK), 31-DK30G (BK) AND 31-DK30H (BK/OG), FOR OPENS

1

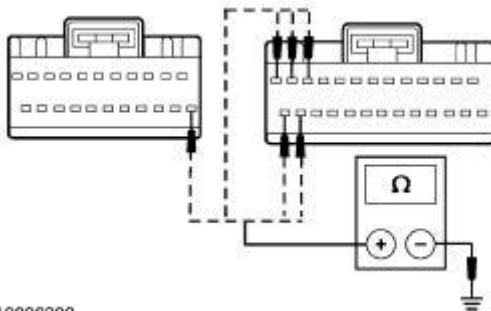


2



REM C420b

3



A0006300

- 3 Using the following table, measure the resistance between REM connectors, harness side and ground:

REM	Pin	Circuit
C420c	13	29S-DK31 (OG/BK)
C420c	12	31-DK30E (BK)
C420c	11	31-DK30D (BK)
C420c	26	31-DK30G (BK)
C420c	25	31-DK30F (BK)
C420b	12	31-DK30H (BK/OG)

- Are the resistances less than 5 ohms?

→ **Yes**


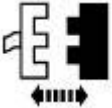

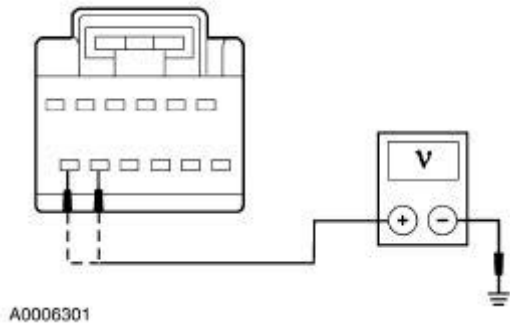

REFER to Section 418-00.

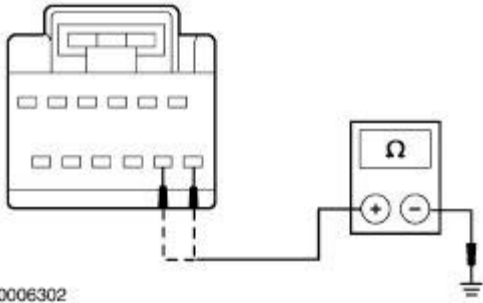
→ **No**

REPAIR the circuit(s) in question. TEST

the system for normal operation.

PINPOINT TEST C: NO COMMUNICATION WITH THE DRIVER DOOR MODULE (DDM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK CIRCUITS 29-AJ80 (OG) AND 29S-AJ86 (OG/BU) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1 </p> <p>2 </p> <p>DDM C501a</p> <p>3 </p> <p>4 </p> <p>A0006301</p>	<p>4 Measure the voltage between DDM C501a pin 11, circuit 29-AJ80 (OG), harness side and ground; and between DDM C501a pin 12, circuit 29S-AJ86 (OG/BU), harness side and ground.</p> <p>● Is the voltage greater than 10 volts?</p> <p>→ Yes GO to <u>C2</u>.</p> <p>→ No REPAIR the circuit(s) in question. TEST the system for normal operation.</p>
C2 CHECK CIRCUITS 31-AJ80B (BK/OG) AND 91-AJ80 (BN/BU) FOR OPENS	
<p>1 </p> <p>2</p>	<p>2 Measure the resistance between DDM C501a pin 7, circuit 91-AJ80 (BN/BU),</p>



A0006302

harness side and ground; and between DDM C501a pin 8, circuit 31-AJ80B (BK/OG), harness side and ground.

- Is the resistance less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

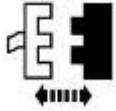
PINPOINT TEST D: THE COURTESY LAMPS ARE INOPERATIVE — ALL COURTESY AND INTERIOR LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>D1 CHECK CIRCUIT 30-DD2 (RD) FOR OPEN</p>	
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.</p>	
<p>1</p> <p>BJB Fuse 405 (10A)</p> <p>2</p> <p>A0004308</p>	<p>2</p> <p>Measure the voltage between BJB Fuse 405 (10A) pin 1, circuit 30-DD2 (RD), and ground.</p> <ul style="list-style-type: none"> ● Is the voltage greater than 10 volts? <p>→ Yes INSTALL Fuse 405 (10A).GO to <u>D2</u>.</p>

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

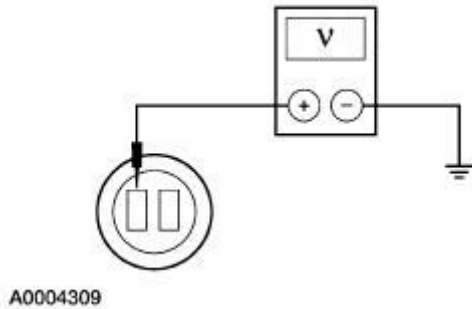
D2 CHECK CIRCUIT 29S-LC36 (OG/YE) FOR AN OPEN

1



RF Door Courtesy Lamp C606

2



2 Measure the voltage between the right front door courtesy lamp C606 pin 1, circuit 29S-LC36 (OG/YE), harness side and ground.

• **Is the voltage greater than 10 volts?**

→ **Yes**
RECONNECT C606 and GO to D3.

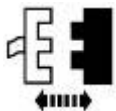
→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

D3 CHECK CIRCUIT 29S-LC3 (OG/BU) FOR SHORT TO POWER

1



3

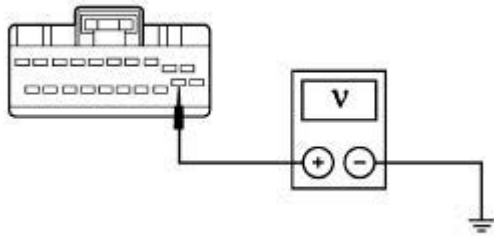


FEM C201f

4

2 Remove BJB Fuse 405 (10A).

4 Measure the voltage between FEM C201f pin 12, circuit 29S-LC3 (OG/BU), harness side and ground.



A0005552

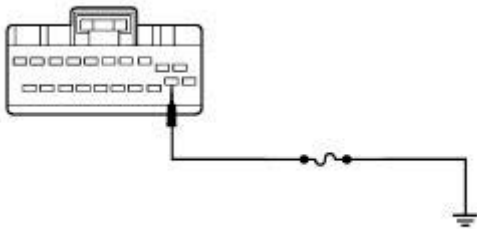
● Is the voltage greater than 10 volts?

→ **Yes**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to D4.

D4 CHECK FEM FOR OPENS

1



A0004310

1

Connect a 30A fused jumper between FEM C201f pin 12, circuit 29S-LC3 (OG), harness side and ground.

● Did the courtesy lamps illuminate?

→ **Yes**
INSTALL a new FEM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

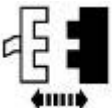
→ **No**
GO to D5.

D5 CHECK CIRCUIT 29S-LC3 (OG) FOR AN OPEN

1



2

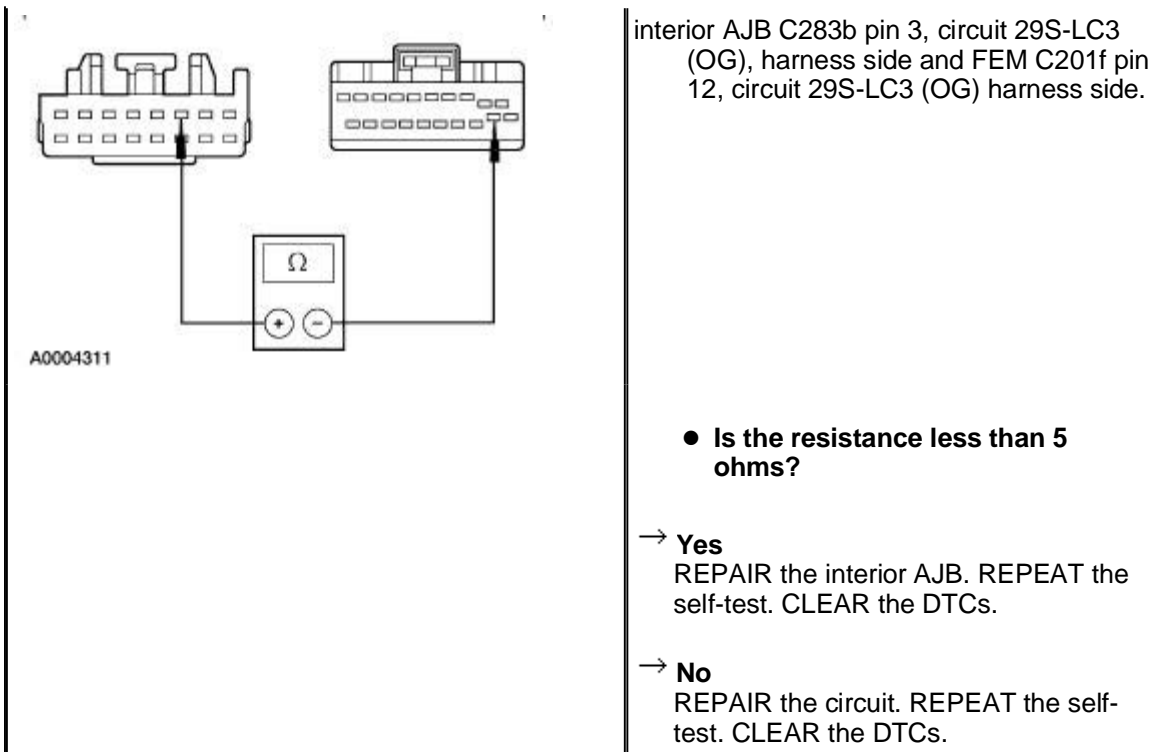


Interior AJB C283b

3

3

Measure the resistance between the



PINPOINT TEST E: AN INDIVIDUAL COURTESY LAMP IS INOPERATIVE — INDIVIDUAL AND MULTIPLE LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 VERIFY COURTESY LAMP SYMPTOM	<p>1 Verify the courtesy lamp symptom.</p> <ul style="list-style-type: none"> ● Is more than one lamp inoperative? <p>→ Yes GO to <u>E26</u>.</p> <p>→ No If a front door courtesy lamp is inoperative,GO to <u>E2</u>.</p> <p>If a map lamp is inoperative,GO to <u>E9</u>.</p> <p>If the dome lamp is inoperative,GO to <u>E16</u>.</p> <p>If a footwell lamp is inoperative,GO to <u>E19</u>.</p>
E2 VERIFY FRONT DOOR COURTESY LAMP SYMPTOM	<p>1 Verify the area of the front door courtesy lamp symptom.</p> <ul style="list-style-type: none"> ● Which front door courtesy lamp is inoperative?

→ **Yes**
Driver door GO to E3.

→ **No**
Front passenger door GO to E6.

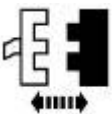
E3 CHECK CIRCUIT 29S-LC34 (OG/YE) FOR VOLTAGE

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1

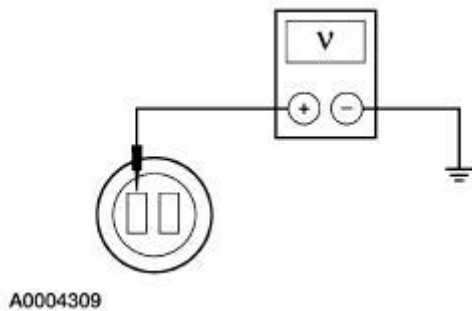


2



Driver Door Courtesy Lamp C506

3



3 Measure the voltage between the driver door courtesy lamp C506, circuit 29S-LC34 (OG/YE), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to E5.

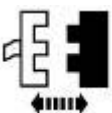
→ **No**
GO to E4.

E4 CHECK CIRCUIT 29S-L34 (OG/YE) FOR AN OPEN

1



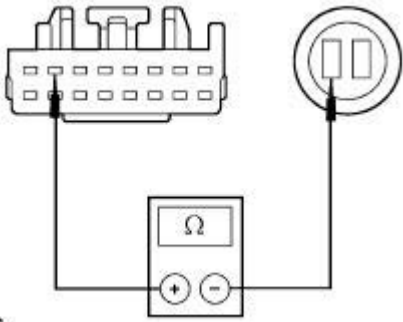
2



Interior AJB C283b

3

3 Measure the resistance between interior AJB C283b pin 7, circuit 29S-L34



A0004312

(OG/YE), harness side and driver door courtesy lamp C506, circuit 29S-LC34 (OG/YE) harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new interior AJB. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

E5 CHECK CIRCUIT 9-LC34 (BN) FOR AN OPEN

1

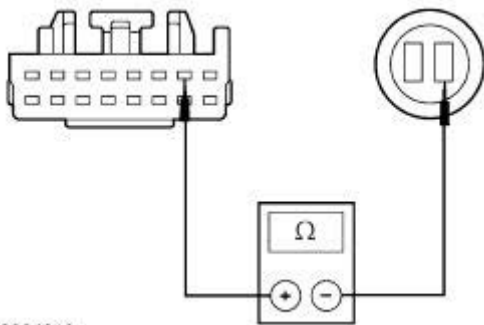


2



Interior AJB C283b

3



A0004313

3 Measure the resistance between interior AJB C283b pin 2, circuit 9-LC34 (BN), harness side and driver door courtesy lamp C506, circuit 9-LC34 (BN) harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new interior AJB. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

E6 CHECK CIRCUIT 29S-LC36 (OG/YE) FOR VOLTAGE

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1

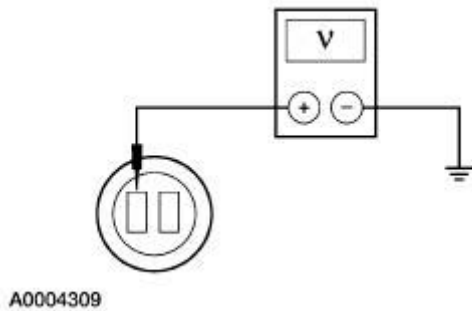


2



Front Passenger Door Courtesy Lamp C606

3



3

Measure the voltage between the front passenger door courtesy lamp C606, circuit 29S-LC36 (OG/YE), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to E8.

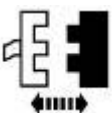
→ **No**
GO to E7.

E7 CHECK CIRCUIT 29S-LC36 (OG/YE) FOR AN OPEN

1



2

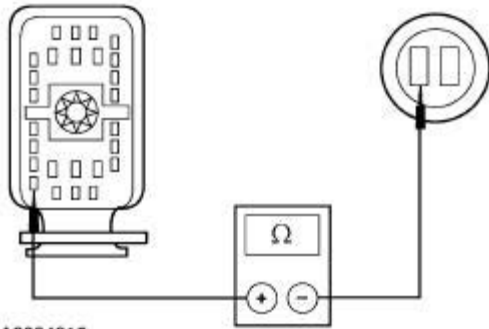


BJB C270d

3

3

Measure the resistance between BJB C270d pin 20, circuit 29S-LC36 (OG/YE), harness side and front passenger door courtesy lamp C606, circuit 29S-LC36 (OG/YE) harness side.



A0004315

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new BJB. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

E8 CHECK CIRCUIT 9-LC36 (BN) FOR AN OPEN

1

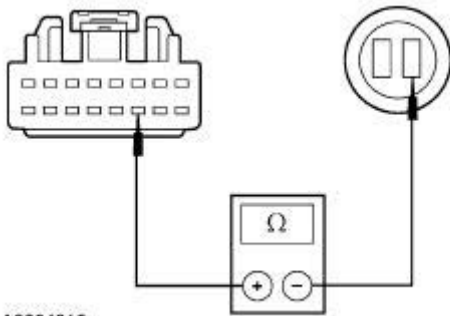


2



Interior AJB C283a

3



A0004316

3 Measure the resistance between interior AJB C283a pin 11, circuit 9-LC36 (BN), harness side and front passenger door courtesy lamp C606, circuit 9-LC36 (BN), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new interior AJB. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

E9 VERIFY COURTESY MAP LAMP SYMPTOM

1 Verify the area of the courtesy map lamp symptom.

● Is the left map lamp inoperative?

→ Yes
GO to E10.

→ No
GO to E13.

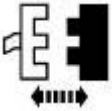
E10 CHECK LEFT MAP LAMP SWITCH FOR VOLTAGE

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1

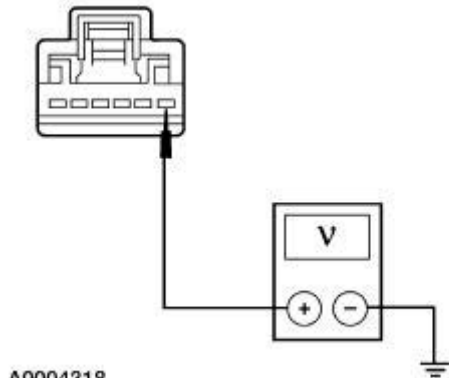


2



LF Map Reading Lamp Switch C910

3



3 Measure the voltage between the left front map reading lamp switch C910 pin 1, circuit 31S-LB12 (BK/YE), harness side and ground.

● Is the voltage greater than 10 volts?

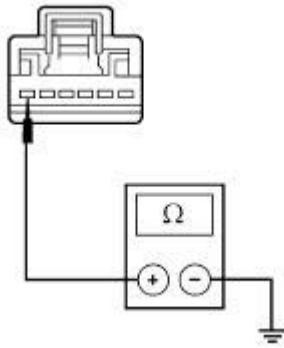
→ Yes
GO to E11.

→ No
GO to E12.

E11 CHECK CIRCUIT 9-LB13 (BN/RD) FOR AN OPEN

1

1 Measure the resistance between left map lamp switch C910 pin 6, circuit 9-LB13 (BN/RD), harness side and ground.



A0004317

2 Open the driver door.

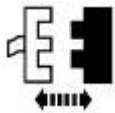
- **When the driver door is opened, does resistance drop to less than 5 ohms?**

→ **Yes**
 INSTALL a new front map lamp assembly. REFER to Lamp Assembly—Front Map in this section. REPEAT the self-test. CLEAR the DTCs.

→ **No**
 REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

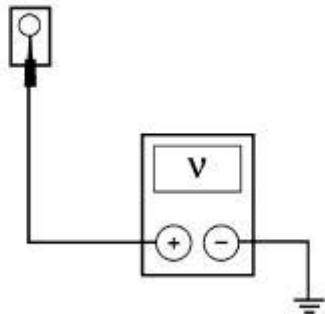
E12 CHECK CIRCUITS 29S-LB12 (OG/YE) AND 31S-LB12 (BK/YE) FOR AN OPEN

1



LF Map Lamp Bulb C908

2



A0004319

2 Measure the voltage between LF map lamp bulb C908a, circuit 29S-LB12 (OG/YE), harness side and ground.

- **Is the voltage greater than 10 volts?**

→ **Yes**
 REPAIR circuit 31S-LB12 (BK/YE). REPEAT the self-test. CLEAR the DTCs.

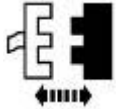
→ **No**

REPAIR circuit 29S-LB12 (OG/YE).
REPEAT the self-test. CLEAR the DTCs.

E13 CHECK THE RIGHT MAP LAMP SWITCH FOR VOLTAGE

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1

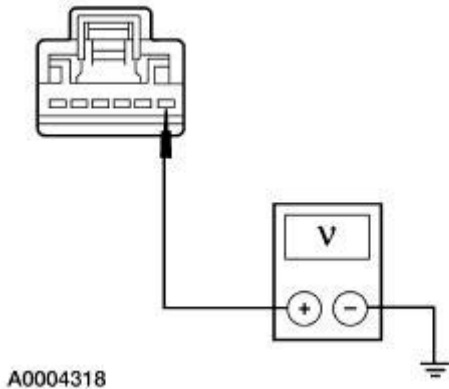


RF Map Reading Lamp Switch C905

2



3



3 Measure the voltage between the RF map reading lamp switch C905 pin 1, circuit 31S-LB19 (BK/BU), harness side and ground.

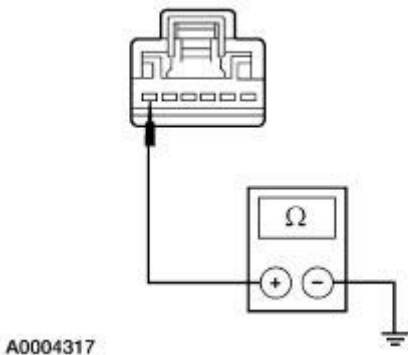
• Is the voltage greater than 10 volts?

→ **Yes**
GO to E14.

→ **No**
GO to E15.

E14 CHECK CIRCUIT 9-LB20 (BN/BU) FOR AN OPEN

1



1 Measure the resistance between RF map reading lamp switch C905 pin 6, circuit 9-LB20 (BN/BU), harness side and ground.

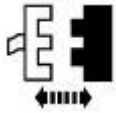
2 Open the driver door.

- **When the driver door is opened, does resistance drop to less than 5 ohms?**

- **Yes**
INSTALL a new front map lamp assembly. For additional information, REFER to Lamp Assembly—Front Map in this section. REPEAT the self-test. CLEAR the DTCs.
- **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

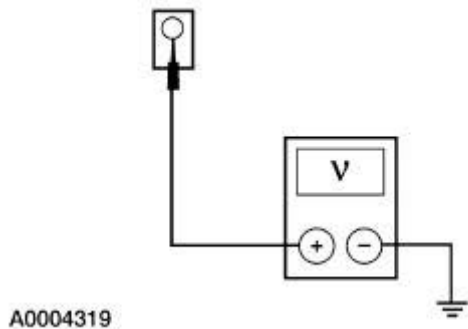
E15 CHECK CIRCUITS 29S-LB19 (OG/BU) AND 31S-LB19 (BK/BU) FOR AN OPEN

1



RF Map Lamp Bulb C903

2



- 2 Measure the voltage between RF map lamp bulb C903, circuit 29S-LB19 (OG/BU), harness side and ground.

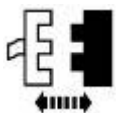
- **Is the voltage greater than 10 volts?**

- **Yes**
REPAIR circuit 31S-LB19 (BK/BU). REPEAT the self-test. CLEAR the DTCs.
- **No**
REPAIR circuit 29S-LB19 (OG/BU). REPEAT the self-test. CLEAR the DTCs.

E16 CHECK REAR DOME LAMP SWITCH FOR VOLTAGE

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1

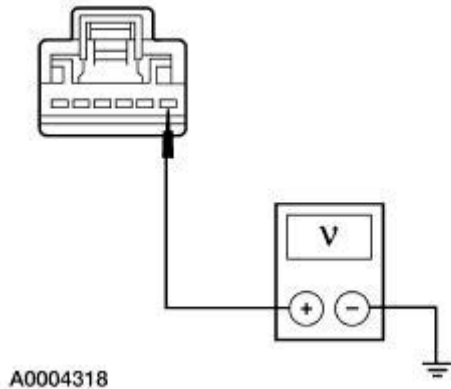


Rear Dome Lamp Switch C900

2



3



3 Measure the voltage between the rear dome lamp switch C900 pin 1, circuit 31S-LB29 (BK/OG), harness side and ground.

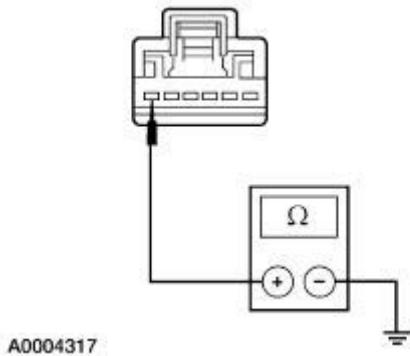
• Is the voltage greater than 10 volts?

→ **Yes**
GO to E17.

→ **No**
GO to E18.

E17 CHECK CIRCUIT 9-LB32 (BN/WH) FOR AN OPEN

1



1 Measure the resistance between rear dome lamp switch C900 pin 6, circuit 9-LB20 (BN/BU), harness side and ground.

2 Open the driver door.

• When the driver door is opened, does resistance drop to less than 5 ohms?

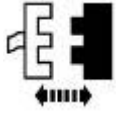
→ **Yes**
INSTALL a new rear dome lamp assembly. REFER to Lamp Assembly—Rear Reading in this section. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-

test. CLEAR the DTCs.

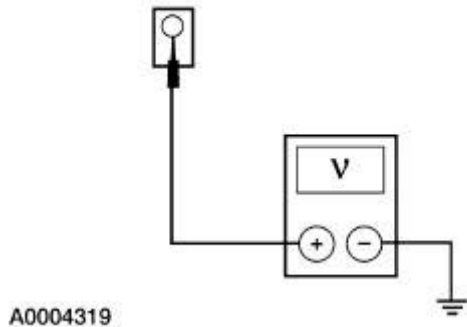
E18 CHECK CIRCUITS 29S-LB29 (OG) AND 31S-LB29 (BK/OG) FOR AN OPEN

1



Rear Dome Lamp Bulb C901

2



2

Measure the voltage between rear dome lamp bulb C901, circuit 29S-LB29 (OG/BU), harness side and ground.

● **Is the voltage greater than 10 volts?**

→ **Yes**

REPAIR circuit 31S-LB29 (BK/OG). REPEAT the self-test. CLEAR the DTCs.

→ **No**

REPAIR circuit 29S-LB29 (OG). REPEAT the self-test. CLEAR the DTCs.

E19 VERIFY COURTESY FRONT FOOTWELL LAMP SYMPTOM

1

Verify the area of the front footwell courtesy lamp symptom.

● **Are both front footwell lamps inoperative?**

→ **Yes**

GO to E26.

→ **No**

If the left footwell lamp is inoperative, GO to E20.

If the right footwell lamp is inoperative, GO to E23.

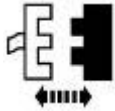
E20 CHECK CIRCUIT 29S-LC11 (OG/WH) FOR VOLTAGE

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1

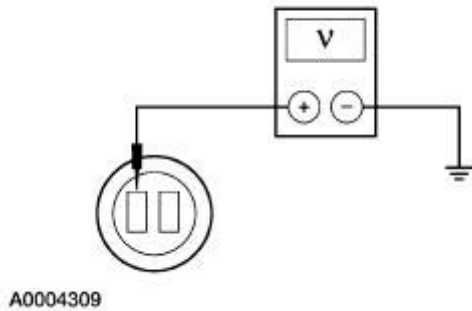


2



LF Footwell Lamp Bulb C209

3



3 Measure the voltage between the LF footwell lamp C209, circuit 29S-LC11 (OG/WH), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to E22.

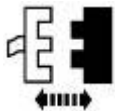
→ No
GO to E21.

E21 CHECK CIRCUIT 29S-LC11 (OG/WH) FOR AN OPEN

1

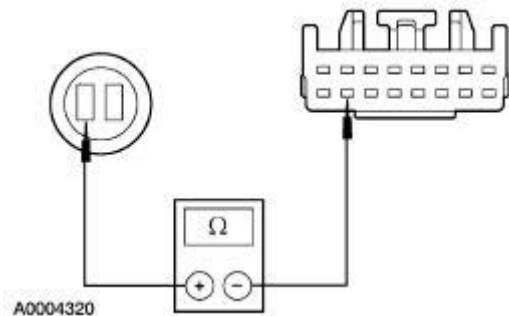


2



Interior AJB C283d

3



3 Measure the resistance between the LF footwell lamp C209, circuit 29S-LC11 (OG/WH), harness side and interior AJB C283d pin 15, circuit 29S-LC11 (OG/WH), harness side.

• Is the resistance less than 5 ohms?

- **Yes**
INSTALL a new interior AJB. REPEAT the self-test. CLEAR the DTCs.
- **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

E22 CHECK CIRCUIT 31S-LC11 (BK/WH) FOR AN OPEN

1

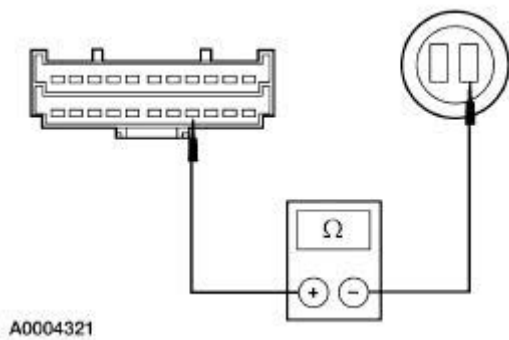


2



Joint Connector No. 3, C224

3



A0004321

- 3 Measure the resistance between joint connector No. 3, C224 pin 19, circuit 31S-LC11 (BK/WH), harness side and left front footwell lamp C209, circuit 31S-LC11 (BK/WH), harness side.

- Is the resistance more than 5 ohms?

- **Yes**
REPAIR joint connector No. 3, C224. REPEAT the self-test. CLEAR the DTCs.
- **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

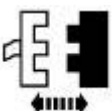
E23 CHECK CIRCUIT 29S-LC23 (OG/WH) FOR VOLTAGE

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1

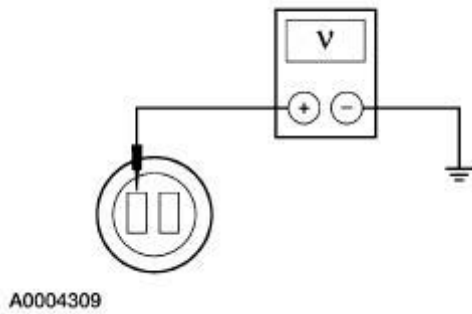


2



RF Footwell Lamp Bulb C266

3



3 Measure the voltage between the right front footwell lamp C266, circuit 29S-LC23 (OG/WH), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to E25.

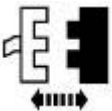
→ **No**
GO to E24.

E24 CHECK CIRCUIT 29S-LC23 (OG/WH) FOR AN OPEN

1

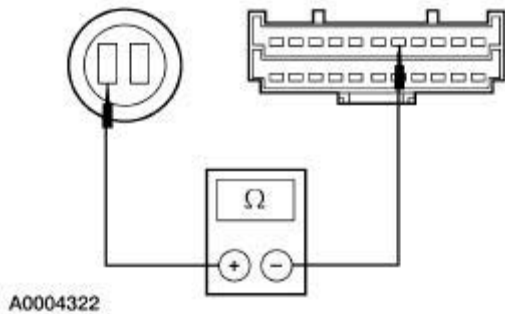


2



Joint Connector No. 1, C261

3



3 Measure the resistance between the RF footwell lamp C266, circuit 29S-LC23 (OG/WH), harness side and joint connector No. 1, C261 pin 7, circuit 29S-LC23 (OG/WH) harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
Verify if the glove box lamp is operating correctly. If it is OK, REPAIR junction connector No. 1 C261. REPEAT the self-test. CLEAR the DTCs.

If the glove box lamp is not operating correctly, GO to E26.

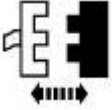
→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

E25 CHECK CIRCUIT 31S-LC23 (BK/WH) FOR AN OPEN

1

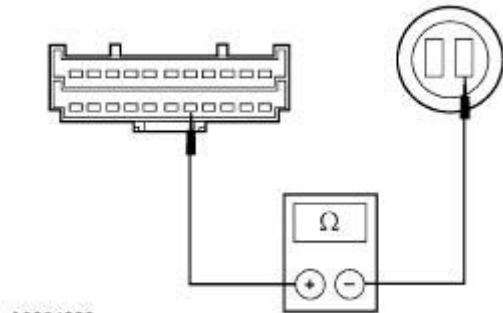


2



Joint Connector No. 3, C224

3



3 Measure the resistance between the joint connector No. 3, C224 pin 18, circuit 31S-LC23 (BK/WH), harness side and right front footwell lamp C266, circuit 31S-LC23 (BK/WH), harness side.

● **Is the resistance more than 5 ohms?**

→ **Yes**
REPAIR joint connector No. 3, C224.
REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

E26 CHECK LEFT AND RIGHT FRONT FOOTWELL LAMPS

1 Verify the symptom.

● **Are both door courtesy lamps inoperative only?**

→ **Yes**
INSTALL a new interior AJB. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to E27.

E27 CHECK LEFT AND RIGHT FRONT FOOTWELL LAMPS

1 Verify the symptom.

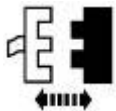
- Are both front footwell courtesy lamps inoperative only?

→ **Yes**
GO to E28.

→ **No**
GO to E30.

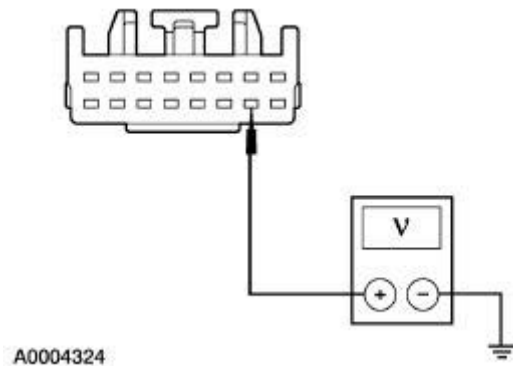
E28 CHECK VOLTAGE TO INTERIOR AJB

1



Interior AJB C283d

2



A0004324

2 Measure the voltage between the interior AJB C283d pin 10, circuit 31S-LC4 (BK/GN), harness side and ground.

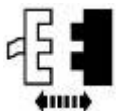
- Is the voltage greater than 10 volts?

→ **Yes**
INSTALL a new interior AJB. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to E29.

E29 CHECK CIRCUIT 31S-LC4 (BK/GN) FOR AN OPEN

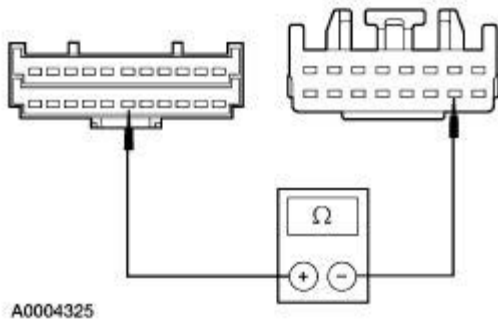
1



Joint Connector No. 3, C224

2

2 Measure the resistance between the joint connector No. 3, C224 pin 17, circuit 31S-LC4 (BK/GN), harness side and interior AJB C283d pin 10, circuit 31S-LC4 (BK/GN), harness side.



- Is the resistance less than 5 ohms?

- **Yes**
REPAIR joint connector No. 3, C224.
REPEAT the self-test. CLEAR the DTCs.
- **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

E30 CHECK RIGHT FRONT FOOTWELL LAMP AND GLOVE BOX LAMP

- 1 Verify the symptom.

- Are the right front footwell and glove box lamps the only lamps that are inoperative?

- **Yes**
GO to E31.
- **No**
GO to E32.

E31 CHECK FOR VOLTAGE TO JOINT CONNECTOR No. 1, C261

1



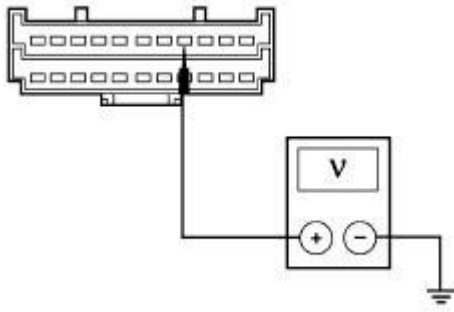
Joint Connector No. 1, C261

2



3

- 3 Measure the voltage between joint connector No. 1, C261 pin 15, circuit 29S-LC1 (OG/YE), harness side and ground.



A0004326

- Is the voltage greater than 10 volts?

- **Yes**
REPAIR joint connector No. 1, C261.
REPEAT the self-test. CLEAR the DTCs.
- **No**
REPAIR circuit 29S-LC1 (OG/YE).
REPEAT the self-test. CLEAR the DTCs.

E32 CHECK LEFT FRONT FOOTWELL LAMP AND GLOVE BOX LAMP

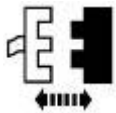
- 1 Verify the symptom.

- Are the left front footwell and left door courtesy lamps the only lamps that are inoperative?

- **Yes**
GO to E33.
- **No**
GO to E34.

E33 CHECK FOR VOLTAGE TO THE INTERIOR AJB

1



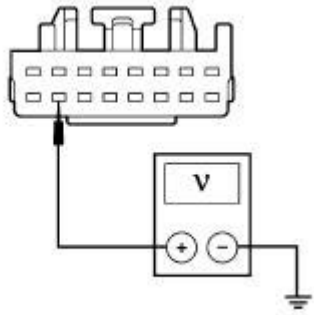
Interior AJB C283b

2



3

- 3 Measure the voltage between the interior AJB C283b pin 15, circuit 29S-LC5 (OG/GN), harness side and ground.



A0004327

- Is the voltage greater than 10 volts?

- **Yes**
INSTALL a new interior AJB. REPEAT the self-test. CLEAR the DTCs.
- **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

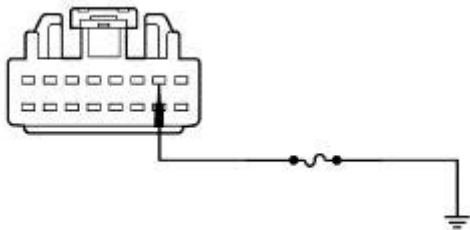
E34 CHECK BOTH MAP AND DOME LAMPS OPERATION AT THE INTERIOR AJB

1



Interior AJB C283a

2



A0004328

- 2 Connect a 10A fused jumper between interior AJB C283a pin 2, circuit 9-LB1 (BN), harness side and ground.

- Do both map and dome lamps illuminate?

- **Yes**
INSTALL a new interior AJB. REPEAT the self-test. CLEAR the DTCs.
- **No**
GO to E35.

E35 CHECK CIRCUIT 9-LB1 (BN) FOR AN OPEN

1

2

Rear Dome Lamp C900

3

A0004329

3 Measure the resistance between the rear dome lamp C900 pin 6, circuit 9-LB32 (BN/WH), harness side and interior AJB C283a pin 2, circuit 9-LB1 (BN), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
REPAIR circuit 29S-LB2 (OG/BU) between BJB, map and dome lamps. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR circuit 9-LB1 (BN). REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST F: THE COURTESY LAMPS STAY ON CONTINUOUSLY — ALL COURTESY AND INTERIOR LAMPS

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 USE THE RECORDED RESULTS FROM FEM SELF-TESTS	
	<p>1 Use the recorded FEM continuous and self-test DTCs.</p> <ul style="list-style-type: none"> • Are any DTCs recorded? <p>→ Yes If DTC B1319, GO to <u>F3</u>. If DTC B1327, GO to <u>F6</u>.</p> <p>→ No GO to <u>F2</u>.</p>
F2 USE THE RECORDED RESULTS FROM REM SELF-TESTS	
	<p>1 Use the recorded REM continuous and</p>

self-test DTCs.

- **Are any DTCs recorded?**

→ **Yes**

If DTC B1335, GO to F20.

If DTC B1571, GO to F23.

→ **No**

GO to F9.

F3 CHECK THE DRIVER DOOR AJAR SWITCH

1

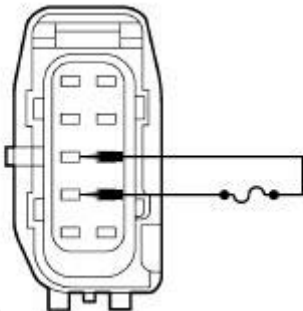


2



Driver Door Lock Actuator C525

3



A0005553

3

Connect a fused jumper wire between driver door lock actuator C525 pin 6, circuit 31-AA58 (BK), harness side and pin 8, circuit 31S-GL46 (BK/YE), harness side.

- **After 20-30 seconds did the interior lamps turn OFF?**

→ **Yes**

INSTALL a new driver door lock actuator/ajar switch. REFER to Section 501-14B.

→ **No**

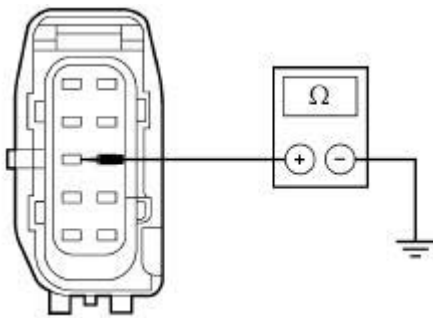
GO to F4.

F4 CHECK CIRCUIT 31-AA58 (BK) FOR AN OPEN

1

1

Measure the resistance between driver door lock actuator C525 pin 6, circuit 31-AA58 (BK), harness side and ground.



A0005554

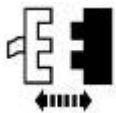
● Is the resistance less than 5 ohms?

→ **Yes**
GO to F5.

→ **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

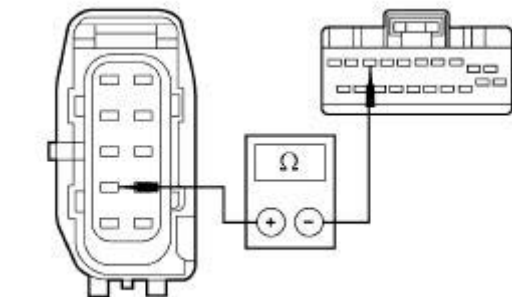
F5 CHECK CIRCUIT 31S-GL46 (BK/YE) FOR AN OPEN

1



FEM C201f

2



A0004332

2 Measure the resistance between driver door lock actuator C525 pin 8, circuit 31S-GL46 (BK/YE), harness side and FEM C201f pin 8, circuit 31S-GL46 (BK/YE), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new FEM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

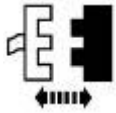
→ **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

F6 CHECK THE FRONT PASSENGER DOOR AJAR SWITCH

1

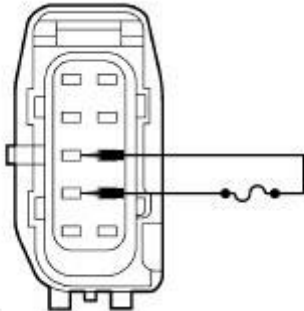


2



Front Passenger Door Lock Actuator C609

3



A000553

3

Connect a fused jumper wire between front passenger door lock actuator C609 pin 6, circuit 31-AA5BB (BK), harness side and pin 8, circuit 31S-GL47 (BK/BU), harness side.

- After 20-30 seconds did the interior lamps turn OFF?

→ Yes

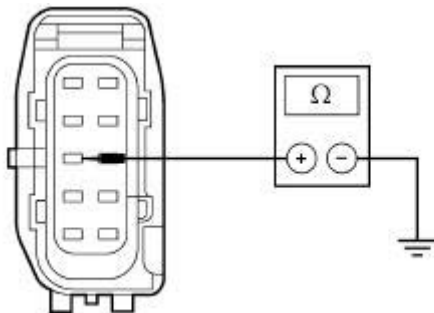
INSTALL a new passenger door lock actuator/ajar switch. REFER to [Section 501-14B](#).

→ No

GO to [F7](#).

F7 CHECK CIRCUIT 31-AA5BB (BK) FOR AN OPEN

1



A000554

1

Measure the resistance between front passenger door lock actuator C609 pin 6, circuit 31-AA5BB (BK), harness side and ground.

- Is the resistance less than 5 ohms?

→ Yes

GO to [F8](#).

→ No

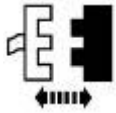
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

F8 CHECK CIRCUIT 31S-GL47 (BK/BU) FOR AN OPEN

1

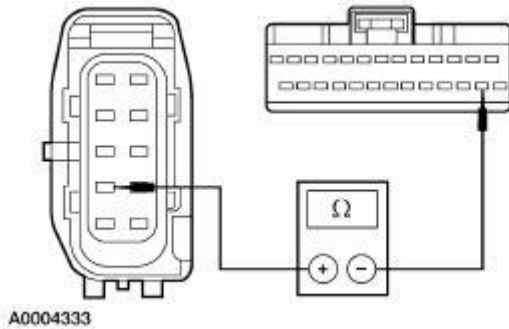


2



FEM C201e

3



3

Measure the resistance between front passenger door lock actuator C609 pin 8, circuit 31S-GL47 (BK/BU), harness side and FEM C201e pin 15, circuit 31S-GL47 (BK/BU), harness side.

● Is the resistance less than 5 ohms?

→ Yes

INSTALL a new FEM. REFER to [Section 419-10](#) . REPEAT the self-test. CLEAR the DTCs.

→ No

REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

F9 CHECK LEFT FRONT MAP READING LAMP OPERATION

1



2

Activate the left front map reading lamp demand switch.

● Do ALL other courtesy lamps turn OFF?

→ Yes

GO to [F12](#) .

→ No

GO to [F10](#) .

F10 CHECK RIGHT FRONT MAP READING LAMP OPERATION

1

Activate the right front map lamp switch.

● Do ALL other courtesy lamps turn OFF?

→ Yes

GO to [F13](#) .

→ **No**
GO to F11.

F11 CHECK REAR DOME LAMP OPERATION

- 1 Activate the rear dome lamp switch.
- **Do ALL other courtesy lamps turn OFF?**
- **Yes**
GO to F14.
- **No**
GO to F15.

F12 CHECK CIRCUIT 31S-LB12 (BK) FOR SHORT TO GROUND

1

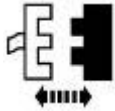


LF Map Reading Lamp Switch C910

- **Does the LF map lamp stay ON?**
- **Yes**
REPAIR the circuit. TEST the system for normal operation.
- **No**
INSTALL a new front map lamp assembly. REFER to Lamp Assembly—Front Map in this section. REPEAT the self-test. CLEAR the DTCs.

F13 CHECK FRONT MAP LAMP

1

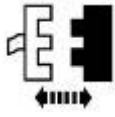


RF Map Reading Lamp Switch C905

- **Does the RF map lamp stay ON?**
- **Yes**
REPAIR the circuit. TEST the system for normal operation.
- **No**
INSTALL a new front map lamp assembly. REFER to Lamp Assembly—Front Map in this section. REPEAT the self-test. CLEAR the DTCs.

F14 CHECK CIRCUIT 31S-LB29 (BK) FOR SHORT TO GROUND

1



Rear Dome Lamp Switch C900

● Does the rear dome lamp stay ON?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

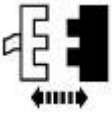
→ **No**
INSTALL a new rear dome lamp assembly. REFER to Lamp Assembly—Rear Reading in this section . REPEAT the self-test. CLEAR the DTCs.

F15 ISOLATE CIRCUIT 29S-LC3 (OG/BU) AND FEM FOR SHORT TO GROUND

1

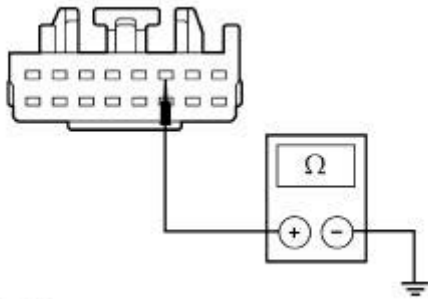


2



Interior AJB C283b

3



A0004334

3 Measure the resistance between interior AJB C283b pin 3, circuit 29S-LC3 (OG), harness side and ground.

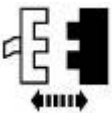
● Is resistance greater than 10,000 ohms?

→ **Yes**
GO to F17.

→ **No**
GO to F16.

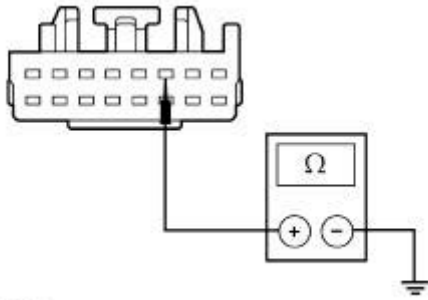
F16 CHECK CIRCUIT 29S-LC3 (OG/BU) FOR SHORT TO GROUND

1



FEM C201f

2



A0004334

2

Measure the resistance between interior AJB C283b pin 3, circuit 29S-LC3 (OG), harness side and ground.

● Is the resistance greater than 10,000 ohms?

→ Yes

INSTALL a new FEM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

→ No

REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

F17 CHECK CIRCUIT 9-LC34 (BN) FOR SHORT TO GROUND

1

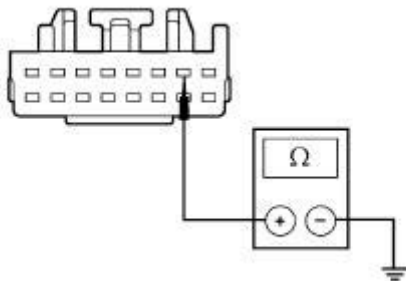


2



Interior AJB C283b

3



A0005600

3

Measure the resistance between interior AJB C283b pin 2, circuit 9-LC34 (BN), harness side and ground.

● Is the resistance greater than 10,000 ohms?

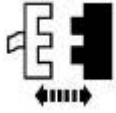
→ Yes

REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to F18.

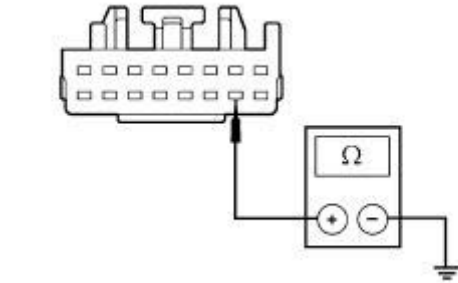
F18 ISOLATE THE INSTRUMENT PANEL LAMP CIRCUITS FOR SHORT TO GROUND

1



Interior AJB C283d

2



A0005601

2 Measure the resistance between interior AJB C283d pin 10, circuit 31S-LC4 (BK/GN), harness side and ground.

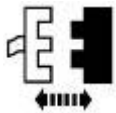
- Is the resistance greater than 10,000 ohms?

→ **Yes**
REPAIR the circuit. TEST system for normal operation.

→ **No**
GO to F19.

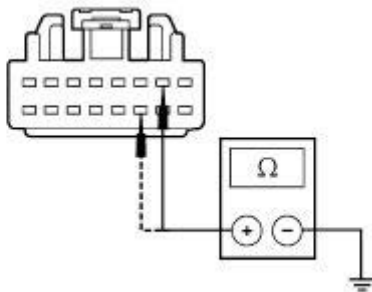
F19 CHECK CIRCUITS 9-LB1 (BN) AND 9-LC36 (BN) FOR SHORT TO GROUND

1



Interior AJB C283a

2



A0005602

2 Measure the resistance between interior AJB C283a pin 2, circuit 9-LB1 (BN), harness side and ground; and between AJB C283a pin 11, circuit 9-LC36 (BN), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**

INSTALL a new AJB. TEST system for normal operation.

→ **No**
REPAIR the circuit in question. TEST system for normal operation.

F20 CHECK THE RIGHT REAR PASSENGER DOOR AJAR SWITCH

1

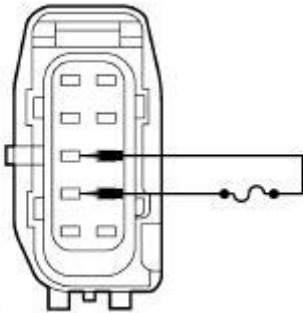


2



RR Passenger Door Lock Actuator C804

3



A000553

3 Connect a fused jumper wire between RR passenger door lock actuator C804 pin 6, circuit 31-AA58C (BK), harness side and pin 8, circuit 31S-GL19 (BK/GN), harness side.

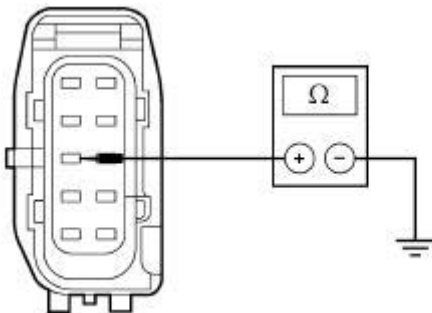
● After 20-30 seconds did the interior lamps turn OFF?

→ **Yes**
INSTALL a new RR passenger door lock actuator/ajar switch. REFER to [Section 501-14B](#). REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to [F21](#).

F21 CHECK CIRCUIT 31-AA58C (BK) FOR AN OPEN

1



A000554

1 Measure the resistance between RR passenger door lock actuator C804 pin 6, circuit 31-AA58C (BK), harness side and ground.

● Is the resistance less than 5 ohms?

- **Yes**
GO to F22.
- **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

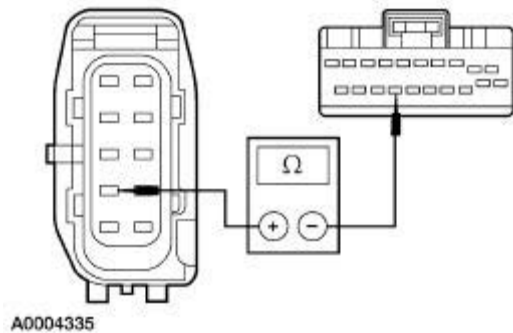
F22 CHECK CIRCUIT 31S-GL19 (BK/GN) FOR AN OPEN

1



REM C420d

2



- 2 Measure the resistance between RR passenger door lock actuator C804 pin 8, circuit 31S-GL19 (BK/GN), harness side and REM C420d pin 17, circuit 31S-GL19 (BK/GN), harness side.

● **Is the resistance less than 5 ohms?**

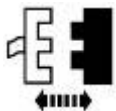
- **Yes**
INSTALL a new REM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.
- **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

F23 CHECK THE LEFT REAR PASSENGER DOOR AJAR SWITCH

1



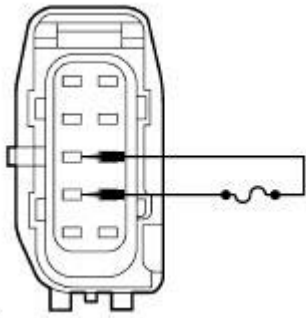
2



LR Passenger Door Lock Actuator C704

3

- 3 Connect a fused jumper wire between LR passenger door lock actuator C704 pin 6, circuit 31-AA58D (BK), harness side and pin 8, circuit 31S-GL12 (BK/OG), harness side.



A0005553

- After 20-30 seconds did the interior lamps turn OFF?

→ **Yes**

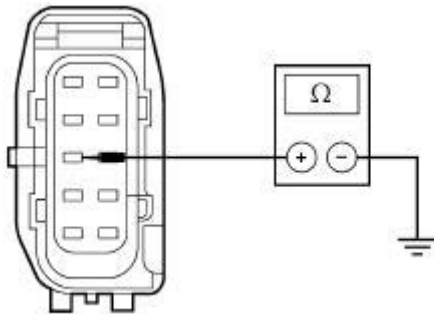
INSTALL a new LR passenger door lock actuator/ajar switch. REFER to [Section 501-14B](#). REPEAT the self-test. CLEAR the DTCs.

→ **No**

GO to [F24](#).

F24 CHECK CIRCUIT 31-AA58D (BK) FOR AN OPEN

1



A0005554

1

Measure the resistance between left rear passenger door lock actuator C704 pin 6, circuit 31-AA58D (BK), harness side and ground.

- Is the resistance less than 5 ohms?

→ **Yes**

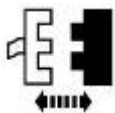
GO to [F25](#).

→ **No**

REPAIR circuit 31-AA58D (BK). REPEAT the self-test. CLEAR the DTCs.

F25 CHECK CIRCUIT 31S-GL12 (BU/OG) FOR AN OPEN

1

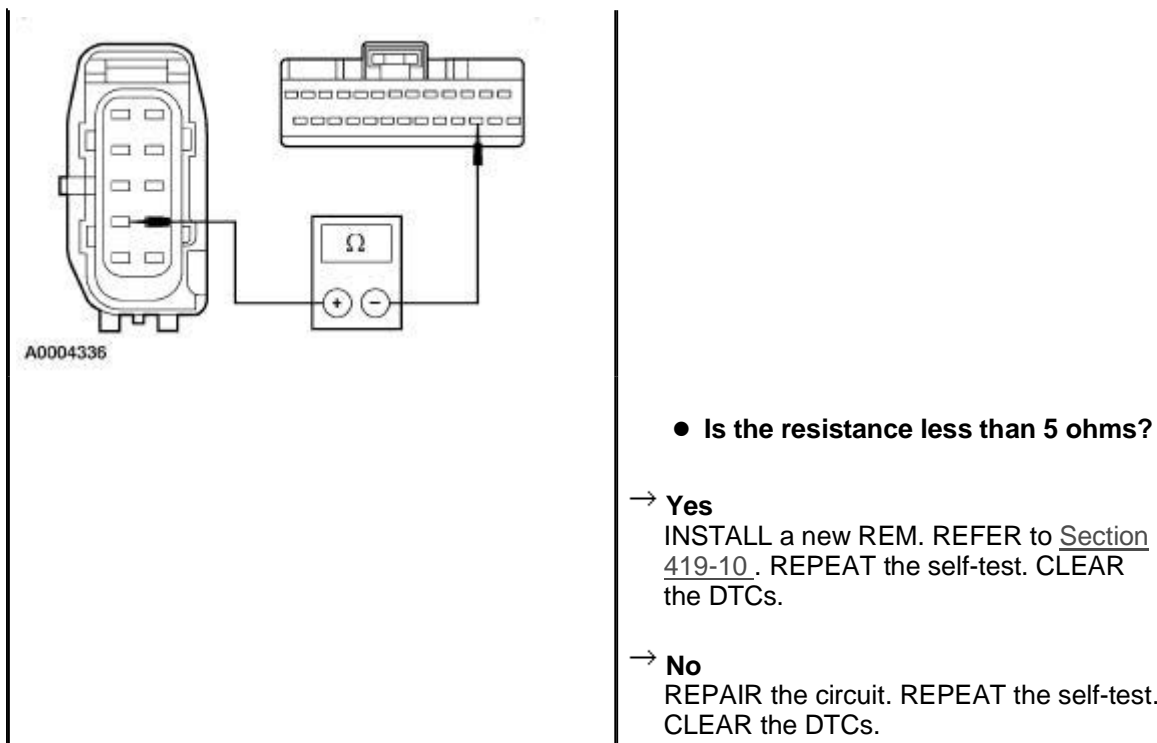


REM C420c

2

2

Measure the resistance between LR passenger door lock actuator C704 pin 8, circuit 31S-GL12 (BK/OG), harness side and REM C420c pin 16, circuit 31S-GL12 (BU/OG), harness side.



PINPOINT TEST G: THE DEMAND LAMPS STAY ON CONTINUOUSLY — LEFT MAP, RIGHT MAP OR REAR DOME LAMP

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 VERIFY DEMAND LIGHTING	
	<ol style="list-style-type: none"> 1 Close all doors. 2 Toggle demand switch in question to the courtesy and demand positions. <p>● Does the lamp in question turn OFF?</p> <p>→ Yes System OK.</p> <p>→ No INSTALL a new switch. TEST system for normal operation.</p>

PINPOINT TEST H: THE COURTESY LAMPS DO NOT TURN ON WITH ONE DOOR OPEN

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 VERIFY COURTESY LAMP SYMPTOM	
	<ol style="list-style-type: none"> 1 Open and close all the doors one at a time and observe the courtesy lamps. <p>● Are the courtesy lamps inoperative from the driver door?</p>

→ **Yes**
GO to H2.

→ **No**
If the courtesy lamps are inoperative from the front passenger door, GO to H5.

If the courtesy lamps are inoperative from the left rear door, GO to H8.

If the courtesy lamps are inoperative from the right rear door, GO to H11.

H2 CHECK DRIVER DOOR INPUT TO THE FEM

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1



2



Diagnostic Tool

3



4



4 Monitor the FEM PID D_DOOR.

5 Open the driver door.

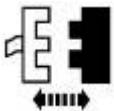
● **Does the FEM PID D_DOOR read AJAR?**

→ **Yes**
INSTALL a new FEM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to H3.

H3 CHECK DRIVER DOOR AJAR SWITCH

1



Driver Door Lock Actuator C525

- Are the courtesy lamps illuminated?

→ **Yes**
INSTALL a new driver door lock actuator/ajar switch. REFER to [Section 501-14B](#). REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to [H4](#).

H4 CHECK CIRCUIT 31S-GL46 (BK/YE) FOR SHORT TO GROUND

1

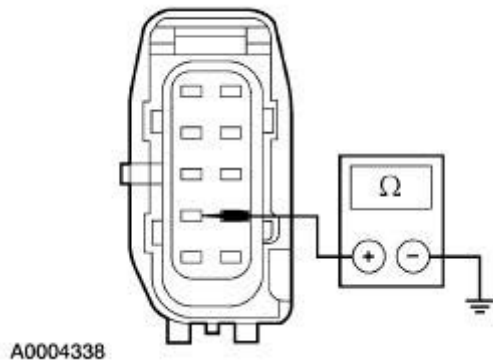


2



FEM 201f

3



3 Measure the resistance between driver door lock actuator C525 pin 8, circuit 31S-GL46 (BK/YE), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

H5 CHECK FRONT PASSENGER DOOR INPUT TO THE FEM

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1



2



Diagnostic Tool

3



4



4 Monitor the FEM PID P_DOOR.

5 Open the front passenger door.

● Does the FEM PID P_DOOR read AJAR?

→ Yes
INSTALL a new FEM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

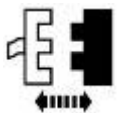
→ No
GO to H6.

H6 CHECK FRONT PASSENGER DOOR AJAR SWITCH

1



2



Front Passenger Door Lock Actuator C609

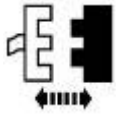
● Are the courtesy lamps illuminated?

→ Yes
INSTALL a new front passenger door lock actuator/ajar switch. REFER to Section 501-14B. REPEAT the self-test. CLEAR the DTCs.

→ No
GO to H7.

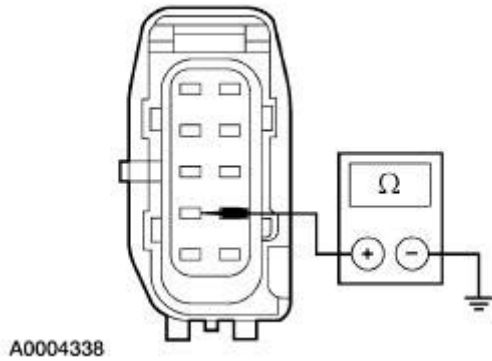
H7 CHECK CIRCUIT 31S-GL47 (BK/BU) FOR SHORT TO GROUND

1



FEM 201e

2



A0004338

2

Measure the resistance between passenger door lock actuator C609 pin 8, circuit 31S-GL47 (BK/BU), harness side and ground.

● Is the resistance greater than 10,000 ohms?

→ **Yes**

INSTALL a new FEM. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs.

→ **No**

REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

H8 CHECK LR DOOR INPUT TO THE REM

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1



2



Diagnostic Tool

3



4

4

Monitor the REM PID LRDR_SW.



5 Open the left rear door.

- Does the REM PID LRDR_SW read AJAR?

→ **Yes**
INSTALL a new REM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.

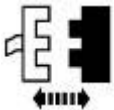
→ **No**
GO to [H9](#).

H9 CHECK LR DOOR AJAR SWITCH

1



2



LR Door Lock Actuator C704

- Are the courtesy lamps illuminated?

→ **Yes**
INSTALL a new LR door lock actuator/ajar switch. REFER to [Section 501-14B](#). REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to [H10](#).

H10 CHECK CIRCUIT 31S-GL12 (BK/OG) FOR SHORT TO GROUND

1



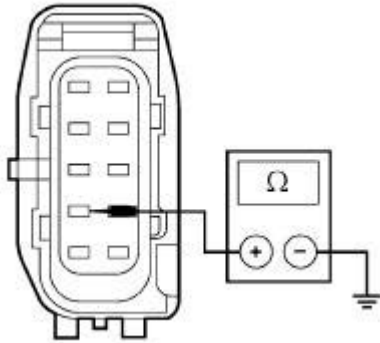
2



REM 420c

3

3 Measure the resistance between LR door lock actuator C704 pin 8, circuit 31S-GL12 (BK/OG), harness side and ground.



A0004338

- Is the resistance greater than 10,000 ohms?

- **Yes**
 INSTALL a new REM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.
- **No**
 REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

H11 CHECK RR DOOR INPUT TO THE REM

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1



2



Diagnostic Tool

3



4



- 4 Monitor the REM PID RRDR_SW.

- 5 Open the RR door.

- Does the REM PID RRDR_SW read AJAR?

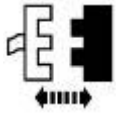
- **Yes**
 INSTALL a new REM. REFER to

Section 419-10. REPEAT the self-test.
CLEAR the DTCs.

→ **No**
GO to H12.

H12 CHECK RIGHT REAR DOOR AJAR SWITCH

1



RR Door Lock Actuator C804

● **Are the courtesy lamps illuminated?**

→ **Yes**
INSTALL a new RR door lock actuator/ajar switch. REFER to Section 501-14B. REPEAT the self-test.
CLEAR the DTCs.

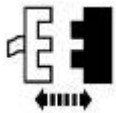
→ **No**
GO to H13.

H13 CHECK CIRCUIT 31S-GL19 (BK/GN) FOR SHORT TO GROUND

1

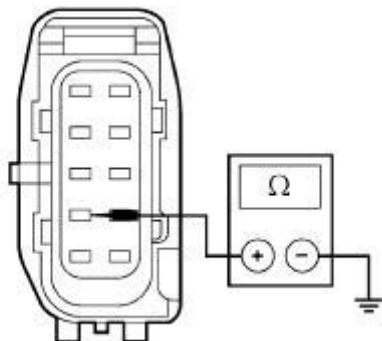


2



REM 420d

3



A0004338

3 Measure the resistance between RR door lock actuator C804 pin 8, circuit 31S-GL19 (BK/GN), harness side and ground.

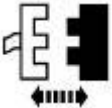
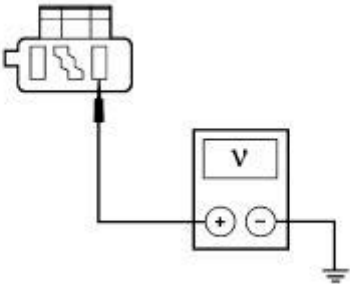
● **Is the resistance greater than 10,000 ohms?**

→ **Yes**
INSTALL a new REM. REFER to Section 419-10. REPEAT the self-test.

CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST I: INDIVIDUAL DEMAND LAMP IS INOPERATIVE — GLOVE COMPARTMENT, VANITY MIRROR(S), MAP OR REAR DOME LAMP

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 VERIFY LAMP SYMPTOM	
NOTE: If any of the courtesy lamps are also inoperative, refer to symptom chart. If multiple lamps are inoperative, refer to Pinpoint Test E.	
	<p>1 Verify the inoperative lamp.</p> <ul style="list-style-type: none">● Is the glove box lamp inoperative? <p>→ Yes GO to <u>12</u>.</p> <p>→ No If the left hand visor lamp is inoperative, GO to <u>14</u>.</p> <p>If the right hand visor lamp is inoperative, GO to <u>16</u>.</p> <p>If a map lamp is inoperative, GO to <u>18</u>.</p> <p>If the rear dome lamp is inoperative, GO to <u>19</u>.</p>
I2 CHECK CIRCUIT 29S-LB8 (OG) FOR AN OPEN	
NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.	
<p>1</p>  <p>Glove Box Lamp and Switch C254</p> <p>2</p>  <p>A0005603</p>	<p>2 Measure the voltage between glove box lamp and switch C254 pin 3, circuit 29S-LB8 (OG), harness side and ground.</p>

● Is the voltage greater than 10 volts?

→ **Yes**
GO to 13.

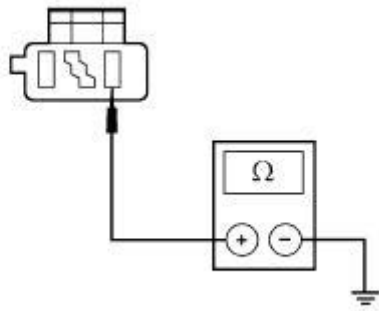
→ **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

13 CHECK CIRCUIT 31-LB8 (OG) FOR AN OPEN

1



2



A0004340

2 Measure the resistance between glove box lamp and switch C254, circuit 31-LB8 (OG), harness side and ground.

● Is the resistance less than 5 ohms?

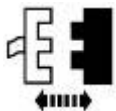
→ **Yes**
INSTALL a new glove box lamp and switch. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

14 CHECK CIRCUIT 29S-LB16 (OG/GN) FOR OPEN

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

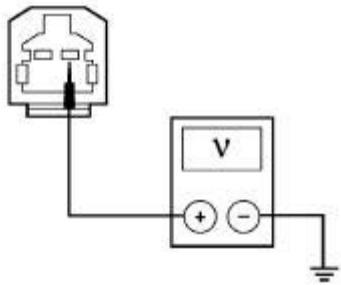
1



Left Vanity Mirror Lamp and Switch C907

2

2 Measure the voltage between left vanity mirror lamp and switch C907 pin 2, circuit 29S-LB16 (OG/GN), harness side and ground.



A0004342

● Is the voltage greater than 10 volts?

→ **Yes**
GO to 15.

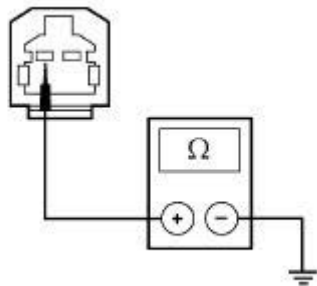
→ **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

15 CHECK CIRCUIT 31-LB16 (BK) FOR AN OPEN

1



2



A0004341

2 Measure the resistance between left vanity mirror lamp and switch C907 pin 1, circuit 31-LB16 (BK), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new left vanity mirror lamp and switch. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

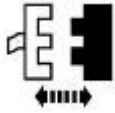
16 CHECK CIRCUIT 29S-LB23 (OG/WH) FOR AN OPEN

NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.

1



2

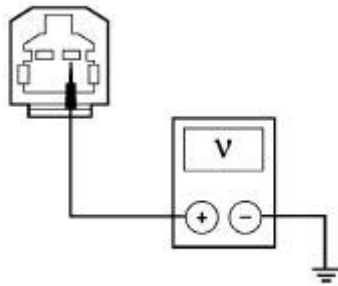


Right Vanity Mirror Lamp and Switch C906

3



4



A0004342

4 Measure the voltage between right vanity mirror lamp and switch C906 pin 2, circuit 29S-LB23 (OG/WH), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to 17.

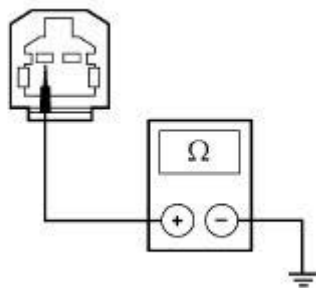
→ No
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

17 CHECK CIRCUIT 31-LB23 (BK) FOR AN OPEN

1



2



A0004341

2 Measure the resistance between right vanity mirror lamp and switch C906 pin 1, circuit 31-LB23 (BK), harness side and ground.

• Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new right vanity mirror lamp and switch. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

18 CHECK GROUND CIRCUIT TO MAP SWITCH

1

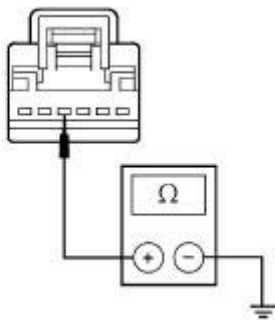


2



Front Map Reading Lamp Switch C905 or C910

3



A0005604

3 For the LF map reading lamp switch measure the resistance between C910 pin 4, circuit 31-LB13 (BK), harness side and ground. For the RF map reading lamp switch measure the resistance between C905 pin 4, circuit 31-LB20 (BK), harness side and ground.

● **Are the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new front map lamp assembly. REFER to Lamp Assembly—Front Map in this section. REPEAT the self-test. CLEAR the DTCs.

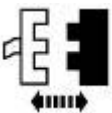
→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

19 CHECK GROUND CIRCUIT TO REAR DOME LAMP SWITCH

1

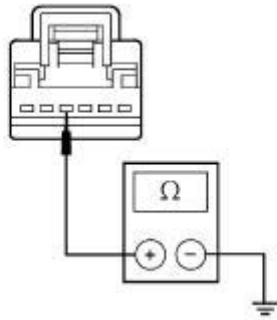


2



Rear Dome Lamp Switch C900

3



A0005604

3

Measure the resistance between the rear dome lamp switch C900 pin 4, circuit 31-LB32 (BK), harness side and ground.

● Is the resistance less than 5 ohms?



→ Yes

INSTALL a new rear dome lamp assembly. REFER to Lamp Assembly—Rear Reading in this section. REPEAT the self-test. CLEAR the DTCs.

→ No

REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST J: THE COURTESY LAMP STAYS ON CONTINUOUSLY — LUGGAGE COMPARTMENT LAMP ONLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 RETRIEVE DIAGNOSTIC TROUBLE CODES	
<p>1</p> 	<p>1 Use recorded results from REM self-test.</p> <p>● Are any DTCs recorded?</p> <p>→ Yes If B1331GO to <u>J4</u>.</p> <p>For all other DTCs REFER to the REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>J2</u>.</p>
J2 CHECK THE LUGGAGE COMPARTMENT LID AJAR SWITCH INPUT TO THE REM	
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is turned OFF. Refer to Principles of Operation for Switched System Power operation.</p>	
<p>1</p> 	<p>1 While opening and closing the luggage compartment lid, monitor the REM PID DECKLID.</p>

- Do the REM PID values agree with the luggage compartment lid positions?

→ **Yes**
GO to J3.

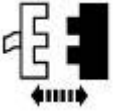
→ **No**
GO to J4.

J3 CHECK CIRCUIT 31S-LB25 (BK/BU) FOR SHORT TO GROUND

1

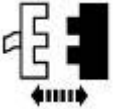


2



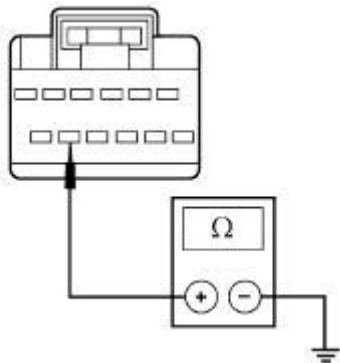
REM C420a

3



Luggage Compartment Lid Lamp C428

4



A0004343

- 4 Measure the resistance between the REM C420a pin 11, circuit 31S-LB25 (BK/BU), harness side and ground.

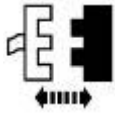
- Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new REM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

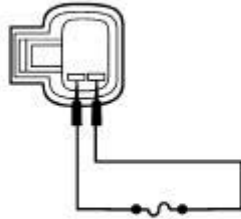
J4 CHECK THE LUGGAGE COMPARTMENT LID AJAR SWITCH

1



Luggage Compartment Lid Ajar Switch C429

2



A0004345

2

Connect a fused (10A) jumper wire between the luggage compartment lid ajar switch C429 pins 1 and 2, harness side.

● Does the luggage compartment lid lamp go OFF?

→ **Yes**
INSTALL a new luggage compartment lid ajar switch. REFER to Section 501-14A.

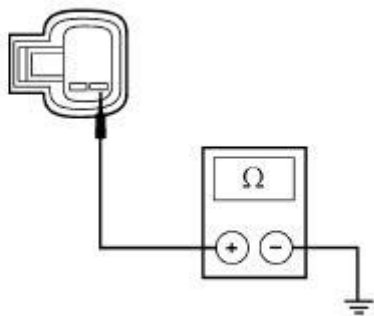
→ **No**
GO to J5.

J5 CHECK CIRCUIT 31-GL20 (BK/RD) FOR AN OPEN

1



2



A0004346

2

Measure the resistance between the luggage compartment lid ajar switch C429 pin 2, circuit 31-GL20 (BK/RD), harness side and ground.

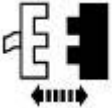
● Is the resistance less than 5 ohms?

→ **Yes**
GO to J6.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

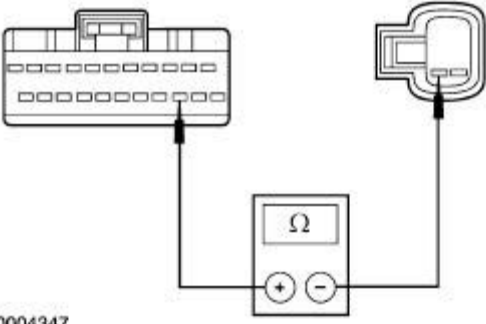
J6 CHECK CIRCUIT 8-GL20 (WH/BK) FOR AN OPEN

1



REM C420b

2



A0004347


2 Measure the resistance between the REM C420b pin 14, circuit 8-GL20 (WH/BK) , harness side and luggage compartment lid ajar switch C429 pin 1, circuit 8-GL20 (WH/BK), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new REM. REFER to [Section 419-10](#) . REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST K: THE COURTESY LAMPS DO NOT TURN ON WITH ONE DOOR OPEN — LUGGAGE COMPARTMENT LID LAMP INOPERATIVE WITH LUGGAGE COMPARTMENT LID OPEN

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 RETRIEVE REM DIAGNOSTIC TROUBLE CODES	
<p>1</p> 	<p>1 Use recorded results from REM self-test.</p> <ul style="list-style-type: none"> ● Are any REM DTCs recorded? <p>→ Yes REFER to REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to K2 .</p>
K2 CHECK THE LUGGAGE COMPARTMENT LID AJAR SWITCH INPUT TO THE REM	
<p>NOTE: The ignition switch must be cycled from OFF to RUN to enable the switched system power feature. The switched system power will remain active for one half-hour after ignition is</p>	

turned OFF. Refer to Principles of Operation for Switched System Power operation.

1



1

While opening and closing the luggage compartment lid, monitor the REM PID DECKLID.

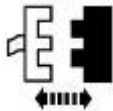
- Does the REM PID values DECKLID agree with the luggage compartment lid position?

→ **Yes**
GO to K3.

→ **No**
GO to K8.

K3 CHECK POWER TO THE BJB FUSE 404 (10A)

1

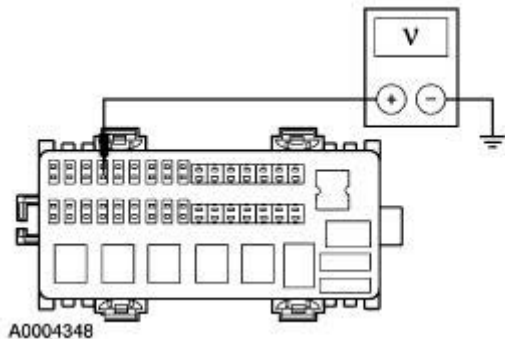


BJB Fuse 404 (10A)

2



3



3

Measure the voltage between the BJB Fuse 404 (10A) input side and ground.

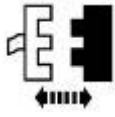
- Is the voltage greater than 10 volts?

→ **Yes**
INSTALL BJB fuse 404 (10A) and GO to K4.

→ **No**
REPAIR supply circuit to the BJB.
REPEAT the self-test. CLEAR the DTCs.

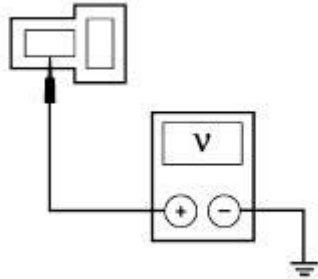
K4 CHECK CIRCUIT 29S-LB25 (OG/BU) FOR AN OPEN

1



Luggage Compartment Lid Lamp C428

2



A0004349

2

Measure the voltage between luggage compartment lid lamp C428, circuit 29S-LB25 (OG/BU), harness side and ground.

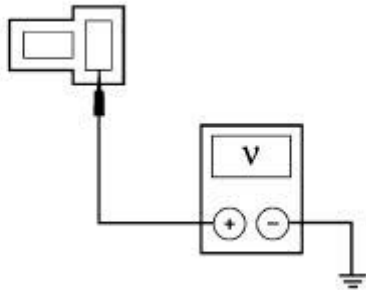
● Is the voltage greater than 10 volts?

→ **Yes**
GO to K5.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

K5 CHECK CIRCUIT 31S-LB25 (BK/BU) FOR VOLTAGE

1



A0004350

1

Measure the voltage between luggage compartment lid lamp C428, circuit 31S-LB25 (BK/BU), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to K7.

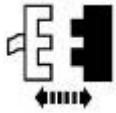
→ **No**
GO to K6.

K6 CHECK CIRCUIT 31S-LB25 (BK/BU) FOR AN OPEN

1

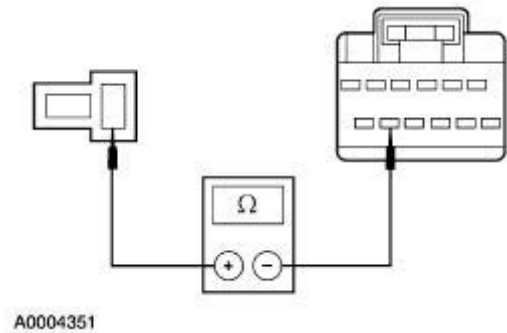


2



REM C420a

3



3

Measure the resistance between the REM C420a pin 11, circuit 31S-LB25 (BK/BU), harness side and luggage compartment lid lamp C429, circuit 31S-LB25 (BK/BU), harness side.

● Is the resistance less than 5 ohms?

→ Yes

INSTALL a new REM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.

→ No

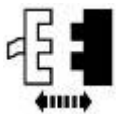
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

K7 CHECK CIRCUIT 31S-LB25 (BK/BU) FOR SHORT TO BATTERY

1



2



REM C420b

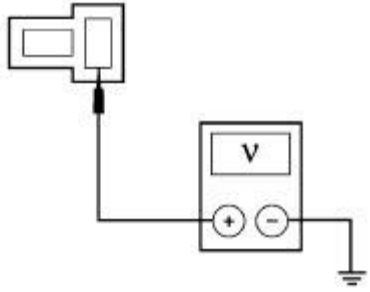
3



4

4

Measure the voltage between the luggage compartment lid lamp C428, circuit 31S-LB25 (BK/BU) harness side and ground.



A0004350

- **Is the voltage greater than 10 volts?**

- **Yes**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.
- **No**
INSTALL a new REM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.

K8 CHECK FOR A STUCK OR STICKING LUGGAGE COMPARTMENT AJAR SWITCH

1



2



Luggage Compartment Lid Ajar Switch C429

- 3 While disconnecting the luggage compartment lid ajar switch observe luggage compartment lamp.

- **Does the luggage compartment lid lamp go ON?**

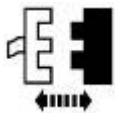
- **Yes**
INSTALL a new luggage compartment lid ajar switch. REFER to [Section 501-14A](#).
- **No**
GO to [K9](#).

K9 CHECK CIRCUIT 8-GL20 (WH/BK) FOR SHORT TO GROUND

1

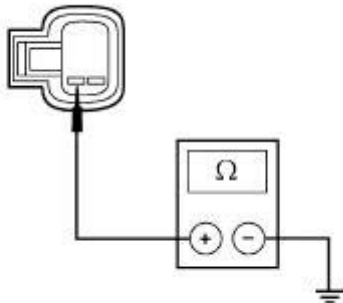


2



REM C420b

3



A0004352

- 3 Measure resistance between the luggage compartment lid ajar switch C429 pin 1, circuit 8-GL20 (WH/BK), harness side and ground.

● Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new REM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

Lamp Assembly —Rear Reading

Removal and Installation

NOTE: The rear reading lamp assembly is an integral part of the headliner. This does not include the reading lamp lens and the bulbs.

For additional information, refer to [Section 501-05](#).

Lamp Assembly —Front Map

Removal and Installation

NOTE: The front map lamp assembly is an integral part of the headliner. This does not include the front map lamp lens and bulbs.

For additional information, refer to [Section 501-05](#).

Daytime Running Lamps (DRL)

Refer to Wiring Diagrams Section [417-01](#) for schematic and connector information.

Principles of Operation

The daytime running lamps (DRL) feature will illuminate the high beam headlamps, pulse width modulated at a 40% duty cycle when the following conditions exist:

- The ignition switch (11572) is in the RUN position.
- The headlamp switch (11654) is in the OFF or PARK position.
- The autolamps feature has not illuminated the parking lamps and the headlamps.

The headlamps are controlled by the front electronic module (FEM) and the instrument cluster (10849) in all phases of operation. The headlamp switch is hardwired to the instrument cluster, which sends a command through the standard corporate protocol (SCP) network to the FEM, which outputs the appropriate voltage to the headlamps. For additional information, refer to [Section 417-01](#).

Inspection and Verification

NOTE: The FEM must be reconfigured upon replacement. Refer to [Section 418-01](#).

1. Verify the customer concern by operating the DRL following these steps:
 1. Place the ignition switch in the RUN position.
 2. Place the autolamp switch in the OFF position.
 3. Place the headlamp switch in the OFF or PARK position.
 2. Verify the parking lamp operation.
 1. Place the headlamp switch in the PARK position.
If at least one of the parking lamps operates correctly, proceed to the next step.
If none of the parking lamps operate, refer to [Section 417-01](#).
 3. Verify the high beam headlamp operation.
 1. Place the headlamp switch in the ON position.
 2. Place the multifunction switch in the high beam headlamp position.
If the high beam headlamp operation is correct and the DRL operation is incorrect, install a new FEM; refer to [Section 419-10](#).
If the high beam operation is incorrect, refer to [Section 417-01](#).
-

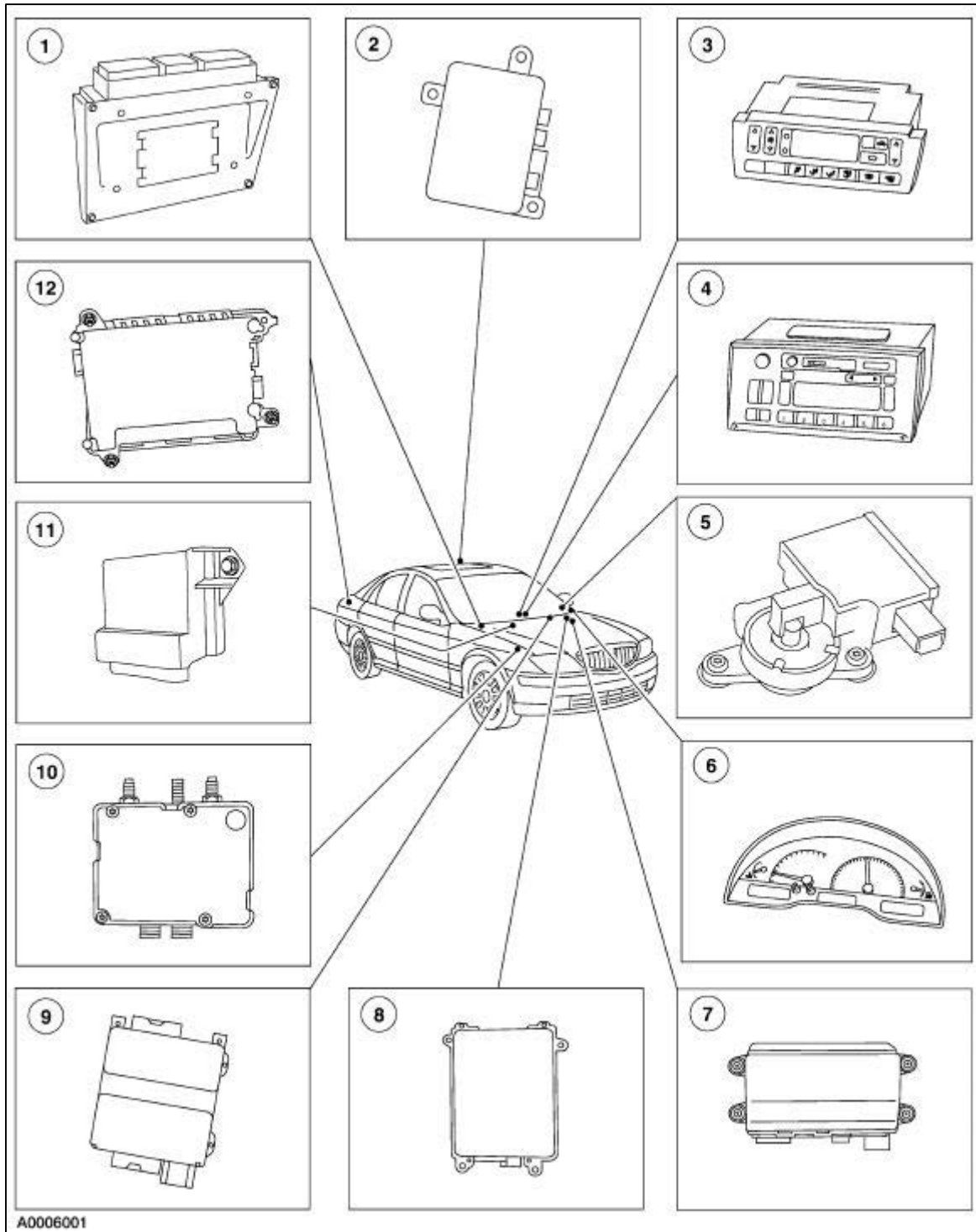
General Specifications

Item	Specification
Heat shrink tube overlap mm (inch)	12.7 (0.5)
Wire insulation removal length (twist side) mm (inch)	37.2 (1.5)
Wire insulation removal length (receiving side) mm (inch)	19.5 (0.75)
Raychem SCT® heat shrink tubing, Motorcraft part number WT-5627	ESB-M99056-AZ

Torque Specifications

Description	Nm	lb-in
Battery ground cable	10	89

Communications Network



A0006001



Item	Part Number	Description
1	12A650	Powertrain control module (PCM)
2	—	Remote emergency satellite cellular unit (RESCU) module

3	18C612	Dual automatic temperature control (DATC) module
4	—	Audio control module (ACM)
5	—	Steering column lock module (SCLM)
6	—	Instrument cluster
7	—	Driver door module (DDM)
8	13B525	Front electronic module (FEM)
9	—	Driver seat module (DSM)
10	—	Anti-lock brake system (ABS)/traction control (TC) module/stability assist module
11	—	Restraint control module (RCM)
12	13B520	Rear electronic module (REM)

Communications Network

Refer to Wiring Diagrams Section [418-00](#), Multiplex Communication Network for schematic and connector information.

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool

Principles of Operation

The vehicle has two module communication networks. The standard corporate protocol (SCP), which is an unshielded twisted pair cable: data bus plus and data bus minus, and the International Standards Organization (ISO) 9141 communications network, which is a single wire network. Both networks can be connected to the diagnostic tool by one connector called the data link connector (DLC). This makes troubleshooting these systems easier by allowing one smart tester to be able to diagnose and control any module on the two networks from one connector. The DLC can be found under the instrument panel, between the steering column and the radio.

The ISO 9141 communication network does not permit inter-module communication. When the diagnostic tool communicates to modules on the ISO 9141 communication network, the diagnostic tool must ask for all information; the modules cannot initiate communications.

The SCP communication network will remain operational even with the severing of one of the bus wires. Communications will also continue if one of the bus wires is shorted to ground or voltage, or if some, but not all, termination resistors are lost.

Unlike the SCP communication network, the ISO 9141 communication network will not function if the wire is shorted to ground or voltage. Also, if one of the modules on the ISO 9141 communication network loses power or shorts internally, communications to that module will fail.

The anti-lock brake control module is connected to the SCP communication network. The module comes in three types. The first type is the standard equipped anti-lock brake system (ABS). It controls the brake pressure to the four wheels to keep the vehicle under control while braking. For additional information, refer to [Section 206-09A](#). The second type of ABS, if fitted, adds traction control to the anti-lock brake control module. For additional information, refer to [Section 206-09B](#). The third type of ABS, if fitted, is called the stability assist module. This module adds yaw rate sensors, lateral accelerometer, and a steering angle rate sensor to the package to help in sensing a loss of vehicle control. For additional information, refer to [Section 206-09C](#). All three types use the SCP communication network for diagnosis and communication between other SCP networked modules.

The audio control module (ACM) is connected to the SCP communication network and also to the audio control protocol (ACP) communication network. The ACM communicates with the compact disc player/changer and the cellular phone transceiver. For additional information on the compact disc player/changer, refer to [Section 415-00](#). For additional information on the cellular phone, refer to [Section 419-08](#).

The driver door module (DDM) is connected to the SCP communication network. The module controls many functions including power windows, power locks, and remote keyless entry. The DDM also communicates with the driver seat module (DSM) to control power seat and mirror memory. For additional information, refer to [Section 501-14B](#).

The DSM is connected to the SCP communication network. The DSM controls the driver power seat. The module also communicates with the DDM to control the driver seat memory functions. For additional information, refer to [Section 501-10](#).

The dual automatic temperature control (DATC) module is connected to the SCP communication network. The DATC module controls automatic climate functions that maintain the vehicle at a constant temperature setting. For additional information, refer to [Section 412-00](#).

The instrument cluster (also known as an instrument cluster module [ICM]) is connected to the SCP communication network. The instrument cluster displays information received on the SCP including speedometer, odometer, fuel, and message center warnings. The instrument cluster also controls the passive anti-theft system (PATS). For additional information, refer to [Section 413-00](#) for instrument cluster operation and [Section 419-01B](#) for PATS.

The front electronic module (FEM) and rear electronic module (REM) are connected to the SCP communication network. The FEM and REM controls both interior and exterior lighting and active anti-theft functions. For additional information on interior lamps, refer to [Section 417-02](#). For additional information on exterior lighting, refer to [Section 417-01](#). For additional information on active anti-theft, refer to [Section 419-01A](#).

The powertrain control module (PCM) is connected to the SCP communication network. The PCM controls the engine performance, electronic ignition, emission controls, speed control, and on board diagnostics. For additional information, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

The remote emergency satellite cellular unit (RESCU) module is connected to the SCP communication network. The module allows a user to request emergency assistance (police, ambulance, fire, wrecker) or directions to a desired location at the touch of a button. Also, if any of the vehicle's airbags are deployed while the RESCU System is powered ON, the system automatically issues a call for emergency assistance. For additional information, refer to [Section 419-05](#).

The steering column lock module (SCLM) is connected to the SCP communication network. The module controls locking of the steering column and is only equipped on vehicles with manual transmissions. For additional information, refer to [Section 211-05](#).

The restraint control module (RCM) is connected to the ISO 9141 communication network. The RCM controls the deployment of the air bags and safety belt pretensioners based on sensor input. For additional information, refer to [Section 501-20B](#).

Inspection and Verification

1. Verify the customer concern by operating the system in question.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
<ul style="list-style-type: none"> ● Central junction box (CJB) Fuses 206 (10A) and 232 (20A) ● Wiring harness ● Loose or corroded connections

3. If the concern remains after the inspection, connect diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from diagnostic tool menu. If diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check that the correct version of the program card is installed.
 - check the connections to the vehicle.
 - check the ignition switch position.

If the diagnostic tool still does not communicate with the vehicle, go to Pinpoint Test O.

4. Go to Pinpoint Test PC.

System Precheck

PINPOINT TEST PC: DATA LINK DIAGNOSTICS NETWORK TEST

CONDITIONS	DETAILS/RESULTS/ACTIONS
PC1 DATA LINK DIAGNOSTICS NETWORK TEST	
	<p>1 Run the DATA LINK DIAGNOSTICS network test.</p> <ul style="list-style-type: none"> ● Is SYSTEM PASSED obtained? <p>→ Yes Test PASSED. RETURN to the Symptom Chart of the section for the module in question.</p> <p>→ No If CKT70 = ALL ECUS NO RESP / NOT EQUIP, GO to <u>Pinpoint Test C</u> .</p> <p>If CKT914 = ALL ECUS NO RESP / NOT EQUIP, GO to <u>Pinpoint Test N</u> .</p> <p>If CKT915 = ALL ECUS NO RESP/NOT EQUIP, GO to <u>Pinpoint Test N</u> .</p> <p>If no response from the diagnostic tool, GO to <u>Pinpoint Test O</u> .</p> <p>If CKT70, CKT914, or CKT915 = SOME ECUS NO RESP/NOT EQUIP, REFER to Symptom Chart.</p> <p>If the module in question is NO RESPONSE ON CKT914 (BUS+), REFER to Symptom Chart.</p> <p>If the module in question is NO RESPONSE ON CKT915 (BUS-), REFER to</p>

Symptom Chart.

If the module in question is NO RESPONSE/NOT EQUIPPED, REFER to Symptom Chart.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> The anti-lock brake control module does not respond to the diagnostic tool 	<ul style="list-style-type: none"> Wire or connection in standard corporate protocol (SCP) network. Anti-lock brake control module. Anti-lock brake control module with traction control (if fitted). Stability assist module (if fitted). 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> The front electronic module (FEM) does not respond to the diagnostic tool 	<ul style="list-style-type: none"> Wire or connection in SCP network. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
<ul style="list-style-type: none"> The restraint control module (RCM) does not respond to the diagnostic tool 	<ul style="list-style-type: none"> Wire or connection in International Standards Organization (ISO) 9141 network. RCM. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> The instrument cluster module does not respond to the diagnostic tool 	<ul style="list-style-type: none"> Wire or connection in SCP network. Instrument cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test D.
<ul style="list-style-type: none"> The powertrain control module (PCM) does not respond to the diagnostic tool 	<ul style="list-style-type: none"> Wire or connection in SCP network. PCM. 	<ul style="list-style-type: none"> GO to Pinpoint Test E.
<ul style="list-style-type: none"> The dual automatic temperature control (DATC) module does not respond to the diagnostic tool 	<ul style="list-style-type: none"> Wire or connection in SCP network. DATC module. 	<ul style="list-style-type: none"> GO to Pinpoint Test F.
<ul style="list-style-type: none"> The audio control module (ACM) does not respond to the diagnostic tool 	<ul style="list-style-type: none"> Wire or connection in SCP network. ACM. 	<ul style="list-style-type: none"> GO to Pinpoint Test G.
<ul style="list-style-type: none"> The steering column lock module (SCLM) does not respond to the diagnostic tool 	<ul style="list-style-type: none"> Wire or connection in SCP network. SCLM. 	<ul style="list-style-type: none"> GO to Pinpoint Test H.
<ul style="list-style-type: none"> The remote emergency satellite cellular unit (RESCU) module (optional) does not respond to the diagnostic tool 	<ul style="list-style-type: none"> Wire or connection in SCP network. RESCU module. 	<ul style="list-style-type: none"> GO to Pinpoint Test I.
<ul style="list-style-type: none"> The driver seat module (DSM) does not respond to the diagnostic tool 	<ul style="list-style-type: none"> Wire or connection in SCP network. DSM (if fitted). 	<ul style="list-style-type: none"> GO to Pinpoint Test J.
<ul style="list-style-type: none"> The driver door module (DDM) does not respond to the diagnostic tool 	<ul style="list-style-type: none"> Wire or connection in SCP network. DDM. 	<ul style="list-style-type: none"> GO to Pinpoint Test K.
<ul style="list-style-type: none"> The rear electronic module (REM) does not respond to the 	<ul style="list-style-type: none"> Wire or connection in SCP network. 	<ul style="list-style-type: none"> GO to Pinpoint


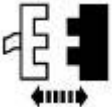

diagnostic tool	<ul style="list-style-type: none"> ● REM. 	<u>Test L.</u>
<ul style="list-style-type: none"> ● No ISO 9141 network communication 	<ul style="list-style-type: none"> ● Wire or connection in ISO 9141 network. ● RCM. ● Anti-lock brake control module. ● Anti-lock brake control module with traction control (if fitted). ● Stability assist module (if fitted). 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test M.</u>
<ul style="list-style-type: none"> ● No SCP network communication 	<ul style="list-style-type: none"> ● Wire or connection in SCP network. ● SCP networked modules. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test N.</u>
<ul style="list-style-type: none"> ● No module/network communication — no power to the diagnostic tool 	<ul style="list-style-type: none"> ● CJB Fuses: 206 (10A) and 232 (20A). ● DLC pins. ● Diagnostic Tool. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test O.</u>

Pinpoint Tests



CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

PINPOINT TEST A: THE ANTI-LOCK BRAKE CONTROL MODULE DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK ANTI-LOCK BRAKE CONTROL MODULE FOR DAMAGE	
<p>1</p> 	
<p>2</p> 	<p>2</p> <p>Disconnect the anti-lock brake control module with or without traction control C135 or the stability assist module C155.</p>
<p>4</p> 	<p>3</p> <p>Inspect anti-lock brake control module C135 or stability assist module C155 for damage; repair as necessary.</p>
<p>5</p>	<p>4</p> <p>Reconnect the anti-lock brake control module with or without traction control C135 or the stability assist module C155.</p>



Diagnostic Tool

6



7



DATA LINK DIAGNOSTICS

- Was the result received ABS: NO RESPONSE ON CKT914 (BUS+)?

→ **Yes**
GO to A2.

→ **No**
GO to A7.

A2 CHECK FOR OPEN BETWEEN DLC C251 AND ANTI-LOCK BRAKE CONTROL MODULE C135 OR C155 — SCP (+)

1

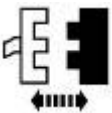


2

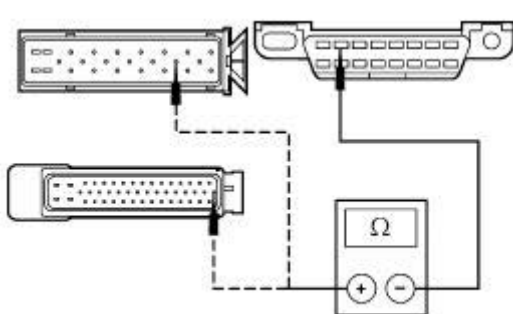


Diagnostic Tool

3



4



A0004353

- 3 Disconnect the anti-lock brake control module with or without traction control C135 or the stability assist module C155.

- 4 Measure the resistance between anti-lock brake control module C135 pin 11 or stability assist module C155 pin 17, circuit 4-CF6 (GY), harness side and DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new anti-lock brake control module or stability assist module. REFER to [Section 206-09A](#) , [Section 206-09B](#) , or [Section 206-09C](#) .

→ **No**
GO to [A3](#) .

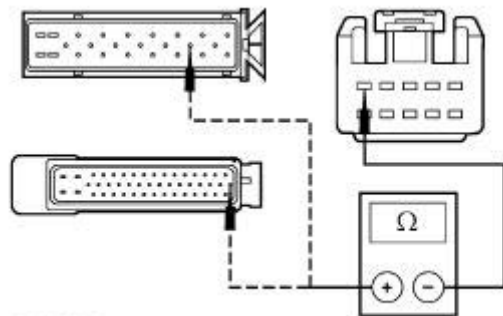
A3 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND ANTI-LOCK BRAKE CONTROL MODULE C135 OR C155 — SCP (+)

1



Interior AJB C283c

2



A0004354

2 Measure the resistance between anti-lock brake control module C135 pin 11 or stability assist module C155 pin 17, circuit 4-CF6 (GY), harness side and interior AJB C283c pin 5, circuit 4-CF6 (GY), harness side.

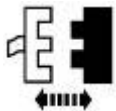
● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to [A4](#) .

→ **No**
REPAIR circuit 4-CF6 (GY). For additional information, REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

A4 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND INTERIOR AJB C283d — SCP (+)

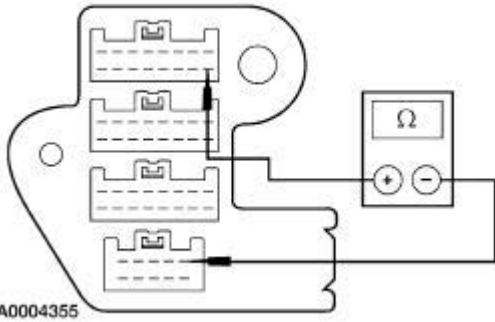
1



Interior AJB C283d

2

2 Measure the resistance between interior AJB C283d pin 16 and interior AJB C283c pin 5, component side.



● Is the resistance less than 5 ohms?

→ **Yes**
GO to A5.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

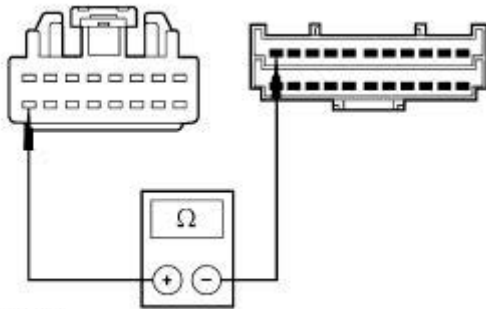
A5 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (+)

1



Joint Connector #4 C223

2



2

Measure the resistance between interior AJB C283d pin 16, circuit 4-EG1 (GY), harness side and joint connector #4 C223 pin 12, circuit 4-EG1 (GY), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to A6.

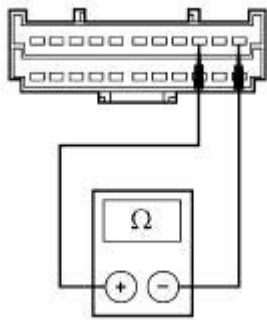
→ **No**
REPAIR circuit 4-EG1 (GY). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

A6 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (+)

1

1

Measure the resistance between joint connector #4 C223 pin 12 and pin 14, component side.



A0004357

- Is the resistance less than 5 ohms?

→ **Yes**
 REPAIR circuit 4-EG7 (GY/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**
 REPAIR joint connector #4 C223. TEST the system for normal operation.

A7 CHECK FOR OPEN BETWEEN DLC C251 AND ANTI-LOCK BRAKE CONTROL MODULE C135 OR C155 — SCP (-)

1

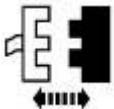


2

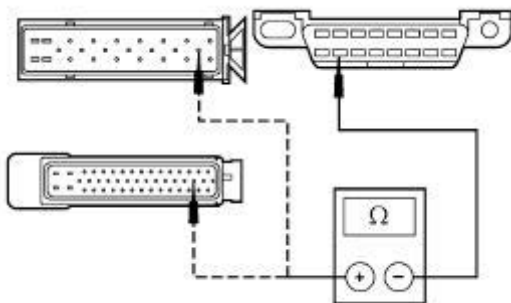


Diagnostic Tool

3



4



A0004358

- 3 Disconnect the anti-lock brake control module with or without traction control C135 or the stability assist module C155.
- 4 Measure the resistance between anti-lock brake control module C135 pin 10 or stability assist module C155 pin 19, circuit 5-CF6 (BU), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new anti-lock brake control module or stability assist module. REFER to [Section 206-09A](#) , [Section 206-09B](#) , or [Section 206-09C](#) .

→ **No**
GO to [A8](#) .

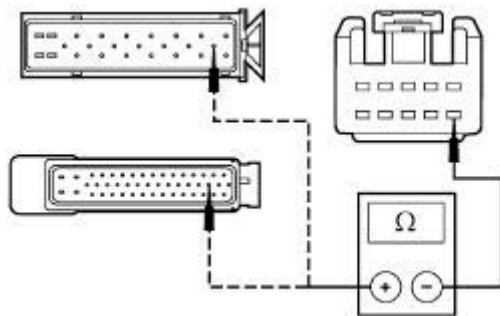
A8 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND ANTI-LOCK BRAKE CONTROL MODULE C135 OR C155 — SCP (-)

1



Interior AJB C283c

2



A0004359

2 Measure the resistance between anti-lock brake control module C135 pin 10 or stability assist module C155 pin 19, circuit 5-CF6 (BU), harness side and interior AJB C283c pin 6, circuit 5-CF6 (BU), harness side.

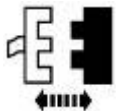
● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to [A9](#) .

→ **No**
REPAIR circuit 5-CF6 (BU). REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

A9 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND INTERIOR AJB C283d — SCP (-)

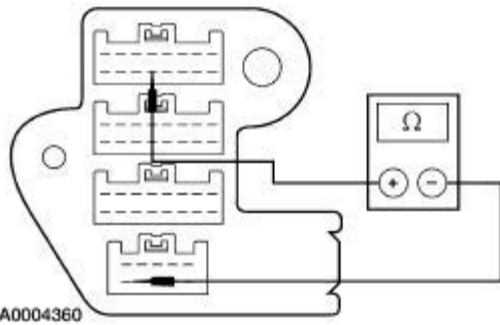
1



Interior AJB C283d

2

2 Measure the resistance between interior AJB C283d pin 12 and interior AJB C283c pin 6, component side.



● Is the resistance less than 5 ohms?

→ **Yes**
GO to A10.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

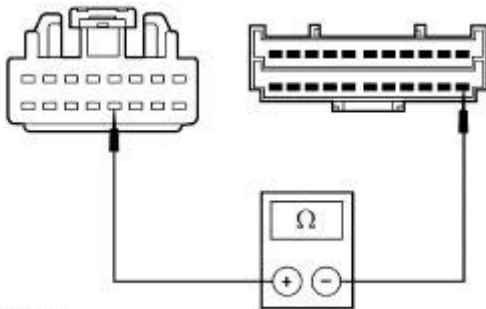
A10 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (-)

1



Joint Connector #4 C223

2



2

Measure the resistance between interior AJB C283d pin 12, circuit 5-EG1 (BU), harness side and joint connector #4 C223 pin 11, circuit 5-EG1 (BU), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to A11.

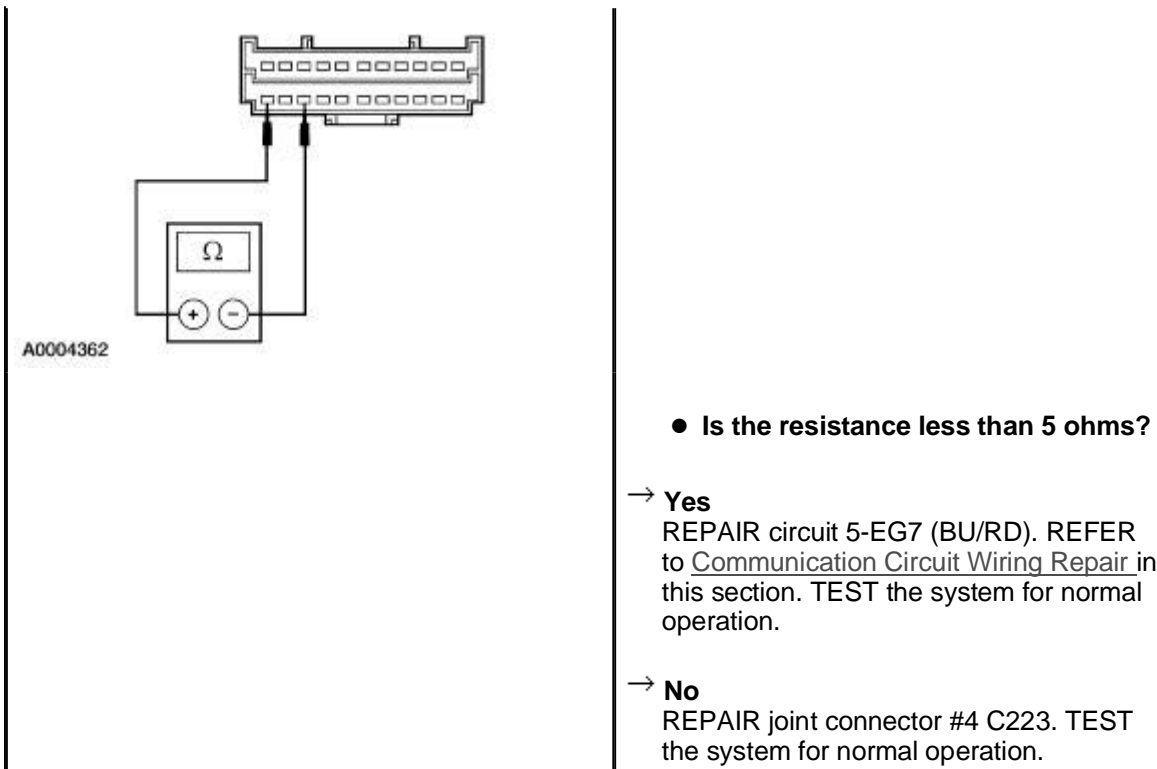
→ **No**
REPAIR circuit 5-EG1 (BU). For additional information, REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

A11 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (-)





1

1

Measure the resistance between joint connector #4 C223 pin 9 and pin 11, component side.



PINPOINT TEST B: THE FRONT ELECTRONIC MODULE (FEM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK FEM C201c FOR DAMAGE	
<p>1 </p> <p>2  FEM C201c</p> <p>4  FEM C201c</p> <p>5  Diagnostic Tool</p>	<p>3 Inspect FEM C201c for damage; repair as necessary.</p>

6



7



DATA LINK DIAGNOSTICS

- Was the result received GEM: NO RESPONSE ON CKT914 (BUS+)?

→ Yes
GO to B2.

→ No
GO to B7.

B2 CHECK FOR OPEN BETWEEN DLC C251 AND FEM C201c — SCP (+)

1

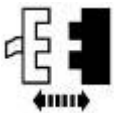


2



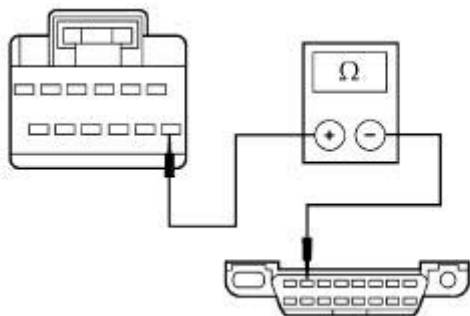
Diagnostic Tool

3



FEM C201c

4



A0004363

- 4 Measure the resistance between FEM C201c pin 7, circuit 4-EG11 (GY), harness side and DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

- Is the resistance less than 5 ohms?

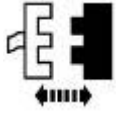
→ Yes
INSTALL a new FEM. REFER to Section 419-10. TEST the system for normal

operation.

→ **No**
GO to B3.

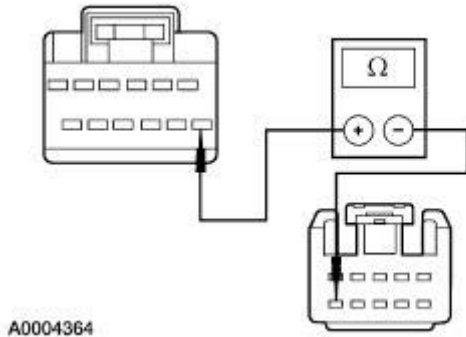
B3 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND FEM C201c — SCP (+)

1



Interior AJB C283c

2



2

Measure the resistance between FEM C201c pin 7, circuit 4-EG11 (GY), harness side and interior AJB C283c pin 10, circuit 4-EG11 (GY), harness side.

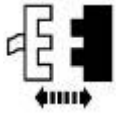
● Is the resistance less than 5 ohms?

→ **Yes**
GO to B4.

→ **No**
REPAIR circuit 4-EG11 (GY). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

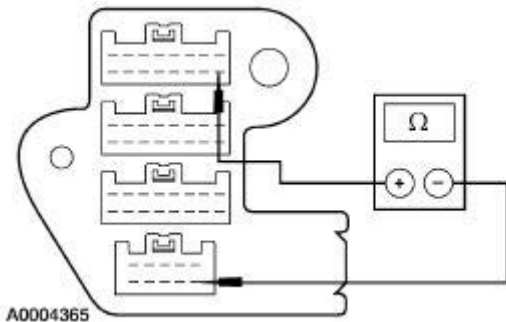
B4 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND INTERIOR AJB C283d — SCP (+)

1



Interior AJB C283d

2



2

Measure the resistance between interior AJB C283d pin 16 and interior AJB C283c pin 10, component side.

● Is the resistance less than 5 ohms?

- **Yes**
GO to B5.
- **No**
INSTALL a new AJB. TEST the system for normal operation.

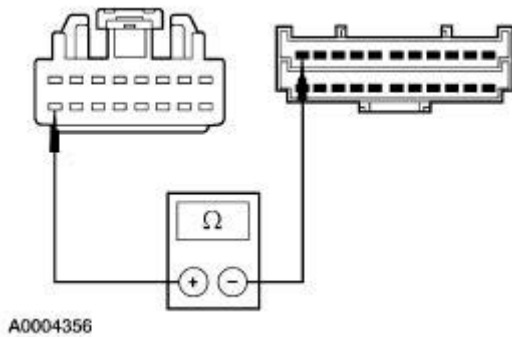
B5 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (+)

1



Joint Connector #4 C223

2



2

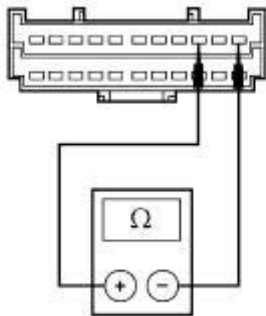
Measure the resistance between interior AJB C283d pin 16, circuit 4-EG1 (GY), harness side and joint connector #4 C223 pin 12, circuit 4-EG1 (GY), harness side.

- Is the resistance less than 5 ohms?

- **Yes**
GO to B6.
- **No**
REPAIR circuit 4-EG1 (GY). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

B6 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (+)

1



A0004357

1

Measure the resistance between joint connector #4 C223 pin 12 and pin 14, component side.

- Is the resistance less than 5 ohms?

- **Yes**

REPAIR circuit 4-EG7 (GY/RD). REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

B7 CHECK FOR OPEN BETWEEN DLC C251 AND FEM C201c — SCP (-)

1



2



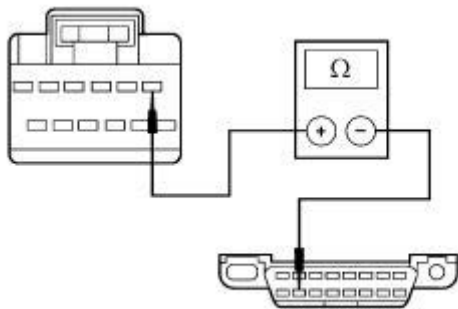
Diagnostic Tool

3



FEM C201c

4



A0004366

4 Measure the resistance between FEM C201c pin 1, circuit 5-EG11 (BU), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.

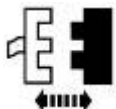
● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
GO to [B8](#).

B8 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND FEM C201c — SCP (-)

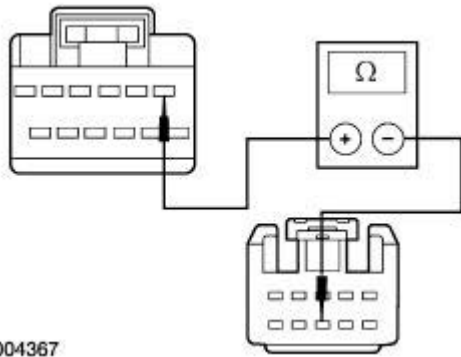
1



Interior AJB C283c

2

2 Measure the resistance between FEM



A0004367

C201c pin 1, circuit 5-EG11 (BU), harness side and interior AJB C283c pin 8, circuit 5-EG11 (BU), harness side.

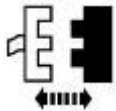
● Is the resistance less than 5 ohms?

→ **Yes**
GO to B9.

→ **No**
REPAIR circuit 5-EG11 (BU). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

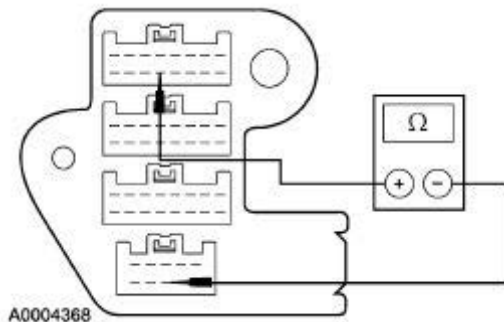
B9 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND INTERIOR AJB C283d — SCP (-)

1



Interior AJB C283d

2



A0004368

2 Measure the resistance between interior AJB C283d pin 12 and interior AJB C283c pin 8, component side.

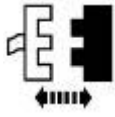
● Is the resistance less than 5 ohms?

→ **Yes**
GO to B10.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

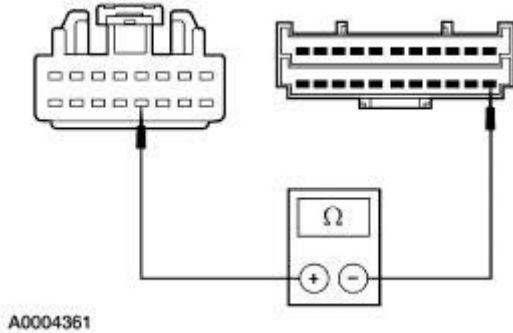
B10 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (-)

1



Joint Connector #4 C223

2



2

Measure the resistance between interior AJB C283d pin 12, circuit 5-EG1 (BU), harness side and joint connector #4 C223 pin 11, circuit 5-EG1 (BU), harness side.

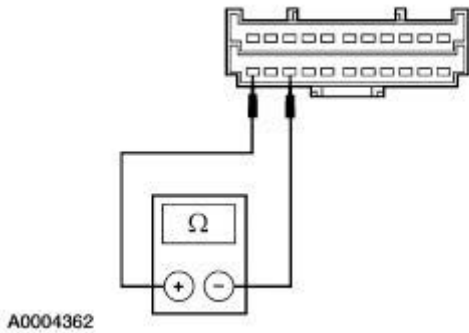
● Is the resistance less than 5 ohms?

→ **Yes**
GO to B11.

→ **No**
REPAIR circuit 5-EG1 (BU). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

B11 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (-)

1



1

Measure the resistance between joint connector #4 C223 pin 9 and pin 11, component side.


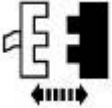
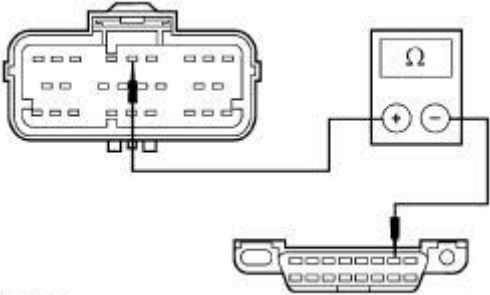
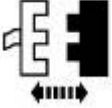
● Is the resistance less than 5 ohms?

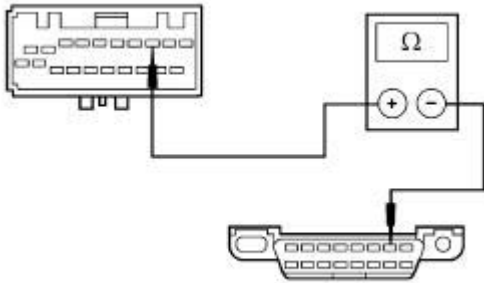
→ **Yes**
REPAIR circuit 5-EG7 (BU/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

PINPOINT TEST C: THE RESTRAINT CONTROL MODULE (RCM)

DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>C1 CHECK FOR AN OPEN CIRCUIT BETWEEN RCM C310a AND DLC C251</p> <p>1</p>  <p>4</p>  <p>RCM C310a</p> <p>6</p>  <p>A0004369</p>	<p>2 Inspect the DLC C251 and diagnostic tool terminal for damage; repair as necessary.</p> <p>3 Deactivate the air bag system. Refer to Section 501-20B.</p> <p>5 Inspect RCM C310a for damage, repair as necessary.</p> <p>6 Measure the resistance between DLC C251 pin 7, circuit 4-EE10 (GY/BK), harness side and RCM C310a pin 5, circuit 4-EE1 (GY), harness side.</p> <p>● Is the resistance less than 5 ohms?</p> <p>→ Yes GO to Pinpoint Test M.</p> <p>→ No GO to C2.</p>
<p>C2 CHECK FOR AN OPEN CIRCUIT BETWEEN DLC C251 AND IN-LINE C212M</p> <p>1</p>  <p>In-Line C212</p> <p>2</p>	<p>2 Measure the resistance between DLC C251 pin 7, circuit 4-EE10 (GY/BK), harness side and in-line C212m pin 8, circuit 4-EE10 (GY/BK), harness side.</p>



A0004370

● Is the resistance less than 5 ohms?


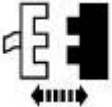


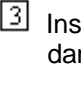
→ **Yes**

REPAIR circuit 4-EE1 (GY) and circuit 4-EE10 (GY/BK) between the RCM C310a and in-line C212F. TEST the system for normal operation.

→ **No**

REPAIR circuit 4-EE10 (GY/BK) between the DLC C251 and in-line C212m. TEST the system for normal operation.

PINPOINT TEST D: THE INSTRUMENT CLUSTER MODULE DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK INSTRUMENT CLUSTER C220b FOR DAMAGE	
<p>1 </p> <p>2  Instrument Cluster C220b</p> <p>4  Instrument Cluster C220b</p> <p>5  Diagnostic Tool</p>	<p>3  Inspect instrument cluster C220b for damage; repair as necessary.</p>

6



7



DATA LINK DIAGNOSTICS

- Was the result received ICM: NO RESPONSE ON CKT914 (BUS+)?

→ Yes
GO to D2.

→ No
GO to D5.

D2 CHECK FOR OPEN BETWEEN DLC C251 AND INSTRUMENT CLUSTER C220b — SCP (+)

1

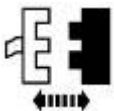


2



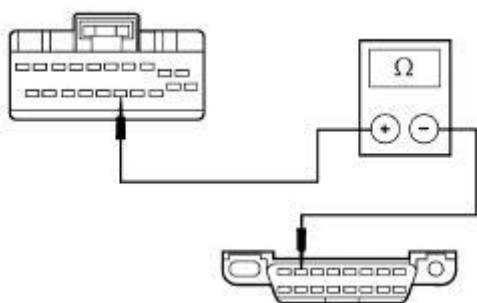
Diagnostic Tool

3



Instrument Cluster C220b

4



A0004371

- 4 Measure the resistance between instrument cluster C220b pin 15, circuit 4-EG8 (GY/VT), harness side and DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

- Is the resistance less than 5 ohms?

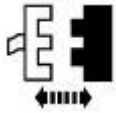
→ Yes
INSTALL a new instrument cluster.
REFER to Section 413-01 . TEST the

system for normal operation.

→ **No**
GO to D3.

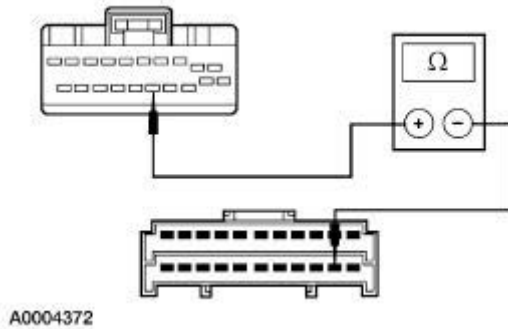
D3 CHECK FOR OPEN BETWEEN INSTRUMENT CLUSTER C220b AND JOINT CONNECTOR #4 C223 — SCP (+)

1



Joint Connector #4 C223

2



2

Measure the resistance between instrument cluster C220b pin 15, circuit 4-EG8 (GY/VT), harness side and joint connector #4 C223 pin 13, circuit 4-EG8 (GY/VT), harness side.

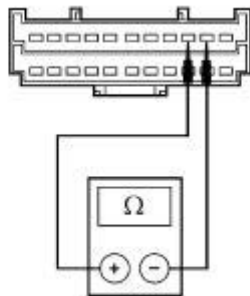
● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to D4.

→ **No**
REPAIR circuit 4-EG8 (GY/VT). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

D4 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (+)

1



A0004373

1

Measure the resistance between joint connector #4 C223 pin 13 and pin 14, component side.

● **Is the resistance less than 5 ohms?**

→ **Yes**
REPAIR circuit 4-EG7 (GY/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

D5 CHECK FOR OPEN BETWEEN DLC C251 AND INSTRUMENT CLUSTER C220b — SCP (-)

1

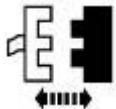


2



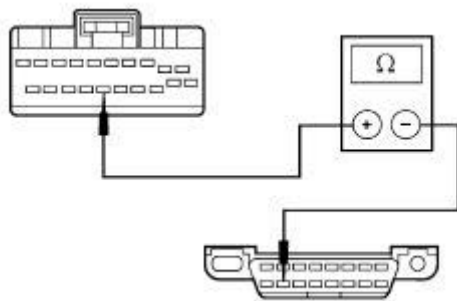
Diagnostic Tool

3



Instrument Cluster C220b

4



A0004374

4

Measure the resistance between instrument cluster C220b pin 16, circuit 5-EG8 (BU/WH), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.

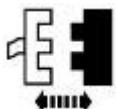
● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new instrument cluster. REFER to Section 413-01. TEST the system for normal operation.

→ **No**
GO to D6.

D6 CHECK FOR OPEN BETWEEN INSTRUMENT CLUSTER C220b AND JOINT CONNECTOR #4 C223 — SCP (-)

1

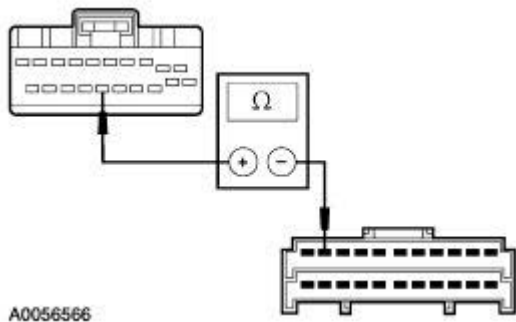


Joint Connector #4 C223

2

2

Measure the resistance between instrument cluster C220b pin 16, circuit 5-EG8 (BU/WH), harness side and joint



A0056566

connector #4 C223 pin 10, circuit 5-EG8 (BU), harness side.

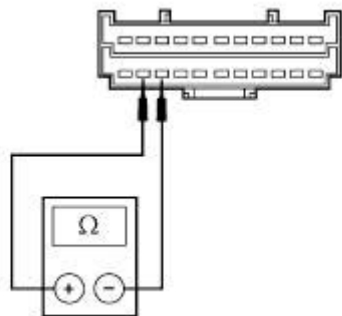
- Is the resistance less than 5 ohms?

→ **Yes**
GO to D7.

→ **No**
REPAIR circuit 5-EG8 (BU/WH). REFER to Communication Circuit Wiring Repair. TEST the system for normal operation.

D7 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (-)

1



A0004376

1

Measure the resistance between joint connector #4 C223 pin 9 and pin 10, component side.

- Is the resistance less than 5 ohms?

→ **Yes**
REPAIR circuit 5-EG7 (BU/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

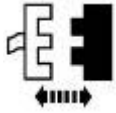
→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

PINPOINT TEST E: THE POWERTRAIN CONTROL MODULE (PCM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK PCM C175a FOR DAMAGE	
1	



2



PCM C175a

4



PCM C175a

5



Diagnostic Tool

6



7



DATA LINK DIAGNOSTICS

3 Inspect PCM C175a for damage; repair as necessary.

• Was the result received PCM: NO RESPONSE ON CKT914 (BUS+)?

→ Yes
GO to E2.

→ No
GO to E7.

E2 CHECK FOR OPEN BETWEEN DLC C251 AND PCM C175a — SCP (+)

1

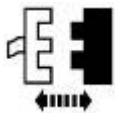


2



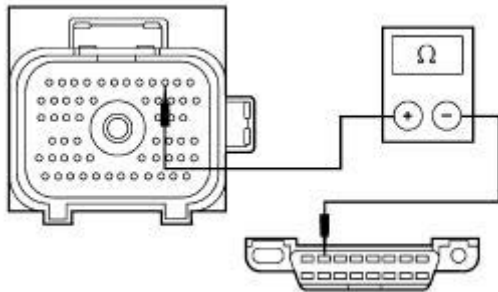
Diagnostic Tool

3



PCM C175a

4



A0004377

4

Measure the resistance between PCM C175a pin 3, circuit 4-RE8 (GY), harness side and DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

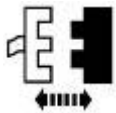
● Is the resistance less than 5 ohms?

→ **Yes**
REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

→ **No**
GO to E3.

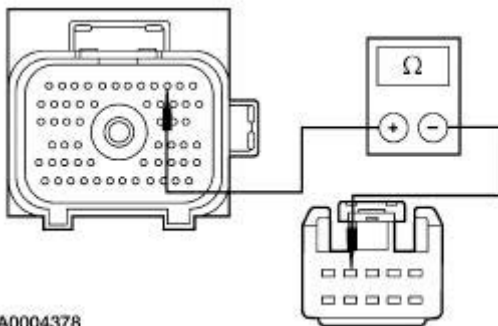
E3 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND PCM C175a — SCP (+)

1



Interior AJB C283c

2



A0004378

2

Measure the resistance between PCM C175a pin 3, circuit 4-RE8 (GY), harness side and interior AJB C283c pin 4, circuit 4-RE8 (GY), harness side.

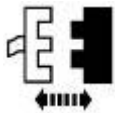
● Is the resistance less than 5 ohms?

→ **Yes**
GO to E4.

→ **No**
REPAIR circuit 4-RE8 (GY). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

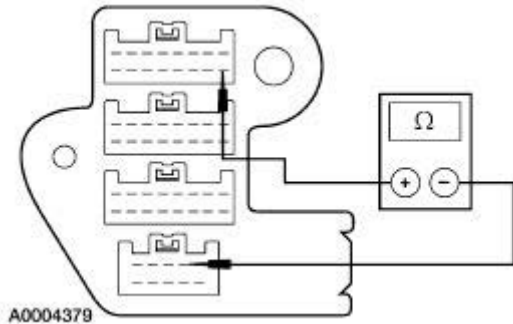
E4 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND INTERIOR AJB C283d — SCP (+)

1



Interior AJB C283d

2



2

Measure the resistance between interior AJB C283d pin 16 and interior AJB C283c pin 4, component side.

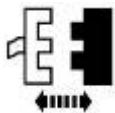
● Is the resistance less than 5 ohms?

→ **Yes**
GO to E5.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

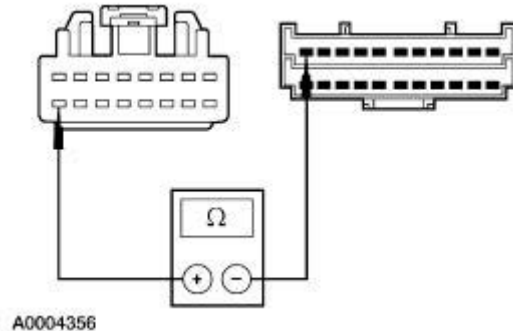
E5 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (+)

1



Joint Connector #4 C223

2



2

Measure the resistance between interior AJB C283d pin 16, circuit 4-EG1 (GY), harness side and joint connector #4 C223 pin 12, circuit 4-EG1 (GY), harness side.

● Is the resistance less than 5 ohms?

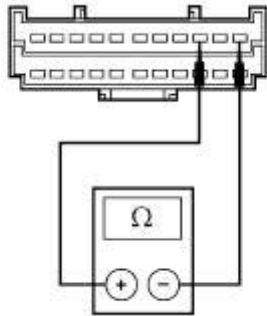
→ **Yes**
GO to E6.

→ **No**

REPAIR circuit 4-EG1 (GY). REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

E6 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (+)

1



A0004357

1

Measure the resistance between joint connector #4 C223 pin 12 and pin 14, component side.

● Is the resistance less than 5 ohms?

→ **Yes**

REPAIR circuit 4-EG7 (GY/RD). REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

→ **No**

REPAIR joint connector #4 C223. TEST the system for normal operation.

E7 CHECK FOR OPEN BETWEEN DLC C251 AND PCM C175a — SCP (-)

1



2



Diagnostic Tool

3

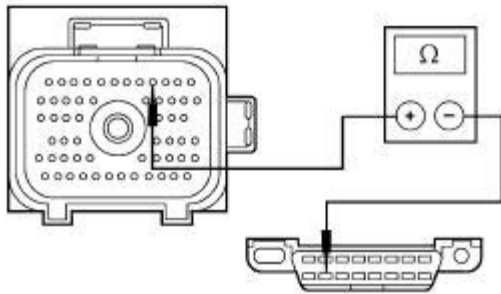


PCM C175a

4

4

Measure the resistance between PCM C175a pin 4, circuit 5-RE8 (BU), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.



A0004380

● Is the resistance less than 5 ohms?

→ **Yes**
REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

→ **No**
GO to E8.

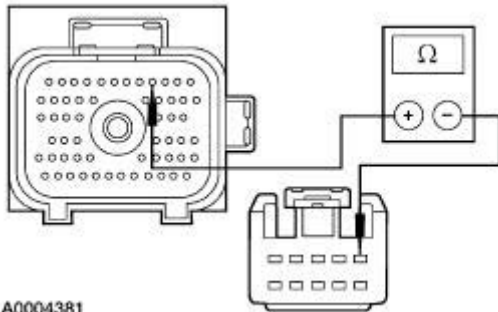
E8 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND PCM C175a — SCP (-)

1



Interior AJB C283c

2



A0004381

2 Measure the resistance between PCM C175a pin 4, circuit 5-RE8 (BU), harness side and interior AJB C283c pin 1, circuit 5-RE8 (BU), harness side.

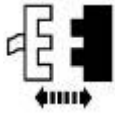
● Is the resistance less than 5 ohms?

→ **Yes**
GO to E9.

→ **No**
REPAIR circuit 5-RE8 (BU). REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

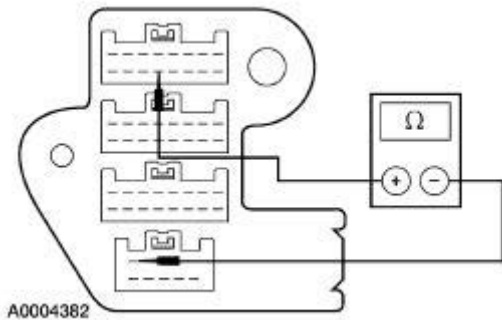
E9 CHECK FOR OPEN BETWEEN INTERIOR AJB C283c AND INTERIOR AJB C283d — SCP (-)

1



Interior AJB C283d

2



2

Measure the resistance between interior AJB C283d pin 12 and interior AJB C283c pin 1, component side.

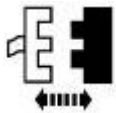
● Is the resistance less than 5 ohms?

→ **Yes**
GO to E10.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

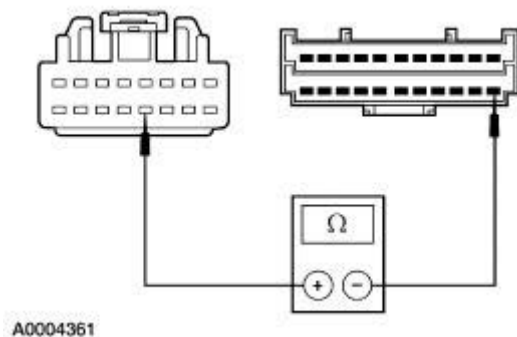
E10 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (-)

1



Joint Connector #4 C223

2



2

Measure the resistance between interior AJB C283d pin 12, circuit 5-EG1 (BU), harness side and joint connector #4 C223 pin 11, circuit 5-EG1 (BU), harness side.

● Is the resistance less than 5 ohms?

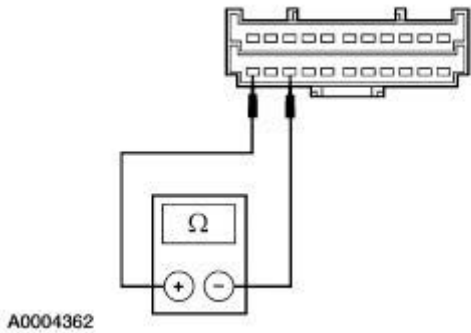
→ **Yes**
GO to E11.

→ **No**
REPAIR circuit 5-EG1 (BU). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal

operation.

E11 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (-)

1



1

Measure the resistance between joint connector #4 C223 pin 9 and pin 11, component side.

● Is the resistance less than 5 ohms?


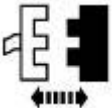

→ Yes

REPAIR circuit 5-EG7 (BU/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ No

REPAIR joint connector #4 C223. TEST the system for normal operation.

PINPOINT TEST F: THE DUAL AUTOMATIC TEMPERATURE CONTROL (DATC) MODULE DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK DATC MODULE C228 FOR DAMAGE	
<p>1</p>  <p>2</p>  <p>DATC Module C228</p> <p>4</p>  <p>DATC Module C228</p> <p>5</p>	<p>3</p> <p>Inspect DATC module C228 for damage; repair as necessary.</p>



Diagnostic Tool

6



7



DATA LINK DIAGNOSTICS

- Was the result received DATC: NO RESPONSE ON CKT914 (BUS+)?

→ Yes
GO to F2.

→ No
GO to F5.

F2 CHECK FOR OPEN BETWEEN DLC C251 AND DATC MODULE C228a — SCP (+)

1



2



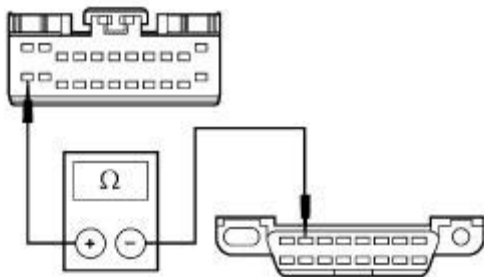
Diagnostic Tool

3



DATC Module C228a

4



A0004383

- 4 Measure the resistance between DATC module C228a pin 12, circuit 4-FA10 (GY/BK), harness side and DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new DATC module. REFER to [Section 412-00](#) . TEST the system for normal operation.

→ **No**
GO to [F3](#) .

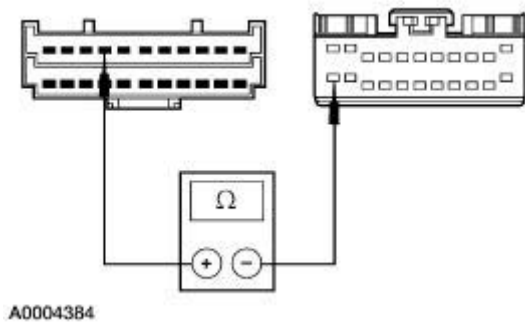
F3 CHECK FOR OPEN BETWEEN DATC MODULE C228a AND JOINT CONNECTOR #4 C223 — SCP (+)

1



Joint Connector #4 C223

2



2

Measure the resistance between DATC module C228a pin 12, circuit 4-FA10 (GY/BK), harness side and joint connector #4 C223 pin 15, circuit 4-FA10 (GY/BK), harness side.

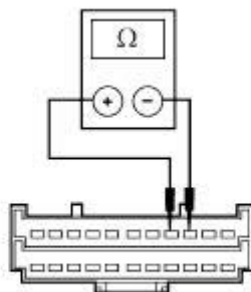
● Is the resistance less than 5 ohms?

→ **Yes**
GO to [F4](#) .

→ **No**
REPAIR circuit 4-FA10 (GY/BK). REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

F4 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (+)

1



1

Measure the resistance between joint connector #4 C223 pin 14 and pin 15, component side.

● Is the resistance less than 5 ohms?

→ **Yes**
REPAIR circuit 4-EG7 (GY/RD). REFER

to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

F5 CHECK FOR OPEN BETWEEN DLC C251 AND DATC MODULE C228a — SCP (-)

1



2



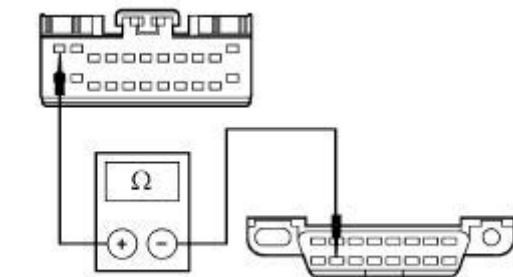
Diagnostic Tool

3



DATC Module C228a

4



A0004386

4 Measure the resistance between DATC module C228a pin 1, circuit 5-FA10 (BU/YE), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.

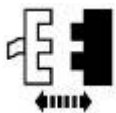
● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new DATC module. REFER to [Section 412-00](#). TEST the system for normal operation.

→ **No**
GO to [F6](#).

F6 CHECK FOR OPEN BETWEEN DATC MODULE C228a AND JOINT CONNECTOR #4 C223 — SCP (-)

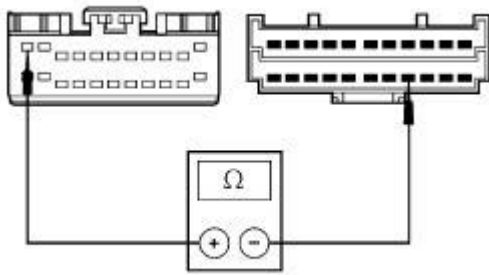
1



Joint Connector #4 C223

2

2 Measure the resistance between DATC module C228a pin 1, circuit 5-FA10



A0004387

(BU/YE), harness side and joint connector #4 C223 pin 8, circuit 5-FA10 (BU/YE), harness side.

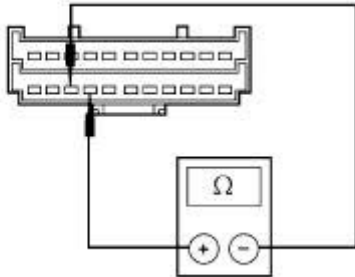
● Is the resistance less than 5 ohms?

→ **Yes**
GO to F7.

→ **No**
REPAIR circuit 5-FA10 (BU/YE). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

F7 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (-)

1



A0004388

1

Measure the resistance between joint connector #4 C223 pin 8 and pin 9, component side.

● Is the resistance less than 5 ohms?

→ **Yes**
REPAIR circuit 5-EG7 (BU/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

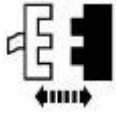
→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

PINPOINT TEST G: THE AUDIO CONTROL MODULE (ACM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK ACM C240a FOR DAMAGE	
1	



2



ACM C240a

4



ACM C240a

5



Diagnostic Tool

6



7



DATA LINK DIAGNOSTICS

3 Inspect ACM C240a for damage; repair as necessary.

• Was the result received ACM: NO RESPONSE ON CKT914 (BUS+)?

→ Yes
GO to G2.

→ No
GO to G5.

G2 CHECK FOR OPEN BETWEEN DLC C251 AND ACM C240a — SCP (+)

1

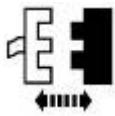


2



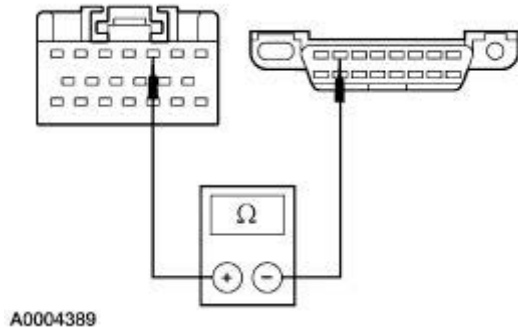
Diagnostic Tool

3



ACM C240a

4



4

Measure the resistance between ACM C240a pin 3, circuit 4-EG10 (GY/BK), harness side and DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

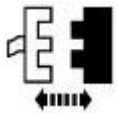
● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new ACM. REFER to [Section 415-01](#). TEST the system for normal operation.

→ **No**
GO to [G3](#).

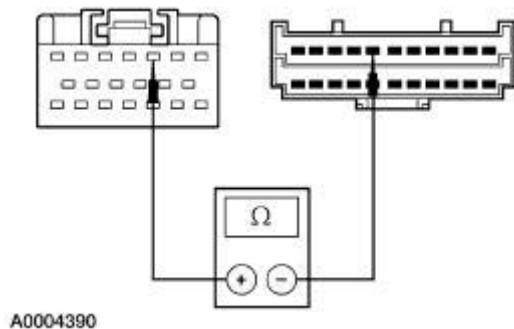
G3 CHECK FOR OPEN BETWEEN ACM C240a AND JOINT CONNECTOR #4 C223 — SCP (+)

1



Joint Connector #4 C223

2



2

Measure the resistance between ACM C240a pin 3, circuit 4-EG10 (GY/BK), harness side and joint connector #4 C223 pin 16, circuit 4-EG10 (GY/BK), harness side.

● Is the resistance less than 5 ohms?

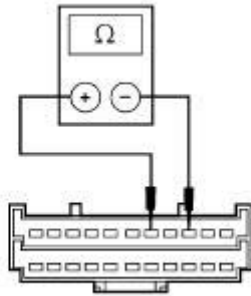
→ **Yes**
GO to [G4](#).

→ **No**
REPAIR circuit 4-EG10 (GY/BK). REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal

operation.

G4 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (+)

1



A0004391

1

Measure the resistance between joint connector #4 C223 pin 14 and pin 16, component side.

● **Is the resistance less than 5 ohms?**

→ **Yes**

REPAIR circuit 4-EG7 (GY/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**

REPAIR joint connector #4 C223. TEST the system for normal operation.

G5 CHECK FOR OPEN BETWEEN DLC C251 AND ACM C240a — SCP (-)

1



2



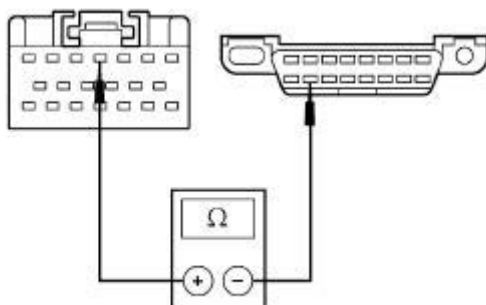
Diagnostic Tool

3



ACM C240a

4



A0004392

4

Measure the resistance between ACM C240a pin 4, circuit 5-EG10 (BU/YE), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.

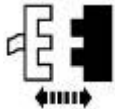
● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new ACM. REFER to [Section 415-01](#). TEST the system for normal operation.

→ **No**
GO to [G6](#).

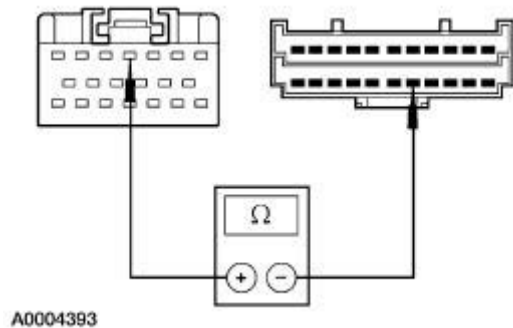
G6 CHECK FOR OPEN BETWEEN ACM C240a AND JOINT CONNECTOR #4 C223 — SCP (-)

1



Joint Connector #4 C223

2



2

Measure the resistance between ACM C240a pin 4, circuit 5-EG10 (BU/YE), harness side and joint connector #4 C223 pin 7, circuit 5-EG10 (BU/YE), harness side.

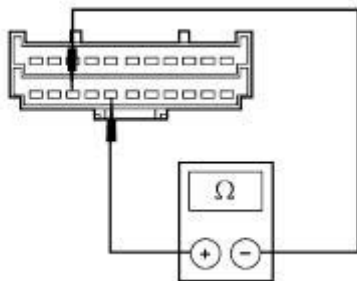
● Is the resistance less than 5 ohms?

→ **Yes**
GO to [G7](#).

→ **No**
REPAIR circuit 5-EG10 (BU/YE). REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

G7 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (-)

1



A0004394


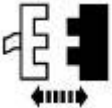




1

Measure the resistance between joint connector #4 C223 pin 7 and pin 9, component side.

● Is the resistance less than 5 ohms?

- **Yes**
REPAIR circuit 5-EG7 (BU/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.
- **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

PINPOINT TEST H: THE STEERING COLUMN LOCK MODULE (SCLM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK SCLM C267 FOR DAMAGE	
<p>1 </p> <p>2  SCLM C267</p> <p>4  SCLM C267</p> <p>5  Diagnostic Tool</p> <p>6 </p> <p>7  DATA LINK DIAGNOSTICS</p>	<p>3 Inspect SCLM C267 for damage; repair as necessary.</p> <p>● Was the result received SCLU: NO RESPONSE ON CKT914 (BUS+)?</p>

→ **Yes**
GO to H2.

→ **No**
GO to H6.

H2 CHECK FOR OPEN BETWEEN DLC C251 AND SCLM C267 — SCP (+)

1

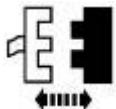


2



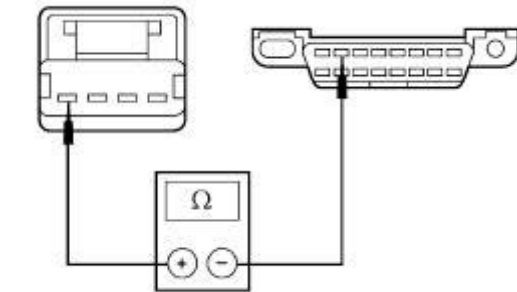
Diagnostic Tool

3



SCLM C267

4



A0004395

4 Measure the resistance between SCLM C267 pin 4, circuit 4-GL58 (GY/OG), harness side and DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

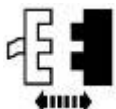
● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new SCLM. REFER to Section 211-05. TEST the system for normal operation.

→ **No**
GO to H3.

H3 CHECK FOR OPEN BETWEEN SCLM C267 AND JOINT CONNECTOR #4 C223 — SCP (+)

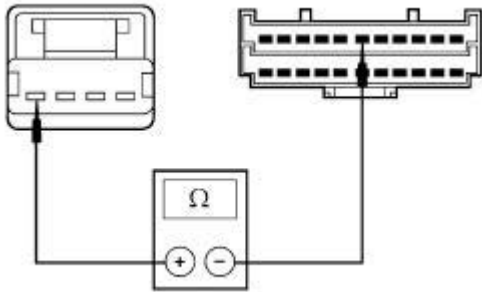
1



Joint Connector #4 C223

2

2 Measure the resistance between SCLM C267 pin 4, circuit 4-GL58 (GY/OG), harness side and joint connector #4



A0004396

C223 pin 17, circuit 4-GL58 (GY/OG), harness side.

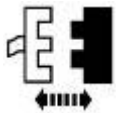
● Is the resistance less than 5 ohms?

→ **Yes**
GO to H5.

→ **No**
GO to H4.

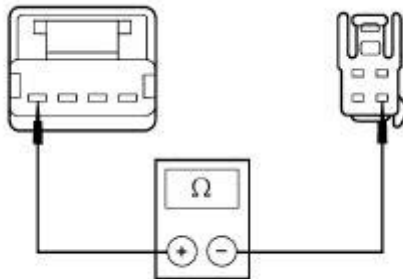
H4 CHECK FOR OPEN BETWEEN SCLM C267 AND IN-LINE C248F — SCP (+)

1



In-Line C248

2



A0004397

2

Measure the resistance between SCLM C267 pin 4, circuit 4-GL58 (GY/OG), harness side and in-line C248F pin 3, circuit 4-GL58 (GY/OG), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
REPAIR circuit 4-GL58 (GY/OG) between in-line C248M and joint connector #4 C223. REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

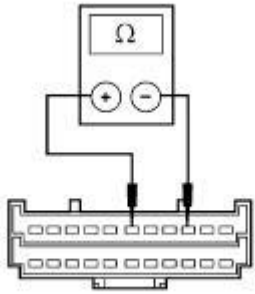
→ **No**
REPAIR circuit 4-GL58 (GY/OG) between in-line C248F and SCLU C267. REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

H5 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (+)

1

1

Measure the resistance between joint



A0004398

connector #4 C223 pin 17 and pin 14, component side.

- Is the resistance less than 5 ohms?

→ **Yes**
REPAIR circuit 4-EG7 (GY/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

H6 CHECK FOR OPEN BETWEEN DLC C251 AND SCLM C267 — SCP (-)

1

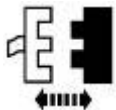


2



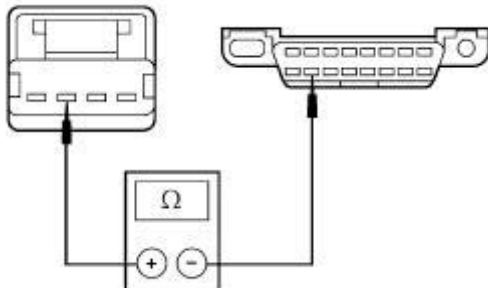
Diagnostic Tool

3



SCLM C267

4



A0004399

4 Measure the resistance between SCLM C267 pin 3, circuit 5-GL58 (BU/BK), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.

- Is the resistance less than 5 ohms?

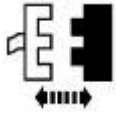
→ **Yes**

INSTALL a new SCLM. REFER to Section 211-05. TEST the system for normal operation.

→ **No**
GO to H7.

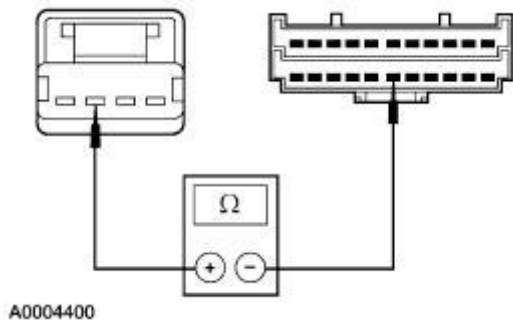
H7 CHECK FOR OPEN BETWEEN SCLM C267 AND JOINT CONNECTOR #4 C223 — SCP (-)

1



Joint Connector #4 C223

2



2

Measure the resistance between SCLM C267 pin 3, circuit 5-GL58 (BU/BK), harness side and joint connector #4 C223 pin 6, circuit 5-GL58 (BU/BK), harness side.

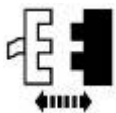
● Is the resistance less than 5 ohms?

→ **Yes**
GO to H9.

→ **No**
GO to H8.

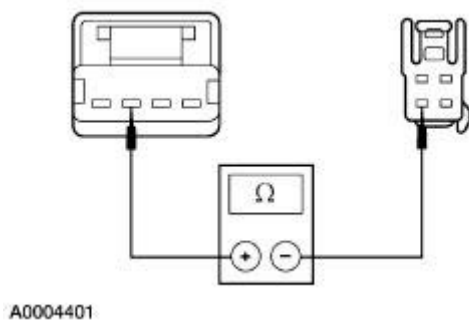
H8 CHECK FOR OPEN BETWEEN SCLM C267 AND IN-LINE C248F — SCP (+)

1



In-Line C248

2



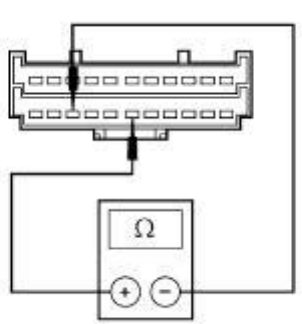
2

Measure the resistance between SCLM C267 pin 3, circuit 5-GL58 (BU/BK), harness side and in-line C248F pin 4, circuit 5-GL58 (BU/BK), harness side.



● Is the resistance less than 5 ohms?

	<p>→ Yes REPAIR circuit 5-GL58 (BU/BK) between in-line C248M and joint connector #4 C223. REFER to <u>Communication Circuit Wiring Repair</u> in this section. TEST the system for normal operation.</p> <p>→ No REPAIR circuit 5-GL58 (BU/BK) between in-line C248F and SCLM C267. REFER to <u>Communication Circuit Wiring Repair</u> in this section. TEST the system for normal operation.</p>
--	--

H9 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (-)

<p>1</p>  <p>A0004402</p>	<p>1 Measure the resistance between joint connector #4 C223 pin 6 and pin 9, component side.</p> <ul style="list-style-type: none"> ● Is the resistance less than 5 ohms? <p>→ Yes REPAIR circuit 5-EG7 (BU/RD). REFER to <u>Communication Circuit Wiring Repair</u> in this section. TEST the system for normal operation.</p> <p>→ No REPAIR joint connector #4 C223. TEST the system for normal operation.</p>
--	---

PINPOINT TEST I: THE REMOTE EMERGENCY SATELLITE CELLULAR UNIT (RESCU) MODULE DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 CHECK RESCU MODULE C401a FOR DAMAGE	
<p>1</p>  <p>2</p> 	

RESCU Module C401a

4



RESCU Module C401a

5



Diagnostic Tool

6



7



DATA LINK DIAGNOSTICS

3 Inspect RESCU module C401a for damage; repair as necessary.

• Was the result received RESCU: NO RESPONSE ON CKT914 (BUS+)?

→ Yes
GO to 12.

→ No
GO to 17.

12 CHECK FOR OPEN BETWEEN DLC C251 AND RESCU MODULE C401a — SCP (+)

1



2



Diagnostic Tool

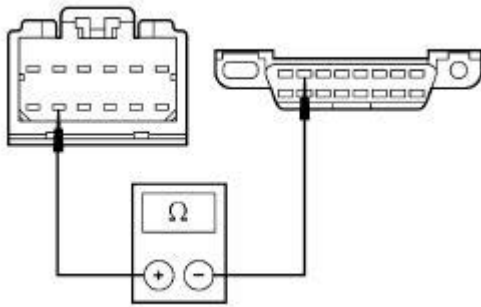
3



RESCU Module C401a

4

4 Measure the resistance between RESCU module C401a pin 8, circuit 4-GP8 (GY/BK), harness side and DLC



A0004403

C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
 INSTALL a new RESCU module. REFER to Section 419-05. TEST the system for normal operation.

→ **No**
 GO to 13.

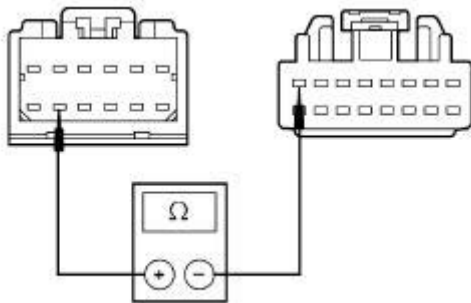
13 CHECK FOR OPEN BETWEEN INTERIOR AJB C283b AND RESCU MODULE C401a — SCP (+)

1



Interior AJB C283b

2



A0004404

2

Measure the resistance between RESCU module C401a pin 8, circuit 4-GP8 (GY/BK), harness side and interior AJB C283b pin 8, circuit 4-GP8 (GY/BK), harness side.

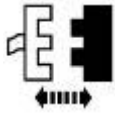
● Is the resistance less than 5 ohms?

→ **Yes**
 GO to 14.

→ **No**
 REPAIR circuit 4-GP8 (GY/BK). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

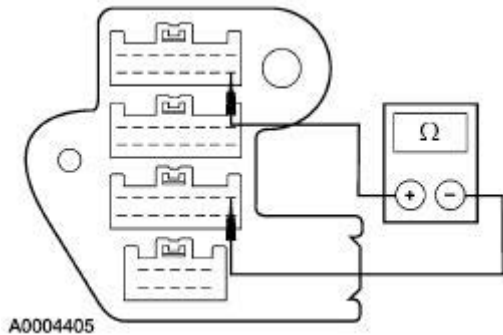
14 CHECK FOR OPEN BETWEEN INTERIOR AJB C283b AND INTERIOR AJB C283d — SCP (+)

1



Interior AJB C283d

2



2

Measure the resistance between interior AJB C283d pin 16 and interior AJB C283b pin 8, component side.

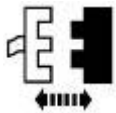
● Is the resistance less than 5 ohms?

→ **Yes**
GO to 15.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

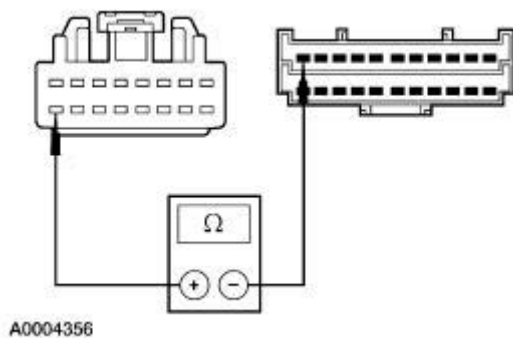
15 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (+)

1



Joint Connector #4 C223

2



2

Measure the resistance between interior AJB C283d pin 16, circuit 4-EG1 (GY), harness side and joint connector #4 C223 pin 12, circuit 4-EG1 (GY), harness side.

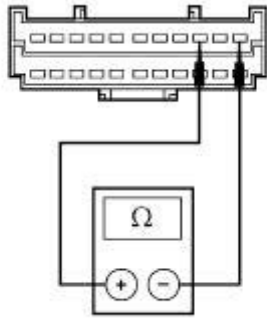
● Is the resistance less than 5 ohms?

→ **Yes**
GO to 16.

→ **No**
REPAIR circuit 4-EG1 (GY). REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

I6 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (+)

1



A0004357

1

Measure the resistance between joint connector #4 C223 pin 12 and pin 14, component side.

● **Is the resistance less than 5 ohms?**

→ **Yes**

REPAIR circuit 4-EG7 (GY/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**

REPAIR joint connector #4 C223. TEST the system for normal operation.

I7 CHECK FOR OPEN BETWEEN DLC C251 AND RESCU MODULE C401a — SCP (-)

1

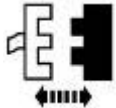


2



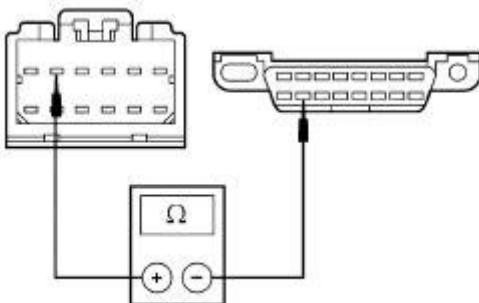
Diagnostic Tool

3



RESCU Module C401a

4



A0004406

4

Measure the resistance between RESCU module C401a pin 2, circuit 5-GP8 (BU/YE), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.

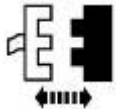
● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new RESCU module. REFER to [Section 419-05](#). TEST the system for normal operation.

→ **No**
GO to [18](#).

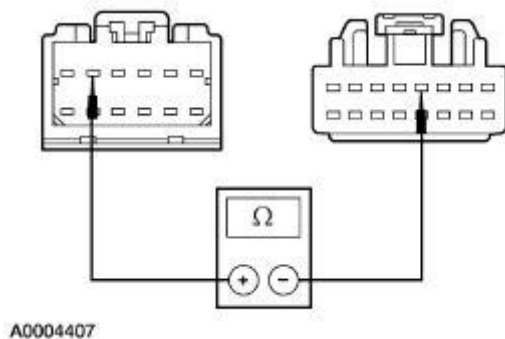
18 CHECK FOR OPEN BETWEEN INTERIOR AJB C283b AND RESCU MODULE C401a — SCP (-)

1



Interior AJB C283b

2



2

Measure the resistance between RESCU module C401a pin 2, circuit 5-GP8 (BU/YE), harness side and interior AJB C283b pin 4, circuit 5-GP8 (BU/YE), harness side.

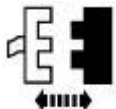
● Is the resistance less than 5 ohms?

→ **Yes**
GO to [19](#).

→ **No**
REPAIR circuit 5-GP8 (BU/YE). REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

19 CHECK FOR OPEN BETWEEN INTERIOR AJB C283b AND INTERIOR AJB C283d — SCP (-)

1

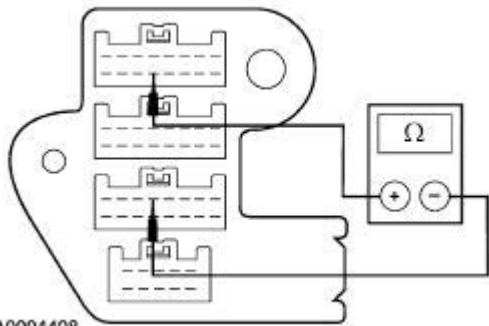


Interior AJB C283d

2

2

Measure the resistance between interior AJB C283d pin 12 and interior AJB C283b pin 4, component side.



A0004408

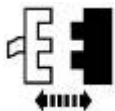
● Is the resistance less than 5 ohms?

→ **Yes**
GO to I10.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

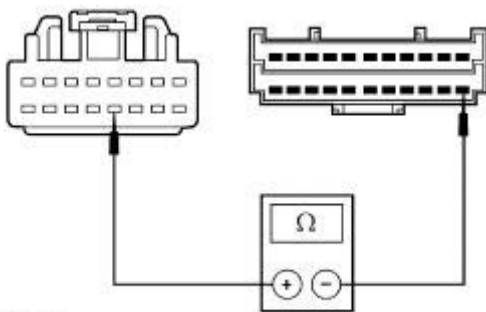
I10 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (-)

1



Joint Connector #4 C223

2



A0004361

2

Measure the resistance between interior AJB C283d pin 12, circuit 5-EG1 (BU), harness side and joint connector #4 C223 pin 11, circuit 5-EG1 (BU), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to I11.

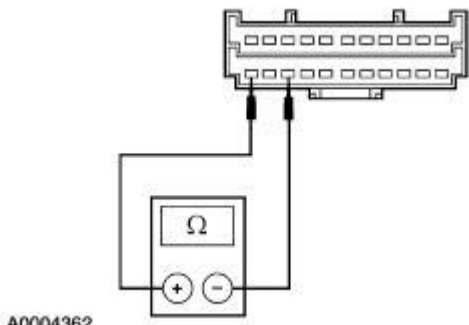
→ **No**
REPAIR circuit 5-EG1 (BU). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

I11 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (-)

1

1

Measure the resistance between joint connector #4 C223 pin 9 and pin 11, component side.


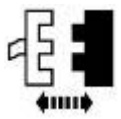




● Is the resistance less than 5 ohms?

→ **Yes**
REPAIR circuit 5-EG7 (BU/RD). REFER to *Communication Circuit Wiring Repair* in this section. TEST the system for normal operation.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

PINPOINT TEST J: THE DRIVER SEAT MODULE (DSM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 CHECK DSM 341c FOR DAMAGE	
<p>1 </p> <p>2  DSM 341c</p> <p>4  DSM 341c</p> <p>5  Diagnostic Tool</p>	<p>3 Inspect DSM 341c for damage; repair as necessary.</p>

6



7



DATA LINK DIAGNOSTICS

- Was the result received DSM: NO RESPONSE ON CKT914 (BUS+)?

→ **Yes**
GO to J2.

→ **No**
GO to J8.

J2 CHECK FOR OPEN BETWEEN DLC C251 AND DSM 341c — SCP (+)

1

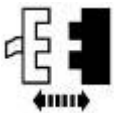


2



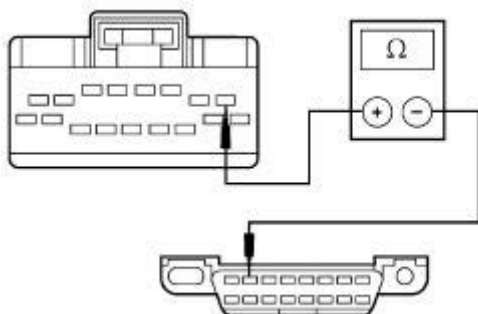
Diagnostic Tool

3



DSM 341c

4



A0004409

- 4 Measure the resistance between DSM 341c pin 1, circuit 4-AH80 (GY/WH), harness side and DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

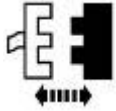
- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new DSM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
GO to J3.

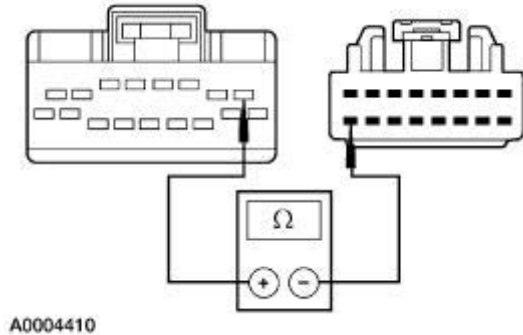
J3 CHECK FOR OPEN BETWEEN INTERIOR AJB C283a AND DSM 341c — SCP (+)

1



Interior AJB C283a

2



A0004410

2 Measure the resistance between DSM 341c pin 1, circuit 4-AH80 (GY/WH), harness side and interior AJB C283a pin 16, circuit 4-AH80 (GY/WH), harness side.

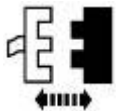
● Is the resistance less than 5 ohms?

→ **Yes**
GO to J5.

→ **No**
GO to J4.

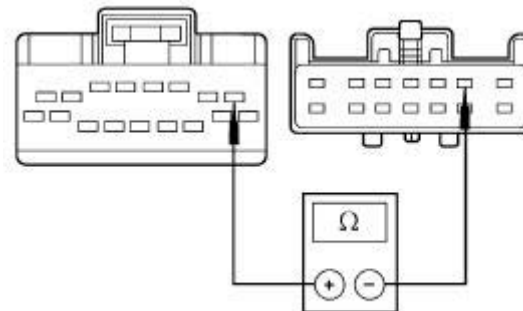
J4 CHECK FOR OPEN BETWEEN IN-LINE C315M AND DSM 341c — SCP (+)

1



In-Line C315

2



A0004411

2 Measure the resistance between DSM 341c pin 1, circuit 4-AH80 (GY/WH), harness side and in-line C315M pin 6, circuit 4-AH80 (GY/WH), harness side.

● Is the resistance less than 5 ohms?

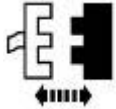
→ **Yes**
REPAIR circuit 4-AH80 (GY/WH) between in-line C315F and interior AJB C283a. REFER to Communication Circuit

Wiring Repair in this section. TEST the system for normal operation.

→ **No**
REPAIR circuit 4-AH80 (GY/WH) between in-line C315M and DSM C341c. REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

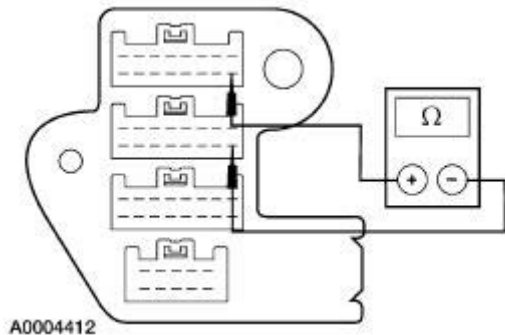
J5 CHECK FOR OPEN BETWEEN INTERIOR AJB C283a AND INTERIOR AJB C283d — SCP (+)

1



Interior AJB C283d

2



2 Measure the resistance between interior AJB C283d pin 16 and interior AJB C283a pin 16, component side.

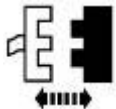
● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to J6.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

J6 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (+)

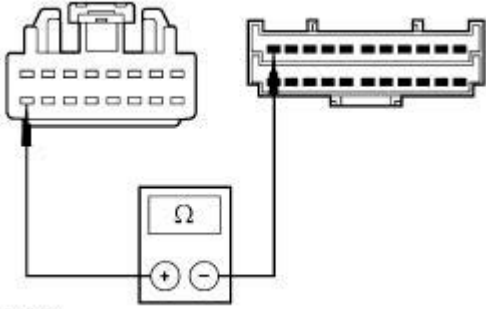
1



Joint Connector #4 C223

2

2 Measure the resistance between interior AJB C283d pin 16, circuit 4-EG1 (GY), harness side and joint connector #4 C223 pin 12, circuit 4-EG1 (GY), harness side.



A0004356

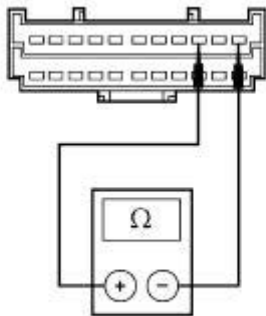
● Is the resistance less than 5 ohms?

→ **Yes**
GO to J7.

→ **No**
REPAIR circuit 4-EG1 (GY). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

J7 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (+)

1



A0004357

1 Measure the resistance between joint connector #4 C223 pin 12 and pin 14, component side.

● Is the resistance less than 5 ohms?

→ **Yes**
REPAIR circuit 4-EG7 (GY/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

J8 CHECK FOR OPEN BETWEEN DLC C251 AND DSM 341c — SCP (-)

1



2



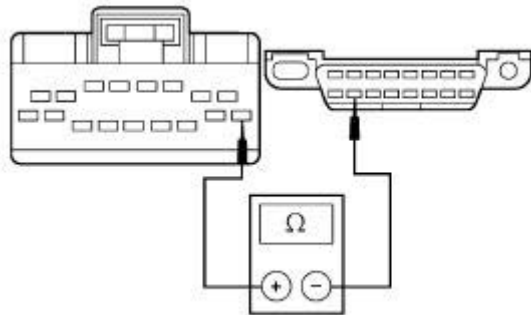
Diagnostic Tool

3



DSM 341c

4



A0004413

4

Measure the resistance between DSM 341c pin 9, circuit 5-AH80 (BU/OG), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.

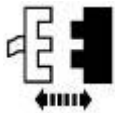
● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new DSM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
GO to [J9](#).

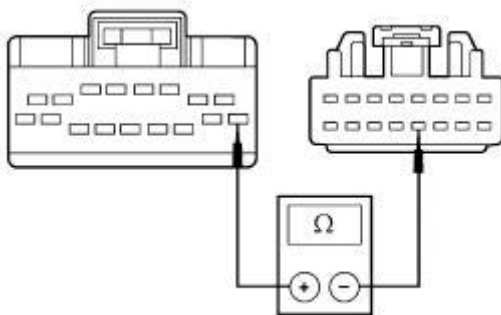
J9 CHECK FOR OPEN BETWEEN INTERIOR AJB C283a AND DSM 341c — SCP (-)

1



Interior AJB C283a

2



A0004414

2

Measure the resistance between DSM 341c pin 9, circuit 5-AH80 (BU/OG), harness side and interior AJB C283a pin 12, circuit 5-AH80 (BU/OG), harness side.

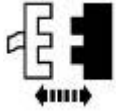
● Is the resistance less than 5 ohms?

→ **Yes**
GO to [J11](#).

→ **No**
GO to J10.

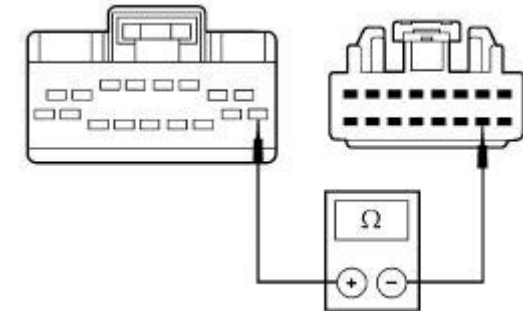
J10 CHECK FOR OPEN BETWEEN IN-LINE C315M AND DSM 341c — SCP (+)

1



In-Line C315

2



A0004415

2

Measure the resistance between DSM 341c pin 9, circuit 5-AH80 (BU/OG), harness side and in-line C315M pin 13, circuit 5-AH80 (BU/OG), harness side.

● **Is the resistance less than 5 ohms?**

→ **Yes**

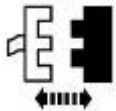
REPAIR circuit 5-AH80 (BU/OG) between in-line C351F and interior AJB C283a. REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**

REPAIR circuit 5-AH80 (BU/OG) between in-line C351M and DSM C341c. REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

J11 CHECK FOR OPEN BETWEEN INTERIOR AJB C283a AND INTERIOR AJB C283d — SCP (-)

1

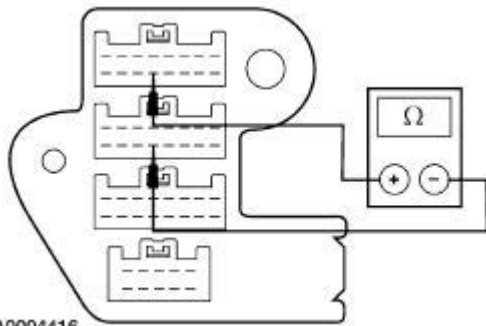


Interior AJB C283d

2

2

Measure the resistance between interior AJB C283d pin 12 and interior AJB C283a pin 12, component side.



A0004416

● Is the resistance less than 5 ohms?

→ **Yes**
GO to J12.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

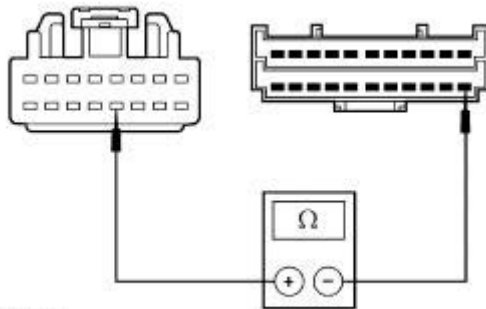
J12 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (-)

1



Joint Connector #4 C223

2



A0004361

2

Measure the resistance between interior AJB C283d pin 12, circuit 5-EG1 (BU), harness side and joint connector #4 C223 pin 11, circuit 5-EG1 (BU), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to J13.

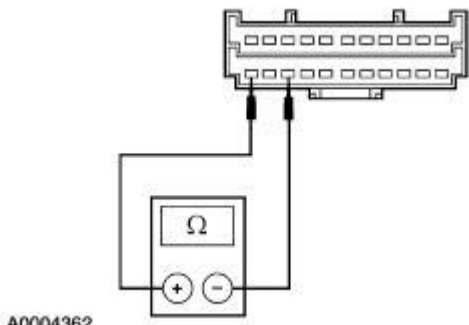
→ **No**
REPAIR circuit 5-EG1 (BU). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

J13 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (-)

1

1

Measure the resistance between joint connector #4 C223 pin 9 and pin 11, component side.




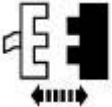


A0004362

● Is the resistance less than 5 ohms?

→ **Yes**
 REPAIR circuit 5-EG7 (BU/RD). REFER to *Communication Circuit Wiring Repair* in this section. TEST the system for normal operation.

→ **No**
 REPAIR joint connector #4 C223. TEST the system for normal operation.

PINPOINT TEST K: THE DRIVER DOOR MODULE (DDM) DOES NOT RESPOND TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 CHECK DDM C501a FOR DAMAGE	
<p>1 </p> <p>2  DDM C501a</p> <p>4  DDM C501a</p> <p>5  Diagnostic Tool</p>	<p>3 Inspect DDM C501a for damage; repair as necessary.</p>

6



7



DATA LINK DIAGNOSTICS

- Was the result received DDM: NO RESPONSE ON CKT914 (BUS+)?

→ Yes
GO to K2.

→ No
GO to K7.

K2 CHECK FOR OPEN BETWEEN DLC C251 AND DDM C501a — SCP (+)

1

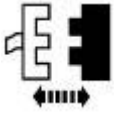


2



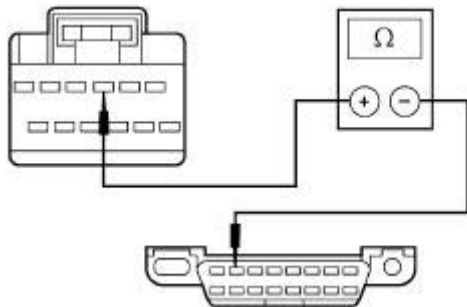
Diagnostic Tool

3



DDM C501a

4



A0004417

- 4 Measure the resistance between DDM C501a pin 3, circuit 4-EG13 (GY/OG), harness side and DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

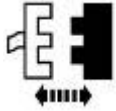
- Is the resistance less than 5 ohms?

→ Yes
INSTALL a new DDM. REFER to Section 419-10. TEST the system for normal operation.

→ **No**
GO to K3.

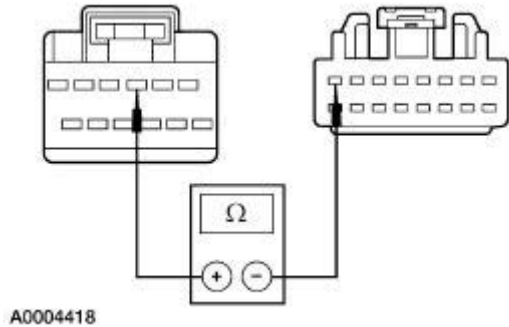
K3 CHECK FOR OPEN BETWEEN INTERIOR AJB C283a AND DDM C501a — SCP (+)

1



Interior AJB C283a

2



2

Measure the resistance between DDM C501a pin 3, circuit 4-EG13 (GY/OG), harness side and interior AJB C283a pin 8, circuit 4-EG13 (GY/OG), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to K4.

→ **No**
REPAIR circuit 4-EG13 (GY/OG). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

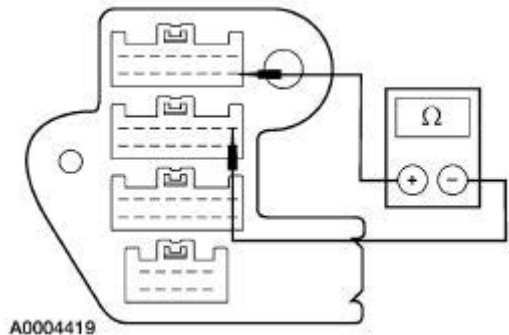
K4 CHECK FOR OPEN BETWEEN INTERIOR AJB C283a AND INTERIOR AJB C283d — SCP (+)

1



Interior AJB C283d

2



2

Measure the resistance between interior AJB C283d pin 16 and interior AJB C283a pin 8, component side.

● Is the resistance less than 5 ohms?

- **Yes**
GO to K5.
- **No**
INSTALL a new AJB. TEST the system for normal operation.

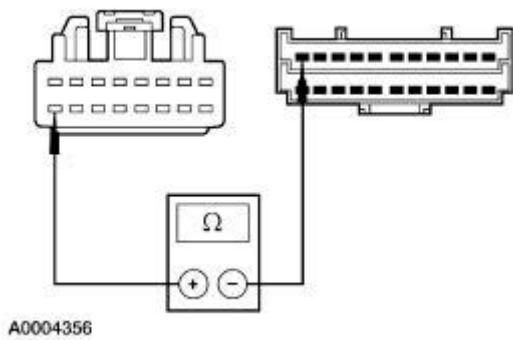
K5 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (+)

1



Joint Connector #4 C223

2



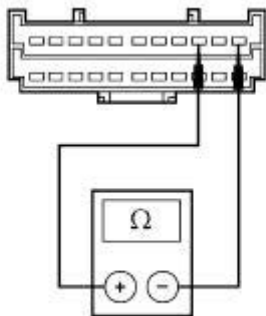
- 2 Measure the resistance between interior AJB C283d pin 16, circuit 4-EG1 (GY), harness side and joint connector #4 C223 pin 12, circuit 4-EG1 (GY), harness side.

● Is the resistance less than 5 ohms?

- **Yes**
GO to K6.
- **No**
REPAIR circuit 4-EG1 (GY). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

K6 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (+)

1



- 1 Measure the resistance between joint connector #4 C223 pin 12 and pin 14, component side.

● Is the resistance less than 5 ohms?

- **Yes**
REPAIR circuit 4-EG7 (GY/RD). REFER

to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

K7 CHECK FOR OPEN BETWEEN DLC C251 AND DDM C501a — SCP (-)

1



2



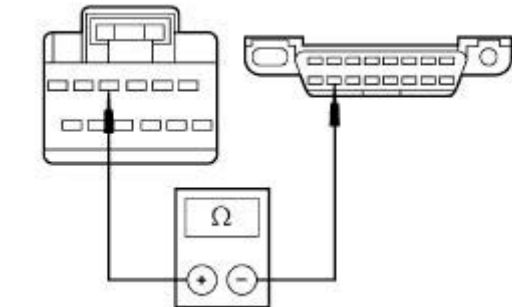
Diagnostic Tool

3



DDM C501a

4



A0004420

4 Measure the resistance between DDM C501a pin 4, circuit 5-EG13 (BU/BK), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.

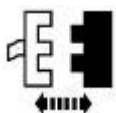
● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new DDM. REFER to Section 419-10. TEST the system for normal operation.

→ **No**
GO to K8.

K8 CHECK FOR OPEN BETWEEN INTERIOR AJB C283a AND DDM C501a — SCP (-)

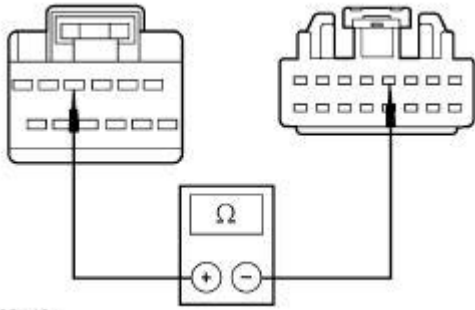
1



Interior AJB C283a

2

2 Measure the resistance between DDM C501a pin 4, circuit 5-EG13 (BU/BK), harness side and interior AJB C283a pin



A0004421

4, circuit 5-EG13 (BU/BK), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to K9.

→ **No**
REPAIR circuit 5-EG13 (BU/BK). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

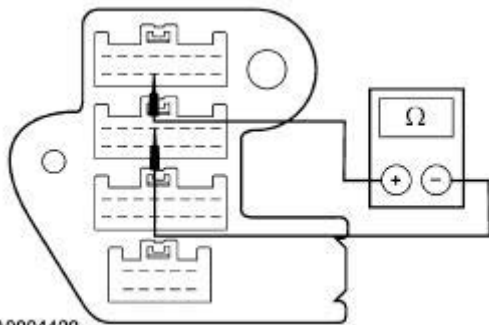
K9 CHECK FOR OPEN BETWEEN INTERIOR AJB C283a AND INTERIOR AJB C283d — SCP (-)

1



Interior AJB C283d

2



A0004422

2

Measure the resistance between interior AJB C283d pin 12 and interior AJB C283a pin 4, component side.

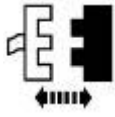
● Is the resistance less than 5 ohms?

→ **Yes**
GO to K10.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

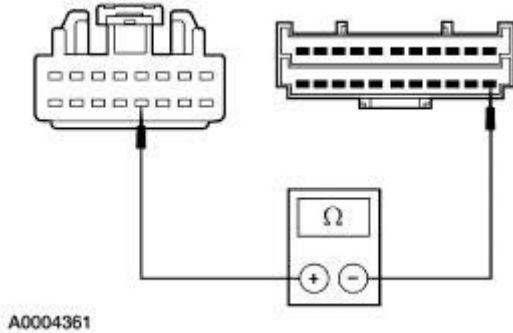
K10 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (-)

1



Joint Connector #4 C223

2



2

Measure the resistance between interior AJB C283d pin 12, circuit 5-EG1 (BU), harness side and joint connector #4 C223 pin 11, circuit 5-EG1 (BU), harness side.

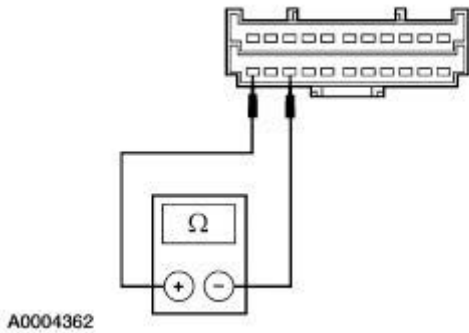
● Is the resistance less than 5 ohms?

→ **Yes**
GO to K11.

→ **No**
REPAIR circuit 5-EG1 (BU). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

K11 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (-)

1



1

Measure the resistance between joint connector #4 C223 pin 9 and pin 11, component side.


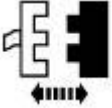





● Is the resistance less than 5 ohms?

→ **Yes**
REPAIR circuit 5-EG7 (BU/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

PINPOINT TEST L: THE REAR ELECTRONIC MODULE (REM) DOES

NOT RESPOND TO THE DIAGNOSTIC TOOL

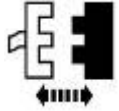
CONDITIONS	DETAILS/RESULTS/ACTIONS
L1 CHECK REM C420b FOR DAMAGE	
<p>1 </p> <p>2  REM C420b</p> <p>4  REM C420b</p> <p>5  Diagnostic Tool</p> <p>6 </p> <p>7  DATA LINK DIAGNOSTICS</p>	<p>3 Inspect REM C420b for damage; repair as necessary.</p> <p>● Was the result received REM: NO RESPONSE ON CKT914 (BUS+)?</p> <p>→ Yes GO to <u>L2</u>.</p> <p>→ No GO to <u>L7</u>.</p>
L2 CHECK FOR OPEN BETWEEN DLC C251 AND REM C420b — SCP (+)	
<p>1 </p>	

2



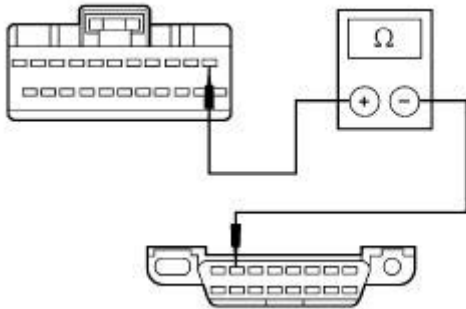
Diagnostic Tool

3



REM C420b

4



A0004423

4

Measure the resistance between REM C420b pin 1, circuit 4-EG12 (GY/WH), harness side and DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

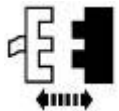
● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new REM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
GO to [L3](#).

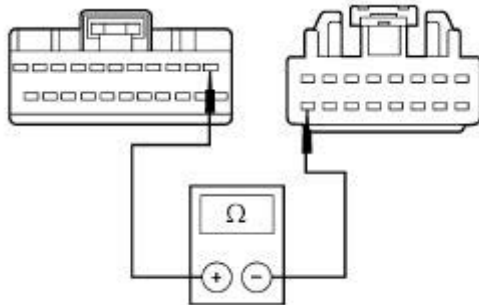
L3 CHECK FOR OPEN BETWEEN INTERIOR AJB C283b AND REM C420b — SCP (+)

1



Interior AJB C283b

2



A0004424

2

Measure the resistance between REM C420b pin 1, circuit 4-EG12 (GY/WH), harness side and interior AJB C283b pin 16, circuit 4-EG12 (GY/WH), harness side.

● Is the resistance less than 5 ohms?

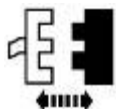
→ **Yes**

GO to L4.

→ **No**
REPAIR circuit 4-EG12 (GY/WH). REFER to *Communication Circuit Wiring Repair* in this section. TEST the system for normal operation.

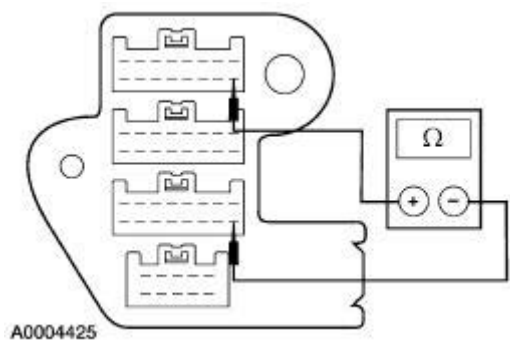
L4 CHECK FOR OPEN BETWEEN INTERIOR AJB C283b AND INTERIOR AJB C283d — SCP (+)

1



Interior AJB C283d

2



2

Measure the resistance between interior AJB C283d pin 16 and interior AJB C283b pin 16, component side.

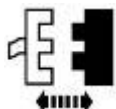
● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to L5.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

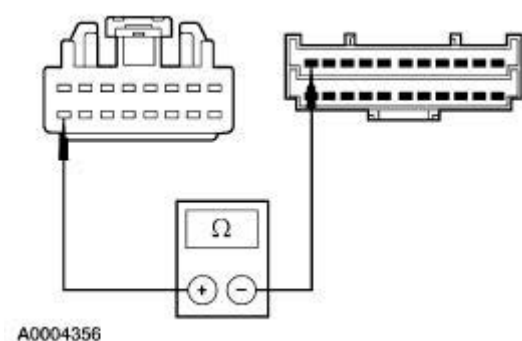
L5 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (+)

1



Joint Connector #4 C223

2



2

Measure the resistance between interior AJB C283d pin 16, circuit 4-EG1 (GY), harness side and joint connector #4 C223 pin 12, circuit 4-EG1 (GY), harness side.

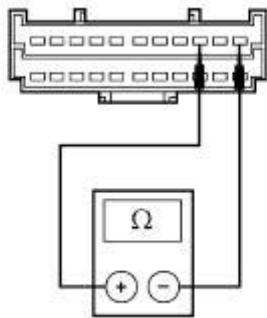
● Is the resistance less than 5 ohms?

→ **Yes**
GO to L6.

→ **No**
REPAIR circuit 4-EG1 (GY). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

L6 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (+)

1



A0004357

1 Measure the resistance between joint connector #4 C223 pin 12 and pin 14, component side.

● Is the resistance less than 5 ohms?

→ **Yes**
REPAIR circuit 4-EG7 (GY/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

L7 CHECK FOR OPEN BETWEEN DLC C251 AND REM C420b — SCP (-)

1

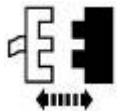


2



Diagnostic Tool

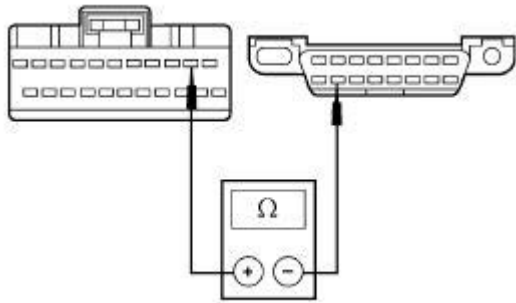
3



REM C420b

4

4 Measure the resistance between REM



A0004426

C420b pin 2, circuit 5-EG12 (BU/OG), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
 INSTALL a new REM. REFER to [Section 419-10](#). TEST the system for normal operation..

→ **No**
 GO to [L8](#).

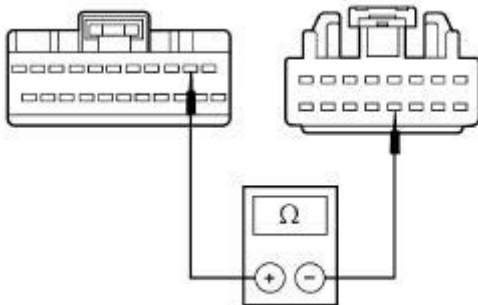
L8 CHECK FOR OPEN BETWEEN INTERIOR AJB C283b AND REM C420b — SCP (-)

1



Interior AJB C283b

2



A0004427

2 Measure the resistance between REM C420b pin 2, circuit 5-EG12 (BU/OG), harness side and interior AJB C283b pin 12, circuit 5-EG12 (BU/OG), harness side.

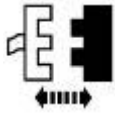
● Is the resistance less than 5 ohms?

→ **Yes**
 GO to [L9](#).

→ **No**
 REPAIR circuit 5-EG12 (BU/OG). REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

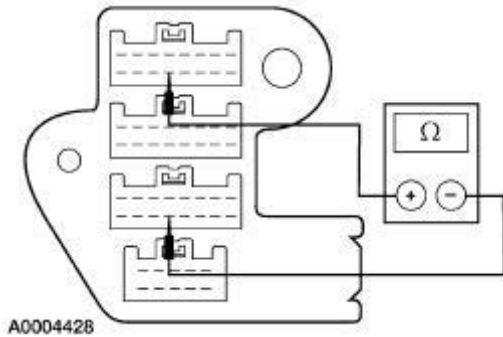
L9 CHECK FOR OPEN BETWEEN INTERIOR AJB C283b AND INTERIOR AJB C283d — SCP (-)

1



Interior AJB C283d

2



2

Measure the resistance between interior AJB C283d pin 12 and interior AJB C283b pin 12, component side.

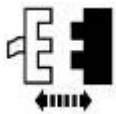
● Is the resistance less than 5 ohms?

→ **Yes**
GO to L10.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

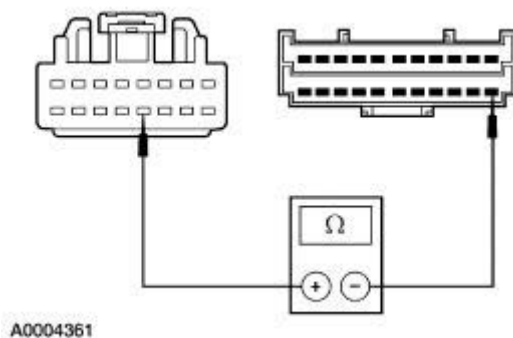
L10 CHECK FOR OPEN BETWEEN INTERIOR AJB C283d AND JOINT CONNECTOR #4 C223 — SCP (-)

1



Joint Connector #4 C223

2



2

Measure the resistance between interior AJB C283d pin 12, circuit 5-EG1 (BU), harness side and joint connector #4 C223 pin 11, circuit 5-EG1 (BU), harness side.

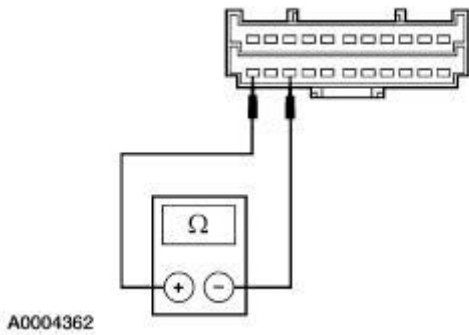
● Is the resistance less than 5 ohms?

→ **Yes**
GO to L11.

→ **No**
REPAIR circuit 5-EG1 (BU). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

L11 CHECK FOR OPEN BETWEEN JOINT CONNECTOR #4 C223 PINS — SCP (-)

1



1

Measure the resistance between joint connector #4 C223 pin 9 and pin 11, component side.

● **Is the resistance less than 5 ohms?**

→ **Yes**
REPAIR circuit 5-EG7 (BU/RD). REFER to Communication Circuit Wiring Repair in this section. TEST the system for normal operation.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

PINPOINT TEST M: NO ISO 9141 NETWORK COMMUNICATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1 CHECK CIRCUIT 4-EE10 (GY/BK) FOR SHORT TO VOLTAGE AND GROUND	
<p>1</p> <p>2</p>	<p>2</p> <p>Measure the voltage between DLC C251 pin 7, circuit 4-EE10 (GY/BK), harness side and DLC C251 pin 4, circuit 31-ED6 (BK), harness side; and between DLC C251 pin 7, circuit 4-EE10 (GY/BK), harness side and DLC C251 pin 16, circuit 29-ED6 (OG/YE), harness side.</p> <p>● Is the voltage zero volts in either measurement?</p> <p>→ Yes GO to <u>M2</u>.</p>

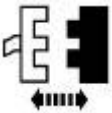
→ **No**
INSTALL a new RCM. REFER to [Section 501-20B](#). TEST the system for normal operation.

M2 CHECK CIRCUIT ANTI-LOCK BRAKE CONTROL MODULE FOR THE SOURCE OF THE CONCERN

1



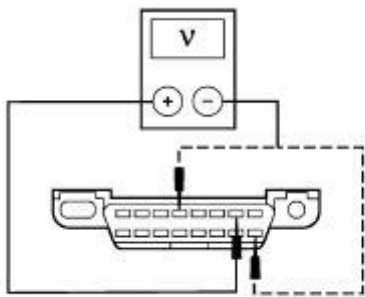
2



3



4



A0004429

2 Disconnect the anti-lock brake control module with or without traction control C135 or the stability assist module C155.

4 Measure the voltage between DLC C251 pin 7, circuit 4-EE10 (GY/BK), harness side and DLC C251 pin 4, circuit 31-ED6 (BK), harness side; and between DLC C251 pin 7, circuit 4-EE10 (GY/BK), harness side and DLC C251 pin 16, circuit 29-ED6 (OG/YE), harness side.

● Is the voltage zero volts in either measurement?

→ **Yes**
GO to [M3](#).

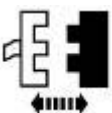
→ **No**
INSTALL a new anti-lock brake control module or stability assist module. REFER to [Section 206-09A](#), [Section 206-09B](#), or [Section 206-09C](#).

M3 CHECK CIRCUITS 4-EE10 (GY/BK), 4-EE6 (GY), AND 4-EE1 (GY) FOR SHORT TO VOLTAGE AND GROUND

1



2

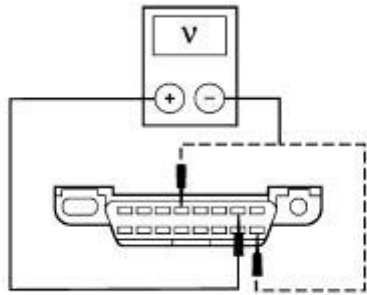


In-Line C211

3



4



A0004429

4

Measure the voltage between DLC C251 pin 7, circuit 4-EE10 (GY/BK), harness side and DLC C251 pin 4, circuit 31-ED6 (BK), harness side; and between DLC C251 pin 7, circuit 4-EE10 (GY/BK), harness side and DLC C251 pin 16, circuit 29-ED6 (OG/YE), harness side.

- Is the voltage greater than 10 volts in either measurement?

→ **Yes**
GO to M4.

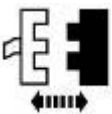
→ **No**
REPAIR circuit 4-EE6 (GY) between the in-line C211F and anti-lock brake control module with or without traction control C135 or the stability assist module C155. TEST the system for normal operation.

M4 CHECK CIRCUITS 4-EE10 (GY/BK), 4-EE6 (GY), AND 4-EE1 (GY) FOR SHORT TO VOLTAGE AND GROUND

1



2



In-Line C212

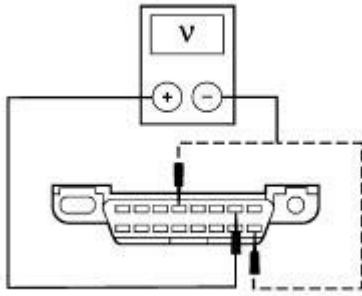
3



4

4

Measure the voltage between DLC C251 pin 7, circuit 4-EE10 (GY/BK), harness side and DLC C251 pin 4, circuit 31-ED6 (BK), harness side; and between DLC C251 pin 7, circuit 4-EE10 (GY/BK), harness side and DLC C251 pin 16, circuit 29-ED6 (OG/YE), harness side.



A0004429

- Is the voltage greater than 10 volts in either measurement?


→ **Yes**

REPAIR circuit 4-EE10 (GY/BK) between in-line C212M and DLC C251. TEST the system for normal operation.

→ **No**

REPAIR Circuits 4-EE10 (GY/BK), 4-EE1 (GY), and 4-EE6 (GY) between the RCM C310a, in-line C211M, and in-line C212F. TEST the system for normal operation.

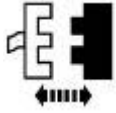
PINPOINT TEST N: NO SCP NETWORK COMMUNICATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
N1 CHECK DIAGNOSTIC TOOL PINS FOR DAMAGE	
	<p>1 Inspect diagnostic tool pins for damage.</p> <ul style="list-style-type: none"> ● Are the diagnostic tool pins OK? <p>→ Yes GO to <u>N2</u>.</p> <p>→ No REPAIR the diagnostic tool terminals. TEST the system for normal operation.</p>
N2 CHECK DLC C251 PINS 2 AND 10 FOR DAMAGE	
<p>1</p> 	<p>2 Inspect the DLC C251 pins for damage.</p> <ul style="list-style-type: none"> ● Are the pins OK? <p>→ Yes GO to <u>N3</u>.</p>

→ **No**
REPAIR the DLC C251. TEST the system for normal operation.

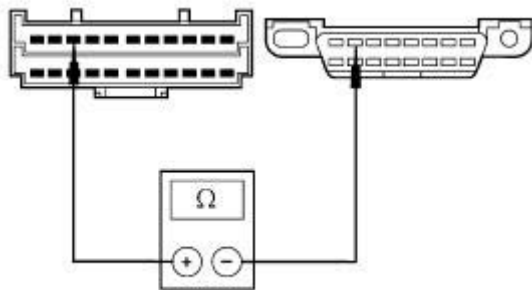
N3 CHECK CIRCUIT 4-EG7 (GY/RD) AND CIRCUIT 5-EG7 (BU/RD) FOR OPEN — JOINT CONNECTOR #4 C223 DISCONNECTED

1



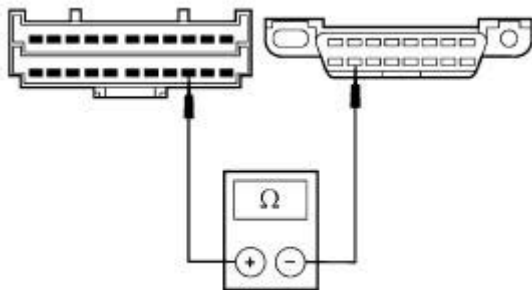
Joint Connector #4 C223

2



A0004430

3



A0004431

2 Measure the resistance between joint connector #4 C223 pin 14, circuit 4-EG7 (GY/RD), harness side and DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side.

3 Measure the resistance between joint connector #4 C223 pin 9, circuit 5-EG7 (BU/RD), harness side and DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side.

- Are the resistances less than 5 ohms?

→ **Yes**
GO to N4.

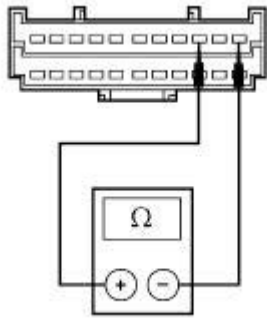
→ **No**
REPAIR the circuit(s) in question between joint connector #4 C223 and DLC C251. REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

N4 CHECK FOR OPENS IN JOINT CONNECTOR #4 C223

1

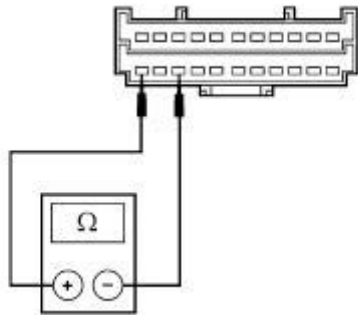
1

Measure the resistance between joint connector #4 C223 pin 12 and pin 14, component side.



A0004357

2



A0004362

2 Measure the resistance between joint connector #4 C223 pin 9 and pin 11, component side.

• Are the resistances less than 5 ohms?

→ **Yes**
GO to N5.

→ **No**
REPAIR joint connector #4 C223. TEST the system for normal operation.

N5 CHECK SCP COMMUNICATIONS WITH INTERIOR AJB C283d DISCONNECTED

1



Joint Connector #4 C223

2



Interior AJB C283d

3



4



DATA LINK DIAGNOSTICS

- Did only the ACM, ICM, DATC, and the SCLM (if equipped with manual transmission) pass the DATA LINK DIAGNOSTICS test?

→ **Yes**
GO to N12.

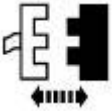
→ **No**
GO to N6.

N6 CHECK SCP COMMUNICATIONS WITH ACM C240a DISCONNECTED

1



2



ACM C240a

3



4



DATA LINK DIAGNOSTICS

- Did only the ICM, DATC, and the SCLM (if equipped with manual transmission) pass the DATA LINK DIAGNOSTICS test?

→ **Yes**
INSTALL a new ACM. REFER to Section 415-01. TEST the system for normal operation.

→ **No**
If equipped with the SCLM, GO to N7.

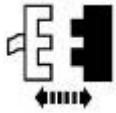
If not equipped with the SCLM, GO to N9.

N7 CHECK SCP COMMUNICATIONS WITH SCLU C267 DISCONNECTED

1



2



SCLM C267

3



4



DATA LINK DIAGNOSTICS

- Did only the ICM and DATC pass the DATA LINK DIAGNOSTICS test?

→ **Yes**
 INSTALL a new SCLM. For additional information, REFER to Section 211-05. TEST the system for normal operation.

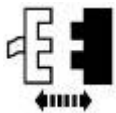
→ **No**
 GO to N8.

N8 CHECK SCP COMMUNICATIONS WITH IN-LINE C248 DISCONNECTED

1



2



In-Line C248

3



4



DATA LINK DIAGNOSTICS

- Did only the ICM and DATC pass the DATA LINK DIAGNOSTICS test?

→ **Yes**
 REPAIR the circuits in question between

in-line C248F and SCLM C267. REFER to Communication Circuit Wiring Repair in the section. TEST the system for normal operation.

→ **No**
GO to N9.

N9 CHECK SCP COMMUNICATIONS WITH DATC C228 DISCONNECTED

1



2



DATC C228

3



4



DATA LINK DIAGNOSTICS

● Did only the ICM pass the DATA LINK DIAGNOSTICS test?

→ **Yes**
INSTALL a new DATC. REFER to Section 412-00. TEST the system for normal operation.

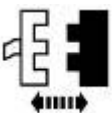
→ **No**
GO to N10.

N10 CHECK INSTRUMENT CLUSTER FOR THE SOURCE OF THE CONCERN

1



2

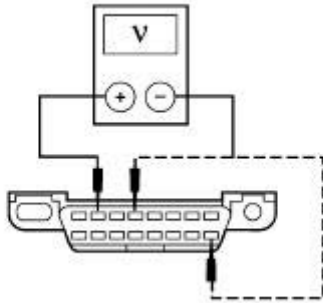


Instrument Cluster C220b

3

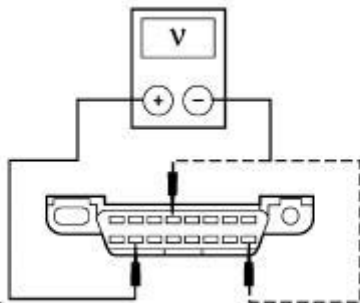


4



A0004789

5



A0004790

4

Measure the voltage between DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side and DLC C251 pin 4, circuit 31-ED6 (BK), harness side; and between DLC C251 pin 2, circuit 4-EG7 (GY/RD), harness side and DLC C251 pin 16, circuit 29-ED6 (OG/YE).

5

Measure the voltage between DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side and DLC C251 pin 4, circuit 31-ED6 (BK), harness side; and between DLC C251 pin 10, circuit 5-EG7 (BU/RD), harness side and DLC C251 pin 16, circuit 29-ED6 (OG/YE).

• Is any voltage indicated?

→ Yes
GO to N11.

→ No
INSTALL a new instrument cluster.
REFER to Section 413-01. TEST the system for normal operation.

N11 CHECK SCP CIRCUITS FOR THE SHORT TO VOLTAGE AND GROUND

1



2



Joint Connector #4 C223

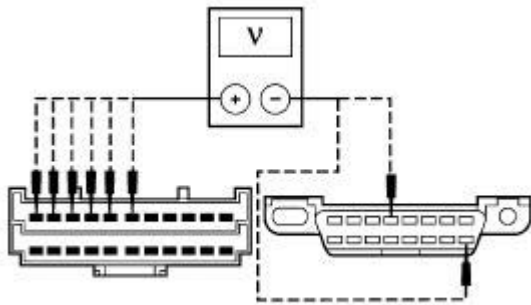
3



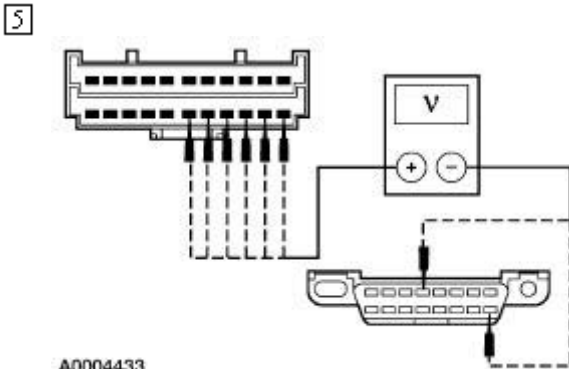
4

4

Using the following table, measure the voltage between joint connector #4 C223



A0004432



A0004433

pins, harness side and DLC C251 pin 4, circuit 31-ED6 (BK), harness side; and between joint connector #4 C223 pins, harness side and DLC C251 pin 16, circuit 29-ED6 (OG/YE).

Pin	Circuit
17 (if equipped with SCLM)	4-GL58 (GY/OG)
16	4-EG10 (GY/BK)
15	4-FA10 (GY/BK)
14	4-EG7 (GY/RD)
13	4-EG8 (GY/VT)
12	4-EG1 (GY)

5 Using the following table, measure the voltage between joint connector #4 C223 pins, harness side and DLC C251 pin 4, circuit 31-ED6 (BK), harness side; and between joint connector #4 C223 pins, harness side and DLC C251 pin 16, circuit 29-ED6 (OG/YE).

Pin	Circuit
6 (if equipped with SCLM)	5-GL58 (BU/BK)
7	5-EG10 (BU/YE)
8	5-FA10 (BU/YE)
9	5-EG7 (BU/RD)
10	5-EG8 (BU/WH)
11	5-EG1 (BU)

- Is any voltage indicated for any measurement?

→ Yes

REPAIR the circuit(s) in question between joint connector #4 C223 and in-line C248M (if equipped with SCLM), ACM C240a, instrument cluster C220b, DATC C228, interior AJB C283d, or DLC C251. REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

→ No

REPAIR joint connector #4 C223. TEST the system for normal operation.

N12 CHECK SCP COMMUNICATIONS WITH INTERIOR AJB C283a DISCONNECTED

1



2



Interior AJB C283d

3



Interior AJB C283a

4



5



DATA LINK DIAGNOSTICS

- Did only the DDM and DSM fail the DATA LINK DIAGNOSTICS test (RESCU module, DSM, and SCLM are optional modules and will fail if not equipped on the vehicle)?

→ Yes
GO to N16.

→ No
GO to N13.

N13 CHECK SCP COMMUNICATIONS WITH DDM C501 DISCONNECTED

1

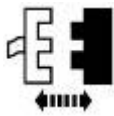


2



Interior AJB C283a

3



DDM C501

4



5



DATA LINK DIAGNOSTICS

- Did only the DDM fail the DATA LINK DIAGNOSTICS test (RESCU module, DSM, and SCLM are optional modules and will fail if not equipped on the vehicle)?

→ Yes

INSTALL a new DDM. REFER to Section 419-10. TEST the system for normal operation.

→ No

If equipped with the DSM, GO to N14.

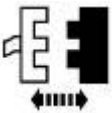
If not equipped with the DSM, GO to N15.

N14 CHECK SCP COMMUNICATIONS WITH DSM C341c DISCONNECTED

1



2



DSM C341c

3



4



DATA LINK DIAGNOSTICS

- Did only the DSM and DDM fail the

DATA LINK DIAGNOSTICS test (RESCU module, DSM, and SCLM are optional modules and will fail if not equipped on the vehicle)?

→ **Yes**
INSTALL a new DSM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
GO to [N15](#).

N15 CHECK SCP COMMUNICATIONS WITH IN-LINE C315 DISCONNECTED

1



2



In-Line C315

3



4



DATA LINK DIAGNOSTICS

● **Did only the DDM and DSM fail the DATA LINK DIAGNOSTICS test (RESCU module, DSM, and SCLM are optional modules and will fail if not equipped on the vehicle)?**

→ **Yes**
REPAIR the circuit in question between in-line C315M and DSM C341c. TEST the system for normal operation.

→ **No**
REPAIR the circuit(s) in question between interior AJB C283a and in-line C315F (if equipped with DSM) or DDM. REFER to [Communication Circuit Wiring Repair](#) in this section. TEST the system for normal operation.

N16 CHECK SCP COMMUNICATIONS WITH INTERIOR AJB C283b DISCONNECTED

1

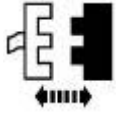


2



Interior AJB C283a

3



Interior AJB C283b

4



5



DATA LINK DIAGNOSTICS

- Did only the REM and RESC fail the DATA LINK DIAGNOSTICS test (RESCU module, DSM, and SCLM are optional modules and will fail if not equipped on the vehicle)?

→ Yes
GO to N17.

→ No
GO to N19.

N17 CHECK SCP COMMUNICATIONS WITH REM C420b DISCONNECTED

1

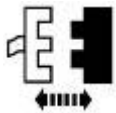


2



Interior AJB C283b

3



REM C420b

4



5



DATA LINK DIAGNOSTICS

- Did only the REM fail the DATA LINK DIAGNOSTICS test (RESCU module, DSM, and SCLM are optional modules and will fail if not equipped on the vehicle)?

→ Yes

INSTALL a new REM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ No

If equipped with the RESCU module, GO to [N18](#).

If not equipped with the RESCU module, REPAIR Circuits 4-EG12 (GY/WH) and 5-EG12 (BU/OG). TEST the system for normal operation.

N18 CHECK SCP COMMUNICATIONS WITH RESCU MODULE C401a DISCONNECTED

1



2



RESCU Module C401a

3



4



DATA LINK DIAGNOSTICS

- Did only the RESC and REM fail the DATA LINK DIAGNOSTICS test (DSM, and SCLM are optional

modules and will fail if not equipped on the vehicle)?

→ **Yes**
INSTALL a new RESCU module. REFER to Section 419-05. TEST the system for normal operation.

→ **No**
REPAIR circuits 4-GP8 (GY/BK) and 5-GP8 (BU/YE). TEST the system for normal operation.

N19 CHECK SCP COMMUNICATIONS WITH INTERIOR AJB C283c DISCONNECTED

1



2



Interior AJB C283b

3



Interior AJB C283c

4



5



DATA LINK DIAGNOSTICS

● Did only the ABS, GEM, and PCM fail the DATA LINK DIAGNOSTICS test (RESCU module, DSM, and SCLM are optional modules and will fail if not equipped on the vehicle)?

→ **Yes**
GO to N20.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

N20 CHECK SCP COMMUNICATIONS WITH FEM C201c DISCONNECTED

1

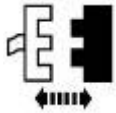


2



Interior AJB C283c

3



FEM C201c

4



5



DATA LINK DIAGNOSTICS

- Did only the GEM fail the DATA LINK DIAGNOSTICS test (RESCU module, DSM, and SCLM are optional modules and will fail if not equipped on the vehicle)?

→ **Yes**
 INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

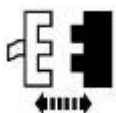
→ **No**
 GO to [N21](#).

N21 CHECK SCP COMMUNICATIONS WITH ANTI-LOCK BRAKE CONTROL MODULE C135 OR C155 DISCONNECTED

1



2



3



2 Disconnect the anti-lock brake control module with or without traction control C135 or the stability assist module C155.

4



DATA LINK DIAGNOSTICS

- Did only the ABS and GEM fail the DATA LINK DIAGNOSTICS test (RESCU module, DSM, and SCLM are optional modules and will fail if not equipped on the vehicle)?

→ Yes

INSTALL a new anti-lock brake control module or stability assist module. REFER to [Section 206-09A](#), [Section 206-09B](#), or [Section 206-09C](#).

→ No

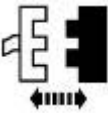
GO to [N22](#).

N22 CHECK SCP COMMUNICATIONS WITH FEM C201c DISCONNECTED

1



2



PCM C175a

3



4



DATA LINK DIAGNOSTICS


- Did only the GEM, PCM, and the ABS fail the DATA LINK DIAGNOSTICS test (RESCU module, DSM, and SCLM are optional modules and will fail if not equipped on the vehicle)?

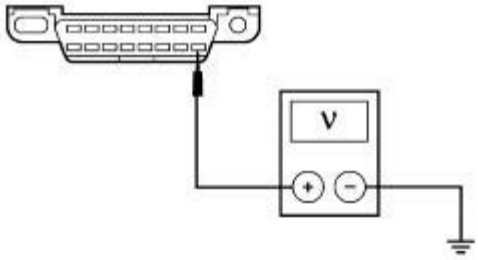
→ Yes

INSTALL a new PCM. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual. TEST the system for normal operation.

	<p>→ No REPAIR the circuit(s) in question between interior AJB C283c and FEM C201c, PCM C175a, anti-lock brake control module C135 or stability assist C155. REPAIR circuit 4-CF53 (GY/WH) between interior AJB C283c and the ABS test connector C126. REFER to Communication Circuit Wiring Repair in the section. TEST the system for normal operation.</p>
--	---

PINPOINT TEST O: NO MODULE / NETWORK COMMUNICATION — NO POWER TO THE DIAGNOSTIC TOOL

CONDITIONS	DETAILS/RESULTS/ACTIONS
O1 CHECK DIAGNOSTIC TOOL PINS FOR DAMAGE	
	<p>1 Inspect diagnostic tool pins.</p> <ul style="list-style-type: none"> ● Are the pins OK? <p>→ Yes GO to <u>O2</u>.</p> <p>→ No REPAIR diagnostic tool pins. TEST the system for normal operation.</p>
O2 CHECK DLC C251 FOR DAMAGE	
<p>1</p> 	<p>2 Inspect the DLC C251 pins for damage.</p> <ul style="list-style-type: none"> ● Are the pins OK? <p>→ Yes GO to <u>O3</u>.</p> <p>→ No REPAIR DLC C251. TEST the system for normal operation.</p>
O3 CHECK VOLTAGE TO DLC C251 PIN 16 — CIRCUIT 29-ED6 (OG/YE).	
<p>1</p>	<p>1 Measure the voltage between DLC C251 pin 16, circuit 29-ED6 (OG/YE), harness side and ground.</p>



A0004434

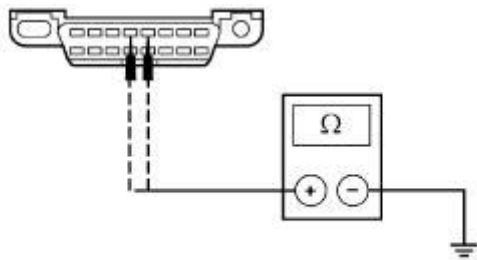
● Is the voltage greater than 10 volts?

→ **Yes**
GO to Q4.

→ **No**
REPAIR circuit 29-ED6 (OG/YE). TEST the system for normal operation.

Q4 CHECK THE DLC GROUND — CIRCUIT 31-ED6 (BK) AND CIRCUIT 91-ED6 (BN)

1



A0004435

1

Measure the resistance between DLC C251 pin 4, circuit 31-ED6 (BK), harness side and ground; and between DLC C251 pin 5, circuit 91-ED6 (BN), harness side and ground.

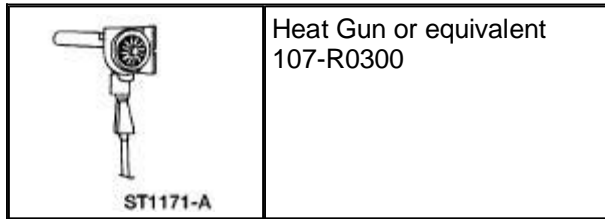
● Is the resistance less than 5 ohms?

→ **Yes**
CHECK diagnostic tool. TEST the system for normal operation.

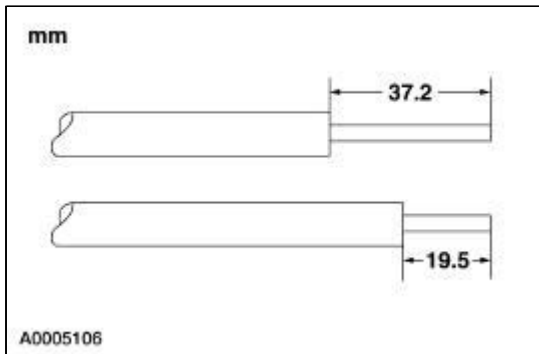
→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

Communication Circuit Wiring Repair

Special Tool(s)



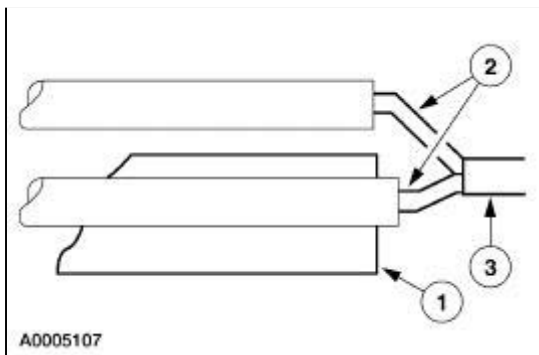
1. Disconnect the battery ground cable. Refer to [Section 414-01](#).
2. Strip the wires.



3. **NOTE:** Use rosin core mildly activated (RMA) solder, not acid core solder.

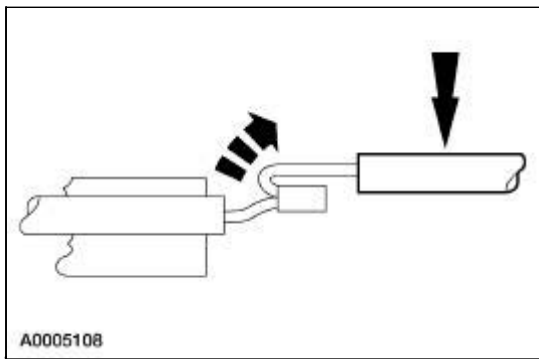
Solder the wires.

1. Install the heat shrink tube.
2. Twist the wires together.
3. Solder the wires together.

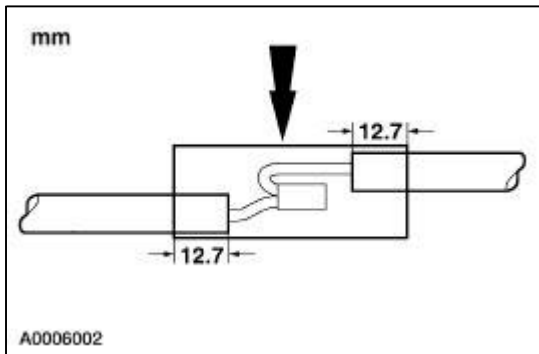


4. **NOTE:** Wait for the solder to cool before moving the wires.

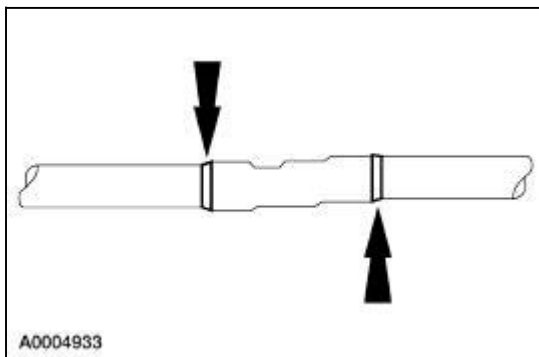
Bend the wires back in a straight line.



5. Position the heat shrink tube over the wire repair.
 - Overlap the heat shrink tube on both wires.




6. Use Heat Gun to heat the repaired area until adhesive flows out both ends of the heat shrink tube.



7. Reconnect the battery ground cable.
-

Module Configuration

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224 New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool
---	---

Principles of Operation

Some modules must be programmed as part of the repair procedure. If this procedure is not followed the module will not function correctly and may set a number of DTCs, including B2477 or P1639, which indicate that some necessary data has not been programmed into the module.

Modules that need programming should not be exchanged between vehicles. In most cases the parameter values or settings are unique to that vehicle, and if not set correctly will cause concerns or faults.

Some programmable parameters, such as belt minder on/off, can be changed from the factory setting at the customer's request.

WDS will automatically attempt to retrieve the module configuration information from all modules, and from a backup location in the powertrain control module (PCM) when vehicle ID is carried out. If the module and the PCM do not contain correct information, the diagnostic tool will either request "As Built" data or display a list of items that you will need to manually configure. The diagnostic tool will program the module based on the data you enter.

There are three different methods that are used for module programming:

- programmable module installation (PMI)
- calibration update
- programmable parameters

Some modules do not support all three methods.

Programmable Module Installation (PMI)

The programmable module installation (PMI) method is used when a new programmable module is installed on the vehicle. It is no longer necessary to command the diagnostic tool to gather module option content from the old module. The diagnostic tool automatically obtains any available module option content information from the old module during the vehicle ID routine that runs when the diagnostic tool is initially connected to the vehicle. It is important that you connect WDS to the vehicle and allow it to identify the vehicle and obtain configuration data prior to removing any modules.

Calibration Update

Calibration update is used to install a new calibration and strategy into a module. The updates are usually issued to fix a concern in the module software and would normally be addressed by a technical service bulletin (TSB). This method has been used by the PCM for several years. Other modules will be adopting this strategy as well.

Programmable Parameters

This method is used to configure parameters that can be modified in service. These are typically at the preference of the customer. Not all features controlled by the module are listed in this configuration method. Refer to the Module Configuration Index for a list of features by system.

If a module that has been modified using programmable parameters needs to be installed, the PMI procedure will maintain the parameters in their altered state if WDS is able to communicate with the old module during Vehicle ID. Otherwise you may need to use programmable parameters to return them to the altered state.

Vehicle Identification (VID) Block

Some PCMs contain a memory area called a vehicle identification (VID) block. The VID block is used to store backup data for each programmable module, as well as powertrain configuration information.

If the diagnostic tool cannot retrieve module option content information from the suspect module, the diagnostic tool will attempt to extract backup information from the PCM VID block.

The PCM VID block contains the factory settings for the configurable modules unless the PCM is flashed with a new calibration, in which case some PCM parameters may be modified.

As-Built Data Center

The As-Built Data Center maintains a record of the vehicle configuration in a database. The vehicle VIN is required to obtain this information. The As-Built Data Center records the applicable module configurations stored in each module before the vehicle leaves the factory. The As-Built Data Center will always reflect the original build of the vehicle as it left the factory. Only contact the As-Built Data Center when directed to do so by the diagnostic tool.

Inspection and Verification

1. Visually inspect for obvious signs of electrical damage. Refer to the following chart:

Visual Inspection Chart

Electrical
<ul style="list-style-type: none">● Wiring harness● Connectors

Configurable Modules

The vehicle contains the following modules that are configurable:

- anti-lock brake/traction control/IVD module (ABS)
- dual automatic temperature control (DATC)
- drivers door module (DDM)

- instrument cluster module (ICM)
- front electronics module (FEM)
- message center module (MCM)
- rear electronics module (REM)
- remote emergency satellite cellular unit (RESCU)
- audio control module (ACM)

Programmable Parameters Index

System	Programmable Parameter Items
Warnings and chimes	Belt minder
Security	<ul style="list-style-type: none"> ● Two-stage unlock ● Easy entry/exit <ul style="list-style-type: none"> ● Horn chirp ● Auto-locks
Message center	<ul style="list-style-type: none"> ● Default oil life warning threshold

Torque Specifications

Description	Nm	lb-in
Battery ground cable	10	89

Anti-Theft —Perimeter

The perimeter anti-theft system consists of:

- front door ajar switches (integral part of the latch assemblies)
 - rear door ajar switches (integral part of the latch assemblies)
 - underhood ajar switch
-

Anti-Theft — Perimeter

Refer to Wiring Diagrams Section [419-01A](#) for schematic and connector information.

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool

Principles of Operation

Anti-Theft Perimeter Protection Feature

The anti-theft perimeter protection feature is controlled by the front electronic module (FEM), the rear electronic module (REM), and the driver door module (DDM). This feature is configurable to the FEM and REM. The alarm can be armed using the remote transmitter to the DDM module which sends a message via the Standard Corporate Protocol (SCP) communication network to the FEM, or by using the driver door lock switch. The FEM and REM will then monitor all features which will activate the alarm. These features are:

- all door ajar switches
- hood and luggage compartment lid ajar switches
- radio and ignition switch, anti-theft switches

Additionally, a single security hardwire from the FEM to the REM is monitored for an open.

If any of the above features receive any activation once the alarm has been armed, the alarm will activate the visual and audible alerts.

Inspection and Verification

NOTE: If installing a new FEM, REM or DDM, the new module must be reconfigured. Refer to [Section 418-01](#).

1. Verify the customer concern by operating the perimeter anti-theft system.

2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Hood switch ● Door disarm switch(es) ● Luggage compartment lid disarm switch ● Ignition switch ● Anti-theft horn 	<ul style="list-style-type: none"> ● Central junction box CJB (CJB) Fuses: <ul style="list-style-type: none"> ■ 205 (5A) ■ 207 (5A) ■ 222 (10A) ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 422 (20A) ■ 425 (40A) ● FEM ● REM ● DDM ● Connectors ● Circuitry

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for front electronic module (FEM), go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for rear electronic module (REM), go to Pinpoint Test B.
 - NO RESP/NOT EQUIP for driver door module (DDM), go to Pinpoint Test C.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the FEM or REM.
6. If the DTCs retrieved are related to the concern, go to FEM Diagnostic Trouble Code (DTC) Index or REM Diagnostic Trouble Code (DTC) Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit	FEM	REFER to Section 417-02 .

	Failure		
B1342	ECU Is Defective	FEM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to <u>Section 419-10</u> . CLEAR the DTCs. REPEAT the self-test.
B1438	Wiper Mode Select Switch Circuit Failure	FEM	REFER to <u>Section 501-16</u> .
B1446	Wiper Park Sense Circuit Failure	FEM	REFER to <u>Section 501-16</u> .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to <u>Section 413-01</u> .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	REFER to <u>Section 417-01</u> .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to <u>Section 417-01</u> .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to <u>Section 417-01</u> .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	REFER to <u>Section 417-01</u> .
B1519	Hood Switch Circuit Failure	FEM	GO to <u>Pinpoint Test D</u> .
B1567	Lamp Headlamp High Beam Circuit Failure	FEM	REFER to <u>Section 417-01</u> .
B1676	Battery Pack Voltage Out of Range	FEM	REFER to <u>Section 414-00</u> .
B1794	Lamp Headlamp Low Beam Circuit Failure	FEM	REFER to <u>Section 417-01</u> .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	REFER to <u>Section 501-11</u> .
B2215	Window Passenger Front Down Switch Short to Battery	FEM	REFER to <u>Section 501-11</u> .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	REFER to <u>Section 501-09</u> .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	REFER to <u>Section 501-09</u> .
B2443	Powertrain Performance Mode Switch Circuit Failure	FEM	Not Used
B2477	Module Configuration Failure	FEM	REFER to <u>Section 418-01</u> .
C1284	Oil Pressure Switch Failure	FEM	REFER to <u>Section 413-01</u> .
C1446	Brake Switch Circuit Failure	FEM	REFER to <u>Section 413-01</u> .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to <u>Section 211-00</u> .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to <u>Section 211-00</u> .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	CARRY OUT the Powertrain Control Module (PCM) self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1041	SCP (J1850) Invalid or	ABS	CARRY OUT the Anti-Lock Brake Control Module

	Missing Data for Vehicle Speed		(ABS) self-test. REFER to Section 206-09A .
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the Powertrain Control Module (PCM) self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the Instrument Cluster (ICM) self-test. REFER to Section 413-01 .
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	CARRY OUT the Instrument Cluster (ICM) self-test. REFER to Section 413-01 .
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	ICM	CARRY OUT the Instrument Cluster (ICM) self-test. REFER to Section 413-01 .

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
AL_EVT1	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT2	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT3	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT4	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT5	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT6	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT7	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT8	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR
FLUID_1	Brake Fluid Level Switch #1	OFF, ON
HOOD_SW	Hood Ajar Switch	CLOSED, AJAR

IGN_R	Ignition Switch -RUN Position	NO, YES
L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position Sensor (Left/Right)	#####
PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%
R_HIGH	Right High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RADIOSW	Security Input Switch Status	OFF, ON
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-
STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	Volts
WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKS	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%
BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON

FRONT WINDOW CONTROL	PR DOWN	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
POWER MIRROR CONTROL	PR DOWN	OFF, ON
POWER MIRROR CONTROL	PR LEFT	OFF, ON
POWER MIRROR CONTROL	PR RIGHT	OFF, ON
POWER MIRROR CONTROL	PR UP	OFF, ON
STEERING COLUMN CONTROL COMMAND	LOCK_GND	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON
VAPS II OUTPUT PULSE CONTROL	VAPSIIOUT	%

REM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	REM	REFER to Section 413-01 .
B1300	Power Door Lock Circuit Failure	REM	REFER to Section 501-14B .
B1310	Power Door Unlock Circuit Failure	REM	REFER to Section 501-14B .
B1331	Decklid Ajar Rear Door Circuit Failure	REM	REFER to Section 417-02 .
B1335	Door Ajar RR Circuit Failure	REM	REFER to Section 417-02 .
B1342	ECU Is Defective	REM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1483	Brake Pedal Input Circuit Failure	REM	REFER to Section 417-01 .
B1499	Lamp Turn Signal Left Circuit Failure	REM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	REM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	REM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	REM	REFER to Section 417-01 .
B1551	Decklid Release Circuit Failure	REM	REFER to Section 501-14B .
B1571	Door Ajar LR Circuit Failure	REM	REFER to Section 417-02 .
B1676	Battery Pack Voltage Out of Range	REM	REFER to Section 414-00 .
B2172	Inertia Switch Input Circuit Open	REM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the Anti-Lock Brake Control Module (ABS) self-test. REFER to Section 206-09A .
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the Powertrain Control Module (PCM) self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the Instrument Cluster (ICM) self-test. REFER to Section 413-01 .

REM Parameter Identification (PID) Index

PID	Description	Expected Value
BOO	Brake Switch Input	OFF, ON
DECKLID	Decklid Ajar Switch	CLOSED, AJAR
DL_DSRM	Decklid Disarm	NO, YES
DLIDOUT	Decklid Driver	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
DLIDRLS	Deck Lid Release	OFF, ON
L_TAIL	Left and Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LMRKOUT	Left Marker Lamp Driver Output State	OFF, ON
LMRKSTB	Left Marker Lamp Driver Short To Battery	NO, YES
LR_TURN	Left and Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LRDN_SW	Left Rear Window Down Switch	OFF, UP
LRDR_SW	Left Rear Door Ajar Switch	CLOSED, AJAR
LRUP_SW	Left Rear Window Up Switch	OFF, DOWN
PD_LOCK	Passenger Door Lock	NO, YES
PD_UNLK	Passenger Door Unlock	NOTLOC, LOCK
R_TAIL	Left and Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-,

		OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RR_TURN	Left and Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RRDN_SW	Right Rear Window Down Switch	OFF, UP
RRDR_SW	Right Rear Door Ajar Switch	CLOSED, AJAR
RRUP_SW	Right Rear Window Up Switch	OFF, DOWN

REM Active Command Index

Active Command	Display	Action
EXTERIOR LAMP CONTROL	BACKUPLMP	OFF, ON
EXTERIOR LAMP CONTROL	H MNT STP	OFF, ON
EXTERIOR LAMP CONTROL	L STOP	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
EXTERIOR LAMP CONTROL	R DEF RLY	OFF, ON
EXTERIOR LAMP CONTROL	R FOG LMP	OFF, ON
EXTERIOR LAMP CONTROL	R STOP	OFF, ON
POWER WINDOW ENABLE COMMAND	PSGR RLY	OFF, ON
REAR DOOR LOCK CONTROL	LR LOCK	OFF, ON
REAR DOOR LOCK CONTROL	LR UNLOCK	OFF, ON
REAR DOOR LOCK CONTROL	RELEASE	OFF, ON
REAR WINDOW CONTROL	LR DOWN	OFF, ON
REAR WINDOW CONTROL	LR UP	OFF, ON
REAR WINDOW CONTROL	RR DOWN	OFF, ON
REAR WINDOW CONTROL	RR UP	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

DDM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1309	Power Door Lock Circuit Short to Ground	DDM	REFER to Section 501-14B .
B1341	Power Door Unlock Circuit Short to Ground	DDM	REFER to Section 501-14B .
B1342	ECU Is Defective	DDM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new DDM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.

B1400	Driver Power Window One Touch Window Relay Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1405	Driver Power Window Down Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1408	Driver Power Window Up Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1416	Power Window LR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1420	Passenger Power Window Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1424	Power Window RR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1530	Memory Set Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1534	Memory 1 Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1538	Memory 2 Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1676	Battery Pack Voltage Out of Range	DDM	REFER to Section 419-10 .
B2112	Door Driver Set Switch Stuck Failure	DDM	REFER to Section 501-14B .
B2116	Door Driver Reset Switch Stuck Failure	DDM	REFER to Section 501-14B .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2336	Mirror Switch Assembly Circuit Failure	DDM	REFER to Section 501-09 .
B2425	Remote Keyless Entry Out of Synchronization	DDM	REFER to Section 501-14B .
B2477	Module Configuration Failure	DDM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the Anti-Lock Brake Control Module (ABS) self-test. REFER to Section 206-09A .
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the Powertrain Control Module (PCM) self-test. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

DDM Parameter Identification (PID) Index

PID	Description	Expected Value
ALLOCK	All Doors Lock Sense	notACT, ACTIVE
CCNT	Number Of Continuous DTCs In Module	one count per bit

CNTUNLK	Central Door Unlock Switch Status	notACT, ACTIVE
D_DN_SW	Driver Window Down Switch	OFF, DOWN
D_DSRM	Driver Door Unlock Disarm Switch	NO, YES
D_PWPK	Driver Power Window Peak Current	AMP
D_UP_SW	Driver Window Up Switch	OFF, UP
DMIR_H	Driver Side Mirror Horizontal Motor	notSEN, SENSED
DMIR_V	Driver Mirror Vertical	notSEN, SENSED
DR_LOCK	Driver Door Lock Output State	NO, YES
DR_UNLK	All Doors Unlock Output State	NO, YES
DRLKCYL	Door Lock Cylinder	notACT, ACTIVE
DVMRPSH	Driver Mirror Horizontal Position	one count per bit
DVMRPSV	Driver Mirror Position	one count per bit
LRDN_SW	Left Rear Down Activated	OFF, DOWN
LRUP_SW	Left Rear Up Activated	OFF, UP
MEM1_SW	Memory Recall Switch #1	notACT, ACTIVE
MEM2_SW	Memory Recall Switch #2	notACT, ACTIVE
MEMS_SW	Memory Set Switch	notACT, ACTIVE
MIR_SEL	Power Mirror Select Switch	DRVMIR, PSGMIR, OFF
MIRH_SW	Pow Mir Position Switch - Horizontal	SHORT, RIGHT, LEFT, OFF
MIRV_SW	Power Mir Position Switch - Vertical	SHORT, UP, DOWN, OFF
OTD_SW	One Touch Down Switch	OFF, DOWN
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_UP_SW	Passenger Up Activated	OFF, UP
RRDN_SW	Right Rear Down Activated	OFF, DOWN
RRUP_SW	Right Rear Up Activated	OFF, UP
VBAT	Battery Voltage	Volts

DDM Active Command Index

Active Command	Display	Action
DOOR LOCK CONTROL	DD LOCK	OFF, ON
DOOR LOCK CONTROL	DD UNLOCK	OFF, ON
DOUBLE LOCK COMMAND	DOUBLE LK	UNLOCK, LOCK
FRONT WINDOW CONTROL	DR DOWN	OFF, ON
FRONT WINDOW CONTROL	DR UP	OFF, ON
ONE TOUCH WINDOW DOWN & ACCY DELAY	ONE TOUCH	OFF, ON
POWER MIRROR CONTROL	DR DOWN	OFF, ON
POWER MIRROR CONTROL	DR LEFT	OFF, ON
POWER MIRROR CONTROL	DR RIGHT	OFF, ON
POWER MIRROR CONTROL	DR UP	OFF, ON

Symptom Chart

Symptom Chart


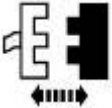
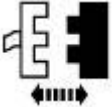

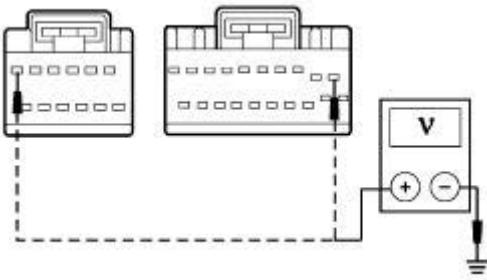
Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the front electronic module (FEM) 	<ul style="list-style-type: none"> FEM. BJB Fuses 425 (40A), 422 (20A). Circuitry. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> No communication with the rear electronic module (REM) 	<ul style="list-style-type: none"> CJB Fuse 235 (5A). Circuitry. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
<ul style="list-style-type: none"> No communication with the driver door module (DDM) 	<ul style="list-style-type: none"> CJB Fuse 207 (5A), 222 (10A). Circuitry. DDM. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> The alarm system does not operate correctly — lights flash five times when arming the system 	<ul style="list-style-type: none"> CJB Fuse 205 (5A). Ignition switch. Hood ajar switch. Door ajar switch. Circuitry. FEM. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test D.
<ul style="list-style-type: none"> The alarm system does not arm/disarm — using the driver set switch 	<ul style="list-style-type: none"> Switch. Circuitry. DDM. 	<ul style="list-style-type: none"> GO to Pinpoint Test E.
<ul style="list-style-type: none"> The alarm system does not arm/disarm — using the remote transmitter 	<ul style="list-style-type: none"> Transmitter. DDM. 	<ul style="list-style-type: none"> GO to Pinpoint Test F.
<ul style="list-style-type: none"> Battery voltage out of range — FEM 	<ul style="list-style-type: none"> Circuitry. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test G.
<ul style="list-style-type: none"> Battery voltage out of range — REM 	<ul style="list-style-type: none"> Circuitry. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test H.
<ul style="list-style-type: none"> Battery voltage out of range — DDM 	<ul style="list-style-type: none"> Circuitry. DDM. 	<ul style="list-style-type: none"> GO to Pinpoint Test I.
<ul style="list-style-type: none"> The alarm system does not operate correctly — alarm does not activate with hood ajar/open 	<ul style="list-style-type: none"> Circuitry. Hood ajar switch. FEM. 	<ul style="list-style-type: none"> GO to Pinpoint Test J.

Pinpoint Tests



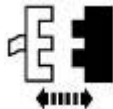
CAUTION: Electronic modules are sensitive to electrical charges. If exposed to these charges, damage may result.

PINPOINT TEST A: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE (FEM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK22 (OG/YE) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"> 1  </div> <div style="margin-bottom: 10px;"> 2  <p style="margin-left: 100px;">FEM C201c</p> </div> <div style="margin-bottom: 10px;"> 3  <p style="margin-left: 100px;">FEM C201f</p> </div> <div style="margin-bottom: 10px;"> 4  </div> <div style="margin-bottom: 10px;"> 5  <p style="margin-left: 20px;">A0006297</p> </div> </div>	<div style="margin-top: 20px;"> 5 Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22 (OG/YE) harness side and ground. </div> <div style="margin-top: 20px;"> <ul style="list-style-type: none"> ● Are the voltages greater than 10 volts? </div> <div style="margin-top: 10px;"> <p>→ Yes GO to <u>A2</u>.</p> </div> <div style="margin-top: 10px;"> <p>→ No REPAIR the circuit(s) in question. TEST the system for normal operation.</p> </div>
A2 CHECK CIRCUITS 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS	
1	

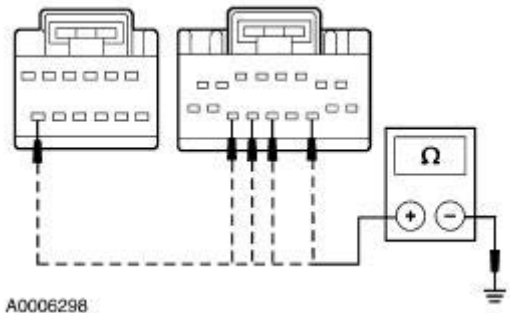


2



FEM C201a

3



A0006298

3 Using the following table, measure the resistance between FEM connectors, harness side and ground:

FEM	Pin	Circuit
C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)
C201a	15	31-DK20D (BK/RD)

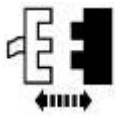
• Are the resistances less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST B: NO COMMUNICATION WITH THE REAR ELECTRONIC MODULE (REM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CIRCUIT 29-DK31 (OG/BK) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p> <p>2</p> <p>REM C420d</p> <p>3</p>	

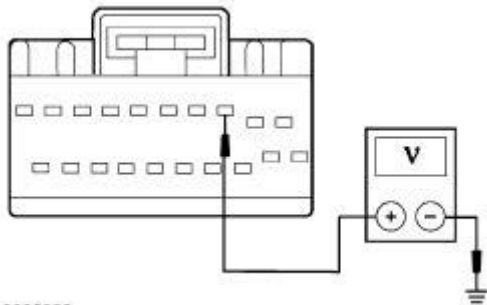


REM C420c

4



5



A0006299

5

Measure the voltage between REM C420d pin 3, circuit 29-DK31 (OG/BK), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to B2.

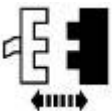
→ **No**
REPAIR the circuit. TEST the system for normal operation.

B2 CHECK CIRCUITS 29S-DK31 (OG/BK), 31-DK30D (BK), 31-DK30E (BK), 31-DK30F (BK), 31-DK30G (BK) AND 31-DK30H (BK/OG), FOR OPENS

1

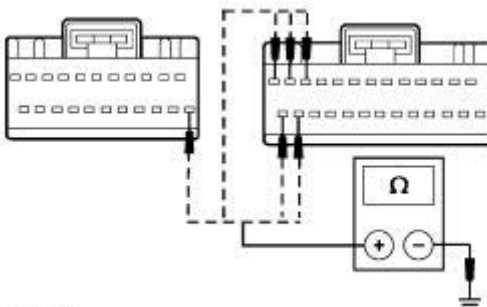


2



REM C420b

3



A0006300

3

Using the following table, measure the resistance between REM connectors, harness side and ground:

REM	Pin	Circuit
C420c	13	29S-DK31 (OG/BK)
C420c	12	31-DK30E (BK)
C420c	11	31-DK30D (BK)
C420c	26	31-DK30G (BK)
C420c	25	31-DK30F (BK)


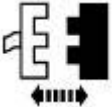

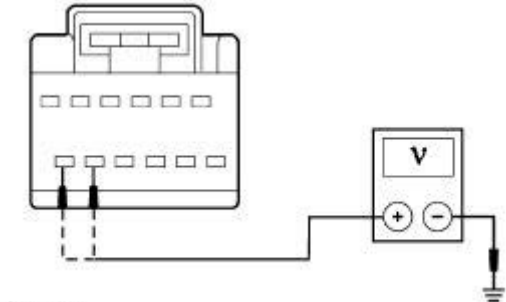
C420b | 12 | 31-DK30H (BK/OG)


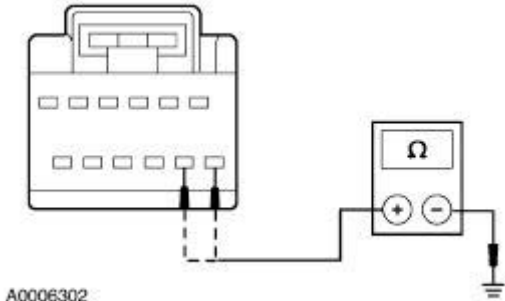
- Are the resistances less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST C: NO COMMUNICATION WITH THE DRIVER DOOR MODULE (DDM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK CIRCUITS 29-AJ80 (OG) AND 29S-AJ86 (OG/BU) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>2</p>  <p>DDM C501a</p> <p>3</p>  <p>4</p>  <p>A0006301</p>	<p>4</p> <p>Measure the voltage between DDM C501a pin 11, circuit 29-AJ80 (OG), harness side and ground; and between DDM C501a pin 12, circuit 29S-AJ86 (OG/BU), harness side and ground.</p> <ul style="list-style-type: none">● Is the voltage greater than 10 volts? <p>→ Yes GO to <u>C2</u>.</p> <p>→ No</p>

	REPAIR the circuit(s) in question. TEST the system for normal operation.
C2 CHECK CIRCUITS 31-AJ80B (BK/OG) AND 91-AJ80 (BN/BU) FOR OPENS	
<p>1</p>  <p>2</p>  <p>A0006302</p>	<p>2</p> <p>Measure the resistance between DDM C501a pin 7, circuit 91-AJ80 (BN/BU), harness side and ground; and between DDM C501a pin 8, circuit 31-AJ80B (BK/OG), harness side and ground.</p> <ul style="list-style-type: none"> ● Is the resistance less than 5 ohms? <p>→ Yes REFER to Section 418-00.</p> <p>→ No REPAIR the circuit(s) in question. TEST the system for normal operation.</p>

PINPOINT TEST D: THE ANTI-THEFT SYSTEM DOES NOT OPERATE CORRECTLY — LIGHTS FLASH FIVE TIMES WHEN ARMING THE SYSTEM

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — FEM	<p>1</p> <p>Use the recorded FEM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any FEM DTCs recorded? <p>→ Yes If DTC B1519, GO to D5.</p> <p>For all other FEM DTCs, REFER to the FEM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to D2.</p>
D2 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — REM	

1 Use the recorded REM DTCs from the continuous and on-demand self-test.

- **Are any REM DTCs recorded?**

→ **Yes**
REFER to the REM Diagnostic Trouble Code (DTC) Index.

→ **No**
GO to D3.

D3 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — DDM

1 Use the recorded DDM DTCs from the continuous and on-demand self-test.

- **Are any DDM DTCs recorded?**

→ **Yes**
REFER to the DDM Diagnostic Trouble Code (DTC) Index.

→ **No**
GO to D4.

D4 CHECK THE INTERIOR COURTESY LAMP OPERATION

1 Open and close each door, while observing the interior courtesy lamps.

2 Open and close the luggage compartment lid, while observing the luggage compartment lamp.


- **Do the courtesy lamps operate correctly?**

→ **Yes**
GO to D5.

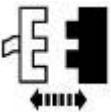
→ **No**
REFER to Section 417-02.

D5 CHECK FOR A FAULTY HOOD AJAR SWITCH

1



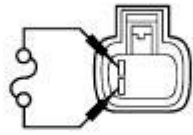
2



Hood Ajar Switch C127

3

3 Monitor the FEM PID HOOD_SW, while connecting a fused jumper wire between



A0003769

hood ajar switch C127 pin 1, circuit 8-GL7 (WH), harness side and hood ajar switch C127 pin 2, circuit 31-GL7 (BK/YE), harness side.

- Does the FEM PID HOOD_SW change from AJAR to CLOSED?

→ **Yes**
INSTALL a new hood ajar switch. CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to D6.

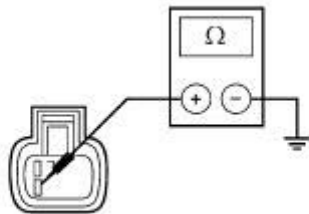
D6 CHECK CIRCUIT 31S-GL7 (BK/YE) FOR AN OPEN

1



Hood Ajar Switch C127

2



A0003770

- 2 Measure the resistance between hood ajar switch C127 pin 2, circuit 31-GL7 (BK/YE), harness side and ground.

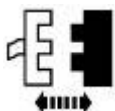
- Is the resistance less than 5 ohms?

→ **Yes**
GO to D7.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

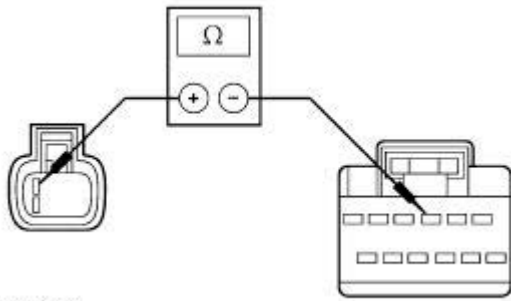
D7 CHECK CIRCUIT 8-GL7 (WH) FOR AN OPEN

1



FEM C201c

2



A0003771

2 Measure the resistance between hood ajar switch C127 pin 2, circuit 8-GL7 (WH), harness side and FEM C201c pin 3, circuit 8-GL7 (WH) harness side.

● Is the resistance less than 5 ohms?

→ **Yes**

Vehicles equipped with manual transmission GO to D8.

All others INSTALL a new FEM. For additional information, REFER to Section 419-10.

CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

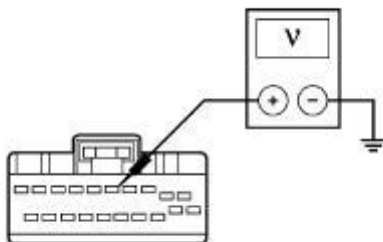
D8 CHECK CIRCUIT 91S-GL13 (BK/YE) FOR SHORT TO BATTERY

1



FEM C201f

2



A0003766

2 Measure the voltage between FEM C201f pin 5, circuit 91S-GL13 (BK/YE), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**

GO to D9.

→ **No**

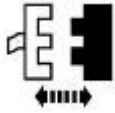
GO to D10.

D9 CHECK REM FOR AN INTERNAL SHORT TO BATTERY

1



2

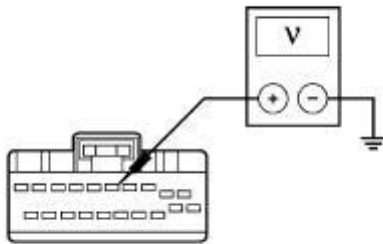


REM C420d

3



4



A0003766

4 Measure the voltage between FEM C201f pin 5, circuit 91S-GL13 (BK/YE), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

→ **No**
INSTALL a new REM. For additional information, REFER to Section 419-10.
CLEAR the DTCs. REPEAT the self-test.

D10 CHECK REM OPERATION

1

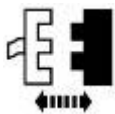


2



FEM C201f

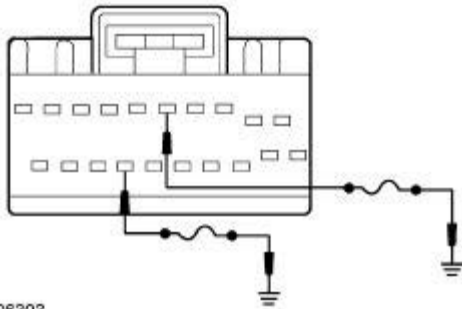
3



REM C420d

4

4 Using a fused jumper wire, jumper REM



A0006303

C420d pin 5, circuit 91S-GL13 (BN) to ground. Using a second fused jumper wire, jumper C420d pin 17, circuit 31S-GL19 (BK/GN) to ground.

- 5 Close all doors, hood and luggage compartment lid.
- 6 Arm the anti-theft system.

● **Do the lights flash five times when the system is armed?**

- **Yes**
Remove jumper wires. GO to D11.
- **No**
INSTALL a new REM. For additional information, REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

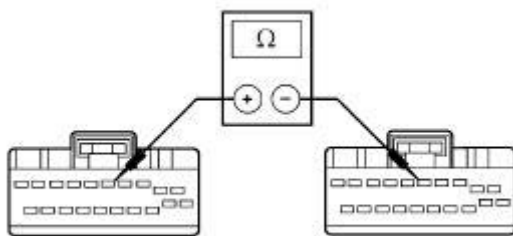
D11 CHECK CIRCUIT 91S-GL13 (BK/YE) FOR AN OPEN

1



FEM C201f

2




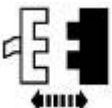
A0003768

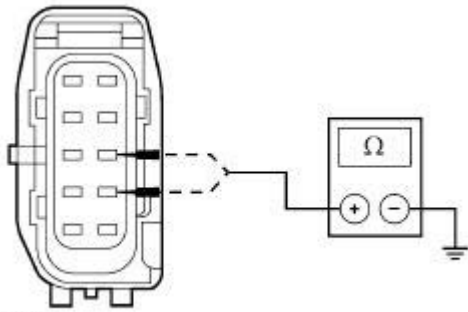
- 2 Measure the resistance between FEM C201f pin 5, circuit 91S-GL13 (BK/YE), harness side and REM C420d pin 5, circuit 91S-GL13 (BK/YE), harness side.

● **Is the resistance less than 5 ohms?**

- **Yes**
INSTALL a new FEM. For additional information, REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.
- **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST E: THE ALARM SYSTEM DOES NOT ARM/DISARM — USING THE DRIVER SET SWITCH

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 RETRIEVE THE RECORDED DTC CODES — DDM	
	<p>1 Use the recorded DDM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DDM DTCs recorded? <p>→ Yes If DTC B2112 or B2116, GO to <u>E3</u>.</p> <p>→ No GO to <u>E2</u>.</p>
E2 CHECK THAT THE DRIVER DOOR LOCK AND UNLOCK PIDS READ CORRECTLY	
	<p>1 Monitor the DDM PIDs D_DSRRM and DRLKCYL while turning the key in the driver door lock cylinder to the LOCK and UNLOCK positions.</p> <ul style="list-style-type: none"> ● Do the DDM PID values agree with the LOCK positions? <p>→ Yes INSTALL a new DDM. For additional information, REFER to <u>Section 419-10</u>. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No GO to <u>E5</u>.</p>
E3 CHECK CIRCUIT 31S-AA78 (BK/BU) AND 31S-AA79 (BK/WH) FOR SHORT TO GROUND	
<p>1</p>  <p>2</p>  <p style="text-align: center;">Driver Door Lock Actuator C525</p> <p>3</p>	<p>3 Measure the resistance between driver door lock actuator C525 pin 5, circuit 31S-AA79 (BK/WH) harness side and ground; and between C525 pin 7, circuit 31S-AA78 (BK/BU) harness side and ground.</p>



A0003772

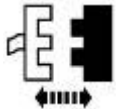
- Are the resistances greater than 10,000 ohms?

→ **Yes**
 INSTALL a new driver door lock actuator/ajar switch. For additional information, REFER to [Switch—Front Door Ajar](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
 GO to [E4](#).

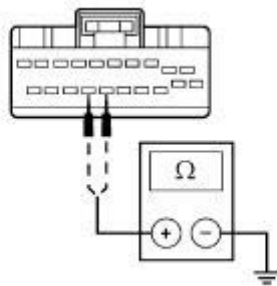
E4 CHECK THE DDM FOR INTERNAL SHORT TO GROUND

1



DDM C501c

2



A0003773

- 2 Measure the resistance between DDM C501c pin 16, circuit 31S-AA78 (BK/BU), harness side and ground; and between DDM C501c pin 17, circuit 31S-AA79 (BK/WH), harness side and ground.

- Are the resistances greater than 10,000 ohms?

→ **Yes**
 INSTALL a new DDM. For additional information, REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

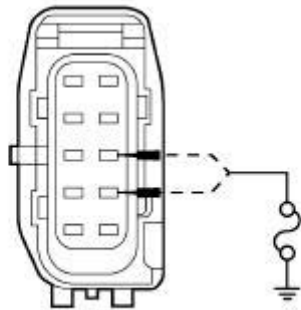
→ **No**
 REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

E5 CHECK THE DRIVER SET AND DRIVER RESET SWITCH

1



2



A0003774

2

Monitor the DDM PIDs D_DSRLM and DRLKCYL while connecting a jumper wire between the driver door ajar switch C525 pin 5, circuit 31S-AA79 (BK/WH) harness side and ground; and between C525 pin 7, circuit 31S-AA78 (BK/BU) harness side and ground.

- Do the DDM PID values agree with the LOCK positions?

→ Yes

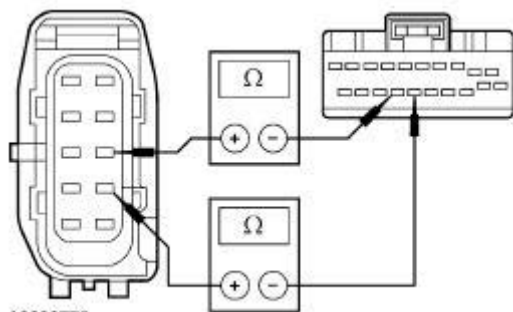
INSTALL a new driver door lock actuator/ajar switch. For additional information, REFER to Switch—Front Door Ajar. CLEAR the DTCs. REPEAT the self-test.

→ No

GO to E6.

E6 CHECK CIRCUITS 31S-AA78 (BK/BU) AND 31S-AA79 (BK/WH)

1



A0003775

1

Measure the resistance between DDM C501c pin 16, circuit 31S-AA78 (BK/BU), harness side and driver door ajar switch C525 pin 7, circuit 31S-AA78 (BK/BU), harness side; and DDM C501c pin 17, circuit 31S-AA79 (BK/WH), harness side and driver door ajar switch C525 pin 5, circuit 31S-AA79 (BK/WH), harness side.

- Is the resistance less than 5 ohms?

→ Yes



INSTALL a new DDM. For additional information, REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ No

REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST F: THE ALARM SYSTEM DOES NOT ARM/DISARM



— USING THE REMOTE TRANSMITTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE ALARM SYSTEM USING THE DRIVER SET SWITCH	
	<p>1 ARM and DISARM the alarm system using the driver set switch.</p> <ul style="list-style-type: none"> ● Does the alarm system set and reset correctly? <p>→ Yes GO to <u>F2</u>.</p> <p>→ No GO to <u>Pinpoint Test E</u>.</p>
F2 DETERMINE IF DDM IS RECEIVING CORRECT UNLOCK COMMANDS FROM THE KEY FOB	
<p>2</p> 	<p>1 Remove the key from the ignition.</p> <p>2 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the lock and unlock buttons on the remote transmitter.</p> <ul style="list-style-type: none"> ● Does LAST DATA RECEIVED match the button pressed of the remote transmitter? <p>→ Yes INSTALL a new DDM. For additional information, REFER to <u>Section 419-10</u>. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No GO to <u>F3</u>.</p>
F3 REPLACE THE BATTERY IN REMOTE TRANSMITTER AND RETEST	
<p>2</p> 	<p>1 Replace battery in remote transmitter.</p> <p>2 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the lock and unlock buttons on the remote transmitter.</p> <ul style="list-style-type: none"> ● Does LAST DATA RECEIVED match the button pressed of the remote transmitter? <p>→ Yes Fault found as low battery. TEST for normal operation.</p> <p>→ No GO to <u>F4</u>.</p>
F4 REPROGRAM REMOTE TRANSMITTER TO DDM	
<p>NOTE: When carrying out the following procedure, it must be noted that all previous programmed remote transmitters will be erased. The customer needs to be informed that any remote transmitters not present during the programming mode will not operate the vehicle. All remote transmitters must be programmed at the same time.</p>	

Reprogram the remote transmitter to the DDM. For additional information, refer to [Section 501-14B](#).

	<p>1 Monitor the DDM FUNCTION TEST TIC/DATA while pressing the lock and unlock buttons on the remote transmitter.</p> <ul style="list-style-type: none"> ● Does LAST DATA RECEIVED match the button pressed of the remote transmitter? <p>→ Yes SYSTEM is OK. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No PROGRAM a new remote transmitter to the vehicle. For additional information, REFER to Section 501-14B. CLEAR the DTCs. REPEAT the self-test. If the problem still remains, INSTALL a new DDM and program the remote transmitter to the vehicle. For additional information, REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p>
--	---

PINPOINT TEST G: BATTERY VOLTAGE OUT OF RANGE— FEM

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — FEM	<p>1 Use the recorded FEM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any FEM DTCs recorded? <p>→ Yes If DTC B1676, GO to G2.</p> <p>→ No GO to G3.</p>
G2 CHECK PID FOR BATTERY VOLTAGE	
NOTE: Cycle the ignition from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>2</p> 	<p>2 Monitor the FEM PID VBAT.</p> <ul style="list-style-type: none"> ● Is the voltage between 9 and 16 volts? <p>→ Yes RUN self-test. If DTC B1676 is still present, INSTALL a new FEM. For</p>

additional information, REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
GO to [G3](#).

G3 CHECK VOLTAGE SUPPLY TO THE MODULE

1



2



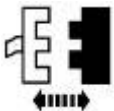
FEM C201f

3



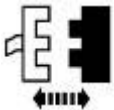
FEM C201c

4



FEM C201a

5



FEM C201d

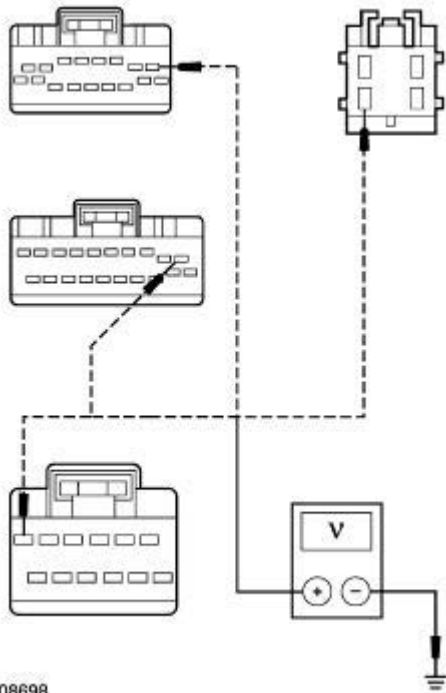
6



7

7 Using the following table, measure the voltage between FEM connectors, harness side and ground:

FEM Connector	Pin	Circuit
C201f	1	29-DK22 (OG/YE)
C201c	6	29-DK20 (OG/GN)
C201a	1	29S-DK21 (OG/WH)
C201d	3	30-AJ71 (RD/YE)



- Are the voltages between 9 and 16 volts?

→ **Yes**
 INSTALL a new FEM. For additional information, REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**
 REFER to Section 414-00 for further diagnosis.

PINPOINT TEST H: BATTERY VOLTAGE OUT OF RANGE— REM

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — REM	<p>1 Use the recorded REM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes If DTC B1676, GO to <u>H2</u>.</p> <p>→ No GO to <u>H3</u>.</p>
H2 CHECK PID FOR BATTERY VOLTAGE	
NOTE: Cycle the ignition from OFF to RUN to enable the switched system power feature.	

1



2



2 Monitor the REM PID VBAT.

● Is the voltage between 9 and 16 volts?

→ **Yes**
RUN self-test. If DTC B1676 is still present, INSTALL a new REM. For additional information, REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

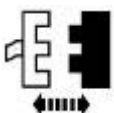
→ **No**
GO to [H3](#).

H3 CHECK VOLTAGE SUPPLY TO THE MODULE

1

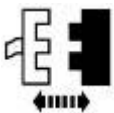


2



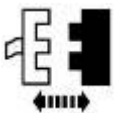
REM C420d

3



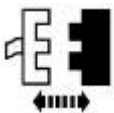
REM C420c

4



REM C420f

5

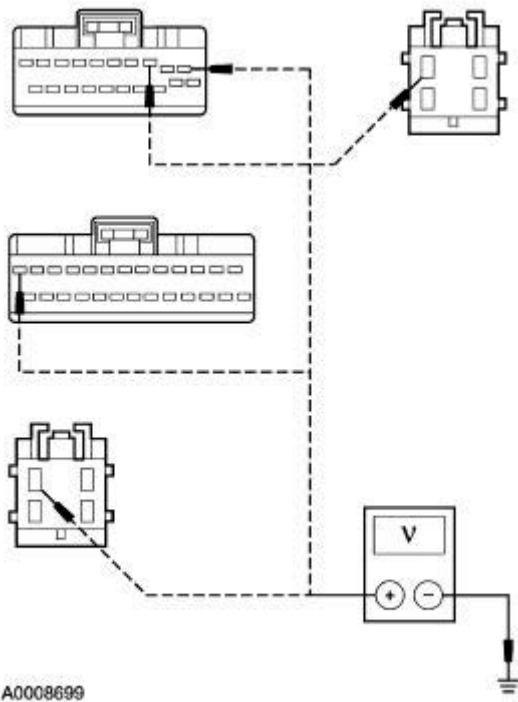


REM C420g

6



7



7

Using the following table, measure the voltage between REM connectors, harness side and ground:

REM Connector	Pin	Circuit
C420d	1	15S-DK32 (GN/RD)
C420d	3	30-DK31 (OG/BK)
C420c	13	29S-DK31 (OG/BK)
C420f	4	30-DK30A (BK)
C420g	2	30-DK30 (RD)

- Are the voltages between 9 and 16 volts?

→ **Yes**
 INSTALL a new REM. For additional information, REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
 REFER to [Section 414-00](#) for further diagnosis.

PINPOINT TEST I: BATTERY VOLTAGE OUT OF RANGE— DDM

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 RETRIEVE THE RECORDED DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — DDM	<p>I1 Use the recorded DDM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> • Are any DTCs recorded? <p>→ Yes If DTC B1676, GO to I2.</p> <p>→ No GO to I3.</p>
I2 CHECK PID FOR BATTERY VOLTAGE	

NOTE: Cycle the ignition from OFF to RUN to enable the switched system power feature.

1



2



2

Monitor the DDM PID VBAT.

● **Is the voltage between 9 and 16 volts?**

→ **Yes**

RUN self-test. If DTC B1676 is still present, **INSTALL** a new DDM. For additional information, REFER to [Section 419-10](#). **CLEAR** the DTCs. **REPEAT** the self-test.

→ **No**

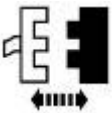
GO to [I3](#).

I3 CHECK VOLTAGE SUPPLY TO THE MODULE

1

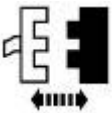


2



DDM C501a

3



DDM C501b

4

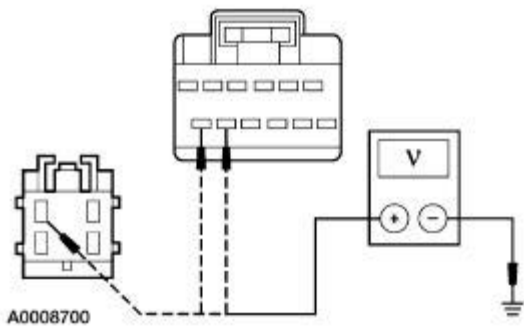


5

5

Using the following table, measure the voltage between DDM connectors, harness side and ground:

DDM Connector	Pin	Circuit
C501a	11	29-AJ80 (OG)
C501a	12	29S-AJ86 (OG/BU)



- Are the voltages between 9 and 16 volts?

→ **Yes**

INSTALL a new DDM. For additional information, REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

REFER to [Section 414-00](#) for further diagnosis.

PINPOINT TEST J: THE ALARM SYSTEM DOES NOT OPERATE CORRECTLY — ALARM DOES NOT ACTIVATE WITH HOOD AJAR/OPEN

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — FEM	<p>1 Use the recorded FEM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any FEM DTCs recorded? <p>→ Yes If DTC B1519, GO to D5.</p> <p>For all other FEM DTCs, REFER to the FEM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to J2.</p>
J2 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — REM	<p>1 Use the recorded REM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any REM DTCs recorded? <p>→ Yes</p>

REFER to the REM Diagnostic Trouble Code (DTC) Index.

→ **No**
GO to J3.

J3 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — DDM

1 Use the recorded DDM DTCs from the continuous and on-demand self-test.

● **Are any DDM DTCs recorded?**

→ **Yes**
REFER to the DDM Diagnostic Trouble Code (DTC) Index.

→ **No**
GO to J4.

J4 CHECK HOOD AJAR SWITCH OPERATION

1



3



2 Close hood.

3 Monitor the FEM PID HOOD_SW while opening the hood.

● **Does the FEM PID HOOD_SW change from CLOSED to AJAR?**

→ **Yes**
CHECK for sticking hood ajar switch.
TEST for normal operation.

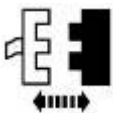
→ **No**
GO to J5.

J5 CHECK FOR A FAULTY HOOD AJAR SWITCH

1



2



Hood Ajar Switch C127

1 Monitor the FEM PID HOOD_SW.

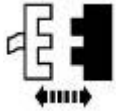
● **Does the FEM PID HOOD_SW change when hood ajar switch is**

disconnected?

- **Yes**
INSTALL a new hood ajar switch. CLEAR the DTCs. REPEAT the self-test.
- **No**
GO to J6.

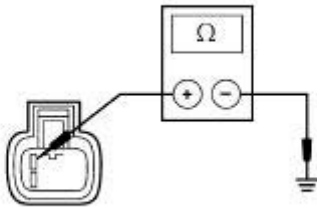
J6 CHECK CIRCUIT 8-GL7 (WH) FOR AN OPEN

1



FEM C201c

2



A0006304

- 2 Measure the resistance between hood ajar switch C127 pin 1, circuit 8-GL7 (WH), harness side and ground.

● **Is the resistance greater than 10,000 ohms?**

- **Yes**
INSTALL a new FEM. For additional information, REFER to Section 419-10 .
CLEAR the DTCs. REPEAT the self-test.
- **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Switch —Front Door Ajar

Removal and Installation

NOTE: The front door ajar switch is an integral part of the door latch assembly.

For additional information, refer to [Section 501-14A](#).

Switch —Rear Door Ajar

Removal and Installation

NOTE: The rear door ajar switch is an integral part of the door latch assembly.

For additional information, refer to [Section 501-14A](#).

Torque Specifications

Description	Nm	lb-in
Battery ground cable	10	89

Anti-Theft — Passive Anti-Theft System (PATS)

The passive anti-theft system (PATS) contains the following components:

- theft indicator
- encoded ignition key
- transceiver module
- instrument cluster
- powertrain control module (PCM)
- standard corporate protocol (SCP) communication network
- starter relay

The PATS uses radio frequency identification technology to deter a driveaway theft. Passive means that it does not require any activity from the user. This system is known as SecuriLock® in North America, Safeguard® in the U.K. and PATS in continental Europe. This information can be found in customer literature such as the Owner's Literature.

The PATS uses a specially encoded ignition key. Each encoded ignition key contains a permanently installed electronic device called a transponder. Each transponder contains a unique electronic identification code, with over 10 billion billion combinations.

Each encoded ignition key must be programmed into the vehicle instrument cluster before it can be used to start the engine. There are special diagnostic procedures outlined in the manual that must be carried out if the encoded ignition keys need to be replaced.

The encoded key is larger than a traditional ignition key. The key does not require batteries and should last the life of the vehicle.

The transceiver module communicates with the encoded ignition key. The transceiver contains an antenna connected to a small electronics module and is located behind the instrument panel attached to the ignition lock casting. During each vehicle start sequence, the transceiver module reads the encoded ignition key identification code and sends the data to the instrument cluster.

The control functions are contained in the instrument cluster. This module carries out all of the PATS functions such as receiving the identification code from the encoded ignition key and controlling the engine enable. The instrument cluster initiates the key interrogation sequence when the key is inserted into the vehicle ignition switch and also when the vehicle ignition switch is turned to RUN or START.

The PATS uses the PCM to enable or disable the engine. The instrument cluster communicates with the PCM over the SCP communication network in order to enable engine operation. The instrument cluster and the PCM use sophisticated messages in order to prevent a theft. The instrument cluster and the PCM share security data when first installed together that makes them a matched pair. After this security data sharing, these modules will not function in other vehicles. The shared PCM ID is remembered even if the battery is disconnected. The instrument cluster also stores the vehicle key identification code even if the battery is disconnected. There are special diagnostic procedures outlined in this workshop manual that may be carried out if either the instrument cluster or the PCM needs replacement.

All elements of PATS must be functional before the engine is allowed to start. If any of the components are not working correctly, the vehicle will not start.

PATS uses a visual theft indicator. This indicator will prove out for three seconds when the ignition

switch is turned to RUN or START under normal operation. If there is a PATS problem, this indicator will either flash rapidly or glow steadily (for more than three seconds) when the ignition switch is turned to RUN or START.

PATS differs from perimeter anti-theft systems in that PATS enables and disables the engine from starting. If equipped, the perimeter anti-theft system protects the perimeter of the vehicle (doors, hood and trunk) and sounds an alarm.

PATS also disables the starter motor in addition to the PCM disabling the engine. When PATS disables the vehicle, it will neither crank nor start. If the instrument cluster is removed from the vehicle, the engine will not crank.

The starter relay is used as an additional means of disabling the vehicle engine. The starter relay is disabled when the PATS cannot read a valid encoded ignition key at ignition ON. The PATS will not store a diagnostic trouble code (DTC) or flash the theft indicator if a valid encoded ignition key is read but a fault occurs in the starter relay circuit.

The PATS is not compatible with aftermarket remote start system, which allow the vehicle to be started from outside the vehicle. These systems may reduce the vehicle security level, and also may cause no-start issues. Remote start systems must be removed before investigation of PATS-related no start issues.

Anti-Theft — Passive Anti-Theft System (PATS)

Refer to Wiring Diagrams Section [419-01B](#), Anti-Theft for schematic and connector information.

Special Tool(s)

 <p>ST1137-A</p>	<p>73III Automotive Meter 105-R0057</p>
 <p>ST2332-A</p>	<p>Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool</p>

Inspection and Verification

NOTE: The instrument cluster must be reconfigured after replacement. Refer to [Section 418-01](#).

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Large metallic objects, devices such as electronic debit transponders or a second ignition key on the same key ring as the PATS ignition key ● Ignition lock cylinder ● Encoded ignition key (PATS key) ● Use of non-encoded ignition key (key without the molded plastic head, non-PATS key) ● Use of a non-programmed encoded ignition key 	<ul style="list-style-type: none"> ● Central junction box (CJB) Fuse 224 (5A) ● Instrument cluster ● PATS transceiver module ● Connectors ● Ignition switch

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.

4. If diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTICS. If diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for instrument cluster module (ICM), go to Pinpoint Test A.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the ICM.
6. If the DTCs retrieved are related to the concern, go to Instrument Cluster Diagnostic Trouble Code (DTC) Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

Instrument Cluster Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	ICM	REFER to Section 413-01 .
B1205	EIC Switch-1 Assembly Circuit Failure	ICM	REFER to Section 413-01 .
B1209	EIC Switch-2 Assembly Circuit Failure	ICM	REFER to Section 413-01 .
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	ICM	GO to Pinpoint Test D .
B1246	Dim Panel Potentiometer Switch Circuit Failure	ICM	REFER to Section 413-00 .
B1342	ECU Is Defective	ICM	CLEAR the DTCs. Carry out the instrument cluster self-test. If DTC B1342 is retrieved again, INSTALL a new instrument cluster. REFER to Section 413-01 .
B1352	Ignition Key-In Circuit Failure	ICM	REFER to Section 211-05 .
B1470	Lamp Headlamp Input Circuit Failure	ICM	REFER to Section 417-01 .
B1567	Lamp Headlamp High Beam Circuit Failure	ICM	REFER to Section 417-01 .
B1600	PATS Ignition Key Transponder Signal Is Not Received	ICM	GO to Pinpoint Test G .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	ICM	GO to Pinpoint Test H .
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	ICM	GO to Pinpoint Test I .
B1676	Battery Pack Voltage Out of Range	ICM	REFER to Section 413-01 .
B1681	PATS Transceiver Module Signal Is Not Received	ICM	GO to Pinpoint Test J .
B1689	Autolamp Delay Circuit Failure	ICM	REFER to Section 417-01 .

B1875	Turn Signal / Hazard Switch Signal Circuit Failure	ICM	REFER to <u>Section 417-01</u> .
B2103	Antenna Not Connected	ICM	GO to <u>Pinpoint Test K</u> .
B2139	Data Mismatch (Receive Data Does Not Match What Was Expected)	ICM	GO to <u>Pinpoint Test E</u> .
B2141	NVM Configuration Failure	ICM	GO to <u>Pinpoint Test F</u> .
B2143	NVM Memory Failure	ICM	REFER to <u>Section 413-01</u> .
B2162	Data Mismatch #2 (receive data does not match what was expected)	ICM	GO to <u>Pinpoint Test E</u> .
B2328	Column Reach Feedback Potentiometer Circuit Failure	ICM	REFER to <u>Section 211-04</u> .
B2332	Column Tilt Feedback Potentiometer Circuit Failure	ICM	REFER to <u>Section 211-04</u> .
B2351	Steering Column Switch Circuit Failure	ICM	REFER to <u>Section 211-04</u> .
B2431	Transponder Programming Failed	ICM	GO to <u>Pinpoint Test G</u> .
B2472	Fog Lamp Switch Failure	ICM	REFER to <u>Section 417-01</u> .
B2477	Module Configuration Failure	ICM	REFER to <u>Section 418-01</u> .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS, ABS/TC, IVD	CARRY OUT the ABS, ABS/TC, or IVD self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/ PRNDL	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1073	SCP (J1850) Invalid or Missing Data for Engine Coolant Fluid Temperature	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1123	SCP (J1850) Invalid or Missing Data for Odometer Rolling Count	ABS, ABS/TC, IVD	CARRY OUT the ABS, ABS/TC, IVD self-test.
U1147	SCP (J1850) Invalid or Missing Data for Vehicle Security	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Instrument Cluster Parameter Identification (PID) Index

PID	Description	Expected Value
ABCHIME	Air Bag Chime	OFF, ON
ANTISCN	Anti-Scan Function	DISABL, ENABLE
ASWSTAT	Autolamp Switch Input Status	OFF, DELAY7, DELAY6, DELAY5, DELAY4, DELAY3, DELAY2, DELAY1, INVLD
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_SBELT	Driver Seat Belt	OUT, IN
DSWSTAT	Dimmer Switch Input Status	ON, LVL1, LVL2, LVL3, LVL4, LVL5, LVL6, LVL7,

		LVL8, LVL9, LVL10, LVL11, LVL12, LVL13, LVL14, LVL15, LVL16, LVL17, LVL18, LVL19, LVL20, LVL21, INVLD
ENABL_S	Vehicle Enable Status	DISABL, ENABLE
FOG_SW	Fog Lamp Switch	OFF, ON
HAZ_SW	Hazard Switch	OFF, ON
HEAD_L	Headlamp Switch Input Status	OFF, PARK, HEADLP, R_FOG, INVLD, (OPEN/SHORT)
HIBEAM	High Beam Switch Input Status	OFF, HIGH, PASS, INVLD, ?
HORN_SW	Horn Input Switch	OFF, ON
IGN_A	Ignition Switch -ACCY Position	NO, YES
IGN_KEY	Ignition Key In / Out	OUT, IN
IGN_O/U	Ignition Switch -OFF/Unlock Position	NO, YES
IGN_R	Ignition Switch -RUN Position	NO, YES
IGN_S	Ignition Switch -START Position	NO, YES
LIGHTSN	Night(True) / Day(False)	NO, YES
LTURN	Left Turn Switch	OFF, ON
M_KEY	Master Key Present	notPRE, PRESNT
MIN#KEY	Number of Key Codes Required to be Initially Programmed to Start the Vehicle	2 to 8
NUMKEYS	Number Of Keys Stored In Module	one count per bit
PCM_ID	PCM ID Status	notSTR, STORED
PCM_VFY	PCM Verify OK	NO, YES
RESETSW	Reset Switch	OFF, ON
RURN	Right Turn Switch	OFF, ON
SELECT	Select/Mode Switch	OFF, ON
SERVMOD	Service Module	0-25
SPARE_KY	Spare Key Programming Switch Status	ENABLE, DISABLE
TILT	Steering Column Tilt Switch	SHORT, UP, DOWN, OFF
TELEPOS	Telescope Position Sensor	notSEN, SENSED
TELESCP	Steering Column Telescope Switch	SHORT, IN, OUT, OFF
TILTPOS	Tilt Position Sensor	notSEN, SENSED
TR_PARK	Transmission Select Lever In Park Pos	NO, YES

Instrument Cluster Active Command Index

Active Command	Display	Action
ANTI-THEFT INDICATOR LAMP	THEFT_LAMP	OFF, ON
DISPLAY DIMMING CONTROL	ILLUMINAT	OFF, ON
DISPLAY SEGMENT CONTROL II	SEGMENTS	OFF, ON
ENGINE COOLANT GAUGE CONTROL	ENGCOOLNT	0%-100%
EXTERIOR LAMP CONTROL	R_FOG_LMP	OFF, ON
FUEL GAUGE CONTROL	FUELLEVEL	0%-100%
MEMORY SELECT CONTROL	MEMORY 1	OFF, ON
MEMORY SELECT CONTROL	MEMORY 2	OFF, ON
RF_SIGNAL	RF	OFF, ON
SPEEDOMETER CONTROL	SPDOMETER	0%-100%
TACHOMETER CONTROL	TCHOMETER	0%-100%
WARNING LAMPS AND CHIME	ALL_LAMPS	OFF, ON
WARNING LAMPS AND CHIME	CHIME	OFF, ON

Symptom Chart


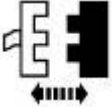
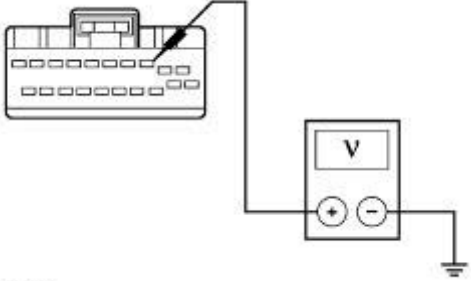
Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the instrument cluster 	<ul style="list-style-type: none"> CJB Fuse 204 (5A). Circuitry. Instrument cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> The anti-theft indicator is always/never on — no three second theft indicator prove out 	<ul style="list-style-type: none"> Instrument cluster. Circuitry. CJB Fuse 207 (5A). 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
<ul style="list-style-type: none"> The alarm system does not operate correctly — the vehicle starts but flashes rapidly at key on 	<ul style="list-style-type: none"> Incorrect PCM calibration. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> The vehicle does not start — theft indicator does not prove out and flashes rapidly 	<ul style="list-style-type: none"> SCP not connected/failure. PCM. Instrument Cluster. 	<ul style="list-style-type: none"> GO to Pinpoint Test L.
<ul style="list-style-type: none"> The vehicle does not start — theft indicator proves out for three seconds as normal, vehicle does not crank 	<ul style="list-style-type: none"> Starter circuit. Steering column lock module. 	<ul style="list-style-type: none"> REFER to Section 303-06. CARRY OUT steering column lock module diagnostics. REFER to Section 211-05.
<ul style="list-style-type: none"> The vehicle does not start — theft indicator proves out for three seconds as normal 	<ul style="list-style-type: none"> Powertrain concern. 	<ul style="list-style-type: none"> CARRY OUT powertrain diagnostics. REFER to Powertrain Control/Emissions

but the starter does not engage		Diagnosis (PC/ED) manual.
<ul style="list-style-type: none"> The vehicle starts and runs for longer than one second, then stalls 	<ul style="list-style-type: none"> This is not a PATS issue. PATS never disables a running engine. 	<ul style="list-style-type: none"> CARRY OUT powertrain diagnostics.REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

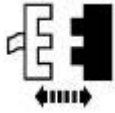
Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE MODULE — INSTRUMENT CLUSTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK HOT AT ALL TIMES POWER SUPPLY CIRCUIT	
<p>1</p>  <p>2</p>  <p>Instrument Cluster C220b</p> <p>3</p>  <p>A0002792</p>	<p>3 Measure the voltage between instrument cluster C220b pin 3, circuit 29-GG11 (OG/BU), harness side and ground.</p> <ul style="list-style-type: none"> Is the voltage greater than 10 volts? <p>→ Yes GO to <u>A2</u>.</p> <p>→ No REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.</p>
A2 CHECK HOT IN RUN POWER SUPPLY CIRCUITS	
<p>1</p>	



2

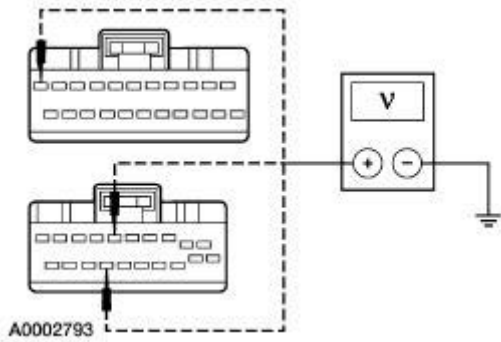


Instrument cluster C220a

3



4



4 Measure the voltage between the instrument cluster and ground as follows:

Connector Pin	Circuit
C220a pin 11	15-JA14 (GN/BK)
C220b pin 6	15-GG14 (GN/RD)
C220b pin 17	75-GG15 (YE/GN)

• Are the voltages greater than 10 volts?

→ **Yes**
GO to A3.

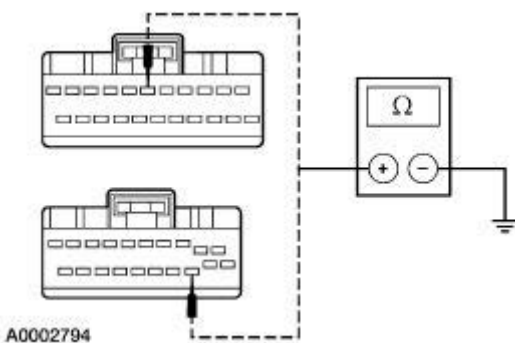
→ **No**
REPAIR the circuit(s). REPEAT the self-test. CLEAR the DTCs.

A3 CHECK GROUND CIRCUITS

1



2







2 Using the following table, measure the resistance between the instrument cluster connectors, harness side and ground.

Connector Pin	Circuit
C220a pin 6	31-AL11 (BK/BU)
C220b pin 13	91-GG11 (BN/RD)

• Are the resistances less than 5

	<p>ohms?</p> <p>→ Yes REFER to <u>Section 418-00</u>.</p> <p>→ No REPAIR the circuit(s). REPEAT the self-test. CLEAR the DTCs.</p>
--	---

PINPOINT TEST B: THE ANTI-THEFT INDICATOR IS ALWAYS/NEVER ON — NO THREE SECOND THEFT INDICATOR PROVE OUT

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 ENTER THE ICM ACTIVE COMMAND MODE	
<p>1 </p> <p>2  Diagnostic Tool</p> <p>3 </p>	<p>3 Enter the ICM active command mode.</p> <p>● Can the ICM active command mode be entered?</p> <p>→ Yes GO to <u>B2</u>.</p> <p>→ No GO to <u>Pinpoint Test A</u>.</p>
B2 CHECK THE ANTI-THEFT INDICATOR — TRIGGER THE ICM ACTIVE COMMAND THEFT_LAMP TO ON	
<p>1 </p>	<p>1 Trigger the ICM active command THEFT_LAMP to ON.</p> <p>● Does the anti-theft indicator illuminate?</p> <p>→ Yes The anti-theft indicator is OK. VERIFY the</p>

concern with the customer.

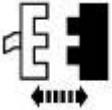
→ **No**
GO to B3.

B3 CHECK THE INSTRUMENT CLUSTER OUTPUT TO THE AUTOLAMP DAY/NIGHT SENSOR FOR VOLTAGE — CIRCUIT 10-GL6 (GY/VT)

1



2

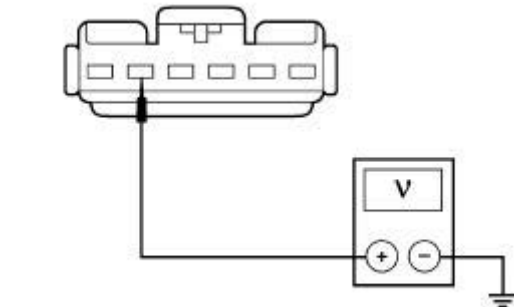


Autolamp Day/Night Sensor C287

3



4



A0003818

4 While triggering the ICM active command THEFT_LAMP to ON, measure the voltage between autolamp day/night sensor C287 pin 2, circuit 10-GL6 (GY/VT), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to B5.

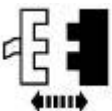
→ **No**
GO to B4.

B4 CHECK CIRCUIT 10-GL6 (GY/VT) FOR OPEN

1



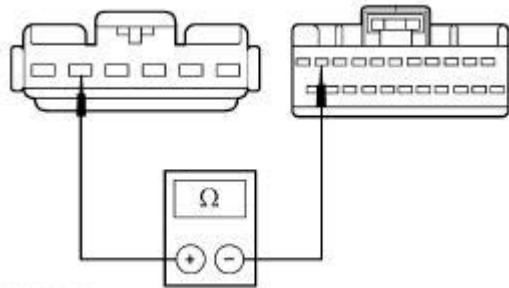
2



Instrument Cluster C220a

3

3 Measure the resistance between instrument cluster C220a pin 10, circuit



A0003819

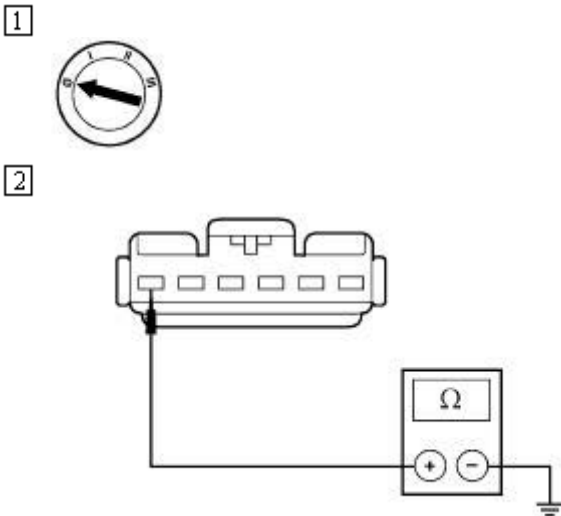
10-GL6 (GY/VT), harness side and autolamp day/night sensor C287 pin 2, circuit 10-GL6 (GY/VT), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
 INSTALL a new instrument cluster. Refer to [Section 413-01](#). REPEAT the self-test. CLEAR the DTCs.

→ **No**
 REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

B5 CHECK THE AUTOLAMP DAY/NIGHT SENSOR GROUND — CIRCUIT 31-LE42 (BK)



A0003895

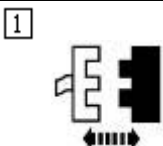
2 Measure the resistance between autolamp day/night sensor C287 pin 1, circuit 31-LE42 (BK), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
 GO to [B6](#).

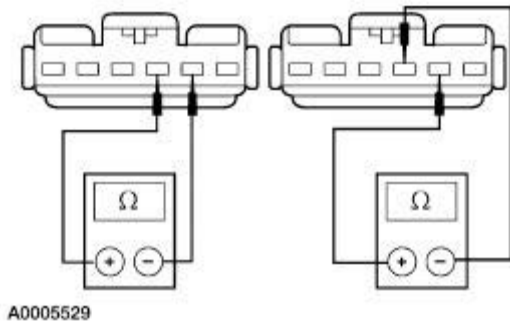
→ **No**
 REPAIR the circuit. REPEAT the self-tast. CLEAR the DTCs.

B6 CHECK THE ANTI -THEFT LED



Anti-Theft LED

2



2 Measure the resistance between C287 pin 2 and pin 3 component side.

- Is the resistance greater than 10,000 ohms in one direction and 10-20 ohms in the other direction?

→ **Yes**
GO to B7.

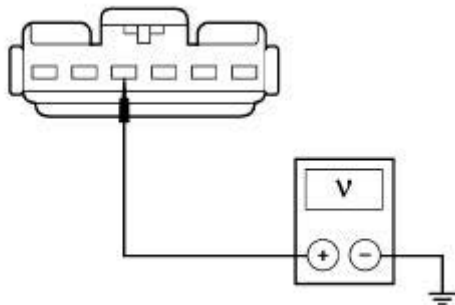
→ **No**
REPLACE the anti-theft LED. REFER to Section 413-01. REPEAT the self-test. CLEAR the DTCs. .

B7 CHECK THE AUTOLAMP DAY/NIGHT SENSOR FOR VOLTAGE — CIRCUIT 29-GL6 (OG)

1



2




2 Measure the voltage between autolamp day/night sensor C287 pin 3, circuit 29-GL6 (OG), and ground.

- Is the voltage greater than 10 volts?





→ **Yes**
INSTALL a new autolamp day/night sensor. Refer to Section 417-01. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST C: THE ALARM SYSTEM DOES NOT OPERATE CORRECTLY — THE VEHICLE STARTS BUT FLASHES RAPIDLY AT KEY ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE ANTI-THEFT INDICATOR FOR CORRECT OPERATION	
<p>1</p> 	<p>2 Verify the anti-theft indicator proves out correctly.</p> <ul style="list-style-type: none"> • Does the vehicle start with the anti-theft indicator flashing? <p>→ Yes If the vehicle starts, VERIFY proper PCM calibration for vehicle. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.</p> <p>→ No System is OK.</p>

PINPOINT TEST D: ANTI-THEFT NUMBER OF PROGRAMMED KEYS IS BELOW MINIMUM

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 RETRIEVE THE ICM DTCS	
<p>1</p>  <p>2</p>  <p>Diagnostic Tool</p> <p>3</p>  <p>4</p>  <p>Clear Continuous DTCs</p> <p>5</p>	<p>3 Retrieve and document continuous ICM DTCs.</p>



ICM On-Demand
Self-Test

- Is DTC B1213 the only DTC retrieved?

→ **Yes**

GO to D2.

→ **No**

REPAIR the other DTCs retrieved. REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index. CLEAR the DTCs. REPEAT the instrument cluster self-test.

D2 CHECK FOR PROGRAMMED ENCODED IGNITION KEYS — MONITOR THE ICM PID NUMKEYS

1



1 Monitor the ICM PID NUMKEYS.

- Does the ICM PID NUMKEYS display less than two encoded ignition keys programmed?

→ **Yes**

GO to D3.

→ **No**

System is OK.

D3 PROGRAM ENCODED IGNITION KEYS

2



1 **NOTE:** Two encoded ignition keys must be programmed in order to start the vehicle.

Cut a new encoded ignition key.

2 Turn the ignition switch to RUN. The new encoded ignition key should now be programmed.

3 Program the new encoded ignition key.

- Does the anti-theft indicator illuminate for three seconds and then go out?







→ **Yes**

CLEAR the DTCs. CARRY OUT instrument cluster self-test to verify all codes have been cleared. REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to Key Programming—Program a Key Using Two Programmed Keys in this section.

→ **No**
 If the anti-theft indicator is on continuously, REPEAT step D3 with a second new encoded ignition key.

If the theft indicator is flashing, RETRIEVE DTC stored for new fault and REPAIR the other DTC(s) retrieved. REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index

PINPOINT TEST E: DATA MISMATCH (RECEIVE DATA DOES NOT MATCH WHAT WAS EXPECTED)

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 USE THE DTCS FROM THE INSTRUMENT CLUSTER SELF-TEST	
	<p>1 Use the recorded instrument cluster continuous self-test DTCs.</p> <ul style="list-style-type: none"> ● Is DTC B2139 or U1147 recorded? <p>→ Yes GO to <u>E2</u>.</p> <p>→ No System is OK.</p>
E2 CLEAR PCM ID FROM INSTRUMENT CLUSTER AND PCM	
<p>2 </p> <p>3 </p> <p>4 </p> <p>6 </p> <p>7 </p> <p>8 </p>	<p>1 Carry out the security access procedure for the instrument cluster. Refer to <u>Security Access—Procedure</u>.</p> <p>2 NOTE: DO NOT carry out ignition key code erase.</p> <p>Select Ford service function (FSF) card PARAMETER RESET command for instrument cluster.</p> <p>3 Use diagnostic card for PCM active command KEEP ALIVE MEMORY RESET.</p> <p>5 Turn the ignition switch to RUN for three seconds.</p> <p>6 Clear the DTCs.</p> <p>8 Retrieve continuous DTCs.</p>



● **Is DTC B2139, B2162 or U1147 retrieved?**


→ **Yes**

VERIFY PCM calibration is correct for the vehicle. If correct, VERIFY instrument cluster calibration and configuration for the vehicle. If correct, INSTALL a new instrument cluster. Refer to [Section 413-01](#). CYCLE the ignition to RUN using two encoded ignition keys. REPEAT [Pinpoint Test E](#). CLEAR the DTCs. REPEAT instrument cluster self-test. If DTC B2139 or U1147 still exists, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to [Key Programming—Program a Key Using Two Programmed Keys](#) in this section.

→ **No**

System is OK. CHECK for any other DTCs. REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.

PINPOINT TEST F: THE ANTI-THEFT SYSTEM DOES NOT OPERATE CORRECTLY — NVM CONFIGURATION FAILURE (NO PCM ID EXCHANGED BETWEEN INSTRUMENT CLUSTER AND PCM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 USE THE DTCS FROM THE INSTRUMENT CLUSTER SELF-TEST	
	<p>1 Use the recorded instrument cluster continuous self-test DTCs.</p> <p>● Is DTC B2141 retrieved?</p> <p>→ Yes GO to F2.</p> <p>→ No System is OK.</p>
F2 CARRY OUT KEEP ALIVE MEMORY RESET FROM PCM	
<p>1</p> 	<p>1 Use diagnostic card for PCM active command — KEEP ALIVE MEMORY RESET.</p> <p>● Did the keep alive memory reset occur?</p> <p>→ Yes GO to F3.</p> <p>→ No REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.</p>
F3 CARRY OUT KEEP ALIVE MEMORY RESET FROM PCM	

1



1 Use diagnostic card for PCM active command — KEEP ALIVE MEMORY RESET.

2



3



3 Leave the key in the RUN position for 30 seconds.

4



5



● Does the vehicle START?

→ Yes
System is OK.

→ No
GO to F4.

F4 RETRIEVE THE INSTRUMENT CLUSTER DTCS

1



Clear Continuous DTCS

2



3



4




4 Retrieve continuous instrument cluster DTCS.

● Is DTC B2141 retrieved?

	<p>→ Yes REPEAT step F2. If the fault persists, VERIFY the PCM calibration. If the calibration is OK, INSTALL a new instrument cluster. REFER to Section 413-01. Cycle the ignition key to RUN using two encoded ignition keys. GO to Pinpoint Test E to initialize the module. REPEAT the self-test. CLEAR the DTCs. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to Key Programming—Program a Key Using Two Programmed Keys in this section.</p> <p>→ No REFER to the Instrument Cluster Diagnostic Trouble Code (DTC) Index.</p>
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PINPOINT TEST G: THE ANTI-THEFT SYSTEM DOES NOT OPERATE CORRECTLY — PATS IGNITION KEY TRANSPONDER SIGNAL IS NOT RECEIVED OR TRANSPONDER PROGRAMMING FAILED (DAMAGED KEY OR NON-PATS KEY)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	<p>NOTE: Large metallic objects, electronic debit transponder devices or a second key on the same key ring as the PATS ignition key may cause vehicle starting problems and record DTCs under certain conditions. If a fault cannot be identified, examine the customer's key for such objects or devices. If present, inform the customer that they need to keep these objects from touching the PATS ignition key while starting the engine. These objects and devices cannot damage the PATS ignition key, but can cause a momentary problem if they are too close to the key during engine start. If a problem occurs, turn ignition OFF and restart the engine with all other objects on the key ring held away from the ignition key. Check to ensure the encoded ignition key used by the customer is an approved Ford encoded ignition key (encoded ignition keys from Rotunda, Ilco, Curtis, C.E. Marshall, or Strattec are approved Ford encoded ignition keys).</p>
	<p>G1 USE THE DTCS FROM THE INSTRUMENT CLUSTER SELF-TEST</p>
	<p>1 Use the recorded instrument cluster continuous self-test DTCs.</p> <p style="padding-left: 40px;">● Is DTC B1600 or B2431 retrieved?</p> <p>→ Yes GO to G2.</p> <p>→ No If other DTCs are retrieved, REFER to Instrument Cluster Diagnostic Trouble Code (DTC) Index.</p> <p>If no DTCs are retrieved, system is OK.</p>
	<p>G2 PROGRAM A NEW ENCODED IGNITION KEY</p>
<p>1</p> 	<p>2 NOTE: Check to make sure the customer and replacement encoded ignition keys are approved Ford encoded PATS ignition keys. Unapproved PATS keys do not always operate correctly over different temperature ranges (encoded ignition keys from Rotunda, Ilco, Curtis, C.E. Marshall, or Strattec are approved encoded ignition keys).</p>

Cut a new encoded ignition key.

3



4 Program the new encoded ignition key. Refer to [Key Programming—Additional Key With One Programmed Key](#).

5



5 Clear the DTCs. Carry out the instrument cluster self-test.

● Is DTC B1600 or B2431 still present?

→ **Yes**
GO to [G3](#).

→ **No**
If no other DTCs are retrieved, system is OK.

If other DTCs are retrieved, REFER to Instrument Cluster Diagnostic Trouble Code (DTC) Index.

G3 INSTALL A NEW PATS TRANSCIEVER

1



2 Install a new PATS transceiver. Refer to [Module—Passive Anti-Theft Transceiver](#).

3



3 **NOTE:** Use the customer's original encoded ignition key, not the encoded ignition key that was cut in the previous step.

4




4 Clear the DTCs. Carry out the instrument cluster self-test.

● Is DTC B1600 or B2431 retrieved?

→ **Yes**
INSTALL a new instrument cluster. REFER to [Section 413-01](#). CYCLE the ignition to RUN using two encoded ignition keys. GO to [Pinpoint Test E](#) to initialize the module. REPEAT the self-test. CLEAR the DTCs. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to [Key Programming—Program a Key Using Two Programmed Keys](#) in this section.

→ **No**
System is OK.

PINPOINT TEST H: THE ANTI-THEFT SYSTEM DOES NOT OPERATE CORRECTLY — PATS RECEIVED INCORRECT KEY-CODE FROM IGNITION KEY TRANSPONDER (UNPROGRAMMED ENCODED IGNITION KEY)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	<p>NOTE: Large metallic objects, electronic debit transponder devices or a second key on the same key ring as the PATS ignition key may cause vehicle starting problems and record DTCs under certain conditions. If a fault cannot be identified, examine the customer's key for such objects or devices. If present, inform the customer that they need to keep these objects from touching the PATS ignition key while starting the engine. These objects and devices cannot damage the PATS ignition key, but can cause a momentary problem if they are too close to the key during engine start. If a problem occurs, turn ignition OFF and restart the engine with all other objects on the key ring held away from the ignition key. Check to ensure the encoded ignition key used by the customer is an approved Ford encoded ignition key (encoded ignition keys from Rotunda, Ilco, Curtis, C.E. Marshall, or Strattec are approved Ford encoded ignition keys).</p>
	<p>H1 USE THE DTCS FROM THE INSTRUMENT CLUSTER SELF-TEST</p>
	<p>1 Use the recorded instrument cluster continuous self-test DTCs.</p> <ul style="list-style-type: none"> ● Is DTC B1601 recorded? <p>→ Yes GO to <u>H2</u>.</p> <p>→ No System is OK. CHECK all customer encoded ignition keys with instrument cluster self-test to verify all other encoded ignition keys are programmed.</p>
	<p>H2 CHECK FOR PROGRAMMED ENCODED IGNITION KEYS — MONITOR THE INSTRUMENT CLUSTER PID NUMKEYS</p>
<p>1</p> 	<p>1 Monitor the INSTRUMENT CLUSTER PID NUMKEYS.</p> <ul style="list-style-type: none"> ● Does the INSTRUMENT CLUSTER PID NUMKEYS display 8? <p>→ Yes ERASE and REPROGRAM the key codes. REFER to <u>Key Programming—Erase All Key Codes and Program Two Keys</u>. REPEAT the self-test. CLEAR the DTCs. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to <u>Key Programming—Program a Key Using Two Programmed Keys</u> in this section.</p> <p>→ No GO to <u>H3</u>.</p>
	<p>H3 CHECK THE NUMBER OF PROGRAMMED ENCODED IGNITION KEYS AVAILABLE</p>
	<p>1 Verify there are at least two currently programmed encoded ignition keys available with the vehicle.</p> <ul style="list-style-type: none"> ● Are at least two currently programmed encoded ignition keys available with the vehicle?

→ **Yes**
GO to H4.

→ **No**
CUT new encoded ignition key(s) so that at least two encoded ignition keys are available. PROGRAM the encoded ignition keys; REFER to Key Programming—Erase All Key Codes and Program Two Keys. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to Key Programming—Program a Key Using Two Programmed Keys in this section. GO to H4.

H4 VERIFY THE INSTRUMENT CLUSTER PID SPARE_KY INDICATES ENABLE

1



1 Monitor the INSTRUMENT CLUSTER PID SPARE_KY.

● **Does the INSTRUMENT CLUSTER PID SPARE_KY indicate ENABLE?**

→ **Yes**
GO to H5.

→ **No**
ENABLE the PID SPARE KEY to the enable setting. REFER to Key Programming—Enable/Disable Spare Key Programming. REPEAT the self-test. CLEAR the DTCs. Once completed, GO to H5.

H5 CHECK THE ENCODED IGNITION KEYS FOR CORRECT OPERATION

1



2



3



4



2 Start the vehicle using the first encoded ignition key.

3 Start the vehicle with the second ignition key.

● **Does the vehicle start correctly using both encoded ignition keys?**

→ **Yes**
System is OK. If there are additional keys that need to be programmed. REFER to Key Programming—Program a Key Using Two Programmed Keys. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service.

REFER to [Key Programming—Program a Key Using Two Programmed Keys](#) in this section.

→ **No**
GO to [H6](#).

H6 RETRIEVE THE INSTRUMENT CLUSTER DTCS — CHECK FOR DTC B1601

1



1 Retrieve and document continuous DTCs.

2



Clear Continuous DTCs

3 Carry out the instrument cluster self-test using both ignition keys from Step H5.

3



● **Is DTC B1601 retrieved?**

→ **Yes**
INSTALL a new instrument cluster. REFER to [Section 413-01](#). CYCLE the ignition to RUN using two encoded ignition keys. GO to [Pinpoint Test E](#) to initialize the vehicle. REPEAT the self-test. CLEAR the DTCs. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to [Key Programming—Program a Key Using Two Programmed Keys](#) in this section.

→ **No**
System is OK.

If other DTCs are retrieved, REFER to Instrument Cluster Diagnostic Trouble Code (DTC) Index.

PINPOINT TEST I: THE ANTI-THEFT SYSTEM DOES NOT OPERATE CORRECTLY — PATS RECEIVED INVALID FORMAT OF KEY-CODE FROM IGNITION KEY TRANSPONDER (PARTIAL KEY READ)

CONDITIONS	DETAILS/RESULTS/ACTIONS
	<p>NOTE: Large metallic objects, electronic debit transponder devices or a second key on the same key ring as the PATS ignition key may cause vehicle starting problems and record DTCs under certain conditions. If a fault cannot be identified, examine the customer's key for such objects or devices. If present, inform the customer that they need to keep these objects from touching the PATS ignition key while starting the engine. These objects and devices cannot damage the PATS ignition key, but can cause a momentary problem if they are too close to the key during engine start. If a problem occurs, turn ignition OFF and restart the engine with all other objects on the key ring held away from the ignition key. Check to ensure the encoded ignition key used by the customer is an approved Ford encoded ignition key (encoded ignition keys from Rotunda, Ilco, Curtis, C.E. Marshall, or Strattec are approved Ford encoded ignition keys).</p>

I1 USE THE DTCS FROM THE INSTRUMENT CLUSTER SELF-TEST

1 Use the recorded instrument cluster continuous self-test DTCs.

● **Is DTC B1602 retrieved?**

→ **Yes**
GO to 12.

→ **No**
System is OK. CHECK all customer encoded ignition keys with instrument cluster self-test to verify all other keys are programmed.

I2 OBTAIN A NEW ENCODED IGNITION KEY

1



2 Cut a new encoded ignition key.

3



4 Program a new encoded ignition key. Refer to Key Programming—Additional Key With One Programmed Key.

5



5 Carry out the instrument cluster self-test.

● **Is DTC B1602 retrieved?**

→ **Yes**
GO to 13.

→ **No**
System is OK.

I3 INSTALL A NEW PATS TRANSCIEVER

1



2 Install a new PATS transceiver. Refer to Module—Passive Anti-Theft Transceiver.

3



4 Clear the DTCs. Carry out the instrument cluster self-test.


4



● Are any DTCs retrieved?

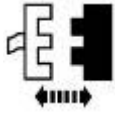
- **Yes**
REFER to Instrument Cluster Diagnostic Trouble Code (DTC) Index.
- **No**
System is OK.

PINPOINT TEST J: THE ANTI-THEFT SYSTEM DOES NOT OPERATE CORRECTLY — PATS TRANSCEIVER SIGNAL IS NOT RECEIVED (NOT CONNECTED, DAMAGED, OR WIRING)

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 USE THE DTCS FROM THE INSTRUMENT CLUSTER SELF-TEST	
	<p>1 Use the recorded instrument cluster continuous self-test DTCs.</p> <p>● Is DTC B1681 retrieved?</p> <p>→ Yes GO to <u>J2</u>.</p> <p>→ No System is OK.</p>
J2 INSPECT THE PATS TRANSCEIVER FOR CORRECT INSTALLATION	
<p>1</p> 	<p>2 Verify the PATS transceiver is correctly installed. Refer to <u>Module—Passive Anti-Theft Transceiver</u>.</p> <p>● Was the transceiver correctly installed?</p> <p>→ Yes GO to <u>J3</u>.</p> <p>→ No Correct installation. REPEAT instrument cluster self-test.</p>
J3 CHECK THE PATS TRANSCEIVER FOR VOLTAGE — CIRCUIT 29S-GL36 (OG/BU)	
1	



2

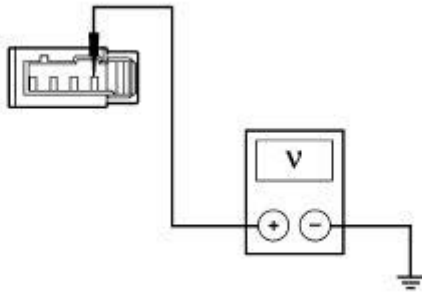


PATS Transceiver C252

3



4



A0003898

4 Measure the voltage between PATS transceiver C252 pin 1, circuit 29S-GL36 (OG/BU), harness side and ground.

• Is the voltage greater than 9 volts?

→ Yes
GO to J4.

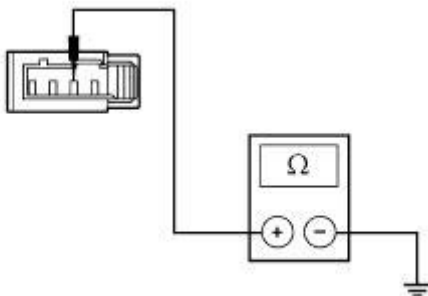
→ No
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

J4 CHECK THE PATS TRANSCEIVER GROUND — CIRCUIT 31-GL36 (BK)

1



2



A0003899

2 Measure the resistance between PATS transceiver C252 pin 2, circuit 31-GL36 (BK), harness side and ground.

• Is the resistance less than 5 ohms?

- **Yes**
GO to J5.
- **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

J5 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT FOR VOLTAGE — CIRCUIT 10-GL36 (GY/RD)

1

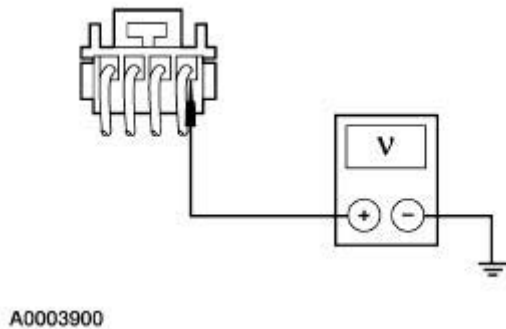


PATS Transceiver C252

2



3



- 3 Measure the voltage by back probing between PATS transceiver C252 pin 4, circuit 10-GL36 (GY/RD), harness side and ground.

● **Is the voltage greater than 9 volts?**

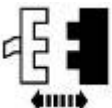
- **Yes**
GO to J7.
- **No**
GO to J6.

J6 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT FOR SHORT TO GROUND — CIRCUIT 10-GL36 (GY/RD)

1



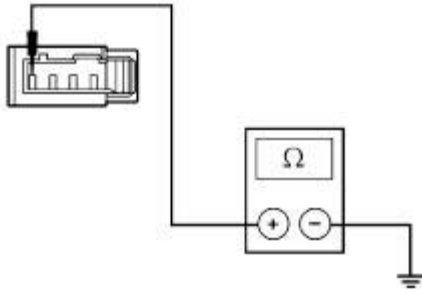
2



PATS Transceiver C252

3

- 3 Measure the resistance between PATS transceiver C252 pin 4, circuit 10-GL36 (GY/RD), harness side and ground.



A0003901

- Is the resistance greater than 100 ohms?

→ **Yes**
GO to J7.

→ **No**
CHECK circuit 10-GL36 (GY/RD) for short to ground with instrument cluster disconnected.

If the circuit is OK, INSTALL a new instrument cluster. REFER to Section 413-01. CYCLE the ignition key to RUN using two encoded ignition keys. GO to Pinpoint Test E to initialize the module. REPEAT the self-test. CLEAR the DTCs.

If the circuit is not OK, REPAIR circuit 10-GL36 (GY/RD). REPEAT the self-test. CLEAR the DTCs. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to Key Programming—Program a Key Using Two Programmed Keys in this section.

J7 CHECK CIRCUIT 10-GL36 (GY/RD) FOR OPEN

1

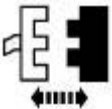


2



PATS Transceiver C252

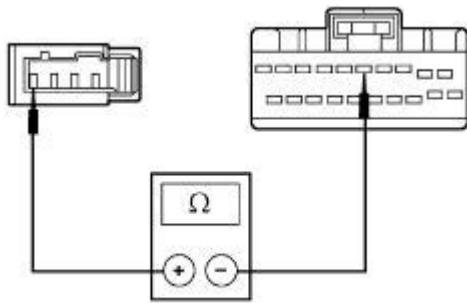
3



Instrument Cluster C220b

4

4 Measure the resistance between PATS



A0003902

transceiver C252 pin 4, circuit 10-GL36 (GY/RD), harness side and instrument cluster C220b pin 5, circuit 10-GL36 (GY/RD), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to J8.

→ **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

J8 CHECK THE PATS TRANSCIEVER TRANSMIT CIRCUIT FOR VOLTAGE — CIRCUIT 8-GL36 (WH/RD)

1



2



PATS Transceiver C252

3

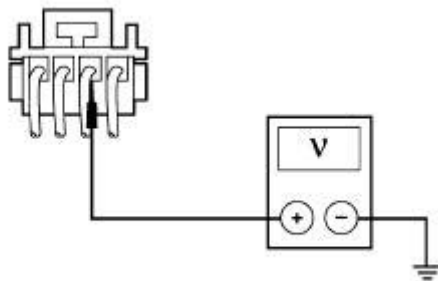


Instrument Cluster C220b

4



5



A0003903

5 Measure the voltage by back probing between PATS transceiver C252 pin 3, circuit 8-GL36 (WH/RD), harness side and ground.

● Is the voltage greater than 9 volts?

→ **Yes**
GO to J10.

→ **No**
GO to J9.

J9 CHECK THE PATS TRANSCIEVER TRANSMIT CIRCUIT FOR OPEN — CIRCUIT 8-GL36 (WH/RD)

1

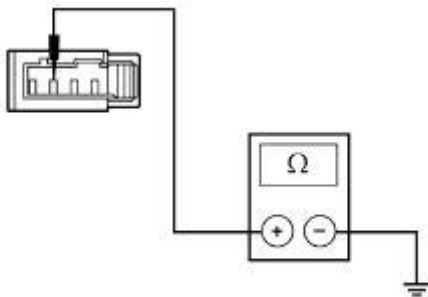


2



PATS Transceiver C252

3



A0003904

3 Measure the resistance between PATS transceiver C252 pin 3, circuit 8-GL36 (WH/RD), harness side and ground.

● Is the resistance greater than 100 ohms?

→ **Yes**
GO to J10.

→ **No**
CHECK circuit 8-GL36 (WH/RD) for short to ground with instrument cluster disconnected.

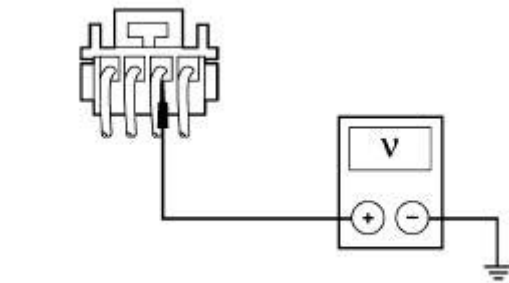
If the circuit is OK, **INSTALL** a new instrument cluster. REFER to Section 413-01. CYCLE the ignition to RUN using two encoded ignition keys. GO to Pinpoint Test E to initialize the module. REPEAT the self-test. CLEAR the DTCs. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to Key Programming—Program a Key Using Two Programmed Keys in this section.

If the circuit is not OK, **REPAIR** circuit 8-

GL36 (WH/RD). REPEAT the self-test.
CLEAR the DTCs.

J10 CHECK THE PATS TRANSMIT CIRCUIT FOR CORRECT OPERATION — CIRCUIT 8-GL36 (WH/RD)

1



A0003903

1

Trigger the ICM active command RF_ SIGNAL to ON while measuring the voltage by back probing between PATS transceiver C252 pin 3, circuit 8-GL36 (WH/RD), harness side and ground.

- Does the voltage drop from greater than 9 volts to less than 1 volt when the ICM active command RF_ SIGNAL is triggered ON?

→ **Yes**
GO to J11.

→ **No**
CHECK circuit 8-GL36 (WH/RD) for an open between instrument cluster C220b pin 4 and PATS transceiver C252 pin 3.

If the circuit is OK, INSTALL a new instrument cluster. REFER to Section 413-01. CYCLE the ignition to RUN using two encoded ignition keys. GO to Pinpoint Test E to initialize the module. REPEAT the self-test. CLEAR the DTCs. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to Key Programming—Program a Key Using Two Programmed Keys in this section.

If the circuit is not OK, REPAIR circuit 8-GL36 (WH/RD). REPEAT the self-test. CLEAR the DTCs.

J11 CHECK THE PATS SYSTEM WITH A NEW PATS TRANSCIEVER INSTALLED

1



3

2

Install a new PATS transceiver. Refer to Module—Passive Anti-Theft Transceiver.



4



4 Carry out the instrument cluster self-test.

● **Is DTC B1681 retrieved?**

→ **Yes**
GO to J12.

→ **No**
System is OK.

J12 CHECK THE PATS SYSTEM WITH A NEW INSTRUMENT CLUSTER

1



2 Install a new instrument cluster. Refer to Section 413-01. Cycle the ignition to RUN using two encoded ignition keys. GO to Pinpoint Test E to initialize the module. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to Key Programming—Program a Key Using Two Programmed Keys in this section.

3



4



4 Clear the DTCs.

5






5 Carry out the instrument cluster self-test.

● **Is DTC B1681 retrieved?**

→ **Yes**
REPAIR circuits 8-GL36 (WH/RD), 10-GL36 (GY/RD), 29S-GL36 (OG/BU), and 31-GL36 (BK). REPEAT the self-test. CLEAR the DTCs.

	<p>→ No If no DTCs are retrieved, the system is OK.</p> <p>If other DTCs are retrieved, REFER to Instrument Cluster Diagnostic Trouble Code (DTC) Index.</p>
--	---

PINPOINT TEST K: THE ANTI-THEFT SYSTEM DOES NOT OPERATE CORRECTLY — ANTENNA NOT CONNECTED OR DEFECTIVE TRANSCEIVER

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 INSPECT THE PATS TRANSCEIVER FOR CORRECT INSTALLATION	
<p>1 </p> <p>3  Diagnostic Tool</p> <p>4  Instrument Cluster Self-Test</p>	<p>2 Verify the PATS transceiver is correctly installed. REFER to <u>Module—Passive Anti-Theft Transceiver</u> .</p> <p>4 Carry out the instrument cluster self-test.</p> <p>● Is DTC B2103 retrieved?</p> <p>→ Yes INSTALL a new PATS transceiver module. REFER to <u>Module—Passive Anti-Theft Transceiver</u> . REPEAT the instrument cluster self-test. CLEAR the DTCs.</p> <p>→ No System is OK.</p>

PINPOINT TEST L: THE VEHICLE DOES NOT START — THEFT INDICATOR DOES NOT PROVES OUT AND FLASHES RAPIDLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1 RECORD THE DTCS FROM THE INSTRUMENT CLUSTER SELF-TEST	

1



2



Diagnostic Tool

3



4



4 Carry out the instrument cluster self-test.

5



5 Use the recorded instrument cluster continuous self-test.

- Is ICM DTC B1213, B1600, B1601, 1602, B1681, B2103, B2139, B2141, B2431 or U1147 retrieved?

→ **Yes**
REPAIR the instrument cluster DTC. Refer to the Instrument Cluster Diagnostic Trouble Code (DTC) Index. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to L2.

L2 CHECK FOR THEFT INDICATOR FLASHING FAULT CODE SEQUENCE 16

1 **NOTE:** The sequence 1-6 will repeat itself.

Check for flashing fault code 16 on the theft indicator.

- When turning ignition to RUN, does the theft indicator flash rapidly for one minute, pause briefly, flash one time, pause briefly and then flash 6 times?

→ **Yes**
GO to L3.

→ **No**
CHECK for other no-start fault.

L3 CARRY OUT PCM DIAGNOSTICS

1 CARRY OUT diagnostics on the PCM module. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

● **Does a PCM module concern exist?**

→ **Yes**


REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
REPEAT the self-test. CLEAR the DTCs.

→ **No**

INSTALL a new instrument cluster. REFER to Section 413-01. CYCLE the ignition to RUN using two encoded ignition keys. GO to Pinpoint Test E to initialize the module. REPEAT the self-test. CLEAR the DTCs. If the vehicle is equipped with the valet feature, program the third key (if available) or instruct the customer on how to carry out this service. REFER to Key Programming—Program a Key Using Two Programmed Keys in this section.

Security Access —Procedure

Special Tool(s)

 <p>ST2332-A</p>	<p>Worldwide Diagnostic System (WDS) 418-F224,</p> <p>New Generation STAR (NGS) Tester 418-F052, or equivalent</p>
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NOTE: The security access procedure is utilized to obtain passive anti-theft system (PATS) security access. PATS security access must be granted to erase ignition keys, enable/disable the spare key programming switch or carry out parameter resets for the instrument cluster. The security access procedure invokes an inherent 10 minute time delay prior to granting security access during which time the diagnostic tool must remain connected to the vehicle. Once security access has been granted, a security access command menu is displayed that offers various command options.

NOTE: Select only the commands required by the appropriate pinpoint test.

1. Using the Ford Service Function (FSF) card, select the appropriate instrument cluster. Enter SECURITY ACCESS PROCEDURE. This procedure will take 10 minutes to carry out, during which time the the ignition switch must be in RUN and the diagnostic tool must be connected to the vehicle.
 2. After the 10-minute security access procedure has been completed, a new menu will be displayed with command options. Select only those functions required before exiting out of this menu. Once exited out of this menu, the security access procedure must be carried out again to select additional commands.
-

Key Programming —Program a Key Using Two Programmed Keys

Special Tool(s)



NOTE: This procedure only works if two or more programmed ignition keys are available and it is desired to program additional key(s). If two keys are not available, follow the procedure in [Key Programming—Erase All Key Codes and Program Two Keys](#).

NOTE: The PID SPARE_KY must be enabled for this procedure to operate. If this Parameter Identification (PID) is not enabled, follow the security access procedure and select Spare Key Programming Switch: Enabled. Refer to [Key Programming—Enable/Disable Spare Key Programming](#).

NOTE: If the programming procedure is successful, the new key(s) will start the vehicle and the THEFT INDICATOR will illuminate for approximately three seconds.

NOTE: If the programming procedure is not successful, the new key(s) will not start the vehicle and the THEFT INDICATOR will flash. If the programming procedure was not successful, repeat the key programming procedure from Step 1. If the failure repeats, check hot at all times in instrument cluster for correct battery voltage. Repair the circuit if voltage is not present. For additional information, refer to Diagnosis and Testing to review diagnostic trouble codes (DTCs) and carry out pinpoint tests as required.

NOTE: A maximum of eight ignition keys can be programmed to a passive anti-theft system (PATS) equipped vehicle. Use INSTRUMENT CLUSTER PID NUMKEYS to determine how many keys are programmed to the vehicle.

NOTE: If the steps are not carried out as outlined, the programming procedure will end.

NOTE: Ignition keys must have correct mechanical key cut for the vehicle and must be a PATS encoded key.

1. Insert the first programmed ignition key into the ignition lock cylinder and turn the ignition switch from OFF to RUN (maintain the ignition switch in RUN for one second).
2. Turn the ignition switch to OFF and remove the first key from the ignition lock cylinder.
3. Within five seconds of turning the ignition switch to OFF, insert the second programmed ignition key into the ignition lock cylinder and turn the ignition switch from OFF to RUN (maintain the ignition switch in RUN for one second).
4. Within five seconds of turning the ignition switch to RUN, turn the ignition switch to OFF and remove the second key from the ignition lock cylinder.

5. Within 10 seconds of turning the ignition lock cylinder to OFF, insert the unprogrammed ignition key (new key) into the ignition lock cylinder and turn the ignition switch from OFF to RUN (maintain the ignition switch in RUN for one second).
 6. If it is desired to program additional key(s), repeat the key programming procedure from the beginning.
-

Key Programming —Erase All Key Codes and Program Two Keys

Special Tool(s)



NOTE: This procedure is used when a customer needs keys programmed into the system and does not have two programmed ignition keys available. This procedure is also useful when programmed ignition key(s) have been lost or a new ignition switch assembly has been installed, and it is desired to erase key(s) from the passive anti-theft system (PATS) memory.

NOTE: This procedure will erase all programmed ignition keys from the vehicle memory and the vehicle will not start until two keys have been reprogrammed to the vehicle.

NOTE: Two PATS encoded keys with the correct mechanical cut must be available to carry out this procedure. One or both of them may be the customer's original keys.

NOTE: If additional (more than two) keys are to be programmed, refer to Key Programming — Program a Key Using Two Programmed Keys. If the remaining keys are with the customer and are not available with the vehicle, then instruct the customer to refer to the owner's literature under the "Programming Spare [SecuriLock® (North America), Safeguard® (U.K.) or PATS for all other markets] Keys Procedure" for instructions on programming the remaining keys.


1. Turn the ignition switch from OFF to RUN.
2. Connect the diagnostic tool. Follow the SECURITY ACCESS PROCEDURE for instrument cluster to obtain security access.
3. From diagnostic tool menu, select IGNITION KEY CODE ERASE.
4. **NOTE:** DO NOT select any additional commands from this menu.

Turn the ignition switch to OFF and disconnect diagnostic tool.

5. Insert the first encoded ignition key into the ignition lock cylinder and turn the switch to RUN for three seconds.
6. Insert the second encoded ignition key into the ignition lock cylinder and turn the switch to RUN for three seconds.
7. The vehicle should now start with both ignition keys.

Key Programming —Enable/Disable Spare Key Programming

Special Tool(s)

	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool
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NOTE: The spare key programming switch is a diagnostic tool programmable switch that provides the capability to enable/disable the spare key programming procedure. The spare key programming procedure can be found in the owner's literature and also in this section under [Key Programming—Program a Key Using Two Programmed Keys](#). This programmable switch is provided as a convenience for rental company fleets or other fleet purchasers who may not want the spare key programming procedure available to the vehicle driver.

NOTE: The spare key programming switch state can be viewed by the instrument cluster PID SPARE_KY found on the Diagnostic Card.

1. Insert a programmed ignition key into the ignition lock cylinder and turn the ignition switch to RUN.
2. Enter diagnostic tool. Follow the SECURITY ACCESS PROCEDURE. For additional information, refer to [Security Access—Procedure](#) to obtain security access.
3. **NOTE:** The default setting on delivery of all new vehicles is <ENABLE>.

From diagnostic tool menu, select SPARE KEY PROGRAMMING SWITCH selection to the desired setting:

<ENABLE> Spare key programming procedure is accessible.

<DISABLE> Spare key programming procedure is not accessible.

Key Programming —Additional Key With One Programmed Key

NOTE: This procedure is used when a customer needs to have an additional key programmed into the vehicle without erasing stored key codes, but does not have two programmed keys available. This procedure is also useful when attempting to determine if an ignition key is defective, as a new key can be installed without erasing keys or without having two programmed keys available.


NOTE: Before programming, the new key must have the correct mechanical cut for the ignition lock.

NOTE: If eight keys are already programmed, this procedure will not allow any further ignition keys to be programmed without erasing all stored key codes first. The number of keys programmed into the system can be determined using the INSTRUMENT CLUSTER PID NUMKEYS.

1. Turn the ignition switch from the OFF position to the RUN position using the new, unprogrammed ignition key.
 2. Enter diagnostic tool using the Ford Service Function (FSF) card and enter the appropriate instrument cluster. Follow Security Access to obtain security access. For additional information, refer to [Security Access—Procedure](#).
 3. From the diagnostic tool menu Select: IGNITION KEY CODE PROGRAM.
 4. Turn the ignition switch to the OFF position and disconnect diagnostic tool.
 5. Attempt to start the engine with the new ignition key. The vehicle engine should start and run normally.
-

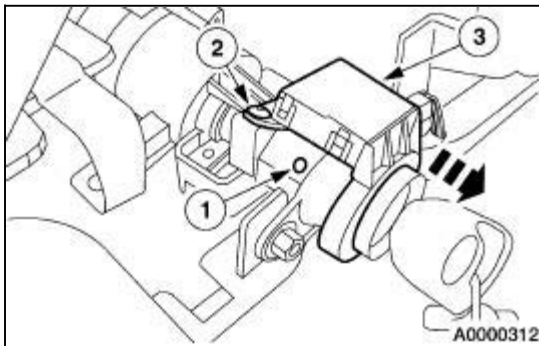
Module —Passive Anti-Theft Transceiver

Removal and Installation

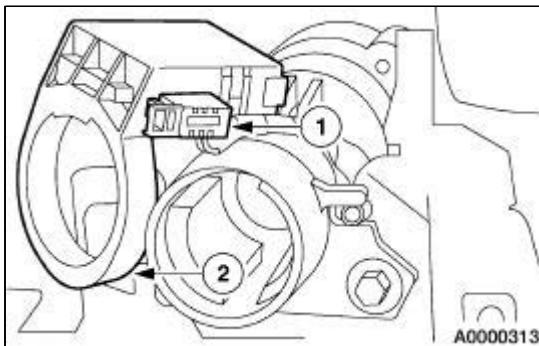
1.  **CAUTION:** Electronic modules are sensitive to electrical charges. If exposed to these charges, damage may result.

Disconnect the battery ground cable. Refer to [Section 414-01](#).

2. Remove the instrument panel cluster finish panel. Refer to [Section 501-12](#).
3. Position the passive anti-theft system (PATS) transceiver module aside.
 1. **NOTE:** The ignition must be turned to the RUN position to remove ignition lock cylinder.
 1. Push the tab and remove the ignition lock cylinder.
 2. Remove the screw.
 3. Position the PATS transceiver module aside.

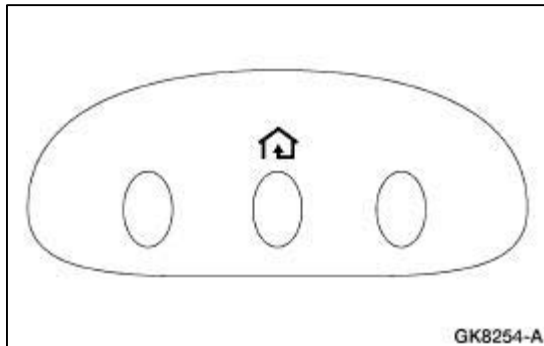


4. Remove the PATS transceiver module.
 1. Disconnect the electrical connector.
 2. Remove the PATS transceiver module.



5. To install, reverse the removal procedure.

Universal Transmitter



The HomeLink® universal transmitter provides a convenient way to substitute up to three hand-held transmitters with a single built-in device. The universal transmitter:

- will operate garage doors, gates and home/office lighting and security systems.
 - will actually learn and transmit the radio frequency of up to three hand-held transmitters from any of the systems mentioned above.
 - is an integral part of the left sun visor assembly and is powered by the vehicle battery and charging system.
-

Universal Transmitter

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
<ul style="list-style-type: none"> ● Damaged universal transmitter ● Damaged receiver

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the fault is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● The universal transmitter is inoperative 	<ul style="list-style-type: none"> ● Universal transmitter. ● Receiver unit. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.

Pinpoint Tests

PINPOINT TEST A: THE UNIVERSAL TRANSMITTER IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK LEFT VANITY MIRROR OPERATION	
	<p>1 Check the illumination of the left vanity mirror lamps.</p> <ul style="list-style-type: none"> ● Do the left vanity mirror lamps illuminate?

→ **Yes**
GO to A2.

→ **No**
For additional information, REFER to Section 417-02.

A2 PROGRAM HAND-HELD TRANSMITTER INTO UNIVERSAL TRANSMITTER

1 **NOTE:** If the garage door is equipped with rolling codes, refer to Training a Garage Door Opener Equipped With "Rolling Codes."


Program the universal transmitter; for additional information, refer to Programming.


● **Did the universal transmitter program successfully?**

→ **Yes**
The universal transmitter is OK. VERIFY receiver operation.

→ **No**
REPLACE the left sun visor assembly. TEST the system for normal operation.

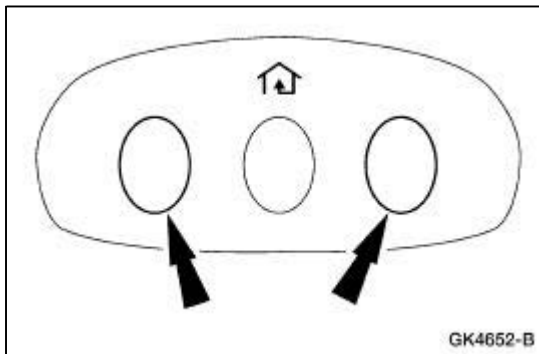
Programming

 **WARNING:** A garage door opening system that cannot stop or reverse itself after detecting an object in its path does not meet current federal safety standards. To decrease the risk of serious injury or death, do not use this HomeLink® transmitter with a door opening system that lacks stop and reverse features as required by federal standards. This includes any garage door opening system manufactured before April 1, 1982. For more information, call HomeLink® customer assistance at 1-800-355-3515.

1.  **CAUTION:** During this procedure, the system that you are programming will be made to operate. Make sure that people or objects are clear of the garage door or gate being programmed.

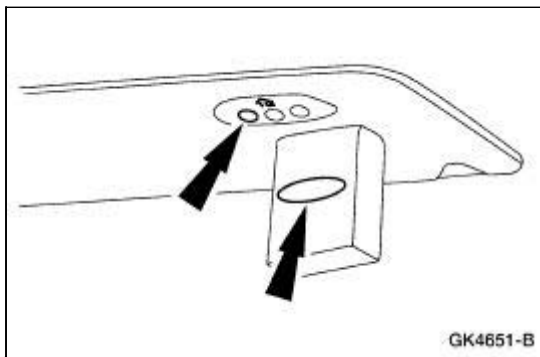
Verify the hand-held transmitter is operative.

2. Prepare for programming the universal transmitter by erasing all three channels by holding down the two outside buttons until the red light begins to flash (20-30 seconds). Release both buttons.



3. Select one of the three universal transmitter channels to be programmed by pressing the desired button.
4. Hold the end of the hand-held transmitter 25-51mm (1-2 in) from the front surface of the universal transmitter so that the red light can still be seen.
5. **NOTE:** During programming, the hand-held transmitter may automatically stop transmitting after two seconds, which may not be long enough to program the universal transmitter. If programming this type of hand-held transmitter, continue to hold the button on the universal transmitter while re-pressing the hand-held transmitter button every two seconds (Canada only).

Use both hands to press the hand-held transmitter button and the desired button on the universal transmitter. Do not release either button.



6. Hold down both buttons until the red light on the universal transmitter flashes, first slowly and then rapidly. Release both buttons when the rapid flashing begins. The universal transmitter has successfully learned the new frequency signal and can be used in place of the hand-held transmitter(s).
7. **NOTE:** If the hand-held transmitter appears to program the universal transmitter but does not open the garage door, the garage door opener may have a "code protected" or "rolling code" feature.

To operate, simply press the appropriate button on the universal transmitter. The red light is on while the signal is being transmitted.

Training a Garage Door Opener Equipped With "Rolling Codes"

8. Program the hand-held transmitter to the universal transmitter. For additional information, refer to [Programming](#) in this section.
9. Train the garage door opener receiver to recognize the universal transmitter.
 1. Remove the cover panel from the garage door opener receiver.
 2. Locate the training button on the garage door opener receiver. Location and color of the button may vary by garage door opener manufacturer. Refer to the garage door opener instruction manual or call HomeLink® customer assistance at 1-800-355-3515.
 3. Press the training button on the garage door opener receiver for 1-2 seconds.
 4. Press the programmed universal transmitter button for as long as the universal transmitter red light flashes (1-2 seconds). Release the button and re-press the button to confirm that the universal transmitter is trained to the receiver.
 5. The garage door opener should recognize the universal transmitter.

Erasing Channels

1. **NOTE:** Individual channels cannot be erased, but can be reprogrammed using the procedures for programming; for additional information, refer to [Programming](#) in this section.

To erase all three programmed channels, hold down the two outside buttons until the red light begins to flash (20-30 seconds). Release both buttons.

Torque Specifications

Description	Nm	lb-in
Remote emergency satellite cellular unit module nuts	9	80

Vehicle Emergency Message (VEMS) —Remote Emergency Satellite Cellular Unit (RESCU)

The remote emergency satellite cellular unit (RESCU) system consists of the following:



- global positioning sensor (GPS) antenna 14B286 (located on the package tray).
- RESCU switch assembly (located in the overhead console)
- RESCU module 14B284 (located in the LH quarter panel)

The vehicle emergency message system (VEMS) is a system that allows a user to request emergency assistance (police, ambulance, fire, wrecker) or roadside assistance. Also, if any of the vehicle's airbags are deployed while the VEMS is powered ON, the system automatically issues a call for emergency assistance.

Vehicle Emergency Message (VEMS) —RESCU

Refer to Wiring Diagrams Section [419-05](#), Vehicle Emergency Message for schematic and connector information.

Special Tool(s)

 ST1137-A	73III Automotive Meter or equivalent 105-R0057
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool

Principles of Operation

System Description

The remote emergency satellite cellular unit (RESCU) module controls the system. It is hardwired to the vehicle's cellular phone system, radio, restraint control module (RCM), message center, console RESCU switch, and global positioning sensor (GPS) antenna. The RESCU module uses the cellular phone system to place calls to the Lincoln Security Response Center. It mutes the radio upon placing a call and un-mutes the radio when the call is ended. It monitors an input from the RCM to determine if an airbag has deployed and it provides the user with visual feedback during an activation by displaying status messages on the message center.

The console RESCU switch provides the user with two buttons (SOS and i) for activating the system. The console RESCU switch SOS button is used to place a call for emergency assistance and the console RESCU switch i button is used to place a call for roadside assistance.

The GPS antenna receives data from a group of GPS satellites and is used by the RESCU module to determine the location of the vehicle when one of the activation buttons is pressed or an airbag is deployed.

Powering Up

The VEMS powers up when the ignition switch is turned to RUN. During power up, the RESCU module will carry out a check of the system. The system check takes about 15 seconds. If a failure is detected, the RESCU module will display RESCU FAILURE on the message center for five seconds.

If the cellular phone is not detected, the RESCU module will display RESCU FAILURE on the message center for five seconds, followed by CELLULAR PHONE REMOVED and RESCU FEATURE DISABLED. Each of these messages will be displayed on the message center for five seconds.

Pressing SOS, Pressing i, and Airbag Deployment

When the console RESCU switch SOS or i button is pressed, or one of the airbags is deployed, the VEMS will try to take control of the cellular phone system and inform the user that an activation is in progress by displaying SOS REQUEST or INFO REQUEST on the message center. The VEMS also mutes the radio causing PHONE to be displayed on the radio display.

If the VEMS determines that the cellular phone is not correctly connected, the message center will display CELLULAR PHONE REMOVED followed by RESCU FEATURE DISABLED then UNABLE TO PLACE CALL and INSTALL PHONE TO CONTINUE.

If the cellular phone is connected, but the VEMS determines that the phone is not RESCU compatible, NON-RESCU PHONE will be displayed on the message center.

Upon determining that the cellular phone is connected and communication with it can be established, the VEMS checks to see if cellular service is available (a cellular signal is sensed by the vehicle's cellular phone).

If cellular service is not available, the VEMS will continue to check for service for up to two minutes. During this time, NO CELLULAR SIGNAL followed by WAITING TO ACQUIRE are continually displayed in rotation on the message center. If service is still not available after two minutes, UNABLE TO PLACE CALL is displayed on the message center and the activation is terminated.

If service is available, the VEMS places a data call to the Lincoln Security Response Center's central computer and CALL IN PROGRESS is displayed on the message center.

If the call has trouble going through because the cellular system is busy, the VEMS will continue trying to place the call for up to one minute. During this time, CELLULAR SYSTEM BUSY followed by PLEASE WAIT are continuously displayed in rotation on the message center, and then the activation is terminated. If the data call goes through, RINGING RESPONSE CENTER is displayed on the message center.

Once the data call is answered by the response center, the VEMS sends it an electronic data message. This message includes: the type of activation (SOS, i, or airbag), a customer identification number (CID), the most recently recorded location (latitude and longitude), the speed and direction of travel of the vehicle, the time at which the location and speed data was taken, and the system's cellular phone number. While this data is being transmitted, the system updates the message center with SENDING LOCATION DATA.

After the data has been received by the response center, DATA RECEIVED will be displayed on the message center. The call will then be displayed on the message center. The call will then be forwarded to the response center's operator switchboard.

If the data call fails to go through, the VEMS will carry out a voice call redial to the Lincoln Security Response Center's operator switchboard. While this call is being placed, REDIAL IN PROGRESS will be displayed on the message center. While the system is waiting for an operator to answer, WAITING FOR OPERATOR will be displayed on the message center.

Upon answering the call, the operator will attempt to talk with the caller to determine the level of assistance required. The operator will contact the appropriate emergency assistance provider if the call was made due to a console RESCU switch SOS button press or an airbag deployment. If the call was caused by pressing the console RESCU switch i button, the operator will provide directions to the location asked for by the caller.

Throughout the rest of the call CID... AT..., and LON... data that was sent to the response center will be continually displayed in rotation on the message center.

If the call is initiated by pressing the console RESCU switch SOS button or by the deployment of an airbag, the caller has no control of the phone and all communication with the response center operator will occur hands-free. If the call is initiated by pressing the console RESCU switch i button,

communication with the response center operator defaults to hands-free but may be switched to private mode (using the phone's internal speaker and microphone) by removing the phone from its cradle.

When the RESCU call is ended, the message center will return to displaying vehicle information and the radio will un-mute and return to its previous operating mode.

Powering Down

When the ignition switch is turned from RUN to OFF, or from RUN to ACC, the VEMS may be powered off so no status messages will be displayed. If the ignition switch is turned from RUN to OFF or ACC while the VEMS is in a call, the call will continue, but the message center will be turned off. After the call is ended, the VEMS will remain on for six minutes. After the six minutes have expired, the VEMS will power OFF. To reuse the VEMS after this time, the ignition switch will have to be turned back to the RUN position.

Inspection and Verification

1. **NOTE:** The RESCU module must be reconfigured upon replacement. For more information refer to [Section 418-01](#).

Verify the customer concern by operating the VEMS. Observe the information and message center display while operating the VEMS. If there is no status information displayed by the information and message center display, refer to [Section 413-08](#).

2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
<ul style="list-style-type: none">● BJB Fuse 414 (5A)● CJB Fuse 229 (5A)● Cellular phone system● Circuitry● Console RESCU switch● RESCU module● GPS antenna coaxial cable and connectors● Portable support electronics (PSE) module

3. Verify the cellular phone system has an activated service.
4. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from diagnostic tool menu. If diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
5. If the Diagnostic Tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
6. Carry out the DATA LINK DIAGNOSTICS. If the diagnostic tool responds with:

- CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
- NO RESP/NOT EQUIP for RESCU, go to Pinpoint Test A.
- SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), clear the continuous DTCs and carry out self-test diagnostics for the RESCU module.

7. If the DTCs retrieved are related to the concern, go to RESCU Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, proceed to the Symptom Chart.

RESCU Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1216	Emergency & Road Side Assistance Switch Circuit Short to Ground	RESCU	GO to Pinpoint Test E .
B1342	ECU is Defective	RESCU	CLEAR the DTCs. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new RESCU module. For additional information, REFER to Module—Remote Emergency Satellite Cellular Unit (RESCU) . CLEAR the DTCs. REPEAT the self-test.
B1871	Passenger Air Bag Disable Module Fault	RESCU	GO to Pinpoint Test F .
B1874	Cellular Phone Handset Not Present (Phone transceiver is connected but not responding to any RESCU query)	RESCU	GO to Pinpoint Test G .
B1893	GPS Antenna Open Circuit	RESCU	GO to Pinpoint Test H .
B2102	GPS Antenna Circuit Short to Ground	RESCU	GO to Pinpoint Test J .
B2141	NVM Configuration Failure [No/invalid telephone number(s) present]	RESCU	CLEAR the DTCs. CARRY OUT RESCU On-Demand Self-Test. If DTC B2141 is retrieved, INSTALL a new RESCU module. For additional information, REFER to Module—Remote Emergency Satellite Cellular Unit (RESCU) . CLEAR the DTCs. REPEAT the self-test.
B2477	Module Configuration Failure (No/invalid VIN present or RESCU configuration error)	RESCU	CHECK the RESCU module configuration. For additional information, REFER to Section 418-01 .

RESCU Parameter Identification (PID) Index

PID	Description	Expected Value
AIRBAGI	Airbag Input Status	notACT, ACTIVE
ASSTREQ	Button Status Assistance Request	notACT, ACTIVE

CCNT	Number Of Continuous DTCs In Module	one count per bit
DEP_IND	Airbag Deployment Indication Input	NORMAL, OPEN, STG, STB
INFOREQ	Button Status Information Request	notACT, ACTIVE


Symptom Chart

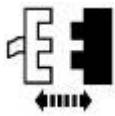
Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the remote emergency satellite cellular unit (RESCU) module 	<ul style="list-style-type: none"> BJB Fuse 414 (5A). CJB Fuse 229 (5A). Circuitry. RESCU module. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> The VEMS does not operate correctly—RESCU does not respond to the console RESCU switch i button 	<ul style="list-style-type: none"> Console RESCU switch. RESCU module. Circuitry. 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
<ul style="list-style-type: none"> The VEMS does not operate correctly — RESCU/cellular phone interface is inoperative 	<ul style="list-style-type: none"> RESCU module. Circuitry. PC phone. Portable support electronics (PSE) module. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> The VEMS does not operate correctly — air bag warning indicator on continuously 	<ul style="list-style-type: none"> RESCU module. Circuitry. Restraint control module (RCM). 	<ul style="list-style-type: none"> GO to Pinpoint Test D.
<ul style="list-style-type: none"> The VEMS does not operate correctly — RESCU does not respond to the console RESCU switch SOS button 	<ul style="list-style-type: none"> Console RESCU switch. RESCU module. Circuitry. 	<ul style="list-style-type: none"> GO to Pinpoint Test K.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE REMOTE EMERGENCY SATELLITE CELLULAR UNIT (RESCU) MODULE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>A1 CHECK THE RESCU MODULE FOR VOLTAGE — CIRCUITS 31-GP8 (BK/RD) AND 20-GP8 (PK/OG)</p> <p>1 </p> <p>2</p>	

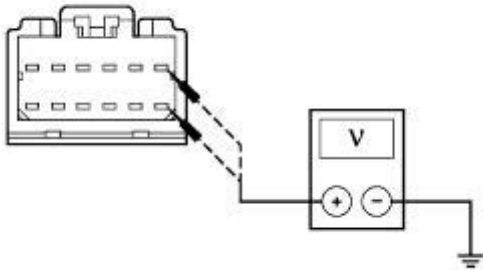


RESCU Module C401a

3



4



A0004042

4 Measure the voltage between RESCU module C401a pin 1, circuit 31-GP8 (BK/RD), harness side and ground; and between RESCU Module C401a pin 7, circuit 20-GP8 (PK/OG), harness side and ground

- Are both voltages greater than 10 volts?

→ Yes
GO to A2.

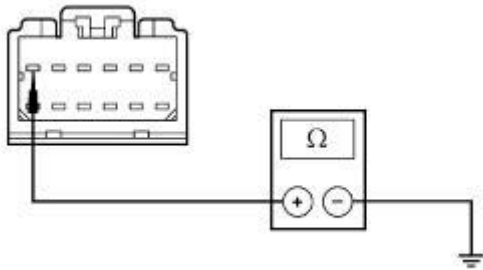
→ No
REPAIR the circuit in question. TEST the system for normal operation.

A2 CHECK THE RESCU MODULE GROUND — CIRCUIT 31-GP8 (BK/RD)

1



2



A0004043

2 Measure the resistance between RESCU module C401a pin 6, circuit 31-GP8 (BK/RD), harness side and ground.


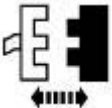
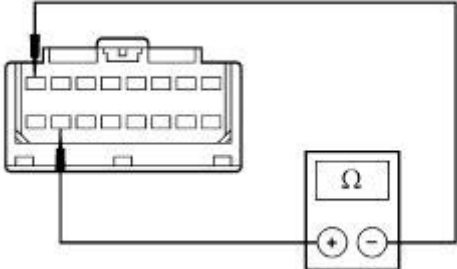
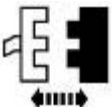
- Is the resistance less than 5 ohms?

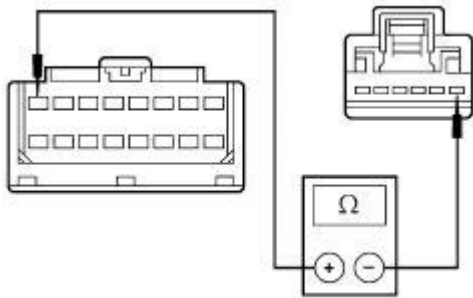
→ Yes
REFER to Section 418-00.

→ No

REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST B: THE VEMS DOES NOT OPERATE CORRECTLY — RESCU DOES NOT RESPOND TO THE CONSOLE RESCU SWITCH i BUTTON

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK THE CONSOLE RESCU SWITCH INPUT	
<p>1 </p> <p>2  RESCU Module C401b</p> <p>3  A0004044</p>	<p>3 Measure the resistance between RESCU module C401b pin 1, circuit 10-GP6 (GY/RD), harness side and RESCU module C401b pin 10, circuit 9-GP6 (BN/RD), harness side, while pressing the console RESCU switch i button.</p> <p>● Is the resistance less than 5 ohms?</p> <p>→ Yes INSTALL a new RESCU module; REFER to <u>Module—Remote Emergency Satellite Cellular Unit (RESCU)</u> . REPEAT the self-test.</p> <p>→ No GO to <u>B2</u> .</p>
B2 CHECK CIRCUIT 10-GP6 (GY/RD) FOR OPEN	
<p>1  Console RESCU switch C915</p> <p>2</p>	<p>2 Measure the resistance between RESCU module C401b pin 1, circuit 10-GP6 (GY/RD), harness side and console RESCU switch C915 pin 1, circuit 10-</p>



A0004045

GP6 (GY/RD), harness side.

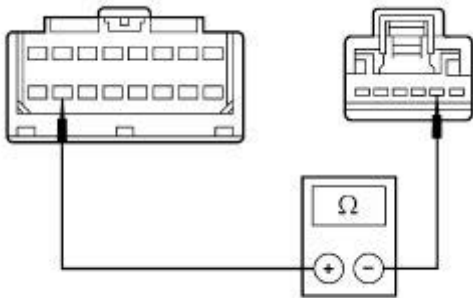
● Is the resistance less than 5 ohms?

→ **Yes**
GO to B3.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

B3 CHECK CIRCUIT 9-GP6 (BN/RD) FOR OPEN

1



A0004046

1

Measure the resistance between RESCU module C401b pin 10, circuit 9-GP6 (BN/RD), harness side and console RESCU switch C915 pin 2, circuit 9-GP6 (BN/RD) harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new console RESCU switch;
REFER to Console—Remote Emergency Satellite Cellular Unit (RESCU) Switch.
CLEAR the DTCs. REPEAT the self-test.

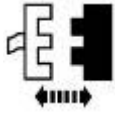
→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

PINPOINT TEST C: THE VEMS DOES NOT OPERATE CORRECTLY — RESCU/CELLULAR PHONE INTERFACE IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE CELLULAR PHONE DISCONNECTED FROM THE VEMS	
1	



2



Cellular Handset Coil Cord C318

3 Operate the cellular phone.

• **Does the cellular phone operate correctly?**

→ **Yes**
GO to C2.

→ **No**
REPAIR the cellular phone. REFER to Section 419-08. CLEAR the DTCs. REPEAT the self-test.

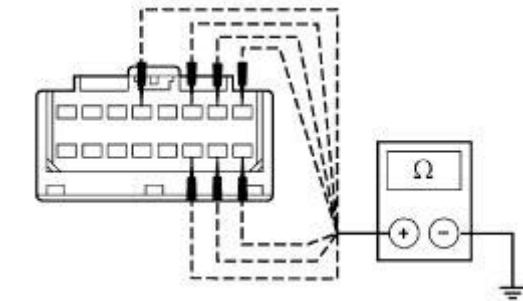
C2 CHECK THE RESCU MODULE CIRCUITS FOR SHORTS TO GROUND

1



RESCU Module C401b

2



A0004047

2 Using the following table, measure the resistance between RESCU module C401b pins, harness side and ground:

Pin	Circuit
8	9-MC10 (BN/YE)
7	2-MC10 (GY/BK)
6	1-MC10 (WH/BK)
4	31-MC10 (BK/RD)
16	4-MC10 (GY/BK)
15	5-MC10 (BU/YE)
14	8-MC10 (WH/BK)

• **Are the resistances greater than 10,000 ohms?**

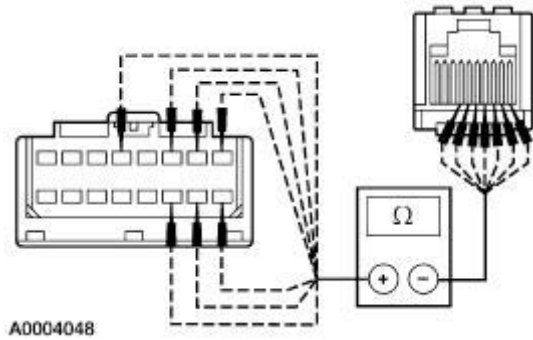
→ **Yes**
GO to C3.

→ **No**
REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

C3 CHECK THE CIRCUITS BETWEEN THE RESCU MODULE AND CELLULAR HANDSET

COIL CORD FOR OPENS

1



A0004048

1

Using the following table, measure the resistance between RESCU module C401b pins, harness side and cellular handset coil cord C318 pins, harness side:

RESCU Module Pin	Circuit	Cellular Handset Coil Cord Pin
6	1-MC10 (WH/BK)	3
7	2-MC10 (GY/BK)	2
16	4-MC10 (GY/BK)	7
15	5-MC10 (BU/YE)	6
14	8-MC10 (WH/BK)	5
8	9-MC10 (BN/YE)	1
4	31-MC10 (BK/RD)	4

• Are the resistances less than 5 ohms?

→ Yes

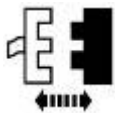
INSTALL a new RESCU module: REFER to [Module—Remote Emergency Satellite Cellular Unit \(RESCU\)](#). CLEAR the DTCs. REPEAT the self-test.

→ No

REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST D: THE VEMS DOES NOT OPERATE CORRECTLY — AIR BAG WARNING INDICATOR ON CONTINUOUSLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK THE AIR BAG WARNING INDICATOR — RESCU MODULE DISCONNECTED	
<p>1</p> <p>2</p>	



RESCU Module C401b

3



- Does the air bag warning indicator flash code 25 or code 27?

→ **Yes**
GO to D2.

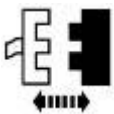
→ **No**
DIAGNOSE the RCM; REFER to Section 501-20B.

D2 CHECK CIRCUIT 8-GP8 (WH/BK) FOR OPEN

1

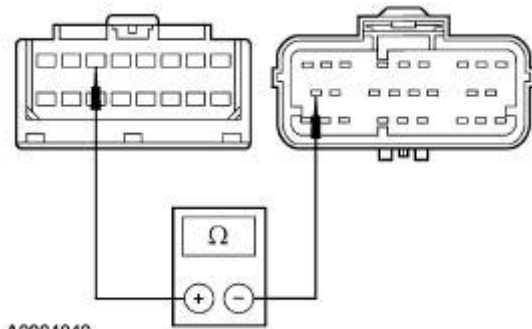


3



RCM C310a

4



2 Deactivate the air bags. Refer to Section 501-20B.


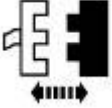





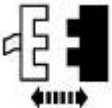


4 Measure the resistance between RESCU module C401b pin 3, circuit 8-GP8 (WH/BK), harness side and RCM C310a pin 17, circuit 8-GP8 (WH/BK), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
DIAGNOSE the RCM; REFER to Section 501-20B.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

PINPOINT TEST E: EMERGENCY & ROAD SIDE ASSISTANCE SWITCH CIRCUIT SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK CONSOLE RESCU SWITCH FOR SHORT TO GROUND	
<p>1 </p> <p>2  Console RESCU switch C915</p> <p>3  Diagnostic Tool</p> <p>4 </p> <p>5 </p>	<p>5  Clear the RESCU DTCs. Carry out the RESCU on-demand self-test.</p> <p>● Is DTC B1216 retrieved?</p> <p>→ Yes GO to <u>E2</u>.</p> <p>→ No INSTALL a new console RESCU switch; REFER to <u>Console—Remote Emergency Satellite Cellular Unit (RESCU) Switch</u>. CLEAR the DTCs. REPEAT the self-test.</p>
E2 CHECK CIRCUIT 8-GP6 (WH/RD) FOR SHORT TO GROUND	
<p>1 </p> <p>2  RESCU Module C401b</p> <p>3 </p>	<p>3  Measure the resistance between console</p>



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RESCU switch C915 pin 6, circuit 8-GP6 (WH/RD), harness side and ground.

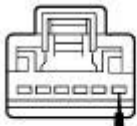
- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to E3.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

E3 CHECK CIRCUIT 10-GP6 (GY/RD) FOR SHORT TO GROUND

1



A0004051

1

Measure the resistance between console RESCU switch C915 pin 1, circuit 10-GP6 (GY/RD), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new RESCU module; REFER to Module—Remote Emergency Satellite Cellular Unit (RESCU). CLEAR the DTCs. REPEAT the self-test.

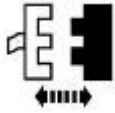
→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST F: PASSENGER AIR BAG DISABLE MODULE FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK CIRCUIT 8-GP8 (WH/BK) FOR SHORT TO GROUND — RCM CONNECTED	
1	

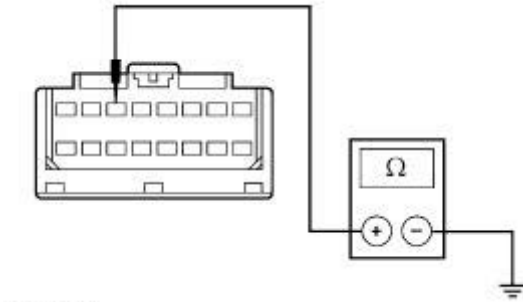


2



RESCU Module C401b

3



A0004052

3

Measure the resistance between RESCU module C401b pin 3, circuit 8-GP8 (WH/BK), harness side and ground.

• Is the resistance greater than 10,000 ohms?

→ Yes

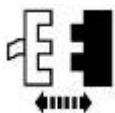
INSTALL a new RESCU module; REFER to Module—Remote Emergency Satellite Cellular Unit (RESCU). CLEAR the DTCs. REPEAT the self-test.

→ No

GO to F2.

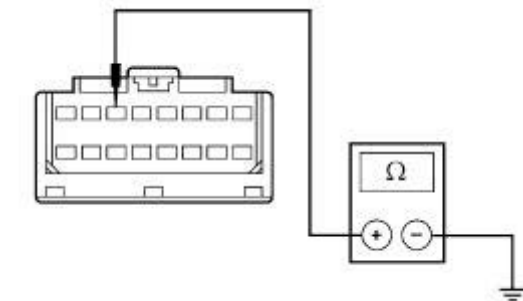
F2 CHECK CIRCUIT 8-GP8 (WH/BK) FOR SHORT TO GROUND — RCM DISCONNECTED

1



RCM C310a

2



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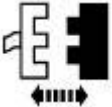
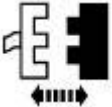
2

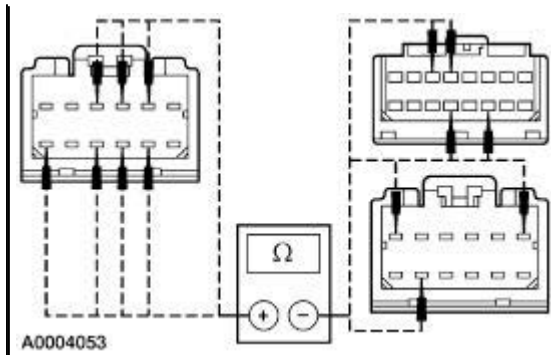
Measure the resistance between RESCU module C401b pin 3, circuit 8-GP8 (WH/BK), harness side and ground.

• Is the resistance greater than 10,000 ohms?

	<p>→ Yes DIAGNOSE the RCM; REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.</p>
--	---

PINPOINT TEST G: CELLULAR PHONE HANDSET NOT PRESENT (PHONE TRANSCEIVER IS CONNECTED BUT NOT RESPONDING TO ANY RESCU QUERY)

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE CELLULAR PHONE	
<p>1</p> 	<p>2 Operate the cellular phone.</p> <ul style="list-style-type: none"> • Does the cellular phone operate correctly? <p>→ Yes GO to G2 .</p> <p>→ No DIAGNOSE the cellular phone; REFER to Section 419-08 . CLEAR the DTCs. REPEAT the self-test.</p>
G2 CHECK THE CIRCUITS BETWEEN THE RESCU MODULE AND THE PSE FOR OPENS	
<p>1</p>  <p>2</p>  <p>RESCU Module C401a</p> <p>3</p>  <p>PSE C403a and C403b</p> <p>4</p>	<p>4 Using the following table, measure the resistance between RESCU module C401a pins, harness side and PSE</p>



connector pins, harness side:

RESCU Module Pin	Circuit	PSE Module Connector
10	1-GP11 (WH/GN)	C403a Pin 1
9	2-GP10 (GY/VT)	C403a Pin 6
2	4-GP14 (GY/RD)	C403b Pin 5
3	5-GP12 (BU/YE)	C403b Pin 6
4	8-GP13 (WH/VT)	C403a Pin 11
8	10-GP9 (GY)	C403b Pin 11
12	31-MC10A (BK/RD)	C403b Pin 13

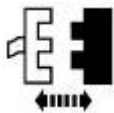
- Are the resistances less than 5 ohms?

→ **Yes**
 INSTALL a new RESCU module; REFER to Module—Remote Emergency Satellite Cellular Unit (RESCU). CLEAR the DTCs. REPEAT the self-test.

→ **No**
 REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

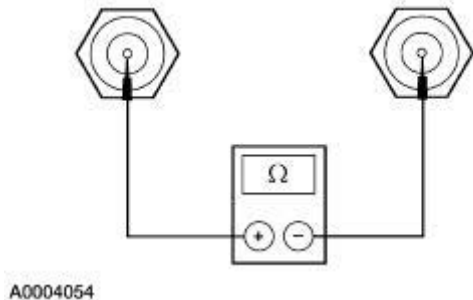
PINPOINT TEST H: GPS ANTENNA OPEN CIRCUIT

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK THE COAXIAL ANTENNA CENTER CONDUCTOR FOR OPEN	
<p>1</p> <p>2</p> <p>GPS Coaxial Antenna Connector C325</p> <p>3</p>	



RESCU Module Coaxial Antenna Connector C401c

4



4

Measure the resistance between GPS coaxial antenna C325 center conductor pin, harness side and RESCU module coaxial antenna C401c center conductor pin, harness side.

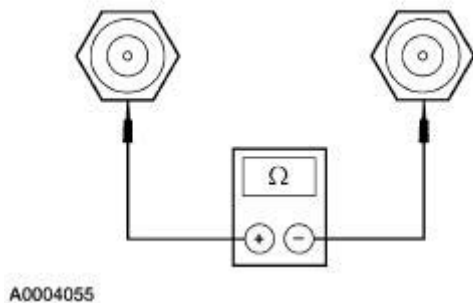
● Is the resistance less than 5 ohms?

→ **Yes**
GO to H2.

→ **No**
INSTALL a new antenna coaxial cable.
CLEAR the DTCs. REPEAT the self-test.

H2 CHECK THE COAXIAL ANTENNA SHIELD FOR OPEN

1



1

Measure the resistance between GPS coaxial antenna C325 shield, harness side and RESCU module coaxial antenna C401c shield, harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to H3.

→ **No**
INSTALL a new antenna coaxial cable.
CLEAR the DTCs. REPEAT the self-test.




H3 REPEAT RESCU ON-DEMAND SELF-TEST

1


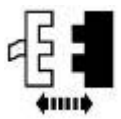


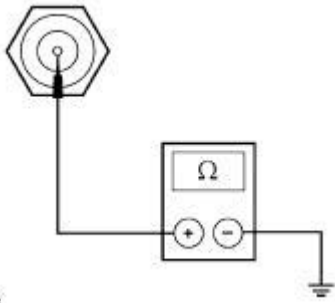
GPS Coaxial Antenna Connector C325

2

 <p>RESCU Antenna Coaxial Connector C401c</p> <p>3</p>  <p>Diagnostic Tool</p> <p>4</p>  <p>RESCU On-Demand Self-Test</p>	<ul style="list-style-type: none"> ● Is DTC B1893 retrieved? <p>→ Yes INSTALL a new GPS antenna; REFER to Antenna—Global Positioning Sensor (GPS). CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No System is OK.</p>
--	---

PINPOINT TEST J: GPS ANTENNA CIRCUIT SHORT TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 CHECK THE COAXIAL ANTENNA CENTER CONDUCTOR FOR SHORT TO GROUND — RESCU MODULE CONNECTED	
<p>1</p>  <p>2</p>  <p>GPS Coaxial Antenna Connector C325</p> <p>3</p>	<p>3 Measure the resistance between GPS coaxial antenna C325 center conductor, harness side and ground.</p>



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- Is the resistance greater than 10,000 ohms?

→ **Yes**
 INSTALL a new GPS antenna; REFER to Antenna—Global Positioning Sensor (GPS). CLEAR the DTCs. REPEAT the self-test.

→ **No**
 GO to J2.

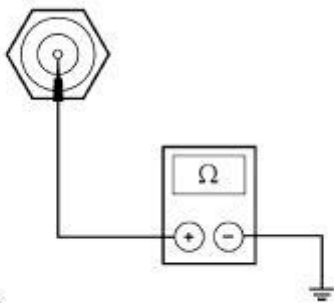
J2 CHECK THE COAXIAL ANTENNA CENTER CONDUCTOR FOR SHORT TO GROUND — RESCU MODULE DISCONNECTED

1



RESCU Module Coaxial Antenna C401c

2



A0004056


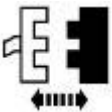
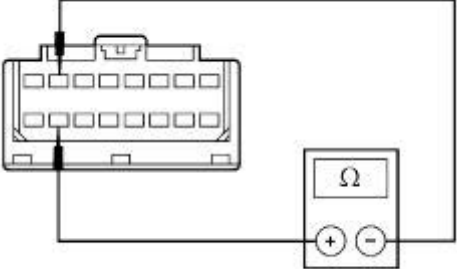

- 2 Measure the resistance between RESCU module coaxial antenna C401c connector center conductor, harness side and ground.

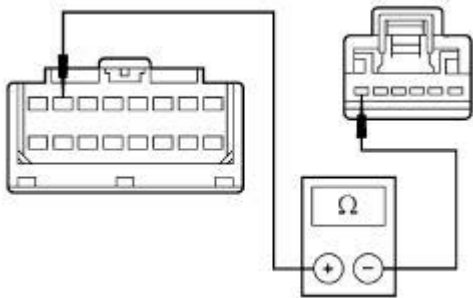
- Is the resistance greater than 10,000 ohms?

→ **Yes**
 INSTALL a new RESCU module; REFER to Module—Remote Emergency Satellite Cellular Unit (RESCU). CLEAR the DTCs. REPEAT the self-test.

→ **No**
 INSTALL a new antenna coaxial cable. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST K: THE VEMS DOES NOT OPERATE CORRECTLY — RESCU DOES NOT RESPOND TO THE CONSOLE RESCU SWITCH SOS BUTTON

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 CHECK THE CONSOLE RESCU SWITCH SOS BUTTON CIRCUIT FOR CONTINUITY	
<p>1 </p> <p>2  RESCU Module C401b</p> <p>3  A0004057</p>	<p>3 Measure the resistance between RESCU module C401b pin 2, circuit 8-GP6 (WH/RD), harness side and RESCU module C401b pin 10, circuit 9-GP6 (BN/RD), harness side while pressing the console RESCU switch SOS button.</p> <p>● Is the resistance less than 5 ohms?</p> <p>→ Yes INSTALL a new RESCU module; REFER to <u>Module—Remote Emergency Satellite Cellular Unit (RESCU)</u>. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No GO to <u>K2</u>.</p>
K2 CHECK CIRCUIT 8-GP6 (WH/RD) FOR OPEN	
<p>1  Console RESCU switch C915</p> <p>2</p>	<p>2 Measure the resistance between RESCU module C401b pin 2, circuit 8-GP6 (WH/RD), harness side and console RESCU switch C915 pin 6, circuit 8-GP6 (WH/RD), harness side.</p>



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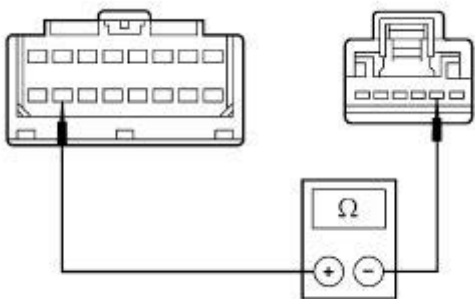
● Is the resistance less than 5 ohms?

→ **Yes**
GO to K3.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

K3 CHECK CIRCUIT 9-GP6 (BN/RD) FOR OPEN

1



A0004046

1

Measure the resistance between RESCU module C401b pin 10, circuit 9-GP6 (BN/RD), harness side and console RESCU switch C915 pin 2, circuit 9-GP6 (BN/RD), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new console RESCU switch;
REFER to Console—Remote Emergency Satellite Cellular Unit (RESCU) Switch.
CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

Module —Remote Emergency Satellite Cellular Unit (RESCU)

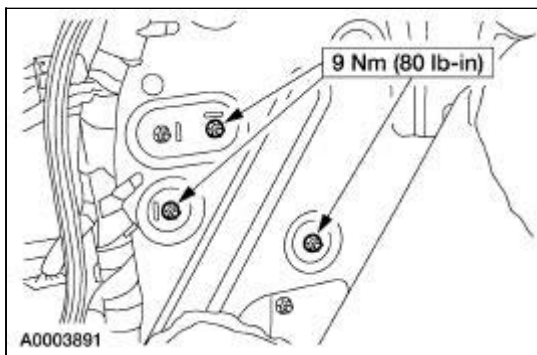
Removal and Installation

1.  **CAUTION:** Electronic modules are sensitive to electrical charges. If exposed to these charges, damage may result.

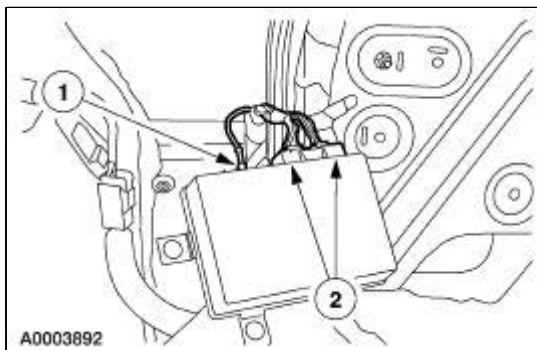
NOTE: The remote emergency satellite cellular unit (RESCU) module must be reconfigured upon replacement. Refer to [Section 418-01](#).

Disconnect the battery ground cable. Refer to [Section 414-01](#).

2. Position the LH quarter trim panel aside.
3. Remove the RESCU module nuts.



4. Remove the RESCU module.
 1. Disconnect the antenna.
 2. Disconnect the electrical connector.

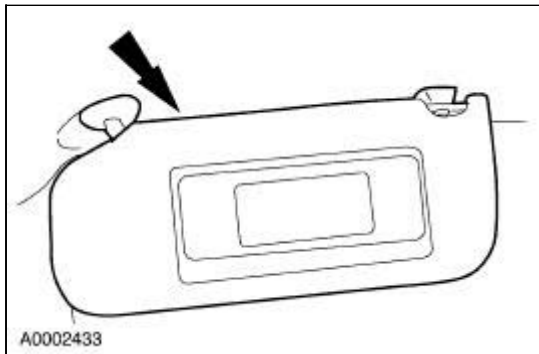


5. To install, reverse the removal procedure.

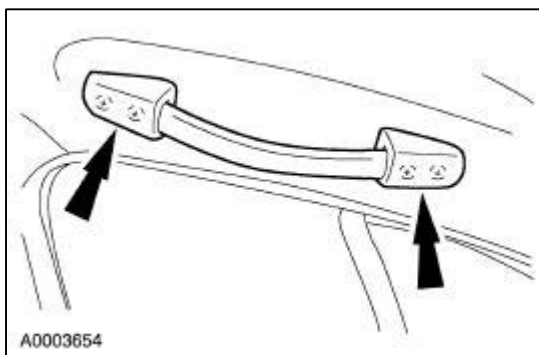
Console —Remote Emergency Satellite Cellular Unit (RESCU) Switch

Removal and Installation

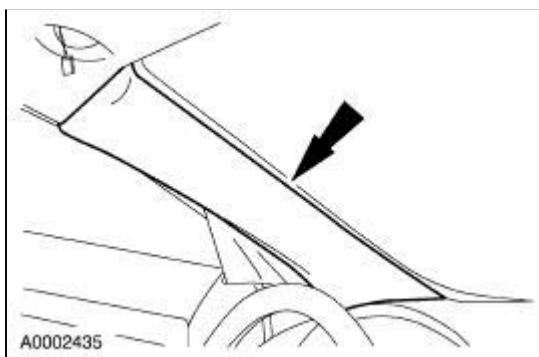
1. Remove the sun visors from each side.



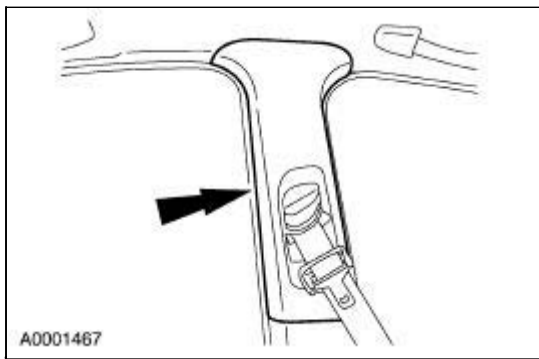
2. Remove the assist handle.



3. Remove the windshield garnish mouldings.



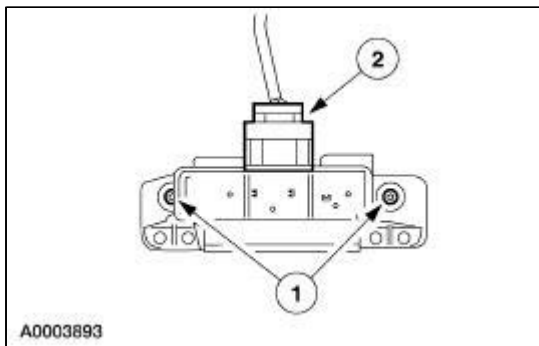
4. Remove the upper B-pillar trim.



5. Remove the front dome lamp assembly bezel.
6. **NOTE:** Folding the headliner will require installing a new headliner.

Carefully pull the front of the headliner down to gain access to the console remote emergency satellite cellular unit (RESCU) switch.

7. Remove the switch.
 1. Remove the screws.
 2. Disconnect the electrical connector.

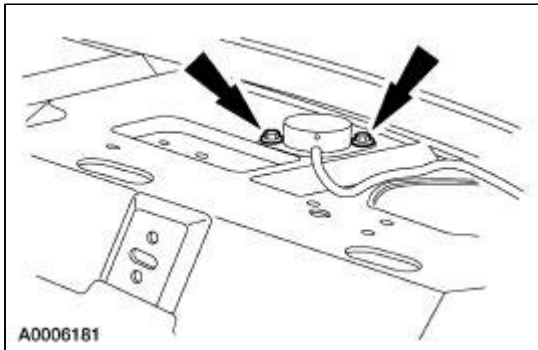


8. To install, reverse the removal procedure.
-

Antenna —Global Positioning Sensor (GPS)

Removal and Installation

1. Remove the package tray trim panel. For additional information, refer to [Section 501-05](#).
2. Remove the two bolts and the global positioning sensor (GPS) antenna.



3. To install, reverse the removal procedure.
-

General Specifications

Item	Specification
Ultra-Clear Spray Glass Cleaner E4AZ-19C507-AA	ESR-M14P5-A

Torque Specifications

Description	Nm	lb-in
Portable support electronic (PSE) module nuts	9	80

Cellular Phone



The portable cellular phone system consists of:

- cellular phone handset
 - handset battery
 - handset holder
 - coil cord
 - steering column shroud-mounted microphone
 - steering wheel switch controls
 - cellular phone module (CPM)
 - on-glass cellular phone antenna (late production)
 - antenna cable
 - audio unit controls
-

Cellular Phone

Refer to Wiring Diagrams Section [419-08](#) for schematic and connector information.

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224 New Generation STAR (NGS) Tester 418-F052 or equivalent

Inspection and Verification

NOTE: The portable cellular phone system is diagnosed through the audio unit.

NOTE: The cellular phone module (CPM) is also referred to as the portable support electronics (PSE) module.

1. Verify the customer concern by operating the portable cellular phone both in portable mode and while connected to the vehicle.
2. Make sure the portable cellular phone is turned on. With the power button on, the system should be on while the ignition switch is in ACC or RUN.
3. Make sure the customer is calling within the coverage area. No Svc will appear in the display if the customer is calling from outside the coverage area.
4. Check to see if the Roam indicator is on. If so, follow the roaming instructions in the owner literature.
5. Check to see if the display reads Locked. If so, press Clr and enter the customer three-digit unlock code.
6. Make sure the portable cellular phone is securely connected to the coil cord and seated in the holder.
7. Check the coil cord connections in the console.
8. Check the portable cellular phone antenna and cellular phone module connections.
9. Check the portable cellular phone system registration. Also, check to make sure that the portable cellular phone is correctly programmed. Incorrect programming can result in single

system scanning, loss of speed dialing, loss of hands-free audio, loss of auto redial, loss of dial tone multi-frequency tones, and the loss of other keypad/portable cellular phone functions.

10. Check the customer account status with the cellular carrier.

If the customer concern is still present, follow these steps to diagnose the concern:

11. Inspect to determine if one of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Portable cellular phone ● Microphone ● Cellular phone module (CPM) ● Vehicle emergency message system (VEMS) module (if equipped) ● Portable cellular phone holder ● Coil cord 	<ul style="list-style-type: none"> ● Central junction box (CJB) fuses: <ul style="list-style-type: none"> ■ 218 (20A) ■ 227 (10A) ■ 202 (5A) ● Battery junction box (BJB) fuses: <ul style="list-style-type: none"> ■ 422 (20A) ■ 414 (5A) ● Circuitry ● Loose or corroded connectors

12. If inspection reveals obvious concerns which can be readily identified, repair as necessary.
13. If the cause of the fault is not visually evident, proceed to diagnose the portable cellular phone system by:
 - entering the Diagnostic Tool or
 - entering the Audio Unit Self-Diagnostic Mode.

Audio Unit Self-Diagnostic Mode

NOTE: To enter the speaker walk-around test or audio unit self-diagnostic mode, the audio unit must be turned on and in radio tuner mode (AM/FM).

Audio unit self-diagnostic mode can only be entered while in the speaker walk-around test.

14. To enter the speaker walk-around test, press the audio unit preset buttons 3 and 6 simultaneously.
15. The speaker walk-around test stops at each speaker and applies a tone to each speaker for about 1-2 seconds. Each speaker is tested and displayed on the audio unit in the following sequence: SPEAKER RF, SPEAKER LF, SPEAKER LR, SPEAKER RR, SUBWOOFER I (for subwoofer, if equipped), and SUBWOOFER II (for center imaging speakers, if equipped). This test can isolate an open circuit for each speaker (broken wire or disconnect). However, a short circuit can only be isolated to either the right pair or left pair.
16. The speaker walk-around test automatically continues and tests:
 - for a speaker circuit short. If a short is present, SPKR SHORT will be displayed. Speaker circuit shorts are detected only in the RF, LF, LR, and RR speaker circuitry.
 - for the CD/DJ. The audio unit display will show NO DJ if not present. The speaker walk-around

test will end and the audio unit will return to its previous setting.

17. Audio unit self-diagnostic mode has six tests available:

- Preset button 1 = Audio internal/external SELF TEST. If SELF FAIL is displayed, press TUNE > to scroll view the DTCs stored. Refer to the Audio Unit Diagnostic Trouble Codes (DTC) Index. If the system is OK, SELF PASS is displayed.
- Preset button 2 = View/Clear continuous diagnostic trouble codes (DTCs). NO DTCS is displayed if no DTCs are retrieved. If DTCS FOUND is displayed, press TUNE > button to view the DTCs retrieved. Refer to the Audio Unit Diagnostic Trouble Codes (DTC) Index. To clear all DTCs, press the EJECT button. DTCS CLEAR will be displayed.
- Preset button 3 = SIGNAL TEST. This test measures the average strength at the current tuner setting.
- Preset button 4 = Software configuration level. This test queries each radio system controller for the software configuration level. SOFT LEVELS will be displayed upon completion of the query. Press TUNE > to scroll view the software configuration version level.

Controller	Description	Radio Display Example
Main	Main Micro Software Version	MAIN ##.##.##
CDSP	CDSP Micro Software Version	CDSP ##.##.##
ADSP	ADSP Micro Software Version	ADSP ##.##.##
Auxiliary	Auxiliary Software Version	AUX ##.##.##
CD/DJ	CDDJ Software Version	DJ ##.##.##
CD Changer	CDR Software Version	CD ##.##.##
Tape Deck	Tape Deck Software Version	TAP ##.##.##
RSC	Rear Seat Controller Software Version	RCP ##.##.##

- Preset button 5 = DISPLAY TEST. This test will light all the audio unit display segments for five seconds, then turn all segments off. When the test is complete, DISPLAY TEST is displayed on the bezel.
 - Preset button 6 = Configuration/EQ ID. This test queries the audio system controller for the software configuration and EQ ID.
18. To enter these tests, press the preset button desired while in the speaker walk-around test. This will abort the speaker walk-around test and start the selected test.
19. To exit audio unit self-diagnostic mode, turn the ignition switch or the audio unit off.
20. If the concern remains and the fault is not detected, proceed to the Diagnostic Tool to continue diagnostics.

Diagnostic Tool

1. Connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:

- check that the program card is correctly installed.
- check the connections to the vehicle.
- check the ignition switch position.

2. **NOTE:** The Audio Unit must be in AM, FM1, or FM2 mode to enter the diagnostic tool .

If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.

3. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:

- CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#) .
- NO RESP/NOT EQUIP for audio unit, refer to [Section 415-00](#) .
- NO RESP/NOT EQUIP for cellular phone module (CPM), go to Pinpoint Test A.
- SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out self-test diagnostics for the CPM.

4. If the DTCs retrieved are related to the concern, go to the Audio Unit Diagnostic Trouble Code (DTC) Index or to the CPM Diagnostic Trouble Code (DTC) Index to continue diagnostics.

5. If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue diagnostics.

Audio Unit Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
U2008	Audio Phone is Not Responding	Audio Unit	GO to Pinpoint Test A .

Note: For a complete master list of all audio unit DTCs, refer to [Section 415-00](#) .

CPM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU is Defective	CPM	INSTALL a new CPM; REFER to Portable Support Electronics (PSE) Module in this section.
B1844	Phone Handset Circuit Failure	CPM	INSTALL a new portable cellular phone. CALL the Ford Cellular Technical Assistance Center at 1-800-755-4161 for additional information.

System/Carrier Concerns

Dropped calls, bad connections, noisy audio and other intermittent symptoms usually indicate a system or cellular carrier concern, and are not the fault of the phone itself. Such symptoms may occur in situations such as the following:

- in certain geographic areas (for example: areas of excessive foliage or hills) or at the edge of coverage areas
- at the same place each day
- at the same time each day
- under bridges, tunnels, in lower freeways, or in congested downtown areas

If the customer phone exhibits any of the above symptoms or symptoms occur under the above conditions, the customer or the dealer should contact customer assistance at their particular cellular provider/carrier or call the 1-800 assistance number provided in the Ford cellular system dealer kit.

Other Possible Concerns

1. If, for some reason, the customer's electronic serial number was incorrectly recorded in the carrier switch, the phone will not work. Call the 1-800 number in your dealer kit to check the electronic serial number.
2. A customer initial call must be made in his/her home coverage area for correct activation of the Ford cellular system.
3. A customer may have to wait 24 hours after the coverage activation before making a call from outside of his/her home coverage area or the phone might be reported stolen and coverage stopped.
4. There may be a slight delay in activation after leaving the dealership.

If, after checking these possibilities, the phone still does not function, do not attempt to repair the phone. Call the cellular distributor, Ford Cellular Technical Assistance Center, at 1-800-755-4161.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● No communication with the audio unit 	<ul style="list-style-type: none"> ● Central junction box (CJB) fuses: <ul style="list-style-type: none"> ■ 218 (20A). ■ 227 (10A). ● Battery junction box (BJB) fuse 422 (20A). ● Circuitry. ● Audio unit. ● Standard corporate protocol (SCP) network. 	<ul style="list-style-type: none"> ● REFER to Section 415-00.
<ul style="list-style-type: none"> ● No communication with the cellular phone module (CPM) 	<ul style="list-style-type: none"> ● CJB fuses: <ul style="list-style-type: none"> ■ 227 (10A). ■ 229 (5A). ● BJB fuses: <ul style="list-style-type: none"> ■ 414 (5A). ■ 422 (20A). ● Circuitry. ● CPM. ● Portable cellular phone. ● Audio unit. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.

	<ul style="list-style-type: none"> ● Audio control protocol (ACP) network. 	
<ul style="list-style-type: none"> ● The phone does not power up 	<ul style="list-style-type: none"> ● CJB fuses: <ul style="list-style-type: none"> ■ 227 (10A). ■ 229 (5A). ● BJB fuses: <ul style="list-style-type: none"> ■ 414 (5A). ■ 422 (20A). ● Circuitry. ● CPM. ● Vehicle emergency message system (VEMS) module (if equipped). ● Portable cellular phone. ● Coil cord. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B.
<ul style="list-style-type: none"> ● The phone information is not displayed—NO PHONE or NO PORTABLE 	<ul style="list-style-type: none"> ● Circuitry. ● CPM. ● Portable cellular phone. ● Audio unit. ● Coil cord. ● Remote emergency satellite cellular unit (RESCU) module (if equipped). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test C.
<ul style="list-style-type: none"> ● Reduced sound or no sound through the speakers 	<ul style="list-style-type: none"> ● Circuitry. ● CPM. ● Portable cellular phone. ● Microphone. ● Audio unit. ● Handset holder. ● Coil cord. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D.
<ul style="list-style-type: none"> ● The phone will not go into hands-free mode 	<ul style="list-style-type: none"> ● Circuitry. ● CPM. ● Portable cellular phone. ● Microphone. ● Handset holder. ● Coil cord. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test E.
<ul style="list-style-type: none"> ● No response to pressing the phone button 	<ul style="list-style-type: none"> ● Circuitry. ● CPM. ● Portable cellular phone. ● Audio unit. ● Coil cord. ● RESCU module (if equipped). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test F.
<ul style="list-style-type: none"> ● Poor reception, static on calls, frequent drop of calls 	<ul style="list-style-type: none"> ● Circuitry. ● Portable cellular phone. ● Antenna. ● Coil cord. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test G.
<ul style="list-style-type: none"> ● No Svc display stays on 	<ul style="list-style-type: none"> ● Circuitry. ● CPM. ● Antenna. ● Portable cellular phone. ● Coil cord. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test H.
<ul style="list-style-type: none"> ● Cannot enter the programming mode 	<ul style="list-style-type: none"> ● Circuitry. ● CPM. ● Portable cellular phone. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test I.
<ul style="list-style-type: none"> ● The cellular phone microphone is not operating 	<ul style="list-style-type: none"> ● Circuitry. ● CPM. 	<ul style="list-style-type: none"> ● GO to Pinpoint

correctly	<ul style="list-style-type: none"> ● Portable cellular phone. ● Microphone. ● Coil cord. 	<u>Test J.</u>
<ul style="list-style-type: none"> ● The voice activated phone functions are inoperative 	<ul style="list-style-type: none"> ● Circuitry. ● CPM. ● Portable cellular phone. ● Microphone. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test K.</u>
<ul style="list-style-type: none"> ● The handset battery does not charge 	<ul style="list-style-type: none"> ● Circuitry. ● CPM. ● Portable cellular phone. ● Phone battery. ● Coil cord. ● RESCU module (if equipped). 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test L.</u>

Pinpoint Tests



CAUTION: Be careful when probing the battery junction box (BJB), central junction box (CJB), or any connectors. Damage will result to the connector receptacle if the probe or terminal being used is too large.



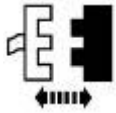
CAUTION: Electronic modules are sensitive to static electrical discharges. If exposed to these charges, damage may result.

NOTE: The cellular phone module (CPM) is also referred to as the portable support electronics (PSE) module.

PINPOINT TEST A: NO COMMUNICATION WITH THE CELLULAR PHONE MODULE (CPM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 RETRIEVE THE RECORDED AUDIO UNIT DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS	
	<p>1 Retrieve the recorded audio unit DTCS from both continuous and on-demand self-tests.</p> <ul style="list-style-type: none"> ● Are any DTCs retrieved? <p>→ Yes If DTC U2008 is retrieved, GO to <u>A2.</u></p> <p>→ No The system is OK.</p>
A2 CHECK THE VOLTAGE TO THE CPM	
<p>1</p>	

2

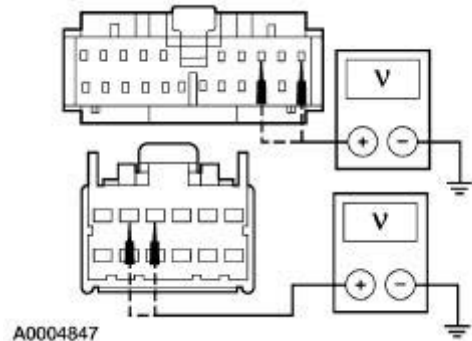


CPM

3



4



4

Measure the voltage between the CPM C404 pin 8, circuit 75-MC9 (YE/GN), harness side and ground; and between the CPM C404 pin 10, circuit 30-MC9 (RD/GN), harness side and ground (without VEMS) or between the CPM C403a pin 5, circuit 75-MC9 (YE/GN), harness side and ground; and between the CPM C403a pin 4, circuit 30-MC9B (RD/GN), harness side and ground (with VEMS).

● Are the voltages greater than 10 volts?

→ Yes
GO to A3.

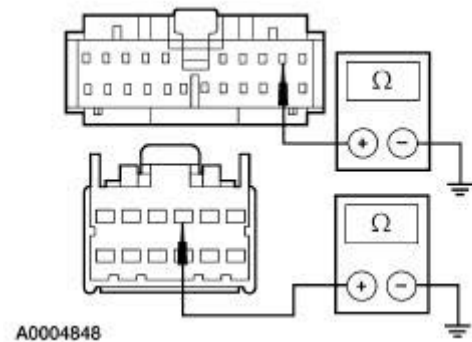
→ No
REPAIR the circuit in question. TEST the system for normal operation.

A3 CHECK THE GROUND TO THE CPM

1



2



2

Measure the resistance between the CPM C403a pin 3, circuit 31-MC9F (BK/GN), harness side and ground (with VEMS) or between the CPM C404 pin 9, circuit 31-MC9 (BK/GN), harness side and ground (without VEMS).

● Is the resistance less than 5 ohms?

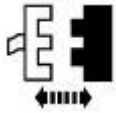
→ Yes

GO to A4.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

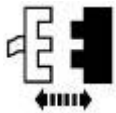
A4 CHECK AUDIO CONTROL PROTOCOL (ACP) CIRCUITS FOR OPEN OR SHORT TO GROUND

1



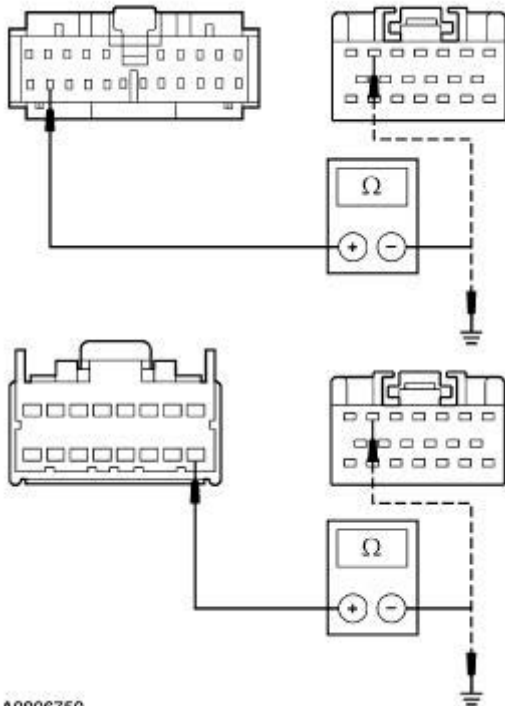
CD Changer C243 (if equipped)

2



Audio Unit C240a

3



A0006750

4

3

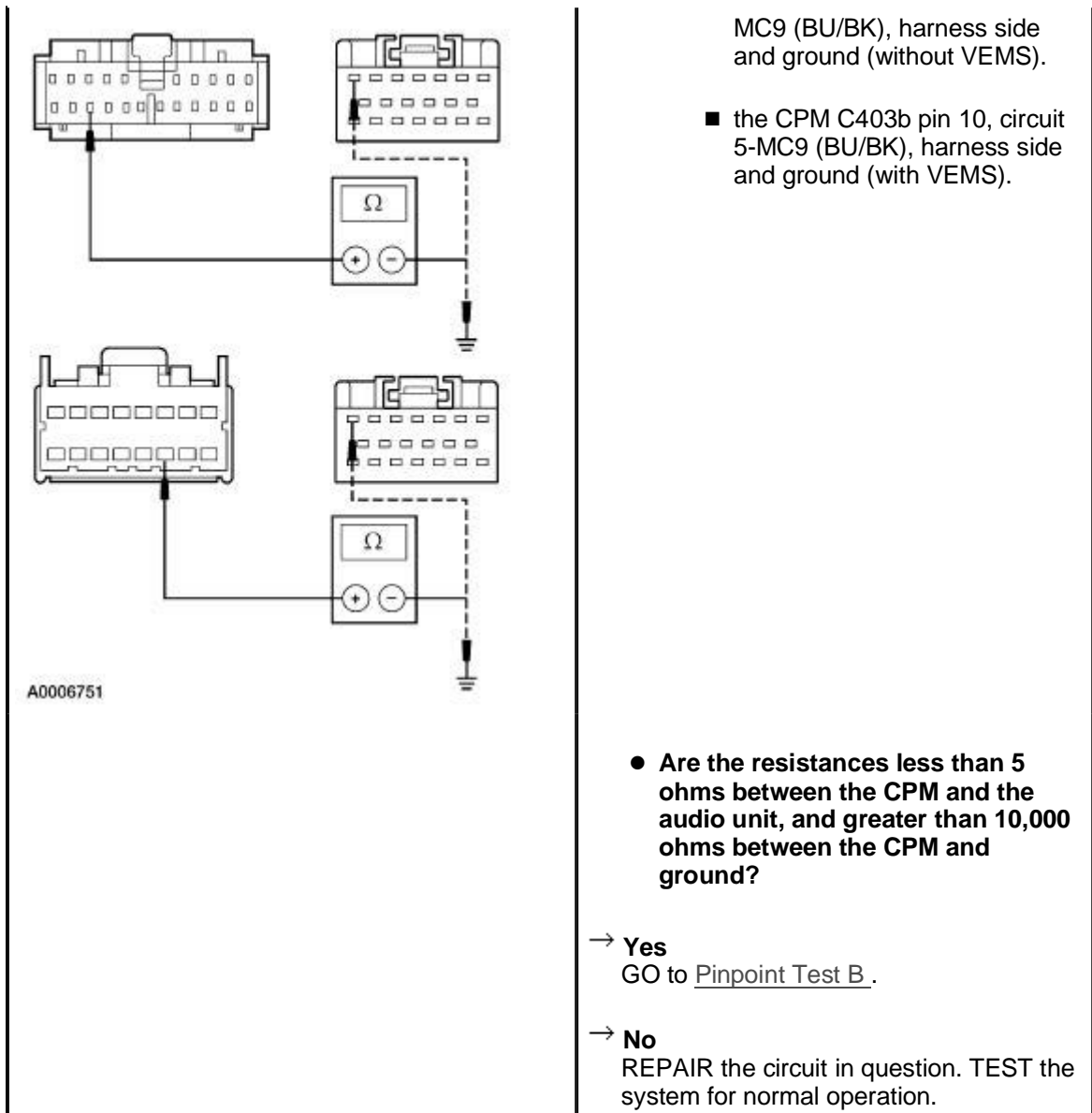
Measure the resistance between:

- the CPM C404 pin 12, circuit 4-MC9 (GY/OG), harness side and the audio unit C240a pin 6, circuit 4-EA8 (GY/VT), harness side (without VEMS); or between the CPM C403b pin 9, circuit 4-MC9 (GY/OG), harness side and the audio unit C240a pin 6, circuit 4-EA8 (GY/VT), harness side (with VEMS).
- the CPM C404 pin 12, circuit 4-MC9 (GY/OG), harness side and ground (without VEMS).
- the CPM C403b pin 9, circuit 4-MC9 (GY/OG), harness side and ground (with VEMS).

4

Measure the resistance between:

- the CPM C404 pin 13, circuit 5-MC9 (BU/BK), harness side and the audio unit C240a pin 7, circuit 5-EA8 (BU/WH), harness side (without VEMS); or between the CPM C403b pin 10, circuit 5-MC9 (BU/BK), harness side and the audio unit C240a pin 7, circuit 5-EA8 (BU/WH), harness side (with VEMS).
- the CPM C404 pin 13, circuit 5-



PINPOINT TEST B: THE PHONE DOES NOT POWER UP

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK THE PORTABLE CELLULAR PHONE	<p>1 Disconnect the portable cellular phone from the vehicle.</p> <ul style="list-style-type: none"> Does the portable cellular phone power up in the portable cellular mode? <p>→ Yes GO to <u>B3</u>.</p> <p>→ No GO to <u>B2</u>.</p>
B2 CHECK THE BATTERY	

1 Install a known good, charged battery on the portable cellular phone.

- Does the portable cellular phone power up in the portable cellular mode?

→ **Yes**

INSTALL a new portable cellular phone battery. TEST the system for normal operation.

→ **No**

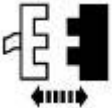
INSTALL a new portable cellular phone. CALL the Ford Cellular Technical Assistance Center at 1-800-755-4161 for additional information. TEST the system for normal operation.

B3 CHECK FOR IGNITION SUPPLY

1



2

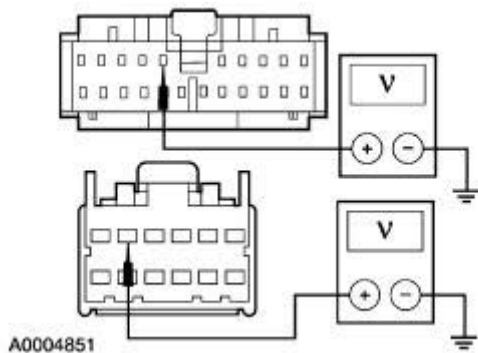


CPM

3



4



4 Measure the voltage between the CPM C404 pin 8, circuit 75-MC9 (YE/GN), harness side and ground (without VEMS); or between the CPM C403a pin 5, circuit 75-MC9 (YE/GN), harness side and ground (with VEMS).

- Is the voltage greater than 10 volts?

→ **Yes**

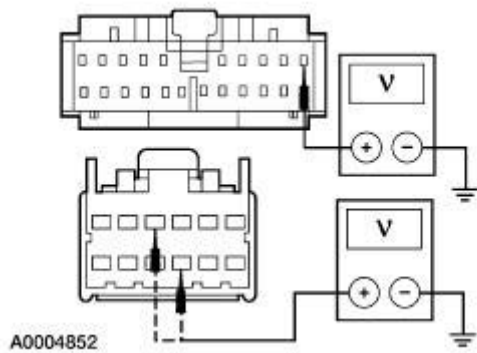
GO to B4.

→ **No**

REPAIR the circuit. TEST the system for normal operation.

B4 CHECK FOR BATTERY SUPPLY

1



1 Measure the voltage between:

- the CPM C403a pin 4, circuit 30-MC9B (RD/GN), harness side and ground.
- the CPM C404 pin 10, circuit 30-MC9 (RD/GN), harness side and ground (without VEMS); or between the CPM C403a pin 9, circuit 30-MC9C (RD/GN), harness side and ground (with VEMS).

● **Is the voltage(s) greater than 10 volts?**

→ **Yes**
GO to B5.

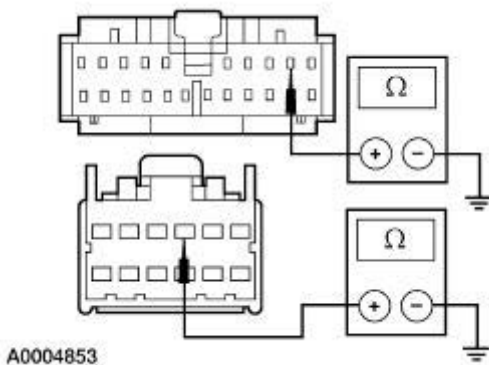
→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

B5 CHECK THE SYSTEM GROUND

1



2



2 Measure the resistance between the CPM C403a pin 3, circuit 31-MC9F (BK/GN), harness side and ground (with VEMS); or between the CPM C404 pin 9, circuit 31-MC9 (BK/GN), harness side and ground (without VEMS).

● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to B6.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

B6 SUBSTITUTE A KNOWN GOOD PORTABLE CELLULAR PHONE

1 Substitute the portable cellular phone with a known good component.

2



● Does the system power up?

→ **Yes**
INSTALL a new portable cellular phone.
CALL the Ford Cellular Technical Assistance Center at 1-800-755-4161 for additional information. TEST the system for normal operation.

→ **No**
GO to B7.

B7 CHECK VEHICLE OPTION CONTENT

1 Check the option content of the vehicle.

● Is the vehicle equipped with vehicle emergency message (VEMS)?

→ **Yes**
REFER to Section 419-05.

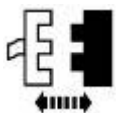
→ **No**
GO to B8.

B8 CHECK CIRCUIT 7-MC10 (YE/BK) FOR OPEN OR SHORT TO GROUND

1

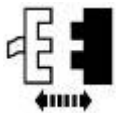


2



CPM C404

3

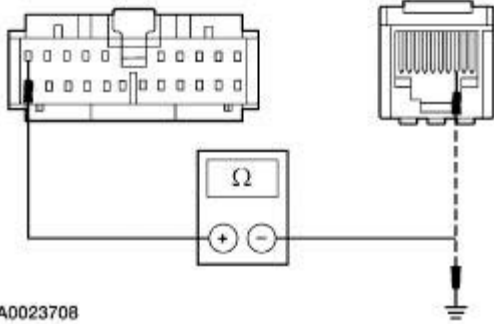


Console C318a

4

4 Measure the resistance between:

- the CPM C404 pin 1, circuit 7-MC10 (YE/BK), harness side and the console C318a pin 8, circuit 7-MC10 (YE/BK), harness side.
- the CPM C404 pin 1, circuit 7-MC10 (YE/BK), harness side



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and ground.

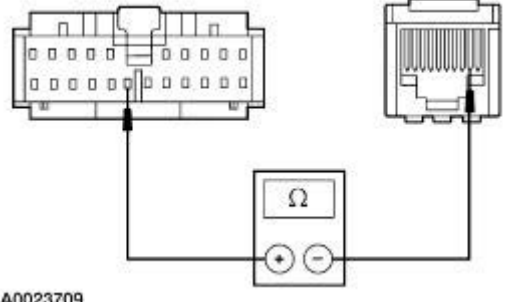
- Is the resistance less than 5 ohms between the CPM and the console; and greater than 10,000 ohms between the CPM and ground?

→ **Yes**
GO to B9.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

B9 CHECK CIRCUIT 91-MC10 (BN/YE) FOR OPEN

1



A0023709

1

Measure the resistance between the CPM C404 pin 16, circuit 91-MC10 (BN/YE), harness side and the console C318a pin 9, circuit 91-MC10 (BN/YE), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to B10.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

B10 CHECK CIRCUIT 91-MC10 (BN/YE) FOR SHORT TO POWER

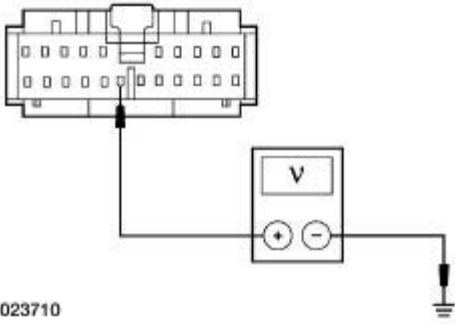
1



2

2

Measure the voltage between the CPM C404 pin 16, circuit 91-MC10 (BN/YE), harness side and ground.



- **Is any voltage indicated?**

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
GO to B11.

B11 SUBSTITUTE A KNOWN GOOD COIL CORD

1



2 Substitute the coil cord with a known good component.

- **Is the system OK?**

→ **Yes**
INSTALL a new coil cord. TEST the system for normal operation.

→ **No**
GO to B12.

B12 CHECK FOR CORRECT CPM OPERATION

1 Disconnect all CPM connectors.

2 Check for:

- corrosion
- pushed-out pins

3 Connect all CPM connectors and make sure they seat correctly.

4 Operate the system and verify the concern is still present.




- **Is the concern still present?**

→ **Yes**
INSTALL a new CPM. REFER to Portable Support Electronics (PSE) Module n this

section. TEST the system for normal operation.

→ **No**
The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

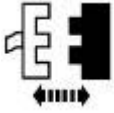
PINPOINT TEST C: THE PHONE INFORMATION IS NOT DISPLAYED— NO PHONE OR NO PORTABLE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE FUNCTION OF THE PHONE/MUTE BUTTON ON THE RADIO AND STEERING WHEEL	
<p>1 </p> <p>2  Phone to Coil Cord</p> <p>3 </p>	<p>4 Press the phone/mute button on the radio and the steering wheel.</p> <ul style="list-style-type: none"> ● Does the radio display PHONE then the signal strength meter when the buttons are pressed? <p>→ Yes The system is operating correctly.</p> <p>→ No GO to <u>C2</u>.</p>
C2 CHECK VEHICLE OPTION CONTENT	
	<p>1 Check the option content of the vehicle.</p> <ul style="list-style-type: none"> ● Is the vehicle equipped with vehicle emergency message (VEMS)? <p>→ Yes REFER to <u>Section 419-05</u>.</p> <p>→ No GO to <u>C3</u>.</p>
C3 CHECK CIRCUITS 4-MC10 (GY/BK), 5-MC10 (BU/YE), AND 8-MC10 (WH/BK) FOR OPEN OR SHORT TO GROUND	

1



2



CPM C404

3



Console C318a

- 4 Measure the resistance between the CPM C404 and the console C318a; and between the CPM C404 and ground as follows:

Circuit	Console C318a	CPM C404
4-MC10 (GY/BK)	pin 7	pin 20
5-MC10 (BU/YE)	pin 6	pin 19
8-MC10 (WH/BK)	pin 5	pin 18

- Are the resistances less than 5 ohms between the CPM C404 and the audio unit C240a; and greater than 10,000 ohms between the CPM C404 and ground?

→ **Yes**
GO to C4.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

C4 SUBSTITUTE A KNOWN GOOD COIL CORD

- 1 Substitute the coil cord with a known good component.

- Is the system OK?

→ **Yes**
INSTALL a new coil cord. TEST the system for normal operation.

→ **No**
GO to C5.

C5 SUBSTITUTE A KNOWN GOOD PORTABLE CELLULAR PHONE


- 1 Substitute the portable cellular phone with a known good component.

- Is the system OK?

→ **Yes**
INSTALL a new portable cellular phone. CALL the Ford Cellular Technical Assistance Center at 1-800-755-4161 for additional information. TEST the

	<p>system for normal operation.</p> <p>→ No GO to <u>C6</u>.</p>
C6 CHECK FOR CORRECT CPM OPERATION	
	<p>1 Disconnect all CPM connectors.</p> <p>2 Check for:</p> <ul style="list-style-type: none"> ● corrosion ● pushed-out pins <p>3 Connect all CPM connectors and make sure they seat correctly.</p> <p>4 Operate the system and verify the concern is still present.</p> <ul style="list-style-type: none"> ● Is the concern still present? <p>→ Yes INSTALL a new CPM. REFER to <u>Portable Support Electronics (PSE) Module</u> in this section. TEST the system for normal operation.</p> <p>→ No The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.</p>

PINPOINT TEST D: REDUCED SOUND OR NO SOUND THROUGH THE SPEAKERS

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK HANDS-FREE MODE	
	<p>1 Place the portable cellular phone in the hands-free mode. Refer to the owner literature.</p> <ul style="list-style-type: none"> ● Does the portable cellular phone operate in the hands-free mode? <p>→ Yes GO to <u>D2</u>.</p> <p>→ No GO to <u>Pinpoint Test E</u>.</p>
D2 CHECK THE RADIO SPEAKERS	
<p>1</p> 	<p>2 Turn the audio unit on.</p> <ul style="list-style-type: none"> ● Do the radio speakers operate correctly? <p>→ Yes</p>

GO to D3.

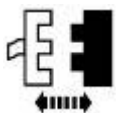
→ **No**
REFER to Section 415-00.

D3 CHECK CIRCUITS 8-MD15 (WH/GN), 2-MC9 (GY/OG), AND 1-MC9 (WH/GN)

1

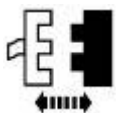


2



CPM

3



Audio Unit C240a

4 Measure the resistance between the CPM and the audio unit C240a; and between the CPM and ground as follows:

With VEMS

Circuit	Audio Unit	CPM C403b
8-MD15 (WH/GN)	C240a Pin 10	C403b Pin 4
2-MC9 (GY/OG)	C240a Pin 11	C403b Pin 14
1-MC9 (WH/GN)	C240a Pin 12	C403b Pin 15

Without VEMS

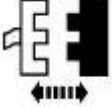
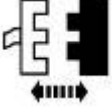
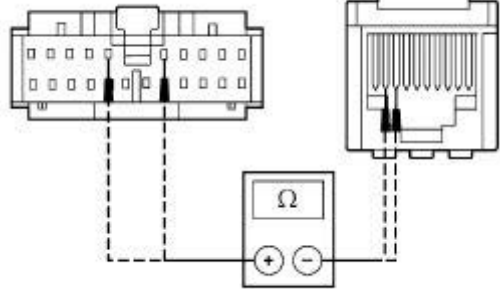
Circuit	Audio Unit	CPM C404
8-MD15 (WH/GN)	C240a Pin 10	C404 Pin 11
2-MC9 (GY/OG)	C240a Pin 11	C404 Pin 21
1-MC9 (WH/GN)	C240a Pin 12	C404 Pin 22

- Are the resistances less than 5 ohms between the CPM and the audio unit C240a; and greater than 10,000 ohms between the CPM and ground?

→ **Yes**
GO to Pinpoint Test E.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation.

PINPOINT TEST E: THE PHONE WILL NOT GO INTO HANDS-FREE MODE

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK THE VEHICLE OPTION CONTENT	
	<p>1 Check the option content of the vehicle.</p> <ul style="list-style-type: none"> ● Is the vehicle equipped with VEMS? <p>→ Yes REFER to Section 419-05.</p> <p>→ No GO to E2.</p>
E2 CHECK CIRCUIT 2-MC10 (GY/BK) AND CIRCUIT 1-MC10 (WH/BK) FOR OPEN	
<p>1</p>  <p>Console C318a</p> <p>2</p>  <p>CPM C404</p> <p>3</p>  <p>A0027825</p>	<p>3 Measure the resistance between:</p> <ul style="list-style-type: none"> ■ the CPM C404 pin 5, circuit 2-MC10 (GY/BK), harness side and the console C318a pin 2, circuit 2-MC10 (GY/BK), harness side. ■ the CPM C404 pin 6, circuit 1-MC10 (WH/BK), harness side and the console C318a pin 3, circuit 1-MC10 (WH/BK), harness side. <ul style="list-style-type: none"> ● Is the resistance less than 5 ohms? <p>→ Yes GO to E3.</p> <p>→ No REPAIR the circuit(s) in question. TEST the system for normal operation.</p>
E3 SUBSTITUTE A KNOWN GOOD PORTABLE CELLULAR PHONE HOLDER	
	<p>1 Substitute the portable cellular phone holder with a known good component.</p> <ul style="list-style-type: none"> ● Is the system OK? <p>→ Yes INSTALL a new portable cellular phone</p>

holder. TEST the system for normal operation.

→ **No**
GO to E4.

E4 SUBSTITUTE A KNOWN GOOD COIL CORD

1 Substitute the coil cord with a known good component.

● **Is the system OK?**

→ **Yes**
INSTALL a new coil cord. TEST the system for normal operation.

→ **No**
GO to E5.

E5 SUBSTITUTE A KNOWN GOOD PORTABLE CELLULAR PHONE

1 Substitute the portable cellular phone with a known good component.

● **Is the system OK?**

→ **Yes**
INSTALL a new portable cellular phone. CALL the Ford Cellular Technical Assistance Center at 1-800-755-4161 for additional information. TEST the system for normal operation.

→ **No**
GO to E6.

E6 CHECK FOR CORRECT CPM OPERATION

1 Disconnect all CPM connectors.

2 Check for:

- corrosion
- pushed-out pins

3 Connect all CPM connectors and make sure they seat correctly.

4 Operate the system and verify the concern is still present.





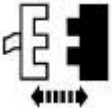
● **Is the concern still present?**

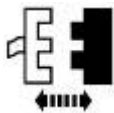
→ **Yes**
INSTALL a new CPM. REFER to Portable Support Electronics (PSE) Module in this section. TEST the system for normal operation.

→ **No**

The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

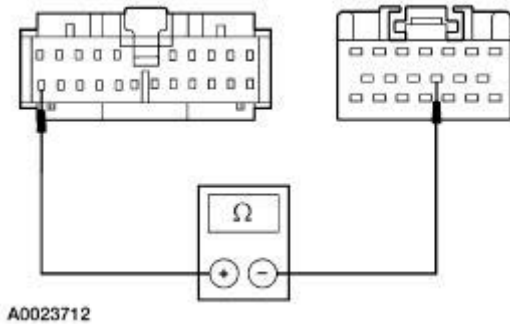
PINPOINT TEST F: NO RESPONSE TO PRESSING THE PHONE BUTTON

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE FUNCTION OF THE PHONE/MUTE BUTTON ON THE RADIO AND STEERING WHEEL	
<p>1 </p> <p>2  Phone to Coil Cord</p> <p>3 </p>	<p>4 Press the phone/mute button on the radio and the steering wheel.</p> <ul style="list-style-type: none"> • Does the radio display PHONE then the signal strength meter when the buttons are pressed? <p>→ Yes The system is operating correctly.</p> <p>→ No GO to <u>F2</u>.</p>
F2 CHECK CIRCUIT 8-MD15 (WH/GN) FOR OPEN	
<p>1 </p> <p>2  CPM C404</p> <p>3</p>	



Audio Unit C240a

4



4

Measure the resistance between the CPM C404 pin 11, circuit 8-MD15 (WH/GN), harness side and the audio unit C240a pin 10, circuit 8-MD15 (WH/GN), harness side.

• Is the resistance less than 5 ohms?

→ **Yes**
GO to F3.

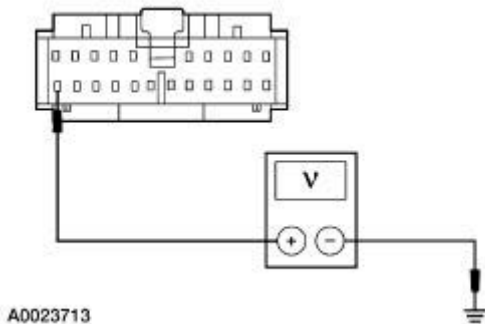
→ **No**
REPAIR the circuit. TEST the system for normal operation.

F3 CHECK CIRCUIT 8-MD15 (WH/GN) FOR SHORT TO POWER

1



2



2

Measure the voltage between the CPM C404 pin 11, circuit 8-MD15 (WH/GN), harness side and ground.

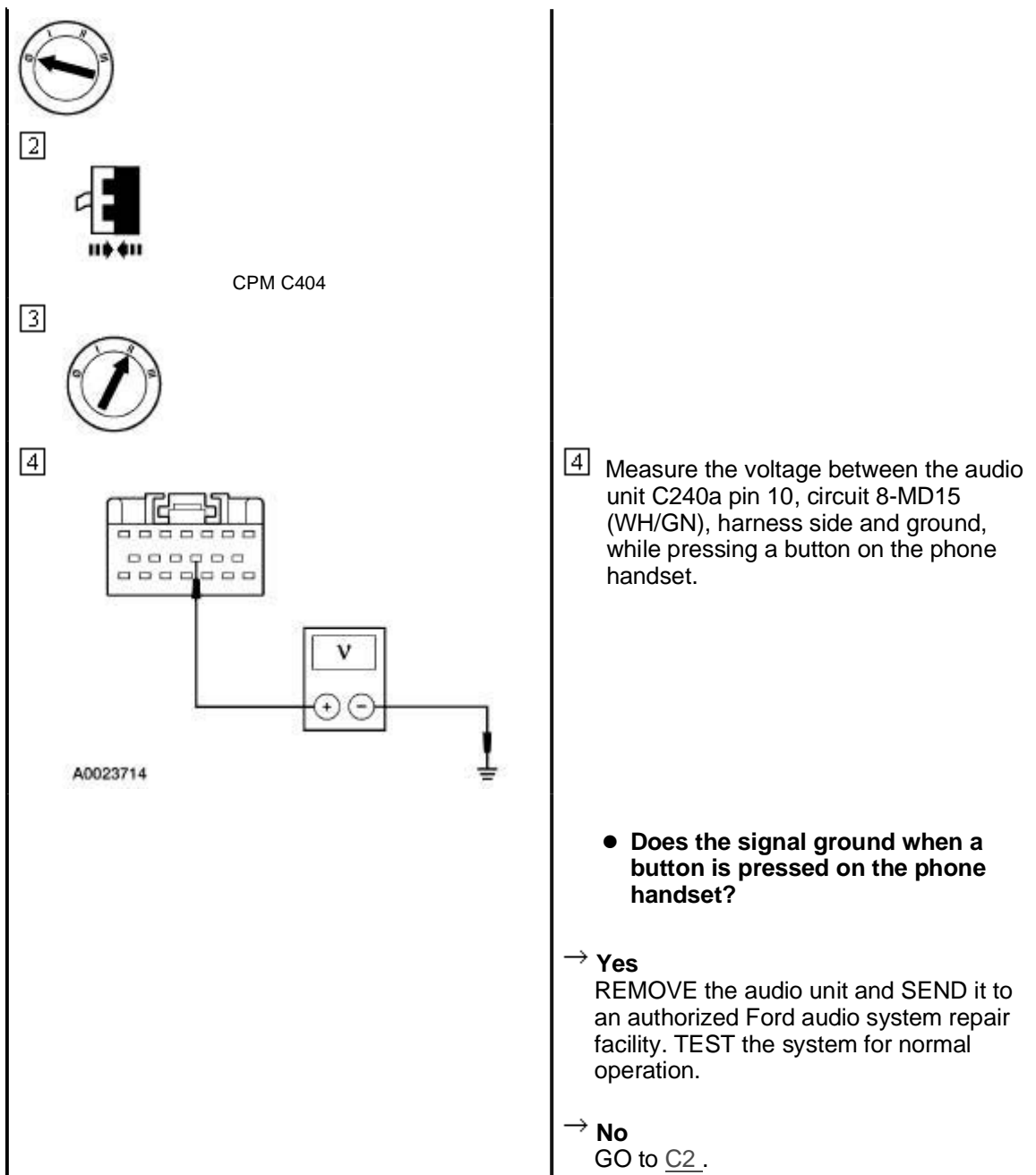
• Is any voltage indicated?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
GO to F4.

F4 CHECK VOLTAGE ON CIRCUIT 8-MD15 (WH/GN) WHEN PHONE IS IN USE/ACTIVE

1



PINPOINT TEST G: POOR RECEPTION, STATIC ON CALLS, FREQUENT DROP OF CALLS

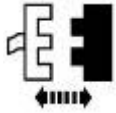
CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE EXTERNAL CELLULAR ANTENNA	<p>1 Check the position of the external cellular antenna.</p> <ul style="list-style-type: none"> • Is the antenna mast installed in the upright position with the inner and outer bases aligned? <p>→ Yes</p>

GO to G2.

→ **No**
INSTALL a new cellular phone antenna.
REFER to Cellular Phone Antenna in this section. TEST the system for normal operation.

G2 CHECK THE ANTENNA CABLE FOR SHORT

1



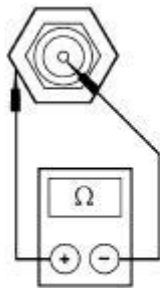
Antenna Console Connection

2



Antenna Cable Rear Window Connection

3



A0004930

3 Measure the resistance between the antenna cable center conductor and the outer shield.

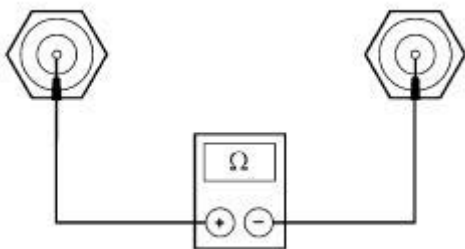
• Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to G3.

→ **No**
INSTALL a new antenna cable. TEST the system for normal operation.

G3 CHECK THE ANTENNA CABLE FOR OPEN

1



A0023715

1 Measure the resistance between the antenna center conductor at both ends of the antenna cable.

	<ul style="list-style-type: none"> ● Is the resistance greater than 5 ohms? <p>→ Yes GO to <u>G4</u>.</p> <p>→ No INSTALL a new antenna cable. TEST the system for normal operation.</p>
G4 SUBSTITUTE A KNOWN GOOD COIL CORD	
	<p>1 Substitute the coil cord with a known good component.</p> <ul style="list-style-type: none"> ● Is the system OK? <p>→ Yes INSTALL a new coil cord. TEST the system for normal operation.</p> <p>→ No GO to <u>G5</u>.</p>
G5 SUBSTITUTE A KNOWN GOOD PORTABLE CELLULAR PHONE	
	<p>1 Substitute the portable cellular phone with a known good component.</p> <ul style="list-style-type: none"> ● Is the system OK? <p>→ Yes INSTALL a new portable cellular phone. CALL the Ford Cellular Technical Assistance Center at 1-800-755-4161 for additional information. TEST the system for normal operation.</p> <p>→ No The system is operating correctly.</p>

PINPOINT TEST H: No Svc DISPLAY STAYS ON

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK THE PORTABLE CELLULAR PHONE	
NOTE: No Svc indicator might illuminate within the coverage area when the vehicle is in totally enclosed areas such as underground parking garages or tunnels. This does not indicate a hardware failure.	
	<p>1 Disconnect the portable cellular phone from the coil cord.</p> <p>2 Power up the portable cellular phone in a known good cellular coverage area.</p> <ul style="list-style-type: none"> ● Is No Svc still displayed in the portable cellular mode?

→ **Yes**
 INSTALL a new portable cellular phone.
 CALL the Ford Cellular Technical Assistance Center at 1-800-755-4161 for additional information. TEST the system for normal operation.

→ **No**
 GO to H2.

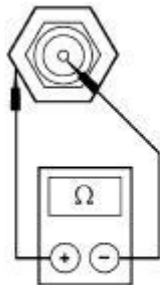
H2 CHECK THE ANTENNA RESISTANCE

1



Antenna Console Connection

2



A0004930

2 Measure the resistance between the antenna cable center conductor and the outer shield at the antenna console connection.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
 REPAIR the cellular phone antenna grid; REFER to Section 415-02 for antenna grid repair procedure. TEST the system for normal operation.

→ **No**
 INSTALL a new antenna cable. TEST the system for normal operation.

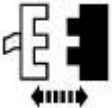
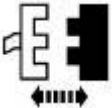
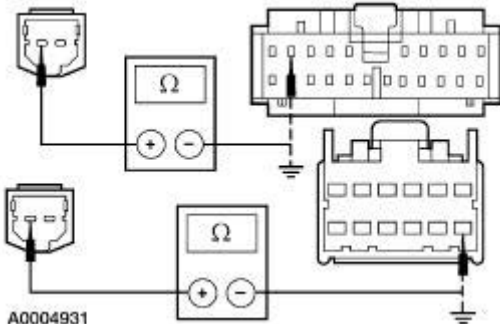
PINPOINT TEST I: CANNOT ENTER THE PROGRAMMING MODE

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 VERIFY THE SECURITY CODE	
	<p>1 Make sure:</p> <ul style="list-style-type: none"> ● correct entry sequence is used ● entry sequence is entered quickly enough <p>2 Verify the security code.</p> <ul style="list-style-type: none"> ● Has the programming mode been entered?

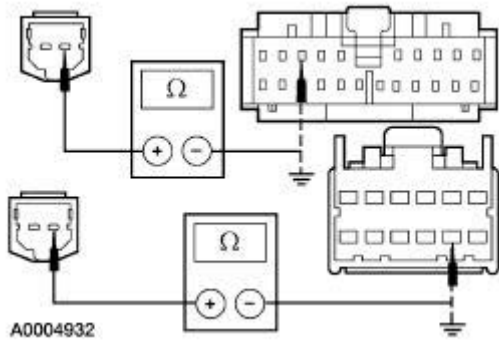
→ **Yes**
The system is operating correctly.

→ **No**
INSTALL a new portable cellular phone. CALL the Ford Cellular Technical Assistance Center at 1-800-755-4161 for additional information. TEST the system for normal operation.

PINPOINT TEST J: THE CELLULAR PHONE MICROPHONE IS NOT OPERATING CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 CHECK CIRCUIT 9-MC8 (BN/RD)	
<p>1</p>  <p>CPM C404</p> <p>2</p>  <p>Microphone C221</p> <p>3</p>  <p>A0004931</p>	<p>3 Measure the resistance between:</p> <ul style="list-style-type: none">■ the microphone C221, circuit 9-MC8 (BN/RD), harness side and the CPM C404 pin 2, circuit 9-MC8 (BN/RD) (without VEMS); or between the microphone C221, circuit 9-MC8 (BN/RD), harness side and the CPM C403a pin 7, circuit 9-MC8 (BN/RD) (with VEMS) harness side.■ the microphone C221, circuit 9-MC8 (BN/RD), harness side and ground. <p>● Is the resistance less than 5 ohms between the microphone and the CPM and greater than 10,000 ohms between the microphone and ground?</p> <p>→ Yes GO to <u>J2</u>.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
J2 CHECK CIRCUIT 8-MC8 (WH/RD)	

1



1 Measure the resistance between:

- the microphone C221, circuit 8-MC8 (WH/RD), harness side and the CPM C404 pin 3, circuit 8-MC8 (WH/RD) (without VEMS); or between the microphone C221, circuit 8-MC8 (WH/RD), harness side and the CPM C403a pin 8, circuit 8-MC8 (WH/RD) (with VEMS) harness side.
- the microphone C221, circuit 8-MC8 (WH/RD), harness side and ground.

- **Is the resistance less than 5 ohms between the microphone and the CPM and greater than 10,000 ohms between the microphone and ground?**

→ **Yes**
GO to J3.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

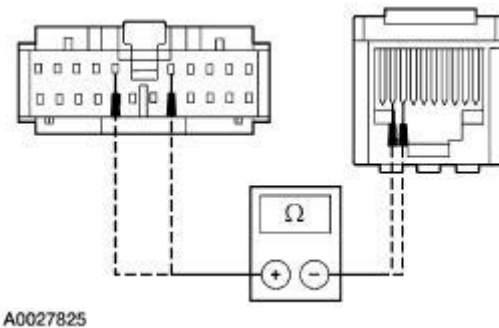
J3 CHECK CIRCUIT 2-MC10 (GY/BK) AND CIRCUIT 1-MC10 (WH/BK) FOR OPEN

1



Console C318a

2



2 Measure the resistance between:

- the CPM C404 pin 5, circuit 2-MC10 (GY/BK), harness side and the console C318a pin 2, circuit 2-MC10 (GY/BK), harness side.
- the CPM C404 pin 6, circuit 1-MC10 (WH/BK), harness side and the console C318a pin 3, circuit 1-MC10 (WH/BK), harness side.

- **Is the resistance less than 5 ohms?**

→ **Yes**
GO to J4.

→ **No**
REPAIR the circuit(s) in question. TEST

the system for normal operation.

J4 SUBSTITUTE A KNOWN GOOD MICROPHONE

1 Substitute the microphone with a known good component.

● **Is the system OK?**

→ **Yes**
INSTALL a new microphone; REFER to Microphone in this section. TEST the system for normal operation.

→ **No**
GO to J5.

J5 SUBSTITUTE A KNOWN GOOD COIL CORD

1 Substitute the coil cord with a known good component.

● **Is the system OK?**

→ **Yes**
INSTALL a new coil cord. TEST the system for normal operation.

→ **No**
GO to J6.

J6 SUBSTITUTE A KNOWN GOOD PORTABLE CELLULAR PHONE

1 Substitute the portable cellular phone with a known good component.

● **Is the system OK?**

→ **Yes**
INSTALL a new portable cellular phone. CALL the Ford Cellular Technical Assistance Center at 1-800-755-4161 for additional information. TEST the system for normal operation.

→ **No**
GO to J7.

J7 CHECK FOR CORRECT CPM OPERATION

1 Disconnect all CPM connectors.

2 Check for:


- corrosion
- pushed-out pins

3 Connect all CPM connectors and make sure they seat correctly.

4 Operate the system and verify the concern is still present.




	<ul style="list-style-type: none"> ● Is the concern still present? <p>→ Yes INSTALL a new CPM. REFER to <u>Portable Support Electronics (PSE) Module</u> in this section. TEST the system for normal operation.</p> <p>→ No The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.</p>
--	--

PINPOINT TEST K: THE VOICE ACTIVATED PHONE FUNCTIONS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 CHECK FOR A BEEP FROM THE AUDIO SYSTEM	
<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 10px;">2</div>  </div>	<p>1 Connect the portable cellular phone to the console coil cord and mount in the holder.</p> <p>3 Power up the phone.</p> <ul style="list-style-type: none"> ● Can a beep be heard? <p>→ Yes If no voice tags are stored; refer to the owner literature to train voice memory tags.</p> <p>→ No GO to <u>K2</u>.</p>
K2 CHECK FOR PHONE RESPONSE	
	<p>1 With the portable cellular phone mounted in the holder, press and hold the # or * button on the portable cellular phone.</p> <ul style="list-style-type: none"> ● Can a READY prompt be heard? <p>→ Yes GO to <u>K3</u>.</p> <p>→ No GO to <u>K4</u>.</p>
K3 CHECK THE FUNCTION BUTTON	
	<p>1 With the portable cellular phone mounted in the holder, press the phone button on the radio.</p>

	<ul style="list-style-type: none"> ● Can a READY prompt be heard? <p>→ Yes The system is operating correctly.</p> <p>→ No GO to <u>K4</u>.</p>
<p>K4 CHECK FOR CORRECT CPM OPERATION</p>	
	<ol style="list-style-type: none"> 1 Disconnect all CPM connectors. 2 Check for: <ul style="list-style-type: none"> ● corrosion ● pushed-out pins 3 Connect all CPM connectors and make sure they seat correctly. 4 Operate the system and verify the concern is still present. <ul style="list-style-type: none"> ● Is the concern still present? <p>→ Yes INSTALL a new CPM. REFER to <u>Portable Support Electronics (PSE) Module</u> in this section. TEST the system for normal operation.</p> <p>→ No The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.</p>

PINPOINT TEST L: THE HANDSET BATTERY DOES NOT CHARGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>L1 CHECK CHARGING STATUS OF PHONE</p>	
<ol style="list-style-type: none"> 1  2  Phone to Coil Cord 3  	<ol style="list-style-type: none"> 4 Observe the phone display. <ul style="list-style-type: none"> ● Is the battery icon in the lower right hand corner flashing?

→ **Yes**
The system is operating correctly.

→ **No**
GO to L2.

L2 CHECK VEHICLE CONTENT

1 Check the option content of the vehicle.

- **Is the vehicle equipped with vehicle emergency message (VEMS)?**

→ **Yes**
REFER to Section 419-05.

→ **No**
GO to L3.

L3 CHECK CIRCUIT 7-MC10 (YE/BK) FOR OPEN OR SHORT TO GROUND

1



2



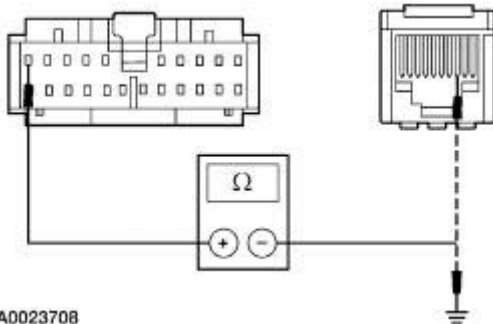
CPM C404

3



Console C318a

4



4 Measure the resistance between:

- the CPM C404 pin 1, circuit 7-MC10 (YE/BK), harness side and the console C318a pin 8, circuit 7-MC10 (YE/BK), harness side.
- the CPM C404 pin 1, circuit 7-MC10 (YE/BK), harness side and ground.

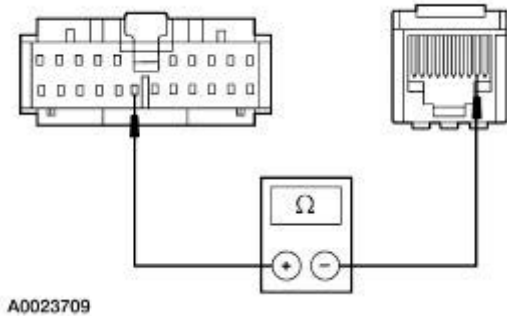
- **Is the resistance less than 5 ohms between the CPM and the console; and greater than 10,000 ohms between the CPM and ground?**

→ **Yes**
GO to L4.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

L4 CHECK CIRCUIT 91-MC10 (BN/YE) FOR OPEN

1



1 Measure the resistance between the CPM C404 pin 16, circuit 91-MC10 (BN/YE), harness side and the console C318a pin 9, circuit 91-MC10 (BN/YE), harness side.

• **Is the resistance less than 5 ohms?**

→ **Yes**
GO to L5.

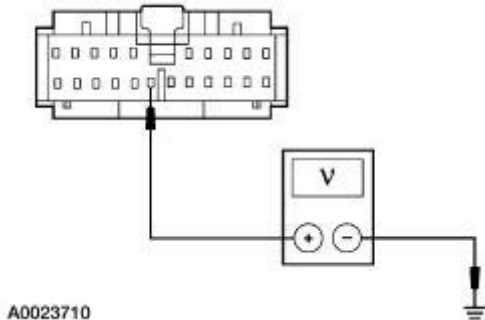
→ **No**
REPAIR the circuit. TEST the system for normal operation.

L5 CHECK CIRCUIT 91-MC10 (BN/YE) FOR SHORT TO POWER

1



2



2 Measure the voltage between the CPM C404 pin 16, circuit 91-MC10 (BN/YE), harness side and ground.

• **Is any voltage indicated?**

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
GO to L6.

L6 SUBSTITUTE A KNOWN GOOD COIL CORD

1 Substitute the coil cord with a known good component.

● **Is the system OK?**

→ **Yes**
INSTALL a new coil cord. TEST the system for normal operation.

→ **No**
GO to L7.

L7 SUBSTITUTE A KNOWN GOOD PORTABLE CELLULAR PHONE

1 Substitute the portable cellular phone with a known good component.

● **Is the system OK?**

→ **Yes**
INSTALL a new portable cellular phone. CALL the Ford Cellular Technical Assistance Center at 1-800-755-4161 for additional information. TEST the system for normal operation.

→ **No**
GO to L8.

L8 CHECK FOR CORRECT CPM OPERATION

1 Disconnect all CPM connectors.

2 Check for:

- corrosion
- pushed-out pins

3 Connect all CPM connectors and make sure they seat correctly.

4 Operate the system and verify the concern is still present.

● **Is the concern still present?**

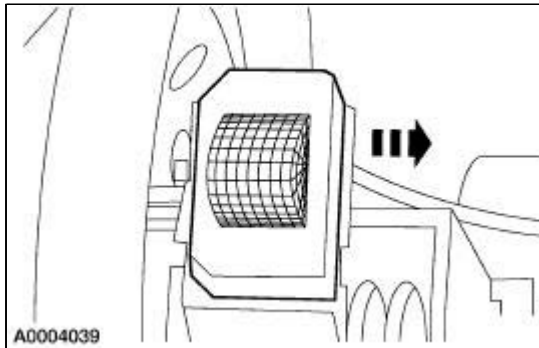
→ **Yes**
INSTALL a new CPM. REFER to Portable Support Electronics (PSE) Module in this section. TEST the system for normal operation.

→ **No**
The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

Microphone

Removal and Installation

1. Remove the air bag sliding contact. For additional information, refer to [Section 501-20B](#).
2. Remove the cellular phone microphone from the air bag sliding contact.

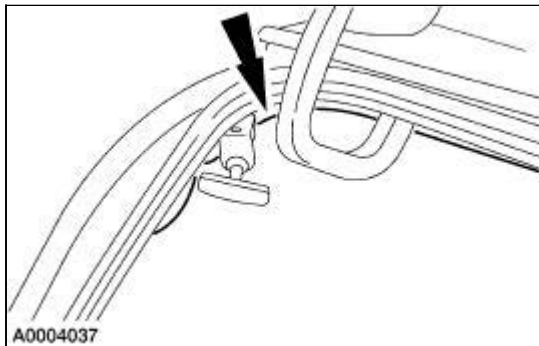


3. To install, reverse the removal procedure.
-

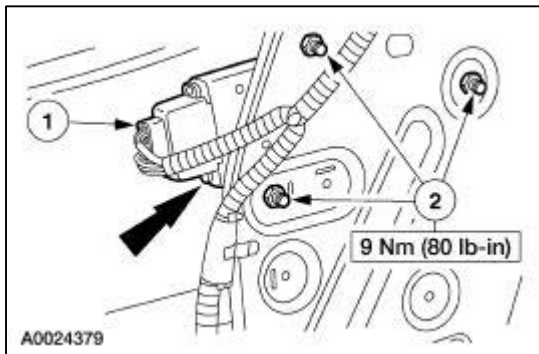
Portable Support Electronics (PSE) Module

Removal and Installation

1. Open the luggage compartment and position the LH trim near the rear seat release handle aside.



2. Remove the portable support electronics (PSE) module.
 1. Disconnect the electrical connector.
 2. Remove the nuts.



3. To install, reverse the removal procedure.

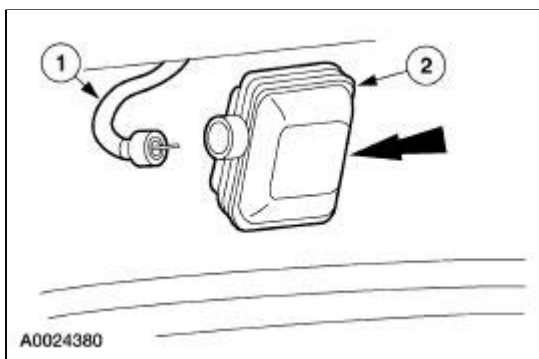
Cellular Phone Antenna

Removal and Installation

1.  **CAUTION:** To avoid damage to the glass, do not pry the antenna base when removing.

Remove the cellular phone antenna base.

1. Disconnect the antenna cable.
2. Cut the two-way tape holding the cellular phone antenna base to the glass.



2. **NOTE:** Before applying new two-way tape to install the cellular phone antenna base, use Ultra-Clear Spray Glass Cleaner E4AZ-19C507-AA meeting Ford specification ESR-M14P5-A or equivalent to thoroughly clean the glass.

NOTE: Inside and outside antenna bases must be carefully and accurately aligned so they don't cover any heater wire grids.

NOTE: The coaxial cable connector must be installed toward the right of the vehicle.

To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-in
Battery ground cable	10	89
Rear electronic module (REM) nuts	7	62
Front electronic module (FEM) bolt	9	80
Front electronic module (FEM) nuts	4	35
Auxiliary junction block nuts	3	27

Module Controlled Functions

The multifunction modules consist of the:

- front electronic module (FEM)
 - rear electronic module (REM)
 - driver door module (DDM)
 - driver seat module (DSM)
-

Multifunction Electronic Module

For warning chime concerns, refer to [Section 413-09](#).

For exterior lighting concerns, refer to [Section 417-01](#).

For interior lighting concerns, refer to [Section 417-02](#).

For perimeter anti-theft concerns, refer to [Section 419-01A](#).

For power mirror concerns, refer to [Section 501-09](#).

For power seat concerns, refer to [Section 501-10](#).

For power window concerns, refer to [Section 501-11](#).

For remote keyless entry and power door lock concerns, refer to [Section 501-14B](#).


For daytime running lamp concerns, refer to [Section 417-04](#).

For variable assist power steering (VAPS) concerns, refer to [Section 211-00](#).

For roof opening panel concerns, refer to [Section 501-17](#).

Module —Driver Door (DDM)

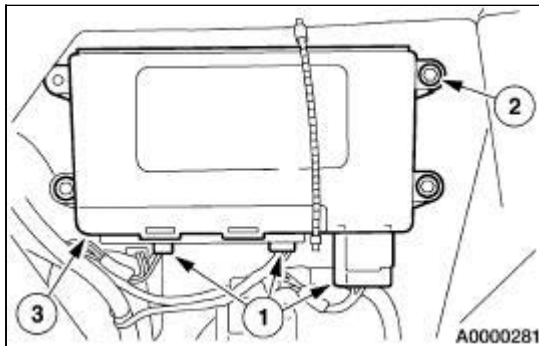
Removal and Installation

1.  **CAUTION:** Prior to removal of the module, it is necessary to upload module configuration information to the appropriate diagnostic equipment. This information needs to be downloaded into the new module once installed. For additional information, refer to [Section 418-01](#).

 **CAUTION:** Electronic modules are sensitive to electrical charges. If exposed to these charges, damages may result.

Disconnect the battery ground cable. Refer to [Section 414-01](#).

2. Remove the driver door trim panel. For additional information, refer to [Section 501-05](#).
3. Remove the driver door module.
 1. Disconnect the electrical connectors.
 2. Remove the three bolts.
 3. Remove the DDM.

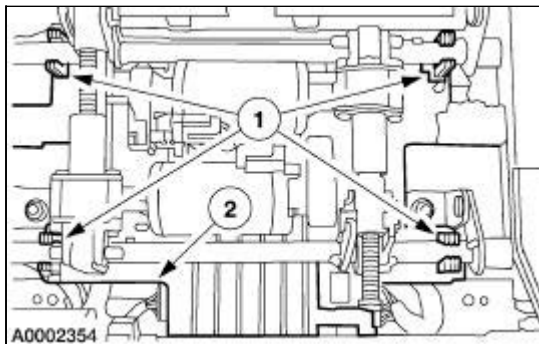


4. To install, reverse the removal procedure.

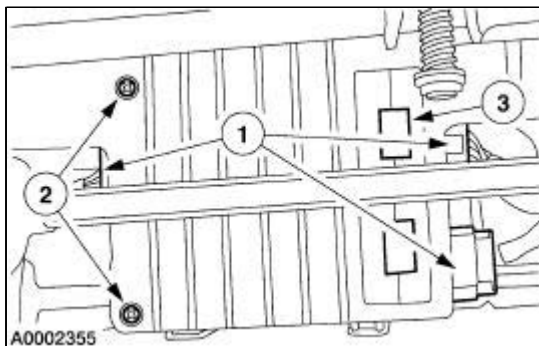
Module —Driver Seat (DSM)

Removal and Installation

1. Remove the driver seat; refer to [Section 501-10](#).
2. Release the driver seat module (DSM) bracket from the seat track.
 1. Release the four retainers.
 2. Release the module bracket.



3. Remove the DSM.
 1. Disconnect the electrical connectors.
 2. Remove the screws.
 3. Remove the DSM.




4. **NOTE:** Once the new module is installed, it is necessary to calibrate the seat. For additional information, refer to [Section 501-10](#).

NOTE: It is important to make sure that the locking tabs are in the correct locations.

To install, reverse the removal procedure.

Module —Rear Electronic (REM)

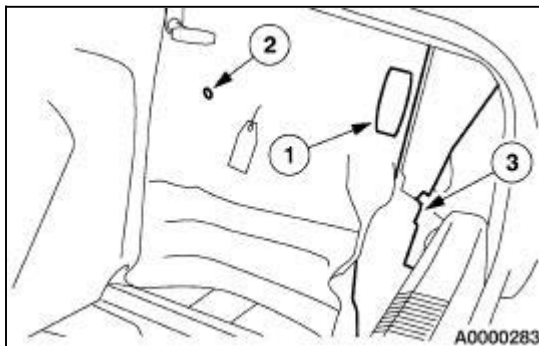
Removal and Installation

1.  **CAUTION:** Prior to removal of the module, it is necessary to upload module configuration information to the appropriate diagnostic equipment. This information needs to be downloaded into the new module once installed. For additional information, refer to [Section 418-01](#).

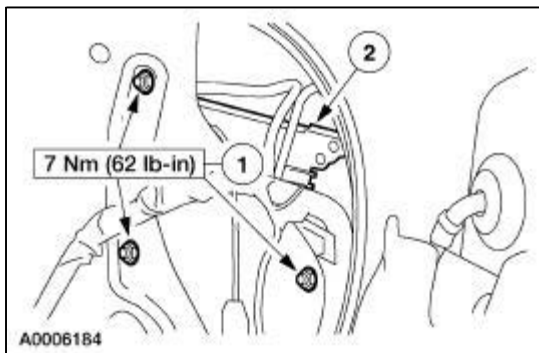
 **CAUTION:** Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

Disconnect the battery ground cable. Refer to [Section 414-01](#).

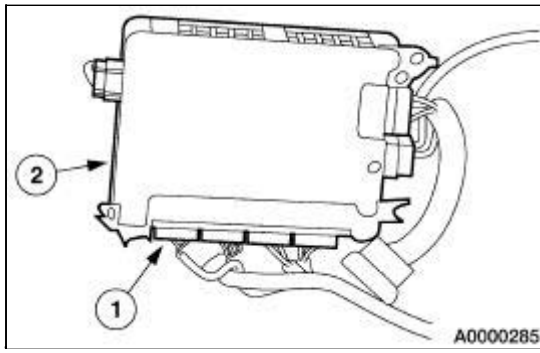
2. Position the RR quarter trim panel aside.
 1. Disconnect the luggage compartment lamp.
 2. Remove the push clip.
 3. Position RR quarter trim panel aside.



3. Position the rear electronic module (REM) aside.
 1. Remove the nuts.
 2. Position the REM aside.




4. Remove the REM.
 1. Disconnect the seven electrical connectors.
 2. Remove the REM.



5. To install, reverse the removal procedure.

Module —Front Electronic (FEM)

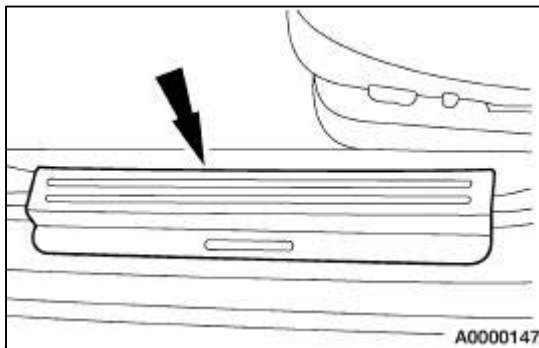
Removal and Installation

1.  **CAUTION:** Prior to removal of the module, it is necessary to upload module configuration information to the appropriate diagnostic equipment. This information needs to be downloaded into the new module once installed. For additional information, refer to [Section 418-01](#).

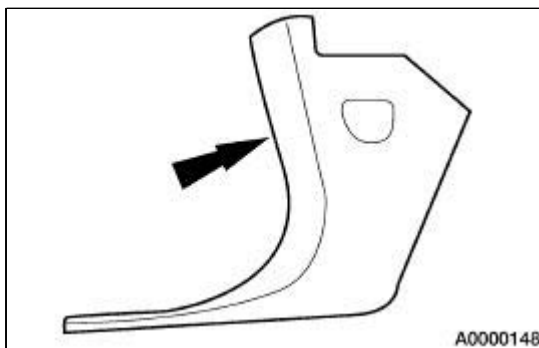
 **CAUTION:** Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

Disconnect the battery ground cable. Refer to [Section 414-01](#).

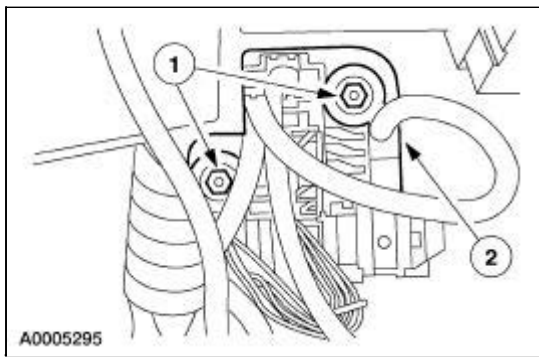
2. Remove the LH scuff plate.



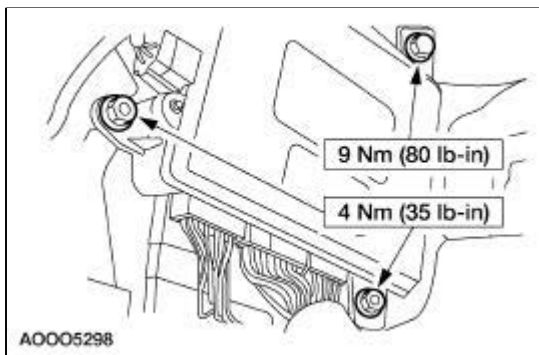
3. Release the retaining clips and remove the LH A-pillar lower trim panel.



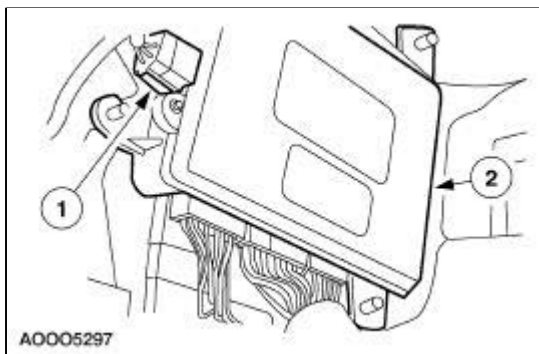
4. Remove the lower instrument panel finish panel.
 - Remove the courtesy lamp from the instrument panel finish panel.
5. Position the driver side carpet aside.
6. Position interior auxiliary junction box (AJB) aside.
 1. Remove the nuts.
 2. Position the AJB aside.



7. Remove the nuts, bolt and position the FEM aside.



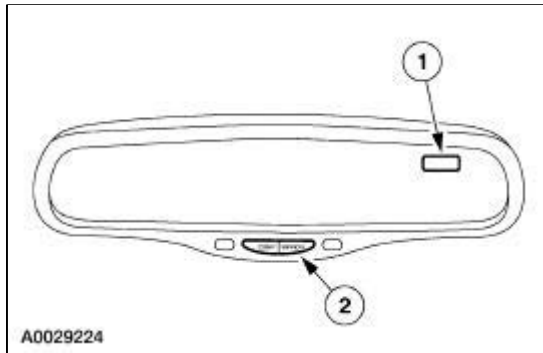
8. Remove the FEM.
 1. Disconnect the six electrical connectors.
 2. Remove the FEM.



9. To install, reverse the removal procedure.
-

Electronic Compass

Compass Display



Item	Part Number	Description
1	—	Compass display
2	—	COMP/MIRROR switch

NOTE: The compass display and module are integral to the inside rear view mirror and not installed separately. For additional information, refer to [Section 501-09](#).


The compass:

- has a two-character display in the upper RH side of the mirror, which indicates the direction in which the vehicle is pointed (N, NE, E, SE, S, SW, W, NW).
- uses an electronic compass sensor that is attached to the mirror to windshield bracket.
- has compass adjustment (calibration and zone variation) controlled by a COMP switch on the mirror.

Electronic Compass

Refer to Wiring Diagrams Section [501-09](#) for schematic and connector information.

Special Tool(s)

 <p>ST1137-A</p>	<p>73III Automotive Meter 105-R0057 or equivalent</p>
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Inspection and Verification

NOTE: Press the COMP button to turn on the display.

1. Verify the customer concern by operating the vehicle along roads of known direction to duplicate the customer concern with the compass.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Mirror assembly 	<ul style="list-style-type: none"> ● Central junction box (CJB) fuse 216 (5A) ● Circuitry ● Loose or corroded connectors ● Compass sensor (part of the inside rear view mirror)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the fault is not visually evident, determine the symptom and proceed to the Symptom Chart.

Symptom Chart


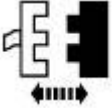

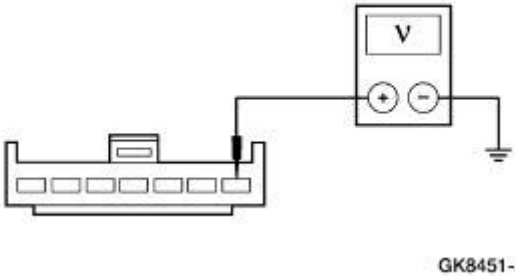

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● The compass is inoperative 	<ul style="list-style-type: none"> ● Central junction box (CJB) fuse 216 (5A). ● Circuitry. ● Inside rear view mirror. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.
<ul style="list-style-type: none"> ● The compass is 	<ul style="list-style-type: none"> ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint

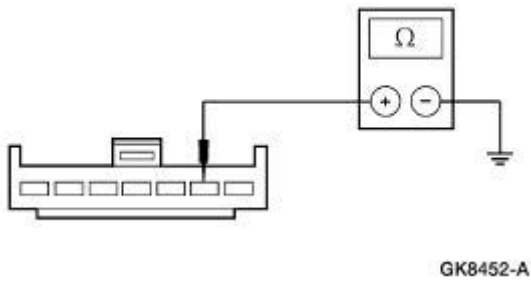
inaccurate	<ul style="list-style-type: none"> ● Zone setting. ● Vehicle magnetization. ● Inside rear view mirror. 	<u>Test B.</u>
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Pinpoint Tests

PINPOINT TEST A: THE COMPASS IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK POWER SUPPLY TO COMPASS — CIRCUIT 20-AD15 (PK)	
<p>1 </p> <p>2  Inside Rear View Mirror C911</p> <p>3 </p> <p>4  GK8451-A</p>	<p>4 Measure the voltage between the inside rear view mirror C911 pin 1, circuit 20-AD15 (PK), harness side and ground.</p> <ul style="list-style-type: none"> ● Is the voltage greater than 10 volts? <p>→ Yes GO to <u>A2</u>.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
A2 CHECK CIRCUIT 31-AD15 (BK) FOR OPEN	
<p>1 </p>	

2



2

Measure the resistance between the inside rear view mirror C911 pin 2, circuit 31-AD15 (BK), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
 INSTALL a new inside rear view mirror. REFER to [Section 501-09](#). TEST the system for normal operation.

→ **No**
 REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST B: THE COMPASS IS INACCURATE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK COMPASS ZONE SETTING	
	<p>1 Carry out the compass zone adjustment procedure. Refer to Compass Zone Adjustment in this section.</p> <p>● Is the compass zone set correctly?</p> <p>→ Yes GO to B2.</p> <p>→ No INSTALL a new inside rear view mirror. REFER to Section 501-09. TEST the system for normal operation.</p>
B2 CALIBRATE THE COMPASS	
	<p>1 Carry out the compass calibration adjustment procedure. Refer to Calibration Adjustment in this section.</p> <p>● Does the compass calibrate correctly?</p> <p>→ Yes GO to B4.</p> <p>→ No GO to B3.</p>
B3 DEMAGNETIZE THE VEHICLE	
	<p>1 Demagnetize the vehicle. Refer to Vehicle Demagnetizing in this section.</p>

● **Does the compass calibrate correctly?**

→ **Yes**
GO to B4.

→ **No**
INSTALL a new inside rear view mirror. REFER to Section 501-09. TEST the system for normal operation.

B4 CHECK COMPASS ACCURACY

1 Position the vehicle and observe the compass display as follows:

Direction	Compass Display
North	N
Northeast	NE
East	E
Southeast	SE
South	S
Southwest	SW
West	W
Northwest	NW

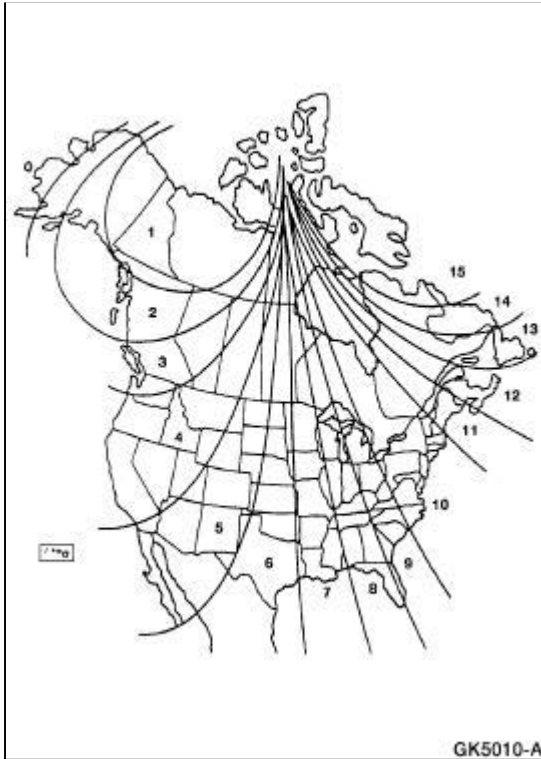
● **Does the compass display as indicated?**

→ **Yes**
The compass is OK.

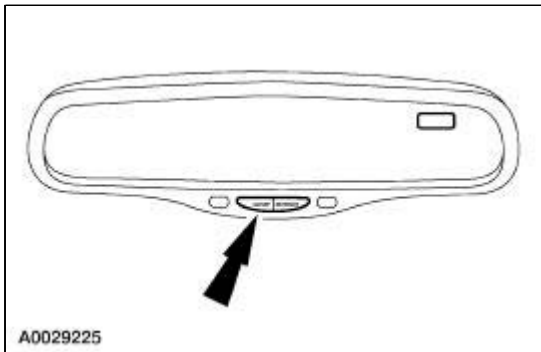
→ **No**
INSTALL a new inside rear view mirror. REFER to Section 501-09. TEST the system for normal operation.

Compass Zone Adjustment

1. Refer to the compass calibration zone map to select the correct compass zone setting for your geographical location.



2. With the compass display turned on, press and hold the COMP button (for three seconds) until the display shows the current zone of operation.

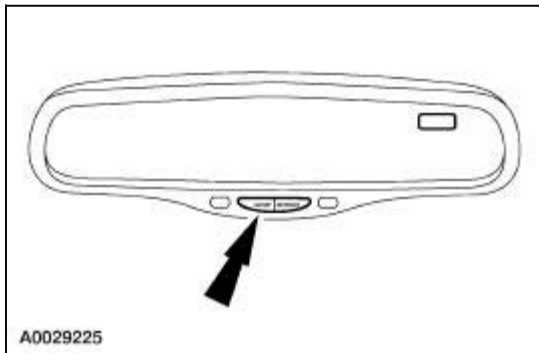


3. Momentarily press the COMP button to cycle the zone number display. Set the zone display number to match the vehicle location on the compass calibration zone map.
4. Releasing the switch for 10 seconds will exit the zone setting mode.

Calibration Adjustment

1. **NOTE:** For optimum calibration, drive to an open, level location away from large metallic objects or structures. Switch off all non-essential electrical accessories (rear window defrost, heater, A/C, map lamps and wipers) and make sure all doors are shut.

Press and hold the COMP button until C appears (six seconds). Release the COMP button.



2. Drive the vehicle at less than 8 km/h (5 mph) in a continuous circle until the compass heading is shown.
 3. If the C message does not turn off within five circles, demagnetize the vehicle. Refer to [Vehicle Demagnetizing](#) in this section.
-

Vehicle Demagnetizing



CAUTION: During demagnetizing, the demagnetizer coil will be pulled toward the vehicle. Place a cloth over the vehicle roof to protect the vehicle surface if contact occurs. Make sure the cloth covers the front third and the entire width of the roof.

NOTE: The demagnetizing process requires the use of a demagnetizing coil commonly used by television repair technicians to demagnetize television tubes.

NOTE: To demagnetize, use a constant circular motion over the vehicle roof. Do not turn off the demagnetizer while sweeping the vehicle roof to prevent remagnetizing ferrous materials contained in the vehicle.

NOTE: During the demagnetizing process, make sure the phenolic surface of the tool (the side opposite the handle) is closest to the vehicle surface.

NOTE: Turn the ignition switch to the OFF position.

1. Demagnetize the front third of the vehicle roof.
 1. Turn on the demagnetizer at least 1 meter (3 ft) away from the vehicle.
 2. Holding the demagnetizer no more than 2.5 cm (1 in) from the roof and starting on the passenger side, demagnetize the front third of the roof closest to the windshield using a constant circular motion. Keep the circle's radius within 30 cm (12 in) while sweeping across the entire surface of the roof closest to the windshield. Continue the circular motion four times.
 3. After the fourth pass and without stopping, move the demagnetizer at least 1 meter (3 ft) away from the vehicle.
 4. Turn the demagnetizer off.
2. **NOTE:** The demagnetizer must be located over the outside of the windshield no greater than 2.5 cm (1 in).

Demagnetize the inside rear view mirror mounting pad.

1. Turn on the demagnetizer at least 1 meter (3 ft) away from the vehicle.
 2. Using a circular motion, pass the demagnetizer over the outside of the windshield near the inside rear view mirror mounting pad. Without stopping, move the demagnetizer at least 1 meter (3 ft) away from the vehicle.
 3. Turn the demagnetizer off.
 3. Carry out the compass zone adjustment procedure; refer to [Compass Zone Adjustment](#) in this section.
 4. Carry out the calibration adjustment procedure; refer to [Calibration Adjustment](#) in this section.
-

General Specifications

Item	Specification
Adhesives	
Weatherstrip Adhesive E8AZ-19552-A	ESB-M2G14-A
Lubricants	
Silicone Lubricant F7AZ-19G208-BA	ESR-M13P4-A
Sealers	
Liquid Butyl Sealer F8AZ-19554-CA	ESB-M4G162-A
3M Strip Caulk-Black 051135-08578	WSB-M4G32-C
Silicone Gasket and Sealant F7AZ-19554-EA	WSE-M4G323-A4

Body

Body and Sheet Metal

The body:

- is a uni-body open cowl structure.
 - is constructed of a monocoque, lightweight, all-steel material with removable bolted hood (16612), front fenders (16005), doors, and luggage compartment lid.
-

Insulation

Insulation is comprised of urethane, PVC, and recycled felt. Insulation is installed:

- under the roof panel.
 - above and below the instrument panel.
 - on the cowl sides.
 - over the front and rear floor areas.
 - in the B-pillar and C-pillar sections.
-

Body Sealer Types and Applications

Liquid Butyl Sealer

Liquid Butyl Sealer F8AZ-19554-CA or equivalent meeting Ford Specification ESB-M4G162-A:

- does not run.
- is fast drying.
- remains semi-elastic.
- can be used for seam sealing on the floor pan, wheelhouse, door openings, and drip rails.

Caulking Cord

3M Strip Caulk-Black 051135-08578 or equivalent meeting Ford specification WSB-M4G32-C:

- is a heavy-bodied, plastic base with a filler.
- is commonly known as perma-gum.
- is used on spot-welds holes and between surfaces not sealed with a gasket.

Weatherstrip Adhesive

Weatherstrip Adhesive E8AZ-19552-A or equivalent meeting Ford specification ESB-M2G14-A:

- is a quick drying, strong adhesive designed to hold weatherstripping onto all body panels and surrounding metal.

Silicone Lubricant

Silicone Lubricant F7AZ-19G208-BA meeting Ford specification ESR-M13P4-A:

- is used to keep the door and the window weatherstrip pliable and soft.
 - should be applied to the weatherstrip at every lubrication period.
 - makes the door easier to close.
 - retards weatherstrip squeaks.
 - retards weatherstrip wear.
 - helps retain door window alignment by reducing friction between the glass frame and the rubber weatherstrip.
 - should not be used prior to painting.
-

Body System

Inspection and Verification

Leaks

NOTE: Trim will reveal the location of most leaks.

1. Remove any trim or carpet in the general area of the leak.
2. Road test or water test the vehicle.
3. Inspect for a dust pattern around the area in question. Inspect for water paths near and above the area in question.
4. Some leaks can be located by placing bright light under the vehicle, removing any necessary trim or carpet, and inspecting the interior of the body at joints and weld lines.

Noise

Wind noise, rattles and their sources are detected by driving the vehicle at highway speeds. The vehicle should be driven in four different directions with all of the windows closed, the radio off, the blower motor off, and all of the ventilation ducts open.

Most wind noise leaks will occur at the door and window seals or at the sheet metal joints in the door or the door opening.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none">● Dust and water leaks	<ul style="list-style-type: none">● Body sealer missing.● Opening in weldings or body joints.● Components not fully installed.● Components missing.● Components damaged.	<ul style="list-style-type: none">● REMOVE trim. CHECK for leaks and SEAL with appropriate sealer. ROAD TEST or WATER TEST for leaks. RECHECK trim for leaks; USE light under the vehicle with trim removed. CHECK interior of body at joints and weld lines.
<ul style="list-style-type: none">● Dust/water leaks at floor pan and grommets	<ul style="list-style-type: none">● Missing or damaged plugs and/or grommets.	<ul style="list-style-type: none">● CHECK plugs for proper installation. REPLACE if necessary.
<ul style="list-style-type: none">● Door drain holes collecting water	<ul style="list-style-type: none">● Holes clogged with mud or road tar.	<ul style="list-style-type: none">● CLEAN drain holes of dirt and foreign material with a punch or screwdriver. CHECK drain holes regularly. TEST the

		system for normal operation.
<ul style="list-style-type: none"> ● Wind noise, air entering vehicle through small holes in body 	<ul style="list-style-type: none"> ● Leaks at door and window seals or sheet metal joints in doors or door openings. 	<ul style="list-style-type: none"> ● SEAL leaks with Silicone Gasket and Sealant F7AZ-19554-EA meeting Ford specifications WSE-M4G323-A4. ROAD TEST.
<ul style="list-style-type: none"> ● Rattles 	<ul style="list-style-type: none"> ● Loose objects in wells, pillars, and quarter panels. ● Misalignment (if tightening bolts does not eliminate rattle). ● Weatherstripping, anti-squeak material. 	<ul style="list-style-type: none"> ● CHECK doors by carefully STRIKING underside of door with a rubber mallet. LISTEN for loose objects in door. REPAIR. TIGHTEN body bolts and screws. ● REFER to <u>Section 501-03</u>. ● APPLY additional sealer. INSTALL in proper location to eliminate rattle.

General Specifications

Item	Specification
RH wiper blade adjustment tolerance	12 mm (.47 in)
LH wiper blade adjustment tolerance	10 mm (.39 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Radiator grille opening panel to front fender bolts	11	8	—
Radiator grille opening panel bolts	11	8	—
Pivot arm nuts	25	18	—
Front fender bolts	9	—	80
Hood assist strut ball stud	16	12	—
Speed control module to front fender bolts	10	7	—

Front End Body Panels

The grille opening reinforcement:

- is bolted to the fenders and bumper beam.
- retains the headlamp assemblies and bumper cover.

The cowl vent screen is a two-piece component. The right side of the cowl vent screen may be removed without the removal of the windshield wiper pivot arm.

Cowl Vent Screen

Removal

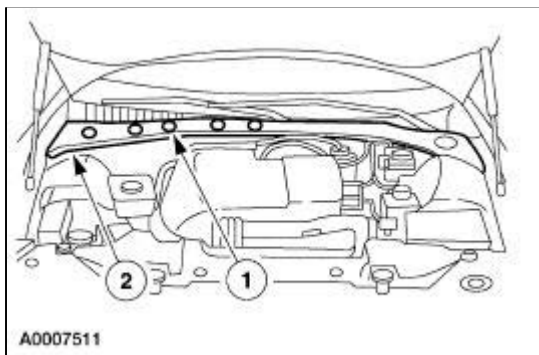
NOTE: To remove the left side cowl vent screen, the right cowl vent screen must be removed first. Follow the entire cowl vent screen procedure.

Right Side Only

1. **NOTE:** The fasteners are reusable.

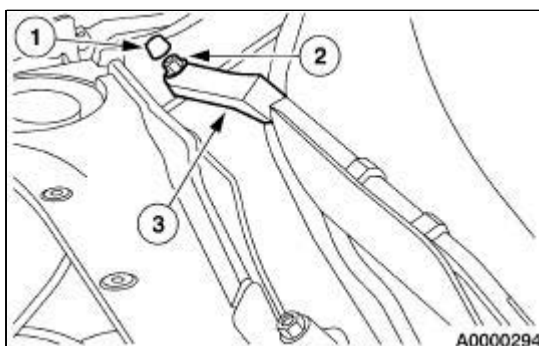
Remove the right side of the cowl vent screen.

1. Remove the two-part pin-type retainers and separate the Velcro® attachment of the rubber hinge cover to the rear outboard corner of the cowl vent screen.
2. Pull up on the cowl vent screen to release the lower clips.



Entire Cowl Vent Screen

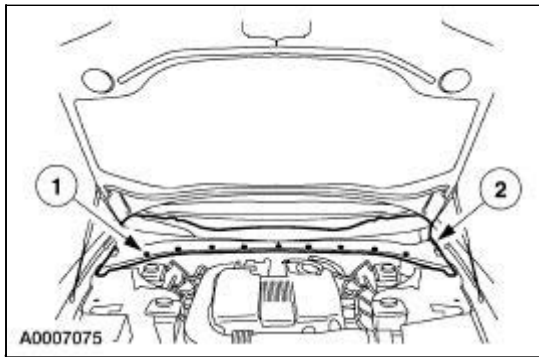
2. Remove the two wiper pivot arms.
 1. Remove the two pivot arm nut covers.
 2. Remove the two nuts.
 3. Remove the two wiper pivot arms.



3. **NOTE:** Remove the right side first when removing the entire cowl vent screen.

Remove the cowl vent screen.

1. Remove the two-part pin-type retainers and separate the Velcro® attachment of the rubber hinge cover to the rear outboard corner of the cowl vent screen.
2. Lift up on the cowl vent screen to release the clips.

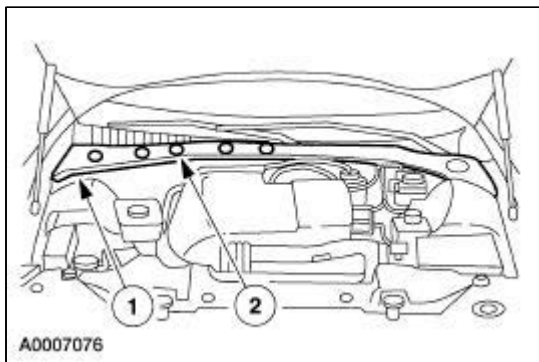


Installation

NOTE: When installing the entire cowl vent screen, install the left side first. Follow the entire cowl vent screen procedure.

Right Side Only

1. Install the right side of the cowl vent screen.
 1. Position the cowl vent screen and the Velcro® attachment of the rubber hinge cover.
 2. Install the two-part pin-type retainers.

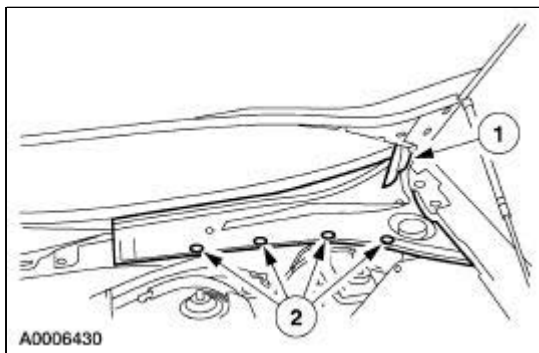


Entire Cowl Vent Screen

2. **NOTE:** Use the lower rearward clips as locators prior to installation, working from the center of the vehicle outward.

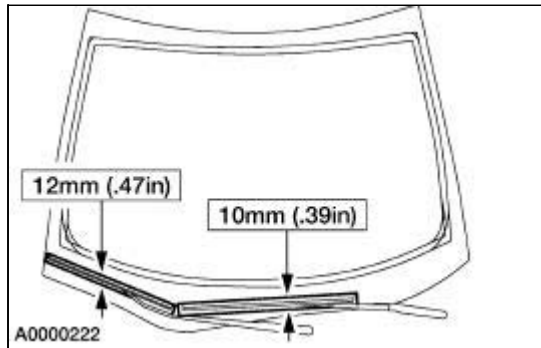
Install the cowl vent screen.

1. Position the windshield moulding flap over the left side cowl vent screen and attach the rubber hinge cover to the cowl screen.
2. Install the cowl vent screens and install the two-part pin-type retainers.

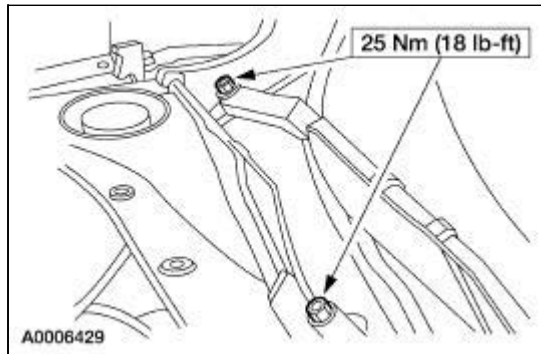


3. Cycle the windshield wiper motor to park the windshield wiper pivot arm shafts.

4. Install the windshield wiper and pivot arms onto the pivot shaft and align the blade to the heated wiper park/windshield wire lines on the windshield glass within the specification.



5. Tighten the windshield wiper pivot arm nuts.
 - Install the two pivot arm nut covers.



Fender

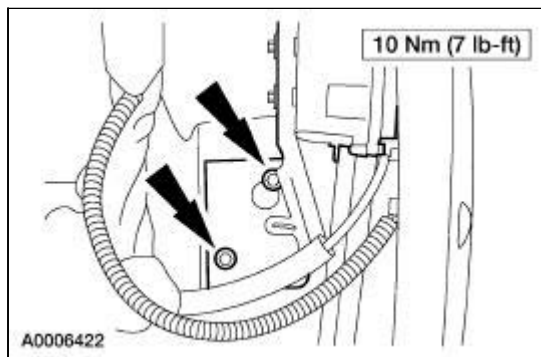
Removal and Installation

LH or RH Side

1. Remove the front bumper cover. For additional information, refer to [Section 501-19](#).
2. Remove the wheel and tire assembly. For additional information, refer to [Section 204-04](#).
3. Remove the front and rear inner splash shield.

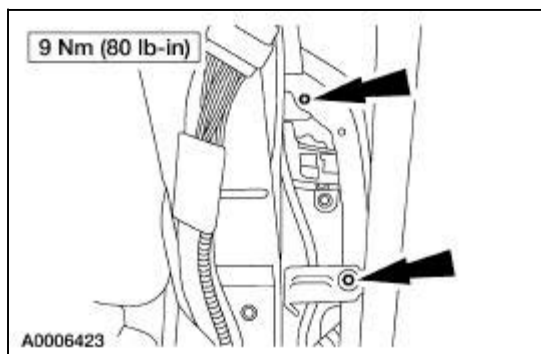
LH Side Only

4. Position the speed control module aside.
 - Loosen the top bolt.
 - Remove the bottom bolt.

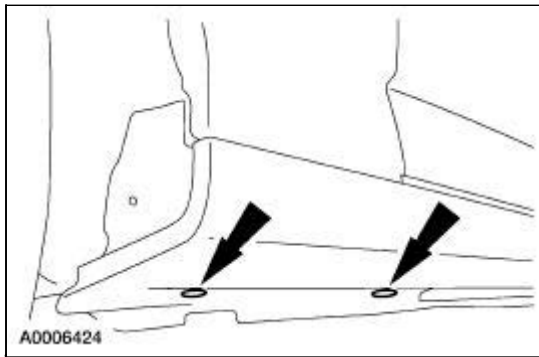


LH or RH Side

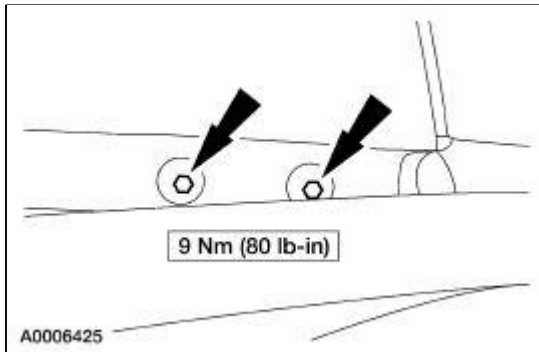
5. Remove the fender stuffer.
6. Remove the inner front fender bolts.



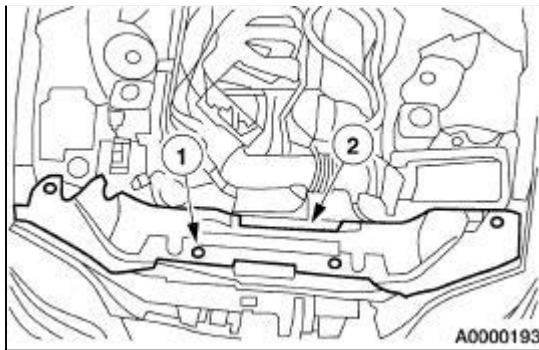
7. Remove the two front two-part pin-type retainers and position the front rocker moulding aside.



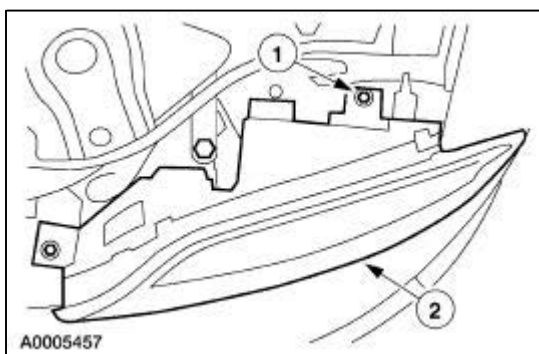
8. Remove the lower front fender bolts.



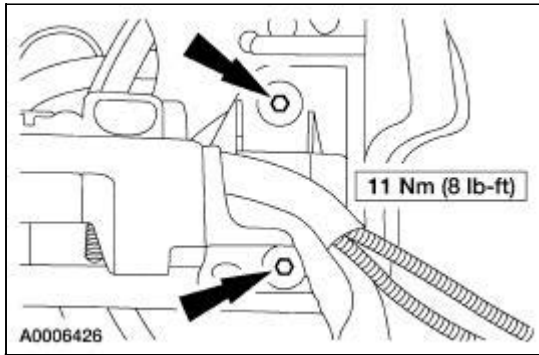
9. Remove the radiator upper sight shield.
 1. Remove the retainers.
 2. Remove the radiator upper sight shield.



10. Remove the headlamp assembly.
 1. Remove the three bolts.
 2. Remove the headlamp assembly.
 - Disconnect the electrical connector.



11. Remove the radiator grille opening panel to front fender bolts.

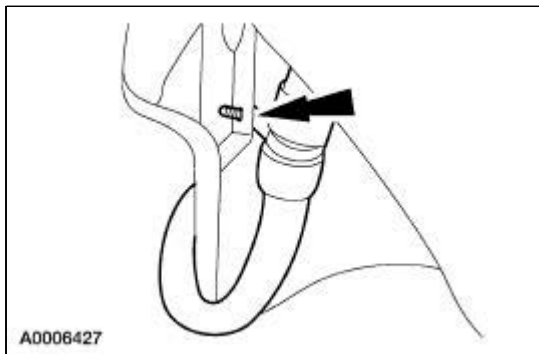


LH Side Only

12. Position the splash shield aside.

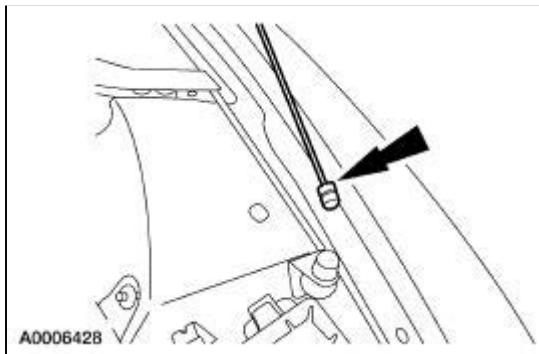
LH or RH Side

13. Disengage the wiring harness locator.

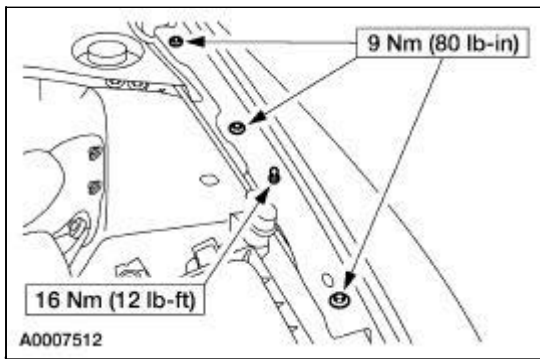


14. **NOTE:** Support the hood using a prop rod.

Disengage the lower hood assist strut.



15. Remove the front fender bolts and the hood assist strut ball stud.

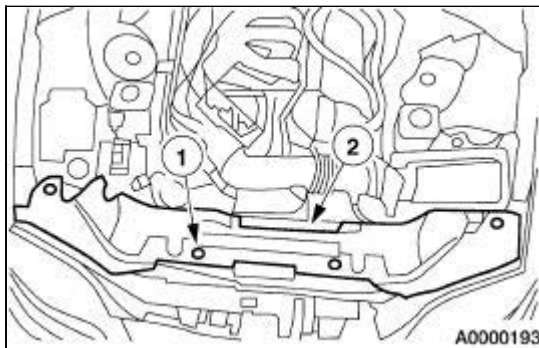


16. Remove the front fender.
 17. To install, reverse the removal procedure.
-

Radiator Grille Opening Panel

Removal and Installation

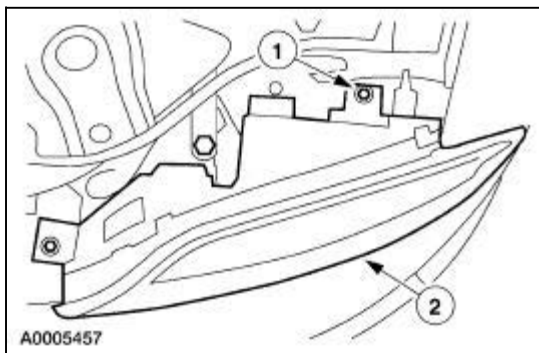
1. Remove the front bumper cover. For additional information, refer to [Section 501-19](#).
2. Remove the radiator upper sight shield.
 1. Remove the retainers.
 2. Remove the radiator upper sight shield.



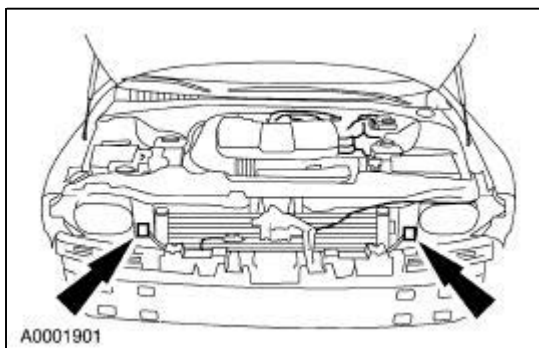
3. **NOTE:** LH side shown, RH side similar.

Remove the two headlamp assemblies.

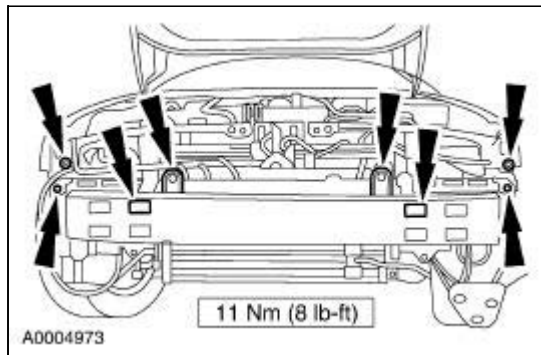
1. Remove the six bolts.
 2. Remove the headlamp assemblies.
- Disconnect the electrical connector.



4. Release the wiring harness fasteners and position the wiring harnesses rearward.



5. Remove the radiator grille opening panel bolts and the brackets.



6. Remove the radiator grille opening panel.
 7. To install, reverse the removal procedure.
-


General Specifications

Item	Specification
Premium Long Life Grease XG-1-C or XG-1-K	ESA-M1C75-B
Silicone Lubricant C0AZ-19553-A	ESR-M13P4-A
Silicone Lubricant (Spray) F5AZ-19533-AA	ESR-M13P4-A
Multi-Purpose Grease Spray F5AZ-19G209-AA	ESR-M1C159-A

Torque Specifications


Description	Nm	lb-ft
Door check strap nuts	12	9
Door check strap screws	12	9
Door latch striker bolts	40	30
Hinge to door bolts	30	22
Hinge to luggage compartment lid bolts	12	9
Inner front door support bracket nuts and bolt	12	9

Torsion Bar Loading

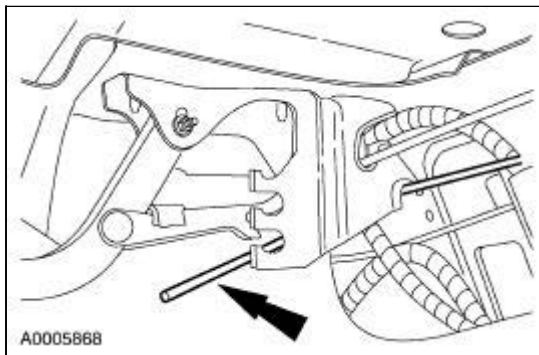
 **WARNING:** Safety glasses must be worn when carrying out this operation. Failure to follow these instructions may result in physical injury.

1. **NOTE:** The luggage compartment lid tension should be decreased if the luggage compartment lid (40110) opens with more force than desired. The luggage compartment lid tension should be increased if the luggage compartment lid opens with less force than desired.

Open and support the luggage compartment lid in the full-open position.

2.  **WARNING:** Use care when adjusting the luggage compartment lid torsion bar. It is under tension and could spring out of control if it is not handled correctly. Failure to follow these instructions could result in personal injury.

Move the luggage compartment lid end of the luggage compartment lid torsion bar to another position.



3. Check the adjustment.
4. If required, move the luggage compartment lid end of the luggage compartment lid torsion bar to another position.

Door

Removal

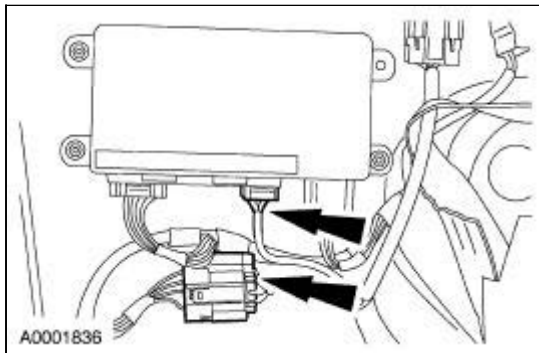
All Doors

1. Remove the door trim panel. For additional information, refer to [Section 501-05](#).
2. Remove the screws and the speaker.

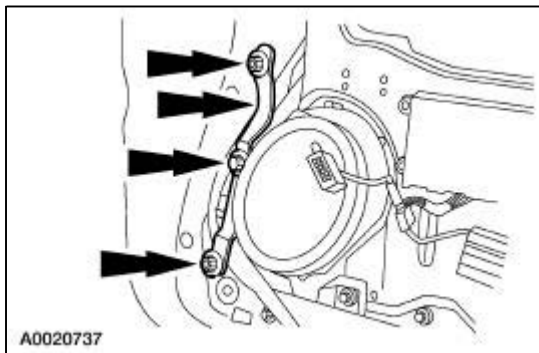
Front Door

3. **NOTE:** Driver door shown, passenger door similar.

Disconnect the electrical connectors.



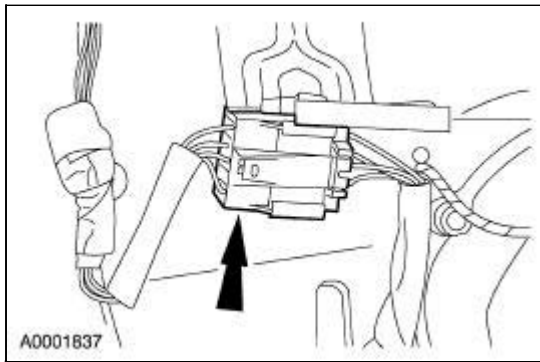
4. Remove the two nuts, the bolt and the inner front door support bracket.



5. Release the wiring harness locators.

Rear Door

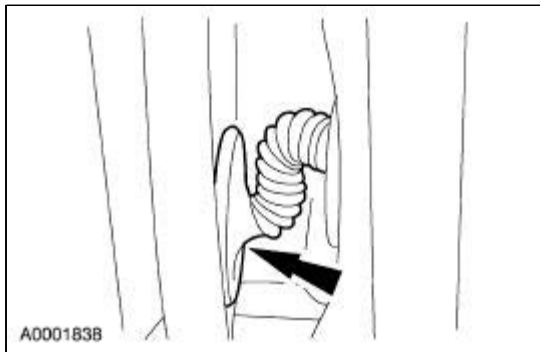
6. Disconnect the electrical connector.



7. Release the wiring harness locators.

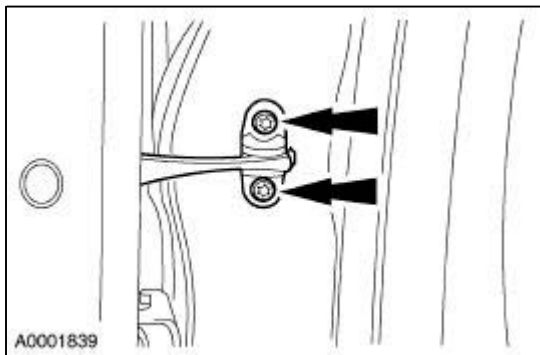
All Doors

8. Remove the grommet and wiring harness.

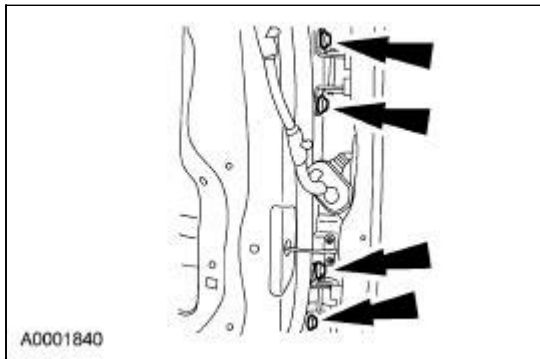


9.  **CAUTION: Do not close the door after the door check screws have been removed.**

Remove the door check strap screws.



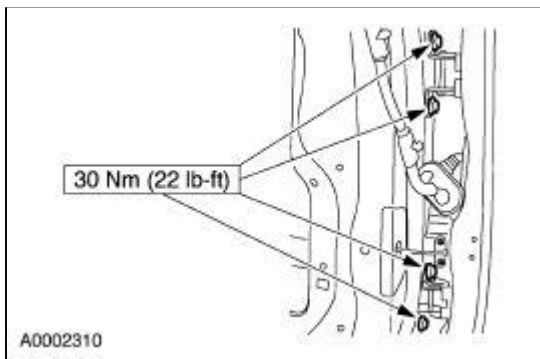
10. Mark the hinge location on the door.
11. **NOTE:** An assistant is required to support the door during its removal.
Remove the hinge to door bolts and the door.



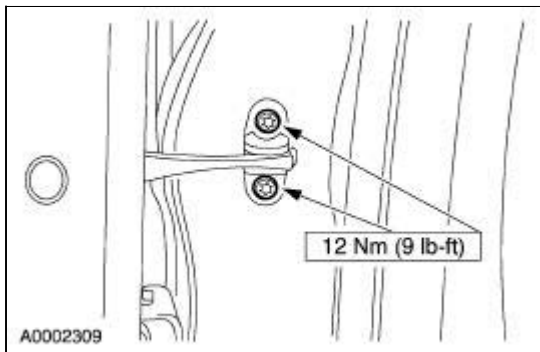
Installation

All Doors

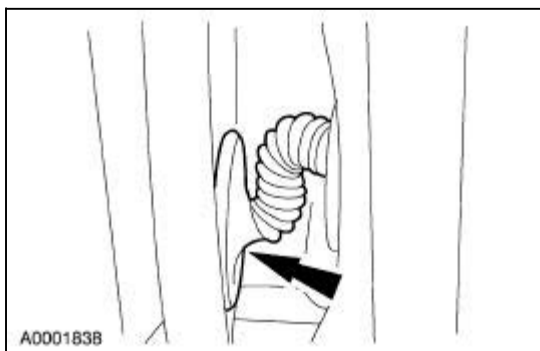
1. Position the door and install the hinge to door bolts.



2. Install the door check strap screws.

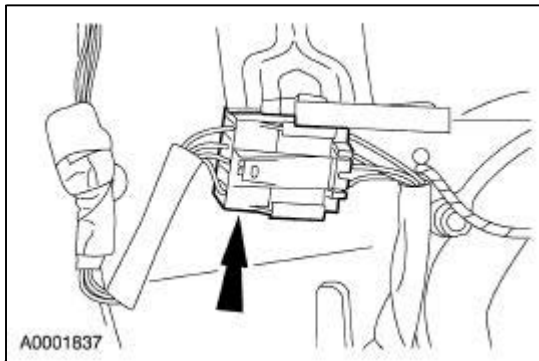


3. Install the grommet and the wiring harness.



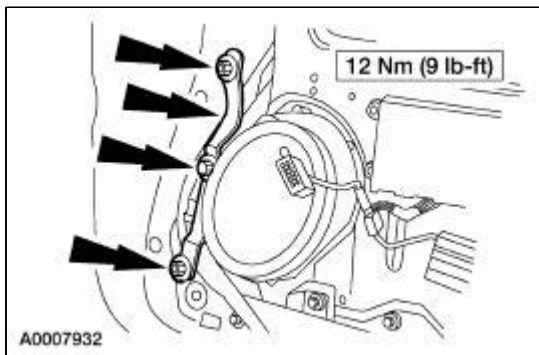
Rear Door

4. Connect the electrical connector.

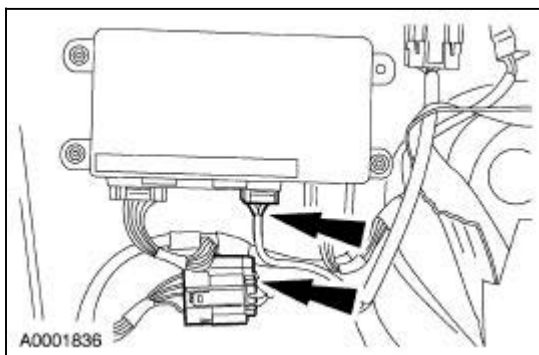


Front Door

5. Install the front door support bracket, the two nuts and the bolt.



6. Connect the electrical connectors.



All Doors

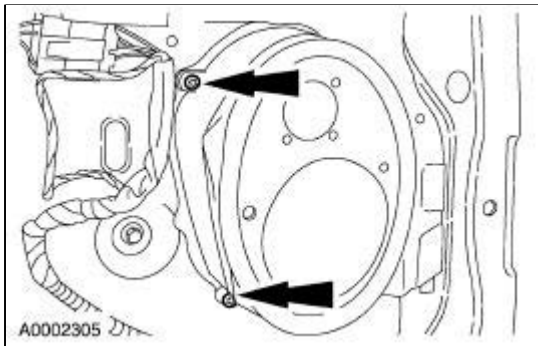
7. Install the screws and the speaker.
 8. Install the door trim panel. For additional information, refer to [Section 501-05](#).
 9. Check the door for a flush fit to the body.
-

Door —Check Strap

Removal and Installation

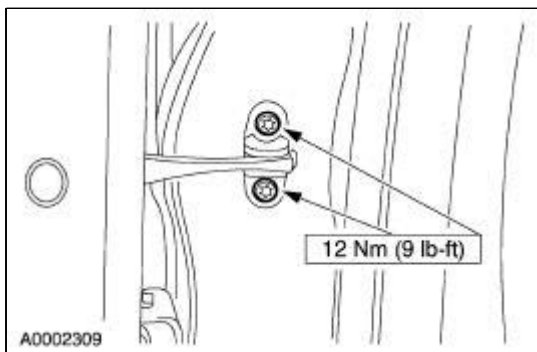
All Doors

1. Remove the door trim panel. For additional information, refer to [Section 501-05](#).
2. Remove the screws and the speaker.



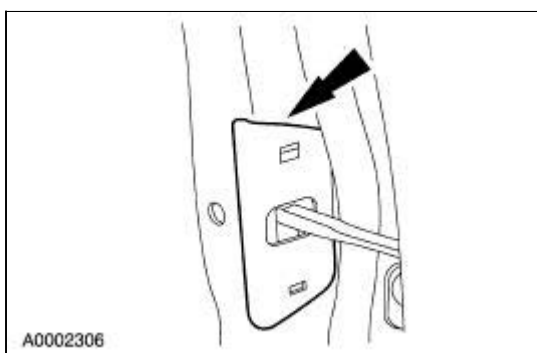
3.  **CAUTION:** Do not close the door after removal of the check strap screws

Remove the door check strap screws.



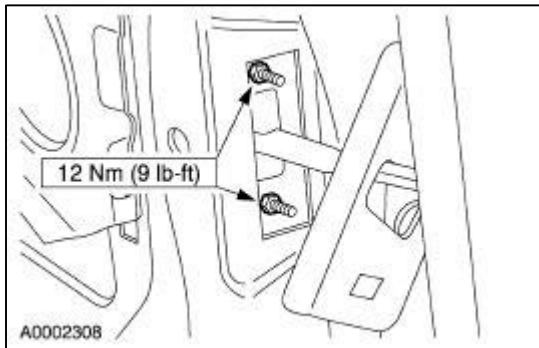
Rear Door

4. Remove the cover.



All Doors

5. Remove the nuts and the door check strap.



6. To install, reverse the removal procedure.
-

General Specifications

Item	Specification
Adhesives	
Headliner Adhesive	WSS-M2G355-B
F1VY-19562-A	

Torque Specifications

Description	Nm	lb-ft
Front seat safety belt nut	40	30
Rear safety belt anchor bolt	40	30

Interior Trim

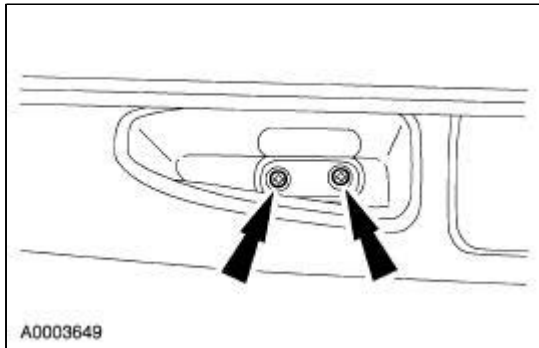
The interior trim consists of:

- door trim panels
 - headliner (coupe)
 - package tray trim panel (coupe)
 - rear quarter trim panels
 - sun visors
 - tether anchor covers (coupe)
 - upper quarter trim panel (coupe)
 - scuff plates
 - lower A-pillar trim panels
 - windshield side garnish mouldings
-

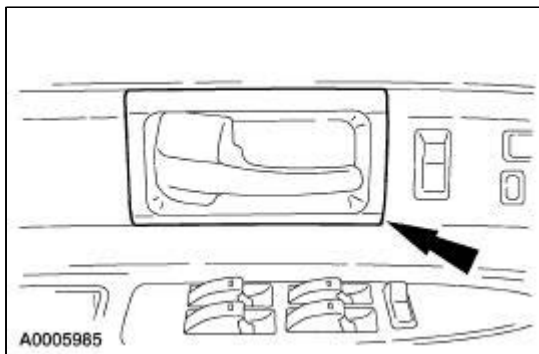
Trim Panel —Front Door

Removal

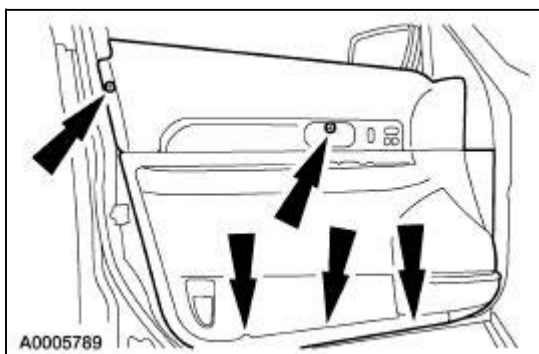
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Lift the cover and remove the screws.



3. Remove the interior door handle trim panel.



4. Remove the five screws and remove the trim panel.
 - Disconnect the electrical connectors.



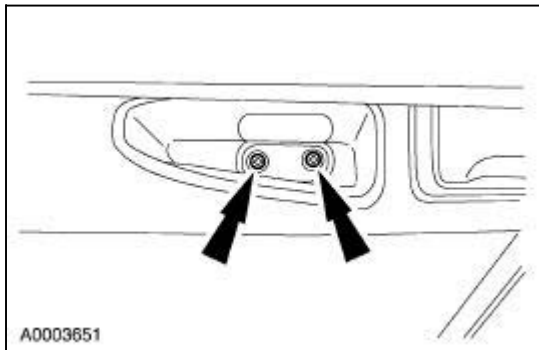
Installation

1. To install, reverse the removal procedure.

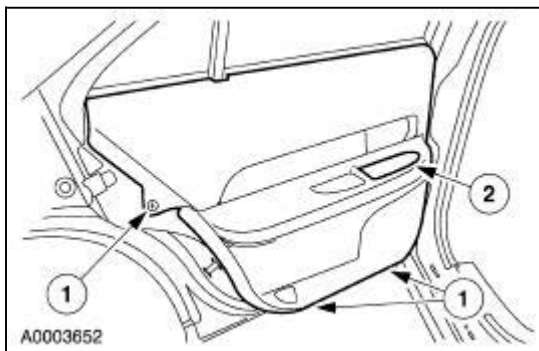
Trim Panel —Rear Door

Removal

1. Lift the cover and remove the screws.



2. Remove the door trim panel.
 1. Remove the three screws.
 2. Remove the ashtray assembly.
 - Disconnect the electrical connectors.



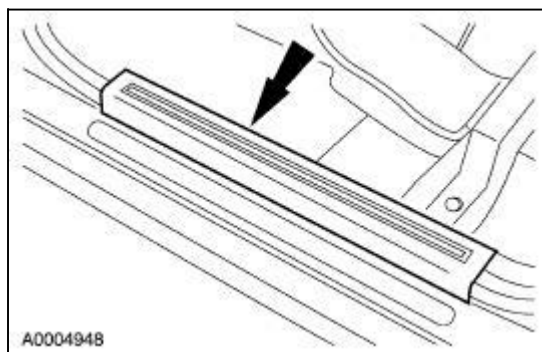
Installation

1. To install, reverse the removal procedure.
-

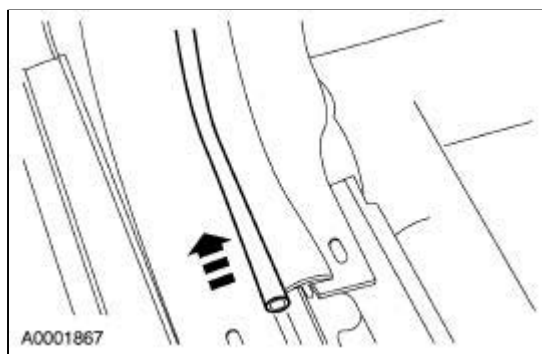
Trim Panel —A-Pillar Lower

Removal

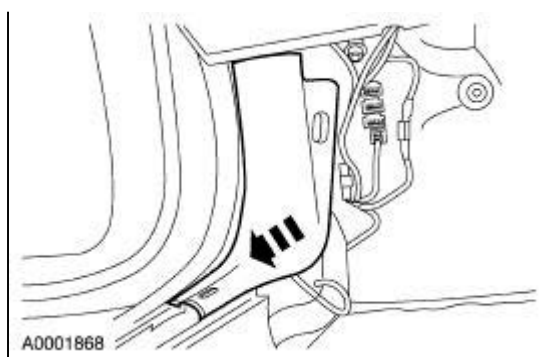
1. Remove the front scuff plate.



2. Pull back the weatherstrip.



3. Remove the A-pillar lower trim panel.



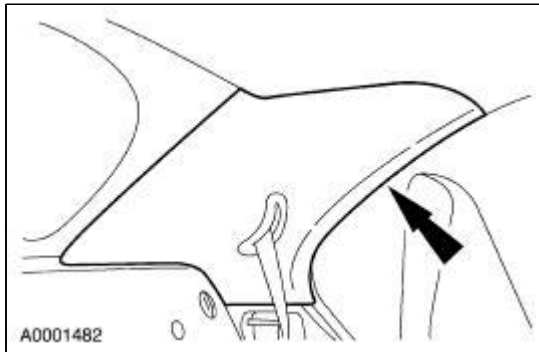
Installation

1. To install, reverse the removal procedure.

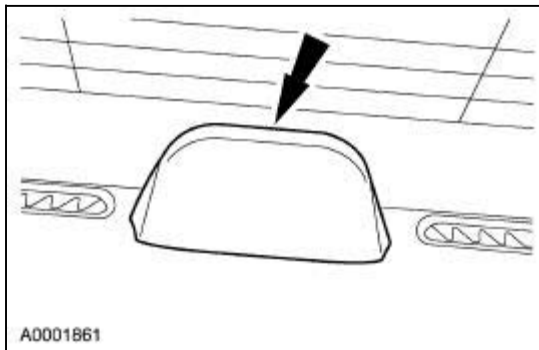
Trim Panel —Package Tray

Removal

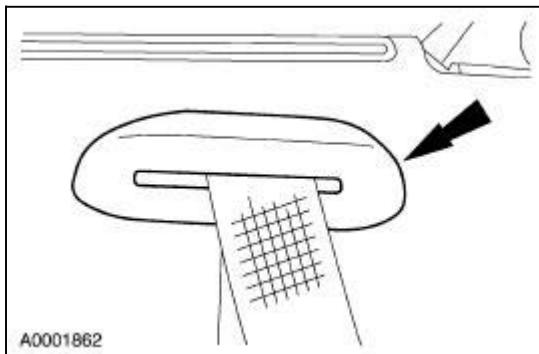
1. Remove the rear seat bolsters. For additional information, refer to [Section 501-10](#).
2. Position the two quarter trim panels aside.



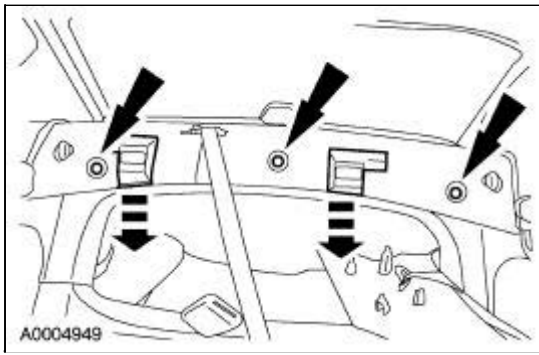
3. Remove the rear high mounted stoplamp (HMSL) cover.



4. Remove the rear center safety belt cover.



5. Remove the pin-type retainers and pull down the rear seat latch covers.



6. Remove the package tray trim panel.

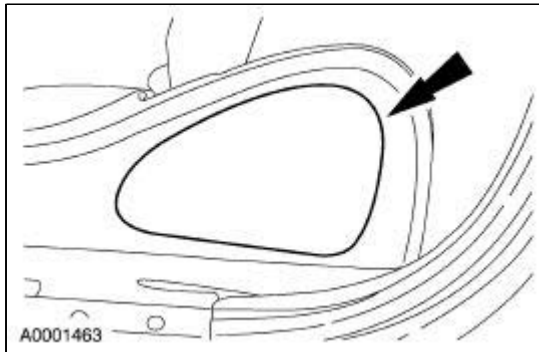
Installation

1. To install, reverse the removal procedure.
-

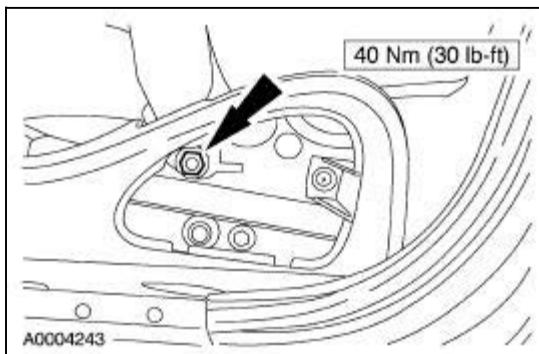
Trim Panel —Upper B-Pillar

Removal

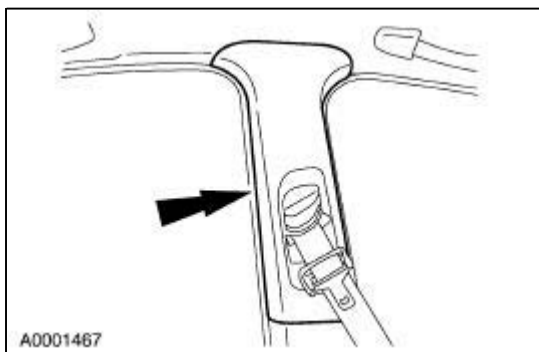
1. Pull back the weatherstrip surrounding the upper B-pillar trim.
2. Remove the front seat safety belt cover.



3. Remove the front seat safety belt nut.



4. Remove the upper B-pillar trim.



Installation

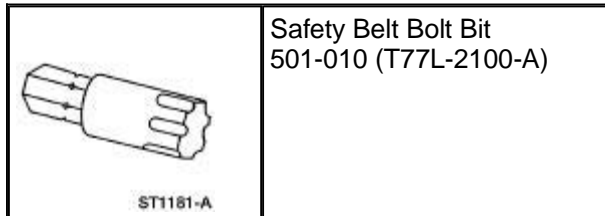
1. **NOTE:** Position the shoulder safety belt height adjuster at its highest setting before installing the B-pillar trim.

To install, reverse the removal procedure.

- Check the restraint system for correct operation.
-

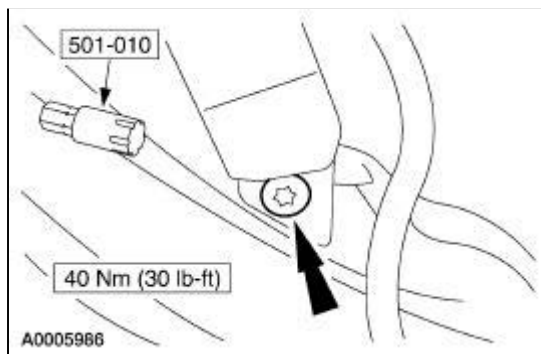
Trim Panel —Quarter

Special Tool(s)

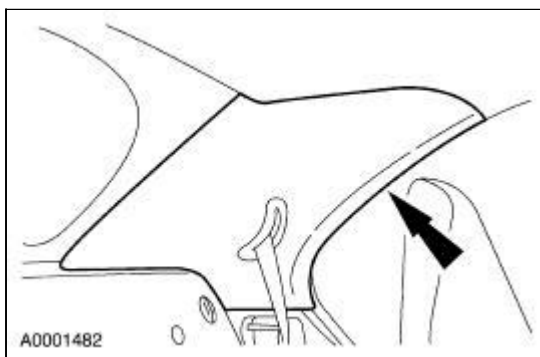


Removal

1. Remove the rear seat bolster. For additional information, refer to [Section 501-10](#).
2. Using the special tool, remove the rear safety belt anchor bolt.



3. Remove the quarter trim panel.



Installation

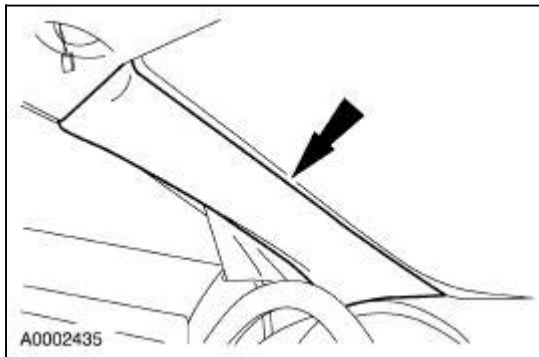
1. **NOTE:** Position the weatherstrip over the quarter trim panel.

To install, reverse the removal procedure.

- Check the restraint system for correct operation.

Trim Panel —Windshield Side Garnish Moulding

1. Position the weatherstrip aside.
2. Remove the windshield side garnish moulding.



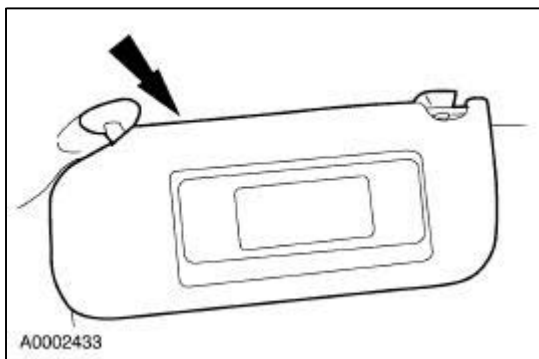
Installation

1. To install, reverse the removal procedure.
-

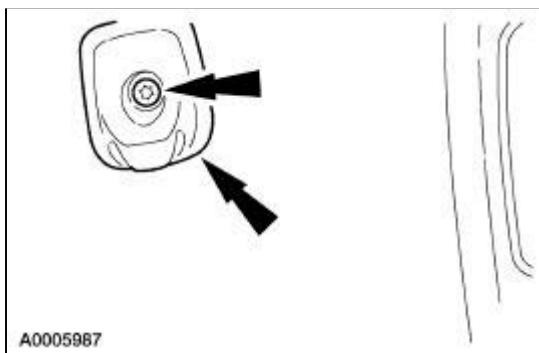
Headliner

Removal

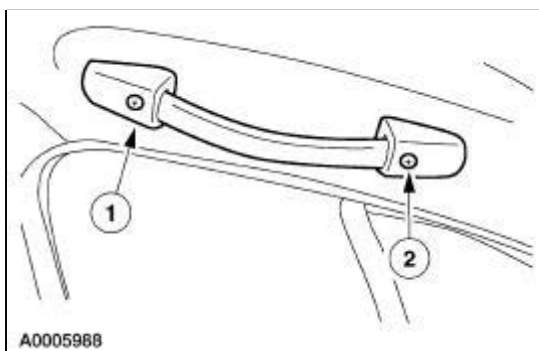
1. Move the front passenger seat fully rearward and fully recline.
2. Move the driver seat fully forward and the seat backrest fully upright.
3. Remove the screws and the sun visors.
 - Disconnect the electrical connectors.



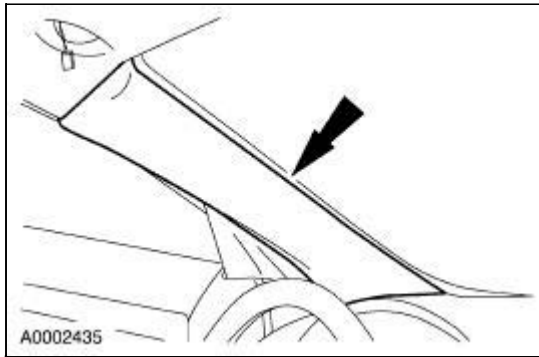
4. Remove the screws and the sun visor clips.



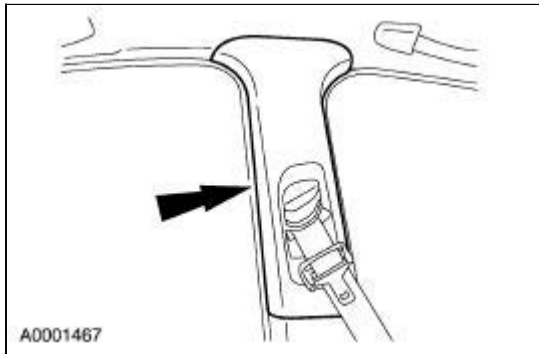
5. Remove the four assist handles.
 1. Position the end caps aside.
 2. Remove the screws.



6. Remove the windshield side garnish mouldings.



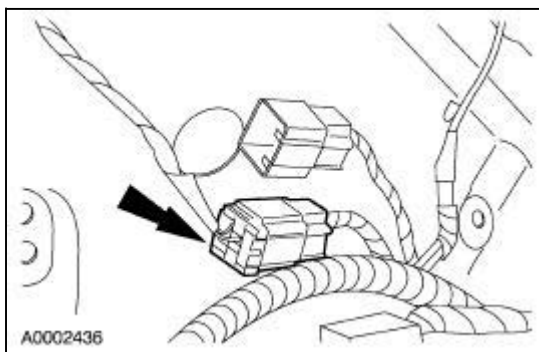
7. Position the upper B-pillar trim aside.



8. Position the upper portion of the door weatherstrip seals aside.
9. Remove the quarter trim panels. For additional information, refer to [Trim Panel—Quarter](#).
10. **NOTE:** Vehicles without moon roofs—Use a plastic scraper to detach the headliner from the roof.

Release the map lamp clips and lower the headliner.

11. Disconnect the electrical connector.



12. Remove the headliner from the left rear door opening.

Installation

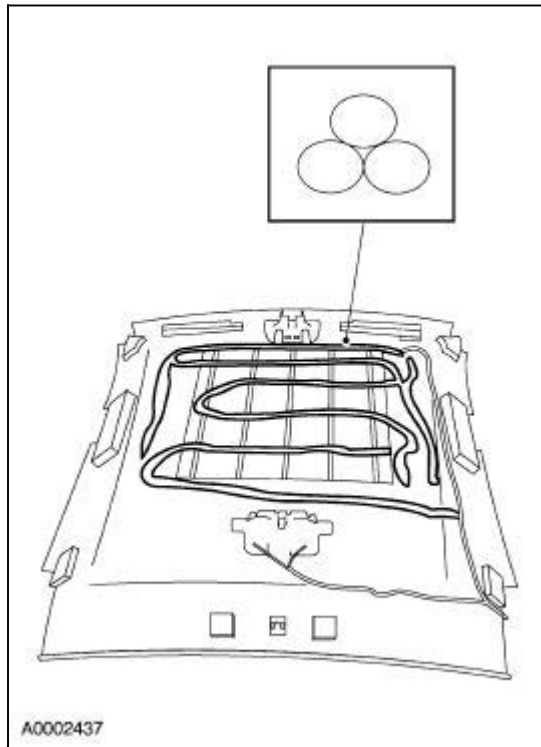
Installing New Headliner

1.  **CAUTION: Folding the headliner will result in damage to the headliner.**

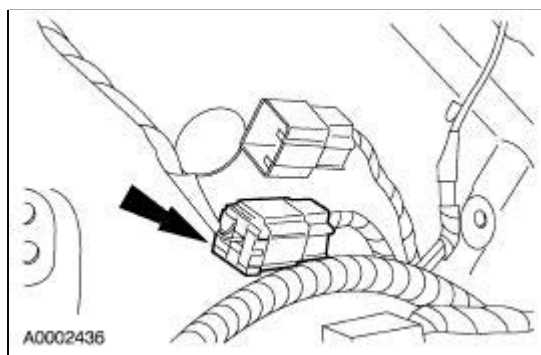
Carefully position the headliner in the vehicle.

2. **NOTE:** Adhesive required for vehicles without moon roofs.

Apply Headliner Adhesive F1VY-19562-A or equivalent meeting Ford specification WSS-M2G355-B in a triangular pattern to the center of the headliner.



3. Connect the electrical connector.



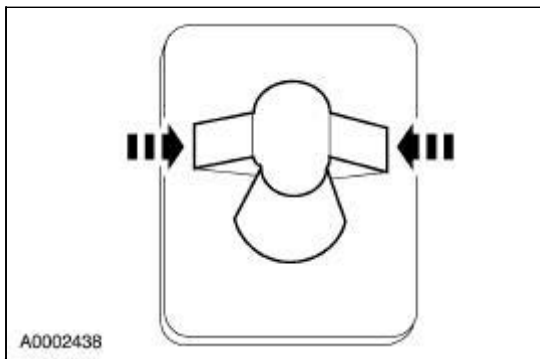
4. Press the headliner against the roof to make sure adhesive contacts both surfaces.

Installing Existing Headliner

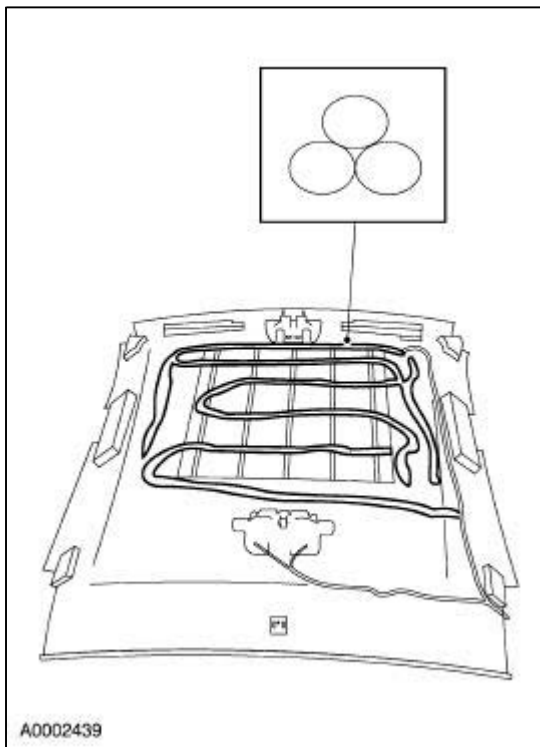
5.  **CAUTION: Folding the headliner will result in damage to the headliner.**

Carefully position the roof headliner in the vehicle.

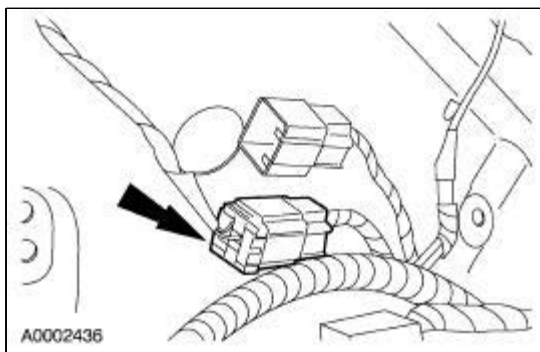
6. Bend the tabs of the rear locator back into their original position.



7. Apply Headliner Adhesive F1VY-19562-A or equivalent meeting Ford specification WSS-M2G355-B in a triangular pattern to the center of the headliner.



8. Connect the electrical connector.

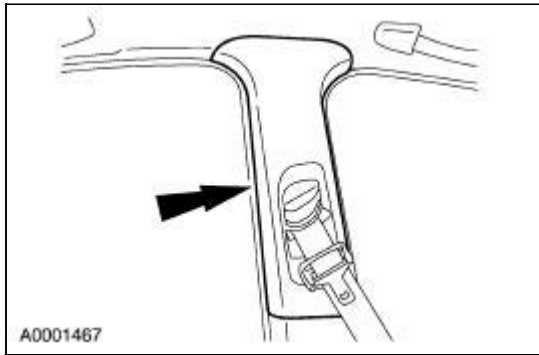


9. Press the headliner against the roof to make sure the adhesive contacts both surfaces.

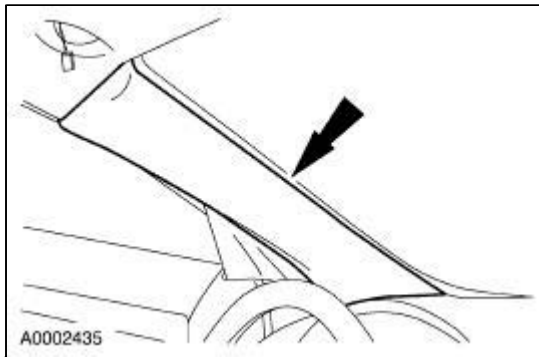
New or Existing Headliner

10. Install the quarter trim panels. For additional information, refer to [Trim Panel—Quarter](#) .

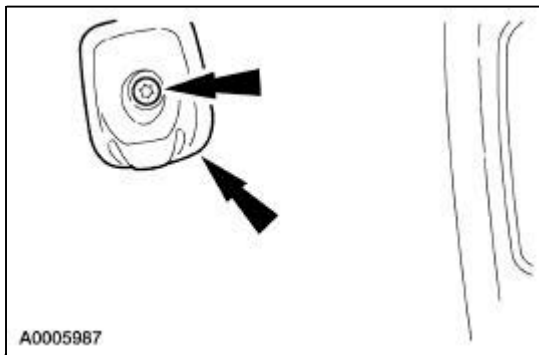
11. Install the upper B-pillar trim.



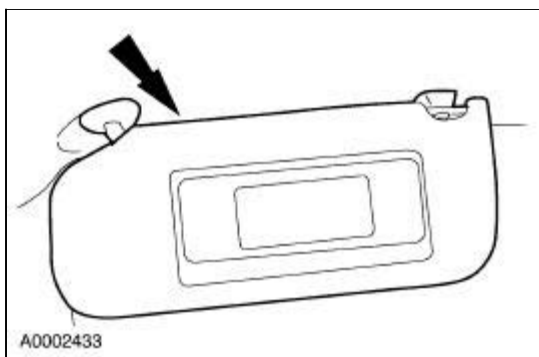
12. Install the windshield garnish mouldings on each side.



13. Position the sun visor clips and install the screws.

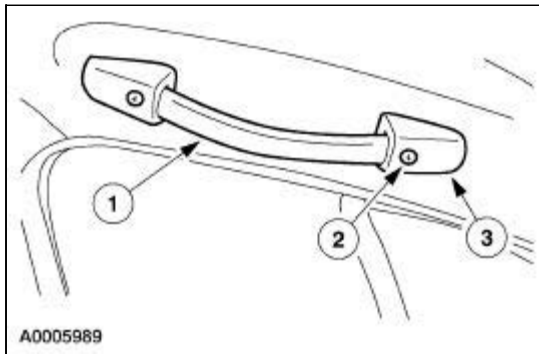


14. Connect the electrical connectors, position the sun visors, and install the screws.



15. Install the four assist handles.
1. Position the assist handles.

2. Install the screws.
3. Install the end caps.

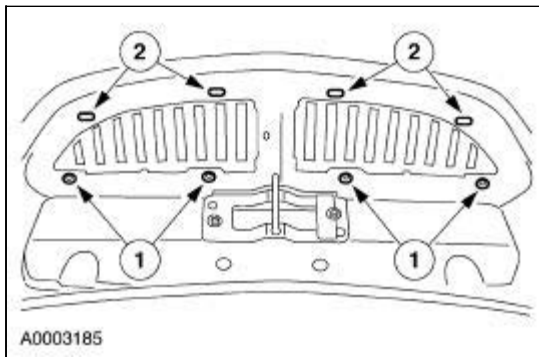


16. Install the door weatherstrips.
 17. Place the seats in upright positions.
-

Radiator Grille

Removal and Installation

1. Open the hood.
2. Remove the radiator grille.
 1. Remove the nuts.
 2. Release the clips.

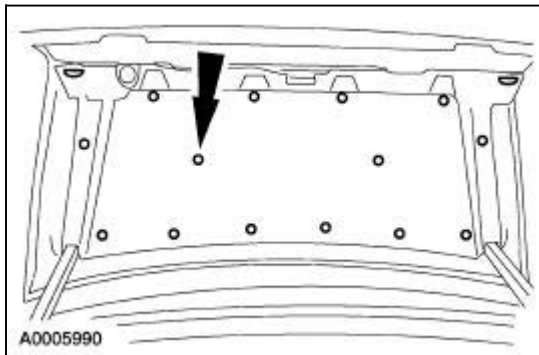


3. To install, reverse the removal procedure.
-

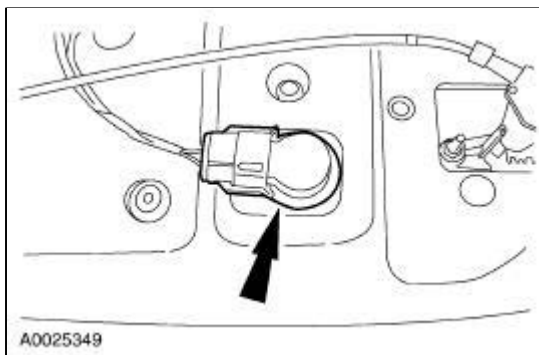
License Plate Housing

Removal and Installation

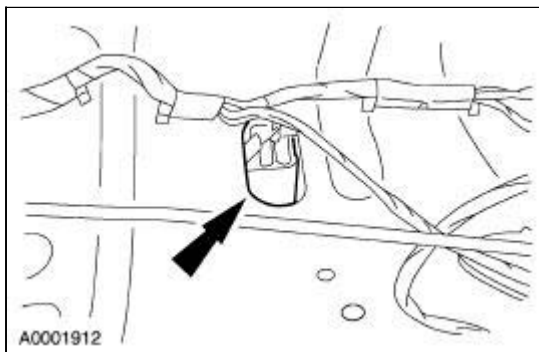
1. Remove the pin-type retainers and the luggage compartment lid trim panel.



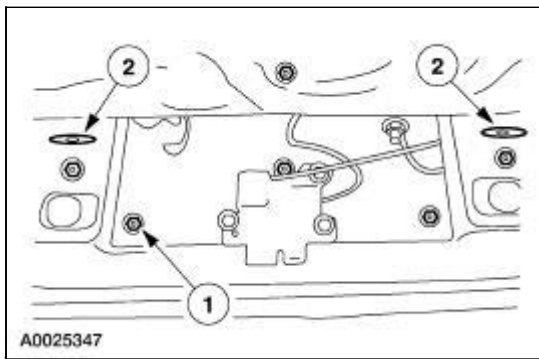
2. Disconnect the two reversing lamp electrical connectors.



3. Disconnect the two license plate lamp electrical connectors.



4. Remove the license plate housing.
 1. Remove the nuts.
 2. Release the retaining clips.



5. To install, reverse the removal procedure.
 - Transfer components as necessary.
-

Torque Specifications

Description	Nm	lb-ft	lb-in
Exterior rear view mirror nuts	5	—	44
Mirror motor screws	2	—	18

Rear View Mirrors

Rear View Mirrors

The exterior rear view mirror is:

- electrically operated.
- controlled by the exterior mirror control switch for both vertical and horizontal movement.

The interior rear view mirror features automatic dimming which:

- automatically reduces glare caused by headlamps reflecting in the interior rear view mirror.
- houses two sensors to determine dimmer actuator.
- activates whenever the ignition is in the RUN or ACC position.
- defaults to the NORMAL setting when the transmission is shifted to REVERSE to allow a bright view for backing up.
- is disabled by pushing the mirror-mounted switch to the OFF position.
- can be manually activated or deactivated.

Memory

The memory mirror:

- automatically provides preferred positioning of the exterior rear view mirrors.
- may be recalled through the door-mounted switches, the remote-entry transmitter or keyless entry keypad.
- provides recall when the ignition switch is in the OFF or RUN position and the transmission is in the PARK or NEUTRAL position.
- position is stored in the driver door module (DDM).

Heated Mirrors

The heated mirror function:

- provides electric heating to both the driver and passenger side exterior rear view mirrors.
- raises the temperature of the glass to clear frost and condensation.
- is activated by activating the rear defrost button.
- automatically shuts off after ten minutes.

Electrochromic Interior Rear View Mirror



The optional electrochromic interior rear view mirror:

- is equipped with an automatic dimming feature that controls the interior rear view mirror reflecting surface to reduce glare caused by headlamps reflecting in the mirror.
 - has two integral sensors to control dimming functions.
 - defaults to normal setting when the transmission is shifted to REVERSE to allow a bright view for backing up.
 - can be switched off by pressing the MODE switch to the OFF position.
-

Rear View Mirrors

Refer to Wiring Diagrams Section [501-09](#), Rear View Mirrors for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool
 ST1137-A	73 III Automotive Meter 105-R0057 or equivalent

Principles of Operation

Exterior Mirrors

The exterior mirrors are controlled by the exterior rear view mirror control. The exterior rear view mirror control is hardwired to the driver door module (DDM). When the driver exterior rear view mirror is selected, adjustment is carried out by moving the control to the desired position. The DDM receives the adjustment input command from the exterior rear view mirror control and supplies power and ground to the appropriate exterior rear view mirror motor to adjust the exterior rear view mirror. The passenger exterior rear view mirror is controlled by the front electronics module (FEM). When the DDM receives an adjustment command for the passenger exterior rear view mirror, the DDM interprets the command and sends the adjustment command over the SCP communication network to the FEM. The FEM interprets the command and supplies power and ground to the appropriate exterior rear view mirror motor to adjust the exterior rear view mirror.

Memory Operation

The DDM and FEM constantly track mirror position. Each exterior mirror motor is equipped with a potentiometer, which the modules monitor to track the mirror position. This position remains in memory as long as the module retains power. When a position is stored in memory by the operator, the module will retain this position in memory for future recall. When a memory position is recalled by the operator, the DDM and FEM will power the exterior mirror motors simultaneously and monitor the potentiometer circuits. When the stored memory position is reached, the DDM and FEM will remove power from the motors. If the exterior rear view mirror control is operated during a memory recall, the modules will stop the memory recall and respond to the exterior rear view mirror control command.

Heated Exterior Mirrors

The heated exterior mirrors will only function when the rear window defrost is operating. There is no separate control for heated exterior mirrors, they will function anytime the rear window defrost is ON. For additional information on the rear window defrost, refer to [Section 501-11](#).

The heated mirror power is supplied by the rear window defrost relay through a separate battery junction box (BJB) fuse that isolates the heated mirrors from the rear window defrost in the event of a concern.

Electrochromic Interior Rear View Mirror

The electrochromic interior rear view mirror will lighten or darken depending on the input of the sensors that are internal to the mirror.

The electrochromic interior rear view mirror reverse input is supplied by a hardwired circuit to the rear electronic module (REM). When REVERSE is selected, the REM will receive the PRNDL message over the SCP communication network from the PCM stating reverse has been selected. The REM will then supply a power signal to the electrochromic interior rear view mirror causing the electrochromic interior rear view mirror to cancel any dimming function currently operating and return to a full bright status. When the gear selector is moved out of REVERSE, the electrochromic interior rear view mirror returns normal operation and resumes any interrupted dimming functions.

If the REM does not receive the PRNDL information from the PCM, a communication DTC will be logged. As a default, the REM will supply power to the dimming circuit preventing the automatic dimming function from operating until the message and communication is restored.

The reverse message supplied to the REM has a time delay before the message is sent by the PCM. This delay allows for the gear selector to be moved through REVERSE without canceling dimming operations.

When installing a new electrochromatic interior rear view mirror, it is necessary to set the compass zone and calibrate the compass, refer to [Section 419-11](#).

Switched System Power (SSP)

The SSP is invoked by both the FEM and REM. This function removes power from relays that provide power to the exterior lamps, interior lamps, and power door locks. This is only accomplished when both the FEM and the REM are in sleep mode. The sleep function of the FEM and REM places the modules in sleep mode when the ignition switch is in the OFF position, and no wake up (inputs) signals occur for 30 minutes. The module will not sleep if the parking lamps or the hazard lamps are active. The following relays are controlled by the SSP function: SSP1, SSP2, SSP3, and SSP4. When either the FEM or REM are not in sleep mode, all SSP relays will be energized. Each relay, when energized, will supply power to multiple features/functions. For additional information, refer to the SSP Relay Index for diagnosis and testing of SSP-related issues.

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Damaged exterior rear view mirrors ● Damaged interior rear view mirror 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuses 406 (10A), 409 (5A), 422 (20A), 423 (30A), 424 (30A), 425 (40A), 427 (30A), and 432 (30A). ● Central junction box (CJB) Fuse 207 (5A), 216 (5A), 222 (10A), and 235 (5A). ● Switched system power (SSP) relays 1 and 2. ● Exterior rear view mirror control. ● Exterior rear view mirror motor. ● Exterior rear view mirror glass. ● Electrochromic interior rear view mirror. ● Wiring harness.

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the diagnostic tool tester does not power up, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTICS. If the diagnostic tool responds with:
 - CKT 914, CKT 915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for FEM, go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for REM, go to Pinpoint Test B.
 - NO RESP/NOT EQUIP for DDM, go to Pinpoint Test C.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the FEM, REM and DDM.
6. If the DTCs retrieved are related to the concern, go to the FEM Diagnostic Trouble Code (DTC) Index, REM Diagnostic Trouble Code (DTC) Index, or DDM Diagnostic Trouble Code (DTC) Index.
7. If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue the diagnostics.

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1342	ECU Is Defective	FEM	CLEAR the DTC. REPEAT the FEM self-test. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1438	Wiper Mode Select Switch Circuit Failure	FEM	REFER to Section 501-16 .
B1446	Wiper Park Sense Circuit Failure	FEM	REFER to Section 501-16 .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to Section 413-01 .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1567	Lamp Headlamp High-Beam Circuit Failure	FEM	REFER to Section 417-01 .

B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B1794	Lamp Headlamp Low-Beam Circuit Failure	FEM	REFER to Section 417-01 .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	REFER to Section 501-11 .
B2215	Window Passenger Front Down Switch Short to Battery	FEM	REFER to Section 501-11 .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	GO to Pinpoint Test E .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	GO to Pinpoint Test E .
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
C1284	Oil Pressure Switch Failure	FEM	REFER to Section 413-01 .
C1446	Brake Switch Circuit Failure	FEM	REFER to Section 413-01 .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to Section 211-00 .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to Section 211-00 .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	CARRY OUT the PCM self-test.
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test.
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	CARRY OUT the ICM self-test.
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	ICM	CARRY OUT the ICM self-test.

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
AL_EVT1	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT2	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT3	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT4	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS,

		NOEVNT, BB_SND
AL_EVT5	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT6	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT7	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT8	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR
FLUID_1	Brake Fluid Level Switch #1	OFF, ON
HOOD_SW	Hood Ajar Switch	CLOSED, AJAR
IGN_R	Ignition Switch -RUN Position	NO, YES
L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position Sensor (Left/Right)	#####
PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%
R_HIGH	Right High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RADIO_SW	Security Input Switch Status	OFF, ON
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-

STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	Volts
WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKS	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%
BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON
FRONT WINDOW CONTROL	PR DOWN	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
POWER MIRROR CONTROL	PR DOWN	OFF, ON
POWER MIRROR CONTROL	PR LEFT	OFF, ON
POWER MIRROR CONTROL	PR RIGHT	OFF, ON
POWER MIRROR CONTROL	PR UP	OFF, ON
STEERING COLUMN CONTROL COMMAND	LOCK_GND	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON
VAPS II OUTPUT PULSE CONTROL	VAPSIIOUT	%

REM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	REM	REFER to Section 413-01 .
B1300	Power Door Lock Circuit Failure	REM	REFER to Section 501-14B .
B1310	Power Door Unlock Circuit Failure	REM	REFER to Section 501-14B .
B1331	Decklid Ajar Rear Door Circuit Failure	REM	REFER to Section 417-02 .

B1335	Door Ajar RR Circuit Failure	REM	REFER to Section 417-02 .
B1342	ECU Is Defective	REM	CLEAR the DTC. REPEAT the REM self-test. If DTC B1342 is retrieved, INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1483	Brake Pedal Input Circuit Failure	REM	REFER to Section 417-01 .
B1499	Lamp Turn Signal Left Circuit Failure	REM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	REM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	REM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	REM	REFER to Section 417-01 .
B1551	Decklid Release Circuit Failure	REM	REFER to Section 501-14B .
B1571	Door Ajar LR Circuit Failure	REM	REFER to Section 417-02 .
B1676	Battery Pack Voltage Out of Range	REM	REFER to Section 414-00 .
B2172	Inertia Switch input Circuit Open	REM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test

REM Parameter Identification (PID) Index

PID	Description	Expected Value
BOO	Brake Switch Input	OFF, ON
DECKLID	Decklid Ajar Switch	CLOSED, AJAR
DL_DSRM	Decklid Disarm	NO, YES
DLIDOUT	Decklid Driver	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
DLIDRLS	Deck Lid Release	OFF, ON

L_TAIL	Left & Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LMRKOUT	Left Marker Lamp Driver Output State	OFF, ON
LMRKSTB	Left Marker Lamp Driver Short To Battery	NO, YES
LR_TURN	Left & Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LRDN_SW	Left Rear Window Down Switch	OFF, UP
LRDR_SW	Left Rear Door Ajar Switch	CLOSED, AJAR
LRUP_SW	Left Rear Window Up Switch	OFF, DOWN
PD_LOCK	Passenger Door Lock	NO, YES
PD_UNLK	Passenger Door Unlock	NOTLOC, LOCK
R_TAIL	Left & Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RR_TURN	Left & Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RRDN_SW	Right Rear Window Down Switch	OFF, UP
RRDR_SW	Right Rear Door Ajar Switch	CLOSED, AJAR
RRUP_SW	Right Rear Window Up Switch	OFF, DOWN

REM Active Command Index

Active Command	Display	Action
EXTERIOR LAMP CONTROL	BACKUPLMP	OFF, ON
EXTERIOR LAMP CONTROL	H MNT STP	OFF, ON
EXTERIOR LAMP CONTROL	L STOP	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
EXTERIOR LAMP CONTROL	R DEF RLY	OFF, ON
EXTERIOR LAMP CONTROL	R FOG LMP	OFF, ON
EXTERIOR LAMP CONTROL	R STOP	OFF, ON
POWER WINDOW ENABLE COMMAND	PSGR RLY	OFF, ON
REAR DOOR LOCK CONTROL	LR LOCK	OFF, ON
REAR DOOR LOCK CONTROL	LR UNLOCK	OFF, ON
REAR DOOR LOCK CONTROL	RELEASE	OFF, ON
REAR WINDOW CONTROL	LR DOWN	OFF, ON

REAR WINDOW CONTROL	RR DOWN	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

DDM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1309	Power Door Lock Circuit Short to Ground	DDM	REFER to Section 501-14B .
B1341	Power Door Unlock Circuit Short to Ground	DDM	REFER to Section 501-14B .
B1342	ECU Is Defective	DDM	CLEAR the DTC. REPEAT the DDM self-test. If DTC B1342 is retrieved, INSTALL a new DDM. REFER to Section 419-10 .CLEAR the DTCs. REPEAT the self-test.
B1400	Driver Power Window One Touch Window Relay Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1405	Driver Power Window Down Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1408	Driver Power Window Up Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1416	Power Window LR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1420	Passenger Power Window Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1424	Power Window RR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1530	Memory Set Switch Circuit Short to Ground	DDM	GO to Pinpoint Test G .
B1534	Memory 1 Switch Circuit Short to Ground	DDM	GO to Pinpoint Test G .
B1538	Memory 2 Switch Circuit Short to Ground	DDM	GO to Pinpoint Test G .
B1676	Battery Pack Voltage Out of Range	DDM	REFER to Section 414-00 .
B2112	Door Driver Set Switch Stuck Failure	DDM	REFER to Section 501-14B .
B2116	Door Driver Reset Switch Stuck Failure	DDM	REFER to Section 501-14B .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	DDM	GO to Pinpoint Test E .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	DDM	GO to Pinpoint Test E .
B2336	Mirror Switch Assembly Circuit Failure	DDM	GO to Pinpoint Test E .
B2425	Remote Keyless Entry Out of Synchronization	DDM	REFER to Section 501-14B .

B2477	Module Configuration Failure	DDM	REFER to <u>Section 418-01</u> .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test. REFER to <u>Section 206-09A</u> .
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Parameter Identification (PID) Index

PID	Description	Expected Value
ALLOCK	All Doors Lock Sense	notACT, ACTIVE
CCNT	Number Of Continuous Dtc's In Module	one count per bit
CNTUNLK	Central Door Unlock Switch Status	notACT, ACTIVE
D_DN_SW	Drivers Window Down Switch	OFF, DOWN
D_DSRM	Driver Door Unlock Disarm Switch	NO, YES
D_PWPK	Drivers Power Window Peak Current	AMP
D_UP_SW	Drivers Window Up Switch	OFF, UP
DMIR_H	Drivers Side Mirror Horizontal Motor	notSEN, SENSED
DMIR_V	Drivers Mirror Vertical	notSEN, SENSED
DR_LOCK	Drivers Door Lock Output State	NO, YES
DR_UNLK	All Doors Unlock Output State	NO, YES
DRLKCYL	Door Lock Cylinder	notACT, ACTIVE
DVMRPSH	Driver Mirror Horizontal Position	one count per bit
DVMRPSV	Driver Mirror Position	one count per bit
LRDN_SW	Left Rear Down Activated	OFF, DOWN
LRUP_SW	Left Rear Up Activated	OFF, UP
MEM1_SW	Memory Recall Switch #1	notACT, ACTIVE
MEM2_SW	Memory Recall Switch #2	notACT, ACTIVE
MEMS_SW	Memory Set Switch	notACT, ACTIVE
MIR_SEL	Power Mirror Select Switch	DRVMIR, PSGMIR, OFF
MIRH_SW	Power Mir Position Switch - Horizontal	SHORT, RIGHT, LEFT, OFF
MIRV_SW	Power Mir Position Switch - Vertical	SHORT, UP, DOWN, OFF
OTD_SW	One Touch Down Switch	OFF, DOWN
P_DN_SW	Passenger's Down Activated	OFF, DOWN
P_UP_SW	Passenger's Up Activated	OFF, UP
RRDN_SW	Right Rear Down Activated	OFF, DOWN
RRUP_SW	Right Rear Up Activated	OFF, UP
VBAT	Battery Voltage	Volts

DDM Active Command Index

Active Command	Display	Action
DOOR LOCK CONTROL	DD LOCK	OFF, ON
DOOR LOCK CONTROL	DD UNLOCK	OFF, ON
DOUBLE LOCK COMMAND	DOUBLE LK	UNLOCK, LOCK
FRONT WINDOW CONTROL	DR DOWN	OFF, ON
FRONT WINDOW CONTROL	DR UP	OFF, ON
ONE TOUCH WINDOW DOWN & ACCY DELAY	ONE TOUCH	OFF, ON
POWER MIRROR CONTROL	DR DOWN	OFF, ON
POWER MIRROR CONTROL	DR LEFT	OFF, ON
POWER MIRROR CONTROL	DR RIGHT	OFF, ON
POWER MIRROR CONTROL	DR UP	OFF, ON

SSP Relay Index ^a

Relay	Fuse	Controlled System(s)
SSP1	BJB Fuse 427 (30A)	<ul style="list-style-type: none"> ● Driver power door lock (FEM) ● LH high beam headlamps (FEM) ● RF park/turn/side marker lamps (FEM) ● RH low beam headlamp ● Driver exterior rear view mirror ● LF park/turn/side marker lamps (FEM)
SSP2	BJB Fuse 432 (30A)	<ul style="list-style-type: none"> ● LH low beam headlamp (FEM) ● RH high beam headlamps (FEM) ● Passenger exterior rear view mirror (FEM) ● Switch illumination backlighting
SSP3	BJB Fuse 424 (30A)	<ul style="list-style-type: none"> ● High mounted stoplamp (REM) ● RR park/stoplamps (REM) ● Reversing lamps (REM) ● LR turn signals (REM) ● Interior courtesy and demand lighting (FEM)
SSP4	BJB Fuse 423 (30A)	<ul style="list-style-type: none"> ● LR park/stoplamps (REM) ● RR turn signals (REM) ● All passenger door locks (REM) ● License lamps ● Luggage compartment release solenoid/switch ● Fuel door release solenoid/switch ● Luggage compartment lamp

^a When diagnosing an SSP relay, check that all systems for that relay are inoperative. REFER to Section 417-01

Symptom Chart

Refer to the Wiring Diagrams for connector numbers stated in the Pinpoint Tests.

Symptom Chart

Condition	Possible Sources	Action

<ul style="list-style-type: none"> ● No communication with the front electronics module (FEM) 	<ul style="list-style-type: none"> ● BJB Fuse 425 (40A), 422 (20A). ● CJB Fuse 207 (5A). ● FEM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.
<ul style="list-style-type: none"> ● No communication with the rear electronics module (REM) 	<ul style="list-style-type: none"> ● BJB Fuse 425 (40A). ● CJB Fuses 207 (5A) and 235 (5A). ● REM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B.
<ul style="list-style-type: none"> ● No communication with the driver door module (DDM) 	<ul style="list-style-type: none"> ● BJB Fuse 425 (40A). ● CJB Fuse 207 (5A). ● DDM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test C.
<ul style="list-style-type: none"> ● The mirrors are inoperative 	<ul style="list-style-type: none"> ● Exterior rear view mirror control. ● Driver door module. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D.
<ul style="list-style-type: none"> ● A single mirror is inoperative 	<ul style="list-style-type: none"> ● Exterior rear view mirror control. ● BJB Fuse 427 (30A), 432 (30A), and 406 (10A) ● CJB Fuse 222 (10A) ● SSP relay 1. ● SSP relay 2. ● FEM. ● DDM. ● Exterior rear view mirror motor. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test E.
<ul style="list-style-type: none"> ● The auto dimming mirror does not operate correctly 	<ul style="list-style-type: none"> ● BJB Fuse 409 (5A). ● CJB Fuse 216 (5A). ● Electrochromic interior rear view mirror. ● Rear electronics module. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test F.
<ul style="list-style-type: none"> ● The memory mirror is inoperative 	<ul style="list-style-type: none"> ● DDM. ● FEM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test G.
<ul style="list-style-type: none"> ● The memory mirror is inoperative — memory set switch LED 	<ul style="list-style-type: none"> ● Driver door module. ● Memory set switch. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test H.
<ul style="list-style-type: none"> ● The heated exterior mirror does not defrost 	<ul style="list-style-type: none"> ● BJB Fuse 409 (5A). ● Exterior rear view mirrors. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test I.


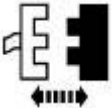
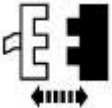

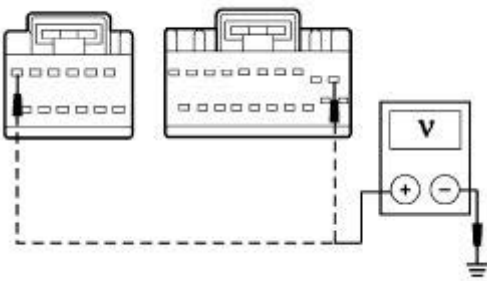

Pinpoint Tests



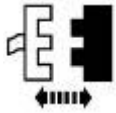
CAUTION: Electronic modules are sensitive to electrical charges. If exposed to these charges, damage may result.

PINPOINT TEST A: NO COMMUNICATION WITH THE FRONT

ELECTRONIC MODULE (FEM)

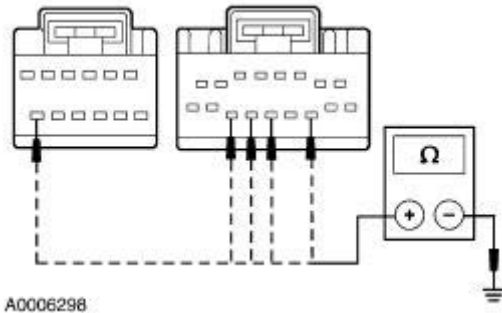
CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK22 (OG/YE) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<ol style="list-style-type: none"> 1  2  FEM C201c 3  FEM C201f 4  5  A0006297 	<ol style="list-style-type: none"> 5 Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22 (OG/YE) harness side and ground. <ul style="list-style-type: none"> • Are the voltages greater than 10 volts? <p>→ Yes GO to <u>A2</u>.</p> <p>→ No REPAIR the circuit(s) in question. TEST the system for normal operation.</p>
A2 CHECK CIRCUITS 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS	
<ol style="list-style-type: none"> 1  	

2



FEM C201a

3



3

Using the following table, measure the resistance between FEM connectors, harness side and ground:

FEM	Pin	Circuit
C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)
C201a	15	31-DK20D (BK/RD)

• Are the resistances less than 5 ohms?

→ Yes

REFER to [Section 418-00](#).

→ No

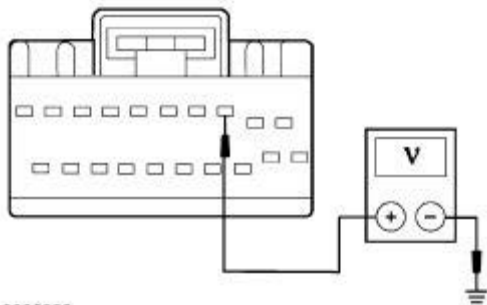
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST B: NO COMMUNICATION WITH THE REAR ELECTRONIC MODULE (REM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CIRCUIT 29-DK31 (OG/BK) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>	
<p>2</p> <p>REM C420d</p>	
<p>3</p> <p>REM C420c</p>	
<p>4</p>	



5



A0006299

5

Measure the voltage between REM C420d pin 3, circuit 29-DK31 (OG/BK), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to B2.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

B2 CHECK CIRCUITS 29S-DK31 (OG/BK), 31-DK30D (BK), 31-DK30E (BK), 31-DK30F (BK), 31-DK30G (BK) AND 31-DK30H (BK/OG), FOR OPENS

1

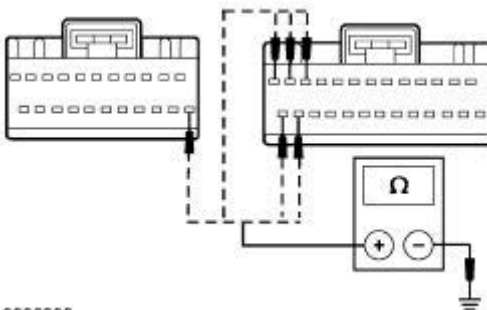


2



REM C420b

3



A0006300

3


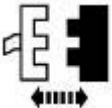

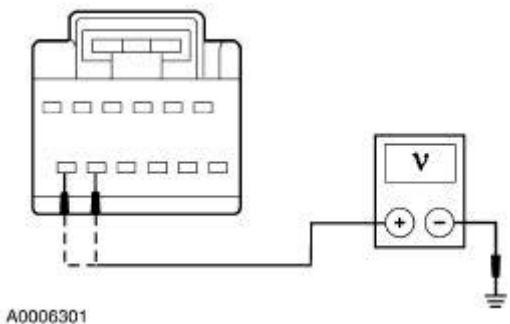
Using the following table, measure the resistance between REM connectors, harness side and ground:

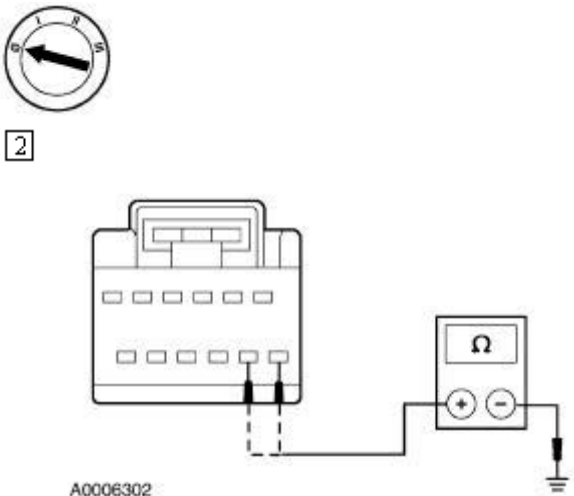
REM	Pin	Circuit
C420c	13	29S-DK31 (OG/BK)
C420c	12	31-DK30E (BK)
C420c	11	31-DK30D (BK)
C420c	26	31-DK30G (BK)
C420c	25	31-DK30F (BK)
C420b	12	31-DK30H (BK/OG)

• Are the resistances less than 5 ohms?

- **Yes**
REFER to Section 418-00.
- **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST C: NO COMMUNICATION WITH THE DRIVER DOOR MODULE (DDM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK CIRCUITS 29-AJ80 (OG) AND 29S-AJ86 (OG/BU) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1 </p> <p>2  DDM C501a</p> <p>3 </p> <p>4 </p>	<p>4 Measure the voltage between DDM C501a pin 11, circuit 29-AJ80 (OG), harness side and ground; and between DDM C501a pin 12, circuit 29S-AJ86 (OG/BU), harness side and ground.</p> <ul style="list-style-type: none"> • Are the voltages greater than 10 volts? <p>→ Yes GO to <u>C2</u>.</p> <p>→ No REPAIR the circuit(s) in question. TEST the system for normal operation.</p>
C2 CHECK CIRCUITS 31-AJ80B (BK/OG) AND 91-AJ80 (BN/BU) FOR OPENS	
1	



A0006302


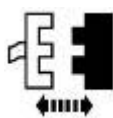
2 Measure the resistance between DDM C501a pin 7, circuit 91-AJ80 (BN/BU), harness side and ground; and between DDM C501a pin 8, circuit 31-AJ80B (BK/OG), harness side and ground.

- Are the resistances less than 5 ohms?

→ **Yes**
REFER to [Section 418-00](#).

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

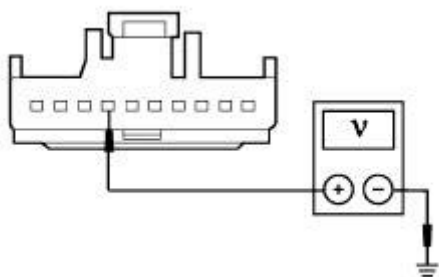
PINPOINT TEST D: THE MIRRORS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK DDM AND FEM DTCS	
	<p>1 Use the recorded results from the FEM and DDM self-tests.</p> <ul style="list-style-type: none"> ● Are any DTCs retrieved? <p>→ Yes For DTC B2336 or B2320, GO to D9.</p> <p>→ No GO to D2.</p>
D2 CHECK CIRCUIT 33-AD12 (YE) FOR VOLTAGE	
<p>1</p>  <p>2</p>  <p style="text-align: center;">Exterior Rear View Mirror Control C204</p>	

3



4



A0002454

4

Measure the voltage between exterior rear view mirror control C204 pin 7, circuit 33-AD12 (YE), harness side and ground.

• Is the voltage greater than 5 volts?

→ Yes
GO to D4.

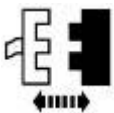
→ No
GO to D3.

D3 CHECK CIRCUIT 33-AD12 (YE) FOR AN OPEN

1



2

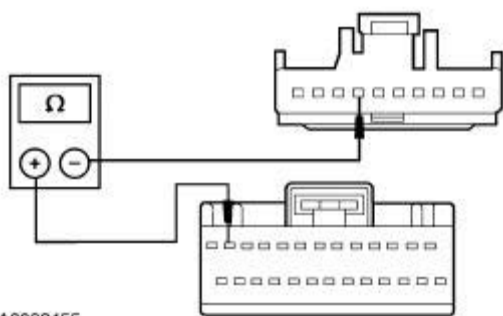


DDM C501d

3



4



A0002455

4

Measure the resistance between the exterior rear view mirror control C204 pin 7, circuit 33-AD12 (YE), harness side and DDM C501d pin 12, circuit 7-AD1 (YE), harness side.

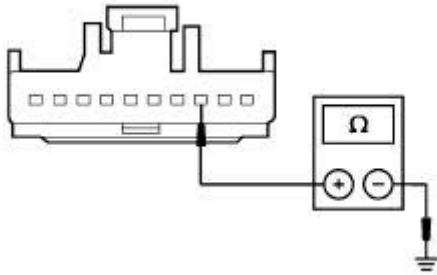
• Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D4 CHECK CIRCUIT 31-AD12 (BK/YE) FOR AN OPEN

1



1 Measure the resistance between exterior rear view mirror control C204 pin 3, circuit 31-AD12 (BK/YE), harness side and ground.

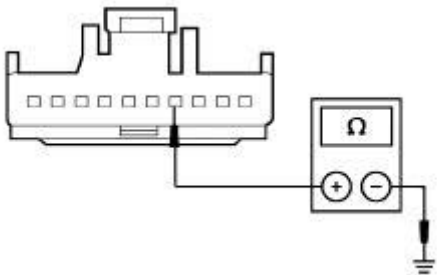
● Is the resistance less than 5 ohms?

→ **Yes**
GO to [D5](#).

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D5 CHECK CIRCUIT 33-AD12 (YE) FOR A SHORT TO GROUND

1



1 Measure the resistance between exterior rear view mirror control C204 pin 4, circuit 33-AD12 (YE), harness side and ground.

● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to [D7](#).

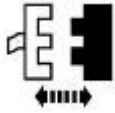
→ **No**
GO to [D6](#).

D6 CHECK DDM FOR AN INTERNAL SHORT TO GROUND

1



2

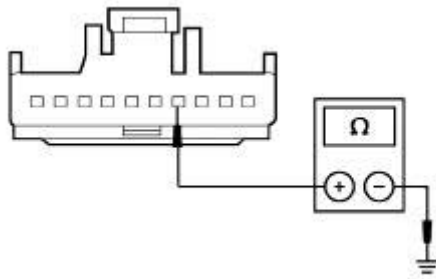


DDM C501d

3



4



A0002458

4 Measure the resistance between exterior rear view mirror control C204 pin 4, circuit 33-AD12 (YE), harness side and ground.

• Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

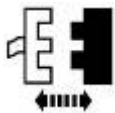
→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D7 CHECK CIRCUIT 33-AD12 (YE) FOR AN OPEN

1



2



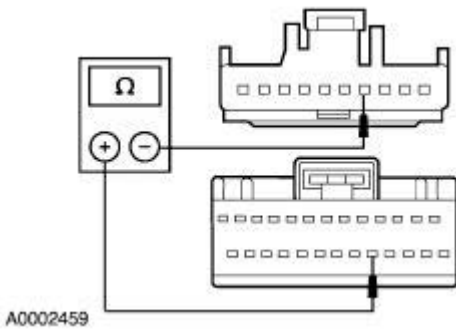
DDM C501d

3



4

4 Measure the resistance between exterior



rear view mirror control C204 pin 4, circuit 33-AD12 (YE), harness side and DDM C501d pin 18, circuit 33-AD12 (YE), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to D8.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D8 CHECK THE EXTERIOR REAR VIEW MIRROR CONTROL

1 Carry out the exterior rear view mirror control component test. Refer to Wiring Diagrams Section 700-09-00, Component Testing.

- Is the exterior rear view mirror control OK?

→ **Yes**
INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

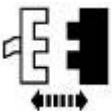
→ **No**
INSTALL a new exterior rear view mirror control. For additional information, REFER to Switch—Exterior Rear View Mirror Control in this section. CLEAR the DTCs. REPEAT the self test.

D9 CHECK THE EXTERIOR REAR VIEW MIRROR CONTROL

1



2



Exterior Rear View Mirror Control C204

3 Carry out the exterior rear view mirror control component test. Refer to Wiring Diagrams Section 700-09-00, Component Testing.

- Is the exterior rear view mirror control OK?

→ **Yes**
GO to D10.

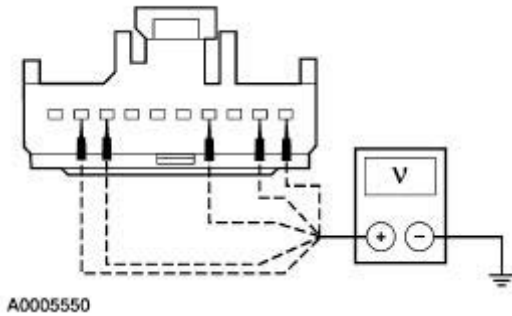
→ **No**
INSTALL a new exterior rear view mirror control. For additional information, REFER to Switch—Exterior Rear View Mirror Control in this section. CLEAR the DTCs. REPEAT the self test.

D10 CHECK EXTERIOR REAR VIEW MIRROR CONTROL CIRCUITS FOR VOLTAGE

1



2



A0005550

2 Using the following table, measure the voltage between the exterior rear view mirror control C204 pins, harness side and ground:

Pin	Circuit
1	32-AD30 (WH/BK)
2	32-AD32 (WH/RD)
4	33-AD12 (YE)
8	34-AD31 (BU/WH)
9	34-AD29 (BU/OG)

- Is the voltage greater than 10 volts for any measurement?

→ **Yes**
GO to D12.

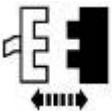
→ **No**
GO to D11.

D11 CHECK EXTERIOR REAR VIEW MIRROR CONTROL CIRCUITS FOR SHORT TO GROUND

1



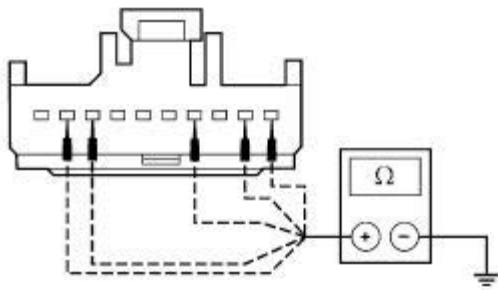
2



DDM C501d

3

3 Using the following table, measure the



A0005551

resistance between the exterior rear view mirror control C204 pins, harness side and ground:

Pin	Circuit
1	32-AD30 (WH/BK)
2	32-AD32 (WH/RD)
4	33-AD12 (YE)
8	34-AD31 (BU/WH)
9	34-AD29 (BU/OG)

- Is the resistance less than 5 ohms for any measurement?

→ **Yes**
 INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**
 REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D12 CHECK EXTERIOR REAR VIEW MIRROR CONTROL CIRCUITS FOR SHORT TO VOLTAGE

1



2

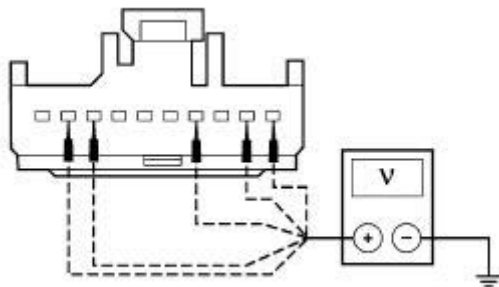


DDM C501d

3



4




A0005550

4 Using the following table, measure the voltage between the exterior rear view mirror control C204 pins, harness side and ground:

Pin	Circuit
1	32-AD30 (WH/BK)
2	32-AD32 (WH/RD)
4	33-AD12 (YE)
8	34-AD31 (BU/WH)
9	34-AD29 (BU/OG)

	<ul style="list-style-type: none"> ● Is voltage present for any measurement? <p>→ Yes REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p>
--	---

PINPOINT TEST E: A SINGLE MIRROR IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK THE DDM DTCS	
	<p>1 Use the recorded results from the DDM self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs retrieved? <p>→ Yes For DTC B2336, GO to E30. For DTC B2320 or B2324, GO to E20. For all other DDM DTCs, REFER to the DDM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to E2.</p>
E2 CHECK THE FEM DTCS	
	<p>1 Use the recorded results from the FEM self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes For DTC B2312 or B2316, GO to E5. For all other FEM DTCs, REFER to the FEM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to E3.</p>
E3 CHECK THE EXTERIOR REAR VIEW MIRROR CONTROL PIDS	
NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>2</p>	



3



3 Monitor the DDM PIDs MIRH_SW, MIRV_SW and MIR_SEL, while operating the exterior rear view mirror control in each direction

- **Did the DDM PID values agree with the exterior rear view mirror control positions?**

→ **Yes**
GO to E4.

→ **No**
GO to E18.

E4 IDENTIFY THE INOPERATIVE MIRROR

1 Operate the driver and passenger exterior rear view mirrors.

- **Is the passenger mirror inoperative?**

→ **Yes**
GO to E5.

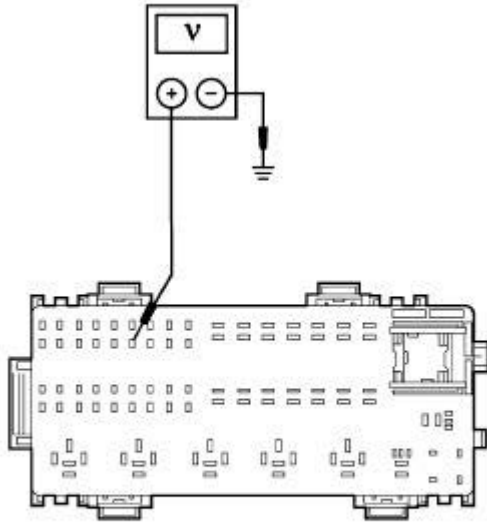
→ **No**
GO to E20.

E5 CHECK BJB FUSE 406 (10A) FOR VOLTAGE

2

1 Remove BJB Fuse 406 (10A).

2 Measure the voltage between BJB Fuse 406 (10A) input side, circuit 30S-DB15 (RD/OG), harness side and ground.



A0002460

● Is the voltage greater than 10 volts?

→ **Yes**
GO to E6.

→ **No**
REPAIR the power source to the fuse.
CLEAR the DTCs. REPEAT the self-test.

E6 CHECK CIRCUIT 29S-DK21 (OG/WH) AND 29S-LG1 (OG/YE) FOR AN OPEN

2



3



FEM C201a

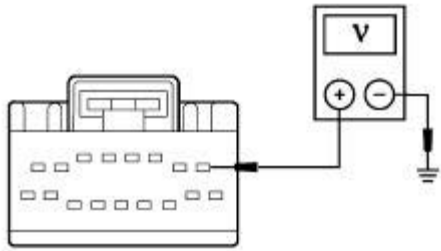
4



5

1 Reinstall Fuse 406 (10A).

5 Measure the voltage between FEM C201a pin 1, circuit 29S-DK21 (OG/WH), harness side and ground.



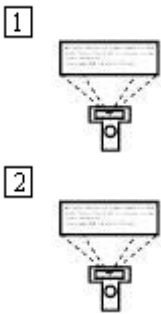
A0002461

● Is the voltage greater than 10 volts?

→ **Yes**
GO to E7.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

E7 CHECK THE PASSENGER MIRROR ACTIVE COMMAND



1 Select the FEM active command menu
POWER MIRROR CONTROL.

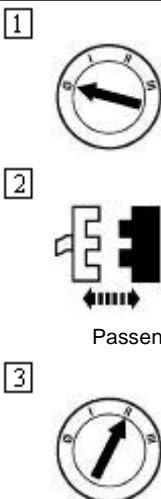
2 Trigger the FEM active commands PR
UP, PR DOWN, PR LEFT and PR
RIGHT ON and OFF.

● Did the passenger exterior rear
view mirror function correctly?

→ **Yes**
GO to E14.

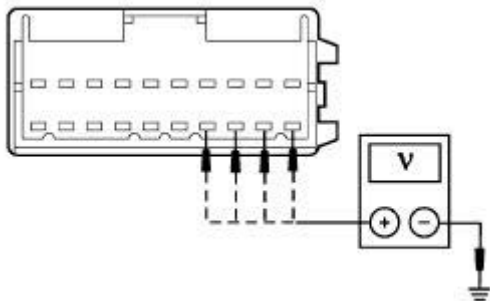
→ **No**
GO to E8.

E8 CHECK FOR VOLTAGE AT THE PASSENGER MIRROR MOTOR



Passenger Exterior Rear View Mirror C601

4



A0002462

4 Using the following table, measure the voltage between the passenger exterior rear view mirror C601 pins, harness side and ground:

Pin	Circuit
4	33-AD10 (YE/BK)
2	32-AD10 (WH/BK)
6	35-AD11 (VT/WH)
8	34-AD11 (BU/OG)

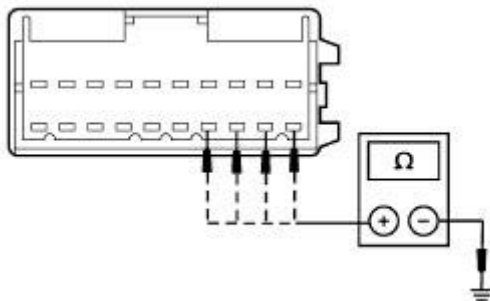
● Is the voltage greater than 10 volts for any measurement?

→ **Yes**
GO to E12.

→ **No**
GO to E9.

E9 CHECK FOR RESISTANCE AT THE PASSENGER EXTERIOR REAR VIEW MIRROR

1



A0002463

1 Using the following table, measure the resistance between passenger exterior rear view mirror C601 pins, harness side and ground:

Pin	Circuit
4	33-AD10 (YE/BK)
2	32-AD10 (WH/BK)
6	35-AD11 (VT/WH)
8	34-AD11 (BU/OG)

● Are the resistances less than 5 ohms?

→ **Yes**
GO to E13.

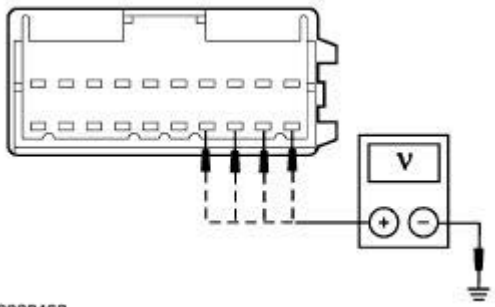
→ **No**
GO to E10.

E10 CHECK FOR AN OPEN AT THE PASSENGER MIRROR ASSEMBLY

1

1 Using the following table, measure the voltage between passenger exterior rear view mirror C601 pins, harness side and ground, while moving the exterior rear view mirror control to the listed positions:

Pin	Circuit	Mirror Position
4	33-AD10 (YE/BK)	RIGHT



A0002462

2	32-AD10 (WH/BK)	LEFT
6	35-AD11 (VT/WH)	DOWN
8	34-AD11 (BU/OG)	UP

- Are the voltages greater than 10 volts for all measurements?

→ **Yes**
 INSTALL a new passenger rear view mirror motor. For additional information, REFER to Mirror—Motor in this section. CLEAR the DTCs. REPEAT the self-test.

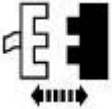
→ **No**
 GO to E11.

E11 CHECK CIRCUITS 33-AD10 (YE/BK), 32-AD10 (WH/BK), 35-AD11 (VT/WH) AND 34-AD11 (BU/OG) FOR AN OPEN

1



2

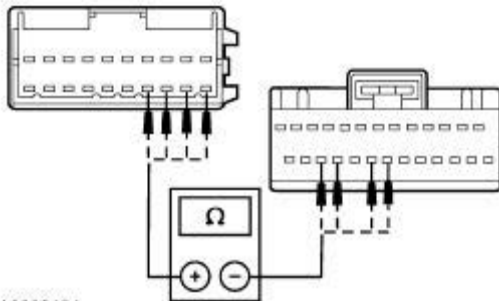


FEM C201e

3



4



A0002464

- 4 Using the following table, measure the resistance between FEM C201e pins, harness side and passenger exterior rear view mirror C601 pins, harness side:

Passenger Exterior Rear View Mirror Pin	Circuit	FEM C201e Pin
4	33-AD10 (YE/BK)	24
2	32-AD10 (WH/BK)	23
6	35-AD11	21

	(VT/WH)	
8	34-AD11 (BU/OG)	20

- Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E12 CHECK CIRCUITS 33-AD10 (YE/BK), 32-AD10 (WH/BK), 35-AD11 (VT/WH) AND 34-AD11 (BU/OG) FOR A SHORT TO VOLTAGE

1



2

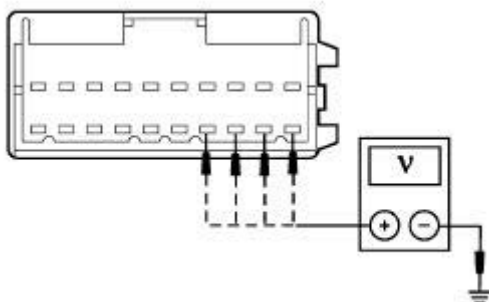


FEM C201e

3



4



A0002462

4 Using the following table, measure the voltage between the passenger exterior rear view mirror C601 pins, harness side and ground:

Pin	Circuit
4	33-AD10 (YE/BK)
2	32-AD10 (WH/BK)
6	35-AD11 (VT/WH)
8	34-AD11 (BU/OG)

- Is voltage present for any measurement?

→ **Yes**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

→ **No**
INSTALL a new FEM. REFER to [Section](#)

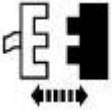
419-10. CLEAR the DTCs. REPEAT the self-test.

E13 CHECK CIRCUITS 33-AD10 (YE/BK), 32-AD10 (WH/BK), 35-AD11 (VT/WH) AND 34-AD11 (BU/OG) FOR A SHORT TO GROUND

1



2

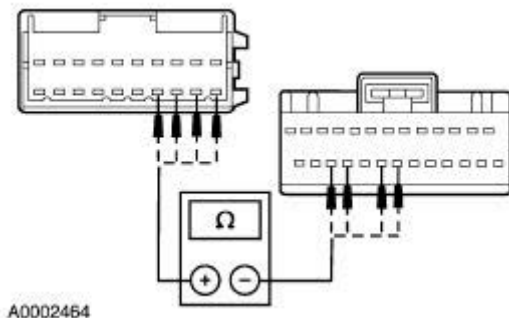


FEM C201e

3



4



4 Using the following table, measure the resistance between FEM C201e pins, harness side and passenger exterior rear view mirror C601 pins, harness side:

Passenger Exterior Rear View Mirror Pin	Circuit	FEM C201e Pin
4	33-AD10 (YE/BK)	24
2	32-AD10 (WH/BK)	23
6	35-AD11 (VT/WH)	21
8	34-AD11 (BU/OG)	20

● Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E14 CHECK THE FEM FOR THE CORRECT OUTPUTS

1



2



3



2

Select FEM active command POWER MIRROR CONTROL.

3

Trigger the FEM active commands PR UP, PR DOWN, PR LEFT and PR RIGHT ON and OFF, while monitoring the FEM PIDs MIRH_SW and MIRV_SW.

- Do the FEM PID values agree with the passenger exterior rear view mirror commanded positions?

→ Yes

INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ No

GO to [E15](#).

E15 CHECK CIRCUITS 8-AD19 (WH/RD), 7-AD19 (YE/RD), 9-AD19 (BN/RD) AND 10-AD19 (GY/RD) FOR A SHORT TO VOLTAGE

1

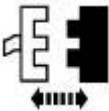


2



Passenger Exterior Rear View Mirror C601

3



FEM C201e

4

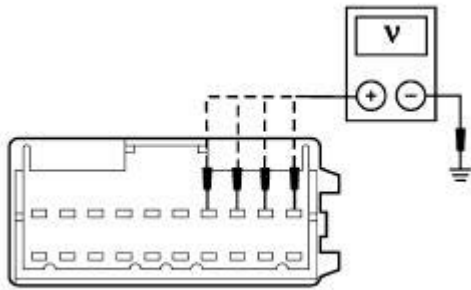


5

5

Using the following table, measure the voltage between the passenger exterior rear view mirror C601 pins, harness side and ground:

Pin	Circuit



A0002465

1	8-AD19 (WH/RD)
7	7-AD19 (YE/RD)
3	9-AD19 (BN/RD)
5	10-AD19 (GY/RD)

● **Is voltage present for any measurement?**

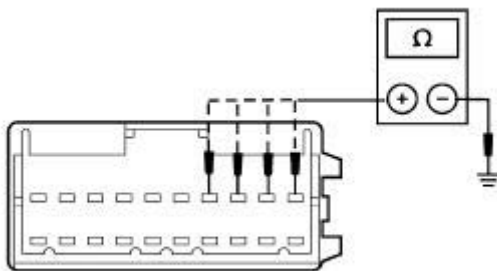
- **Yes**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
- **No**
GO to E16.

E16 CHECK CIRCUITS 8-AD19 (WH/RD), 7-AD19 (YE/RD), 9-AD19 (BN/RD) AND 10-AD19 (GY/RD) FOR A SHORT TO GROUND

1



2



A0002466

- 2 Using the following table, measure the resistance between passenger exterior rear view mirror C601 pins, harness side and ground:

Pin	Circuit
1	8-AD19 (WH/RD)
7	7-AD19 (YE/RD)
3	9-AD19 (BN/RD)
5	10-AD19 (GY/RD)

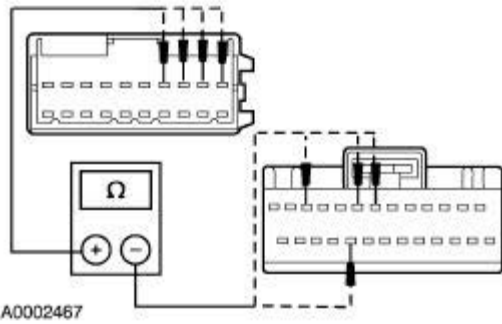
● **Are the resistances greater than 10,000 ohms?**

- **Yes**
GO to E17.
- **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E17 CHECK CIRCUITS 8-AD19 (WH/RD), 7-AD19 (YE/RD), 9-AD19 (BN/RD) AND 10-AD19 (GY/RD) FOR AN OPEN

1

- 1 Using the following table, measure the resistance between FEM C201e pins, harness side and passenger exterior rear view mirror C601 pins, harness



side:

Passenger Exterior Rear View Mirror Pin	Circuit	FEM C201e Pin
1	8-AD19 (WH/RD)	7
7	7-AD19 (YE/RD)	8
3	9-AD19 (BN/RD)	22
5	10-AD19 (GY/RD)	11

- Are the resistances less than 5 ohms?

→ **Yes**
 INSTALL a new passenger exterior rear view mirror. CLEAR the DTCs. REPEAT the self-test.

→ **No**
 REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E18 CHECK THE EXTERIOR REAR VIEW MIRROR CONTROL

1 Carry out the exterior rear view mirror control component test. Refer to Wiring Diagrams Section 700-09-00, Component Testing.

- Did the exterior rear view mirror control pass?

→ **Yes**
 GO to E19.

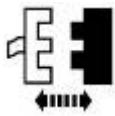
→ **No**
 INSTALL a new exterior rear view mirror control. For additional information, REFER to Switch—Exterior Rear View Mirror Control in this section. CLEAR the DTCs. REPEAT the self-test.

E19 CHECK THE EXTERIOR REAR VIEW MIRROR CONTROL CIRCUITS FOR AN OPEN

1

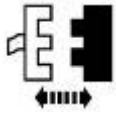


2



Exterior Rear View Mirror Control C204

3

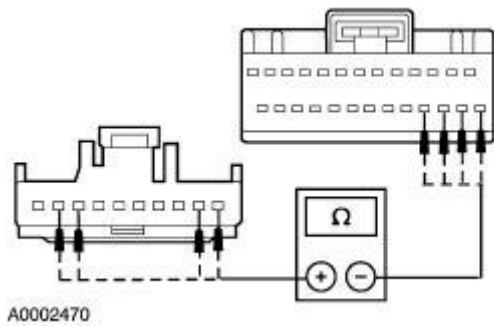


DDM C501d

4



5



5 Using the following table, measure the resistance between the following exterior rear view mirror control C204 pins, harness side and DDM C501d pins, harness side:

Exterior Rear View Mirror Control Pins	Circuit	DDM Pins
1	32-AD30 (WH/BK)	15
2	32-AD32 (WH/RD)	17
9	34-AD29 (BU/OG)	14
8	34-AD31 (BU/WH)	16

• Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E20 CHECK CJB FUSE 222 (10A) FOR VOLTAGE

1 Remove CJB Fuse 222 (10A).

2 Measure the voltage between CJB Fuse 222 (10A) input side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to [E21](#).

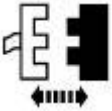
→ **No**
REPAIR the power source to Fuse 222 (10A). CLEAR the DTCs. REPEAT the self-test.

E21 CHECK CIRCUIT 29S-AJ86 FOR AN OPEN

2



3

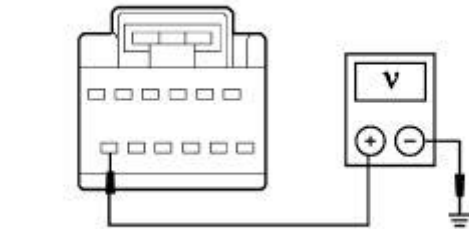


DDM C501a

4



5



A0002471

1 Reinstall Fuse 222 (10A).

5 Measure the voltage between DDM C501a pin 12, circuit 29S-AJ86 (OG/BU), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to E22.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

E22 CHECK THE DRIVER EXTERIOR REAR VIEW MIRROR ACTIVE COMMANDS

1



2



1 Select DDM active command menu POWER MIRROR CONTROL.

2 Trigger the DDM active command DR UP, DR DOWN, DR LEFT and DR RIGHT.

- Did the driver exterior rear view mirror operate correctly?

→ **Yes**
GO to E27.

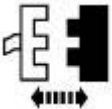
→ **No**
GO to E23.

E23 CHECK FOR VOLTAGE AT THE DRIVER MIRROR MOTOR

1



2

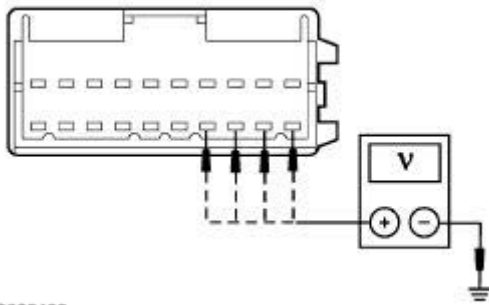


Driver Exterior Rear View Mirror C520

3



4



A0002462

4 Using the following table, measure the voltage between driver exterior rear view mirror C520 pins, harness side and ground:

Pin	Circuit
4	33-AD7 (YE/RD)
2	32-AD7 (WH/RD)
6	35-AD8 (VT)
8	34-AD8 (BU/WH)

- Is any voltage greater than 10 volts?

→ **Yes**
GO to E31.

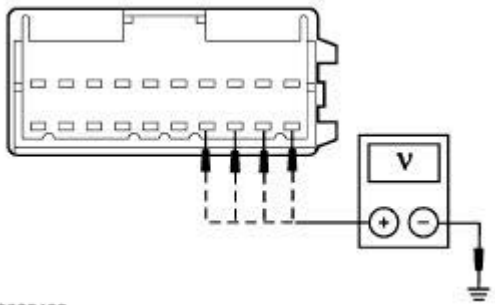
→ **No**
GO to E24.

E24 CHECK FOR OPENS AT THE DRIVER MIRROR ASSEMBLY

1

1 Using the following table, measure the voltage between driver exterior rear view mirror C520 pins, harness side and ground, while moving the exterior rear view mirror control through the listed positions.

		Mirror



A0002462

Pin	Circuit	Position
4	33-AD7 (YE/RD)	RIGHT
2	32-AD7 (WH/RD)	LEFT
6	35-AD8 (VT)	DOWN
8	34-AD8 (BU/WH)	UP

- Are the voltages greater than 10 volts?

→ **Yes**

INSTALL a new driver rear view mirror motor. For additional information, REFER to Mirror—Motor. CLEAR the DTCs. REPEAT the self-test.

→ **No**

GO to E25.

E25 CHECK FOR RESISTANCE AT THE DRIVER EXTERIOR REAR VIEW MIRROR

1



2

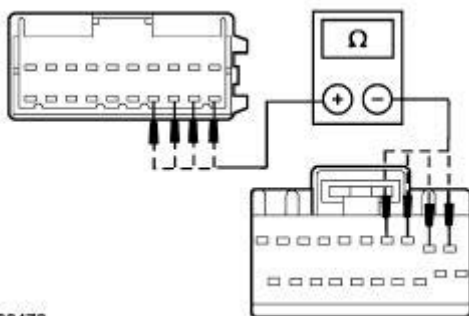


DDM C501c

3



4



A0002472

4

Using the following table, measure the resistance between DDM C501c pins, harness side and driver exterior rear view mirror C520 pins, harness side.

Driver Exterior Rear View Mirror Pin	Circuit	DDM Pin
2	32-AD7 (WH/RD)	1
4	33-AD7 (YE/RD)	2
6	35-AD8 (VT)	4
8	34-AD8	3

(BU/WH)

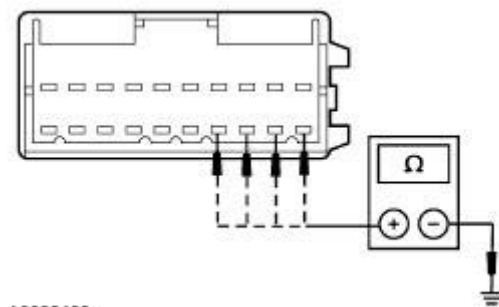
- Are the resistances less than 5 ohms?

→ **Yes**
GO to E26 .

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E26 CHECK CIRCUITS 32-AD7 (WH/RD), 33-AD7 (YE/RD), 34-AD8 (BU/WH) AND 35-AD8 (VT) FOR A SHORT TO GROUND

1



1 Using the following table, measure the resistance between driver exterior rear view mirror C520 pins, harness side and ground.

Pin	Circuit
2	32-AD7 (WH/RD)
4	33-AD7 (YE/RD)
6	35-AD8 (VT)
8	34-AD8 (BU/WH)

- Are the resistances greater than 10,000 ohms?

→ **Yes**
INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E27 CHECK THE DDM FOR THE CORRECT OUTPUTS

1



2



3



2 Select DDM active command menu POWER MIRROR CONTROL.

3 Trigger the DDM active command DR UP, DR DOWN, DR LEFT and DR RIGHT ON and OFF while monitoring the DDM PIDs MIRH_SW and MIRV_SW.

- Do the PID values agree with the

**driver exterior rear view mirror
commanded positions?**

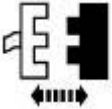
- **Yes**
INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.
- **No**
GO to [E28](#).

E28 CHECK CIRCUITS 8-AD18 (WH/BK), 7-AD18 (YE/BK), 9-AD18 (BN/YE) AND 10-AD18 (GY/BK) FOR A SHORT TO VOLTAGE

1



2



Driver Exterior Rear View Mirror C520

3

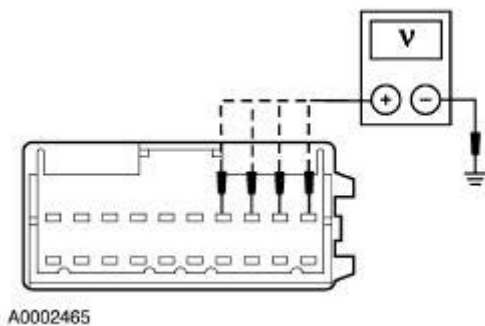


DDM C501c

4



5



- 5 Using the following table, measure the voltage between driver exterior rear view mirror C520 pins, harness side and ground.

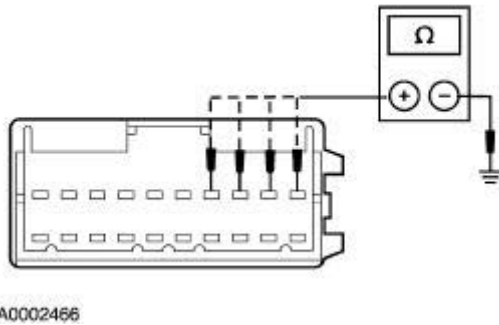
Pin	Circuit
1	8-AD18 (WH/BK)
7	7-AD18 (YE/BK)
3	9-AD18 (BN/YE)
5	10-AD18 (GY/BK)

• Is voltage present for any measurement?

- **Yes**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
- **No**
GO to [E29](#).

E29 CHECK CIRCUITS 8-AD18 (WH/BK), 7-AD18 (YE/BK), 9-AD18 (BN/YE) AND 10-AD18 (GY/BK) FOR A SHORT TO GROUND

1



1

Using the following table, measure the resistance between driver exterior rear view mirror C520 pins, harness side and ground.

Pin	Circuit
1	8-AD18 (WH/BK)
7	7-AD18 (YE/BK)
3	9-AD18 (BN/YE)
5	10-AD18 (GY/BK)

• Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to E30.

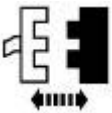
→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E30 CHECK CIRCUITS 8-AD18 (WH/BK), 7-AD18 (YE/BK), 9-AD18 (BN/YE) AND 10-AD18 (GY/BK) FOR AN OPEN

1

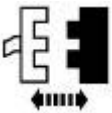


2



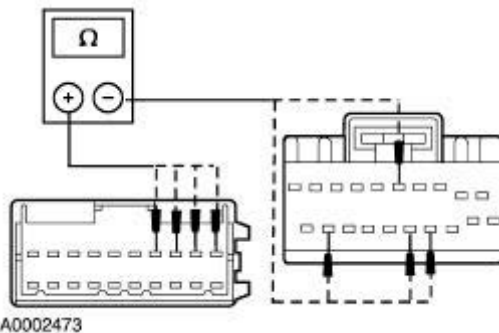
Driver Exterior Rear View Mirror C520

3



DDM C501c

4



4

Using the following table, measure the resistance between DDM C501c pins, harness side and driver exterior rear view mirror C520 pins, harness side.

Driver Exterior Rear View Mirror Pin	Circuit	DDM Pin
1	8-AD18 (WH/BK)	14
7	7-AD18 (YE/BK)	5

3	9-AD18 (BN/YE)	19
5	10-AD18 (GY/BK)	15

- Are the resistances less than 5 ohms?

→ **Yes**
 INSTALL a new driver exterior rear view mirror. For additional information, REFER to Mirror—Exterior Rear View. CLEAR the DTCs. REPEAT the self-test.

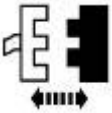
→ **No**
 REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E31 CHECK FOR VOLTAGE AT THE DRIVER EXTERIOR REAR VIEW MIRROR ASSEMBLY

1

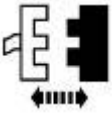


2



Driver Exterior Rear View Mirror C520

3

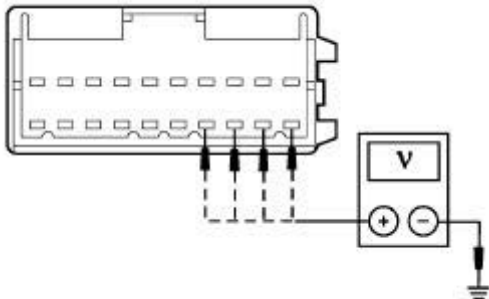


DDM C501c

4



5



A0002462

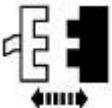

5 Using the following table, measure the voltage between driver exterior rear view mirror C520 pins, harness side and ground.

Pin	Circuit
2	32-AD7 (WH/RD)
4	33-AD7 (YE/RD)
8	34-AD8 (BU/WH)
6	35-AD8 (VT)

- Are any of the voltages greater than 10 volts?

	<p>→ Yes REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.</p>
--	--

PINPOINT TEST F: THE AUTO DIMMING MIRROR DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK FOR REM RETRIEVED DIAGNOSTIC TROUBLE CODES	
	<p>1 Use the recorded results from the REM self-test.</p> <ul style="list-style-type: none"> • Are any DTCs retrieved? <p>→ Yes REFER to the REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to F2.</p>
F2 CHECK POWER TO CJB FUSE 216 (5A)	
<p>1</p>  <p>CJB Fuse 216 (5A)</p> <p>2</p> 	<p>3 Measure the voltage between CJB Fuse 216 (5A) input terminal and ground.</p> <ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes GO to F3.</p> <p>→ No REPAIR the power supply to the fuse. CLEAR the DTCs. REPEAT the self-test.</p>
F3 CHECK CIRCUIT 640 (RD/YE) FOR AN OPEN	
1	

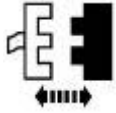


2



CJB Fuse 216 (5A)

3

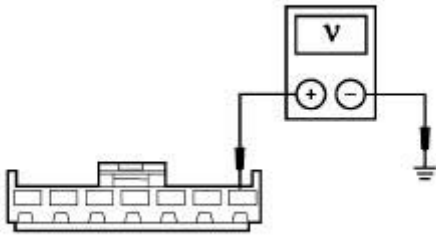


Electrochromic Interior Rear View Mirror C911

4



5



AN2024-A

5 Measure the voltage between electrochromic interior rear view mirror C911, pin 1 circuit 20-AD15 (PK), harness side and ground.

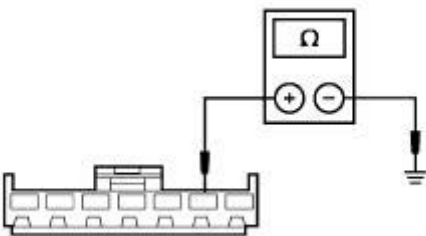
• Is the voltage greater than 10 volts?

→ Yes
GO to F4.

→ No
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

F4 CHECK CIRCUIT 31-AD15 (BK) FOR AN OPEN

1



AN2025-A

1 Measure the resistance between electrochromic interior rear view mirror C911, pin 2 circuit 31-AD15 (BK), harness side and ground.


• Is the resistance less than 5 ohms?

- **Yes**
GO to F5.
- **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

F5 CHECK THE REM OUTPUT

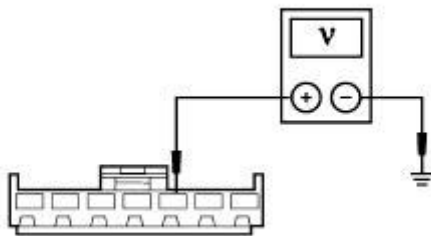
1



2  **CAUTION: Make sure the engine is not running. The ignition switch should be in the RUN position with the engine OFF.**

Engage the parking brake and shift the transmission to the REVERSE position.

3



AN2026-A

3 Measure the voltage between electrochromic interior rear view mirror C911, pin 3 circuit 8-AD15 (WH/BU), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to F8.

→ **No**
GO to F6.

F6 CHECK CIRCUIT 8-AD15 (WH/BU) FOR AN OPEN

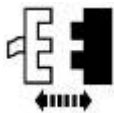
1



2

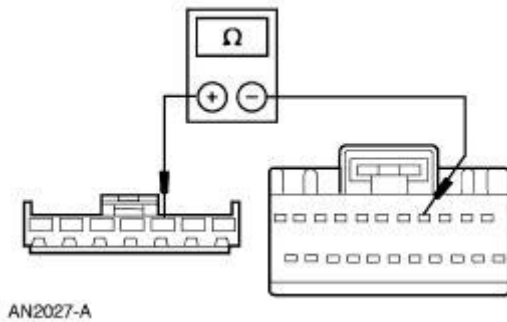


3



REM C420b

4



4

Measure the resistance between electrochromic interior rear view mirror C911, pin 3 circuit 8-AD15 (WH/BU), harness side and REM C420b pin 4, circuit 8-AD15 (WH/BU), harness side.

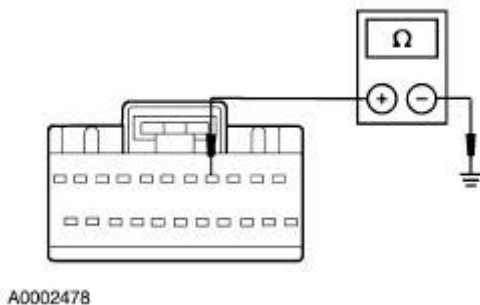
• Is the resistance less than 5 ohms?

→ **Yes**
GO to F7.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

F7 CHECK CIRCUIT 8-AD15 (WH/BU) FOR A SHORT TO GROUND

1



1

Measure the resistance between REM C420b pin 4, circuit 8-AD15 (WH/BU), harness side and ground.

• Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new REM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

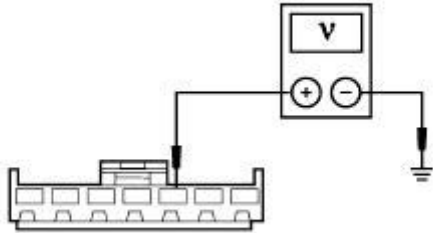
→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

F8 CHECK FOR THE CORRECT OUTPUT TO THE MIRROR

1

PRND
↑

2



AN2026-A

2

Measure the voltage between electrochromic interior rear view mirror C911, pin 3 circuit 8-AD15 (WH/BU), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to F9.

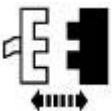
→ **No**
INSTALL a new electrochromic interior rear view mirror. For additional information, REFER to Mirror—Interior Rear View, Electrochromic. CLEAR the DTCs. REPEAT the self-test. If the auto dimming feature continues to function incorrectly, INSTALL a new REM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

F9 CHECK CIRCUIT 8-AD15 (WH/BU) FOR A SHORT TO VOLTAGE

1



2



REM C420b

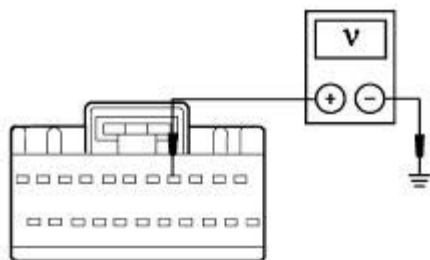
3



4

4

Measure the voltage between REM C420b pin 4, circuit 8-AD15 (WH/BU), harness side and ground.



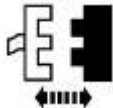
A0002479

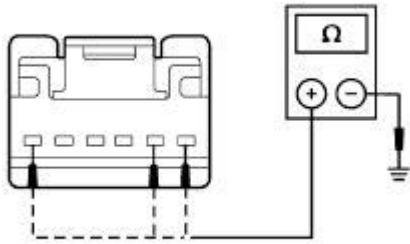
● **Is voltage present?**

→ **Yes**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

→ **No**
INSTALL a new REM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST G: THE MEMORY MIRROR IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS						
G1 CHECK FOR DDM DTCS							
	<p>1 Use the recorded results from the DDM self-test.</p> <p>● Was DTC B1534, B1538 or B1530 retrieved?</p> <p>→ Yes GO to G2.</p> <p>→ No GO to G4.</p>						
G2 CHECK THE MEMORY SET SWITCH FOR A SHORT TO GROUND							
<p>1</p>  <p>Memory Set Switch C503</p> <p>2</p>	<p>2 Using the following table, measure the resistance between memory set switch C503 pins, harness side and ground.</p> <table border="1"> <thead> <tr> <th>Pin</th> <th>Circuit</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>8-AH27 (WH)</td> </tr> <tr> <td>6</td> <td>8-AH31 (WH/RD)</td> </tr> </tbody> </table>	Pin	Circuit	2	8-AH27 (WH)	6	8-AH31 (WH/RD)
Pin	Circuit						
2	8-AH27 (WH)						
6	8-AH31 (WH/RD)						



A0002480

1 | 8-AH32 (WH/BU)

- Are the resistances greater than 10,000 ohms?

→ **Yes**
 INSTALL a new memory set switch.
 CLEAR the DTCs. REPEAT the self-test.

→ **No**
 GO to G3.

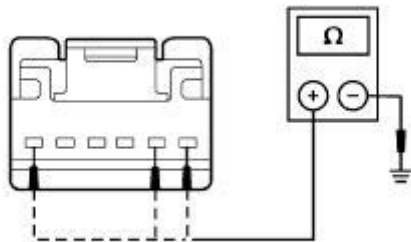
G3 CHECK CIRCUIT 8-AH27 (WH), 8-AH31 (WH/RD) AND 8-AH32 (WH/BU) FOR A SHORT TO GROUND

1



DDM C501c

2



A0002480

2 Using the following table, measure the resistance between memory set switch C503 pins, harness side and ground.

Pin	Circuit
2	8-AH27 (WH)
6	8-AH31 (WH/RD)
1	8-AH32 (WH/BU)

- Are the resistances greater than 10,000 ohms?

→ **Yes**
 INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**
 REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

G4 CHECK THE MEMORY SET SWITCH USING DDM PIDS

1

1 Monitor the DDM PIDs MEMS_SW, MEM1_SW and MEM2_SW, while



actuating the memory set switch buttons.

- Did the DDM PID values agree with the memory set switch positions?

→ **Yes**
 INSTALL a new DDM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.

→ **No**
 GO to G5 .

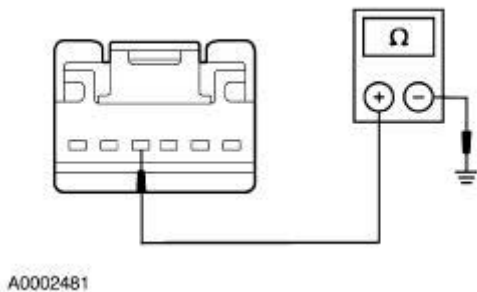
G5 CHECK CIRCUIT 31-AH27 (BK) FOR AN OPEN

1



Memory Set Switch C503

2



2 Measure the resistance between memory set switch C503 pin 4, circuit 31-AH27 (BK), harness side and ground.

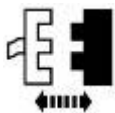
- Is the resistance less than 5 ohms?

→ **Yes**
 GO to G6 .

→ **No**
 REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

G6 CHECK FOR AN OPEN CIRCUIT BETWEEN THE DDM AND MEMORY SET SWITCH

1

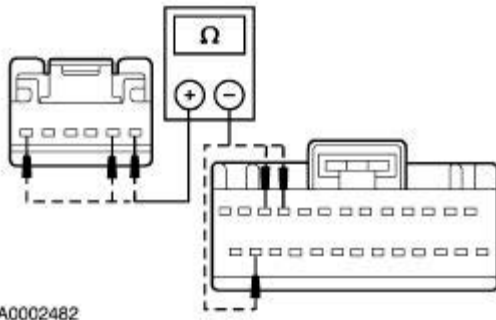


DDM C501c

2

2 Using the following table, measure the resistance between DDM C501d pins, harness side and memory set switch C503 pins, harness side.

DDM	Memory Set
-----	------------



A0002482

Pin	Circuit	Switch Pin
25	8-AH27 (WH)	2
10	8-AH31 (WH/RD)	6
11	8-AH32 (WH/BU)	1

- Are the resistances less than 5 ohms?

→ **Yes**
GO to G7.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

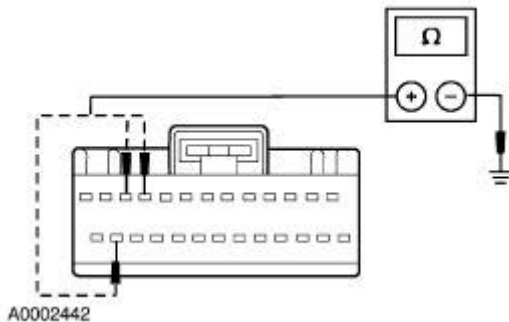
G7 CHECK THE MEMORY SET SWITCH FOR AN OPEN

1



Memory Set Switch C503

2



A0002442

- 2 Using the following table, measure the resistance between DDM C501d pins, harness side and ground, while activating the indicated memory set switch button.

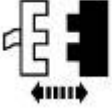
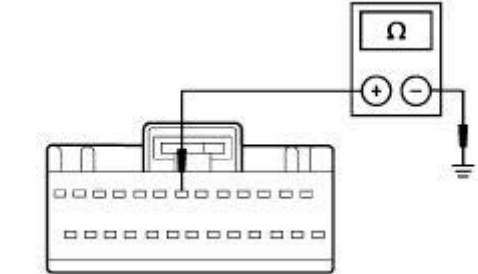
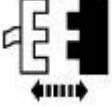
DDM Pin	Circuit	Memory Set Switch Button
25	8-AH27 (WH)	SET
10	8-AH31 (WH/RD)	MEMORY 1
11	8-AH32 (WH/BU)	MEMORY 2

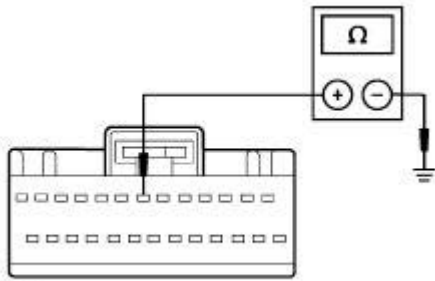
- Is the resistance less than 5 ohms when each button is pressed?

→ **Yes**
INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
INSTALL a new memory set switch. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST H: THE MEMORY MIRROR IS INOPERATIVE — MEMORY SET SWITCH LED

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK THE MEMORY SWITCH LED	
	<p>1 Operate the memory set switch.</p> <ul style="list-style-type: none"> ● Is the memory set switch LED always ON? <p>→ Yes GO to H6.</p> <p>→ No GO to H2.</p>
H2 CHECK CIRCUIT 7S-AH27 (YE) FOR RESISTANCE	
<p>1</p>  <p>DDM C501c</p> <p>2</p>  <p>A0002483</p>	<p>2 Measure the resistance between DDM C501d pin 7, circuit 7S-AH27 (YE), harness side and ground.</p> <ul style="list-style-type: none"> ● Is the resistance greater than 10,000 ohms? <p>→ Yes GO to H4.</p> <p>→ No GO to H3.</p>
H3 CHECK CIRCUIT 7S-AH27 (YE) FOR A SHORT TO GROUND	
<p>1</p>  <p>Memory Set Switch C503</p> <p>2</p>	<p>2 Measure the resistance between DDM C501d pin 7, circuit 7S-AH27 (YE), harness side and ground.</p>



A0002483

- Is the resistance greater than 10,000 ohms?

- **Yes**
 INSTALL a new memory set switch.
 CLEAR the DTCs. REPEAT the self-test.
- **No**
 REPAIR the circuit. CLEAR the DTCs.
 REPEAT the self-test.

H4 CHECK THE DDM

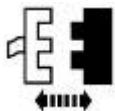
- 1 Connect a 5A fused jumper wire between DDM C501c pin 7, circuit 7S-AH27 (YE), harness side and battery voltage.

- Did the memory set switch LED illuminate?

- **Yes**
 INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.
- **No**
 GO to [H5](#).

H5 CHECK CIRCUIT 7S-AH27 (YE) FOR AN OPEN

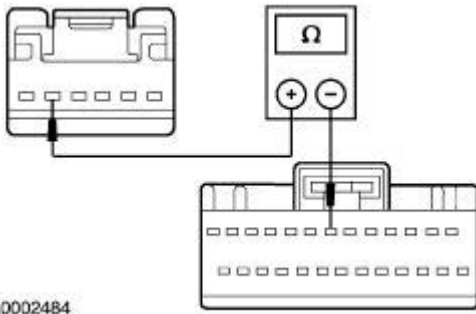
1



Memory Set Switch C503

2

- 2 Measure the resistance between memory set switch C503 pin 5, circuit 7S-AH27 (YE), harness side and DDM C501d pin 7, circuit 7S-AH27 (YE), harness side.



● Is the resistance less than 5 ohms?

- **Yes**
 INSTALL a new memory set switch.
 CLEAR the DTCs. REPEAT the self-test.
- **No**
 REPAIR the circuit. CLEAR the DTCs.
 REPEAT the self-test.

H6 CHECK THE DDM FOR AN INTERNAL SHORT TO VOLTAGE

1



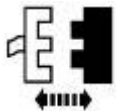
DDM C501c

● Did the memory set switch LED turn OFF?

- **Yes**
 INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.
- **No**
 GO to [H7](#).

H7 CHECK CIRCUIT 7S-AH27 (YE) FOR A SHORT TO VOLTAGE

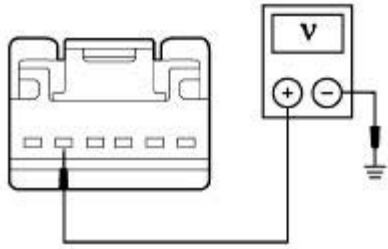
1



Memory Set Switch C503

2

- 2 Measure the voltage between memory set switch C503 pin 5, circuit 7S-AH27 (YE), harness side and ground.





A0002485

● **Is voltage present?**

→ **Yes**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

→ **No**
INSTALL a new memory set switch.
CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST I: THE HEATED EXTERIOR MIRROR DOES NOT DEFROST

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 CHECK THE REAR WINDOW DEFROST OPERATION	
<p>1</p>  <p>2</p> 	<p>3</p> <p>Depress the rear window defrost switch to ON.</p> <p>● Does the rear window defrost or warm up?</p> <p>→ Yes GO to I2.</p> <p>→ No REFER to Section 501-11 to diagnose the rear window defrost system.</p>
I2 CHECK THE HEATED FUNCTION OF THE EXTERIOR REAR VIEW MIRRORS	
	<p>1</p> <p>Check the heated function of the exterior rear view mirrors.</p>

- Is the heated function of both exterior rear view mirrors inoperative?

→ **Yes**
GO to 13.

→ **No**
For the driver side exterior rear view mirror, GO to 14.

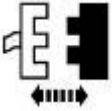
For the passenger side exterior rear view mirror, GO to 16.

13 CHECK CIRCUIT 15S-DC1 (GN/YE) FOR VOLTAGE

1



2

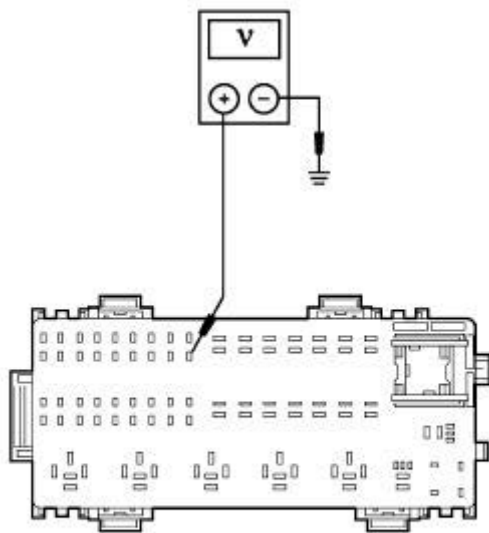


BJB Fuse 409 (5A)

3



5



4 Depress the rear window defrost switch to ON.

5 Measure the voltage between BJB Fuse 409 (5A) input pin, circuit 15S-DC1 (GN/YE), and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
REPAIR circuit 29S-HB1 (OG/YE). TEST the system for normal operation.

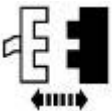
→ **No**
REPAIR circuit 15S-DC1 (GN/YE). TEST the system for normal operation.

I4 CHECK CIRCUIT 29S-HB1 (OG/YE) FOR OPEN

1

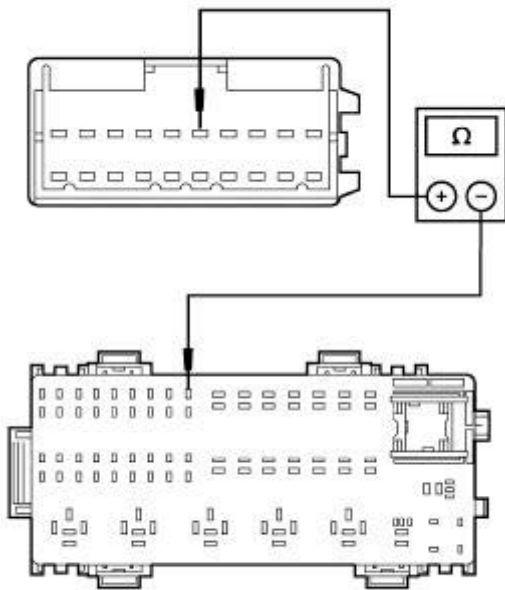


2



Driver Exterior Rear View Mirror C520

3



A0002488

3 Measure the resistance between BJB Fuse 409 (5A) output terminal, circuit 29S-HB1 (OG/YE) and driver exterior rear view mirror C520 pin 9, circuit 29-HB35 (OG/BK), harness side.

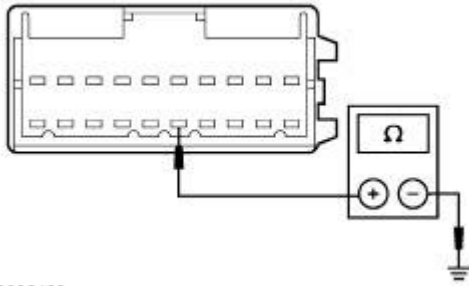
● Is the resistance less than 5 ohms?

→ **Yes**
GO to I5.

→ **No**
REPAIR circuit 29-HB35 (OG/BK). TEST the system for normal operation.

I5 CHECK CIRCUIT 31-HB35 (BK) FOR OPEN

1



A0002489

- 1 Measure the resistance between driver exterior rear view mirror C520 pin 10, circuit 31-HB35 (BK), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
 INSTALL a new driver exterior rear view mirror. For additional information, REFER to [Mirror—Exterior Rear View](#) in this section. TEST the system for normal operation.

→ **No**
 REPAIR circuit 31-HB35 (BK). TEST the system for normal operation.

I6 CHECK CIRCUIT 29-HB36 (OG/GN) FOR OPEN

1



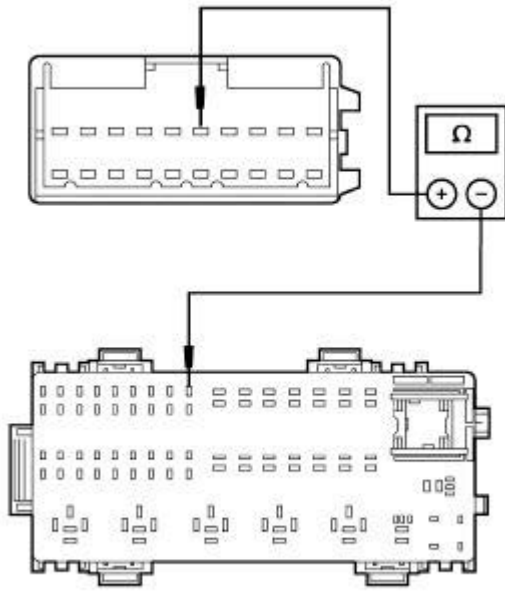
2



Passenger Exterior Rear View Mirror C601

3

- 3 Measure the resistance between BJB Fuse 409 (5A) output terminal, circuit 29S-HB1 (OG/YE) and passenger exterior rear view mirror C601 pin 9, circuit 29-HB36 (OG/GN), harness side.



A0002488

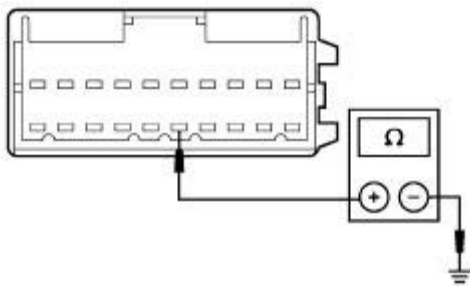
● Is the resistance less than 5 ohms?

→ **Yes**
GO to I7.

→ **No**
REPAIR circuit 29-HB36 (OG/GN). TEST the system for normal operation.

I7 CHECK CIRCUIT 31-HB36 (BK) FOR OPEN

1



A0002489

1

Measure the resistance between passenger exterior rear view mirror C601 pin 10, circuit 31-HB36 (BK), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new passenger exterior rear view mirror. For additional information, REFER to Mirror—Exterior Rear View in this section. TEST the system for normal operation.

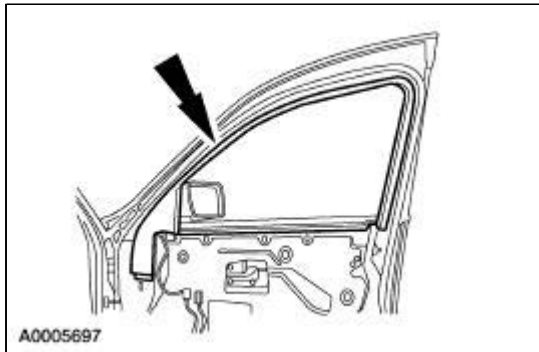
→ **No**

REPAIR circuit 31-HB36 (BK). TEST the system for normal operation.

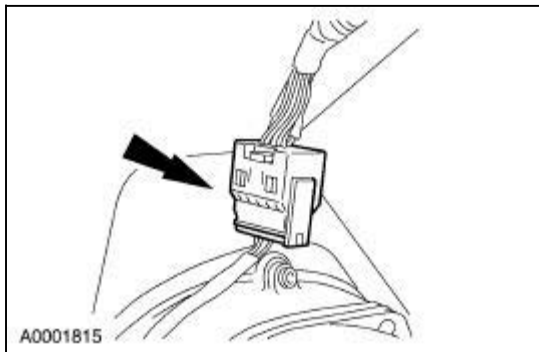
Mirror —Exterior Rear View

Removal and Installation

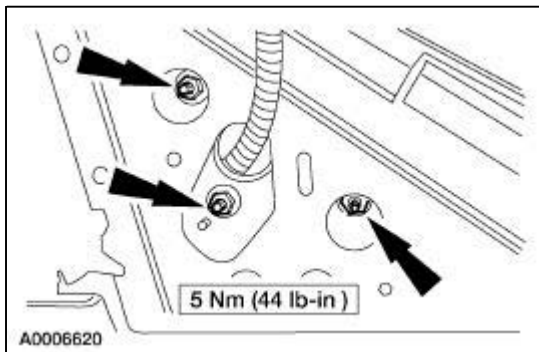
1. Remove the front door trim panel. For additional information, refer to [Section 501-05](#).
2. Remove the interior garnish moulding.



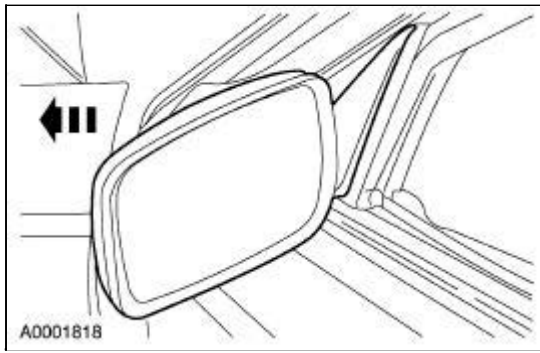
3. Disconnect the electrical connector.



4. Remove the exterior rear view mirror nuts.



5. Remove the exterior rear view mirror.

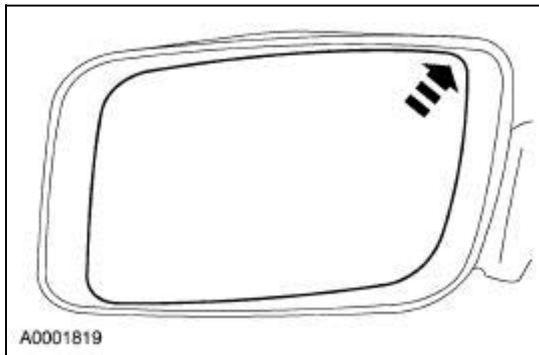


6. To install, reverse the removal procedure.

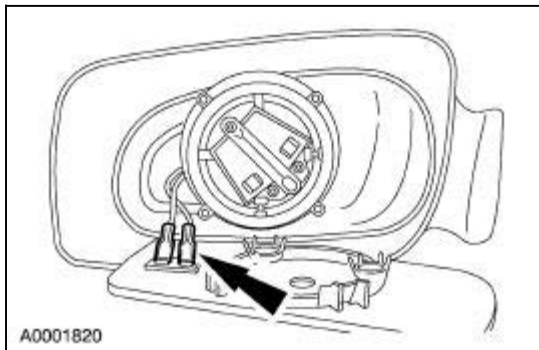
Mirror —Glass

Removal and Installation

1. Push in the upper edge of the mirror glass to the maximum travel.



2. Grasp the bottom of the mirror glass and pull outward.
3. Disconnect the electrical connectors and remove the mirror glass.



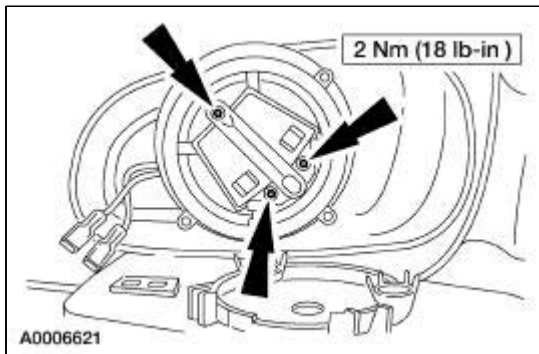
4. **NOTE:** When installing the mirror glass, make sure it snaps into the mirror motor.

To install, reverse the removal procedure.

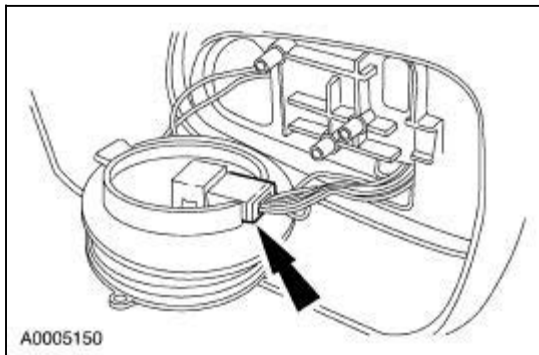
Mirror —Motor

Removal and Installation

1. Remove the exterior rear view mirror glass. For additional information, refer to [Mirror—Glass](#).
2. Remove the mirror motor screws.




3. Disconnect the electrical connector and remove the mirror motor.



4. To install, reverse the removal procedure.
-

Mirror —Interior Rear View, Electrochromic

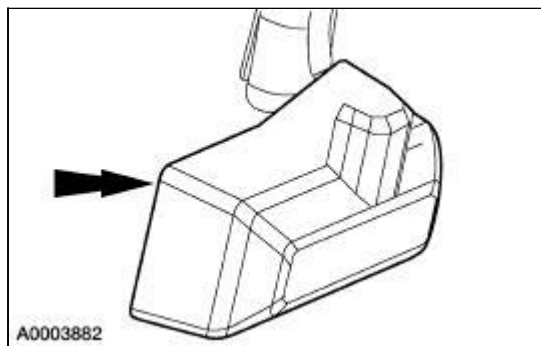
Removal

 **CAUTION:** The interior rear view mirror is a breakaway design. Excessive force in any direction will cause damage to the interior rear view mirror.

Equipped With Rain-Sensitive Wipers

1. **NOTE:** To avoid damage to the rain sensor module cover, push up on the cover while rotating the top of the cover toward the rear of the vehicle.

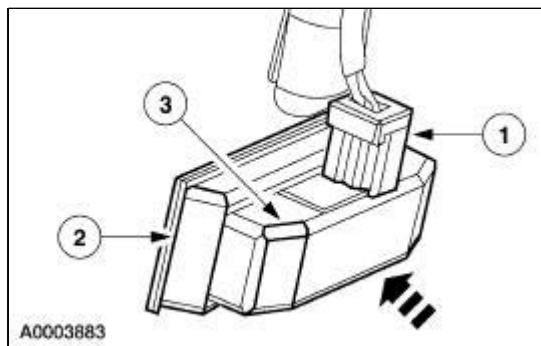
Remove the rain sensor module cover.



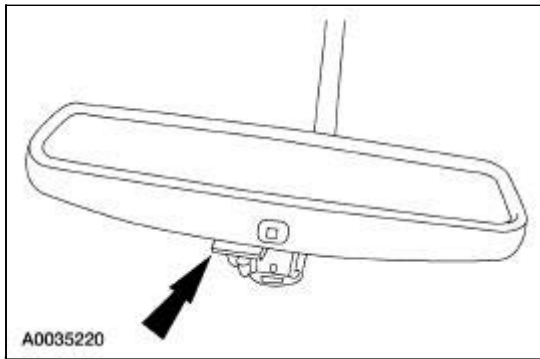
2. Remove the rain sensor module.
 1. Pull the latch on the connector away from the harness and disconnect the electrical connector.
 2. **NOTE:** When removing the rain sensor module, it is necessary to apply inward pressure on the module prior to releasing the rain sensor module retaining slides.

Release the rain sensor module retaining slides.

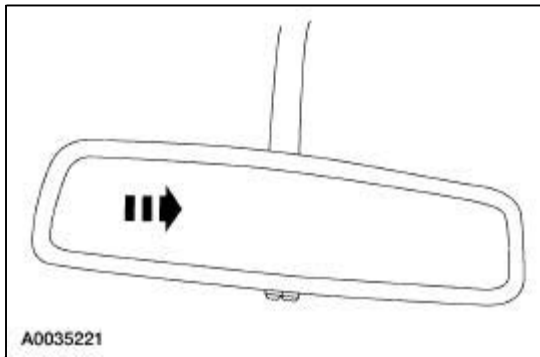
3. Remove the rain sensor module.



3. Disconnect the mirror connector.

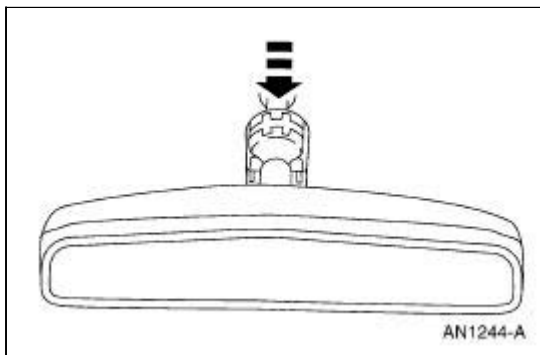


4. Support the mirror with one hand against the windshield and pull towards the passenger side with the other hand.

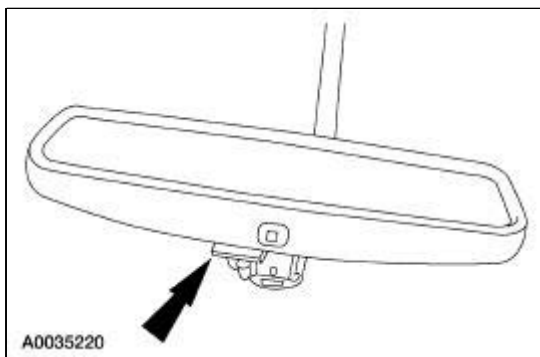


Installation

1. Push the mirror down on the clip until an audible click is heard and the mirror snaps into place.



2. Connect the mirror connector.



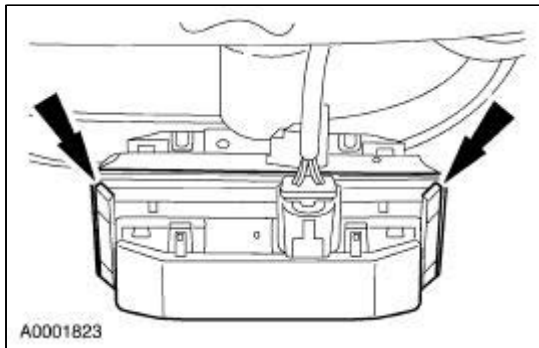
Equipped With Rain-Sensitive Wipers

3. **NOTE:** Prior to installing the rain sensor module, the windshield glass area between the rain sensor module brackets must be cleaned.

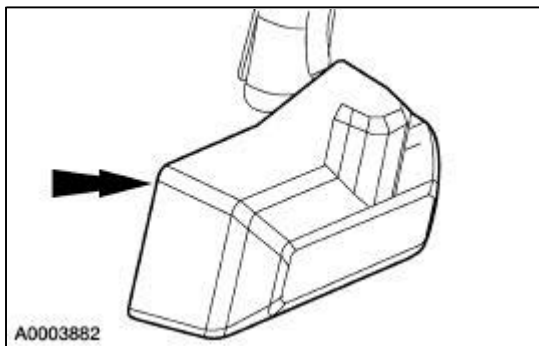
NOTE: When installing the rain sensor module, it is necessary to apply inward pressure on the module prior to locking the rain sensor module retaining slides in place.

Install the rain sensor module.

- Connect the electrical connector.



4. Install the rain sensor module cover.

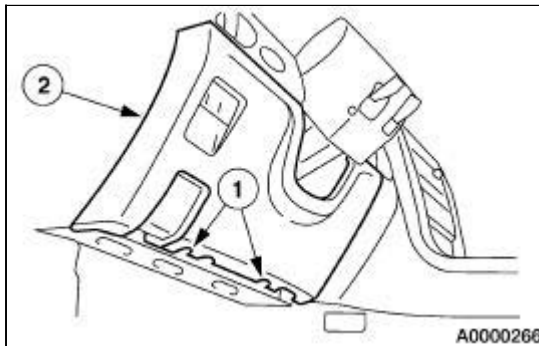


5. Carry out the compass zone adjustment procedure. For additional information, refer to [Section 419-11](#).
 6. Carry out the compass calibration adjustment procedure. For additional information, refer to [Section 419-11](#).
-

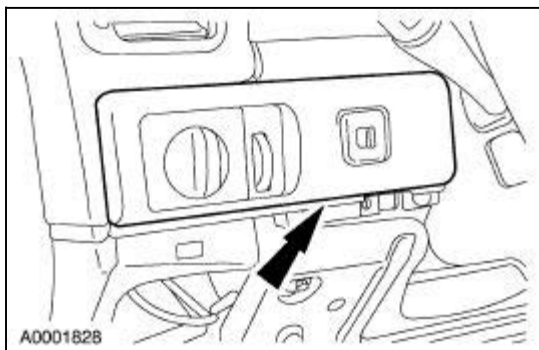
Switch —Exterior Rear View Mirror Control

Removal and Installation

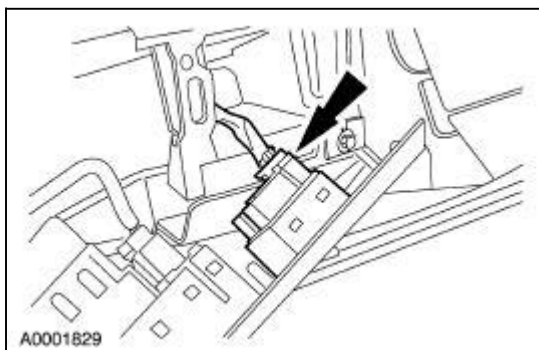
1. Remove the instrument panel steering column cover.
 1. Remove the screws.
 2. Remove the instrument panel steering column cover.
 - Disconnect the electrical connectors.



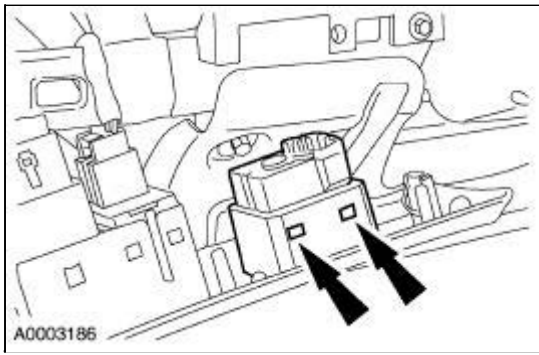
2. Remove the upper finish panel.



3. Disconnect the interior rear view mirror control switch electrical connector.



4. Remove the interior rear view mirror control switch.



5. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
Rear seat bolster nut	11	8	—
Front seat track to floor bolts	25	18	—
Front seat track to floor nuts	25	18	—
Front safety belt to nut	40	30	—
Front seat backrest bolts	25	18	—
Front seat safety belt buckle bolt	40	30	—
Side air bag nuts	7	—	62
Rear seat backrest nuts	48	35	—
Front seat track nuts	20	15	—
Rear center safety belt anchor nut	48	35	—

Seats

Seats — Front

The front seats have the following features:

- memory set (optional)
- power lumbar (optional)
- manual lumbar
- horizontal, vertical and front and rear tilt adjustments
- power recline
- heat (optional)

Adjustment of the seat may be accomplished with the seat regulator control switch located on the side of the seat.

Seats — Rear

The rear seat has the following features:

- fold down seat backrest
- removable cushion retained by two latches located at the front of the cushion
- two rear bolsters on each side of the rear seat backrest

Fold down the rear seat backrest by releasing the two levers in the luggage compartment.

Seats — Power Recliner

The power recliner tilts the seat backrest rearward or forward and is controlled by the seat regulator control switch.

The power recliner cannot be repaired separately. If the power recliner needs to be repaired, an entirely new front seat backrest latch must be installed.

Seats — Power Lumbar Support

The seat has electro-mechanical front seat backrest pad adjuster. The lumbar switch adjustment is on the side of the seat.

Seats — Manual Lumbar Support

The manual front seat backrest lumbar is adjusted by a knob (57620) mounted on the front of the seat cushion.

Seats — Memory Set

This system allows automatic positioning of the driver seat, outside rearview mirrors, and power adjusted tilt/telescope steering column to two programmable positions.

The memory seat control is located on the driver door.

Seats — Heated

Each heated front seat is controlled by a switch on the instrument panel.

The heated seat system will only operate with the ignition switch in the RUN position.

Side Air Bag

Driver and passenger side air bags (611A08) are attached to the seat backrest frame. For diagnostic information or if the side air bag has been deployed, refer to [Section 501-20B](#).

The front seat backrest trim covers cannot be repaired. If the front seat backrest covers need to be repaired, an entirely new cover must be installed. Cleaning the front seat backrest cover is permissible.

If a side air bag deployment took place, a new seat back pad, trim cover and side air bag module must be installed. Install a new seat backrest frame if necessary.



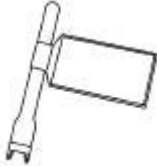

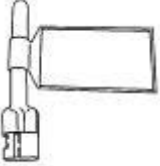
Seats — Driver Seat Module

The driver seat module is attached to the driver seat track. For additional information, refer to [Section 419-10](#) for removal and installation procedures.


Seats

Refer to Wiring Diagrams Section [501-10](#) for schematic and connector information.

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224 New Generation Star (NGS) Tester 418-F052 (007-00500) or equivalent scan tool
 ST2502-A	Diagnostic Tool, Restraint System (2 Required) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (2 Required) 418-F088
 ST2507-A	Diagnostic Tool, Restraint System (2 Required) 418-133

Restraint System Diagnostic Tool Warning

 **WARNING:** The Restraint System Diagnostic Tools are for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

Principles of Operation

Driver Power Seat

The driver power seat is controlled by the driver seat module (DSM). The DSM does not need to be configured, however the driver seat does need to be calibrated when the DSM is installed. The driver seat regulator control switch provides voltage to the DSM when activated. The neutral position of each driver seat regulator control switch position is a ground state through the seat regulator control switch contacts. A voltage input causes the DSM to power the appropriate motor until the input is removed. Ground is the normal state of the motor circuits through the DSM and is not switched to control the motors. The DSM internally switches the appropriate line from ground to power to adjust the motors.

As the seat is adjusted, the DSM constantly monitors the motor position sensors to record the current seat position. The DSM will remove power from the motor upon termination of the seat regulator control switch input or if the DSM does not see movement from the motor by monitoring the position sensor. The DSM must be calibrated to the seat track it is controlling. For additional information, refer to Seat Calibration. Once the DSM is calibrated to the seat track, it will only allow movement within the calibrated range.

Seat Calibration

The DSM is calibrated using a scan tool. The calibration procedure automatically powers the driver power seat through its full range of motion and records the full stop positions by monitoring the motor position sensors. Once the full stop positions or range of the seat have been recorded, the DSM will only operate within the calibrated range. Any input attempting to drive the seat beyond the calibrated range will be ignored. This calibration is used for all seat control functions including manual switch control and memory recall positioning. During the seat calibration, the DSM may identify a function that is inoperative, such as a position sensor not changing. If the DSM identifies a concern that has a related diagnostic trouble code (DTC), the DSM will set the related DTC at the end of the validation procedure.

The calibration procedure powers the seat track adjustments to the end of their travel, which is determined by the DSM seeing a change of state in the motor position sensors. If there is a concern with the seat track or motor position sensor that limits the travel, the DSM will interpret the stopping point as the end of travel and store the position. The DSM is not able to determine if the seat has moved to its full travel position. It is only capable of monitoring and storing the amount of travel seen by the position sensor changing states.

For additional information on carrying out the power seat calibration procedure, refer to the scan tool operating manual.

Memory Seat

Memory seat positioning can be recalled with the memory switches on the driver door panel or a programmed remote keyless entry transmitter. In either case, the DSM receives a memory recall 1 or 2 command from the driver door module (DDM) over the SCP communication network. The memory recall switches are a hardwired input to the DDM. The DDM also receives the remote keyless entry transmitter signals. Once a valid memory recall command is received from the DDM, the DSM moves the driver's seat to the position stored in memory by powering the appropriate motors and monitoring the motor position sensors until the position is reached.

Easy Exit/Easy Entry

The easy exit function moves the seat backwards about two inches when the ignition key is removed from the ignition switch. The DSM receives a key out command over the SCP communication network and powers the driver seat rearward. This function will not operate if the seat is less than the travel distance to the end of the track, or the function has been deactivated at the message center driver personality settings. The DSM will also cancel this operation if a valid input command is received, such as the seat regulator control switch or memory recall request.

The DSM will record the current seat position before powering the seat for a easy exit function. This

recorded position will be used to return the seat to this position on the easy entry operation. During easy entry operation, the seat is returned to the position previous to the easy exit operation. Easy entry operation will be cancelled if a valid input command is received by the DSM.

Passenger Power Seat

The passenger power seat motors are hardwired to the passenger seat regulator control switch. The circuits are normally at ground through the seat regulator control switch. The individual circuit is switched to power when the specific adjustment position is selected.

Heated Seats

The driver and passenger heated seats share a common battery and ignition feed. A separate shared ignition source supplies the heated seat switches. When the heated seat switch is pressed with the ignition switch in RUN, a momentary voltage signal is sent to the heated seat module. The heated seat module then supplies power to the heating element circuit. The cushion element and seat backrest element are wired in series and powered by the same output. The heated seat module also will ground the separate indicator circuit at the heated seat switch to indicate an ON state. The heated seat module will remain on until the heated seat switch is pressed and a momentary voltage signal is received, or until 10 minutes expire. If the ignition source is removed from the module, the heated seat module will enter an off state and will not return to ON until the switch is once again pressed with the ignition switch in RUN. The heated seat module is designed to heat the seat to 37.5°C (99.5°F) and maintain the temperature until time-out or switched off. This temperature is maintained by the heated seat module monitoring the temperature sensor located in the seat cushion element, and adjusting the current flow to the heating elements.

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Front seat track motors. ● Front seat track binding or obstructed. ● Front seat backrest power recline. ● Lumbar motor. 	<ul style="list-style-type: none"> ● BJB Fuses 411 (15A), 421 (20A), 425 (40A), 428 (20A) ● CJB Fuses 205 (5A), 216 (5A), 207 (5A) ● Seat regulator control switch. ● Memory set switch. ● Lumbar seat control switch.

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern remains after the inspection, connect the scan tool to the data link connector (DLC) located beneath the instrument panel. Then select the vehicle to be tested from the scan tool menu. If the scan tool does not communicate with the vehicle:
 - Check that the program card is correctly installed.
 - Check the connections to the vehicle.
 - Check the ignition switch position.
5. If the scan tool still does not communicate with the vehicle, refer to the scan tool manual.
6. Carry out the DATA LINK DIAGNOSTICS test. If the scan tool responds with:

- CKT 914, CKT 915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
- NO RESP/NOT EQUIP for DSM, [Go To Pinpoint Test A](#) .
- NO RESP/NOT EQUIP for DDM, [Go To Pinpoint Test B](#) .
- System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self test diagnostics for the DSM and the DDM.

7. If the DSM DTCs retrieved are related to the concern, go to the DSM Diagnostic Trouble Code (DTC) Index.
8. If the DDM DTCs retrieved are related to the concern, go to the DDM Diagnostic Trouble Code (DTC) Index.
9. If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue the diagnostics.

DSM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1342	ECU Is Defective	DSM	REPEAT the DSM self-test. If DTC B1342 is retrieved again, INSTALL a new DSM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self test.
B1676	Battery Pack Voltage Out of Range	DSM	Go To Pinpoint Test M .
B1703	Seat Driver Recline Forward Switch Circuit Short to Battery	DSM	Go To Pinpoint Test E .
B1707	Seat Driver Recline Rearward Switch Circuit Short to Battery	DSM	Go To Pinpoint Test E .
B1711	Seat Driver Front Up Switch Circuit Short to Battery	DSM	Go To Pinpoint Test E .
B1715	Seat Driver Front Down Switch Circuit Short to Battery	DSM	Go To Pinpoint Test E .
B1719	Seat Driver Forward Switch Circuit Short to Battery	DSM	Go To Pinpoint Test E .
B1723	Seat Driver Rearward Switch Circuit Short to Battery	DSM	Go To Pinpoint Test E .
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	DSM	Go To Pinpoint Test E .
B1731	Seat Driver Rear Down Switch Circuit Short to Battery	DSM	Go To Pinpoint Test E .
B1757	Seat Driver Rear Down Circuit Failure	DSM	Go To Pinpoint Test E .
B1761	Seat Driver Front Down	DSM	Go To Pinpoint Test E .

	Circuit Failure		
B1765	Seat Driver Forward Circuit Failure	DSM	<u>Go To Pinpoint Test E.</u>
B1769	Seat Driver Backward Circuit Failure	DSM	<u>Go To Pinpoint Test E.</u>
B2143	NVM Memory Failure	DSM	CARRY OUT seat calibration of the DSM. CLEAR the DTCs. REPEAT the self test. IF the DTC resets, INSTALL a new DSM. REFER to <u>Section 419-10.</u> CARRY OUT seat calibration of the new DSM.
B2146	Seat Recline Motor Position Out of Range	DSM	<u>Go To Pinpoint Test E.</u>
B2149	Seat Front Vertical Motor Position Out of Range	DSM	<u>Go To Pinpoint Test E.</u>
B2152	Seat Rear Vertical Motor Position Out of Range	DSM	<u>Go To Pinpoint Test E.</u>
B2155	Seat Horizontal Motor Position Out of Range	DSM	<u>Go To Pinpoint Test E.</u>
B2158	Seat Recline Motor Memory Position Out of Range	DSM	<u>Go To Pinpoint Test G.</u>
B2161	Seat Front Vertical Motor Memory Position Out of Range	DSM	<u>Go To Pinpoint Test G.</u>
B2164	Seat Rear Vertical Motor Memory Position Out of Range	DSM	<u>Go To Pinpoint Test G.</u>
B2167	Seat Horizontal Motor Memory Position Out of Range	DSM	<u>Go To Pinpoint Test G.</u>

DDM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1309	Power Door Lock Circuit Short to Ground	DDM	REFER to <u>Section 501-14B.</u>
B1341	Power Door Unlock Circuit Short to Ground	DDM	REFER to <u>Section 501-14B.</u>
B1342	ECU Is Defective	DDM	CLEAR the DTC. REPEAT the DDM self-test. If DTC B1342 is retrieved, INSTALL a new DDM. REFER to <u>Section 419-10.</u> CLEAR the DTCs. REPEAT the self-test.
B1400	Driver Power Window One Touch Window Relay Circuit Short to Battery	DDM	REFER to <u>Section 501-11.</u>
B1405	Driver Power Window Down Circuit Short to Battery	DDM	REFER to <u>Section 501-11.</u>
B1408	Driver Power Window Up Circuit Short to Battery	DDM	REFER to <u>Section 501-11.</u>

B1416	Power Window LR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1420	Passenger Power Window Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1424	Power Window RR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1530	Memory Set Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1534	Memory 1 Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1538	Memory 2 Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1676	Battery Pack Voltage Out of Range	DDM	REFER to Section 419-10 .
B2112	Door Driver Set Switch Stuck Failure	DDM	REFER to Section 501-14B .
B2116	Door Driver Reset Switch Stuck Failure	DDM	REFER to Section 501-14B .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2336	Mirror Switch Assembly Circuit Failure	DDM	REFER to Section 501-09 .
B2425	Remote Keyless Entry Out of Synchronization	DDM	REFER to Section 501-14B .
B2477	Module Configuration Failure	DDM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test. REFER to Section 206-09B .
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the driver seat module (DSM) 	<ul style="list-style-type: none"> DSM. BJB fuse 421 (20A). CJB fuse 207 (5A). Circuitry. 	<ul style="list-style-type: none"> Go To Pinpoint Test A.
<ul style="list-style-type: none"> No communication with the driver door module (DDM) 	<ul style="list-style-type: none"> DDM. BJB fuse 420 (20A). 	<ul style="list-style-type: none"> Go To Pinpoint Test B.

	<ul style="list-style-type: none"> ● CJB fuse 207 (5A). ● Circuitry. 	
<ul style="list-style-type: none"> ● The power seat is inoperative — driver 	<ul style="list-style-type: none"> ● BJB fuse 421 (20A). ● Circuitry. ● Driver seat regulator control switch. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test C.
<ul style="list-style-type: none"> ● The power seat is inoperative — passenger 	<ul style="list-style-type: none"> ● BJB fuse 428 (20A). ● Passenger seat regulator control switch. ● Circuitry. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test D.
<ul style="list-style-type: none"> ● The memory seat does not move horizontally/vertically — driver 	<ul style="list-style-type: none"> ● Seat regulator control switch. ● Front seat track. ● Seat backrest power recline. ● Circuitry. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test E.
<ul style="list-style-type: none"> ● The power seat does not move horizontally/vertically — passenger 	<ul style="list-style-type: none"> ● Passenger front seat track. ● Passenger seat regulator control switch. ● Circuitry. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test F.
<ul style="list-style-type: none"> ● The memory seat is inoperative 	<ul style="list-style-type: none"> ● DSM. ● DDM. ● Circuitry. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test G.
<ul style="list-style-type: none"> ● Easy exit/easy entry is inoperative 	<ul style="list-style-type: none"> ● Message center. ● DSM. 	<ul style="list-style-type: none"> ● CHECK the message center driver personality function to make sure the easy exit/easy entry function is not disabled. ● CHECK for any DSM DTCs. REFER to the DSM Diagnostic Trouble Code (DTC) Index.
<ul style="list-style-type: none"> ● The heated seat is inoperative — driver 	<ul style="list-style-type: none"> ● Driver heated seat switch. ● BJB fuse 411 (15A). ● Circuitry. ● Heated seat control module. ● Heated backrest element. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test H.
<ul style="list-style-type: none"> ● The heated seat is inoperative — passenger 	<ul style="list-style-type: none"> ● Driver heated seat switch. ● BJB fuse 411 (15A). ● Circuitry. ● Heated seat 	<ul style="list-style-type: none"> ● Go To Pinpoint Test I.

	<ul style="list-style-type: none"> control module. ● Heated backrest element. 	
<ul style="list-style-type: none"> ● The heated seats are inoperative 	<ul style="list-style-type: none"> ● CJB fuse 216 (5A), 205 (5A). ● BJB fuse 411 (15A). ● Driver heated seat control module. ● Passenger heated seat control module. ● Circuitry. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test J.
<ul style="list-style-type: none"> ● The power lumbar is inoperative — driver 	<ul style="list-style-type: none"> ● Driver seat lumbar motor. ● BJB fuse 421 (20A). ● Driver seat lumbar control switch. ● Circuitry. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test K.
<ul style="list-style-type: none"> ● The power lumbar is inoperative — passenger 	<ul style="list-style-type: none"> ● Passenger seat lumbar motor. ● BJB fuse 428 (20A). ● Passenger seat lumbar control switch. ● Circuitry. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test L.
<ul style="list-style-type: none"> ● The power seat does not move horizontally/vertically — driver 	<ul style="list-style-type: none"> ● Seat regulator control switch. ● Front seat track. ● Seat backrest power recline. ● Circuitry. 	<ul style="list-style-type: none"> ● Go To Pinpoint Test N.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE DRIVER SEAT MODULE (DSM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK NGS TESTER COMMUNICATION TO THE DDM	
<p>NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced the airbag system must be deactivated per the deactivation procedure contained in Section 501-20B.</p> <p>NOTE: Restraint system diagnostic tools MUST be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety</p>	

belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.

NOTE: After diagnosing/repairing a seat system, **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

1 Using the results from the DATA LINK DIAGNOSTICS test, check for communication to the DDM.

● **Does the NGS Tester communicate with the DDM?**

→ **Yes**
GO to A2 .

→ **No**
Go To Pinpoint Test B .

A2 CHECK CIRCUITS 29-AH80 (OG/WH) AND 30-AH80 (RD) FOR VOLTAGE

1

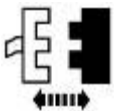


2



DSM C341b

4

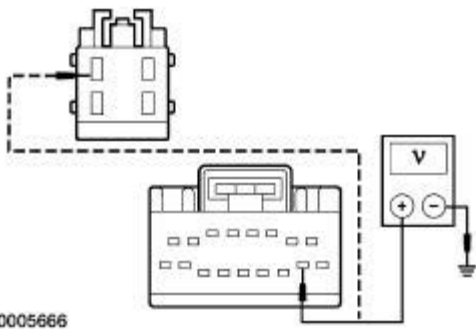


DSM C341c

5

3 Deactivate the supplemental restraint system (SRS). Refer to Section 501-20B .

5 Measure the voltage between DSM C341c pin 10, circuit 29-AH80 (OG/WH), harness side and ground; and between DSM C341b pin 4, circuit 30-AH80 (RD), harness side and ground



A0005666

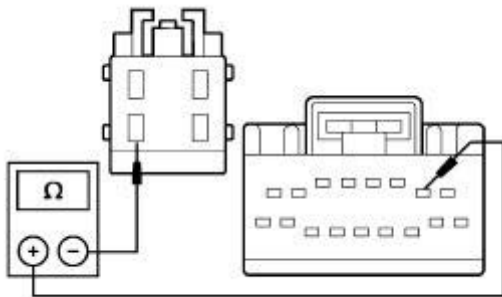
- Are the voltages greater than 10 volts?

→ **Yes**
GO to A3.

→ **No**
REPAIR the circuit in question. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

A3 CHECK CIRCUIT 31-AH80 (BK) AND 91-AH80 (BK) FOR AN OPEN

1



A0003054

1

Measure the resistance between the DSM C341b pin 3, circuit 31-AH80 (BK), harness side and ground; and between DSM C341c pin 2, circuit 91-AH80 (BK), harness side and ground.

- Are the resistances less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

PINPOINT TEST B: NO COMMUNICATION WITH THE DRIVER DOOR MODULE (DDM)

CONDITIONS**DETAILS/RESULTS/ACTIONS****B1 CHECK CIRCUITS 29-AJ80 (OG) AND 29S-AJ86 (OG/BU) FOR VOLTAGE**

NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced **the airbag system must be deactivated** per the deactivation procedure contained in [Section 501-20B](#).

NOTE: Airbag simulators (Restraint system diagnostic tools) **MUST** be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.

NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.

NOTE: After diagnosing/repairing a seat system, **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: Cycle the ignition from OFF to RUN to enable the switched system power feature.

1



3

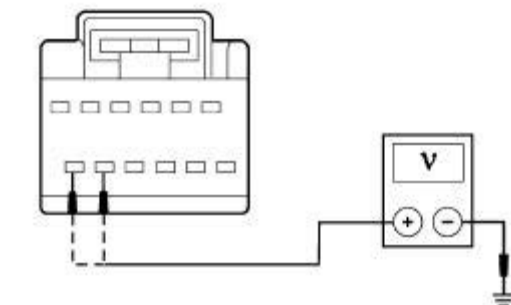


DDM C501a

4



5



A0006301

2

Deactivate the supplemental restraint system (SRS). Refer to [Section 501-20B](#).

5

Measure the voltage between DDM C501a pin 11, circuit 29-AJ80 (OG), harness side and ground; and between DDM C501a pin 12, circuit 29S-AJ86 (OG/BU), harness side and ground.

- Is the voltage greater than 10 volts?

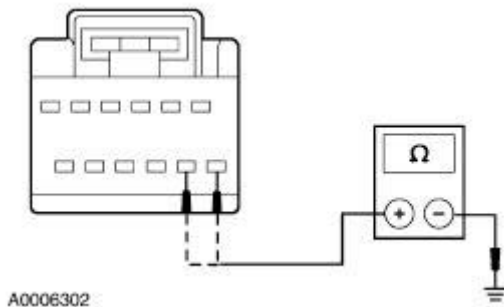
- **Yes**
GO to B2.
- **No**
REPAIR the circuit in question Test the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

B2 CHECK CIRCUITS 31-AJ80 (BK/OG) AND 91-AJ80 (BN/BU) FOR OPENS

1



2



2 Measure the resistance between DDM C501a pin 7, circuit 91-AJ80 (BN/BU), harness side and ground; and between DDM C501a pin 8, circuit 31-AJ80B (BK/OG), harness side and ground.

- Is the resistance less than 5 ohms?

- **Yes**
REFER to Section 418-00.
- **No**
REPAIR the circuit(s) in question. Test the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

PINPOINT TEST C: THE POWER SEAT IS INOPERATIVE — DRIVER

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK CIRCUIT 30-AH35 (RD) FOR VOLTAGE	
<p>NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced the airbag system must be deactivated per the deactivation procedure contained in <u>Section 501-20B</u>.</p>	
<p>NOTE: Airbag simulators (Restraint system diagnostic tools) MUST be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.</p>	
<p>NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to</p>	

diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

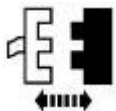
NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.

NOTE: After diagnosing/repairing a seat system, **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

1

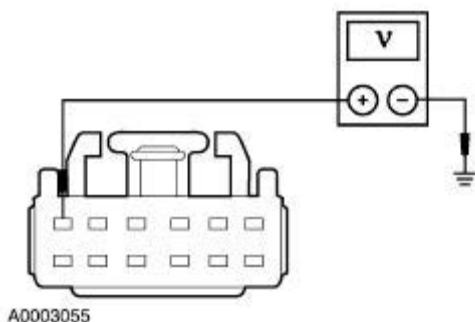


3



Driver Seat Regulator Control Switch C360

4



2 Deactivate the supplemental restraint system (SRS). Refer to [Section 501-20B](#).

4 Measure the voltage between driver seat regulator control switch C360 pin 6, circuit 30-AH35 (RD), harness side and ground.

● Is the voltage greater than 10 volts?

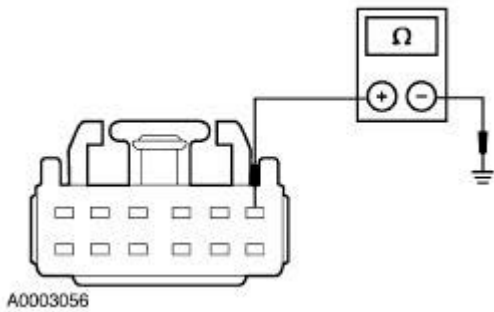
→ **Yes**
GO to [C2](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

C2 CHECK CIRCUIT 31-AH35 (BK) FOR AN OPEN

1

1 Measure the resistance between driver seat regulator control switch C360 pin 1, circuit 31-AH35 (BK), harness side and ground.



- Is the resistance less than 5 ohms?

→ **Yes**

INSTALL a new driver seat regulator control switch. REFER to Seat Control Switch. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

→ **No**

REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

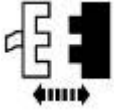
PINPOINT TEST D: THE POWER SEAT IS INOPERATIVE—PASSENGER

CONDITIONS	DETAILS/RESULTS/ACTIONS
	D1 CHECK FOR POWER TO THE PASSENGER SEAT REGULATOR CONTROL SWITCH
	<p>NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced the airbag system must be deactivated per the deactivation procedure contained in <u>Section 501-20B</u>.</p> <p>NOTE: Airbag simulators (Restraint system diagnostic tools) MUST be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p> <p>NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.</p> <p>NOTE: After diagnosing/repairing a seat system, The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p>

1

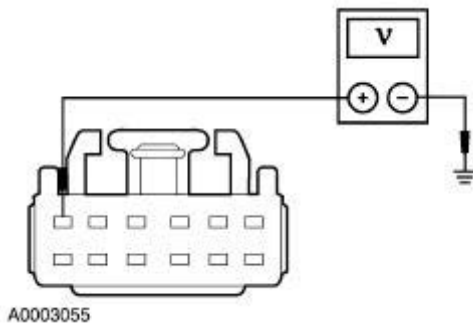


3



Passenger Seat Regulator Control Switch C330

4



2 Deactivate the supplemental restraint system (SRS). Refer to [Section 501-20B](#).

4 Measure the voltage between passenger seat regulator control switch C330 pin 6, circuit 30-AH42 (RD), harness side and ground.

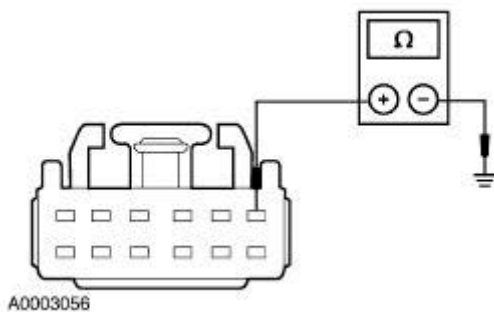
• Is the voltage greater than 10 volts?

→ **Yes**
GO to [D2](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

D2 CHECK CIRCUIT 31-AH42 (BK) FOR AN OPEN

1




1 Measure the resistance between passenger seat regulator control switch C330 pin 1, circuit 31-AH42 (BK), harness side and ground.

• Is the resistance less than 5 ohms?

	<p>→ Yes INSTALL a new passenger seat regulator control switch. REFER to Seat Control Switch . TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B .</p> <p>→ No REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B .</p>
--	--

PINPOINT TEST E: THE MEMORY SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY — DRIVER

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>E1 RETRIEVE THE RECORDED DSM DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS</p>	
<p>NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced the airbag system must be deactivated per the deactivation procedure contained in Section 501-20B .</p> <p>NOTE: Airbag simulators (Restraint system diagnostic tools) MUST be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p> <p>NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.</p> <p>NOTE: After diagnosing/repairing a seat system, The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p>	
<p>1</p> 	<p>2 Deactivate the supplemental restraint system (SRS). Refer to Section 501-20B .</p> <p>3 Use the results recorded from the DSM continuous and on-demand self-tests.</p> <ul style="list-style-type: none"> ● Are any DSM DTCs recorded?

→ **Yes**

If DTC B1703, B1707, B1711, B1715, B1719, B1723, B1727 or B1731 was retrieved, GO to E2.

If any combination of DTC B1757, B1761, B1765, B1769, B2146, B2149, B2152, or B2155 are retrieved, GO to E4.

If only a combination of DTC B2146, B2149, B2152 or B2155 are retrieved, GO to E43.

→ **No**

GO to E45.

E2 CHECK FOR A SHORT TO BATTERY

1

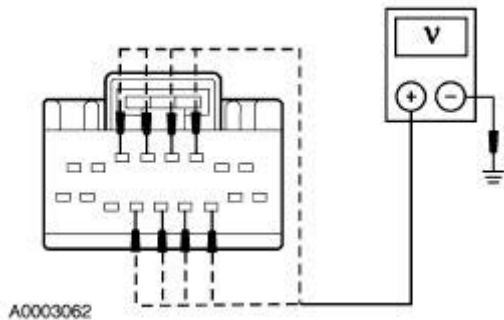


DSM C341c

2



3



3

Using the following table, measure the voltage between DSM C341c pins, harness side and ground.

DSM C341c Pin	Circuit
3	10-AH83 (GY/OG)
4	10-AH82 (GY/RD)
5	8-AH84 (WH/BK)
6	10-AH85 (WH/GN)
11	8-AH83 (WH/GN)
12	8-AH82 (WH/RD)
13	10-AH84 (GY/BK)
14	8-AH85 (WH/VT)

• Are any of the voltages greater than 10 volts?

→ **Yes**

GO to E3.

→ **No**

CLEAR the DSM DTCs. REPEAT the DSM self-test. If DTC B1703, B1707, B1711, B1715, B1719, B1723, B1727 or B1731 is retrieved, INSTALL a new DSM. REFER to Section 419-10. CALIBRATE the driver seat, REFER to Seat

Calibration in Principles of Operation.

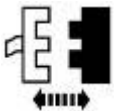
If any other DTCs are retrieved refer the DSM Diagnostic Trouble Code (DTC) Index. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E3 CHECK THE DRIVER SEAT REGULATOR CONTROL SWITCH FOR A SHORT TO BATTERY

1



2

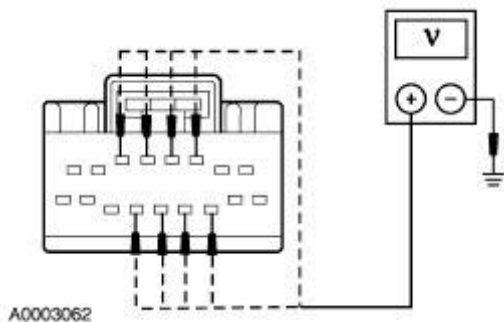


Driver Seat Regulator Control Switch C360

3



4



4 Using the following table, measure the voltage between DSM C341c pins, harness side and ground.

DSM C341c Pin	Circuit
3	10-AH83 (GY/OG)
4	10-AH82 (GY/RD)
5	8-AH84 (WH/BK)
6	10-AH85 (WH/GN)
11	8-AH83 (WH/GN)
12	8-AH82 (WH/RD)
13	10-AH84 (GY/BK)
14	8-AH85 (WH/VT)

● Are any of the voltages greater than 10 volts?

→ **Yes**

REPAIR the circuit in question. REPEAT the DSM self-test. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

→ **No**

INSTALL a new driver seat regulator

control switch. REFER to Seat Control Switch. REPEAT the DSM self-test. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E4 CHECK FOR MULTIPLE DSM DTCS

1 Use the results recorded from the DSM continuous and on-demand self-tests.

- Are the DSM DTCS B1757, B1761 and B1765 all retrieved?

→ Yes
GO to E5.

→ No
GO to E10.

E5 CHECK THE HORIZONTAL POSITION SENSOR COMMON RETURN

1

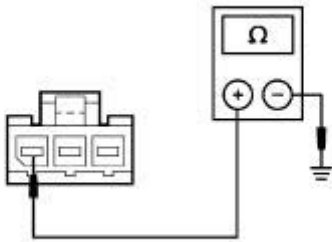


2



Horizontal Position Sensor C372

3



A0003063

3 Measure the resistance between horizontal position sensor C372 pin 3, circuit 7-AH26 (YE/RD), harness side and ground.

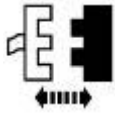
- Is the resistance less than 180 ohms?

→ Yes
GO to E7.

→ No
GO to E6.

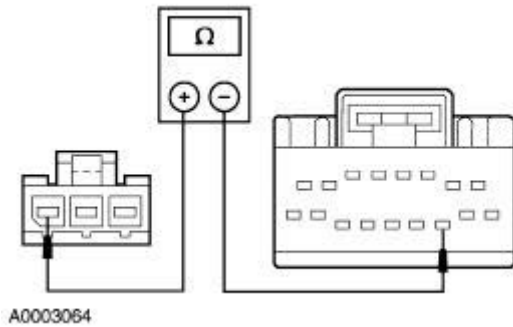
E6 CHECK CIRCUIT 9-AH26 (BN/RD) FOR AN OPEN

1



DSM C341a

2



2

Measure the resistance between horizontal position sensor C372 pin 1, circuit 9-AH26 (BN/RD), harness side and DSM C341a pin 11, circuit 9-AH80 (BN/WH), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**

INSTALL a new DSM. REFER to [Section 419-10](#). CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

E7 CHECK THE POSITION SENSOR COMMON FEED

1



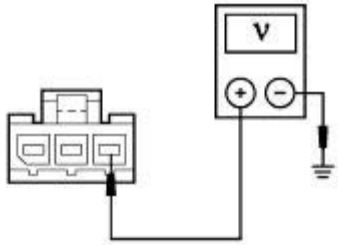
2



3

3

Measure the voltage between horizontal position sensor C372 pin 3, circuit 7-AH26 (YE/RD), harness side and ground.



A0003065

● Is the voltage greater than 10 volts?

→ **Yes**
GO to E10.

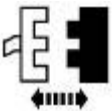
→ **No**
GO to E8.

E8 CHECK CIRCUIT 7-AH26 (YE/RD) FOR A SHORT TO GROUND

1

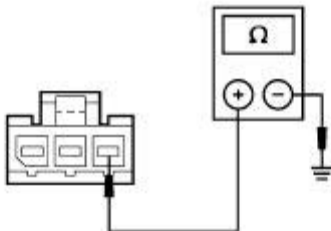


2



DSM C341a

3



A0003066

3 Measure the resistance between horizontal position sensor C372 pin 3, circuit 7-AH26 (YE/RD), harness side and ground.

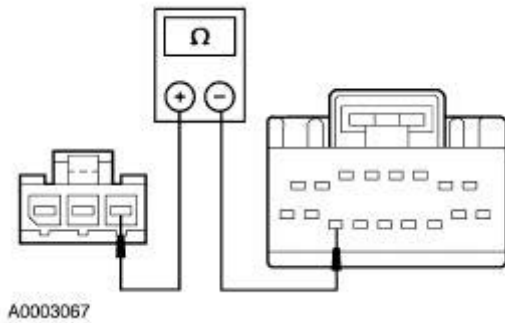
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to E9.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E9 CHECK CIRCUIT 7-AH26 (YE/RD) OR 7-AH80 (YE/VT) FOR AN OPEN

1



1

Measure the resistance between horizontal position sensor C372 pin 3, circuit 7-AH26 (YE/RD), harness side and DSM C341a pin 15, circuit 7-AH80 (YE/VT), harness side.

● **Is the resistance less than 5 ohms?**

→ **Yes**

INSTALL a new DSM. REFER to [Section 419-10](#). CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

E10 CHECK FOR SINGLE DTCS

1

Using the recorded results from the DSM self-test.

● **Was DTC B1757, B1761, B1765 or B1769 retrieved?**

→ **Yes**

For DTC B1757 GO to [E11](#).

For DTC B1761 GO to [E19](#).

For DTC B1765 GO to [E27](#).

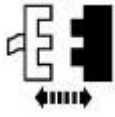
For DTC B1769 GO to [E35](#).

→ **No**

GO to [E43](#).

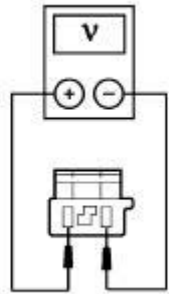
E11 CHECK VOLTAGE TO THE DRIVER SEAT REAR HEIGHT MOTOR

1



Driver Seat Rear Height Motor C382

2



A0003068

2

Measure the voltage between driver seat rear height motor C382, circuit 33-AH41 (YE/VT), harness side and driver seat rear height motor C382, circuit 32-AH41 (WH/VT), harness side.

3

Operate the driver seat regulator control switch to the rear up and rear down position.

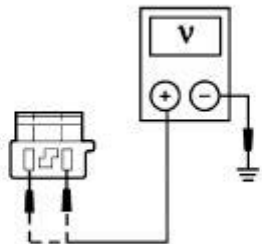
- **Is the voltage greater than 10 volts in both directions?**

→ **Yes**
GO to E15.

→ **No**
GO to E12.

E12 CHECK THE DSM DRIVER SIDE REAR HEIGHT MOTOR CONTROL

1



A0003069

1

Measure the voltage between driver seat rear height motor C382, circuit 33-AH41 (YE/VT), harness side and ground while operating the driver seat regulator control switch to the rear down position; and between driver seat rear height motor C382, circuit 32-AH41 (WH/VT), harness side and ground while operating the driver seat regulator control switch to the rear up position.

- **Is the voltage greater than 10 volts in both directions?**

→ **Yes**
INSTALL a new DSM. REFER to Section 419-10. CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

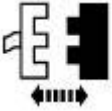
→ **No**
GO to E13.

E13 CHECK CIRCUIT 33-AH41 (YE/VT) AND 32-AH41 (WH/VT) FOR A SHORT TO GROUND

1

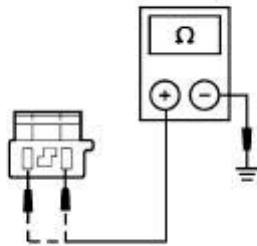


2



DSM C341a

3



A0003070

3 Measure the resistance between driver seat rear height motor C382, circuit 33-AH41 (YE/VT), harness side and ground; and between driver seat rear height motor C382, circuit 32-AH41 (WH/VT), harness side and ground.

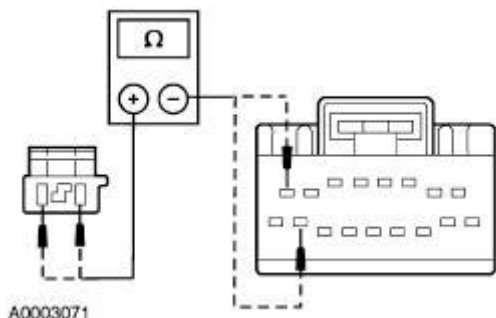
- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to E14.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E14 CHECK CIRCUIT 33-AH41 (YE/VT) AND 32-AH41 (WH/VT) FOR AN OPEN

1



A0003071

1 Measure the resistance between driver seat rear height motor C382, circuit 33-AH41 (YE/VT), harness side and DSM C341a pin 8, circuit 33-AH41 (YE/VT), harness side; and between driver seat rear height motor C382, circuit 32-AH41 (WH/VT), harness side and DSM C341a pin 16, circuit 32-AH41 (WH/VT), harness side.

- Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new DSM. REFER to [Section 419-10](#). CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**
REPAIR the circuit. REPEAT the DSM self-test. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

E15 CHECK CIRCUIT 9-AH25 (BN/GN) FOR AN OPEN

1

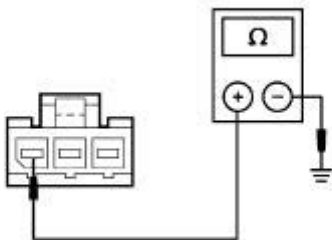


2



Rear Height Motor Position Sensor C383

3



A0003063

3 Measure the resistance between rear height motor position sensor C383 pin 3, circuit 9-AH25 (BN/GN), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to [E16](#).

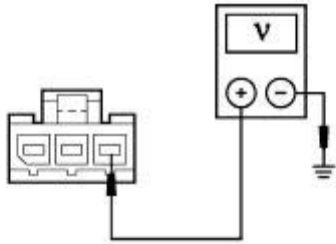
→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

E16 CHECK CIRCUIT 7-AH25 (YE/GN) FOR AN OPEN

1



2



A0003065

2 Measure the voltage between rear height motor position sensor C383 pin 1, circuit 7-AH25 (YE/GN), harness side and ground.

• Is the voltage approximately 5 volts?

→ **Yes**
GO to E17.

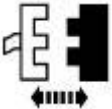
→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E17 CHECK CIRCUIT 8-AH25 (WH/GN) FOR A SHORT TO GROUND

1

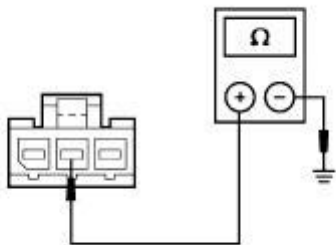


2



DSM C341a

3



A0003072

3 Measure the resistance between rear height motor position sensor C383 pin 2, circuit 8-AH25 (WH/GN), harness side and ground.

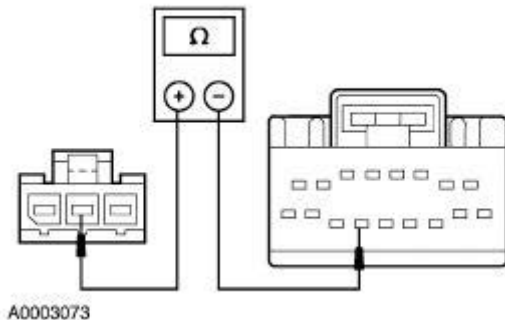
• Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to E18.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E18 CHECK CIRCUIT 8-AH25 (WH/GN) FOR AN OPEN

1



1 Measure the resistance between rear height motor position sensor C383 pin 2, circuit 8-AH25 (WH/GN), harness side and DSM C341a pin 14, circuit 8-AH25 (WH/GN), harness side.

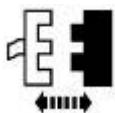
● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new seat track. REFER to Seat Track in this section. CALIBRATE the driver seat. REFER to Principles of Operation. REPEAT the DSM self-test. If DTC B1757 is retrieved, INSTALL a new DSM. REFER to Section 419-10. CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E19 CHECK THE DRIVER SEAT FRONT HEIGHT MOTOR SUPPLY

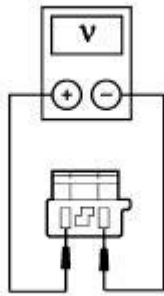
1



Driver Seat Front Height Motor C363

2

2 Measure the voltage between driver seat front height motor C363, circuit 33-AH38 (YE/BK), harness side and driver seat



A0003068

front height motor C363, circuit 32-AH38 (WH/BK), harness side.

3 Operate the driver seat regulator control switch to the front up and front down position.

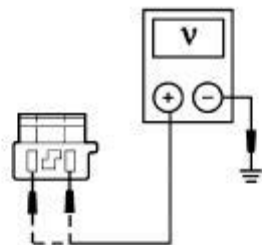
• Is the voltage greater than 10 volts in both directions?

→ Yes
GO to E23.

→ No
GO to E20.

E20 CHECK THE DSM DRIVER SEAT FRONT HEIGHT MOTOR CONTROL

1



A0003069

1 Measure the voltage between driver seat front height motor C363, circuit 33-AH38 (YE/BK), harness side and ground while operating the driver seat regulator control switch to the front down position; and between driver seat front height motor C363, circuit 32-AH38 (WH/BK), harness side and ground, while operating the driver seat regulator control switch to the front up position.

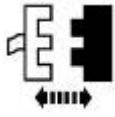
• Is the voltage greater than 10 volts in both directions?

→ Yes
INSTALL a new DSM. REFER to [Section 419-10](#). CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ No
GO to E21.

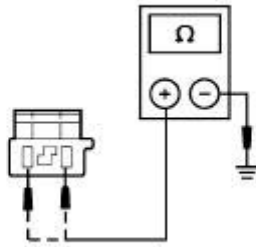
E21 CHECK CIRCUIT 33-AH38 (YE/BK) AND 32-AH38 (WH/BK) FOR A SHORT TO GROUND

1



DSM C341a

2



A0003070

2

Measure the resistance between driver seat front height motor C363, circuit 33-AH38 (YE/BK), harness side and ground; and between driver seat front height motor C363, circuit 32-AH38 (WH/BK), harness side and ground.

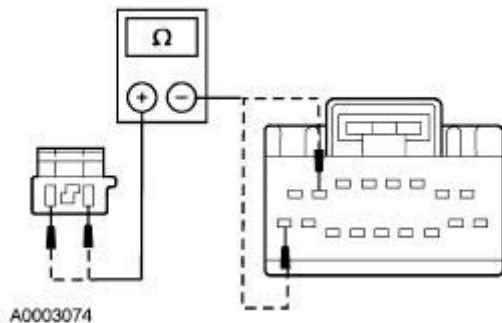
- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to [E22](#).

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

E22 CHECK CIRCUIT 33-AH38 (YE/BK) AND 32-AH38 (WH/BK) FOR AN OPEN

1



A0003074

1

Measure the resistance between driver seat front height motor C363, circuit 33-AH38 (YE/BK), harness side and DSM C341a pin 7, circuit 33-AH38 (YE/BK), harness side; and between driver seat front height motor C363, circuit 32-AH38 (WH/BK), harness side and DSM C341a pin 17, circuit 32-AH38 (WH/BK), harness side.

- Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new DSM. REFER to [Section 419-10](#). CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

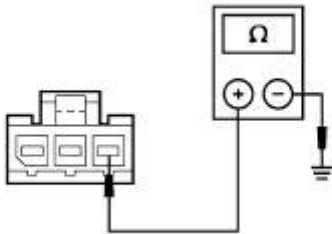
E23 CHECK CIRCUIT 9-AH24 (BN/YE) FOR AN OPEN

1



Front Height Motor Position Sensor C373

2



A0003066

2 Measure the resistance between front height motor position sensor C373 pin 3, circuit 9-AH24 (BN/YE), harness side and ground.

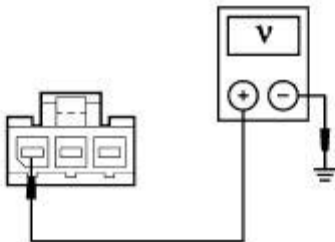
● Is the resistance less than 5 ohms?

→ **Yes**
GO to [E24](#).

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

E24 CHECK CIRCUIT 7-AH24 (YE/BK) FOR AN OPEN

1



A0003075

1 Measure the voltage between front height motor position sensor C373 pin 3, circuit 7-AH24 (YE/BK), harness side and ground.

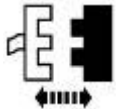
● Is the voltage approximately 5 volts?

→ **Yes**
GO to E25.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self test. REACTIVATE the supplemental restraint system (SRS).
PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

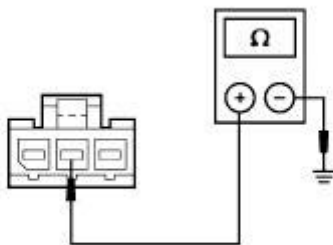
E25 CHECK CIRCUIT 8-AH24 (WH/BK) FOR A SHORT TO GROUND

1



DSM C341a

2



A0003072

2

Measure the resistance between front height motor position sensor C373 pin 2, circuit 8-AH24 (WH/BK), harness side and ground.

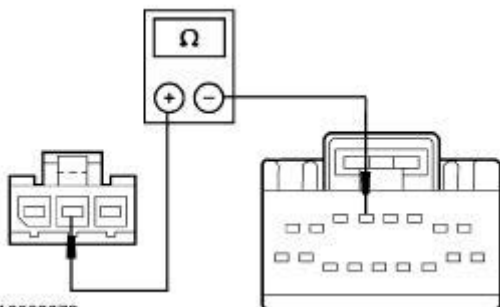
● **Is the resistance greater than 10,000 ohms?**

→ **Yes**
GO to E26.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self test. REACTIVATE the supplemental restraint system (SRS).
PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E26 CHECK CIRCUIT 8-AH24 (WH/BK) FOR AN OPEN

1



A0003076

1

Measure the resistance between front height motor position sensor C373 pin 2, circuit 8-AH24 (WH/BK), harness side and DSM C341a pin 5, circuit 8-AH24 (WH/BK), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**

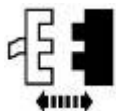
INSTALL a new seat track. REFER to Seat Track. CALIBRATE the driver seat. REFER to Principles of Operation. REPEAT the DSM self-test. If DTC B1761 is retrieved, INSTALL a new DSM. REFER to Section 419-10. CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

→ **No**

REPAIR the circuit. REPEAT the DSM self-test. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

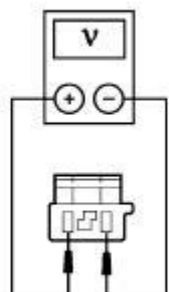
E27 CHECK THE VOLTAGE TO THE DRIVER SEAT FORWARD/REARWARD MOTOR

1



Driver Seat Forward/Rearward Motor C362

2



A0003068

2

Measure the voltage between driver side forward/rearward motor C362, circuit 33-AH37 (WH/GN), harness side and driver side forward/rearward motor C362, circuit 32-AH37 (YE/GN), harness side.

3

Operate the driver seat regulator control switch to the forward and rearward position.

- Is the voltage greater than 10 volts in both directions?

→ **Yes**

GO to E31.

→ **No**

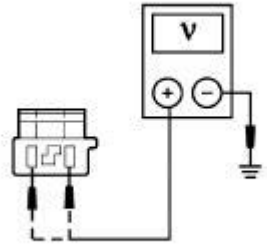
GO to E28.

E28 CHECK THE DSM FORWARD/REARWARD MOTOR CONTROL

1

1

Measure the voltage between driver side



A0003069

forward/rearward motor C362, circuit 33-AH37 (WH/GN), harness side and ground while operating the driver seat regulator control switch to the rearward position; and between driver side forward/rearward motor C362, circuit 32-AH37 (YE/GN), harness side and ground while operating the driver seat regulator control switch to the forward position.

- Is the voltage greater than 10 volts in both directions?

→ **Yes**

INSTALL a new DSM. REFER to [Section 419-10](#). CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

GO to [E29](#).

E29 CHECK CIRCUIT 33-AH37 (WH/GN) AND 32-AH37 (YE/GN) FOR A SHORT TO GROUND

1

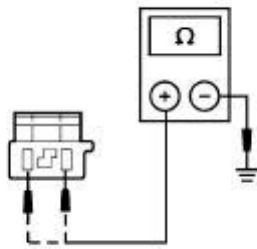


2



DSM C341

3



A0003070

- 3 Measure the resistance between driver side forward/rearward motor C362, circuit 33-AH37 (WH/GN), harness side and ground; and between driver side forward/rearward motor C362, circuit 32-AH37 (YE/GN), harness side and ground.

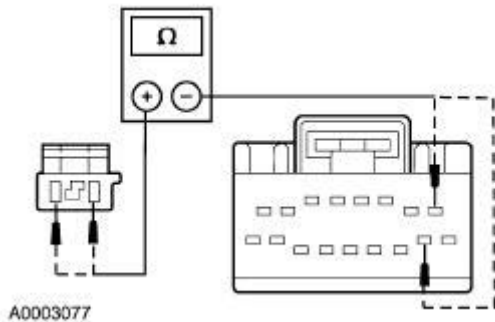
- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to E30.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E30 CHECK CIRCUIT 33-AH37 (WH/GN) AND 32-AH37 (YE/GN) FOR AN OPEN

1



1

Measure the resistance between driver side forward/rearward motor C362, circuit 33-AH37 (WH/GN), harness side and DSM C341a pin 1, circuit 33-AH37 (YE/GN), harness side; and between driver side forward/rearward motor C362, circuit 32-AH37 (YE/GN), harness side and DSM C341a pin 10, circuit 32-AH9 (YE/GN), harness side.

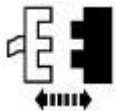
● **Are the resistances less than 5 ohms?**

→ **Yes**
INSTALL a new DSM. REFER to Section 419-10. CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E31 CHECK CIRCUIT 9-AH26 (BN/RD) FOR AN OPEN

1

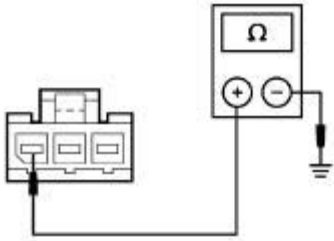


Forward/Rearward Motor Position Sensor C372

2

2

Measure the resistance between forward/rearward motor position sensor C372 pin 1, circuit 9-AH26 (BN/RD), harness side and ground.



A0003063

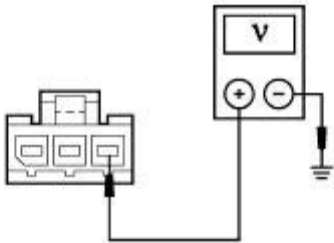
● Is the resistance less than 5 ohms?

→ **Yes**
GO to E32.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E32 CHECK CIRCUIT 7-AH26 (YE/RD) FOR AN OPEN

1



A0003065

1 Measure the voltage between forward/rearward motor position sensor C372 pin 3, circuit 7-AH26 (YE/RD), harness side and ground.

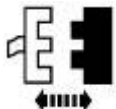
● Is the voltage approximately 5 volts?

→ **Yes**
GO to E33.

→ **No**
REPAIR the circuit. REPEAT the DSM self-test. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

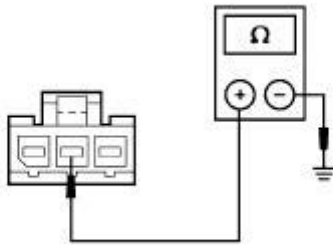
E33 CHECK CIRCUIT 8-AH26 (WH/RD) FOR A SHORT TO GROUND

1



DSM C341a

2



A0003072

2

Measure the resistance between forward/rearward motor position sensor C372 pin 2, circuit 8-AH26 (WH/RD), harness side and ground.

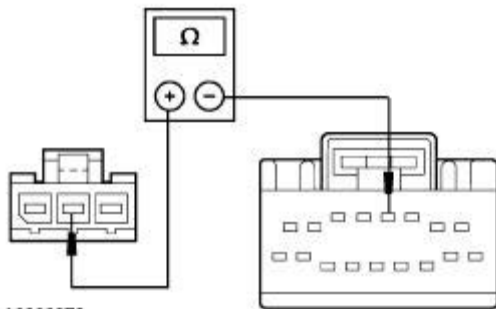
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to E34.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E34 CHECK CIRCUIT 8-AH26 (WH/RD) FOR AN OPEN

1



A0003078

1

Measure the resistance between forward/rearward motor position sensor C372 pin 2, circuit 8-AH26 (WH/RD), harness side and DSM C341a pin 4, circuit 8-AH26 (WH/RD), harness side.

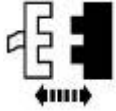
● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new seat track. REFER to Seat Track. CALIBRATE the driver seat. REFER to Principles of Operation. REPEAT the DSM self-test. If DTC B1765 is retrieved, INSTALL a new DSM. REFER to Section 419-10. CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self test. REACTIVATE the
supplemental restraint system (SRS).
PROVE OUT the supplemental restraint
system (SRS). REFER to [Section 501-
20B](#).

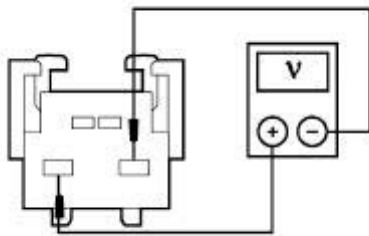
E35 CHECK THE DRIVER SEAT BACKREST MOTOR SUPPLY

1



Driver Seat Backrest Motor C368

2



A0003079

2 Measure the voltage between driver seat
backrest motor C368, circuit 33-AH36
(YE/RD), harness side and driver seat
backrest motor C368, circuit 32-AH36
(WH/RD), harness side, while operating
the driver seat regulator control switch to
the recline forward and recline rearward
position.

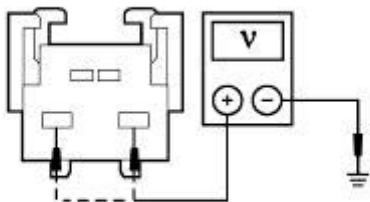
- Is the voltage greater than 10 volts
in both directions?

→ **Yes**
GO to [E39](#).

→ **No**
GO to [E36](#).

E36 CHECK THE DSM BACKREST MOTOR CONTROL

1



A0003080

1 Measure the voltage between driver seat
backrest motor C368, circuit 33-AH36
(YE/RD), harness side and ground while
operating the driver seat regulator
control switch to the backrest forward
position; and between driver seat
backrest motor C368, circuit 32-AH36
(WH/RD), harness side and ground
while operating the driver seat regulator
control switch to the backrest rearward
position.

- Is the voltage greater than 10 volts
in both directions?

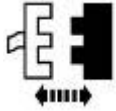
→ **Yes**
INSTALL a new DSM. REFER to [Section
419-10](#). CALIBRATE the driver seat,
REFER to Seat Calibration in Principles

of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**
GO to [E37](#).

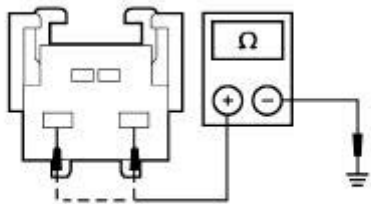
E37 CHECK CIRCUIT 33-AH36 (YE/RD) AND 32-AH36 (WH/RD) FOR A SHORT TO GROUND

1



DSM C341a

2



A0003081

2 Measure the resistance between driver seat backrest motor C368, circuit 33-AH36 (YE/RD), harness side and ground; and between driver seat backrest motor C368, circuit 32-AH36 (WH/RD), harness side and ground.

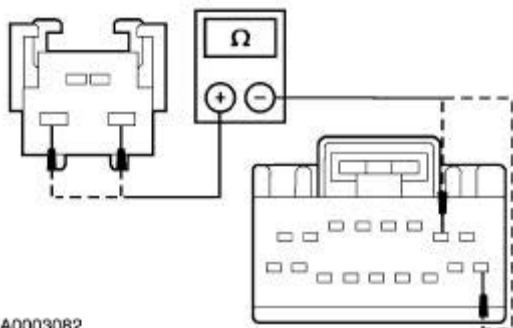
- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to [E38](#).

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

E38 CHECK CIRCUIT 33-AH36 (YE/RD), 33-AH36 (YE/RD), 32-AH36 (WH/RD) AND 32-AH36 (WH/RD) FOR AN OPEN

1



A0003082

1 Measure the resistance between driver seat backrest motor C368, circuit 33-AH36 (YE/RD), harness side and DSM C341a pin 9, circuit 33-AH36 (YE/RD), harness side; and between driver seat backrest motor C368, circuit 32-AH36 (WH/RD), harness side and DSM C341a pin 2, circuit 32-AH36 (WH/RD), harness side.

- Are the resistances less than 5 ohms?

→ **Yes**

INSTALL a new DSM. REFER to [Section 419-10](#) . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#) .

→ **No**

REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#) .

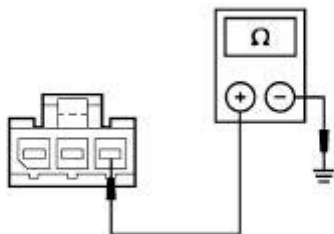
E39 CHECK CIRCUIT 9-AH30 (BN/BU) FOR AN OPEN

1



Backrest Motor Position Sensor C376

2



A0003066

2

Measure the resistance between backrest motor position sensor C376 pin 3, circuit 9-AH30 (BN/BU), harness side and ground.

- Is the resistance less than 5 ohms?

→ **Yes**

GO to [E40](#) .

→ **No**

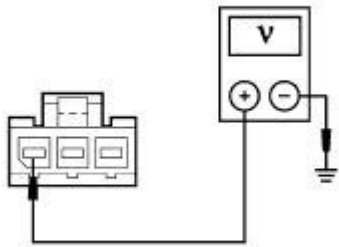
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#) .

E40 CHECK CIRCUIT 7-AH30 (YE/BU) FOR AN OPEN

1

1

Measure the voltage between backrest motor position sensor C376 pin 1, circuit



A0003075

7-AH30 (YE/BU), harness side and ground.

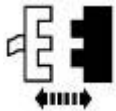
- Is the voltage approximately 5 volts?

→ **Yes**
GO to E41.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

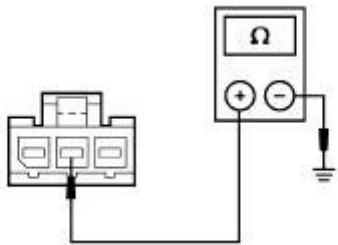
E41 CHECK CIRCUIT 8-AH30 (WH/BU) FOR A SHORT TO GROUND

1



DSM C341a

2



A0003072

2 Measure the resistance between backrest motor position sensor C376 pin 2, circuit 8-AH30 (WH/BU), harness side and ground.

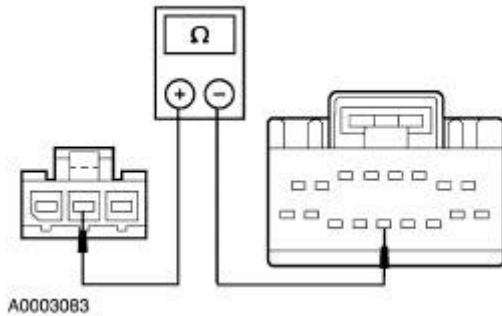
- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to E42.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-

E42 CHECK CIRCUIT 8-AH30 (WH/BU) FOR AN OPEN

1



1

Measure the resistance between backrest motor position sensor C376 pin 2, circuit 8-AH30 (WH/BU), harness side and DSM C341a pin 13, circuit 8-AH30 (WH/BU), harness side.

● Is the resistance less than 5 ohms?

→ Yes

INSTALL a new seat track. REFER to [Seat Track](#). CALIBRATE the driver seat. REFER to Principles of Operation. REPEAT the DSM self-test. If DTC B1769 is retrieved, INSTALL a new DSM. REFER to [Section 419-10](#). CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ No

REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

E43 CHECK FOR HESITATION OR JOGGING

1



2



3



2

Clear all DSM DTCs.

3

Operate the driver seat regulator control switch through all positions while monitoring DSM PIDs SFNT_MT, SREARMT, SFWD_MT and SRCL_MT, while watching seat movement.

● Did the driver seat stop or hesitate,

or did any of the DSM PIDs read inconsistently?

→ **Yes**

INSTALL a new seat track. REFER to Seat Track. CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

→ **No**

GO to E44.

E44 CHECK FOR AN INTERMITTENT CONCERN

1



3



DSM Self-Test

1

Clear all DSM DTCs.

2

Operate the driver power seat. Wiggle the harness and connectors. Inspect for any visual concerns.

● **Were any DTCs retrieved?**

→ **Yes**

If DTC B2146, B2149, B2152 or B2155 is retrieved, INSTALL a new seat track. REFER to Seat Track. CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

→ **No**

CALIBRATE the driver seat. REFER to Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

E45 CHECK THE DRIVER SEAT REGULATOR CONTROL SWITCH PIDS

1

1

Operate the driver seat regulator control seat switch through all positions while monitoring the DSM PIDs SFNT_SW,



SFWD_SW, SREARSW and SRCL_SW.

- Do the DSM PIDs accurately represent the seat regulator control switch positions?

→ **Yes**

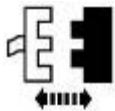
INSTALL a new DSM. REFER to Section 419-10 . CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B .

→ **No**

GO to E46 .

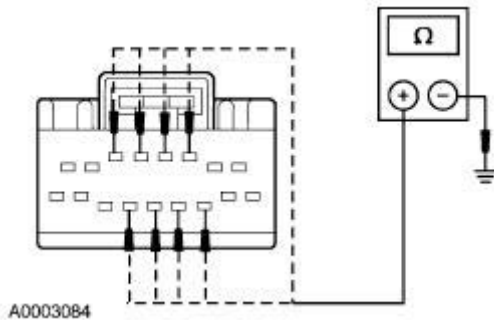
E46 CHECK THE DRIVER SEAT REGULATOR CONTROL SWITCH CIRCUITS FOR AN OPEN

1



DSM C341c

2



2

Using the following table, measure the resistance between DSM C341c pins, harness side and ground.

DSM C341c Pin	Circuit
3	10-AH83 (GY/OG)
4	10-AH82 (GY/RD)
5	8-AH84 (WH/BK)
6	10-AH85 (WH/GN)
11	8-AH83 (WH/GN)
12	8-AH82 (WH/RD)
13	10-AH84 (GY/BK)
14	8-AH85 (WH/VT)

- Are the resistances less than 5 ohms?

→ **Yes**

GO to E47 .

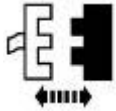
→ **No**

REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the

supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

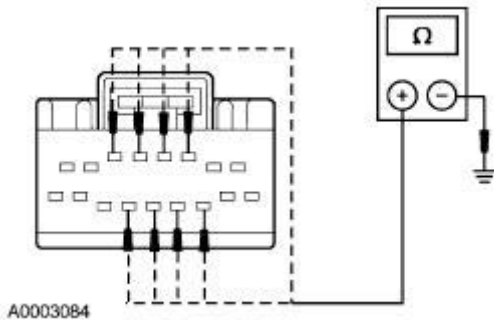
E47 CHECK THE DRIVER SEAT REGULATOR CONTROL SWITCH CIRCUITS FOR A SHORT TO GROUND

1



Driver Seat Regulator Control Switch C360

2



2

Using the following table, measure the resistance between DSM C341c pins, harness side and ground.

DSM C341c Pin	Circuit
3	10-AH83 (GY/OG)
4	10-AH82 (GY/RD)
5	8-AH84 (WH/BK)
6	10-AH85 (WH/GN)
11	8-AH83 (WH/GN)
12	8-AH82 (WH/RD)
13	10-AH84 (GY/BK)
14	8-AH85 (WH/VT)

- Are the resistances greater than 10,000 ohms?

→ **Yes**

INSTALL a new driver seat regulator control switch. REFER to [Seat Track](#). CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

REPAIR the circuit. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

PINPOINT TEST F: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY —PASSENGER

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE PASSENGER SEAT MOTOR OPERATION	

NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced **the airbag system must be deactivated** per the deactivation procedure contained in [Section 501-20B](#).

NOTE: Airbag simulators (Restraint system diagnostic tools) **MUST** be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.

NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

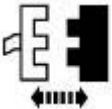
NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.

NOTE: After diagnosing/repairing a seat system, **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

1



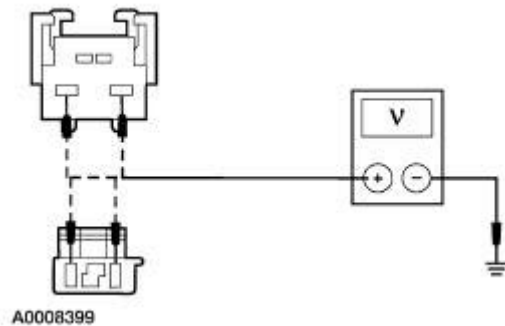
3



4



5



2

Deactivate the supplemental restraint system (SRS). Refer to [Section 501-20B](#).

3

Disconnect the passenger seat motor connector in question: (forward/rearward motor C332, seat height motor C333, or seat backrest motor C338).

5

Using the following table, measure the voltage between the inoperative passenger seat motor connector, harness side and ground, while moving the seat regulator control switch in the indicated direction:

Motor Connector	Pin	Circuit	Direction of Control Switch
Forward/Reverse Motor C332	1	32-AH44 (WH/GN)	Forward
Forward/Reverse Motor C332	2	33-AH44 (YE/GN)	Reverse
Height Motor	1	32-AH34 (WH/BK)	Up

C333			
Height Motor C333	2	33-AH34 (YE/BK)	Down
Backrest Motor C338	1	32-AH15 (WH/RD)	Tilt Up
Backrest Motor C338	2	33-AH15 (YE/RD)	Tilt Down

● Are the voltages greater than 10 volts in the inoperative directions?

→ **Yes**

INSTALL a new passenger seat track or the backrest assembly. REFER to [Seat Track](#) or [Front Seat Backrest](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

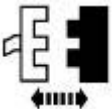
GO to [F2](#).

F2 CHECK THE PASSENGER SEAT MOTOR CIRCUITS FOR A SHORT TO GROUND

1

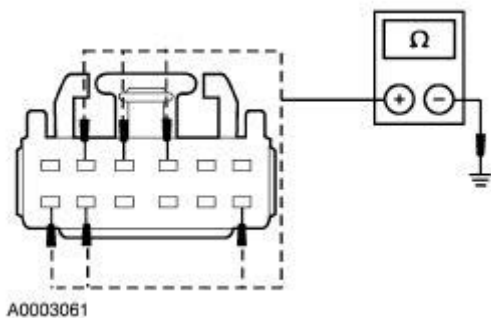


2



Passenger Seat Regulator Control Switch C330

3



3

Using the following table, measure the resistance between passenger seat regulator control switch C330 pins, harness side and ground:

Pin	Circuit	Inoperative Motor
12	32-AH43 (WH/RD)	Backrest
7	33-AH43 (YE/RD)	Backrest
4	32-AH34 (WH/BK)	Height
5	33-AH34 (YE/BK)	Height
3	32-AH44	Forward/

	(WH/GN)	Rearward
11	33-AH44 (YE/GN)	Forward/ Rearward

- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to F3.

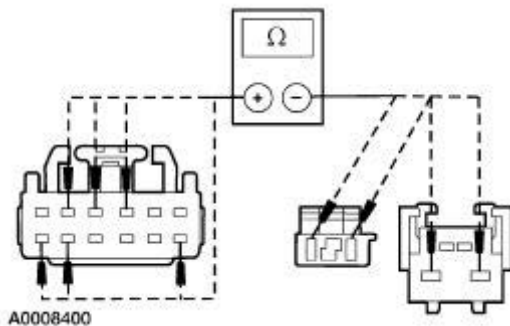
→ **No**
REPAIR the circuit in question. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

F3 CHECK FOR AN OPEN CIRCUIT

1



2



2

Measure the resistance between the passenger seat regulator control switch C330 pins, harness side and the inoperative motor connector, harness side:

C330 Pin	Circuit	Motor Connector
Height Motor		
4	32-AH34 (WH/BK)	C333 pin 1
5	33-AH34 (YE/BK)	C333 pin 2
Forward/Reverse Motor		
3	32-AH44 (WH/GN)	C332 pin 1
11	33-AH44 (YE/GN)	C332 pin 2
Backrest Motor		
12	32-AH43, 32- AH15 (WH/RD)	C338 pin 1
7	33-AH43, 33- AH15 (YE/RD)	C338 pin 2

- Are all resistance readings less than 5 ohms?

→ **Yes**

INSTALL a new passenger seat regulator control switch. REFER to [Seat Control Switch](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**
REPAIR the circuit in question. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

PINPOINT TEST G: THE MEMORY SEAT IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE MEMORY MIRROR OPERATION	
	<p>NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced the airbag system must be deactivated per the deactivation procedure contained in Section 501-20B.</p> <p>NOTE: Airbag simulators (Restraint system diagnostic tools) MUST be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p> <p>NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.</p> <p>NOTE: After diagnosing/repairing a seat system, The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p>
	<p>1 Carry out a memory recall for the exterior rear view mirrors.</p> <ul style="list-style-type: none"> ● Did the memory mirrors operate correctly? <p>→ Yes GO to G2.</p> <p>→ No REFER to Section 501-09.</p>
G2 CHECK THE DTCS FROM THE DSM	
	<p>1 Using the recorded results from DSM self-test.</p> <ul style="list-style-type: none"> ● Was DSM DTC B1342 retrieved? <p>→ Yes</p>

CLEAR the DSM DTCs. REPEAT the DSM self-test. If DTC B1342 is retrieved, INSTALL a new DSM. REFER to [Section 419-10](#). CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. CLEAR the DTCs. REPEAT the self test. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**
GO to [G3](#).

G3 CHECK THE POWER SEAT CALIBRATION

1



CLEAR DSM
DTCs

2 Calibrate the driver seat. Refer to Seat Calibration in Principles of Operation.

● **Were any DSM DTCs retrieved from calibration?**

→ **Yes**
REFER to the DSM Diagnostic Trouble Code (DTC) Index.

→ **No**
GO to [G4](#).

G4 CHECK THE MEMORY RECALL OPERATION

1 Set a new memory seat position for driver 1 and driver 2.

2 Activate the memory recall for driver position 1 and driver position 2 from the memory set switch.

● **Do the memory recall functions operate correctly?**

→ **Yes**
The driver power seat is operating correctly. REVERIFY symptom.

→ **No**
INSTALL a new DSM. REFER to [Section 419-10](#). CALIBRATE the driver seat, REFER to Seat Calibration in Principles of Operation. GO to [G5](#).

G5 CHECK THE MEMORY RECALL OPERATION

1 Set a new memory seat position for driver 1 and driver 2.

2 Activate the memory recall for driver position 1 and driver position 2 from the memory set switch.


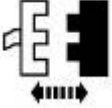
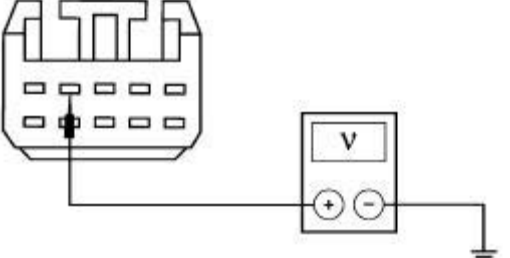
● **Do the memory recall functions operate correctly?**

→ **Yes**
The driver power seat is operating correctly. REVERIFY symptom.

→ **No**
CHECK the DDM for any memory function related DTCs. REPAIR as necessary. REFER to the DDM Diagnostic Trouble Code (DTC) Index.

CHECK for any DSM DTCs. REPAIR as necessary. REFER to the DSM Diagnostic Trouble Code (DTC) Index. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

PINPOINT TEST H: THE HEATED SEAT IS INOPERATIVE — DRIVER


CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK FOR VOLTAGE TO THE HEATED SEAT MODULE — CIRCUIT 30-HC21 (RD)	
<p>NOTE: If a seat equipped with a seat mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced, the airbag system must be deactivated. Refer to Section 501-20B.</p> <p>NOTE: Restraint system diagnostic tools MUST be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p> <p>NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.</p> <p>NOTE: After diagnosing/repairing a seat system the restraint system diagnostic tools must be removed before operating the vehicle over the road.</p>	
<p>1</p>  <p>3</p>  <p>Driver Heated Seat Module C359</p> <p>4</p>  <p>GR3561-A</p>	<p>2 Deactivate the system. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.</p> <p>4 Measure the voltage between driver heated seat module C359 pin 4, circuit 30-HC21 (RD), harness side and ground.</p>

● Is the voltage greater than 10 volts?

→ **Yes**
GO to H2.

→ **No**
REPAIR circuit 30-HC21 (RD). TEST the system for normal operation.
REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

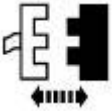
H2 CHECK FOR VOLTAGE TO THE HEATED SEAT SWITCH — CIRCUIT 20-HC17 (PK/YE)

 **WARNING:** The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



2

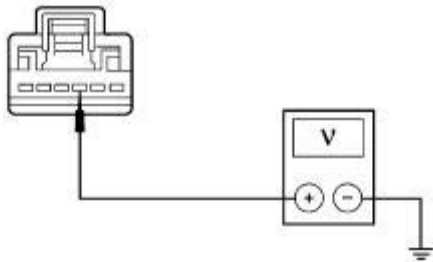


Driver Heated Seat Switch C344

3



4



A0005661

4 Measure the voltage between driver heated seat switch C344 pin 3, circuit 20-HC17 (PK/YE), harness side and ground.


● Is the voltage greater than 10 volts?

→ **Yes**
GO to H3.

→ **No**
REPAIR circuit 20-HC17 (PK/YE). TEST the system for normal operation.

REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

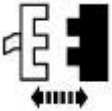
H3 CHECK FOR VOLTAGE TO THE HEATED SEAT MODULE — CIRCUIT 15-HC21 (GN/BK)

 **WARNING:** The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



2

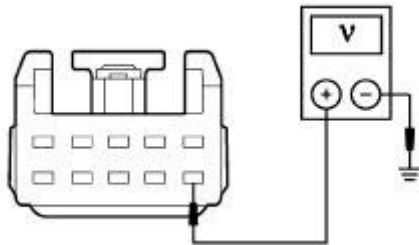


Driver Heated Seat Module C359

3



4



A0003088


4 Measure the voltage between heated seat module C359 pin 6, circuit 15-HC21 (GN/BK), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to [H4](#).

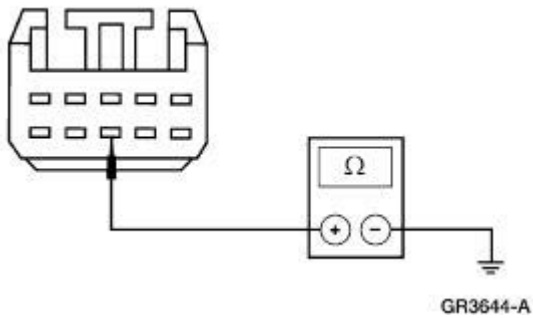
→ **No**
REPAIR circuit 15-HC21 (GN/BK). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

H4 CHECK DRIVER HEATED SEAT MODULE GROUND — CIRCUIT 31-HC21 (BK)

 **WARNING:** The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1

1 Measure the resistance between driver



heated seat module C359 pin 8, circuit 31-HC21 (BK), harness side and ground.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to H5.

→ **No**
REPAIR circuit 31-HC21 (BK). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

H5 CHECK FOR VOLTAGE TO THE HEATED SEAT MODULE

1



2

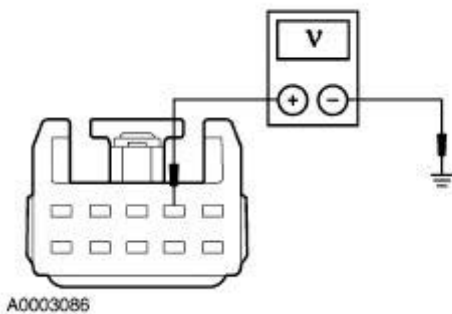


Driver Heated Seat Module C359

3



4




- 4 Measure the voltage between driver heated seat module C359 pin 2, circuit 20S-HC21 (PK/BK), harness side and ground while pressing and holding the heated seat switch.

- Is the voltage greater than 10 volts?

→ **Yes**
GO to H7.

→ **No**
GO to H6.

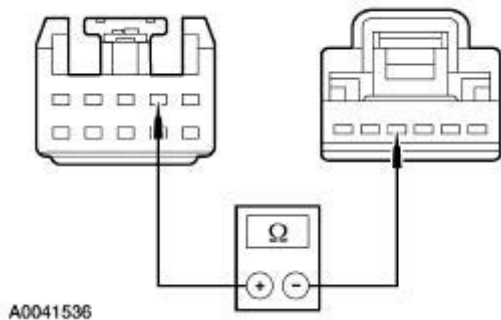
H6 CHECK CIRCUIT 20S-HC21 (PK/BK) FOR OPEN

 **WARNING:** The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



2




2 Measure the resistance between driver heated seat module C359 pin 2, circuit 20S-HC21 (PK/BK), and driver heated seat switch C344 pin 4, circuit 20S-HC21 (PK/BK), harness side.

● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new heated seat switch.
TEST the system for normal operation.
REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

→ **No**
REPAIR circuit 20S-HC21 (PK/BK).
TEST the system for normal operation.
REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

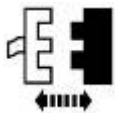
H7 CHECK THE HEATED SEAT CIRCUITRY FOR OPEN AND SHORT TO GROUND

 **WARNING:** The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1

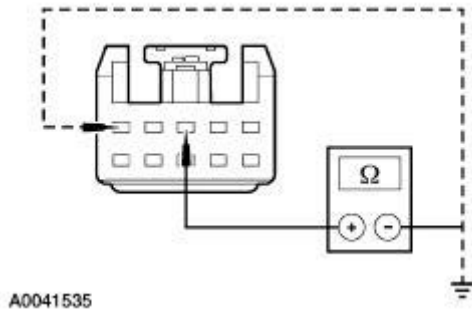


2



Driver Heated Seat Module 359

3



3

Measure the resistance between heated seat module C359 pin 3, circuit 20S-HC17 (PK), and heated seat module C359 pin 5, circuit 31S-HC16 (BK/BU); and between heated seat module C359, circuit 20S-HC17 (PK), harness side and ground.

- Is the resistance less than 5 ohms between the two connectors and greater than 10,000 ohms between the heated seat module connector and ground?

→ Yes

INSTALL a new heated seat module. REFER to [Heated Seat Module](#) in this section. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

→ No

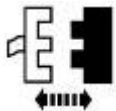
GO to [H8](#).

H8 CHECK CIRCUIT 20S-HC17 (PK) FOR OPEN AND SHORT TO GROUND



WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1

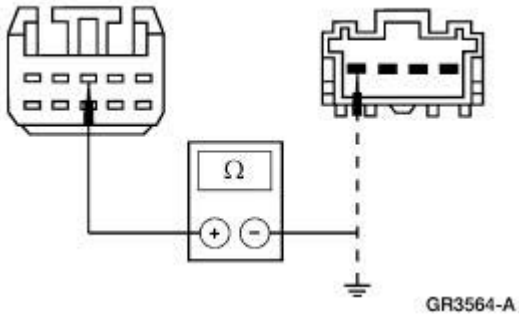


Driver Heated Seat Cushion C364

2

2

Measure the resistance between heated seat module C359 pin 3, circuit 20S-HC17 (PK), and seat cushion heater C364 pin 1, circuit 20S-HC17 (PK); and between heated seat module C359 pin 3, circuit 20S-HC17 (PK), harness side and ground.



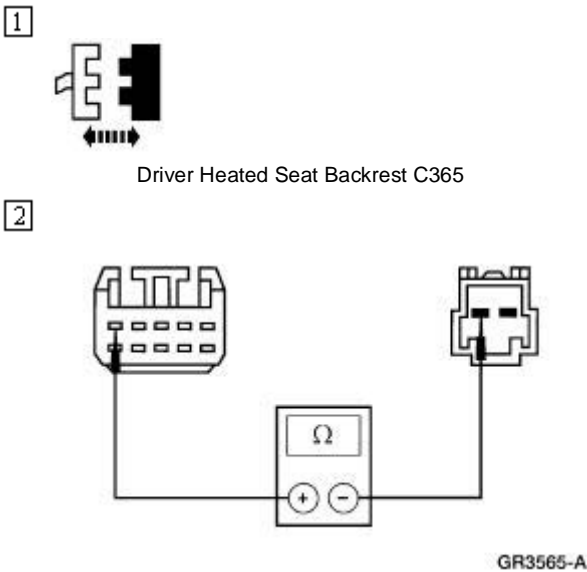
- Is the resistance less than 5 ohms between the two connectors and greater than 10,000 ohms between the seat module connector and ground?

→ **Yes**
GO to H9.

→ **No**
REPAIR circuit 20S-HC17 (PK). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

H9 CHECK CIRCUIT 31S-HC16 (BK/BU) FOR OPEN

⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.




2 Measure the resistance between heated seat module C359 pin 5, circuit 31S-HC16 (BK/BU), and seat back heater C365 pin 2, circuit 31S-HC16 (BK/BU), harness side.

- Is the resistance less than 5 ohms?

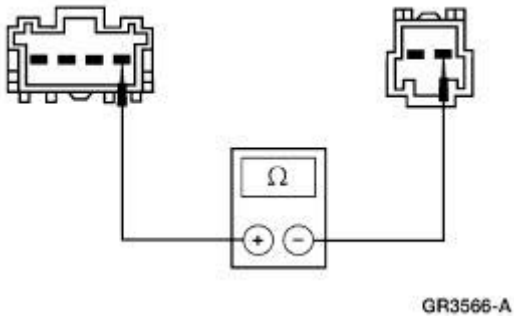
→ **Yes**
GO to H10.

→ **No**
REPAIR circuit 31S-HC16 (BK/BU).
TEST the system for normal operation.
REACTIVATE the supplemental restraint system (SRS). REFER to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

H10 CHECK CIRCUIT 20S-HC16 (PK/BU) FOR OPEN

 **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

1




1 Measure the resistance between seat back heater C365 pin 1, circuit 20S-HC16 (PK/BU), and seat cushion heater C364 pin 4, circuit 20S-HC16 (PK/BU), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to [H11](#).

→ **No**
REPAIR circuit 20S-HC16 (PK/BU).
TEST the system for normal operation.
REACTIVATE the supplemental restraint system (SRS). REFER to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

H11 CHECK THE HEATED SEAT TEMPERATURE SENSOR CIRCUITRY FOR CONTINUITY

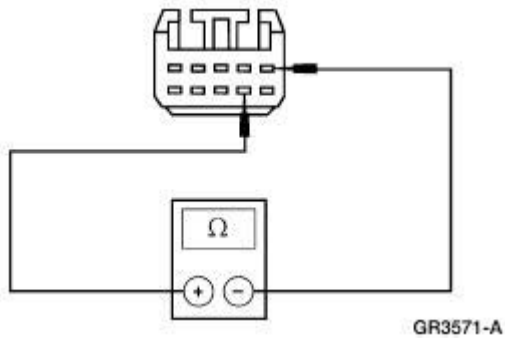
 **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

1



2

2 Measure the resistance between heated seat module C359 pin 7, circuit 8-HC23 (WH/BK), and heated seat module C359 pin 1, circuit 9-HC23 (BN/YE), harness side.



- Is the resistance less than 300,000 ohms and greater than 50 ohms?

→ Yes

INSTALL a new heated seat module. REFER to Heated Seat Module in this section. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

→ No

GO to H12.

H12 CHECK CIRCUIT 8-HC23 (WH/BK) FOR OPEN AND SHORT TO GROUND

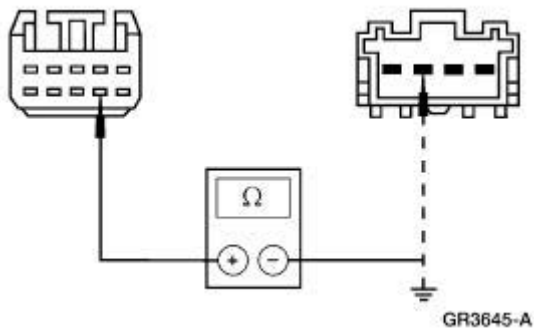
⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



Driver Heated Seat Cushion C364

2



2

Measure the resistance between heated seat module C359 pin 7, circuit 8-HC23 (WH/BK), and seat cushion heater C364 pin 2, circuit 8-HC23 (WH/BK); and between heated seat module C359 pin 7, circuit 8-HC23 (WH/BK), harness side and ground.

- Is the resistance less than 5 ohms between the two connectors and greater than 10,000 ohms between the heated seat module connector and ground?

→ Yes

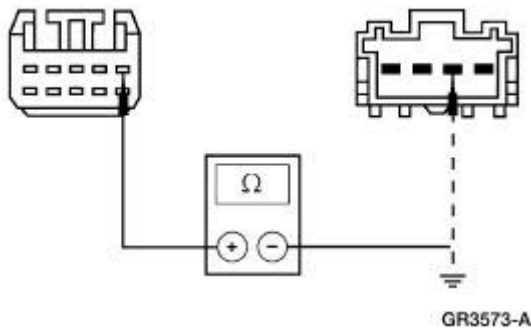
GO to [H13](#).

→ **No**
REPAIR circuit 8-HC23 (WH/BK). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

H13 CHECK CIRCUIT 9-HC23 (BN/YE) FOR OPEN AND SHORT TO GROUND

⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



1

Measure the resistance between heated seat module C359 pin 1, circuit 9-HC23 (BN/YE), and seat cushion heater C364 pin 3, circuit 9-HC23 (BN/YE); and between heated seat module C359 pin 1, circuit 9-HC23 (BN/YE), harness side and ground.

- Is the resistance less than 5 ohms between the two connectors and greater than 10,000 ohms between the heated seat module connector and ground?

→ **Yes**
INSTALL a new seat cushion. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

→ **No**
REPAIR circuit 9-HC23 (BN/YE). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

PINPOINT TEST I: THE HEATED SEAT IS INOPERATIVE — PASSENGER

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 CHECK FOR VOLTAGE TO THE HEATED SEAT MODULE — CIRCUIT 30-HC22 (RD)	
NOTE: If a seat equipped with a seat mounted side airbag and/or a safety belt pretensioner (if	

equipped) system is being serviced, **the airbag system must be deactivated.** Refer to [Section 501-20B](#).

NOTE: Restraint system diagnostic tools **MUST** be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.

NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

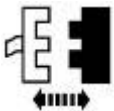
NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.

NOTE: After diagnosing/repairing a seat system **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

1

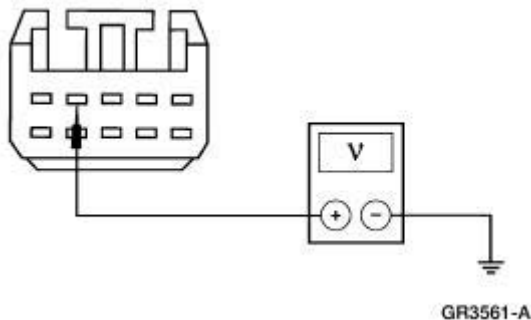


3



Passenger Heated Seat Module C329

4



2

Deactivate the system. Refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

4

Measure the voltage between passenger heated seat module C329 pin 4, circuit 30-HC22 (RD), harness side and ground.


● Is the voltage greater than 10 volts?

→ **Yes**
GO to [12](#).

→ **No**
REPAIR circuit 30-HC22 (RD). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to [Supplemental Restraint System \(SRS\) Deactivation](#)

and Reactivation in this section.

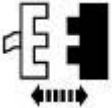
12 CHECK FOR VOLTAGE TO THE HEATED SEAT SWITCH — CIRCUIT 20-HC9 (PK/BK)

 **WARNING:** The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



2

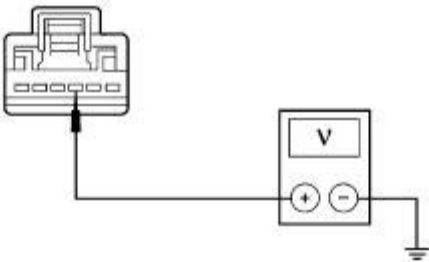


Passenger Heated Seat Switch C342

3



4



A0005661

4 Measure the voltage between the passenger heated seat switch C342 pin 3, circuit 20-HC9 (PK/BK), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to 13.

→ **No**
REPAIR circuit 20-HC9 (PK/BK). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation.

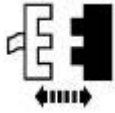
13 CHECK FOR VOLTAGE TO THE HEATED SEAT MODULE — CIRCUIT 15-HC22 (GN/YE)

 **WARNING:** The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



2

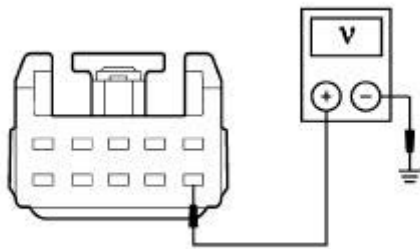


Passenger Heated Seat Module C329

3



4



A0003088

4 Measure the voltage between heated seat module C329 pin 6, circuit 15-HC22 (GN/YE), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to 4.

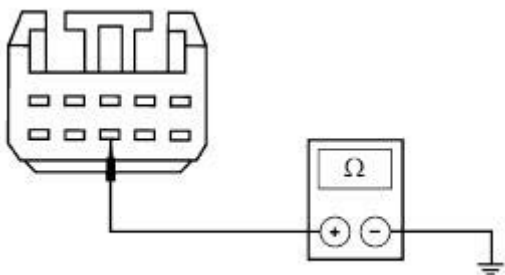
→ No
REPAIR circuit 15-HC22 (GN/YE). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

I4 CHECK PASSENGER HEATED SEAT MODULE GROUND — CIRCUIT 31-HC22 (BK)



WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



GR3644-A

1 Measure the resistance between heated seat module C329 pin 8, circuit 31-HC22 (BK), harness side and ground.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to 15.

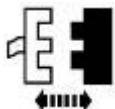
→ **No**
REPAIR circuit 31-HC22 (BK). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

15 CHECK FOR VOLTAGE TO THE HEATED SEAT MODULE

1

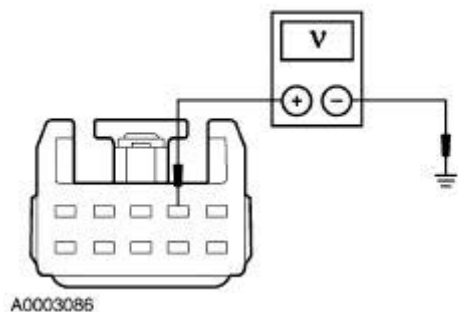


2



Passenger Heated Seat Module C329

3



3 Measure the voltage between heated seat module C329 pin 2, circuit 20S-HC22 (PK/YE), harness side and ground while pressing and holding the heated seat switch.

- Is the voltage greater than 10 volts?

→ **Yes**
GO to 17.

→ **No**
GO to 16.

16 CHECK CIRCUIT 20S-HC22 (PK/YE) FOR OPEN

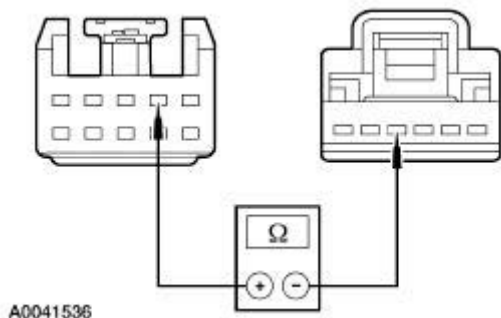


WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



2



2

Measure the resistance between passenger heated seat module C329 pin 2, circuit 20S-HC22 (PK/YE), and passenger heated seat switch C342 pin 4, circuit 20S-HC22 (PK/YE), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new heated seat switch.
TEST the system for normal operation.
REACTIVATE the supplemental restraint system (SRS). REFER to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

→ **No**
REPAIR circuit 20S-HC22 (PK/YE).
TEST the system for normal operation.
REACTIVATE the supplemental restraint system (SRS). REFER to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

17 CHECK THE HEATED SEAT CIRCUITRY FOR OPEN AND SHORT TO GROUND

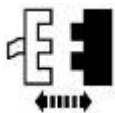


WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



2

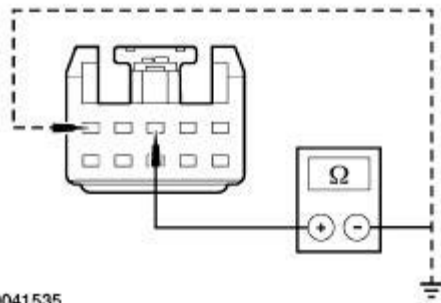


Passenger Heated Seat Module C329

3

3

Measure the resistance between heated seat module C329 pin 3, circuit 20S-HC20 (PK/WH), and heated seat module C329 pin 5, circuit 31S-HC19 (BK/RD); and between heated seat module C329 pin 5, circuit 20S-HC20 (PK/WH), harness side and ground.



A0041535

- Is the resistance less than 5 ohms between the two connectors and greater than 10,000 ohms between the heated seat module connector and ground?

→ **Yes**

INSTALL a new heated seat module. REFER to [Heated Seat Module](#) in this section. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

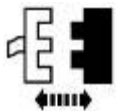
→ **No**

GO to [18](#).

18 CHECK CIRCUIT 20S-HC20 (PK/WH) FOR OPEN AND SHORT TO GROUND

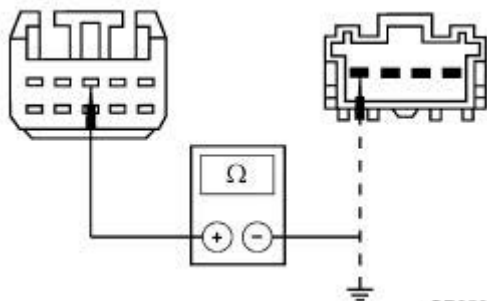
⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



Passenger Heated Seat Cushion C334

2



GR3564-A

2

Measure the resistance between heated seat module C329 pin 3, circuit 20S-HC20 (PK/WH), and seat cushion heater C334 pin 1, circuit 20S-HC20 (PK/WH), and between heated seat module C329 pin 3, circuit 20S-HC20 (PK/WH), harness side and ground.

- Is the resistance less than 5 ohms between the two connectors and greater than 10,000 ohms between the seat module connector and

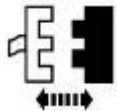
ground?

- **Yes**
GO to 19.
- **No**
REPAIR circuit 20S-HC20 (PK/WH).
TEST the system for normal operation.
REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

19 CHECK CIRCUIT 31S-HC19 (BK/RD) FOR OPEN

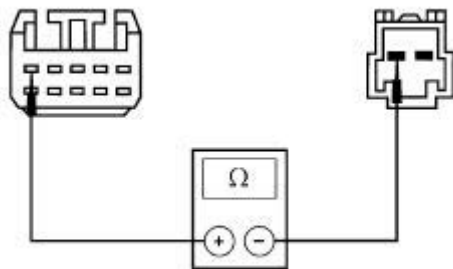
⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



Passenger Heated Seat Backrest C335

2



GR3565-A

2

Measure the resistance between heated seat module C329 pin 5, circuit 31S-HC19 (BK/RD), and seat back heater C335 pin 2, circuit 31S-HC19 (BK/RD), harness side.

● **Is the resistance less than 5 ohms?**

- **Yes**
GO to 110.
- **No**
REPAIR circuit 31S-HC19 (BK/RD).
TEST the system for normal operation.
REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

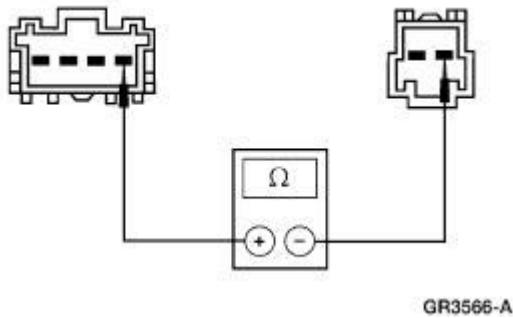
110 CHECK CIRCUIT 20S-HC19 (PK/OG) FOR OPEN

⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1

1

Measure the resistance between seat back heater C335 pin 1, circuit 20S-HC19 (PK/OG), and seat cushion




heater C334 pin 4, circuit 20S-HC19 (PK/OG), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to I11.

→ **No**
REPAIR circuit 20S-HC19 (PK/OG). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

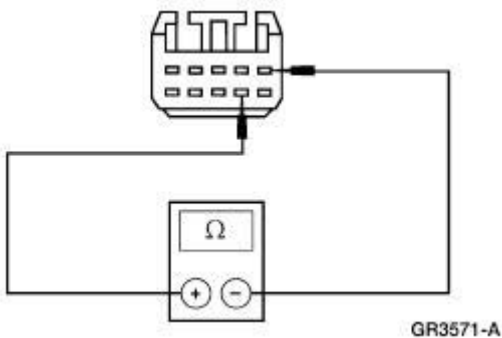
I11 CHECK THE HEATED SEAT TEMPERATURE SENSOR CIRCUITRY FOR CONTINUITY

 **WARNING:** The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



2



- 2 Measure the resistance between heated seat module C329 pin 7, circuit 8-HC24 (WH/RD), and heated seat module C329 pin 1, circuit 9-HC24 (BN/RD), harness side.

- Is the resistance less than 300,000 ohms and greater than 50 ohms?

→ **Yes**
INSTALL a new heated seat module. REFER to Heated Seat Module in this section. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint

System (SRS) Deactivation and Reactivation in this section.

→ **No**
GO to I12.

I12 CHECK CIRCUIT 8-HC24 (WH/RD) FOR OPEN AND SHORT TO GROUND

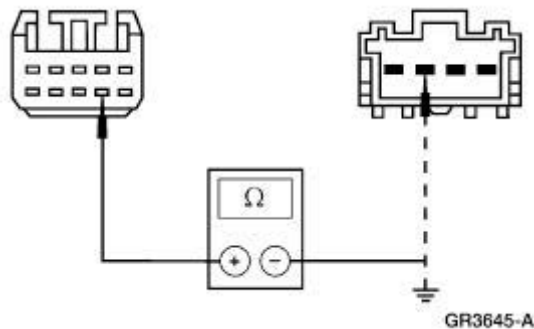
⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1



Passenger Heated Seat Cushion C334

2



2

Measure the resistance between heated seat module C329 pin 7, circuit 8-HC24 (WH/RD), and seat cushion heater C334 pin 2, circuit 8-HC24 (WH/RD), and between heated seat module C329 pin 7, circuit 8-HC24 (WH/RD), harness side and ground.

- **Is the resistance less than 5 ohms between the two connectors and greater than 10,000 ohms between the heated seat module connector and ground?**

→ **Yes**
GO to I13.

→ **No**
REPAIR circuit 8-HC24 (WH/RD). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

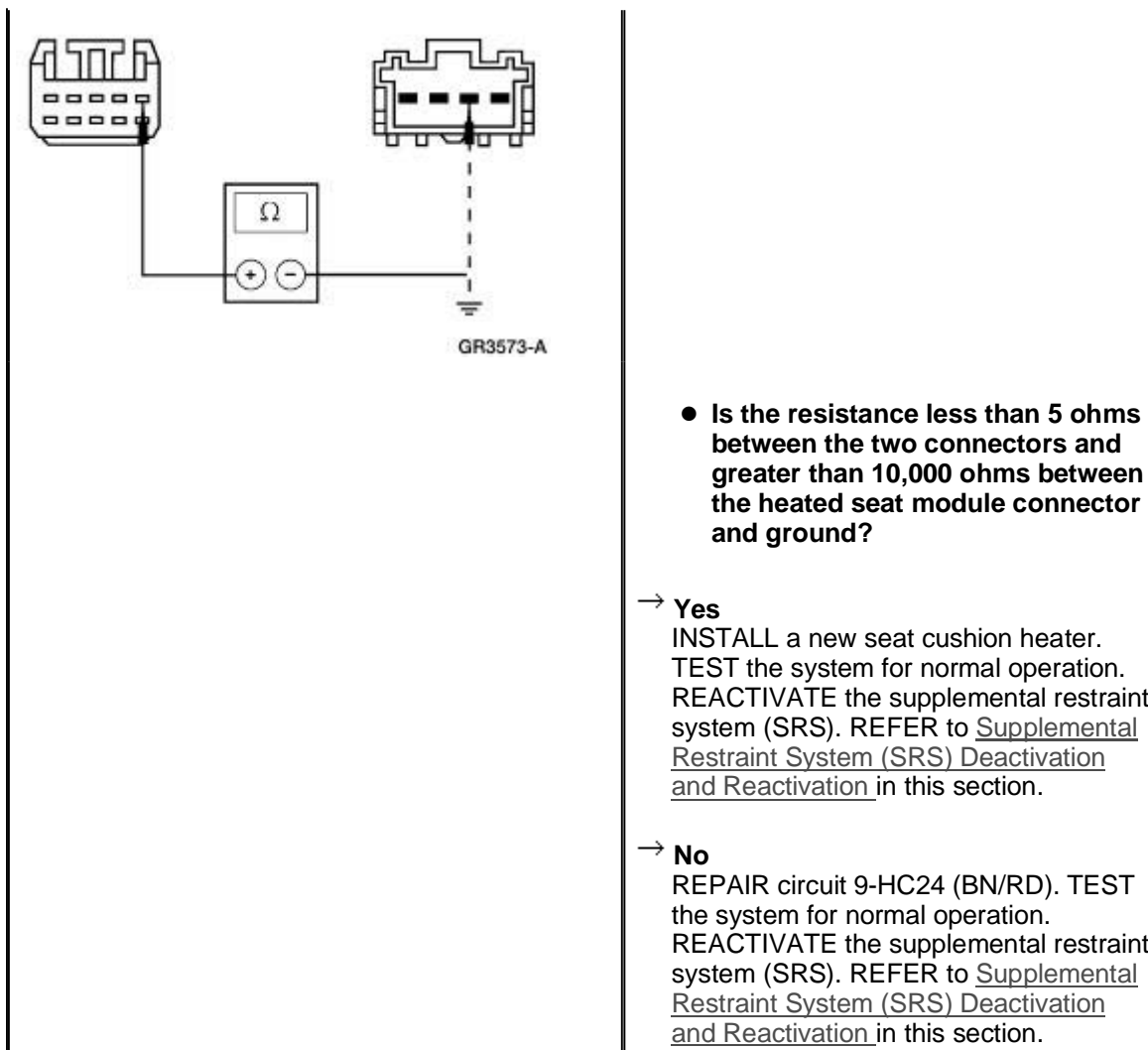
I13 CHECK CIRCUIT 9-HC24 (BN/RD) FOR OPEN AND SHORT TO GROUND

⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

1

1

Measure the resistance between heated seat module C329 pin 1, circuit 9-HC24 (BN/RD), and seat cushion heater C334 pin 3, circuit 9-HC24 (BN/RD), and between heated seat module C329 pin 1, circuit 9-HC24 (BN/RD), harness side and ground.



PINPOINT TEST J: THE HEATED SEATS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 CHECK THE IGNITION INPUT TO THE HEATED SEAT SWITCHES	<p>NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced the airbag system must be deactivated per the deactivation procedure contained in Section 501-20B .</p> <p>NOTE: Airbag simulators (Restraint system diagnostic tools) MUST be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p> <p>NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.</p> <p>NOTE: After diagnosing/repairing a seat system, The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p>

2



3

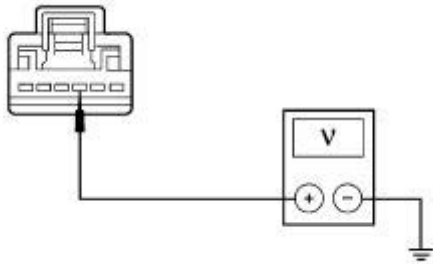


Driver Heated Seat Switch C344

4



5



A0005661

1 Deactivate the supplemental restraint system (SRS). Refer to [Section 501-20B](#).

5 Measure the voltage between driver heated seat switch C344 pin 3, circuit 20-HC6 (PK/YE), harness side and ground.

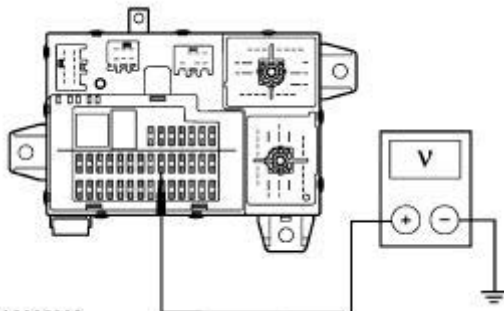
• Is the voltage greater than 10 volts?

→ Yes
GO to [J8](#).

→ No
GO to [J2](#).

J2 CHECK CIRCUIT 20-HC6 (PK/YE) FOR AN OPEN

1



A0005662

1 Measure voltage between CJB fuse 216 (5A), output side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

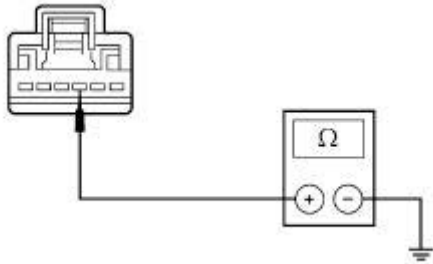
→ **No**
GO to [J3](#).

J3 CHECK CIRCUIT 20-HC6 (PK/YE) FOR A SHORT TO GROUND

1



2



A0005663

2 Measure the resistance between driver heated seat switch C344 pin 3, circuit 20-HC6 (PK/YE), harness side and ground.

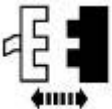
- Is the resistance less than 5 ohms?

→ **Yes**
GO to [J4](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

J4 CHECK CIRCUIT 20S-HC21 (PK/BK) FOR A SHORT TO GROUND

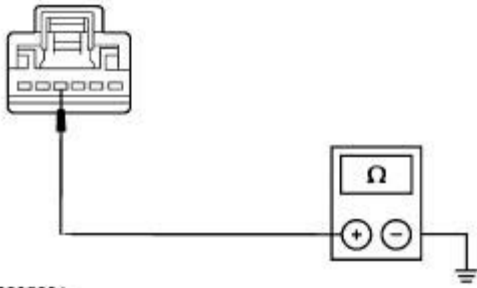
1



Driver Heated Seat Module C359

2

2 Measure the resistance between driver heated seat switch C344 pin 4, circuit 20S-HC21 (PK/BK), harness side and ground.



A0005664

- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to J5.

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

J5 CHECK CIRCUIT 20S-HC22 (PK/YE) FOR A SHORT TO GROUND

1



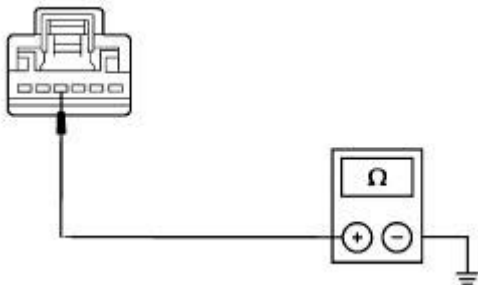
Passenger Heated Seat Module C329

2



Passenger Heated Seat Switch C342

3



A0005664

- 3 Measure the resistance between passenger heated seat switch C342 pin 4, circuit 20S-HC22 (PK/YE), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to J6.

→ **Yes**

REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

J6 CHECK THE PASSENGER HEATED SEAT MODULE FOR A SHORT

1



Passenger Heated Seat Switch C342

2



Passenger Heated Seat Module C329

4



3 Install a new CJB fuse 216 (5A).

5 Press the passenger heated seat switch to ON.

• Is CJB fuse 216 (5A) OK?

→ **Yes**
GO to [J7](#).

→ **No**
INSTALL a new passenger heated seat module. REFER to [Heated Seat Module](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

J7 CHECK THE DRIVER HEATED SEAT MODULE FOR A SHORT

1



Driver Heated Seat Switch C344

2



Driver Heated Seat Module C359

3



4 Press the driver heated seat switch to ON.

● Is CJB fuse 216 (5A) OK?

→ Yes

CHECK the driver and passenger system for an intermittent short to ground. REVERIFY the symptom. REFER to the Symptom Chart.

→ No

INSTALL a new driver heated seat module. REFER to [Heated Seat Module](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

J8 CHECK THE ANTI-THEFT OPERATION

NOTE: The anti-theft system and heated seat system use a common fuse. CJB Fuse 205 (5A) supplies ignition power to both the anti-theft system and heated seat system.

1 Check the anti-theft system operation. Refer to [Section 419-01A](#).

● Does the anti-theft system operate?

→ Yes

GO to [J9](#).

→ No

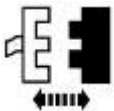
REFER to [Section 419-01A](#) to repair the anti-theft system operation. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#)

J9 CHECK CIRCUIT 15-HC21 (GN/BK) FOR AN OPEN

1



2

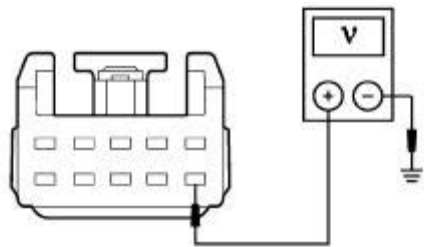


Driver Heated Seat Module C359

3



4



A0003088

4

Measure the voltage between driver heated seat module C359 pin 6, circuit 15-HC21 (GN/BK), harness side and ground.

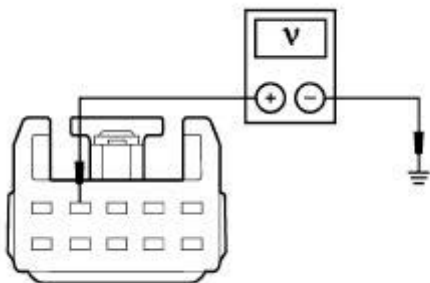
• **Is the voltage greater than 10 volts?**

→ **Yes**
GO to J10.

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

J10 CHECK THE COMMON BATTERY SUPPLY

1



A0003089

1

Measure the voltage between driver heated seat module C359 pin 4, circuit 30-HC21 (RD), harness side and ground.

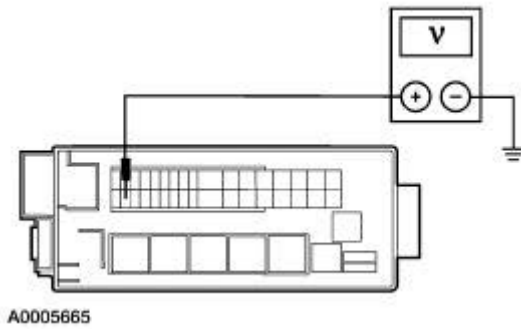
• **Is the voltage greater than 10 volts?**

→ **Yes**
The heated seat system is operating correctly. CHECK each system independently. REVERIFY the symptom. REFER to the Symptom Chart.

→ **No**
GO to J11.

J11 CHECK CIRCUIT 30-HC21 (RD) FOR AN OPEN

1



1 Measure voltage between BJB fuse 411 (15A) and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**
GO to [J12](#).

J12 CHECK CIRCUIT 30-HC21 (RD) FOR A SHORT TO GROUND

1

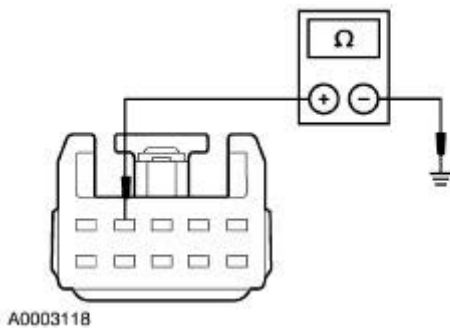


2



Passenger Heated Seat Module C329

3



3 Measure the resistance between driver heated seat module C359 pin 4, circuit 30-HC21 (RD), harness side and ground.

• Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to [J13](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

J13 CHECK FOR A SHORTED PASSENGER HEATED SEAT SYSTEM

1



Passenger Heated Seat Module C329

3



2 Install a new BJB fuse 411 (15A).

4 Press the passenger heated seat switch to ON.

● Is rear BJB fuse 411 (15A) OK?

→ **Yes**
GO to J15.

→ **No**
GO to J14.

J14 CHECK FOR A SHORTED PASSENGER HEATING ELEMENT CIRCUIT

1

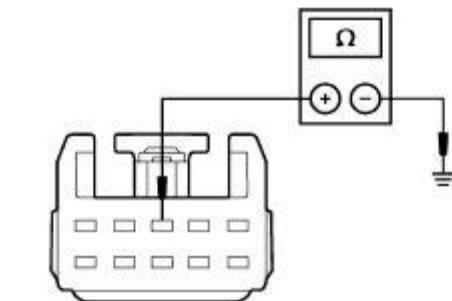


2



Passenger Heated Seat Module C329

3



A0003119

3 Measure the resistance between passenger heated seat module C329 pin 3, circuit 20S-HC20 (PK/WH), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**

INSTALL a new passenger heated seat module. REFER to Heated Seat Module. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

→ **No**

REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

J15 CHECK FOR A SHORTED DRIVER HEATED SEAT SYSTEM

1



Driver Heated Seat Module C359

2



3 Press the driver heated seat switch to ON.

- Is rear BJB fuse 411 (15A) OK?

→ **Yes**

The heated seat system is operating correctly. CHECK each system independently. REVERIFY the symptom. REFER to the Symptom Chart.

→ **No**

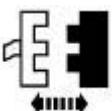
GO to J16.

J16 CHECK FOR A SHORTED DRIVER HEATING ELEMENT CIRCUIT

1

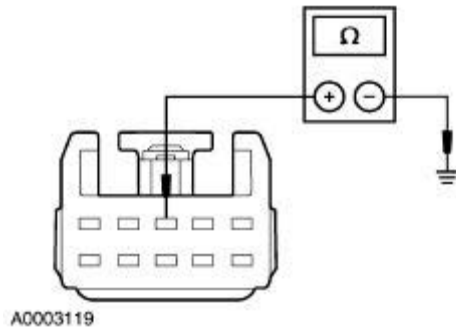


2



Driver Heated Seat Module C359

3



3

Measure the resistance between driver heated seat module C359 pin 3, circuit 20S-HC17 (BK), harness side and ground.

- **Is the resistance greater than 10,000 ohms?**

→ **Yes**

INSTALL a new driver heated seat module. REFER to [Heated Seat Module](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

PINPOINT TEST K: THE POWER LUMBAR IS INOPERATIVE — DRIVER

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 CHECK THE DRIVER POWER SEAT OPERATION	
<p>NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced the airbag system must be deactivated per the deactivation procedure contained in Section 501-20B.</p>	
<p>NOTE: Airbag simulators (Restraint system diagnostic tools) MUST be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.</p>	
<p>NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p>	
<p>NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.</p>	

NOTE: After diagnosing/repairing a seat system, **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

1 Operate the driver power seat.

● **Does the power seat operate?**

→ **Yes**
GO to K2.

→ **No**
Go To Pinpoint Test C.

K2 CHECK CIRCUIT 30-AH40 (RD) FOR AN OPEN

1 Deactivate the supplemental restraint system (SRS). Refer to Section 501-20B.

2



3

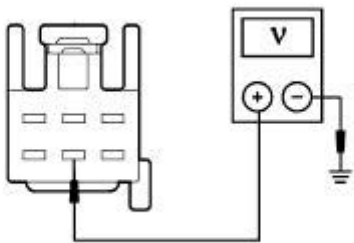


Driver Seat Lumbar Control Switch C361

4



5



A0003120

5 Measure the voltage between the driver seat lumbar control switch C361 pin 5, circuit 30-AH40 (RD), harness side and ground.

● **Is the voltage greater than 10 volts?**

→ **Yes**
GO to K3.

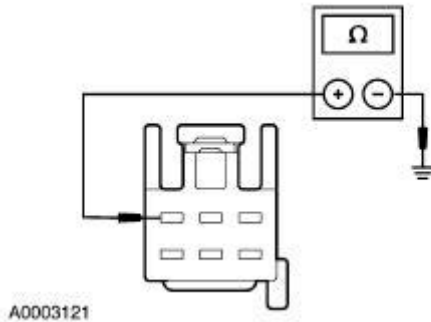
→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-

K3 CHECK CIRCUIT 31-AH40 (BK) FOR AN OPEN

1



2



2

Measure the resistance between driver seat lumbar control switch C361 pin 3, circuit 31-AH40 (BK), harness side and ground.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to K4.

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

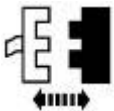
K4 CHECK THE DRIVER SEAT LUMBAR MOTOR

1



Driver Seat Lumbar Control Switch C361

2

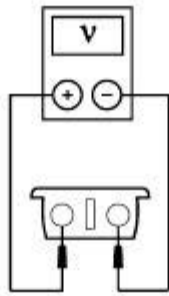


Driver Seat Lumbar Motor C366

3

3

Measure the voltage between driver seat lumbar motor C366, circuit 32-AH39 (WH/BU), harness side and driver seat lumbar motor C366, circuit 33-AH39 (YE/BU), harness side.



A0003122

4 Operate the driver seat lumbar control switch in both directions.

● Is the voltage greater than 10 volts?

→ **Yes**
 INSTALL a new driver seat lumbar motor. REFER to Motor—Front Seat Lumbar. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

→ **No**
 GO to K5.

K5 CHECK CIRCUIT 32-AH39 (WH/BU) AND 33-AH39 (YE/BU) FOR A SHORT TO GROUND

1

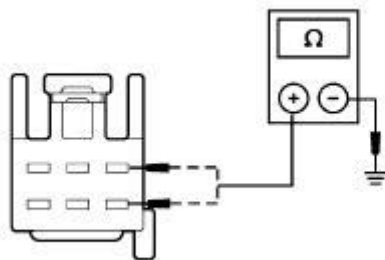


2



Driver Seat Lumbar Control Switch C361

3



A0003060

3 Measure the resistance between driver seat lumbar control switch C361 pin 1, circuit 32-AH39 (WH/BU), harness side and ground; and between driver seat lumbar control switch C361 pin 4, circuit 33-AH39 (YE/BU), harness side and ground.

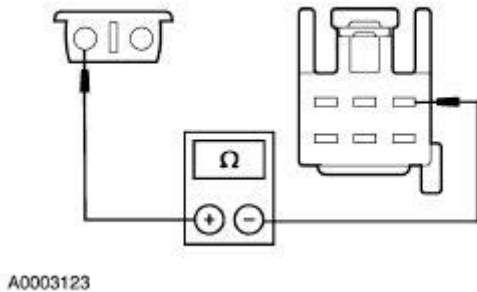
● Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to [K6](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

K6 CHECK CIRCUIT 32-AH39 (WH/BU) FOR AN OPEN

1



1

Measure the resistance between driver seat lumbar control switch C361 pin 1, circuit 32-AH39 (WH/BU), harness side and driver seat lumbar motor C366, circuit 32-AH39 (WH/BU), harness side.

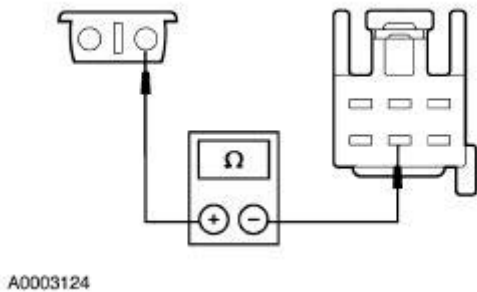
- Is the resistance less than 5 ohms?

→ **Yes**
GO to [K7](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

K7 CHECK CIRCUIT 33-AH39 (YE/BU) FOR AN OPEN

1



1

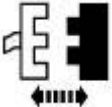
Measure the resistance between driver seat lumbar control switch C361 pin 4, circuit 33-AH39 (YE/BU), harness side and driver seat lumbar motor C366, circuit 33-AH39 (YE/BU), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new driver seat lumbar

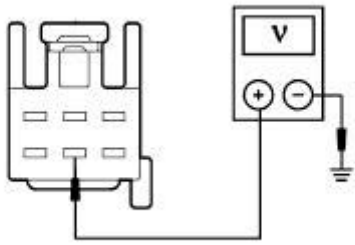
	<p>control switch. REFER to Lumbar Control Switch . TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B .</p> <p>→ No REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B .</p>
--	--

PINPOINT TEST L: THE POWER LUMBAR IS INOPERATIVE — PASSENGER

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1 CHECK THE PASSENGER POWER SEAT OPERATION	
<p>NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced the airbag system must be deactivated per the deactivation procedure contained in Section 501-20B .</p> <p>NOTE: Airbag simulators (Restraint system diagnostic tools) MUST be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p> <p>NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.</p> <p>NOTE: After diagnosing/repairing a seat system, The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p>	
	<p>1 Operate the passenger power seat.</p> <p style="padding-left: 40px;">● Does the power seat operate?</p> <p>→ Yes GO to L2 .</p> <p>→ No Go To Pinpoint Test D .</p>
L2 CHECK CIRCUIT 30-AH46 (RD) FOR AN OPEN	
<p>1</p> 	<p>1 Deactivate the supplemental restraint system (SRS). Refer to Section 501-20B .</p>

Passenger Seat Lumbar Control Switch C331

2



A0003120

2 Measure the voltage between the passenger seat lumbar control switch C331 pin 5, circuit 30-AH46 (RD), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to L3.

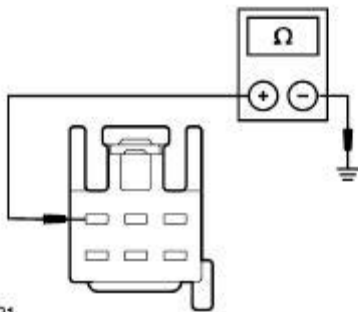
→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

L3 CHECK CIRCUIT 31-XL20 (BK) FOR AN OPEN

1



2



A0003121

2 Measure the resistance between passenger seat lumbar control switch C331 pin 3, circuit 31-AH46 (BK), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to L4.

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint

system (SRS). REFER to [Section 501-20B](#).

L4 CHECK THE PASSENGER SEAT LUMBAR MOTOR

1



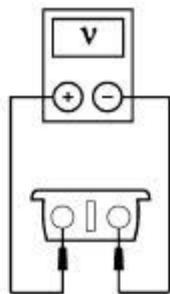
Passenger Seat Lumbar Control Switch C331

2



Passenger Seat Lumbar Motor C336

3



A0003122

3

Measure the voltage between passenger seat lumbar motor C336, circuit 32-AH23 (WH/BU), harness side and passenger seat lumbar motor C336, circuit 33-AH23 (YE/BU), harness side.

4

Operate the passenger seat lumbar control switch in both directions.

- **Is the voltage greater than 10 volts?**

→ **Yes**

INSTALL a new driver seat lumbar motor. REFER to [Motor—Front Seat Lumbar](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

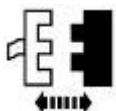
GO to [L5](#).

L5 CHECK CIRCUIT 32-AH45 (WH/BU) AND 33-AH45 (YE/BU) FOR A SHORT TO GROUND

1

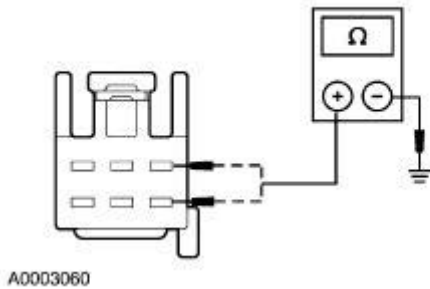


2



Passenger Seat Lumbar Control Switch C331

3



3

Measure the resistance between passenger seat lumbar control switch C331 pin 1, circuit 32-AH45 (WH/BU), harness side and ground; and between passenger seat lumbar control switch C331 pin 4, circuit 33-AH45 (YE/BU), harness side and ground.

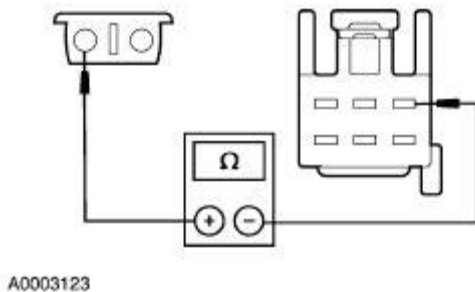
- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to L6.

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

L6 CHECK CIRCUIT 32-AH45 (WH/BU) FOR AN OPEN

1



1

Measure the resistance between passenger seat lumbar control switch C331 pin 1, circuit 32-AH45 (WH/BU), harness side and passenger seat lumbar motor C336, circuit 32-AH45 (WH/BU), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to L7.

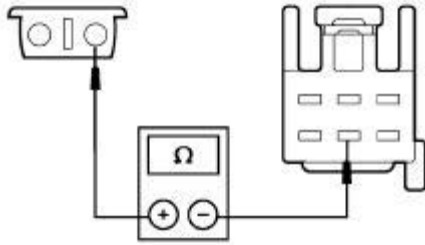
→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

L7 CHECK CIRCUIT 33-AH45 (YE/BU) FOR AN OPEN

1

1

Measure the resistance between passenger seat lumbar control switch



A0003124

C331 pin 4, circuit 33-AH45 (YE/BU), harness side and passenger seat lumbar motor C336, circuit 33-AH23 (YE/BU), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**

INSTALL a new passenger seat lumbar control switch. REFER to Lumbar Control Switch . TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B .


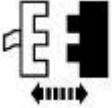

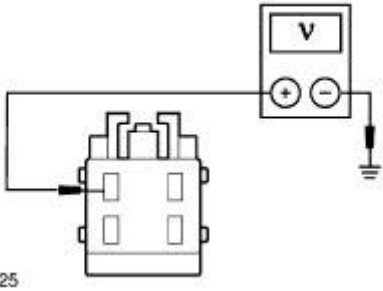
→ **No**

REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B .

PINPOINT TEST M: DTC B1676 BATTERY PACK VOLTAGE OUT OF RANGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1 CHECK FOR VOLTAGE AT THE DSM	
<p>NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced the airbag system must be deactivated per the deactivation procedure contained in <u>Section 501-20B</u> .</p>	
<p>NOTE: Airbag simulators (Restraint system diagnostic tools) MUST be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.</p>	
<p>NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p>	
<p>NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.</p>	
<p>NOTE: After diagnosing/repairing a seat system, The restraint system diagnostic tools must</p>	

be removed prior to operating the vehicle over the road.

<p>1</p>  <p>3</p>  <p>DSM C341b</p> <p>4</p>  <p>5</p>  <p>A0003125</p>	<p>2</p> <p>Deactivate the supplemental restraint system (SRS). Refer to Section 501-20B.</p> <p>5</p> <p>Measure the voltage between DSM C341b pin 4, circuit 30-AH80 (RD), harness side and ground.</p> <ul style="list-style-type: none"> • Is the voltage between 11.5 and 16 volts? <p>→ Yes CLEAR the DTC. REPEAT the DSM self-test. If DTC B1676 is retrieved, INSTALL a new DSM. REFER to Section 419-10. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.</p> <p>→ No REFER to Section 414-00 for battery and charging system repair.</p>
---	---

PINPOINT TEST N: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY — DRIVER

CONDITIONS	DETAILS/RESULTS/ACTIONS
N1 CHECK HORIZONTAL DIRECTION MOTOR FOR CORRECT OPERATION	



NOTE: If a seat equipped with a side mounted side airbag and/or a safety belt pretensioner (if equipped) system is being serviced **the airbag system must be deactivated** per the deactivation procedure contained in [Section 501-20B](#).

NOTE: Airbag simulators (Restraint system diagnostic tools) **MUST** be installed under the seats in the side airbag and safety belt pretensioner (if equipped) to floor connectors.

NOTE: Diagnostics or repairs are not to be performed on a side airbag system and/or a safety belt pretensioner (if equipped) system with the seats in the vehicle. Prior to attempting to diagnose/repair the side airbag system and/or a safety belt pretensioner (if equipped) system the seats must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt pretensioner (if equipped) connectors at the floor connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt pretensioner (if equipped) system (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt pretensioner to floor connectors.

NOTE: After diagnosing/repairing a seat system, **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

<p>1</p>  <p>3</p> 	<p>2 Deactivate the supplemental restraint system (SRS). Refer to Section 501-20B.</p> <p>4 Operate the driver power seat forward and rearward.</p> <ul style="list-style-type: none"> ● Will the seat move horizontally? <p>→ Yes GO to N2.</p> <p>→ No GO to N3.</p>
---	--

N2 CHECK BACKREST MOTOR FOR CORRECT OPERATION

	<p>1 Operate the driver power seat backrest up and down.</p> <ul style="list-style-type: none"> ● Will the seat backrest move up and down? <p>→ Yes GO to N6.</p> <p>→ No GO to N13.</p>
--	--

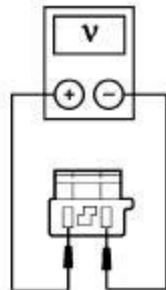
N3 CHECK THE VOLTAGE TO THE DRIVER SEAT FORWARD/REVERSE MOTOR

1



Driver Seat Forward/Reverse Motor C362

2



A0003068

2

Measure the voltage between driver seat forward/reverse motor C362 pin 1, circuit 32-AH37 (YE/GN), harness side and C362 pin 2, circuit 33-AH37 (WH/GN), harness side, while pushing the driver seat regulator control switch forward and rearward.

- Is the voltage greater than 10 volts when the switch is pushed forward, greater than -10 volts when the switch is pushed rearward, and 0 volts when the switch is in a rest position?

→ **Yes**

INSTALL a new driver seat forward/reverse motor. REFER to [Seat Track](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

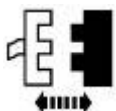
GO to [N4](#).

N4 CHECK CIRCUIT 32-AH37 (WH/GN) FOR AN OPEN AND SHORT TO GROUND

1



2

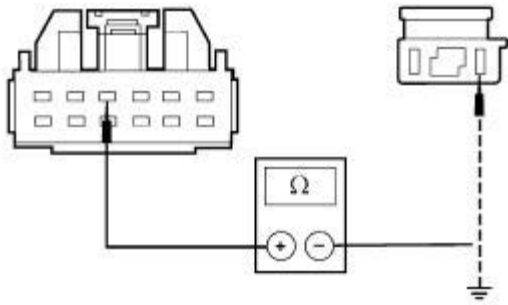


Driver Seat Forward/Reverse Motor C362

3

3

Measure the resistance between driver seat regulator control switch C360 pin 3, circuit 32-AH37 (WH/GN), harness side and driver seat forward/reverse motor C362 pin 2, circuit 32-AH37 (WH/GN), harness side; and between driver seat regulator control switch C360 pin 3, circuit 32-AH37 (WH/GN),



A0005668

harness side and ground.

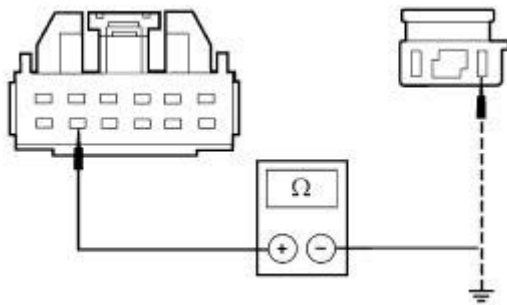
- Is the resistance less than 5 ohms between the driver seat forward/reverse motor and the driver seat regulator control switch, and greater than 10,000 ohms between the driver seat regulator control switch and ground?

→ **Yes**
GO to N5.

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

N5 CHECK CIRCUIT 33-AH37 (YE/GN) FOR AN OPEN AND SHORT TO GROUND

1



A0005669

1

Measure the resistance between driver seat regulator control switch C360 pin 11, circuit 33-AH37 (YE/GN), harness side and driver seat forward/reverse motor C362 pin 2, circuit 33-AH37 (YE/GN), harness side; and between driver seat regulator control switch C360 pin 11, circuit 33-AH37 (YE/GN), harness side and ground.

- Is the resistance less than 5 ohms between the driver seat forward/reverse motor and the driver seat regulator control switch, and greater than 10,000 ohms between the driver seat regulator control switch and ground?

→ **Yes**
INSTALL a new driver seat regulator control switch. REFER to Seat Control Switch. TEST the system for normal

operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

N6 DETERMINE SEAT TILTING FAILURE

1 Determine seat tilting failure.

- **Can the seat be tilted forward or backward?**

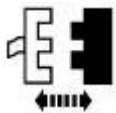
→ **Yes**
If only forward tilting operates, GO to [N7](#).

If only rear tilting operates, GO to [N10](#).

→ **No**
INSTALL a new driver seat regulator control switch. REFER to [Seat Control Switch](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

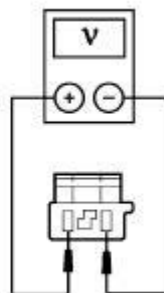
N7 CHECK THE VOLTAGE TO THE DRIVER SEAT REAR HEIGHT MOTOR

1



Driver Seat Rear Height Motor C382

2



A0003068

2 Measure the voltage between driver seat rear height motor C382 pin 1, circuit 32-AH41 (WH/VT), harness side and C382 pin 2, circuit 33-AH41 (WH/VT), harness side, while depressing the rear tilt switch up and down.

- **Is the voltage greater than +10 volts when the rear tilt switch is pressed down, greater than -10**

volts when the rear tilt switch is pressed up and 0 volts when the switch is in the rest position?

→ **Yes**

INSTALL a new the driver seat rear height motor. REFER to Seat Track. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

→ **No**

GO to N8.

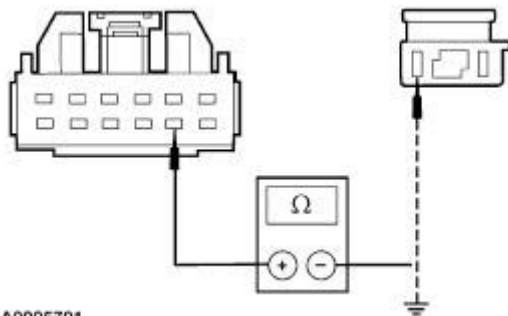
N8 CHECK CIRCUIT 32-AH41 (WH/VT) FOR OPEN AND SHORT TO GROUND

1



Driver Seat Regulator Control Switch C360

2



A0005701

2

Measure the resistance between driver seat regulator control switch C360 pin 8, circuit 32-AH41 (WH/VT), harness side and driver seat rear height motor C382 pin 1, circuit 32-AH41 (WH/VT), harness side; and between driver seat regulator control switch C360 pin 8, circuit 32-AH41 (WH/VT), and ground.

- **Is the resistance less than 5 ohms between the driver seat rear height motor and the driver seat regulator control switch, and greater than 10,000 ohms between the driver seat regulator control switch and ground?**

→ **Yes**

GO to N9.

→ **No**

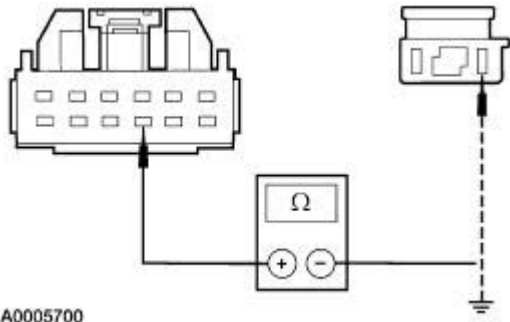
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to Section 501-20B.

N9 CHECK CIRCUIT 33-AH41 (WH/VT) FOR OPEN AND SHORT TO GROUND

1

1

Measure the resistance between driver seat regulator control switch C360 pin 9, circuit 33-AH41 (WH/VT), harness



A0005700

side and driver seat rear height motor C382 pin 2, circuit 33-AH41 (WH/VT), harness side; and between driver seat regulator control switch C360 pin 9, circuit 33-AH41 (WH/VT), harness side and ground.

- Is the resistance less than 5 ohms between the driver seat rear height motor and the driver seat regulator control switch, and greater than 10,000 ohms between the driver seat regulator control switch and ground?

→ **Yes**

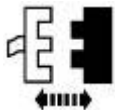
INSTALL a new driver seat regulator control switch. REFER to [Seat Control Switch](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

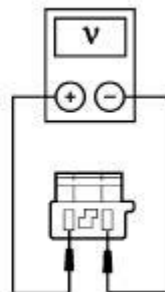
N10 CHECK THE VOLTAGE TO DRIVER SEAT FRONT HEIGHT MOTOR

1



Driver Seat Front Height Motor C363

2



A0003068

2

Measure the voltage between driver seat front height motor C363 pin 1, circuit 33-AH38 (YE/BK), harness side and C363 pin 2, circuit 32-AH38 (WH/BK), while pushing the rear tilting switch up and down.

- Is the voltage greater than +10

volts when the front tilt switch is pressed down, greater than -10 volts when the front tilt switch is pressed up and 0 volts when the switch is in the rest position?

→ **Yes**

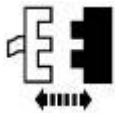
INSTALL a new driver seat front height motor. REFER to [Seat Track](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

GO to [N11](#).

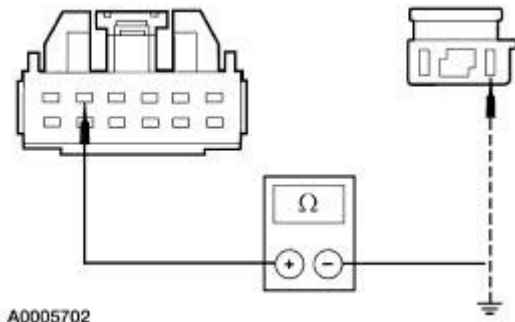
N11 CHECK CIRCUIT 32-AH38 (WH/BK) FOR OPEN AND SHORT TO GROUND

1



Driver Seat Regulator Control Switch C360

2



2

Measure the resistance between driver seat regulator control switch C360 pin 5, circuit 32-AH38 (WH/BK), harness side and driver seat front height motor C363 pin 2, circuit 32-AH38 (WH/BK), harness side; and between driver seat regulator control switch C360 pin 5, circuit 32-AH38 (WH/BK), harness side and ground.

- **Is the resistance less than 5 ohms between the driver seat front height motor and the driver seat regulator control switch, and greater than 10,000 ohms between the driver seat regulator control switch and ground?**

→ **Yes**

GO to [N12](#).

→ **No**

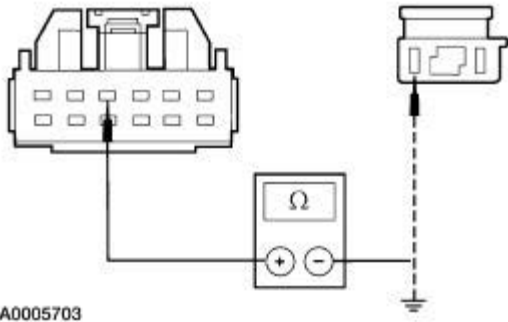
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). REFER to [Section 501-20B](#). PROVE OUT the supplemental restraint system (SRS).

N12 CHECK CIRCUIT 33-AH38 (YE/BK) FOR OPEN

1

1

Measure the resistance between driver



A0005703

seat regulator control switch C360 pin 4, circuit 33-AH38 (YE/BK) harness side, and driver seat front height motor C363 pin 1, circuit 33-AH38 (YE/BK), harness side; and between driver seat regulator control switch C360 pin 4, circuit 33-AH38 (YE/BK), harness side and ground.

- **Is the resistance less than 5 ohms between the driver seat front height motor and the driver seat regulator control switch, and greater than 10,000 ohms between the driver seat regulator control switch and ground?**

→ **Yes**

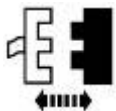
INSTALL a new driver seat regulator control switch. REFER to [Seat Control Switch](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

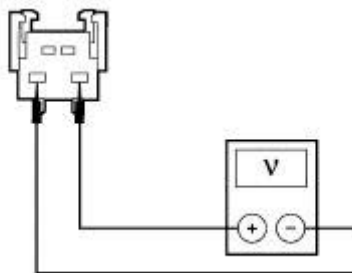
N13 CHECK THE VOLTAGE TO DRIVER SEAT BACKREST MOTOR

1



Driver Seat Backrest Motor C368

2



A0005708

2

Measure the voltage between driver seat backrest motor C368 pin 1, circuit 32-AH36 (WH/RD), harness side and C363 pin 2, circuit 33-AH36 (YE/RD), while pushing the backrest switch forward and rearward.

- **Is the voltage greater than 10 volts**

when the switch is pushed forward, greater than -10 volts when the switch is pushed rearward, and 0 volts when the switch is in a rest position?

→ **Yes**

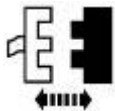
INSTALL a new driver seat backrest motor. REFER to [Front Seat Backrest](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**

GO to [N14](#).

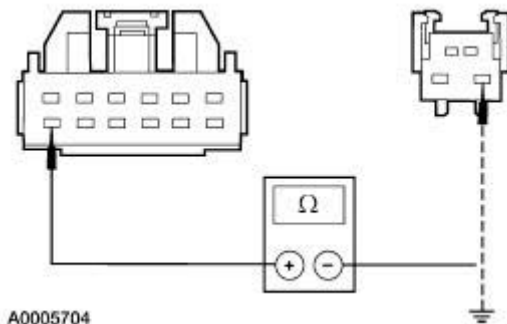
N14 CHECK CIRCUIT 32-AH36 (WH/RD) FOR OPEN AND SHORT TO GROUND

1



Driver Seat Regulator Control Switch C360

2



2

Measure the resistance between driver seat regulator control switch C360 pin 12, circuit 32-AH36 (WH/RD), harness side and driver seat backrest motor C368 pin 1, circuit 32-AH36 (WH/RD), harness side; and between driver seat regulator control switch C360 pin 12, circuit 32-AH36 (WH/RD), harness side and ground.

- **Is the resistance less than 5 ohms between the driver seat backrest motor and the driver seat regulator control switch, and greater than 10,000 ohms between the driver seat regulator control switch and ground?**

→ **Yes**

GO to [N15](#).

→ **No**

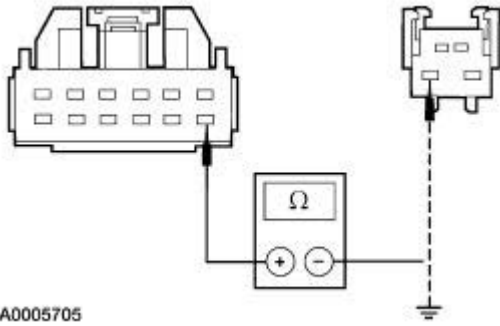
REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

N15 CHECK CIRCUIT 33-AH36 (YE/RD) FOR OPEN

1

1

Measure the resistance between driver



seat regulator control switch C360 pin 7, circuit 33-AH36 (YE/RD) harness side, and driver seat backrest motor C368 pin 2, circuit 33-AH36 (YE/RD), harness side; and between driver seat regulator control switch C360 pin 7, circuit 33-AH36 (YE/RD), harness side and ground.

- **Is the resistance less than 5 ohms between the driver seat backrest motor and the driver seat regulator control switch, and greater than 10,000 ohms between the seat regulator control switch and ground?**

→ **Yes**


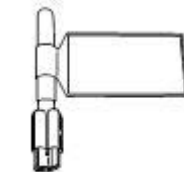
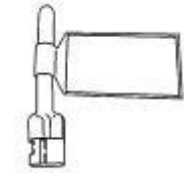
INSTALL a new driver seat regulator control switch. REFER to [Seat Control Switch](#). TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).

→ **No**


REPAIR the circuit. TEST the system for normal operation. REACTIVATE the supplemental restraint system (SRS). PROVE OUT the supplemental restraint system (SRS). REFER to [Section 501-20B](#).


Supplemental Restraint System (SRS) Deactivation and Reactivation

Special Tool(s)


 ST2502-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)


Deactivation


 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

 **WARNING:** The safety belt buckle pretensioner and safety belt retractor pretensioner are pyrotechnic devices. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.



WARNING: Vehicle sensor orientation is critical for proper system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Replace and properly position the sensor or any other damaged supplemental restraint system (SRS) components whether or not the air bag is deployed.



WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

NOTE: If a seat equipped with a seat mounted side air bag and/or a safety belt pretensioner (if equipped) system is being serviced, **the air bag system must be deactivated.**

NOTE: Restraint system diagnostic tools **MUST** be installed under the seats in the seat side air bag (if equipped) and safety belt pretensioner (if equipped) to floor connectors.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.



- WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

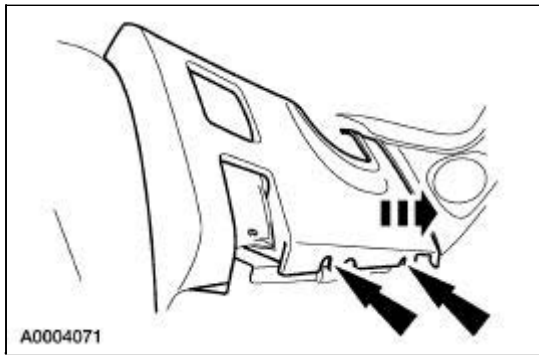
Please refer to the appropriate vehicle workshop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

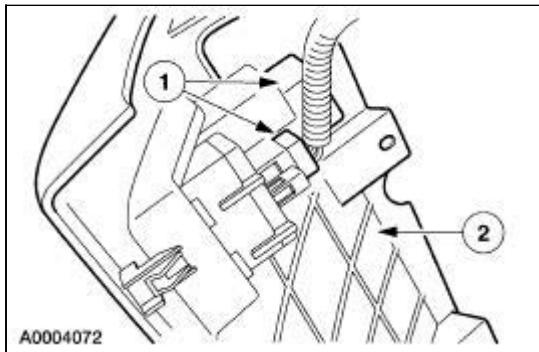
To deplete the backup power supply energy, Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. For additional information, refer to [Section 414-01](#).

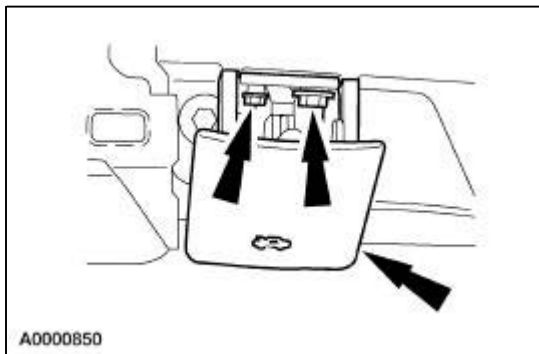
- Remove the two screws and pull out on the lower steering column opening finish panel enough to access the electrical connectors.



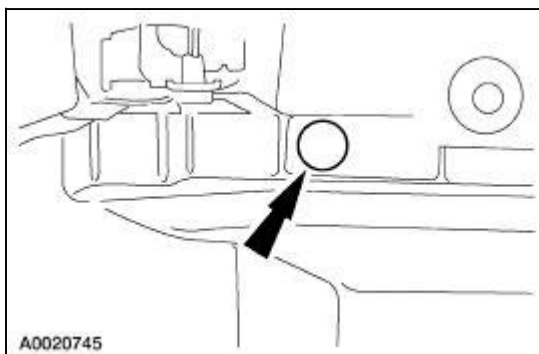
3. Remove the lower steering column opening finish panel.
 1. Disconnect the electrical connectors.
 2. Remove the lower steering column opening finish panel.



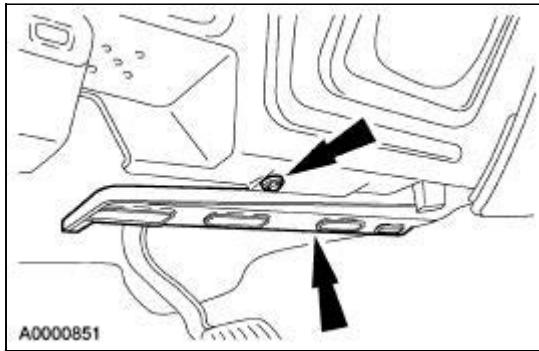
4. Remove the screws. Separate the hood latch release cable and handle assembly from the steering column opening reinforcement.



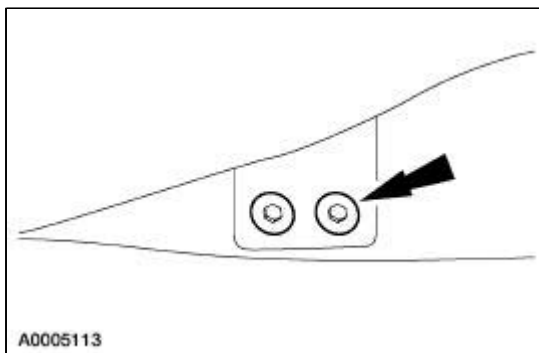
5. Remove the two pin-type retainers and the RH instrument panel insulator.
 - Disconnect the courtesy lamp.



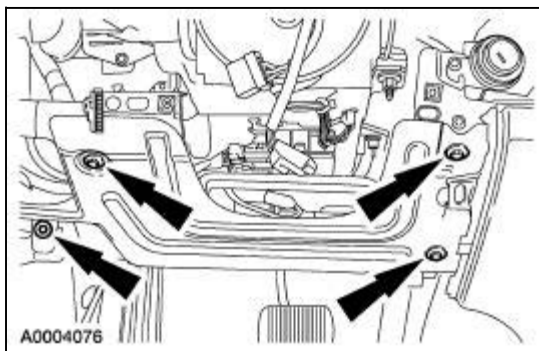
6. Remove the screw and the heater duct.



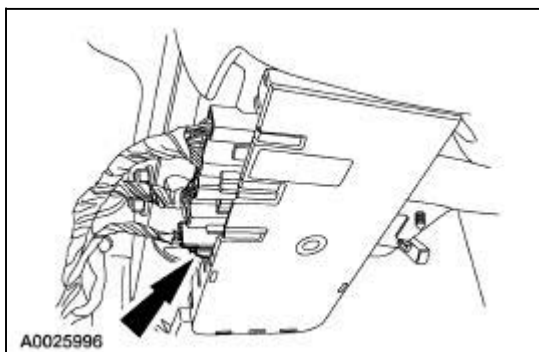
7. Loosen the two driver-side instrument panel tunnel brace bolts.
- Position the carpet aside to gain access to the bolts.



8. Remove the screws and the steering column opening reinforcement.

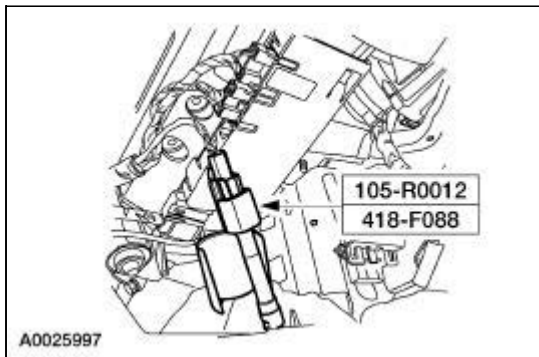


9. Disconnect the clockspring electrical connector at the base of the steering column.

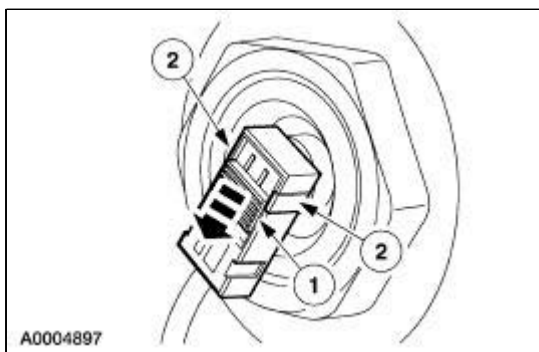


10. Attach the restraint system diagnostic tool to the vehicle harness side of the clockspring

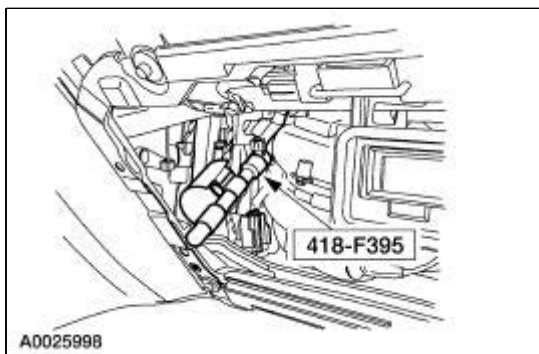
electrical connector.




11. Remove the glove compartment. For additional information, refer to [Section 501-12](#).
12. Disconnect the passenger air bag module electrical connector.
 1. Reaching into the glove box opening toward the center of the instrument panel, under the cross-car beam, slide and disengage the passenger air bag module electrical connector locking clip.
 2. Push in on the two release tabs and disconnect the passenger air bag module electrical connector.



13. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag electrical connector.



14. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
15. Move and tilt the front seats to their highest and most forward position.
16.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors,

instrument panel, console, door latches, strikers, seats and hood latches.

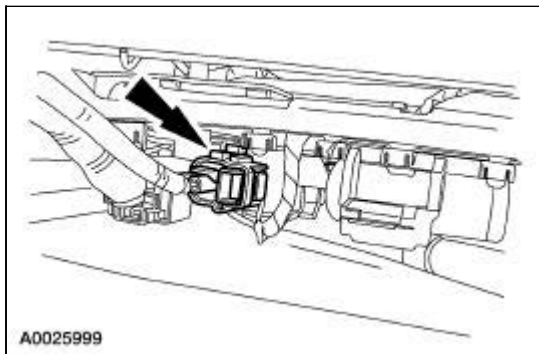
Please refer to the appropriate vehicle workshop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

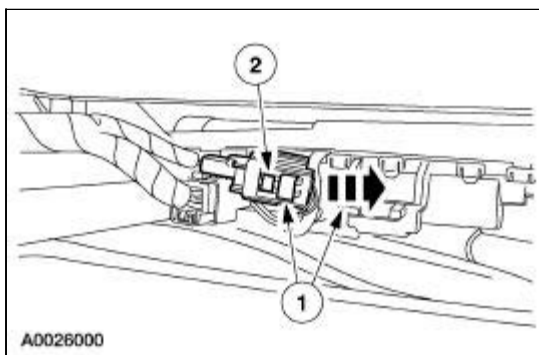
To deplete the backup power supply energy, Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. For additional information, refer to [Section 414-01](#).

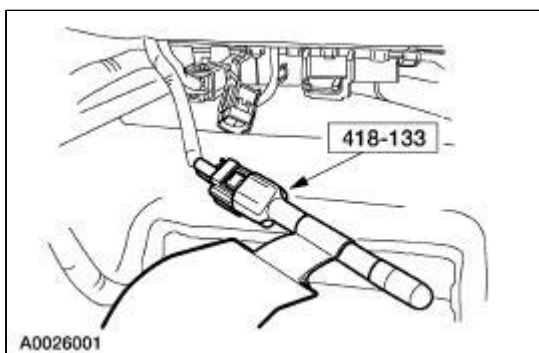
17. From under the passenger seat, release the tab on the connector bracket and remove the passenger seat side air bag electrical connector.



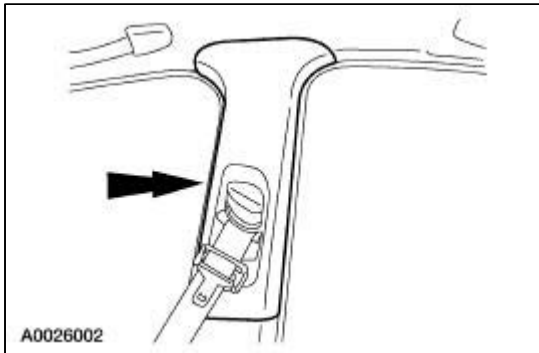
18. Disconnect the passenger seat side air bag electrical connector.
 1. Slide and disengage the passenger seat side air bag electrical connector locking clip.
 2. Push in to release the tab and disconnect the passenger seat side air bag electrical connector.



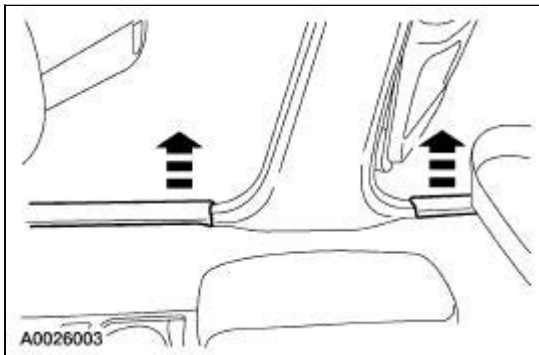
19. Attach the restraint system diagnostic tool to the passenger seat side air bag floor electrical connector.



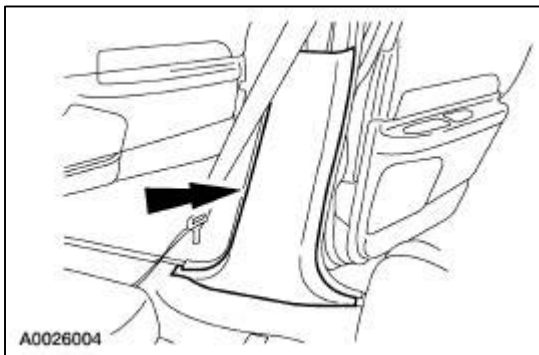
20. Remove the passenger side B-pillar weatherstripping.
21. Position the safety belt D-ring to its highest point.
22. Remove the passenger side B-pillar upper trim panel.



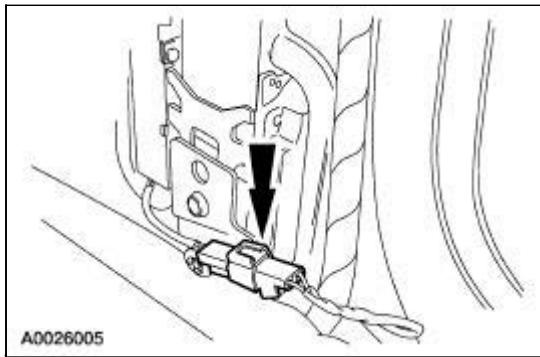
23. Remove the passenger side front and rear door scuff plates.



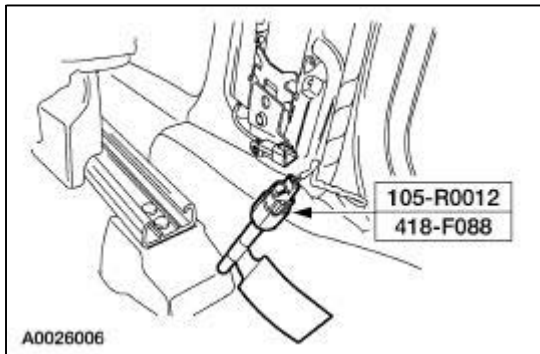
24. Remove the passenger side B-pillar lower trim panel.



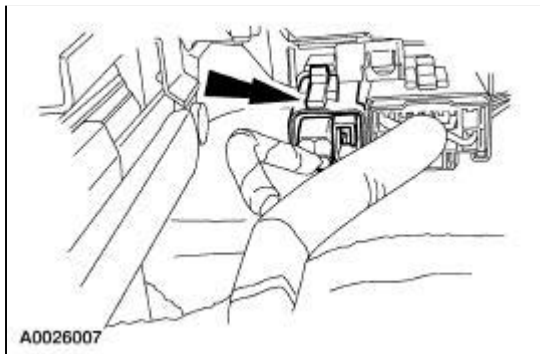
25. Disconnect the passenger side safety belt retractor pretensioner floor electrical connector.



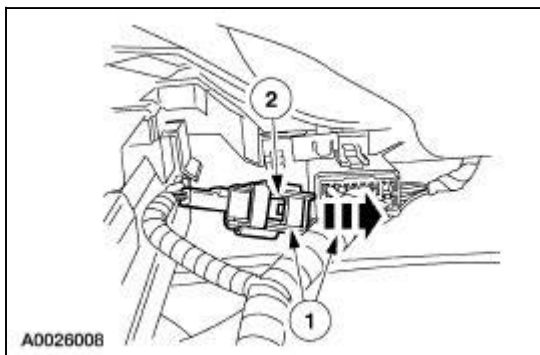
26. Attach the restraint system diagnostic tool to the passenger side safety belt retractor pretensioner floor electrical connector.



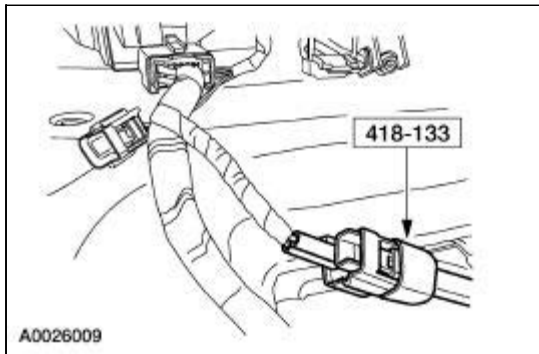
27. From under the driver seat, release the tab on the connector bracket and remove the driver seat side air bag electrical connector.



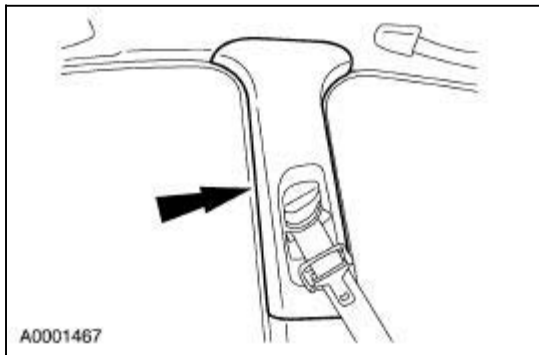
28. Disconnect the driver seat side air bag electrical connector.
1. Slide and disengage the driver seat side air bag electrical connector locking clip.
 2. Push down to release the tab and disconnect the driver seat side air bag electrical connector.



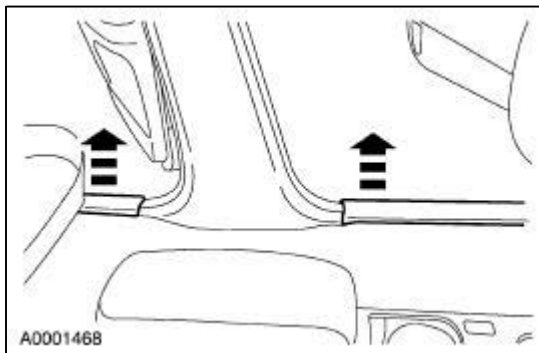
29. Attach the restraint system diagnostic tool to the driver seat side air bag floor electrical connector.



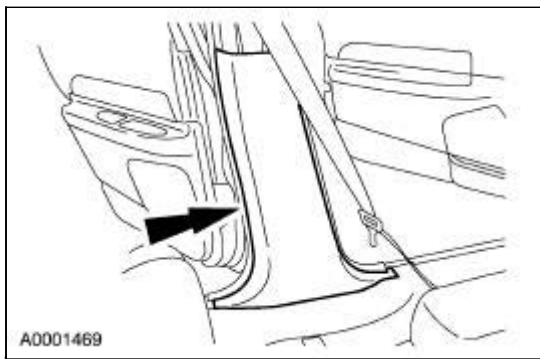
30. Remove the driver side B-pillar weatherstripping.
31. Position the safety belt D-ring to its highest point.
32. Remove the driver side B-pillar upper trim panel.



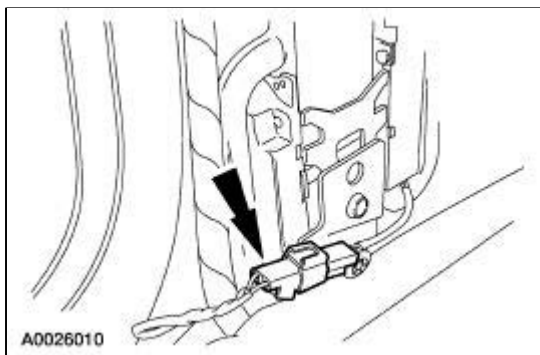
33. Remove the driver side front and rear door scuff plates.



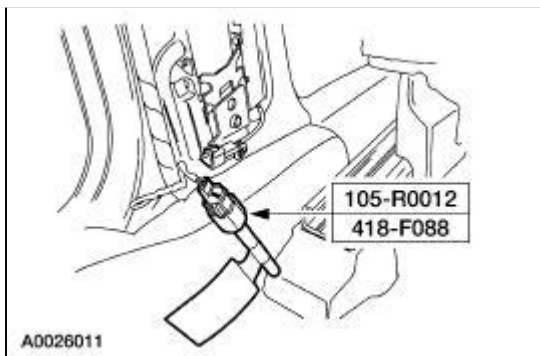
34. Remove the driver side B-pillar lower trim panel.



35. Disconnect the driver side safety belt retractor pretensioner electrical connector.



36. Attach the restraint system diagnostic tool to the driver side safety belt retractor pretensioner floor electrical connector.



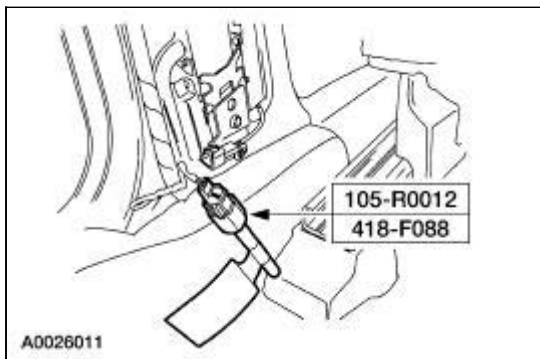
37. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
38. With the restraint system diagnostic tools installed at all deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).
39. Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. For additional information, refer to [Section 414-01](#).

Reactivation

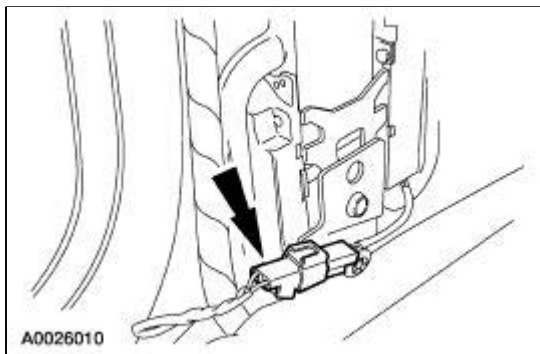


WARNING: To reduce the risk of serious personal injury, read and follow all warnings and notes at the beginning of the deactivation procedure.

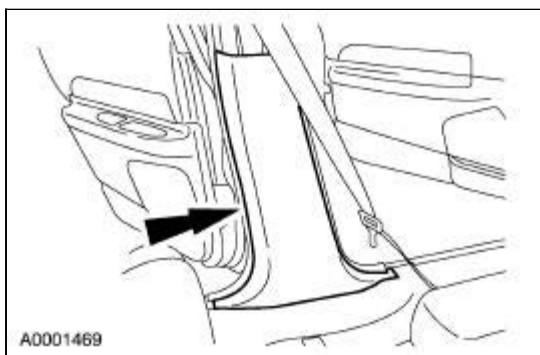
1. Remove the restraint system diagnostic tool from the driver side safety belt retractor pretensioner floor electrical connector.



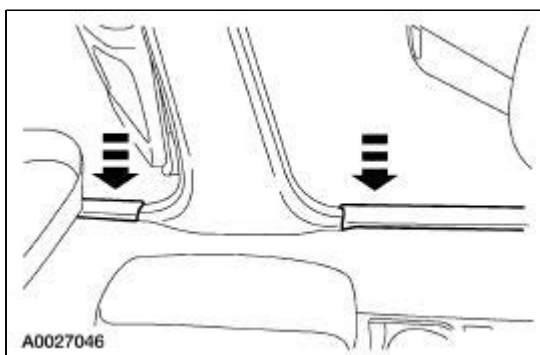
2. Connect the driver side safety belt retractor pretensioner electrical connector.



3. Install the driver side B-pillar lower trim panel.

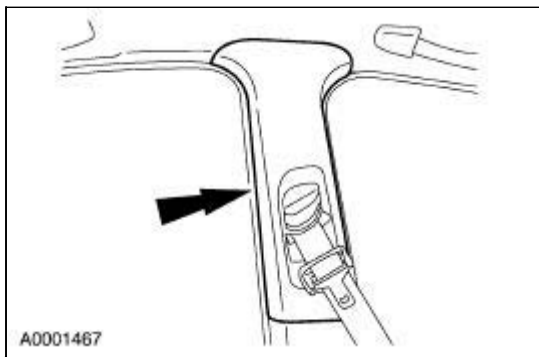


4. Install the driver side front and rear door scuff plates.

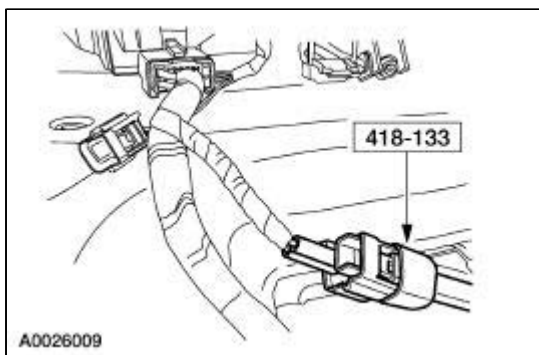


5. **NOTE:** Position the safety belt D-ring to its highest point.

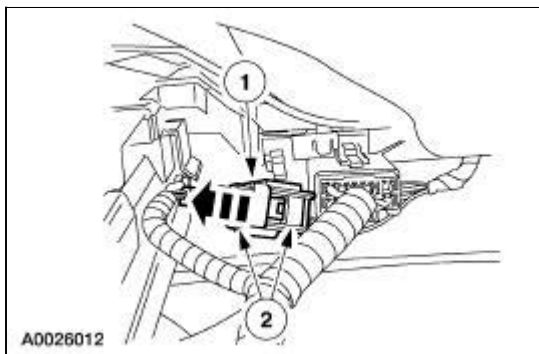
Install the driver side B-pillar upper trim panel.



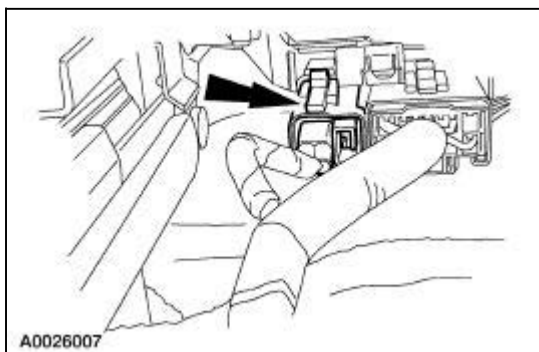
6. Install the driver side B-pillar weatherstripping.
7. Remove the restraint system diagnostic tool from the driver seat side air bag floor electrical connector.



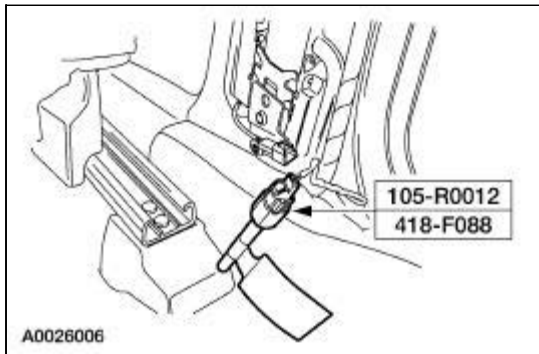
8. Connect the driver seat side air bag electrical connector.
 1. Connect the driver seat side air bag electrical connector.
 2. Slide and engage the driver seat side air bag electrical connector locking clip.



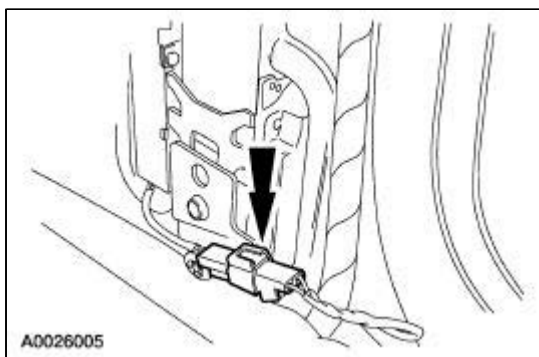
9. Install the driver seat side air bag electrical connector onto the connector bracket under the driver seat.



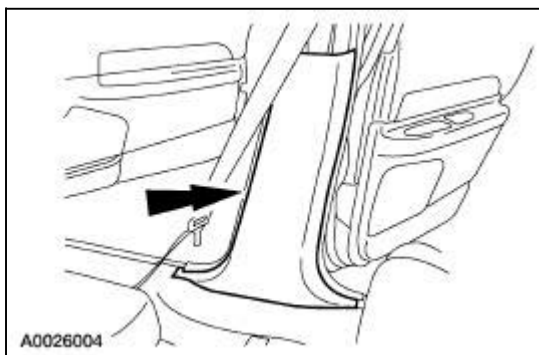
10. Remove the restraint system diagnostic tool from the passenger side safety belt retractor pretensioner electrical connector.



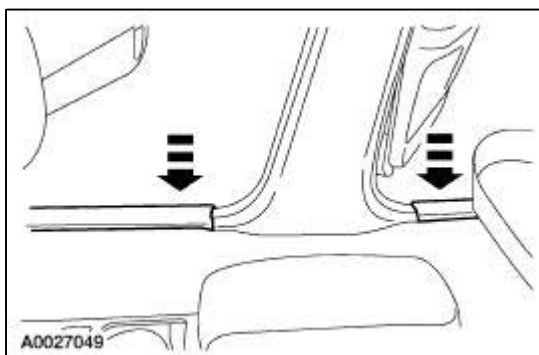
11. Connect the passenger side safety belt retractor pretensioner electrical connector.



12. Install the passenger side B-pillar lower trim panel.

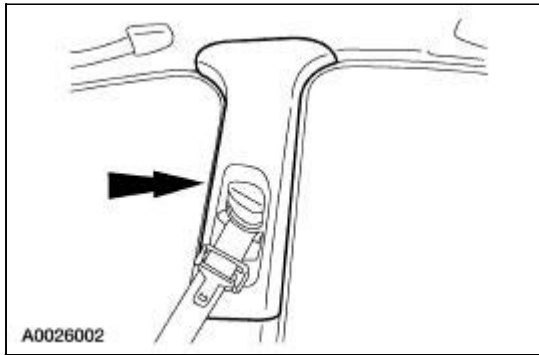


13. Install the passenger side front and rear door scuff plates.



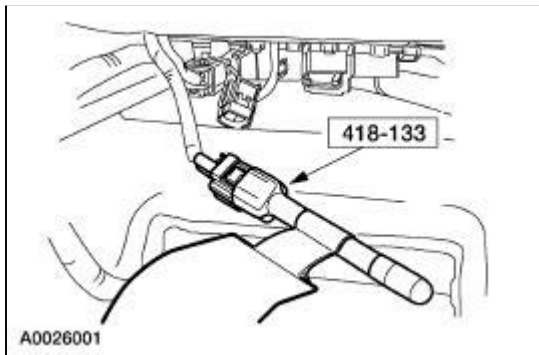
14. **NOTE:** Position the safety belt D-ring to its highest point.

Install the passenger side B-pillar upper trim panel.



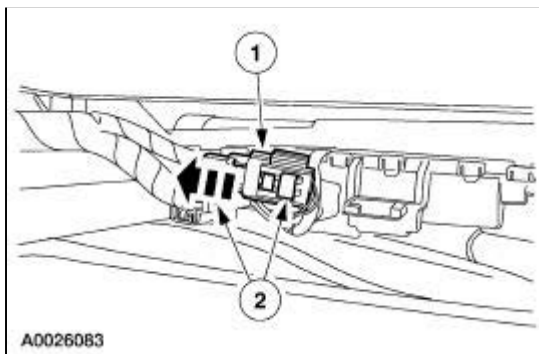
15. Install the passenger side B-pillar weatherstripping.

16. Remove the restraint system diagnostic tool from the passenger seat side air bag floor electrical connector.

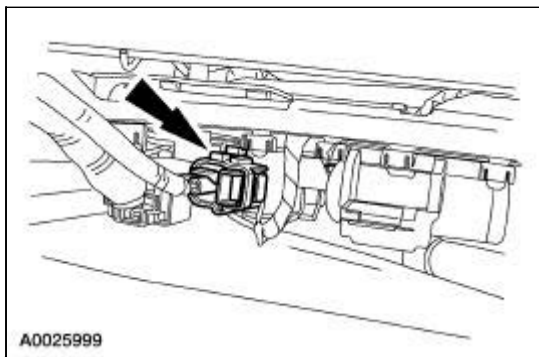


17. Connect the passenger seat side air bag electrical connector.

1. Connect the passenger seat side air bag electrical connector.
2. Slide and engage the passenger seat side air bag electrical connector locking clip.




18. Install the passenger seat side air bag electrical connector onto the connector bracket under the passenger seat.



19. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).

20. Position the front seats rearward.

21.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

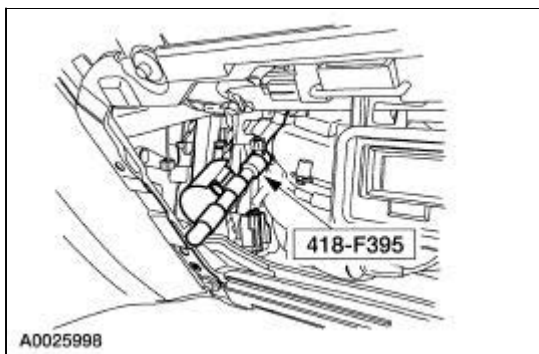
Please refer to the appropriate vehicle workshop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

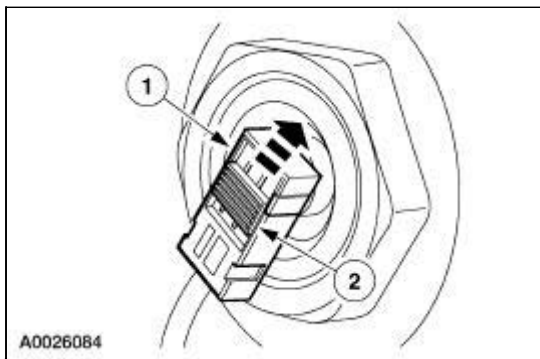
To deplete the backup power supply energy, Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute to allow for the depletion of the restraint system backup power supply. For additional information, refer to [Section 414-01](#).

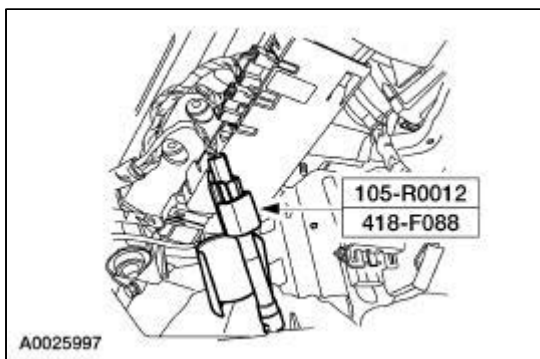
22. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag electrical connector.



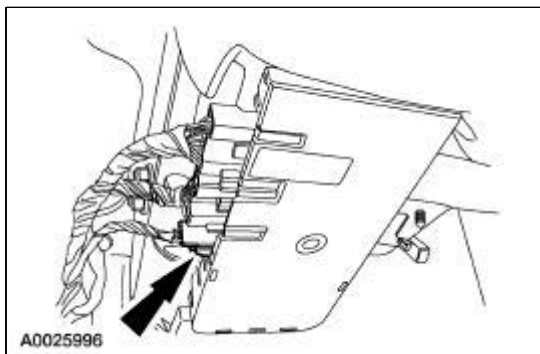
23. Connect the passenger air bag module electrical connector.
1. Reach into the glove box opening toward the center of the instrument panel, under the cross-car beam and connect the passenger air bag module electrical connector.
 2. Slide and engage the passenger air bag module electrical connector locking clip.



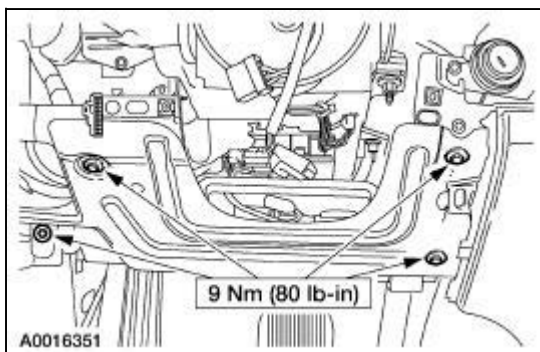
24. Install the glove compartment. For additional information, refer to [Section 501-12](#).
25. Remove the restraint system diagnostic tool from the vehicle harness side of the clockspring electrical connector.



26. Connect the clockspring electrical connector at the base of the steering column.

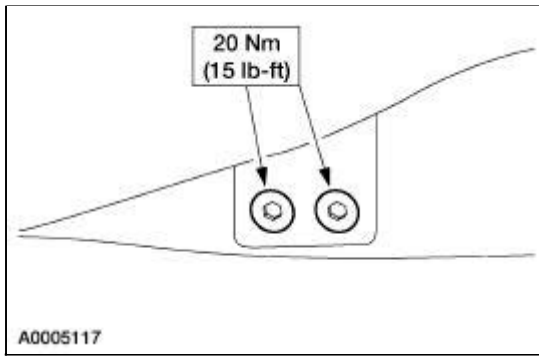


27. Position the steering column opening reinforcement and install the screws.

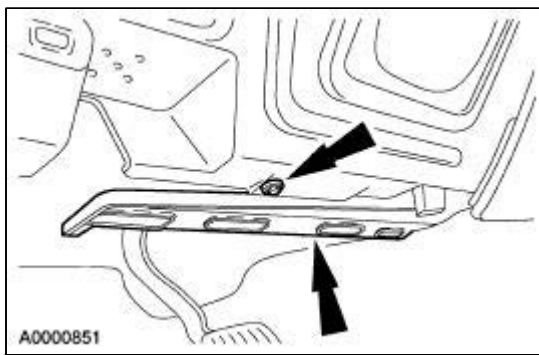


28. Tighten the two driver-side instrument panel tunnel brace bolts.

- Reposition the carpet.

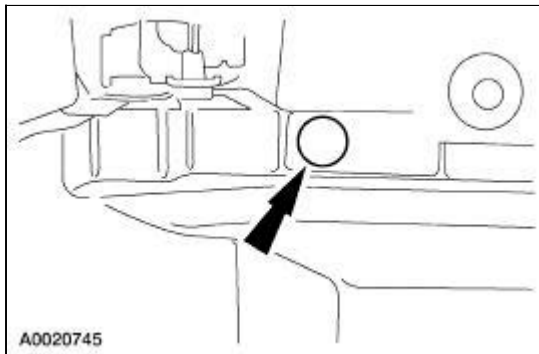


29. Position the heater duct and install the screw.

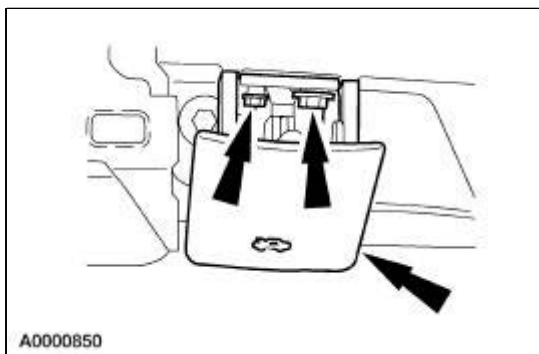


30. Install the RH instrument panel insulator and the two pin-type retainers.

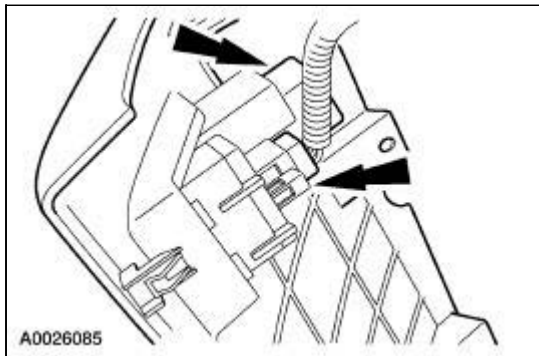
- Connect the courtesy lamp.



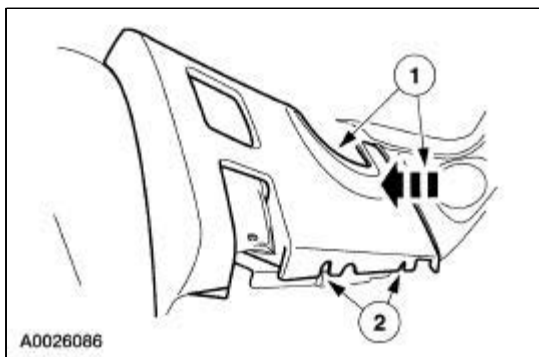
31. Position the hood latch release cable and handle assembly to the steering column opening reinforcement and install the screws.




32. Connect the electrical connectors to the switches in the lower steering column opening finish panel.



33. Install the lower steering column opening finish panel to the instrument panel.
1. Position the lower steering column opening finish panel to the instrument panel and push in, seating the retaining clips.
 2. Install the screws.



34. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).



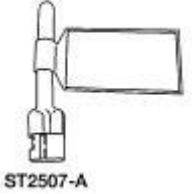
35.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).


36. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).
-


Seat Control Switch

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal


 **WARNING:** Always wear safety glasses when repairing a air bag supplemental restraint system (SRS) vehicle and when handling an airbag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

NOTE: The left side is shown, the right side is similar.

1. Prepare the vehicle for seat control switch removal.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute.

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

2.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.

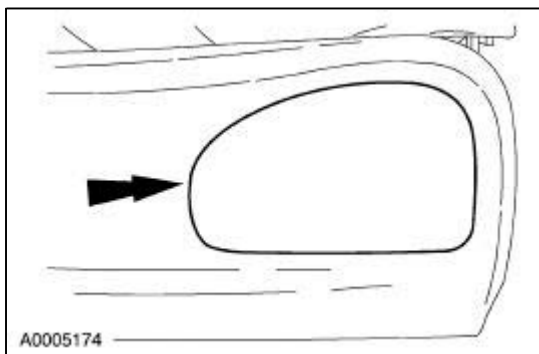
Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.

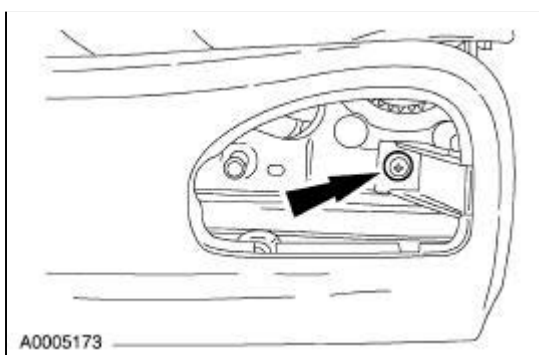
Remove the affected seat. For additional information, refer to [Front Seat](#) in this section.

2.  **CAUTION:** Do not use a screwdriver to remove the safety belt cover.

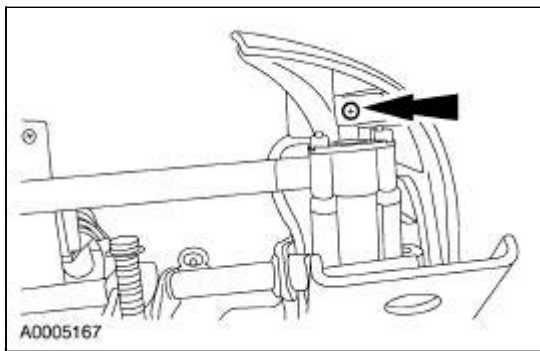
Remove the front safety belt cover by placing fingers behind the cover and pushing outward.



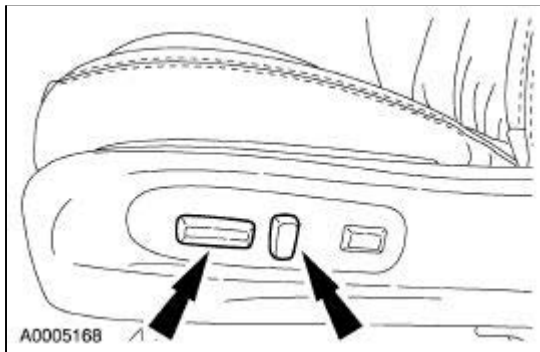
3. Remove the side trim panel screw.



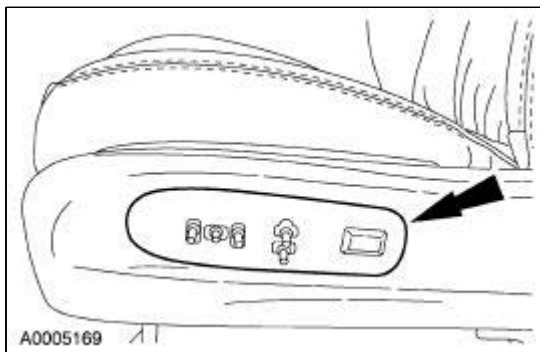
4. Remove the side trim panel screw.



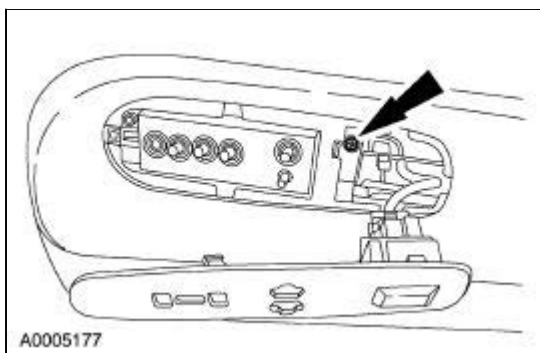
5. Remove the seat control knobs.



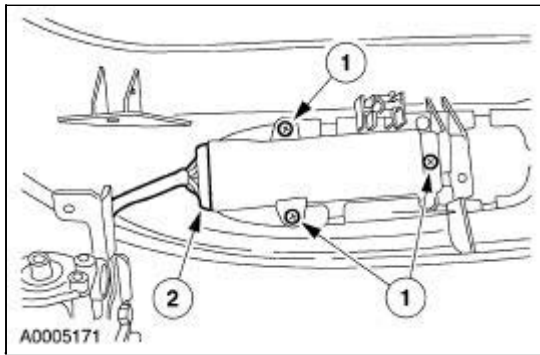
6. Position the seat regulator control switch plate aside.



7. Remove the screw and set aside the front cushion side shield.



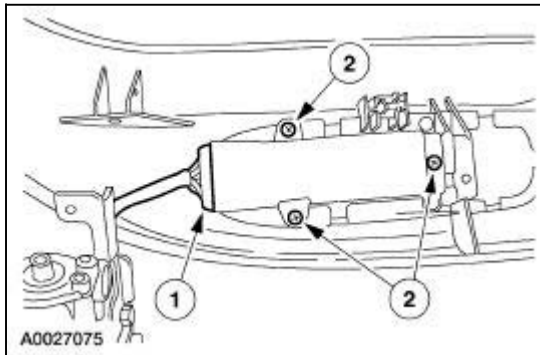
8. Remove the seat regulator control switch.
 1. Remove the screws.
 2. Disconnect the electrical connector.



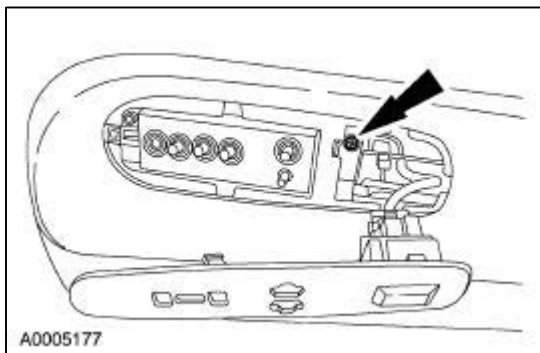
Installation

⚠ WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, and notes at the beginning of the removal procedure.

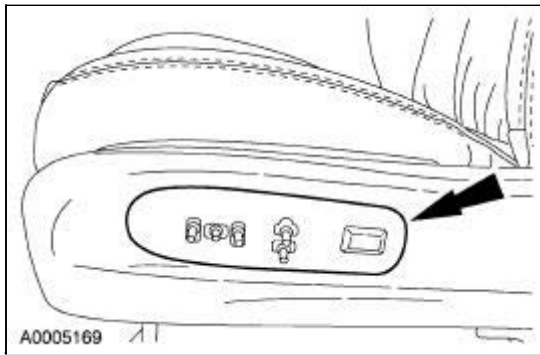
1. Install the seat regulator control switch.
 1. Connect the electrical connector.
 2. Install the screws.



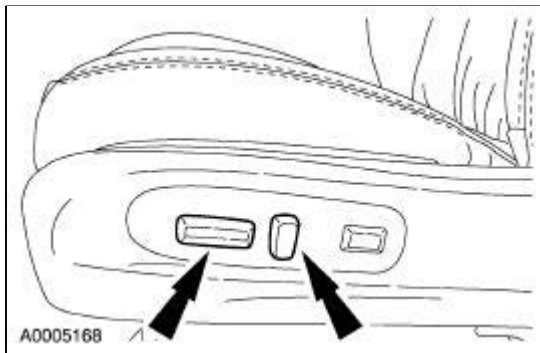
2. Position the front cushion side shield and install the screw.



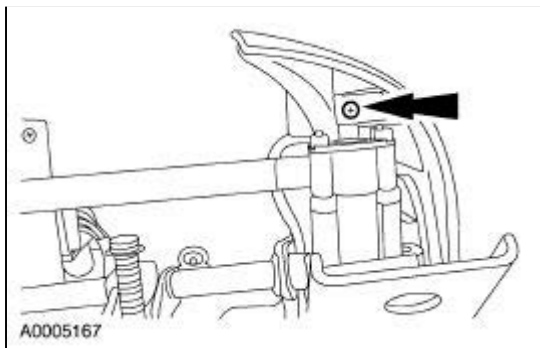
3. Install the seat regulator control switch plate.



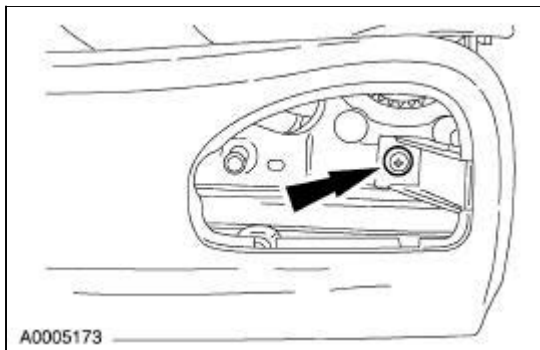
4. Install the seat control knobs.



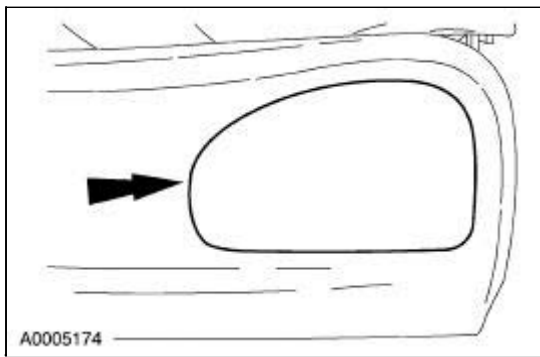
5. Install the side trim panel screw.




6. Install the side panel trim screw.




7. Install the front safety belt cover.




8. Restore the vehicle to operating condition.

1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the seat removal and installation procedure.**

Install the affected seat. For additional information, refer to [Front Seat](#) in this section.

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

4. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).
-

Heated Seat Switch

Removal and Installation

All vehicles

1. Apply the parking brake.

Vehicles with manual transmission

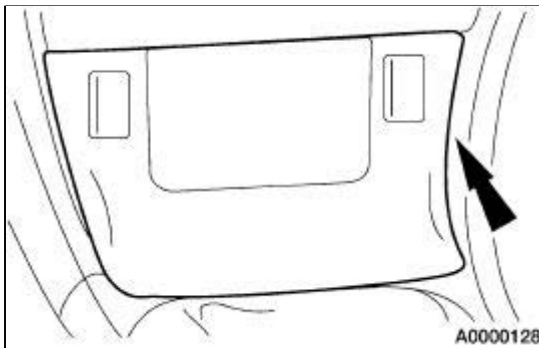
2. If equipped with a manual transmission, place the selector lever in fourth gear.

Vehicles with automatic transmission

3. If equipped with an automatic transmission, place the selector lever in NEUTRAL.

All vehicles



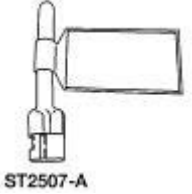
4. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
5. Remove the ashtray finish panel.




6. Remove the two screws and the ashtray assembly.
 - Disconnect the electrical connectors.
 7. Release the locking tabs and remove the heated seat switch.
 8. To install, reverse the removal procedure.
-


Lumbar Control Switch

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal


 **WARNING:** Always wear safety glasses when repairing a air bag supplemental restraint system (SRS) vehicle and when handling an airbag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

NOTE: The left side is shown, the right side is similar.

1. Prepare the vehicle for lumbar control switch removal.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

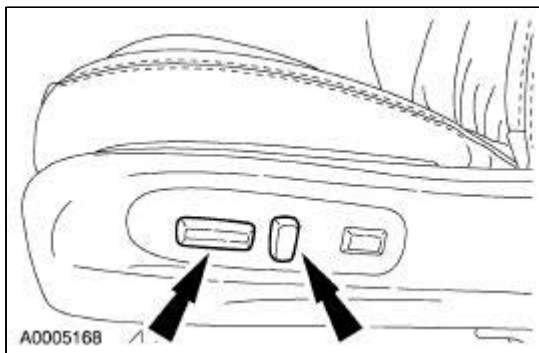
2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

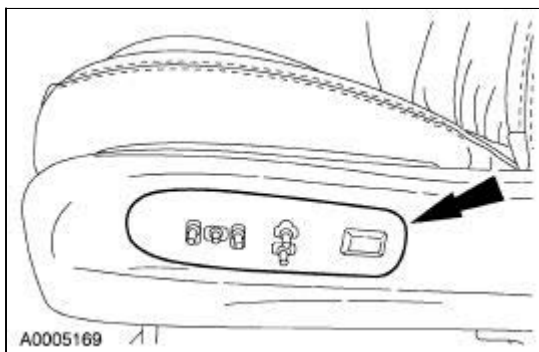
3.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.**

Remove the affected seat. For additional information, refer to [Front Seat](#) in this section.

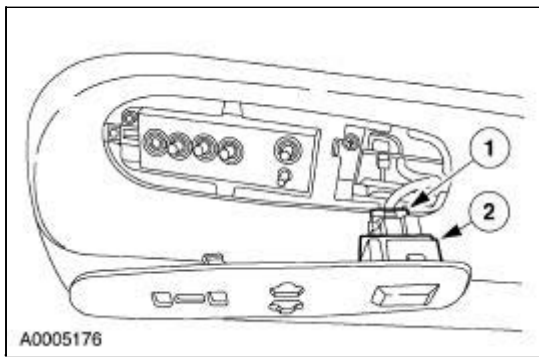
2. Remove the seat control knobs.



3. Position the seat regulator control switch plate aside.



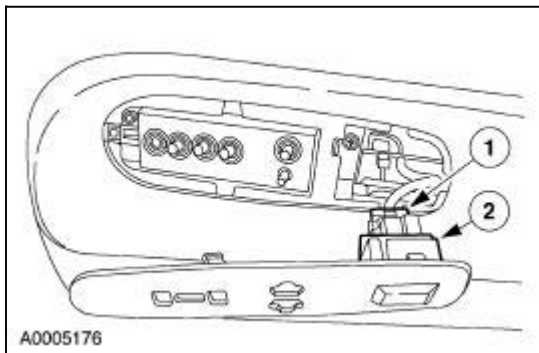
4. Remove the lumbar control switch.
 1. Disconnect the connector.
 2. Remove the lumbar control switch.



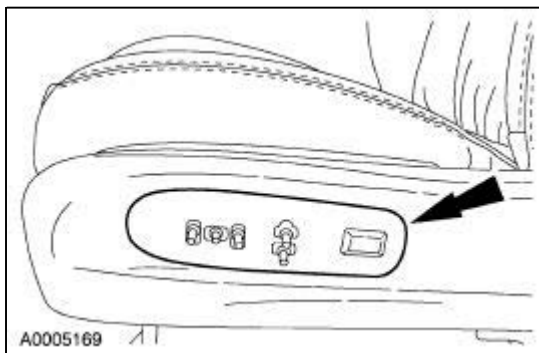
Installation

⚠ WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, and notes at the beginning of the removal procedure.

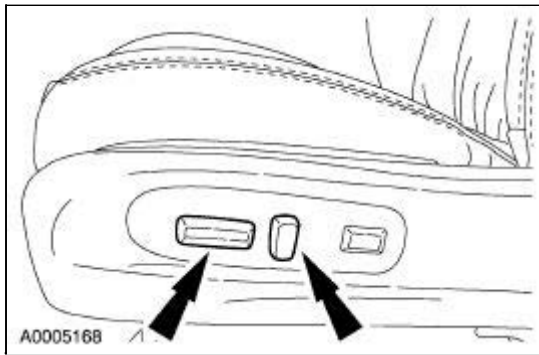
1. Install the lumbar control switch.
 1. Connect the electrical connector.
 2. Install the lumbar control switch.




2. Install the seat regulator control switch plate.




3. Install the seat control knobs.




4. Restore the vehicle to operating condition.

1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the seat removal and installation procedure.**

Install the affected seat. For additional information, refer to [Front Seat](#) in this section.

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.



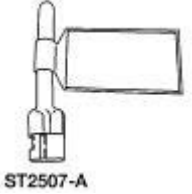
3.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

4. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).
-


Front Seat Backrest


Special Tool(s)


 ST2502-A	Diagnostic Tool, Restraint System (2 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal

All seats

 **WARNING:** Always wear safety glasses when repairing a air bag supplemental restraint system (SRS) vehicle and when handling an airbag module. This will reduce the risk of injury in the event of an accidental deployment.


 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

NOTE: If a side air bag deployment took place the seatback pad, trim cover, and side air bag module must be replaced. The seatback frame should be replaced if necessary.

NOTE: The left side is shown, the right side is similar.

1. Prepare the vehicle for front seat backrest removal.

1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air


bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**


Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.**

Remove the affected seat. For additional information, refer to [Front Seat](#) in this section.

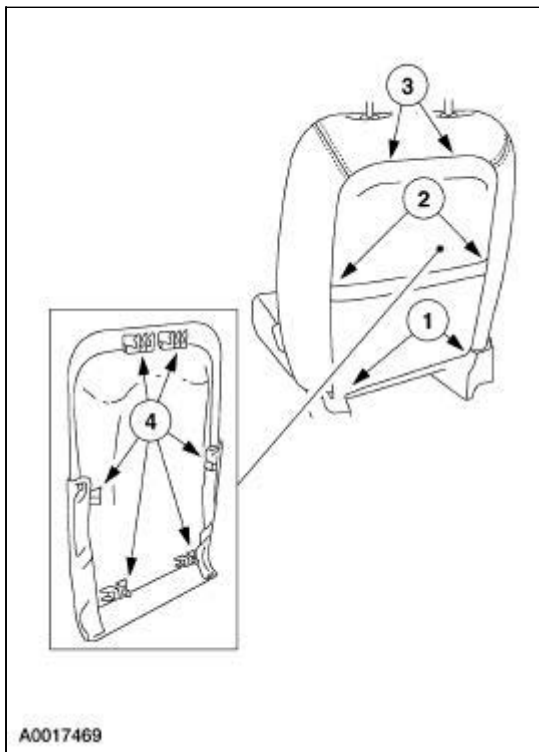
2.  **WARNING: Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced (cleaning is permissible).**

 **CAUTION: When removing the seat backrest trim panel, be careful not to damage the J-hooks. If the seat backrest trim panel J-hooks are damaged, install a new seat backrest trim panel.**

 **CAUTION: When removing the seat backrest trim panel, be careful not to damage the pin-type retainers. Pulling towards you, use a smooth, controlled force to release the pin-type retainers.**

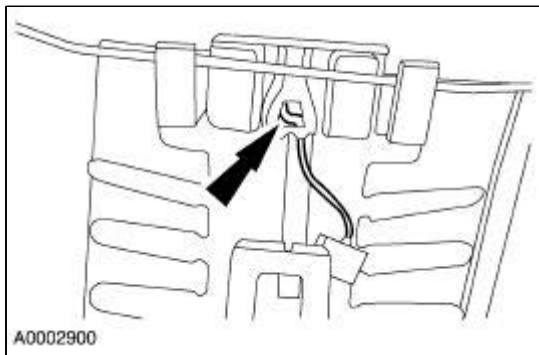
Remove the seat backrest trim panel.

1. Pull and release the pin-type retainers at the bottom of the seat backrest trim panel.
2. While holding the seat backrest trim panel at the bottom, push in on the left side of the panel at the lip of the map pocket and slide it to the right to disengage the J-hook. Repeat this process for the right side J-hook but slide the panel to the left to disengage the hook.
3. While pushing in at the top of the seat backrest trim panel, slide it down to disengage the top J-hooks.
4. Remove the seat backrest trim panel and inspect the J-hooks and pin-type retainers for damage.

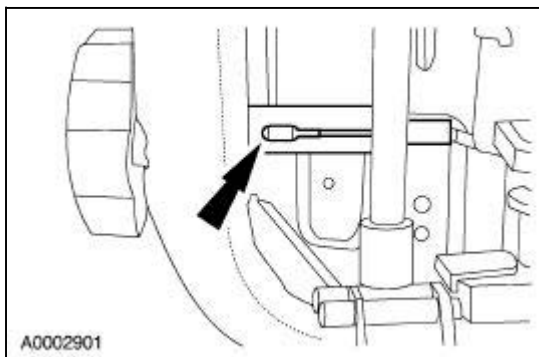


Seats with manual lumbar

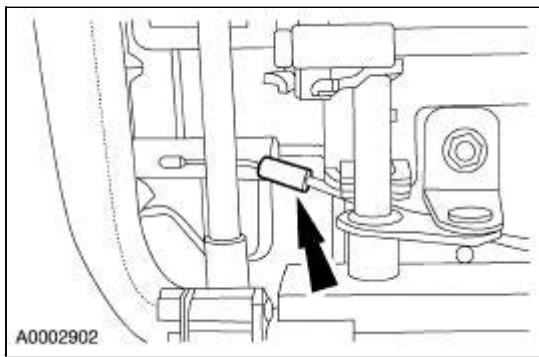
3. Remove the retaining hook.



4. Align the end of the adjusting cable in the slot.

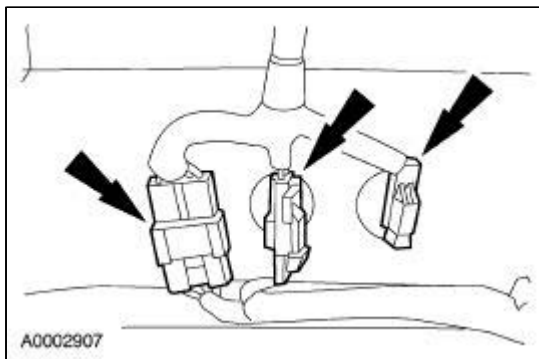


5. Release the adjusting cable.

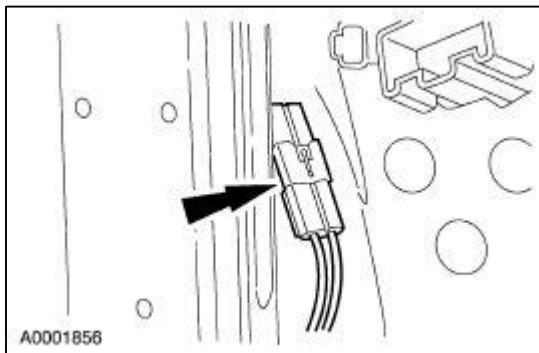


All seats

6. Disconnect the electrical connectors.

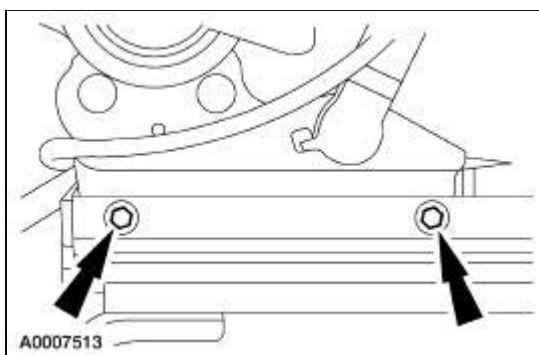


7. Disconnect the electrical connector.




8. Remove the front cushion side shield trim panel. For additional information, refer to [Seat—Front Cushion Side Shield](#) in this section.

9. Remove the two front seat backrest bolts on each side. Remove the front seat backrest.

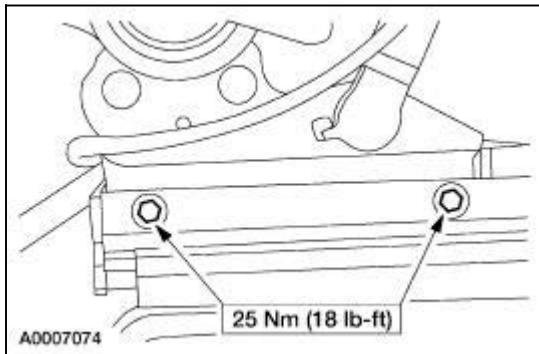


Installation

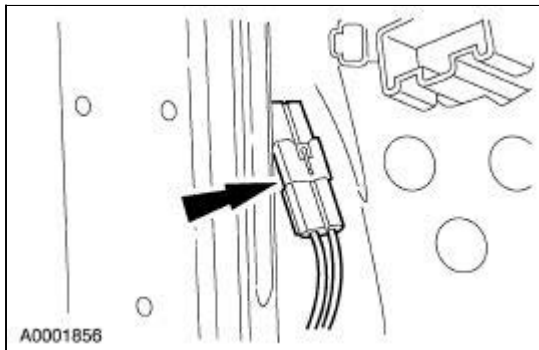
 **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings and notes at the beginning of the removal procedure.

All seats

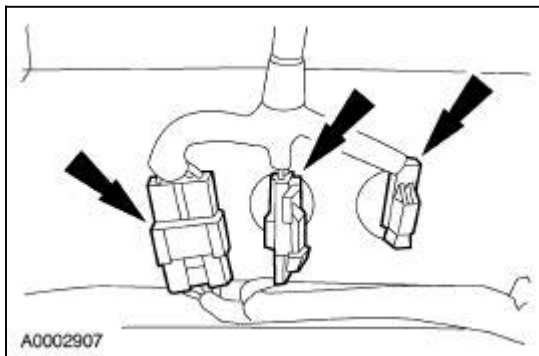
1. Position the front seat backrest and install two bolts on each side.



2. Install the front cushion side shield trim panel. For additional information, refer to [Seat—Front Cushion Side Shield](#) in this section.
3. Connect the electrical connector.

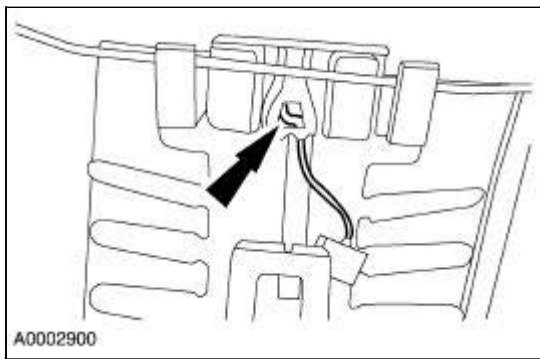


4. Connect the electrical connectors.

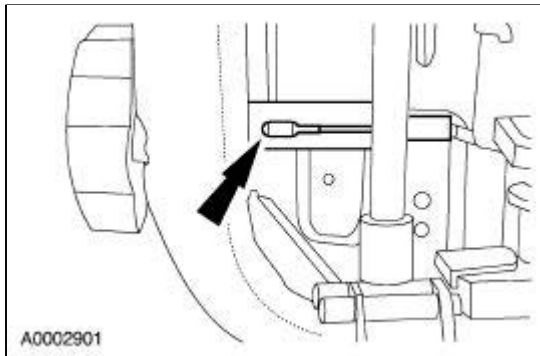


Seats with manual lumbar

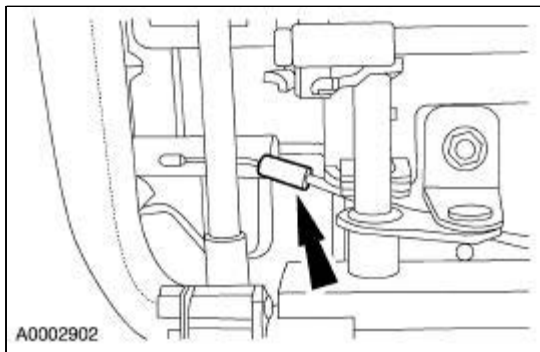
5. Install the retaining hook.




6. Align the end of the adjusting cable in the slot.



7. Install the adjusting cable.

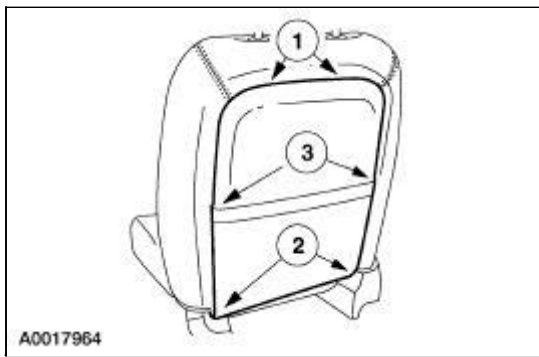


8.  **CAUTION: Inspect the seat backrest trim panel J-hooks for damage. If damaged, install a new seat backrest trim panel.**


NOTE: If re-installing the original seat backrest trim panel, install new pin-type retainers.

Install the seat backrest trim panel.


1. Angle the top of the seat backrest trim panel inward and up to engage the upper J-hooks to the seat backrest frame.
2. While holding the seat backrest trim panel up, align the pin-type retainers at the bottom of the seat backrest trim panel and install them into the seat backrest frame.
3. With the palm of your hand, install the J-clips by pushing down on the seat backrest trim panel and towards the center of the seat.
 - Check the retention of the seat backrest trim panel by lightly pulling on the bottom, sides, and top where the retainers are located.




9. Restore the vehicle to operating condition.

1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the seat removal and installation procedure.**

Install the affected seat. For additional information, refer to [Front Seat](#) in this section.

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

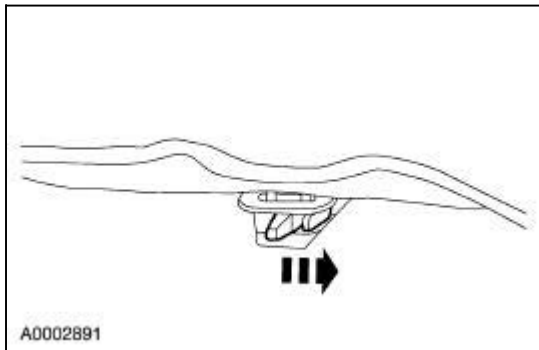
With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

4. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).
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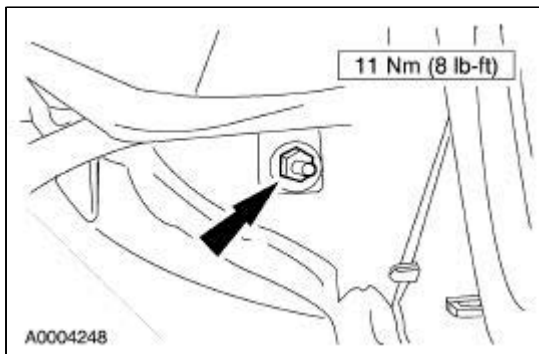
Seat Backrest —Rear Side Bolsters

Removal and Installation

1. Remove the rear seat cushions. For additional information, refer to [Seat—Rear Cushion](#).

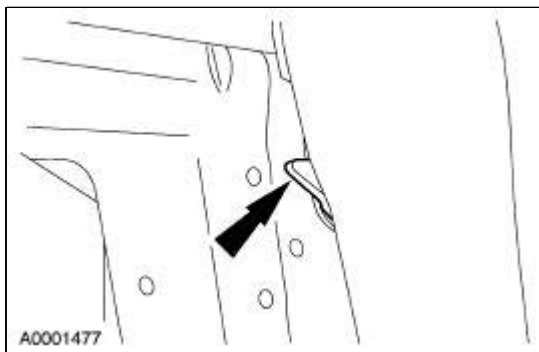


2. From the luggage compartment, release and fold down the seat backrest.
3. Remove the rear seat bolster nut.



4. **NOTE:** Pull down the lever to release the LH latch. Push up the lever to release the RH latch.



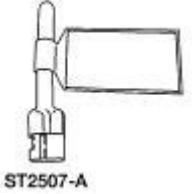
Release the latch and remove the rear seat bolster.




5. To install, reverse the removal procedure.


Front Seat

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (2 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal

 **WARNING:** Always wear safety glasses when repairing a air bag supplemental restraint system (SRS) vehicle and when handling an airbag module. This will reduce the risk of injury in the event of an accidental deployment.


 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

NOTE: The driver seat is shown, the passenger seat is similar.

NOTE: If a side air bag deployment took place the seatback pad, trim cover, and side air bag module must be replaced. The seatback frame should be replaced if necessary.

1. Prepare the vehicle for seat removal.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

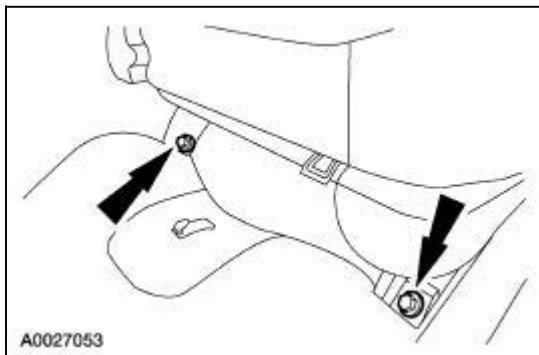
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

2.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.

Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

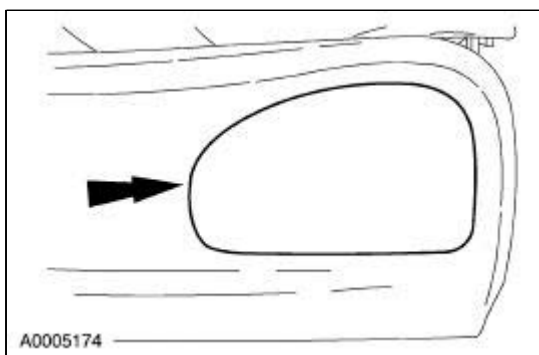
2. Reconnect the battery ground cable.
3. Move the seat rearward.
4. Remove the bolts.



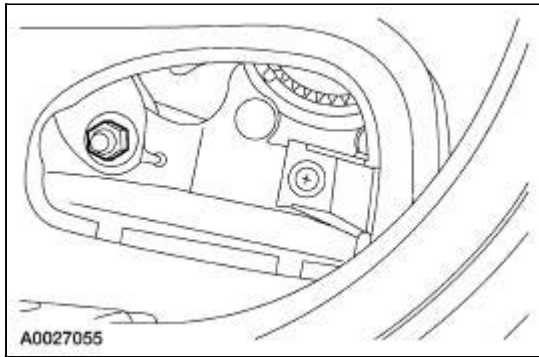
5. Position the seat forward.
6. Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

7.  **CAUTION:** Do not use a screwdriver to remove the safety belt cover.

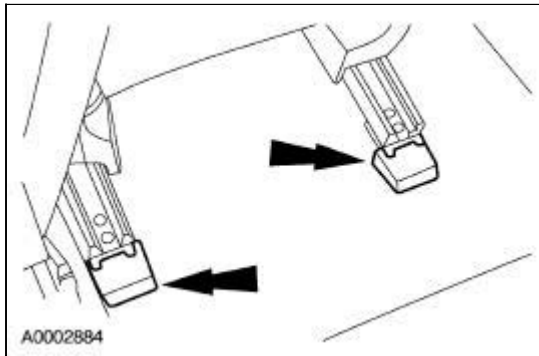
Remove the safety belt cover by placing fingers behind the cover and pushing outward.



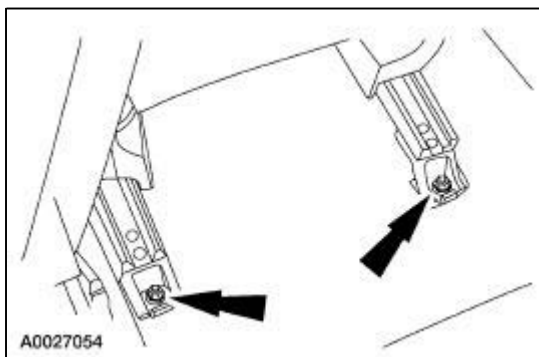
8. Remove the nut and the front safety belt.



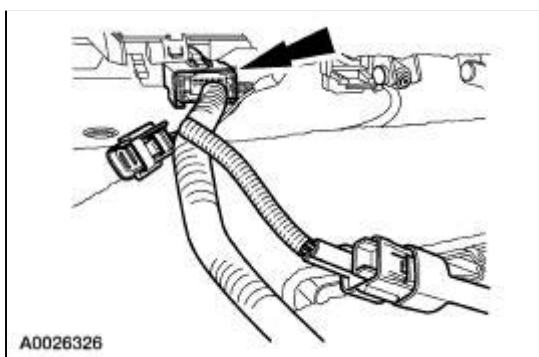
9. Remove the seat track rear covers.



10. Remove the nuts.




11. Disconnect the electrical connector.

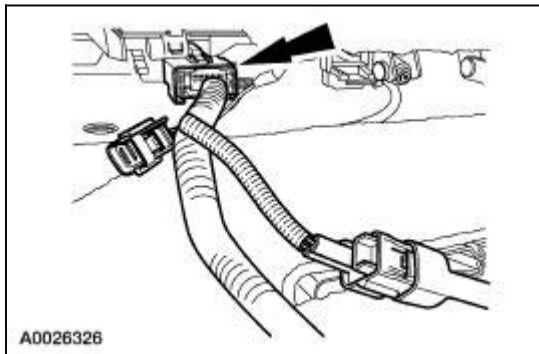


12. Remove the seat.

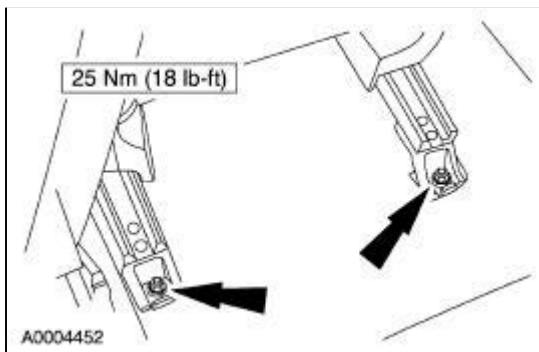
Installation

 **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, and notes at the beginning of the removal procedure.

1. Position the seat in the vehicle.
2. Connect the electrical connectors.

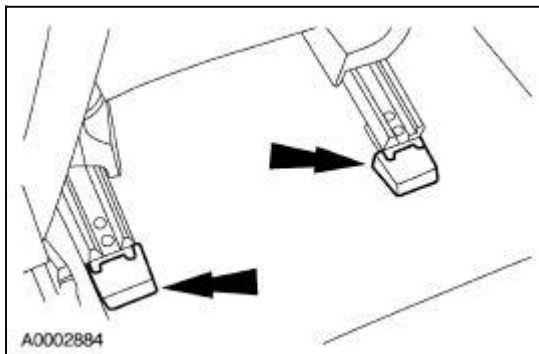


3. Install the nuts.

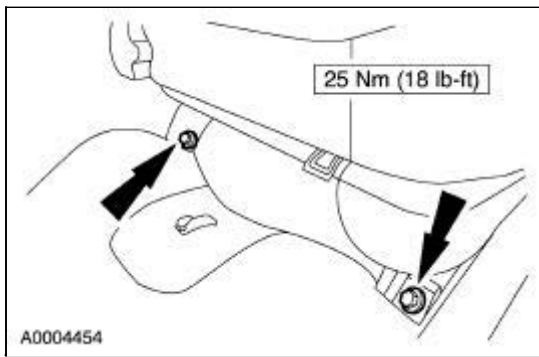


4. **NOTE:** Make sure the seat track covers are positioned below the level of the seat track rail to prevent damage to the cover during seat travel.

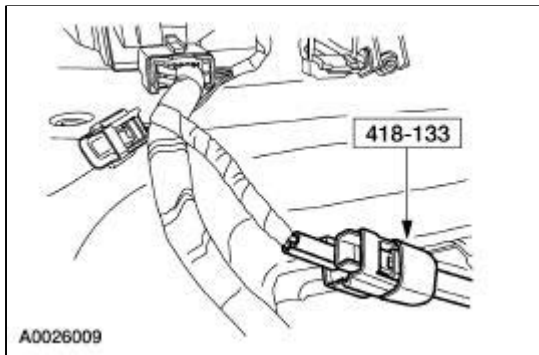
Install the seat track rear covers.



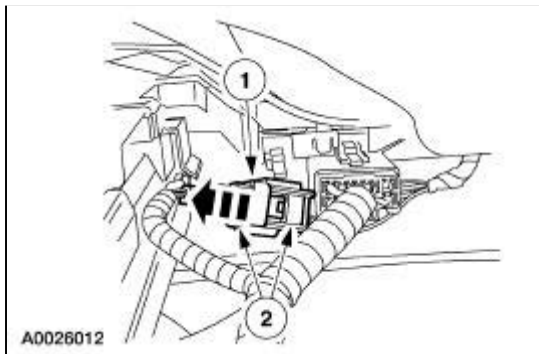
5. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
6. Position the seat rearward.
7. Install the bolts.



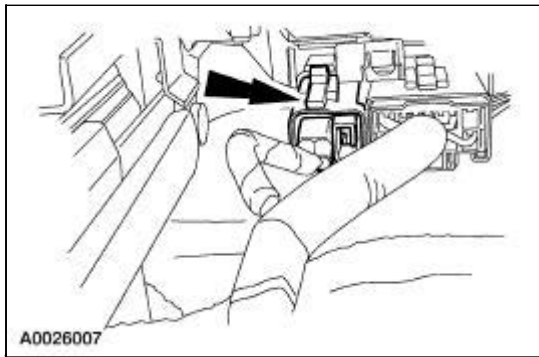
8. Position the seat forward.
9. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
10. Remove the restraint system diagnostic tool from the driver seat side air bag floor electrical connector.




11. Connect the driver seat side air bag electrical connector.
 1. Connect the driver seat side air bag electrical connector.
 2. Slide and engage the driver seat side air bag electrical connector locking clip.



12. Install the driver seat side air bag electrical connector onto the connector bracket under the driver seat.



13. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
14. With the restrain system diagnostic tools still installed at the remaining deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

15.  **WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.**

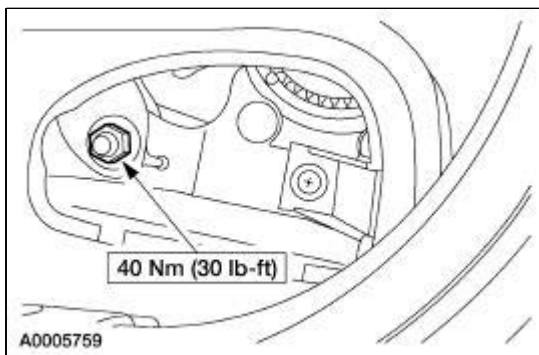
Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

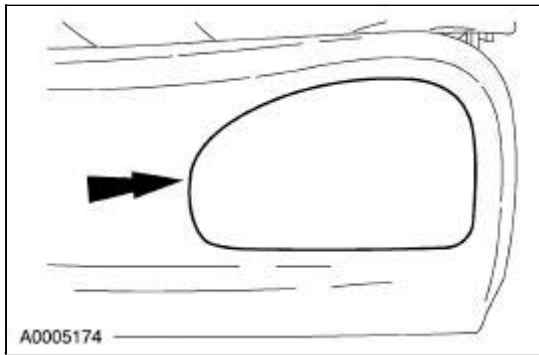
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).


16. Install the front safety belt.
 1. Install the safety belt.
 2. Install the bolt.




17. Install the safety belt cover.



18. Restore the vehicle to operating condition.

1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.



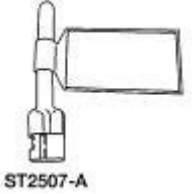
2.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to Section 501-20B.


3. Check the active restraint system for correct operation. For additional information, refer to Section 501-20A.
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Seat —Front Cushion Side Shield

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (2 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal and Installation


 **WARNING:** Always wear safety glasses when repairing a air bag supplemental restraint system (SRS) vehicle and when handling an airbag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

NOTE: The left side is shown, the right side is similar.

1. Prepare the vehicle for front cushion side shield removal.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

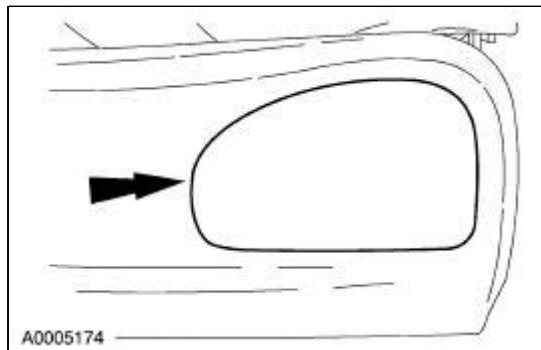
Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.**

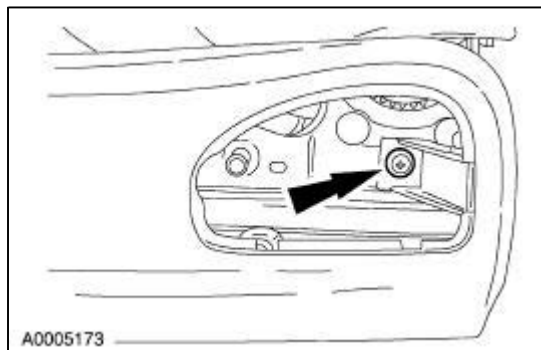
Remove the affected seat. For additional information, refer to [Front Seat](#) in this section.

2.  **CAUTION: Do not use a screwdriver to remove the safety belt cover.**

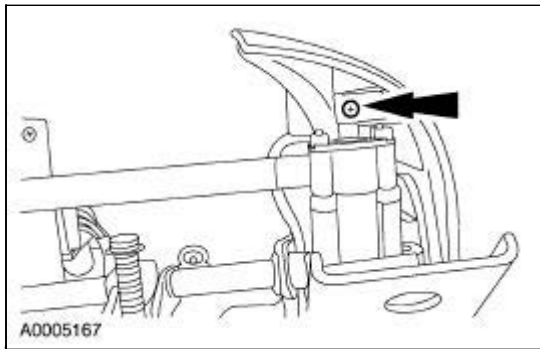
Remove the safety belt cover by placing fingers behind the cover and pushing outward.



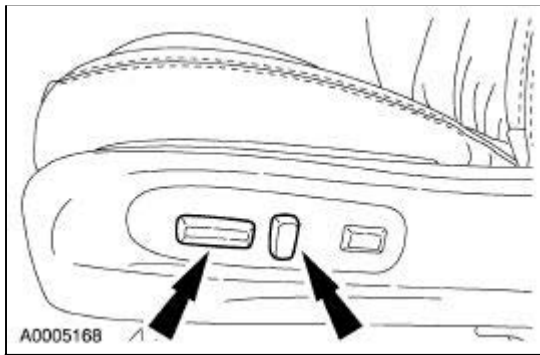
3. Remove the front cushion side shield screw.



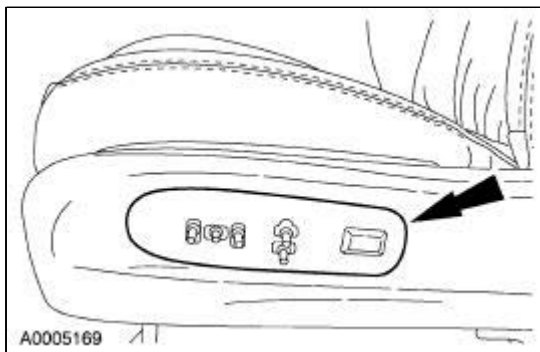
4. Remove the front cushion side shield screw.



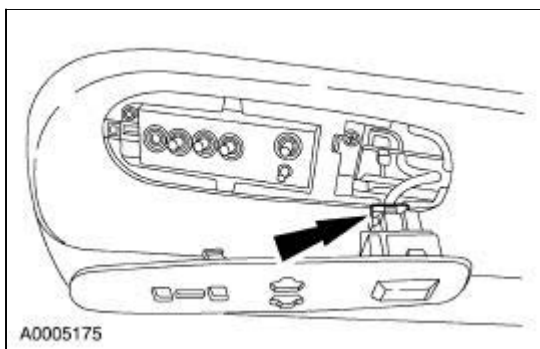
5. Remove the seat control switch knobs.



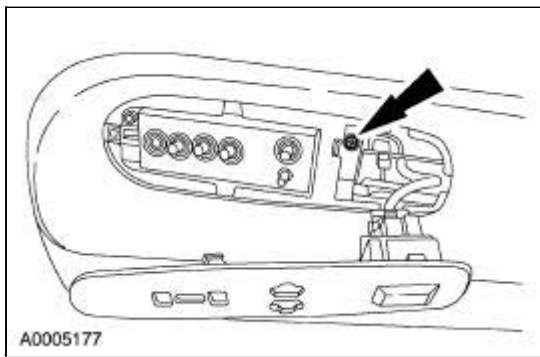
6. Position the seat control switch plate aside.



7. Disconnect the lumbar control switch electrical connector.



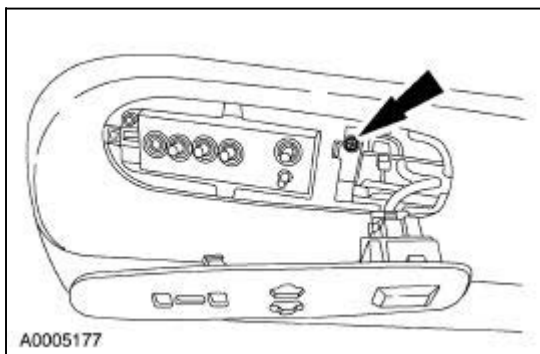
8. Remove the screw and the front cushion side shield.



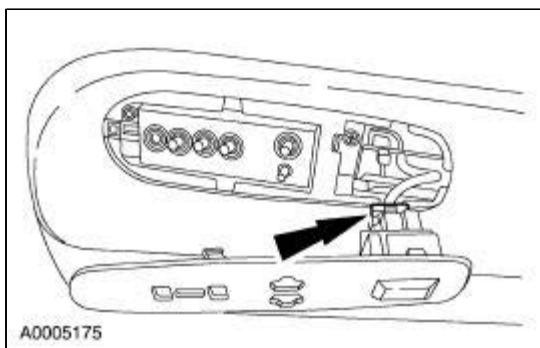
Installation

⚠ WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, and notes at the beginning of the removal procedure.

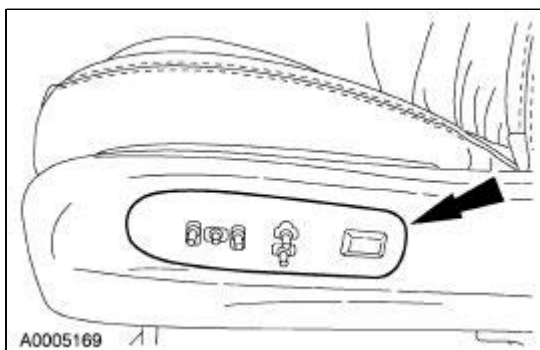
1. Install the front cushion side shield. Install the screw.



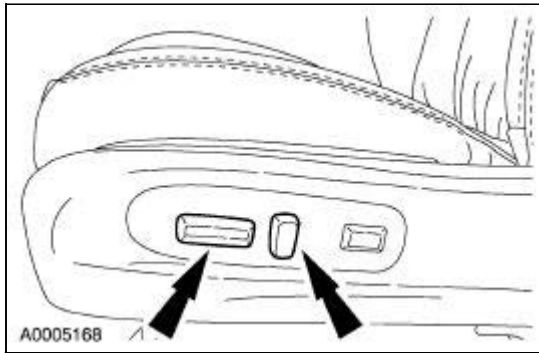
2. Connect the lumbar control switch electrical connector.



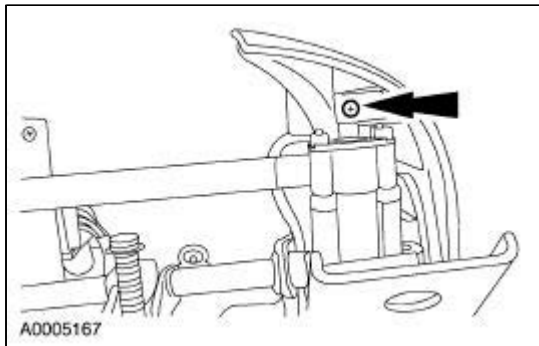
3. Install the seat regulator control switch plate.



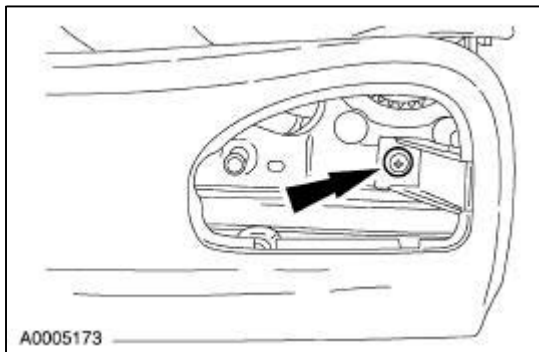
4. Install the seat control switch knobs.



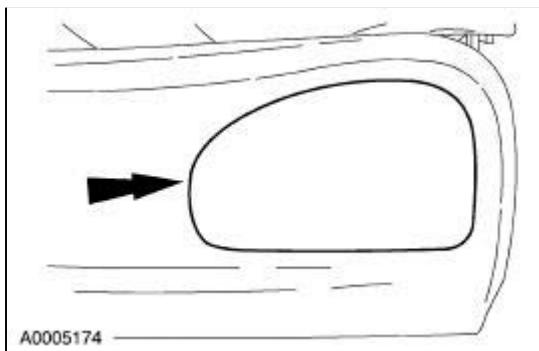
5. Install the front cushion side shield screw.



6. Install the front cushion side shield screw.



7. Install the safety belt cover.




8. Restore the vehicle to operating condition.


1.  **WARNING:** To reduce the risk of serious personal injury, read and follow all

warnings, notes, and instructions in the seat removal and installation procedure.

Install the affected seat. For additional information, refer to [Front Seat](#) in this section.

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

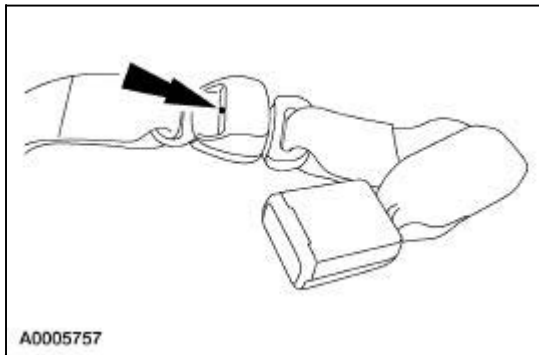
With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

4. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).
-

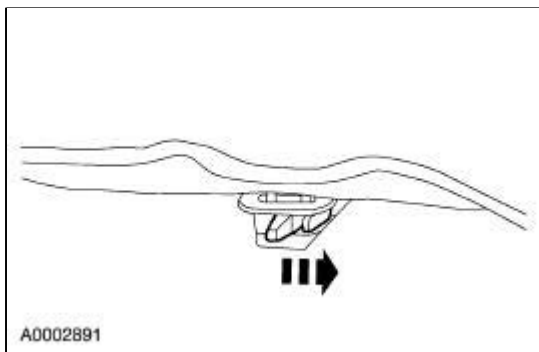
Seat —Rear Cushion

Removal and Installation

1. Using a suitable tool, release the mini-buckle.





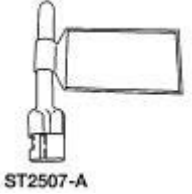
2. Release the two latches and remove the rear seat cushion.




3. To install, reverse the removal procedure.
 - Check the restraint system for correct operation.
-


Seat Track

Special Tool(s)


 ST2502-A	Diagnostic Tool, Restraint System (2 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal

 **WARNING:** Always wear safety glasses when repairing a air bag supplemental restraint system (SRS) vehicle and when handling an airbag module. This will reduce the risk of injury in the event of an accidental deployment.


 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

 **CAUTION:** Use care when handling the seat and track assembly. Dropping the assembly or sitting on a seat not secured in the vehicle may result in damaged components.

NOTE: The left side is shown, the right side is similar.

1. Prepare the vehicle for seat track removal.


-  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

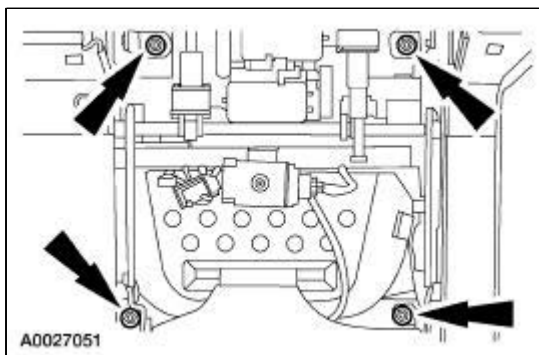
Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.**

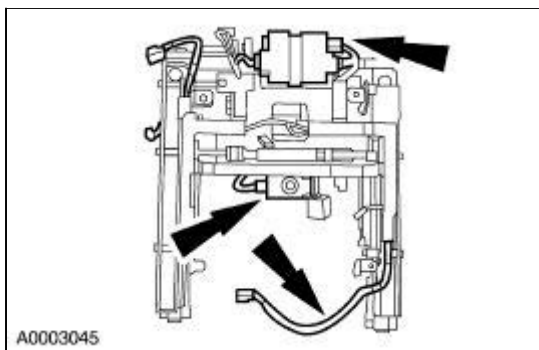
Remove the affected seat. For additional information, refer to [Front Seat](#) in this section.

4. Remove the front cushion side shield. For additional information, refer to [Seat—Front Cushion Side Shield](#) in this section.
5. Remove the seat backrest. For additional information, refer to [Front Seat Backrest](#) in this section.

2. Remove the nuts and the seat track.



3. Remove the wiring harness, driver seat module, seat track trim panel, and if equipped, the heated seat module.

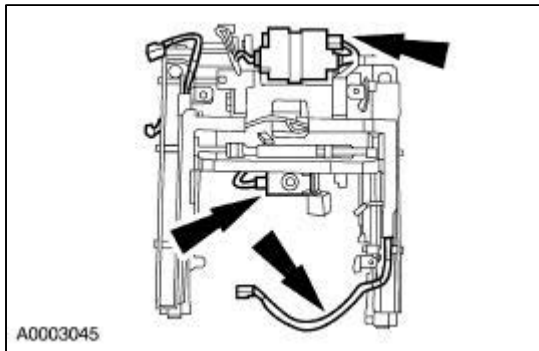


Installation

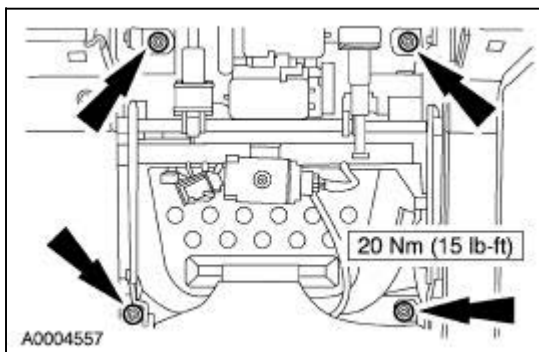



WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, and notes at the beginning of the removal procedure.

1. Install the wiring harness, driver seat module, seat track trim panel, and if equipped, the heated seat module.




2. Install the seat track and nuts.




3. Restore the vehicle to operating condition.
 1. Install the seat backrest. For additional information, refer to [Front Seat Backrest](#) in this section.
 2. Install the front cushion side shield. For additional information, refer to [Seat—Front Cushion Side Shield](#) in this section.
 3.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the seat removal and installation procedure.

Install the affected seat. For additional information, refer to [Front Seat](#) in this section.

4.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

5.  **WARNING:** The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

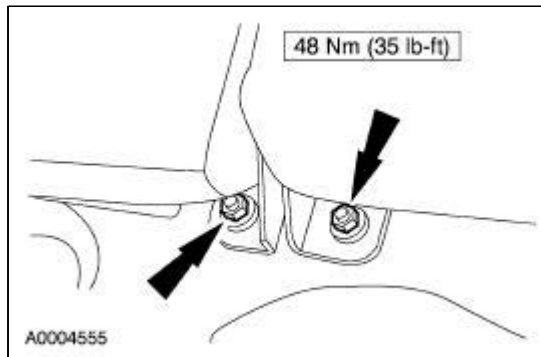
With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

6. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).

Seat —Rear Seatback

Removal and Installation



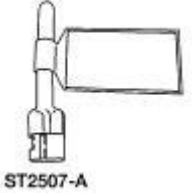
1. From the luggage compartment, release and fold down the seat backrest.
2. Remove the rear seat backrest nuts and remove the seat backrest.




3. To install, reverse the removal procedure.
-


Heated Seat Module

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (2 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal


 **WARNING:** Always wear safety glasses when repairing a air bag supplemental restraint system (SRS) vehicle and when handling an airbag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

NOTE: The left side is shown, the right side is similar.

1. Prepare the vehicle for heated seat module removal.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

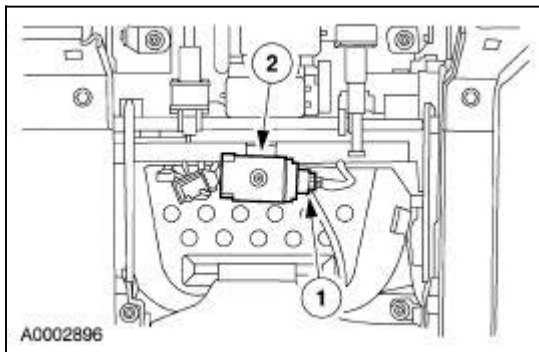
2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.**

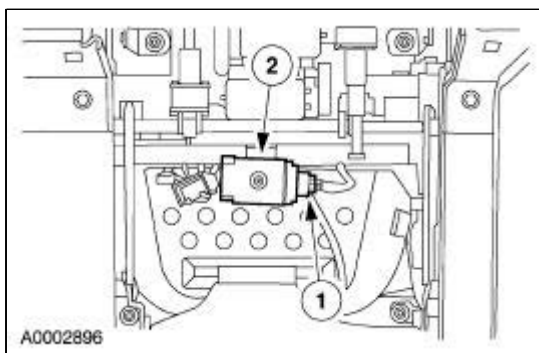
Remove the affected seat. For additional information, refer to [Front Seat](#) in this section.


2. Remove the heated seat module.
 1. Disconnect the electrical connector.
 2. Remove the module.




Installation

1. Install the heated seat module.
 1. Connect the electrical connector.
 2. Install the module.




2. Restore the vehicle to operating condition.
 1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the seat removal and installation procedure.**

Install the affected seat. For additional information, refer to [Front Seat](#) in this section.

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.



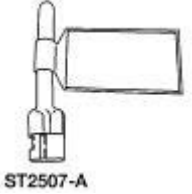
3.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).


4. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).
-


Motor —Front Seat Lumbar

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (2 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal


 **WARNING:** Always wear safety glasses when repairing a air bag supplemental restraint system (SRS) vehicle and when handling an airbag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

NOTE: The left side is shown, the right side is similar.

1. Prepare the vehicle for front seat lumbar motor removal.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**


Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.**

Remove the affected seat. For additional information, refer to [Front Seat](#) in this section.

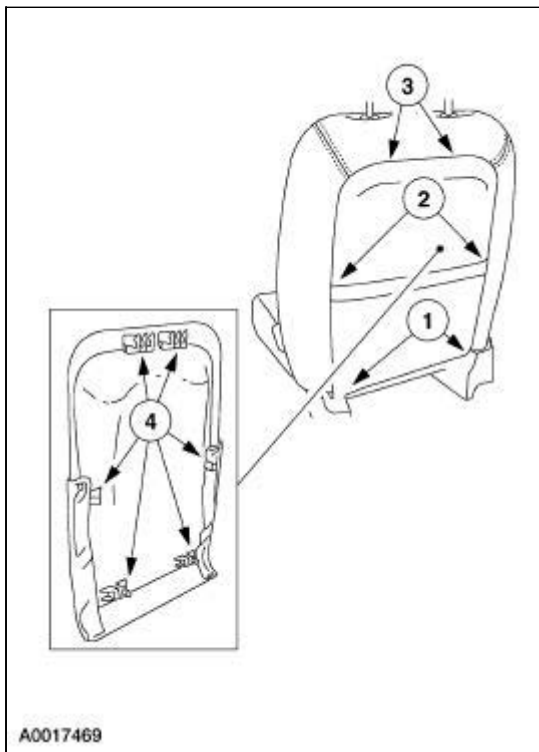
2.  **WARNING: Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced (cleaning is permissible).**

 **CAUTION: When removing the seat backrest trim panel, be careful not to damage the J-hooks. If the seat backrest trim panel J-hooks are damaged, install a new seat backrest trim panel.**

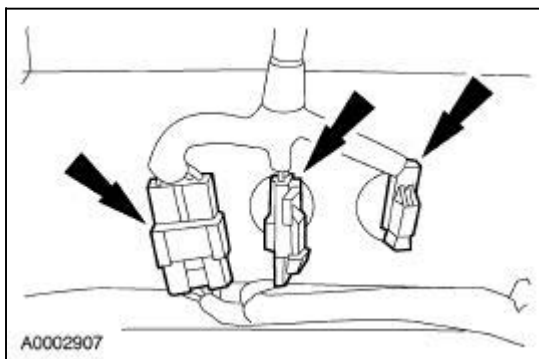
 **CAUTION: When removing the seat backrest trim panel, be careful not to damage the pin-type retainers. Pulling towards you, use a smooth, controlled force to release the pin-type retainers.**

Remove the seat backrest trim panel.

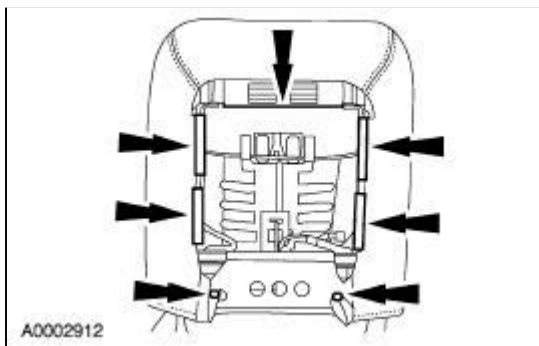
1. Pull and release the pin-type retainers at the bottom of the seat backrest trim panel.
2. While holding the seat backrest trim panel at the bottom, push in on the left side of the panel at the lip of the map pocket and slide it to the right to disengage the J-hook. Repeat this process for the right side J-hook but slide the panel to the left to disengage the J-hook.
3. While pushing in at the top of the seat backrest trim panel, slide it down to disengage the top J-hooks.
4. Remove the seat backrest trim panel and inspect the J-hooks and pin-type retainers for damage. Discard any damaged retainers and install new.



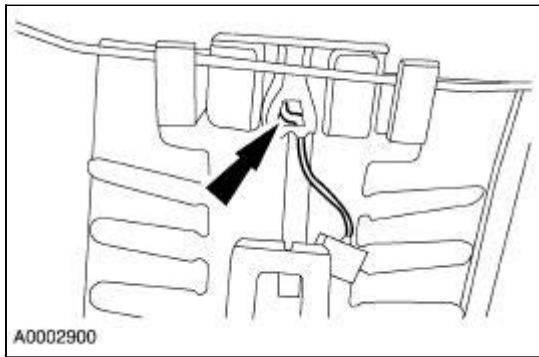
3. Disconnect the electrical connectors.
 - Release the electrical connector locators.



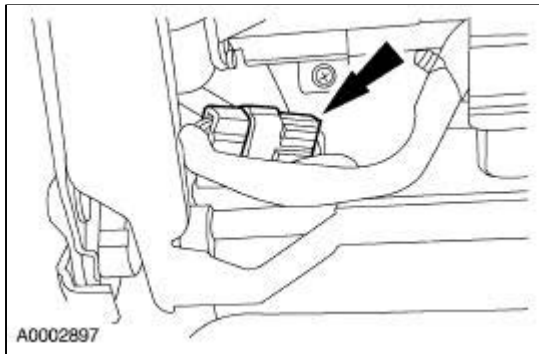
4. Release the J-retainers and pin-type retainers.



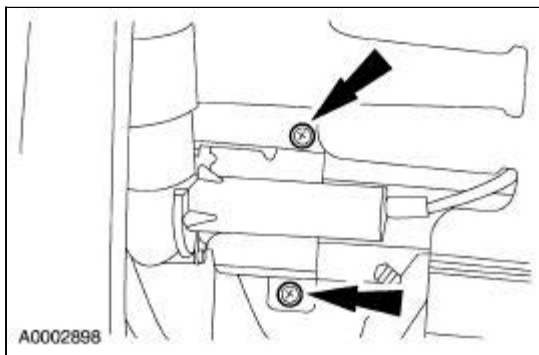
5. Remove the retaining hook.




6. Disconnect the lumbar motor electrical connector.



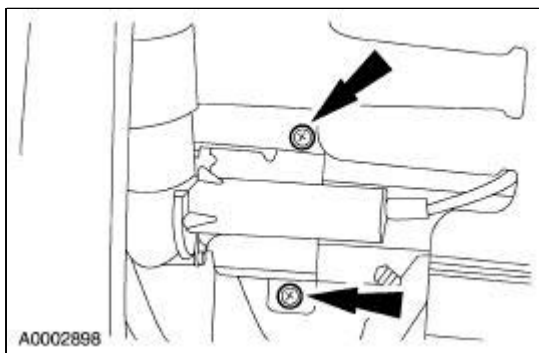
7. Remove the screws and the front seat lumbar motor.



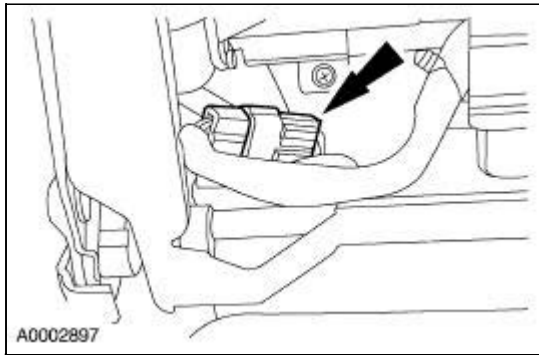
Installation

 **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings and notes at the beginning of the removal procedure.

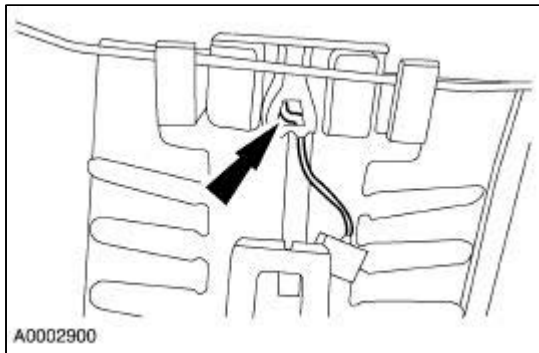
1. Install the front seat lumbar motor and the screws.



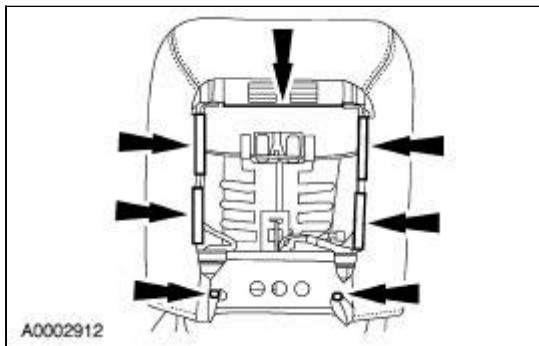
2. Connect the lumbar motor electrical connector.



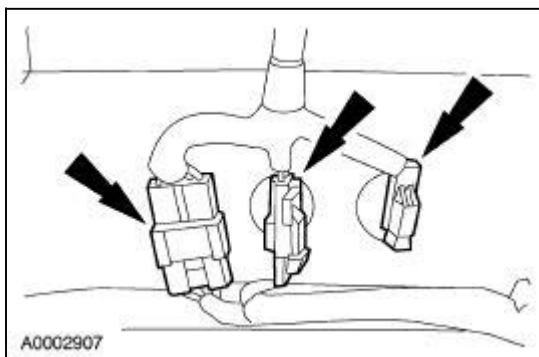
3. Install the retaining hook.




4. Install the J-retainers and pin-type retainers.



5. Connect the electrical connectors.
 - Install the electrical connector locators.

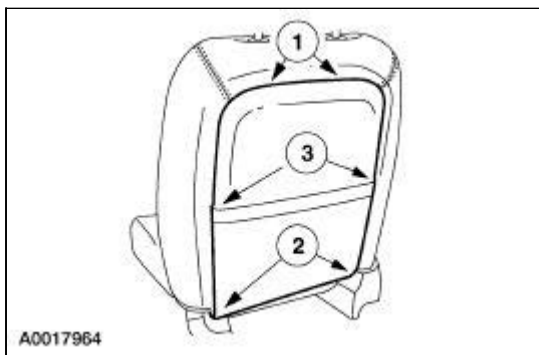


6.  **CAUTION: Inspect the seat backrest trim panel J-hooks for damage. If damaged, install a new seat backrest trim panel.**


NOTE: If re-installing the original seat backrest trim panel, install new pin-type retainers.

Install the seat backrest trim panel.


1. Angle the top of the seat backrest trim panel inward and up to engage the upper J-hooks to the seat backrest frame.
2. While holding the seat backrest trim panel up, align the new pin-type retainers at the bottom of the seat backrest trim panel and install them into the seat backrest frame.
3. With the palm of your hand, install the J-clips by pushing down on the seat backrest trim panel and towards the center of the seat.
 - Check the retention of the seat backrest trim panel by lightly pulling on the bottom, sides, and top where the retainers are located.




7. Restore the vehicle to operating condition.

1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the seat removal and installation procedure.**

Install the affected seat. For additional information, refer to [Front Seat](#) in this section.

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.



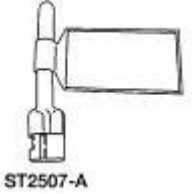
3.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).


4. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).
-


Front Seat Cushion

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (2 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Disassembly

 **WARNING:** Always wear safety glasses when repairing a air bag supplemental restraint system (SRS) vehicle and when handling an airbag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.


 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

NOTE: The left side is shown, the right side is similar.

NOTE: If a side air bag deployment took place the seatback pad, trim cover, and side air bag module must be replaced. The seatback frame should be replaced if necessary.

All seats

1. Prepare the vehicle for front seat cushion disassembly.

1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air


bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

2.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.


Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.

Remove the affected seat. For additional information, refer to [Front Seat](#) in this section.

2.  **WARNING:** Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced (cleaning is permissible).

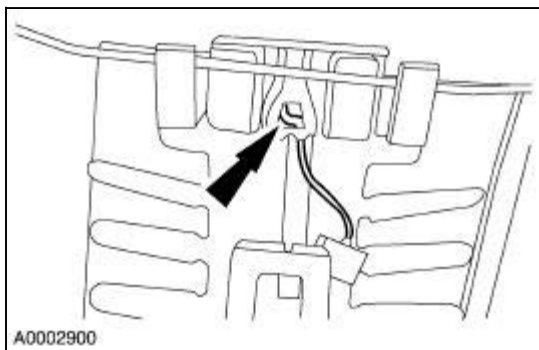
 **CAUTION:** When removing the seat backrest trim panel, be careful not to damage the J-hooks. If the seat backrest trim panel J-hooks are damaged, install a new seat backrest trim panel.

 **CAUTION:** When removing the seat backrest trim panel, be careful not to damage the pin-type retainers. Pulling towards you, use a smooth, controlled force to release the pin-type retainers.

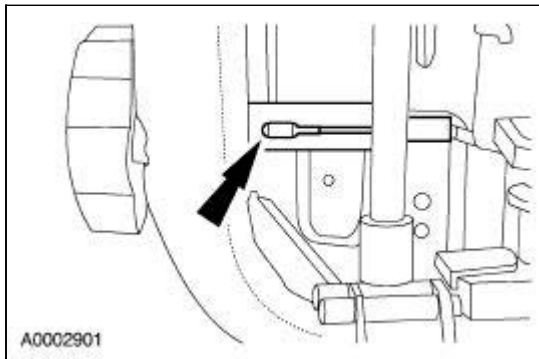
Remove the seat backrest trim panel.

Seats with manual lumbar

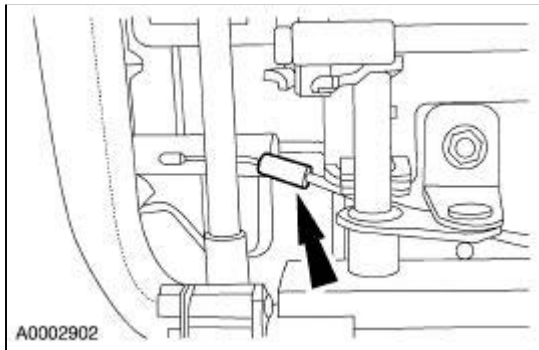
3. Remove the retaining hook.



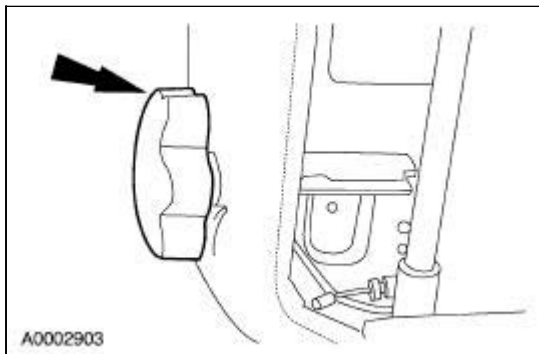
4. Align the end of the adjusting cable in the slot.



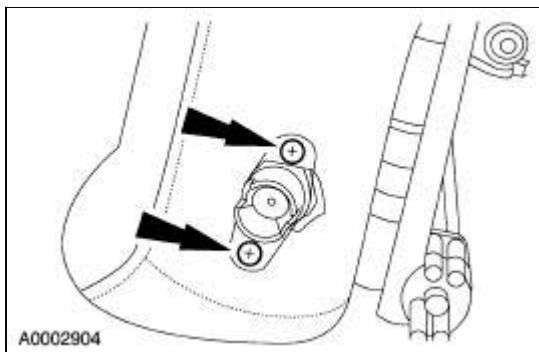
5. Release the adjusting cable.



6. Remove the manual lumbar knob.



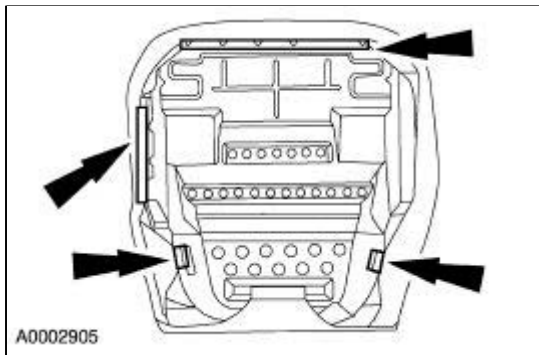
7. Remove the manual lumbar screws.



All seats

8. Remove the front cushion side shield. For additional information, refer to [Seat—Front Cushion Side Shield](#) in this section.

9. Remove the seat track. For additional information, refer to [Seat Track](#) in this section.
10. Remove the seat regulator control switch. For additional information, refer to [Seat Control Switch](#) in this section.
11. Release the J-hooks and seat cushion trim cover.



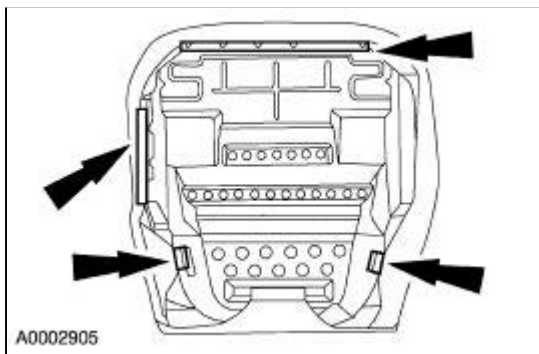
Assembly



WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, and notes at the beginning of the removal procedure.

All seats

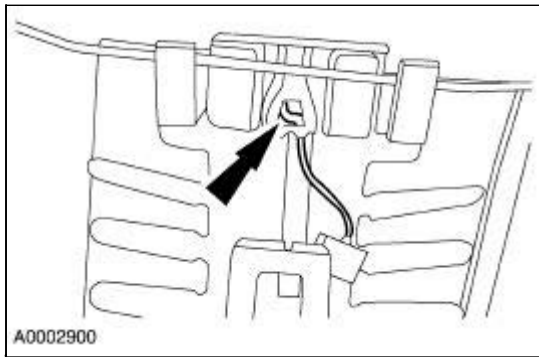
1. Install the J-hooks and the seat trim cover.



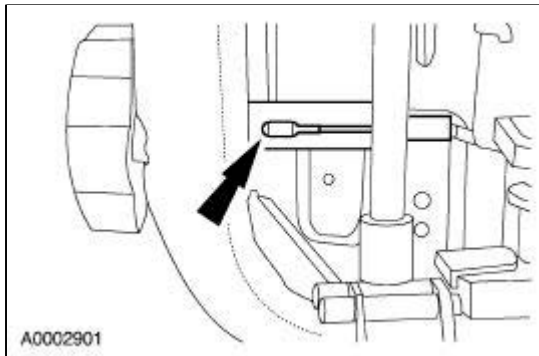
2. Install the front cushion side shield. For additional information, refer to [Seat—Front Cushion Side Shield](#) in this section.
3. Install the seat track. For additional information, refer to [Seat Track](#) in this section.
4. Install the seat regulator control switch. For additional information, refer to [Seat Control Switch](#) in this section.

Seats with manual lumbar

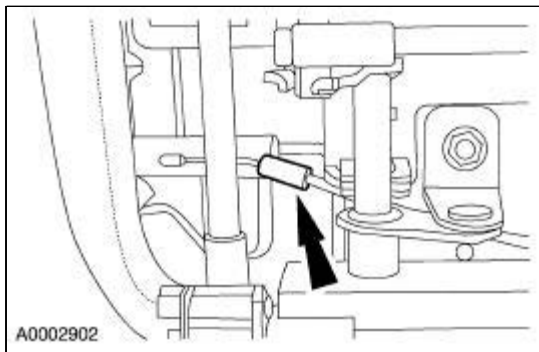
5. Install the retaining hook.



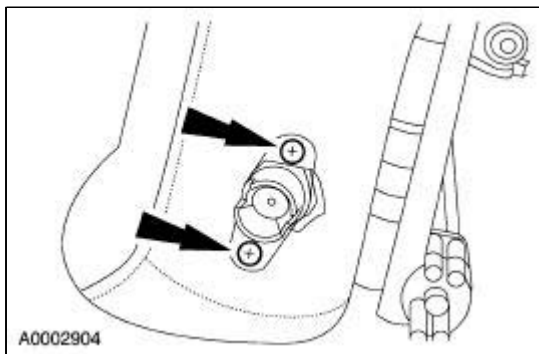
6. Align the end of the adjusting cable in the slot.



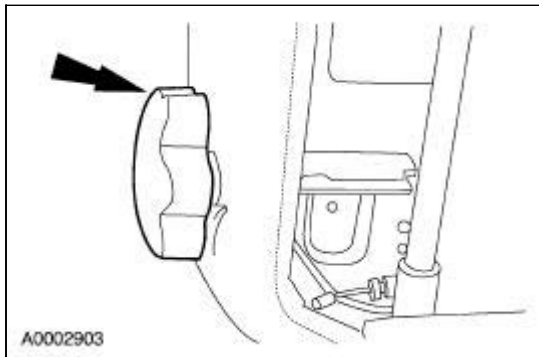
7. Install the adjusting cable.



8. Install the manual lumbar screws.



9. Install the manual lumbar knob.



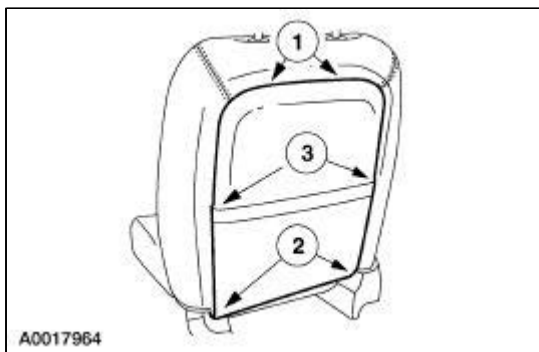
All seats

10.  **CAUTION: Inspect the seat back trim panel J-hooks for damage. If damaged, install a new seat back trim panel.**


NOTE: If re-installing the original seat backrest trim panel, install new pin-type retainers.

Install the seat backrest trim panel.


1. Angle the top of the seat backrest trim panel inward and up to engage the upper J-hooks to the seat backrest frame.
2. While holding the seat backrest trim panel up, align the pin-type retainers at the bottom of the seat backrest trim panel and install them into the seat backrest frame.
3. With the palm of your hand, install the J-clips by pushing down on the seat backrest trim panel and towards the center of the seat.
 - Check the retention of the seat backrest trim panel by lightly pulling on the bottom, sides, and top where the retainers are located.




11. Restore the vehicle to operating condition.

1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the seat removal and installation procedure.**

Install the affected seat. For additional information, refer to [Front Seat](#) in this section.

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.


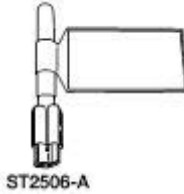
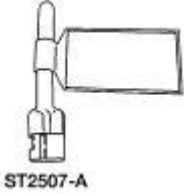
3.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to Section 501-20B .


4. Check the active restraint system for correct operation. For additional information, refer to Section 501-20A .
-


Front Seat Backrest

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (2 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Disassembly

 **WARNING:** Always wear safety glasses when repairing a air bag supplemental restraint system (SRS) vehicle and when handling an airbag module. This will reduce the risk of injury in the event of an accidental deployment.


 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

NOTE: If a side air bag deployment took place the seatback pad, trim cover, and side air bag module must be replaced. The seatback frame should be replaced if necessary.

NOTE: The left side is shown, the right side is similar.

1. Prepare the vehicle for front seat backrest removal.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

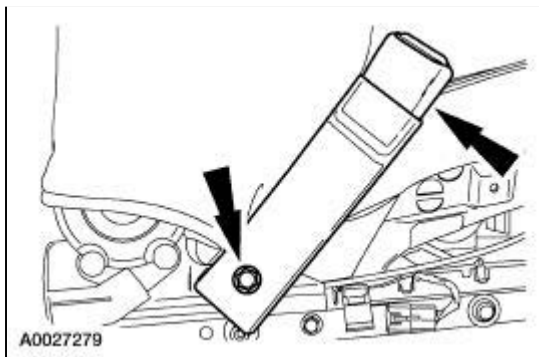
2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

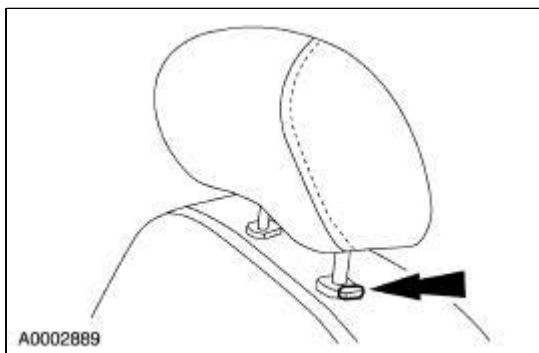
3.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.**

Remove the affected seat. For additional information, refer to [Front Seat](#) in this section.

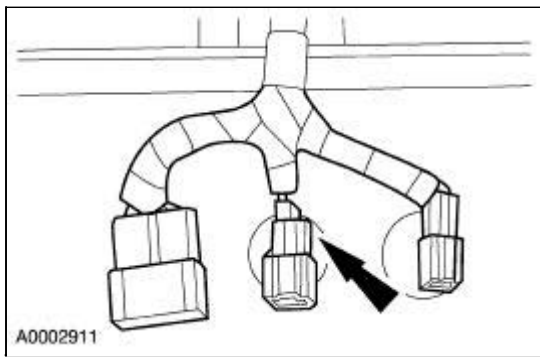
4. Remove the seat backrest. For more information, refer to [Front Seat Backrest](#) in this section.
2. Remove the front cushion side shield trim panel. For additional information, refer to [Seat—Front Cushion Side Shield](#) in this section.
3. Remove the bolt and the safety belt buckle.



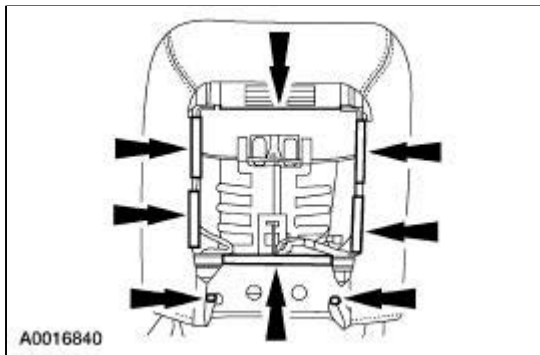
4. Remove the headrest.



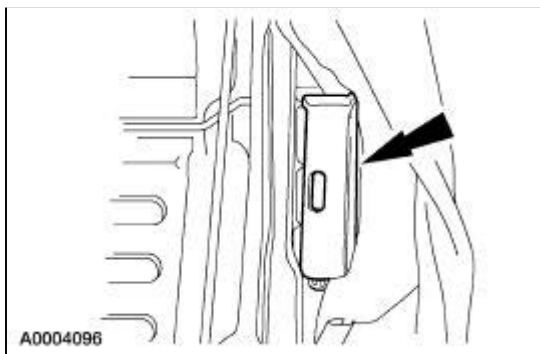
5. Release the electrical connector locators.



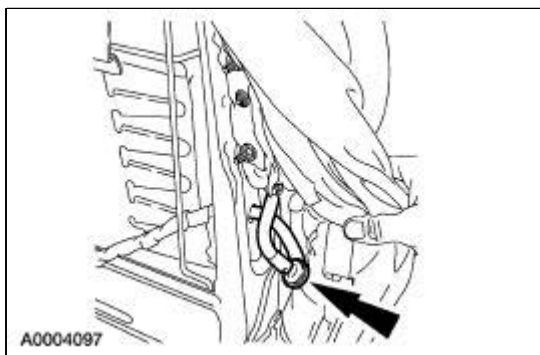
6. Release the J-retainers and pin-type retainers.



7. Reposition the seat backrest trim cover and pad and remove the side air bag module retaining nut cover.

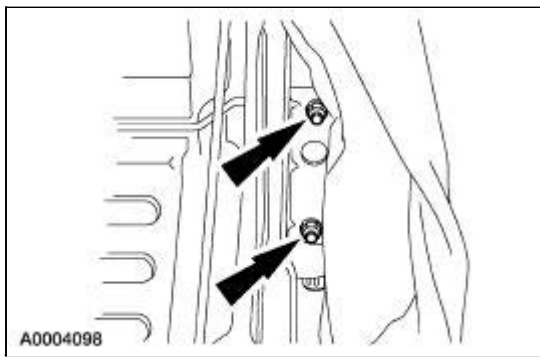


8. Push the wire harness and grommet through the seat backrest frame.

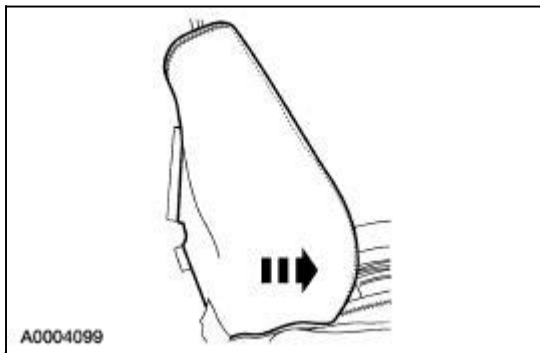


9. **NOTE:** If installing a new side air bag module, use new retaining nuts. If the same side air bag module is to be reused then reuse the side air bag module nuts.

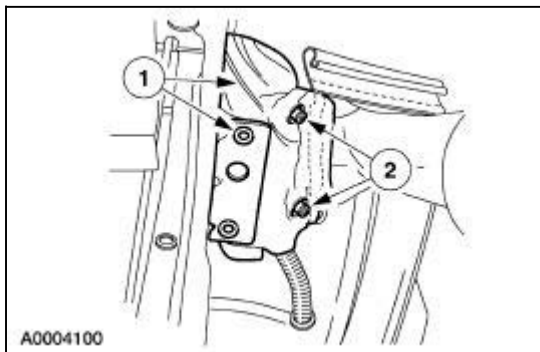
Remove the side air bag nuts. For additional information, refer to [Section 501-20B](#).



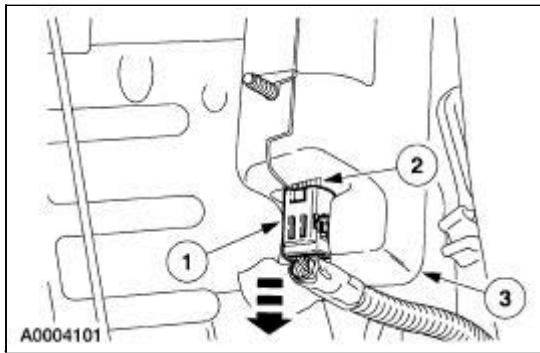
10. With one hand on the side air bag module, position the seat backrest trim cover and pad forward enough to access the side air bag module.



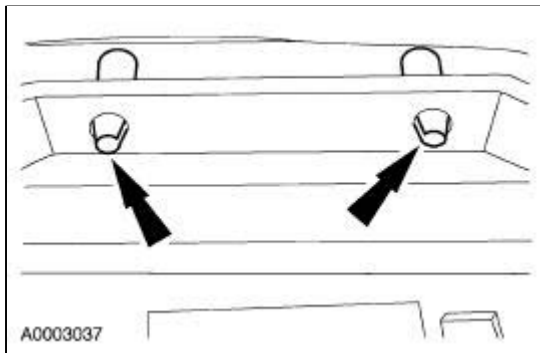
11. Remove the side air bag module from the deployment chute.
 1. Separate the side air bag module and deployment chute from the seat backrest mounting bracket.
 2. Pull the side air bag module mounting studs back through the deployment chute openings and remove the side air bag module from the deployment chute.



12. Disconnect and remove the side air bag module.
 1. Slide the side air bag electrical connector locking clip to disengage it.
 2. Release the two connector tabs (one shown) by pushing in on them and disconnect the side air bag module.
 3. Remove the side air bag module.



13. Pull back the cover to remove the headrest retaining clip.



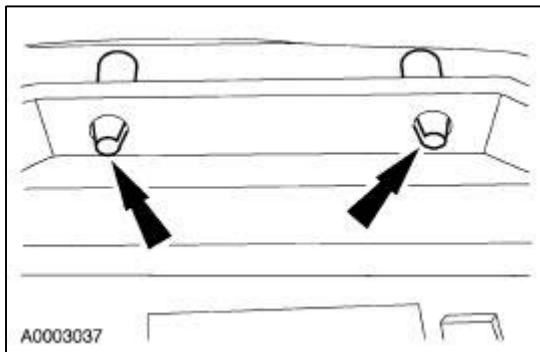
14. Remove the seat backrest cover from the frame.

Assembly

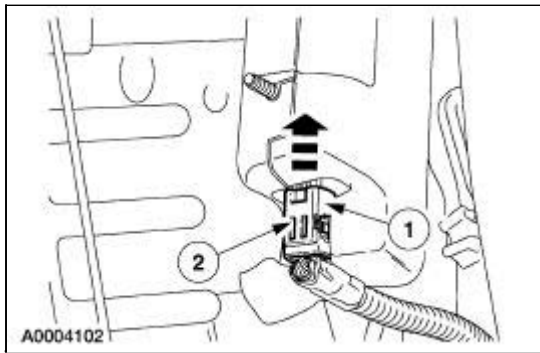


WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, and notes at the beginning of the removal procedure.

1. Position the seat backrest cover and install the headrest guides.



2. Install the seat backrest cover onto the frame.
3. Connect the side air bag module electrical connector.
 1. Install the connector to the side air bag module.
 2. Slide the side air bag module electrical connector locking clip to secure the connector to the side air bag module.



4. Make sure the electrical connector is securely fastened to the side air bag module.

⚠ WARNING: Inspect the mounting surfaces of the side air bag module for any foreign objects before installing the side air bag module. If any foreign objects are found, remove them. Failure to do so may result in personal injury in the event of an air bag deployment.

⚠ WARNING: Inspect the side air bag deployment chute and the side air bag cavity in the seat back pad for any foreign objects. If any foreign objects are found, remove them. Failure to do so may result in personal injury in the event of an air bag deployment.

⚠ WARNING: Before installing the side air bag module into the deployment chute, check it for damage and foreign objects. If the air bag module is damaged, replace it. If any foreign objects are found, remove them. Failure to do so may result in personal injury in the event of an air bag deployment.

⚠ WARNING: If the air bag cover has separated or the air bag material has been exposed, install a new side air bag module. Do not attempt to repair the air bag module. Failure to do so may result in personal injury in the event of an air bag deployment.

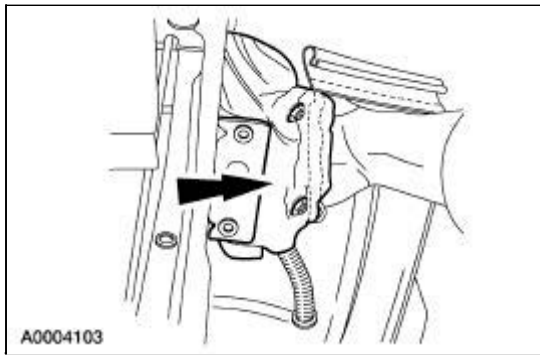
⚠ WARNING: Check the side air bag deployment chute for damage. The deployment chute must not be repaired. If there is any damage to the deployment chute, the seat back trim cover and deployment chute must be installed new as a unit.


⚠ WARNING: If the air bag deployment chute is not properly positioned, the side air bag may not deploy properly.

5. **NOTE:** The alignment pin will only allow the side air bag module to be installed to the seat backrest mounting bracket one way.

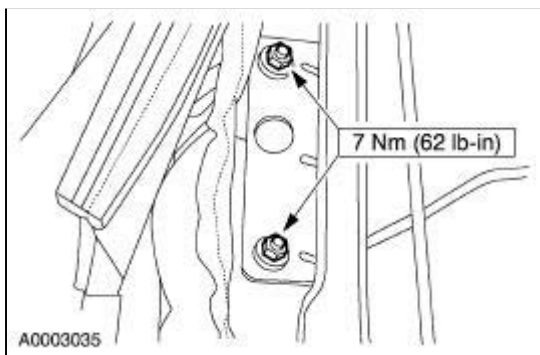
Position the side air bag module into the deployment chute.

- Position the side air bag module into the deployment chute with the alignment pin offset to the top and the electrical connector to the bottom of the seat backrest. This will position the alignment pin correctly when the side air bag module and deployment chute are mounted to the seat backrest frame mounting bracket.
- The side air bag module mounting studs must come through the deployment chute stud openings.

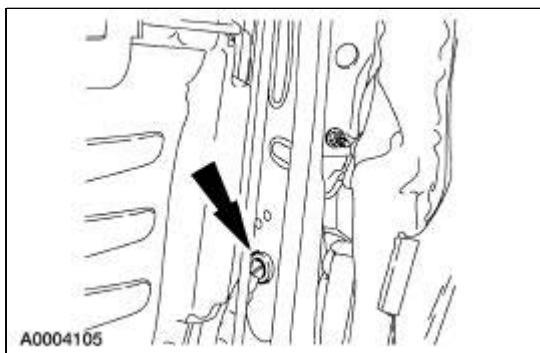


6.  **WARNING:** Inspect the mounting surfaces of the deployment chute and the seat back frame mounting bracket for any foreign objects before installing the side air bag module/deployment chute assembly. If any foreign objects are found, remove them. Failure to do so may result in personal injury in the event of an air bag deployment.

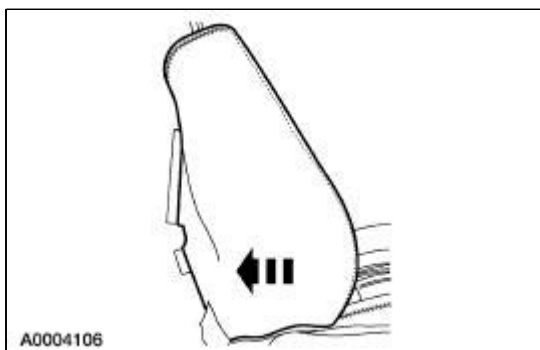
Install the new side air bag module retaining nuts and tighten to specification.



7. Pull the wire harness back through the hole in the seat backrest frame and seat the grommet.

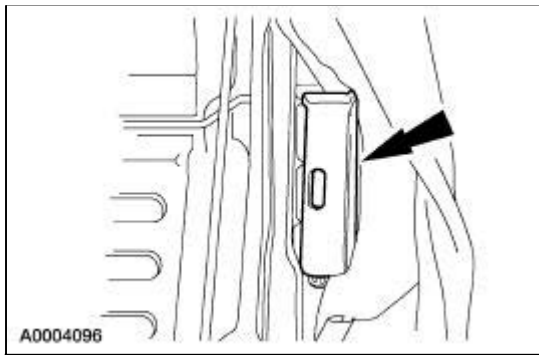


8. Reposition the seat backrest pad and trim cover to the seat backrest frame.

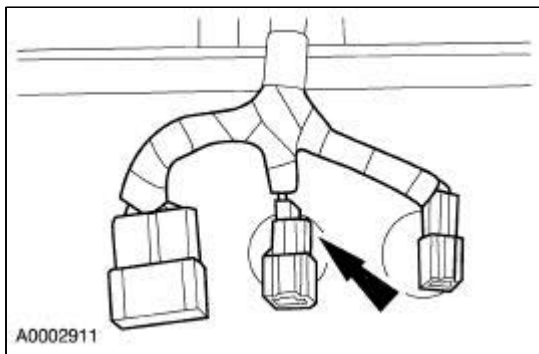


9. Attach the side air bag retaining nut cover.

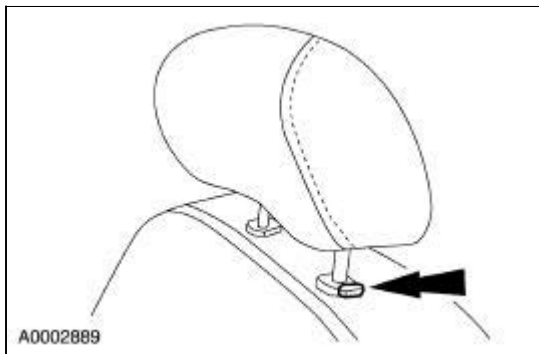
- Check that all three attaching clips on the side air bag nuts cover are correctly installed around the side air bag mounting bracket.



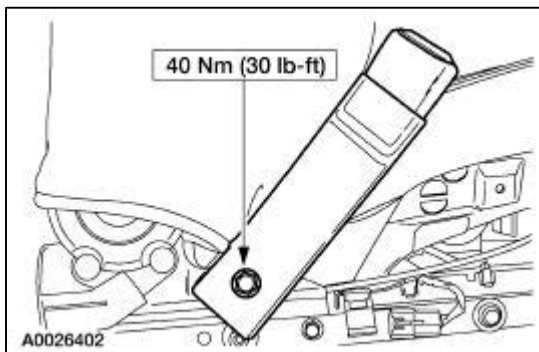
10. Install the electrical connector locators.



11. Install the headrest.




12. Position the front seat safety belt buckle. Install the bolt.




13. Install the front cushion side shield trim panel. For additional information, refer to [Seat—Front Cushion Side Shield](#) in this section.

14. Restore the vehicle to operating condition.


1. Install the seat backrest. For additional information, refer to [Front Seat Backrest](#) in this section.

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the seat removal and installation procedure.**

Install the affected seat. For additional information, refer to [Front Seat](#) in this section.

3.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation and reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

4.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

5. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).

**WINDOW REGULATOR ELECTRIC DRIVE
CURRENT DRAW**

Description	Specification
No load	5 amperes or less at 12.8 volts

Lubricants

Item	Specification
Urethane Glass Prep Essex U-401	WSB-M2G314-B
Urethane Glass Primer Essex U-402	WSB-M5B280-C
Urethane Metal Primer Essex U-413	WSB-M2G234-C
Urethane Adhesive 400-HV	WSB-M2G316-B
Urethane Adhesive Essex U-216	WSB-M2G316-B
Rear Window Defroster Repair D8AZ-19562-AA or equivalent	WSB-M4J58-B
Dark Walnut Metallic Acrylic Lacquer Touch Up Paint ALBZ-19500-5858A or equivalent	ESR-M2-P100-C

Torque Specifications

Description	Nm	lb-ft	lb-in
Anti-theft shield screw	10	—	89
Door lock cylinder nut	10	—	89
Front door window regulator assembly bolts	5	—	44
Front door inner support bolts	12	9	—
Front window regulator to glass bolts	12	9	—
Inner front door support bracket nuts	12	9	—
Latch screws	13	10	—
Window motor screws	3	—	27
Rear door inner support bolts	12	9	—
Rear door window regulator bolts and nuts	5	—	44

Glass, Frames and Mechanisms

The glass, frames and mechanisms include:

- front door window motor
- rear door window motor
- master window regulator control switch
- back window glass
- front door window glass
- rear door window glass
- rear quarter window glass
- front door window regulator
- rear door window regulator
- windshield glass

Window, One-Touch Down

The driver window one-touch down feature is activated by pressing the master window regulator control switch to the second down position. This allows the front door window glass to move downward until it is fully lowered. Momentarily pressing the window regulator control switch while the window is moving downward will stop the front door window glass.

Window Glass, Door

The bottom of the door window glass is mounted on a slider bracket which is part of the door window regulator. Door window glass bracket spacers provide attachment points for the door window glass and prevent direct contact between the slider bracket and the door window glass.

Switch, Window Regulator Control

Power windows are standard in the LS series. The master window regulator control switch can be used to power any or all of the power windows. A single window regulator control is located on all passenger door armrests to activate the individual power window only.



Motor, Window Regulator

The front and rear window regulator motors are replaced separately.

Glass, Frames and Mechanisms

Refer to Wiring Diagrams Section [501-11](#) for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

Front Electronics Module (FEM) and Rear Electronics Module (REM)

The front electronics module (FEM) receives inputs and delivers outputs to a majority of the electronically controlled features which reside primarily in the front section of the vehicle. The rear electronics module (REM) receives inputs and delivers outputs to a majority of the electronically controlled features which reside primarily in the rear section of the vehicle. The FEM and REM are configurable modules and must be correctly configured to the vehicle. The modules may also be configured to allow additional features or functions to be added to the vehicle. The FEM and REM do not have any optional window control configurations.

Driver Door Module (DDM)

The DDM receives inputs from the remote keyless entry transmitter and hardwired components such as the master window regulator control switch and delivers outputs in the form of SCP network messages and hardwired component control. The DDM is a configurable module and must be correctly configured to the vehicle. The DDM may also be configured to allow additional features or functions to be added to the vehicle. The only DDM window feature that can be optionally configured is the window global open and close feature.

Module Inputs and Outputs

This system is unique in that many of the inputs that the FEM, REM and DDM receive are over the SCP communication network. These input messages come from other modules connected to the

network. The FEM, REM and DDM will interpret the inputs, and in turn command the correct output that was requested. The modules also receive inputs which come directly from components which are hardwired to the modules such as the window regulator control switches.

One type of output the modules provide is over the SCP communication network in the form of messages. These types of outputs are usually generated from a module monitoring a hardwired input and sending a status message to another module. These outputs are commonly required by other modules to carry out their functions. The second type of output is the control of a component directly hardwired to the module.

Master Window Regulator Control Switch

The master window regulator control switch is hardwired to the DDM. Activating the master window regulator control switch sends a voltage signal to the DDM. The DDM will interpret the signal and control the power and ground to the driver front window regulator electric drive.

Activation of any of the passenger window switches on the master window regulator control switch sends a voltage signal to the DDM. The DDM interprets the signal and sends out the appropriate message over the SCP communication network. For the passenger front window, the FEM will interpret the DDM message and control the passenger front window regulator electric drive. For the rear passenger windows, the REM will interpret the DDM message and control the appropriate rear window regulator electric drive.

The driver one-touch down feature allows the driver front window to be lowered without holding the master window regulator control switch. Activation of the master window regulator control switch to the second down position sends a separate voltage signal to the DDM. The DDM will then control the power and ground to the driver front window regulator electric drive until a switch input is received or the motor reaches a stalled condition.

Passenger Window Power Supply

The REM controls the power supply to all three remote window regulator control switches. To protect the REM from a potential failure, the REM will remove power from the common passenger window power supply when a short to ground is sensed in any remote window regulator control switch, associated circuitry or the power output circuit of the REM. Power will be restored to the power output circuit upon a cycling of the ignition switch. If the REM output circuit is shorted to ground, the REM will immediately remove power from the common power supply circuit. If any remote window regulator control switch or its associated circuits are shorted to ground, the power will remain on the REM output circuit until the switch or circuit containing the short to ground is activated.

Passenger Window Lock-Out

The master window regulator control switch incorporates a passenger window lock-out switch. Activating the passenger window lock-out switch sends a separate voltage signal to the DDM. The DDM will then output a message to the REM. The REM will in turn remove power from the common passenger window power supply circuit. The rear window operation will be allowed from the master window regulator control switch only.

Passenger Front Power Window

The passenger front power window is controlled by the FEM. The passenger front window regulator control switch is hardwired directly to the FEM. Activating the passenger front window regulator control

switch sends a voltage input to the FEM. The FEM then controls power and ground to the passenger front power window regulator electric drive, which is directly hardwired to the FEM. The voltage signal will only be received if the REM is supplying voltage to the remote window regulator control switch circuit.

The passenger front window can also be controlled by the master window regulator control switch. Activating the passenger front switch on the master window regulator control switch sends a voltage input to the DDM. The DDM will then send a message to the FEM over the network. The FEM then controls power and ground to the passenger front window regulator electric drive.

Left Rear (LR) and Right Rear (RR) Power Windows

The LR and RR power windows are controlled by the REM. Operating commands for the rear power windows are received in two forms, from the master window regulator control switch over the SCP communication network from the DDM, or directly from the LR or RR window regulator control switches, which are hardwired to the REM.

Activating the LR or RR switch on the master window regulator control switch causes the DDM to send a message to the REM over the SCP communication network. The REM will then control power and ground to the appropriate window regulator electric drive to raise or lower the window.

Activating either the LR or RR window regulator control switch sends a voltage signal to the REM. The REM will then control power and ground to the appropriate window regulator electric drive to raise or lower the window. A voltage signal will only be received if the window lock-out is OFF and the REM is supplying voltage to the remote window regulator control switch power circuit.

Rear Window Defrost

The rear window defrost feature is controlled by the REM, powertrain control module (PCM), and the dual automatic temperature control (DATC) module. The rear window defrost switch is incorporated in the climate control head. When the switch is selected ON, the DATC module will send a message over the SCP communication network to the REM. The REM will then check its other messages for vehicle rpm from the PCM. If the rpm message is received, the REM will then ground the rear window defrost relay coil control circuit which is hardwired to the REM. The ground signal closes the rear window defrost relay which applies power to the rear window grid through the antenna isolator module. Fault management of the rear window defrost feature will prevent the rear window defrost from operating when a rpm or ignition switch invalid/missing data message is received.

Diagnosis

The FEM, REM and DDM constantly monitor systems under their control and report a concern in the form of a diagnostic trouble code (DTC). DTCs can be retrieved with the diagnostic tool or an equivalent tester through the SCP communication network.

This vehicle's design makes it unique in that electronic functions are divided into zones. The DDM controls features near the driver front door. The FEM controls features in the front portion of the vehicle and the REM controls the features in the rear portion. These systems rely heavily on the SCP communication network in order to transmit and receive messages. It is vital when diagnosing this vehicle's electronic systems, to understand:

- where the input (command) originates.
- all input information messages necessary in order for a feature to operate correctly.

- which module(s) receive(s) the input (or command message).
- if the module which received the input (message) controls the output of the feature, or does it output a message over the communication network to another module.
- which module controls the output of the feature.

Delayed Accessory

Delayed accessory operation allows the power windows, radio and moon roof (if equipped) to operate for up to ten minutes after the ignition is turned to OFF. The delayed accessory function is controlled by the DDM. When the ignition switch is turned from RUN to OFF, the DDM will begin the timing sequence. If a door is opened or the ignition switch is activated to another position, the DDM will cancel the delayed accessory operation.

Heated Wiper Park

The heated wiper park grid (located within the lower painted area of the windshield) receives power from the heated wiper park relay located in the underhood auxiliary junction box (AJB). The heated wiper park relay coil is connected to a fused circuit from the underhood AJB. The heated wiper park relay is controlled by a switched ground from the DATC module controlled heated wiper park ON/OFF switch. The heated wiper park grid is automatically activated by the DATC module when ambient air temperature drops below 38° F (3° C), and can be manually activated by pushing the heated wiper park ON/OFF switch. The system can be manually switched OFF, and will shut off automatically when ambient air temperature rises above 38° F (3° C) or if the vehicle voltage is low.

Inspection and Verification

NOTE: The DATC module, DDM, FEM, and REM must be reconfigured upon replacement. For more information refer to [Section 418-01](#).

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Window regulator ● Window run weatherstrip ● Door window glass 	<ul style="list-style-type: none"> ● Battery junction box (BJB) fuse(s): 409 (5A), 419 (30A), 420 (20A), 422 (30A), 425 (40A), 426 (30A), 427 (30A), 429 (30A), and 430 (20A) ● Central junction box (CJB) fuse 207 (5A) ● Underhood auxiliary junction box (AJB) fuse 113 (30A) ● Master window regulator control switch ● Remote window regulator control switch ● Window regulator electric drive ● DATC module ● DDM ● FEM ● REM ● Rear window defrost grid ● Heated wiper park grid ● Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the diagnostic tool does not power up, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTICS test. If the diagnostic tool responds with:
 - CKT 914, CKT 915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for FEM, go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for REM, go to Pinpoint Test B.
 - NO RESP/NOT EQUIP for DDM, go to Pinpoint Test C.
 - NO RESP/NOT EQUIP for DATC module, refer to [Section 412-00](#).
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), clear the continuous DTCs and carry out self-test diagnostics for the FEM, REM, DDM, and DATC module.
6. If DTCs related to the DATC module are retrieved, refer to [Section 412-00](#).
7. If the DTCs retrieved are related to the concern, go to the FEM Diagnostic Trouble Code (DTC) Index, REM Diagnostic Trouble Code (DTC) Index, or DDM Diagnostic Trouble Code (DTC) Index.
8. If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue the diagnostics.

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1342	ECU Is Defective	FEM	CLEAR the DTC. REPEAT the FEM self-test. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1438	Wiper Mode Select Switch Circuit Failure	FEM	REFER to Section 501-16 .
B1446	Wiper Park Sense Circuit Failure	FEM	REFER to Section 501-16 .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to Section 413-01 .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1567	Lamp Headlamp High-Beam	FEM	REFER to Section 417-01 .

	Circuit Failure		
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B1794	Lamp Headlamp Low-Beam Circuit Failure	FEM	REFER to Section 417-01 .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	GO to Pinpoint Test G .
B2215	Window Passenger Front Down Switch Short to Battery	FEM	GO to Pinpoint Test G .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
C1284	Oil Pressure Switch Failure	FEM	REFER to Section 413-01 .
C1446	Brake Switch Circuit Failure	FEM	REFER to Section 413-01 .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to Section 211-00 .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to Section 211-00 .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test. REFER to Section 206-09A .
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
AL_EVT1	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND

AL_EVT2	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT3	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT4	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT5	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT6	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT7	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT8	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR
FLUID_1	Brake Fluid Level Switch #1	OFF, ON
HOOD_SW	Hood Ajar Switch	CLOSED, AJAR
IGN_R	Ignition Switch -RUN Position	NO, YES
L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position Sensor (Left/Right)	#####
PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%

R_HIGH	Right High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RADIOSW	Security Input Switch Status	OFF, ON
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-
STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	Volts
WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKS	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%
BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON
FRONT WINDOW CONTROL	PR DOWN	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
POWER MIRROR CONTROL	PR DOWN	OFF, ON
POWER MIRROR CONTROL	PR LEFT	OFF, ON
POWER MIRROR CONTROL	PR RIGHT	OFF, ON
POWER MIRROR CONTROL	PR UP	OFF, ON
STEERING COLUMN CONTROL COMMAND	LOCK_GND	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON
VAPS II OUTPUT PULSE CONTROL	VAPSIIOU	%

REM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	REM	REFER to Section 413-01 .
B1300	Power Door Lock Circuit Failure	REM	REFER to Section 501-14B .
B1310	Power Door Unlock Circuit Failure	REM	REFER to Section 501-14B .
B1331	Decklid Ajar Rear Door Circuit Failure	REM	REFER to Section 417-02 .
B1335	Door Ajar RR Circuit Failure	REM	REFER to Section 417-02 .
B1342	ECU Is Defective	REM	CLEAR the DTC. REPEAT the REM self-test. If DTC B1342 is retrieved, INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1483	Brake Pedal Input Circuit Failure	REM	REFER to Section 417-01 .
B1499	Lamp Turn Signal Left Circuit Failure	REM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	REM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	REM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	REM	REFER to Section 417-01 .
B1551	Decklid Release Circuit Failure	REM	REFER to Section 501-14B .
B1571	Door Ajar LR Circuit Failure	REM	REFER to Section 417-02 .
B1676	Battery Pack Voltage Out of Range	REM	REFER to Section 414-00 .
B2172	Inertia Switch Input Circuit Open	REM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	GO to Pinpoint Test M .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	GO to Pinpoint Test M .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	GO to Pinpoint Test J .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	GO to Pinpoint Test J .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test. REFER to Section 206-09A .
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .

REM Parameter Identification (PID) Index

PID	Description	Expected Value

BOO	Brake Switch Input	OFF, ON
DECKLID	Decklid Ajar Switch	CLOSED, AJAR
DL_DSRM	Decklid Disarm	NO, YES
DLIDOUT	Decklid Driver	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
DLIDRLS	Deck Lid Release	OFF, ON
L_TAIL	Left & Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LMRKOUT	Left Marker Lamp Driver Output State	OFF, ON
LMRKSTB	Left Marker Lamp Driver Short To Battery	NO, YES
LR_TURN	Left & Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LRDN_SW	Left Rear Down Activated	OFF, DOWN
LRDR_SW	Left Rear Door Ajar Switch	CLOSED, AJAR
LRUP_SW	Left Rear Up Activated	OFF, UP
PD_LOCK	Passenger Door Lock	NO, YES
PD_UNLK	Passenger Door Unlock	NOTLOC, LOCK
R_TAIL	Left & Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RR_TURN	Left & Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RRDN_SW	Right Rear Window Down Switch	OFF, UP
RRDR_SW	Right Rear Door Ajar Switch	CLOSED, AJAR
RRUP_SW	Right Rear Window Up Switch	OFF, DOWN

REM Active Command Index

Active Command	Display	Action
EXTERIOR LAMP CONTROL	BACKUPLMP	OFF, ON
EXTERIOR LAMP CONTROL	H MNT STP	OFF, ON
EXTERIOR LAMP CONTROL	L STOP	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
EXTERIOR LAMP CONTROL	R DEF RLY	OFF, ON
EXTERIOR LAMP CONTROL	R FOG LMP	OFF, ON

EXTERIOR LAMP CONTROL	R STOP	OFF, ON
POWER WINDOW ENABLE COMMAND	PSGR RLY	OFF, ON
REAR DOOR LOCK CONTROL	LR LOCK	OFF, ON
REAR DOOR LOCK CONTROL	LR UNLOCK	OFF, ON
REAR DOOR LOCK CONTROL	RELEASE	OFF, ON
REAR WINDOW CONTROL	LR DOWN	OFF, ON
REAR WINDOW CONTROL	LR UP	OFF, ON
REAR WINDOW CONTROL	RR DOWN	OFF, ON
REAR WINDOW CONTROL	RR UP	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

DDM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1309	Power Door Lock Circuit Short to Ground	DDM	REFER to Section 501-14B .
B1341	Power Door Unlock Circuit Short to Ground	DDM	REFER to Section 501-14B .
B1342	ECU Is Defective	DDM	CLEAR the DTC. REPEAT the DDM self-test. If DTC B1342 is retrieved, INSTALL a new DDM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1400	Driver Power Window One Touch Window Relay Circuit Short to Battery	DDM	GO to Pinpoint Test Q .
B1405	Driver Power Window Down Circuit Short to Battery	DDM	GO to Pinpoint Test F .
B1408	Driver Power Window Up Circuit Short to Battery	DDM	GO to Pinpoint Test F .
B1416	Power Window LR Motor Circuit Short to Battery	DDM	GO to Pinpoint Test N .
B1420	Passenger Power Window Motor Circuit Short to Battery	DDM	GO to Pinpoint Test H .
B1424	Power Window RR Motor Circuit Short to Battery	DDM	GO to Pinpoint Test K .
B1530	Memory Set Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1534	Memory 1 Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1538	Memory 2 Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1676	Battery Pack Voltage Out of Range	DDM	REFER to Section 419-10 .
B2112	Door Driver Set Switch Stuck Failure	DDM	REFER to Section 501-14B .
B2116	Door Driver Reset Switch	DDM	REFER to Section 501-14B .

	Stuck Failure		
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2336	Mirror Switch Assembly Circuit Failure	DDM	REFER to Section 501-09 .
B2425	Remote Keyless Entry Out of Synchronization	DDM	REFER to Section 501-14B .
B2477	Module Configuration Failure	DDM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test. REFER to Section 206-09A .
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

DDM Parameter Identification (PID) Index

PID	Description	Expected Value
ALLOCK	All Doors Lock Sense	notACT, ACTIVE
CCNT	Number Of Continuous DTCs In Module	one count per bit
CNTUNLK	Central Door Unlock Switch Status	notACT, ACTIVE
D_DN_SW	Drivers Window Down Switch	OFF, DOWN
D_DSARM	Driver Door Unlock Disarm Switch	NO, YES
D_PWPK	Drivers Power Window Peak Current	AMP
D_UP_SW	Drivers Window Up Switch	OFF, UP
DMIR_H	Drivers Side Mirror Horizontal Motor	notSEN, SENSED
DMIR_V	Drivers Mirror Vertical	notSEN, SENSED
DR_LOCK	Drivers Door Lock Output State	NO, YES
DR_UNLK	All Doors Unlock Output State	NO, YES
DRLKCYL	Door Lock Cylinder	notACT, ACTIVE
DVMRPSH	Driver Mirror Horizontal Position	one count per bit
DVMRPSV	Driver Mirror Position	one count per bit
LRDN_SW	Left Rear Down Activated	OFF, DOWN
LRUP_SW	Left Rear Up Activated	OFF, UP
MEM1_SW	Memory Recall Switch #1	notACT, ACTIVE
MEM2_SW	Memory Recall Switch #2	notACT, ACTIVE
MEMS_SW	Memory Set Switch	notACT, ACTIVE
MIR_SEL	Power Mirror Select Switch	DRVMIR, PSGMIR, OFF
MIRH_SW	Pow Mir Position Switch - Horizontal	SHORT, RIGHT, LEFT, OFF

MIRV_SW	Power Mir Position Switch - Vertical	SHORT, UP, DOWN, OFF
OTD_SW	One Touch Down Switch	OFF, DOWN
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_UP_SW	Passenger Up Activated	OFF, UP
RRDN_SW	Right Rear Down Activated	OFF, DOWN
RRUP_SW	Right Rear Up Activated	OFF, UP
VBAT	Battery Voltage	Volts

DDM Active Command Index

Active Command	Display	Action
DOOR LOCK CONTROL	DD LOCK	OFF, ON
DOOR LOCK CONTROL	DD UNLOCK	OFF, ON
DOUBLE LOCK COMMAND	DOUBLE LK	UNLOCK, LOCK
FRONT WINDOW CONTROL	DR DOWN	OFF, ON
FRONT WINDOW CONTROL	DR UP	OFF, ON
ONE TOUCH WINDOW DOWN & ACCY DELAY	ONE TOUCH	OFF, ON
POWER MIRROR CONTROL	DR DOWN	OFF, ON
POWER MIRROR CONTROL	DR LEFT	OFF, ON
POWER MIRROR CONTROL	DR RIGHT	OFF, ON
POWER MIRROR CONTROL	DR UP	OFF, ON

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the front electronic module (FEM) 	<ul style="list-style-type: none"> BJB fuses: 425 (40A) and 422 (20A). CJB fuse 207 (5A). FEM. Circuitry. 	<ul style="list-style-type: none"> GO to <u>Pinpoint Test A.</u>
<ul style="list-style-type: none"> No communication with the rear electronic module (REM) 	<ul style="list-style-type: none"> BJB fuse 425 (40A). CJB fuses: 207 (5A) and 235 (5A). REM. Circuitry. 	<ul style="list-style-type: none"> GO to <u>Pinpoint Test B.</u>
<ul style="list-style-type: none"> No communication with the driver door module (DDM) 	<ul style="list-style-type: none"> BJB fuse 425 (40A). CJB fuse 207 (5A). DDM. 	<ul style="list-style-type: none"> GO to <u>Pinpoint Test C.</u>


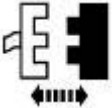
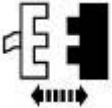

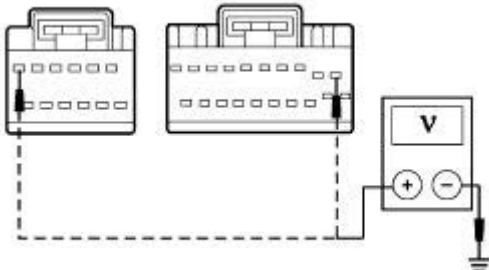
	<ul style="list-style-type: none"> ● Circuitry. 	
<ul style="list-style-type: none"> ● All power windows are inoperative — from the master window regulator control switch only 	<ul style="list-style-type: none"> ● Circuitry. ● Master window regulator control switch. ● DDM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D.
<ul style="list-style-type: none"> ● All passenger power windows are inoperative — from the remote window regulator control switches 	<ul style="list-style-type: none"> ● Circuitry. ● Remote window regulator control switches. ● REM. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test E.
<ul style="list-style-type: none"> ● A single power window is inoperative — driver window from the master window regulator control switch 	<ul style="list-style-type: none"> ● BJB fuse 420 (20A). ● Circuitry. ● Master window regulator control switch. ● DDM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test F.
<ul style="list-style-type: none"> ● A single power window is inoperative — passenger front from master and passenger front window regulator control switches 	<ul style="list-style-type: none"> ● BJB fuse 426 (30A). ● Passenger front window regulator electric drive. ● Passenger front window regulator control switch. ● FEM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test G.
<ul style="list-style-type: none"> ● A single power window is inoperative — passenger front from the master window regulator control switch only 	<ul style="list-style-type: none"> ● Master window regulator control switch. ● DDM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test H.
<ul style="list-style-type: none"> ● A single power window is inoperative — passenger front from the passenger front window regulator control switch only 	<ul style="list-style-type: none"> ● Passenger front window regulator control switch. ● FEM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test I.
<ul style="list-style-type: none"> ● A single power window is inoperative — right rear from master and remote window regulator control switches 	<ul style="list-style-type: none"> ● BJB fuse 430 (20A). ● RR window regulator electric drive. ● RR window regulator control switch. ● REM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test J.
<ul style="list-style-type: none"> ● A single power window is inoperative — right rear from the master window regulator control switch only 	<ul style="list-style-type: none"> ● Master window regulator control switch. ● DDM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test K.

<ul style="list-style-type: none"> ● A single power window is inoperative — right rear from RR window regulator control switch only 	<ul style="list-style-type: none"> ● RR window regulator control switch. ● REM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test L.
<ul style="list-style-type: none"> ● A single power window is inoperative — left rear from all window regulator control switches 	<ul style="list-style-type: none"> ● BJB fuse 419 (30A). ● LR window regulator electric drive. ● LR window regulator control switch. ● REM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test M.
<ul style="list-style-type: none"> ● A single power window is inoperative — left rear from the master window regulator control switch only 	<ul style="list-style-type: none"> ● Master window regulator control switch. ● DDM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test N.
<ul style="list-style-type: none"> ● A single power window is inoperative — left rear from the LR window regulator control switch only 	<ul style="list-style-type: none"> ● LR window regulator control switch. ● REM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test O.
<ul style="list-style-type: none"> ● All/single passenger power windows are inoperative — passenger window lock-out not operating correctly 	<ul style="list-style-type: none"> ● Master window regulator control switch. ● DDM. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test P.
<ul style="list-style-type: none"> ● The one touch down feature is inoperative 	<ul style="list-style-type: none"> ● DDM. ● Master window regulator control switch. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test Q.
<ul style="list-style-type: none"> ● The defrost system is inoperative — rear window defrost 	<ul style="list-style-type: none"> ● BJB fuse 429 (30A). ● Rear window defrost relay. ● Rear window defrost switch. ● REM. ● DATC module. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test R.
<ul style="list-style-type: none"> ● The defrost system is inoperative — heated wiper park 	<ul style="list-style-type: none"> ● Underhood AJB Fuse 113 (30A). ● Heated wiper park relay. ● REM. ● DATC module. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test S.
<ul style="list-style-type: none"> ● The defrost system will not shut off automatically — rear window defrost 	<ul style="list-style-type: none"> ● Rear window defrost relay. ● Rear window defrost switch. ● REM. ● DATC module. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test T.

<ul style="list-style-type: none"> The defrost system will not shut off automatically — heated wiper park 	<ul style="list-style-type: none"> Heated wiper park relay. DATC module. Circuitry. 	<ul style="list-style-type: none"> GO to <u>Pinpoint Test U</u>.
<ul style="list-style-type: none"> The delayed accessory is inoperative/does not operate correctly 	<ul style="list-style-type: none"> DDM. 	<ul style="list-style-type: none"> INSTALL a new DDM. REFER to <u>Section 419-10</u>. TEST the system for normal operation.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE (FEM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK22 (OG/YE) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>2</p>  <p>FEM C201c</p> <p>3</p>  <p>FEM C201f</p> <p>4</p>  <p>5</p>  <p>A0006297</p>	<p>5</p> <p>Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22 (OG/YE) harness side and ground.</p>

- Are the voltages greater than 10 volts?

→ **Yes**
GO to A2.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

A2 CHECK CIRCUITS 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS

1

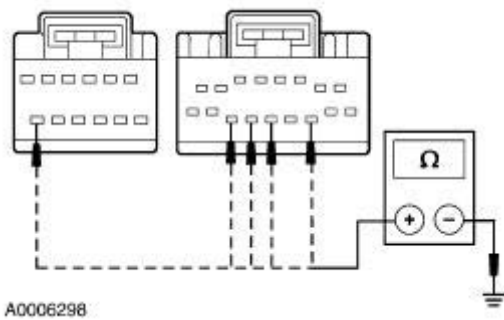


2



FEM C201a

3



3 Using the following table, measure the resistance between FEM connectors, harness side and ground:

FEM	Pin	Circuit
C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)
C201a	15	31-DK20D (BK/RD)

- Is the resistance less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

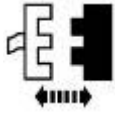
→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST B: NO COMMUNICATION WITH THE REAR ELECTRONIC MODULE (REM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CIRCUIT 29-DK31 (OG/BK) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
1	

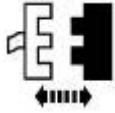


2



REM C420d

3

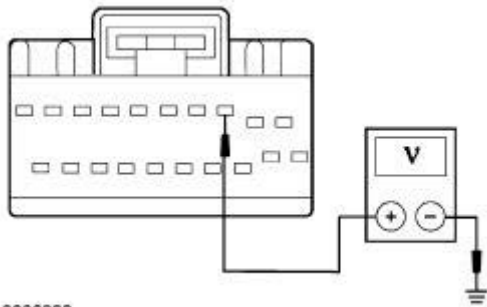


REM C420c

4



5



A0006299

5 Measure the voltage between REM C420d pin 3, circuit 29-DK31 (OG/BK), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to B2 .

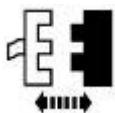
→ No
REPAIR the circuit. TEST the system for normal operation.

B2 CHECK CIRCUITS 29S-DK31 (OG/BK), 31-DK30D (BK), 31-DK30E (BK), 31-DK30F (BK), 31-DK30G (BK) AND 31-DK30H (BK/OG), FOR OPENS

1



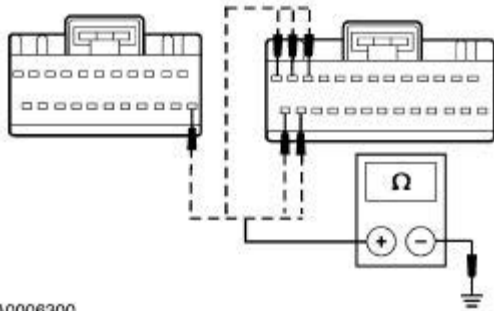
2



REM C420b

3

3 Using the following table, measure the resistance between REM connectors,



A0006300

harness side and ground:

REM	Pin	Circuit
C420c	13	29S-DK31 (OG/BK)
C420c	12	31-DK30E (BK)
C420c	11	31-DK30D (BK)
C420c	26	31-DK30G (BK)
C420c	25	31-DK30F (BK)
C420b	12	31-DK30H (BK)

- Is the resistance less than 5 ohms?


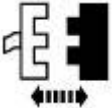

→ **Yes**

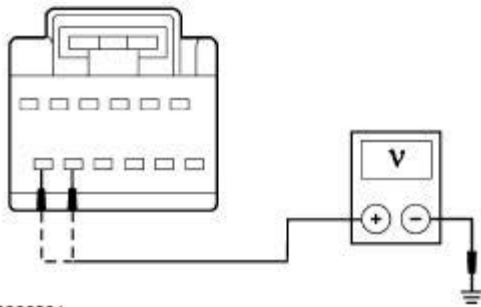
REFER to [Section 418-00](#).

→ **No**

REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST C: NO COMMUNICATION WITH THE DRIVER DOOR MODULE (DDM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK CIRCUITS 29-AJ80 (OG/BU) AND 29S-AJ86 (OG/BU) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>2</p>  <p>DDM C501a</p> <p>3</p>  <p>4</p>	<p>4</p> <p>Measure the voltage between DDM C501a pin 11, circuit 29-AJ80 (OG/BU), harness side and ground; and between DDM C501a pin 12, circuit 29S-AJ86 (OG/BU), harness side and ground.</p>



A0006301

- Is the voltage greater than 10 volts?

→ **Yes**
GO to C2.

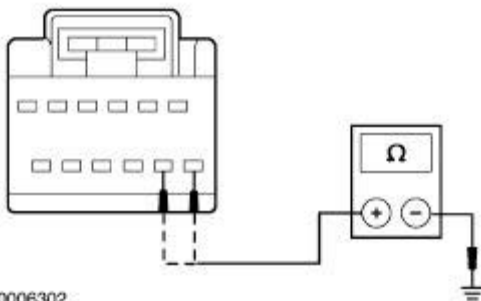
→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

C2 CHECK CIRCUITS 31-AJ80B (BK/OG) AND 91-AJ80 (BN/BU) FOR OPENS

1



2



A0006302

- 2 Measure the resistance between DDM C501a pin 7, circuit 91-AJ80 (BN/BU), harness side and ground; and between DDM C501a pin 8, circuit 31-AJ80B (BK/OG), harness side and ground.

- Is the resistance less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

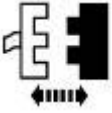
PINPOINT TEST D: ALL POWER WINDOWS ARE INOPERATIVE — FROM THE MASTER WINDOW REGULATOR CONTROL SWITCH ONLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK VOLTAGE TO THE MASTER WINDOW REGULATOR CONTROL SWITCH	

1



2

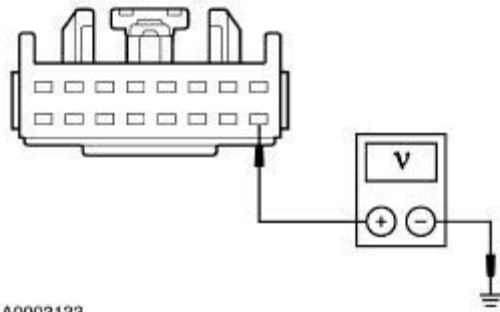


Master Window Regulator Control Switch C504

3



4



4

Measure the voltage between master window regulator control switch C504 pin 9, circuit 7-AJ7 (YE/RD), harness side and ground.

● Is the voltage greater than 6 volts?

→ **Yes**
GO to D2.

→ **No**
GO to D3.

D2 CHECK THE MASTER WINDOW REGULATOR CONTROL SWITCH

1


Check the master window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.

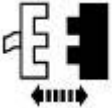
● **Did the master window regulator control switch pass the component test?**

→ **Yes**
INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

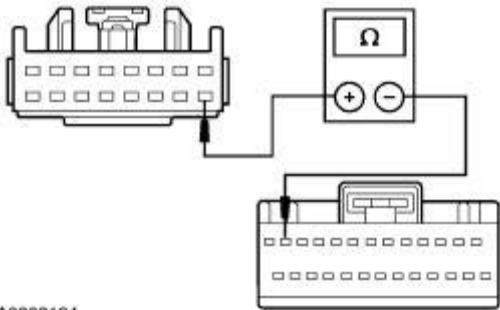
→ **No**
INSTALL a new master window regulator control switch. REFER to Switch—Master Window Regulator Control in this section. CLEAR the DTCs. REPEAT the self-test.

D3 CHECK CIRCUIT 7-AJ7 (YE/RD) FOR AN OPEN

1 

2 

DDM C501d

3 

A0003134

3 Measure the resistance between the master window regulator control switch C504 pin 9, circuit 7-AJ7 (YE/RD), harness side and DDM C501d pin 12, circuit 7-AD1 (YE), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST E: ALL PASSENGER POWER WINDOWS ARE INOPERATIVE — FROM THE REMOTE WINDOW REGULATOR CONTROL SWITCHES

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>NOTE: The REM supplies power to the three remote window regulator control switches through a single output circuit and splice. To protect the REM from potential failure, the REM will remove power when a short to ground is sensed in any remote window regulator control switch, associated circuitry or the power output circuit of the REM. Power will be restored to the power output circuit upon a cycling of the ignition switch. If the REM output circuit is shorted to ground, the REM will immediately remove power from the circuit. If any remote window regulator control switch or its associated circuits are shorted to ground, the REM will continue to supply power to the output circuit until the switch or circuit containing the failure is activated.</p>	
<p>E1 CHECK FOR FEM DTCS</p>	
	<p>1 Retrieve the recorded results from the FEM self-test.</p> <ul style="list-style-type: none"> • Were any FEM DTCs retrieved that are related to the concern?

- **Yes**
REFER to the FEM Diagnostic Trouble Code (DTC) Index.
- **No**
GO to E2.

E2 CHECK FOR REM DTCS

- 1 Retrieve the recorded results from the REM self-test.
 - **Were any REM DTCS retrieved that are related to the concern?**
- **Yes**
REFER to the REM Diagnostic Trouble Code (DTC) Index.
 - **No**
GO to E3.

E3 CHECK CIRCUIT 7-AJ14A (YE/BU) FOR POWER

NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.

1



2

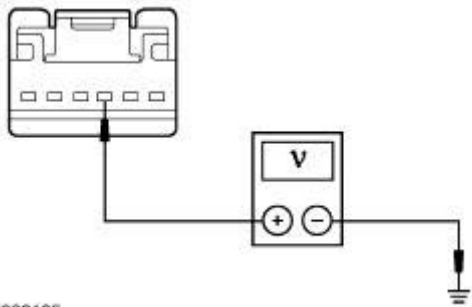


LR Window Regulator Control Switch C701

3



4



A0003135

- 4 Measure the voltage between LR window regulator control switch C701 pin 3, circuit 7-AJ14A (YE/BU), harness side and ground.

- **Is the voltage reading greater than 10 volts?**

- **Yes**
GO to E7.

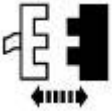
→ **No**
GO to E4.

E4 CHECK CIRCUIT 7-AJ1 (YE) FOR AN OPEN

1

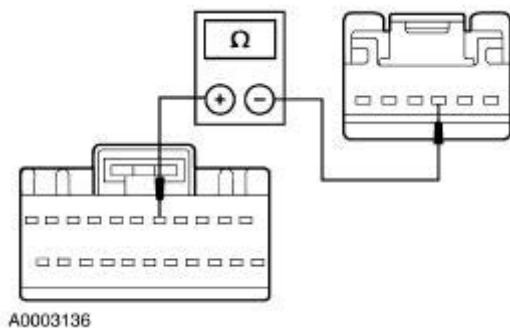


2



REM C420b

3



3 Measure the resistance between LR window regulator control switch C701 pin 3, circuit 7-AJ14A (YE/BU), harness side and REM C420b pin 5, circuit 7-AJ1 (YE), harness side.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to E5.

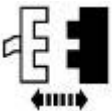
→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

E5 CHECK CIRCUIT 7-AJ1 (YE) FOR A SHORT TO GROUND

1



2

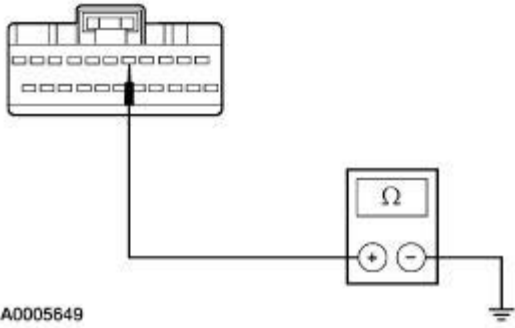


3

2 Disconnect the remote passenger window regulator control switches:

- passenger front C604
- RR passenger C801
- LR passenger C701

3 Measure the resistance between REM C420b pin 5, circuit 7-AJ1 (YE), harness side and ground.



- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to E6.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

E6 CHECK FOR A SHORTED REMOTE WINDOW REGULATOR CONTROL SWITCH

1



2 Check the RR, LR and passenger front window regulator control switches; Refer to Wiring Diagrams Section 700-09, Component Testing.

- Did the remote window regulator control switches pass the component test?

→ **Yes**
INSTALL a new REM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**
INSTALL a new passenger window regulator control switch. CLEAR the DTCs. REPEAT the self-test.

E7 CHECK THE PASSENGER FRONT WINDOW OPERATION

1 Operate the passenger front window UP and DOWN using the passenger front window regulator control switch.

- Does the passenger front window operate correctly?

→ **Yes**
GO to E10.

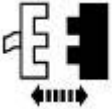
→ **No**
GO to E8.

E8 CHECK THE PASSENGER FRONT WINDOW REGULATOR CONTROL SWITCH

1



2



Passenger Front Window Regulator Control Switch C604

3 Check the passenger front window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.

- **Did the passenger front window regulator control switch pass the component test?**

→ **Yes**
GO to E9.

→ **No**
INSTALL a new passenger window regulator control switch. CLEAR the DTCs. REPEAT the self-test.

E9 CHECK CIRCUITS 8-AJ18 (WH/VT) AND 10-AJ18 (GY/WH) FOR A SHORT TO GROUND

1

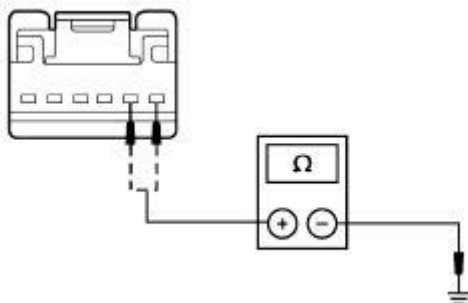


2



FEM C201e

3



A0003137

3 Measure the resistance between passenger front window regulator control switch C604 pin 1, circuit 8-AJ18 (WH/VT), harness side and ground; and between passenger front window regulator control switch C604 pin 2, circuit 10-AJ18 (GY/WH), harness side and ground

- **Are the resistances greater than**

10,000 ohms?

- **Yes**
INSTALL a new FEM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.
- **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

E10 CHECK THE LEFT REAR AND RIGHT REAR WINDOW OPERATION

1



2



LR Window Regulator Control Switch C701

3



- 4 Operate the rear windows UP and DOWN using the LR and RR window regulator control switches.

- **Do the rear windows operate correctly?**

- **Yes**
The system is operating correctly. VERIFY the concern and REFER to the Symptom Chart.

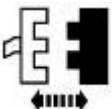
- **No**
GO to E11.

E11 CHECK THE LR AND RR WINDOW REGULATOR CONTROL SWITCH

1



2



LR C701 and RR C801 Window Regulator Control Switches

- 3 Check the LR and RR window regulator control switches; Refer to Wiring Diagrams Section 700-09, Component

Testing.

- **Did the window regulator control switches pass the component test?**

→ **Yes**
GO to E12.

→ **No**
INSTALL a new rear window regulator control switch. CLEAR the DTCs. REPEAT the self-test.

E12 CHECK CIRCUIT 8-AJ24 (WH), 10-AJ24 (GY), 8-AJ14A (WH/BU) and 10-AJ14A (GY/VT) FOR A SHORT TO GROUND

1

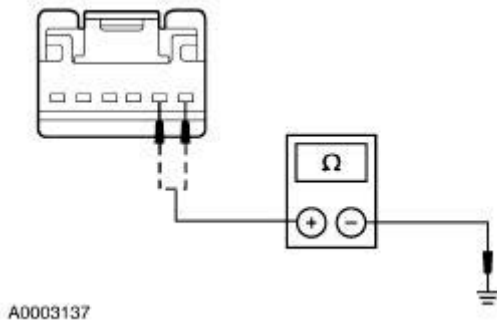


2

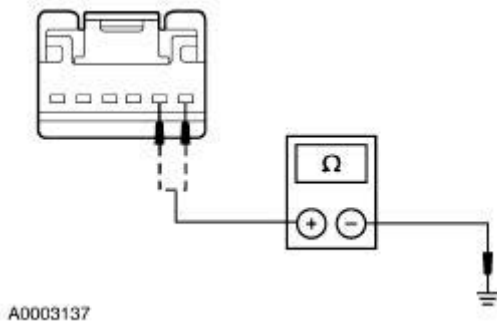


REM C420c and C420d

3



4



3 Measure the resistance between RR window regulator control switch C801 pin 1, circuit 8-AJ24 (WH), harness side and ground; and between RR window regulator control switch C801 pin 2, circuit 10-AJ24A (GY), harness side and ground.

4 Measure the resistance between LR window regulator control switch C701 pin 1, circuit 8-AJ14A (WH/BU), harness side and ground; and between LR window regulator control switch C701 pin 2, circuit 10-AJ14A (GY/VT), harness side and ground.


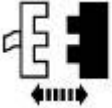
- **Are the resistances greater than 10,000 ohms?**

→ **Yes**
INSTALL a new REM. REFER to Section 419-10. CLEAR the DTCs.

REPEAT the self-test.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST F: A SINGLE POWER WINDOW IS INOPERATIVE — DRIVER WINDOW FROM THE MASTER WINDOW REGULATOR CONTROL SWITCH

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE DDM DTCS	
NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.	
	<p>1 Retrieve the recorded results from the DDM self-test.</p> <ul style="list-style-type: none">● Were any DDM DTCs retrieved that are related to the concern? <p>→ Yes IF DTC B1405 or B1408 was retrieved, GO to <u>F2</u>.</p> <p>Any other DDM DTCs, REFER to the DDM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>F4</u>.</p>
F2 CHECK THE MASTER WINDOW REGULATOR CONTROL SWITCH	
<p>1</p>  <p>2</p>  <p>Master Window Regulator Control Switch C504</p>	<p>3 Check the master window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.</p> <ul style="list-style-type: none">● Did the master window regulator control switch pass the component test? <p>→ Yes GO to <u>F3</u>.</p>

→ **No**
INSTALL a new master window regulator control switch. REFER to [Switch—Master Window Regulator Control](#) in this section. CLEAR the DTCs. REPEAT the self-test.

F3 CHECK CIRCUIT 7S-AJ40 (YE/RD) AND CIRCUIT 7S-AJ41 (YE/BU) FOR A SHORT TO BATTERY

1



2

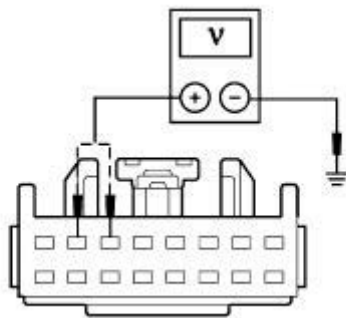


DDM C501d

3



4



4 Measure the voltage between master window regulator control switch C504 pin 6, circuit 7S-AJ40 (YE/RD), harness side and ground; and between master window regulator control switch C504 pin 7, circuit 7S-AJ41 (YE/BU), harness side and ground.

● **Is the voltage greater than 10 volts?**

→ **Yes**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. GO to [E6](#).

→ **No**
INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

F4 CHECK THE DDM OUTPUT

1



2



3



4



4 Select DDM active command FRONT WINDOW CONTROL.

5 Trigger DR UP to ON then OFF. Then trigger DR DOWN to ON then OFF.

• **Did the driver front window raise and lower?**

→ **Yes**
GO to F5.

→ **No**
GO to F9.

F5 CHECK THE DDM PIDS D_UP_SW AND D_DN_SW

1



1 Monitor the DDM PIDs D_UP_SW and D_DN_SW while operating the master window regulator control switch to the UP and DOWN positions.

• **Do the DDM PIDs agree with the master window regulator control switch positions?**

→ **Yes**
INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

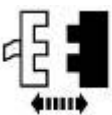
→ **No**
GO to F6.

F6 CHECK THE WINDOW REGULATOR CONTROL SWITCH

1



2



Master Window Regulator Control Switch C504

3 Check the master window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.

• **Did the master window regulator**

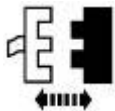
control switch pass the component test?

→ **Yes**
GO to F7.

→ **No**
INSTALL a new master window regulator control switch. REFER to Switch—Master Window Regulator Control in this section. CLEAR the DTCs. REPEAT the self-test.

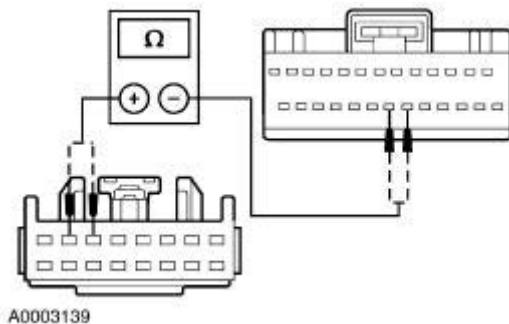
F7 CHECK CIRCUITS 7S-AJ40 (YE/RD) AND 7S-AJ41 (YE/BU) FOR AN OPEN

1



DDM C501d

2



2

Measure the resistance between master window regulator control switch C504 pin 6, circuit 7S-AJ40 (YE/RD), harness side and DDM C501d pin 20 circuit 7S-AJ40 (YE/RD), harness side; and between master window regulator control switch C504 pin 7, circuit 7S-AJ41 (YE/BU), harness side and DDM C501d pin 19 circuit 7S-AJ41 (YE/BU), harness side.

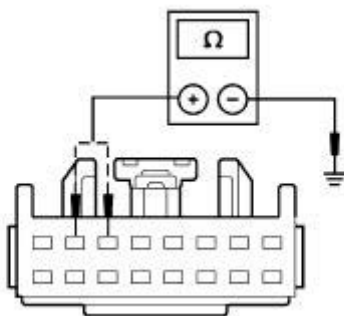
● **Are the resistances less than 5 ohms?**

→ **Yes**
GO to F8.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

F8 CHECK CIRCUITS 7S-AJ40 (YE/RD) AND 7S-AJ41 (YE/BU) FOR A SHORT TO GROUND

1



1

Measure the resistance between master window regulator control switch C504 pin 6, circuit 7S-AJ40 (YE/RD), harness side and ground; and between master window regulator control switch C504 pin 7, circuit 7S-AJ41 (YE/BU), harness side and ground.

● **Are the resistances greater than 10,000 ohms?**

→ **Yes**
INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

F9 CHECK POWER TO BJB FUSE 420 (20A)

1



2



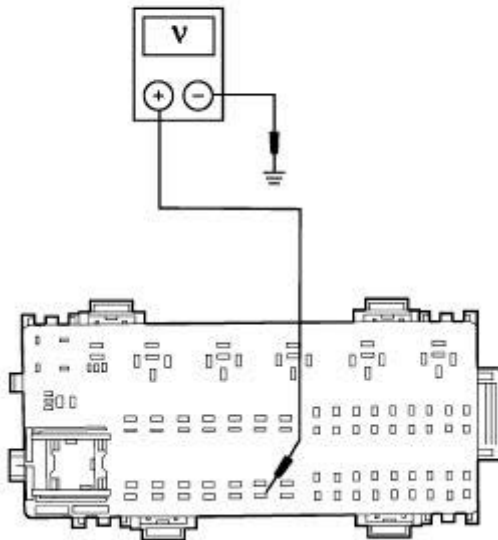
BJB Fuse 420 (20A)

3



4

4 Measure the voltage between BJB fuse 420 (20A), input terminal and ground.



A0003141

● Is the voltage greater than 10 volts?

→ **Yes**
GO to F10.

→ **No**
REPAIR the circuit. CLEAR the DTCs.

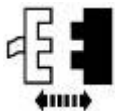
REPEAT the self-test.

F10 CHECK FOR VOLTAGE FROM THE DDM

1



2



Driver Front Window Regulator Electric Drive C524

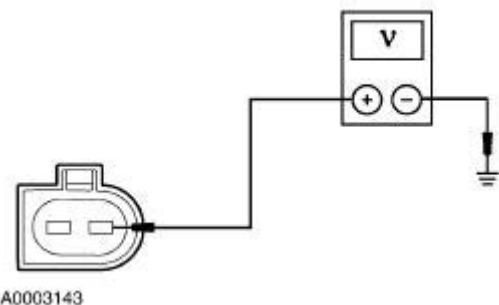
3



4

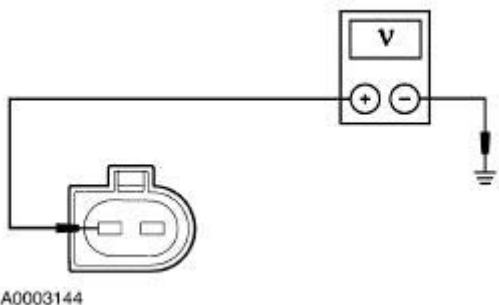


5



A0003143

6



A0003144

4 Select DDM active command FRONT WINDOW CONTROL.

5 Measure the voltage between driver front window regulator electric drive C524, circuit 32-AJ26 (WH), harness side and ground while triggering DR DOWN to ON. Note reading.

6 Measure the voltage between driver front window regulator electric drive C524, circuit 33-AJ26 (YE), harness side and ground while triggering DR UP to ON.

• Are the voltages greater than 10 volts when commanded ON?

→ Yes
GO to F11.

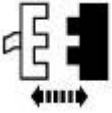
→ No
GO to F12.

F11 CHECK CIRCUIT 31-AJ80 (BK) FOR AN OPEN

1

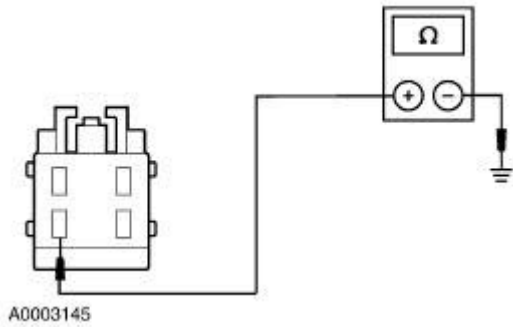


2



DDM C501b

3



3

Measure the resistance between DDM C501b pin 3, circuit 31-AJ80 (BK), harness side and ground.

● **Is the resistance less than 5 ohms?**

→ **Yes**

INSTALL a new driver front window regulator electric drive. REFER to [Motor and Window Regulator—Front Door](#) in this section. CLEAR the DTCs. REPEAT the self-test.

→ **No**

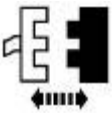
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

F12 CHECK WINDOW POWER TO THE DDM

1



2



DDM C501b

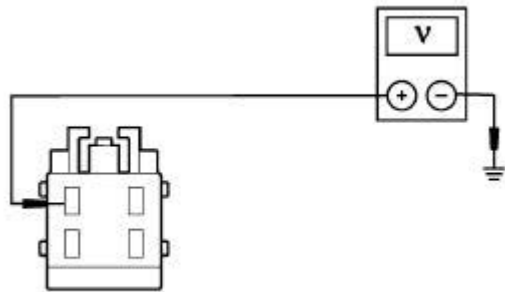
3



4

4

Measure the voltage between DDM C501b pin 4, circuit 30-AJ80 (RD), harness side and ground.



A0003146

- Is the voltage greater than 10 volts?

→ **Yes**

GO to F13.

→ **No**

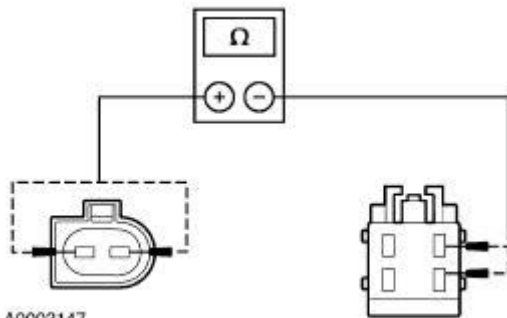
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

F13 CHECK CIRCUIT 32-AJ26 (WH) AND CIRCUIT 33-AJ26 (YE) FOR AN OPEN

1



2



A0003147

2

Measure the resistance between driver front window regulator electric drive C524, circuit 32-AJ26 (WH), harness side and DDM C501b pin 1, circuit 32-AJ26 (WH), harness side; and between driver front window regulator electric drive C524, circuit 33-AJ26 (YE), harness side and DDM C501b pin 2, circuit 33-AJ26 (YE), harness side.

- Are the resistances less than 5 ohms?


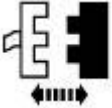
→ **Yes**

INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

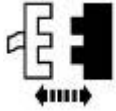
PINPOINT TEST G: A SINGLE POWER WINDOW IS INOPERATIVE — PASSENGER FRONT FROM MASTER AND PASSENGER FRONT WINDOW REGULATOR CONTROL SWITCHES

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE DDM DTCS	
	<p>1 Retrieve the recorded results from the DDM self-test.</p> <ul style="list-style-type: none"> • Were any DDM DTCs retrieved? <p>→ Yes REFER to the DDM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>G2</u>.</p>
G2 CHECK THE FEM DTCS	
	<p>1 Retrieve the recorded results from the FEM self-test.</p> <ul style="list-style-type: none"> • Were any FEM DTCs retrieved that are related to the concern? <p>→ Yes If DTC B2214 or B2215 were retrieved, GO to <u>G3</u>. All others, REFER to the FEM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>G5</u>.</p>
G3 CHECK THE PASSENGER FRONT WINDOW REGULATOR CONTROL SWITCH	
<p>1</p>  <p>2</p>  <p>Passenger Front Window Regulator Control Switch C604</p>	<p>3 Check the passenger front window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.</p> <ul style="list-style-type: none"> • Did the passenger front window regulator control switch pass the component test? <p>→ Yes GO to <u>G4</u>.</p> <p>→ No INSTALL a new passenger front window regulator control switch. CLEAR the</p>

DTCs. REPEAT the self-test.

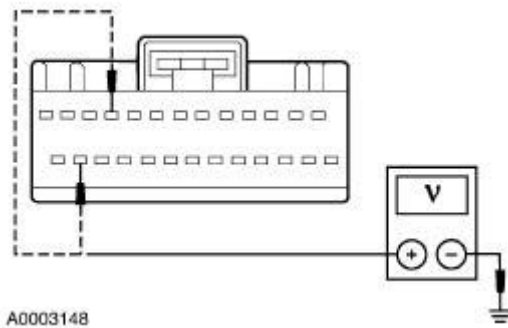
G4 CHECK CIRCUIT 8-AJ18 (WH/VT) AND CIRCUIT 10-AJ18 (GY/WH) FOR A SHORT TO BATTERY

1



FEM C201e

2



2

Measure the voltage between FEM C201e pin 25, circuit 8-AJ18 (WH/VT), harness side and ground; and between FEM C201e pin 10, circuit 10-AJ18 (GY/WH), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**

REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. GO to [G6](#).

→ **No**

INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

G5 CHECK THE FEM OUTPUT

NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.

1



2



3



4



4

Select FEM active command FRONT WINDOW CONTROL.

5

Trigger PR UP to ON then OFF. Then

trigger PR DOWN to ON then OFF.

- Did the passenger front window raise and lower?

→ **Yes**

INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

GO to [G6](#).

G6 CHECK POWER TO BJB FUSE 426 (20A)

1



2

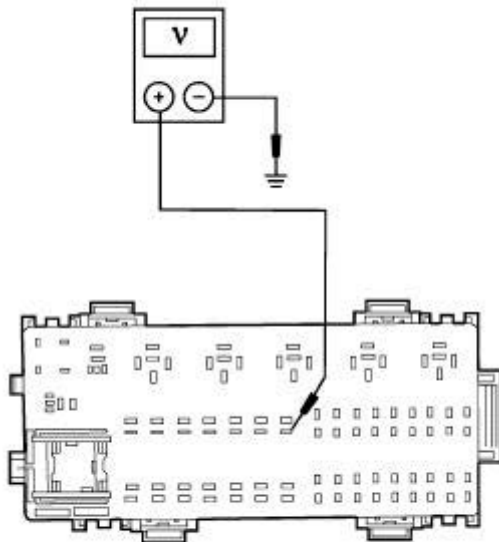


BJB Fuse 426 (30A)

3



4



A0003149

4 Measure the voltage between BJB fuse 426 (30A), input terminal and ground.

- Is the voltage greater than 10 volts?

→ **Yes**
GO to G7.

→ **No**
REPAIR the BJB input circuit. CLEAR the DTCs. REPEAT the self-test.

G7 CHECK THE FEM OUTPUTS

1



2



Passenger Front Window Regulator Electric Drive C608

3



BJB Fuse 426 (30A)

4

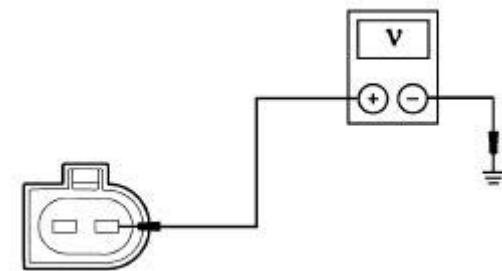


5



5 Select FEM active command FRONT WINDOW CONTROL.

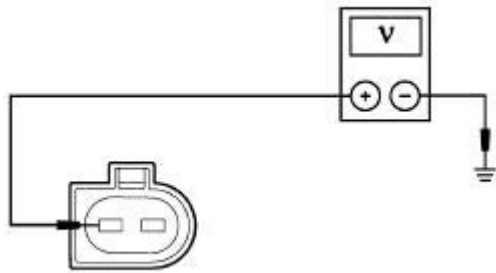
6



6 Measure the voltage between passenger front window regulator electric drive C608, circuit 32-AJ27 (WH/VT), harness side and ground while triggering PR DOWN to ON. Note reading.

7

7 Measure the voltage between passenger front window regulator electric drive C608, circuit 33-AJ27 (YE/VT), harness side and ground while triggering PR UP to ON.



A0003144

- Are the voltages greater than 10 volts when commanded ON?

→ **Yes**
GO to G8.

→ **No**
GO to G9.

G8 CHECK CIRCUIT 31-AJ71 (BK/YE) FOR AN OPEN

1

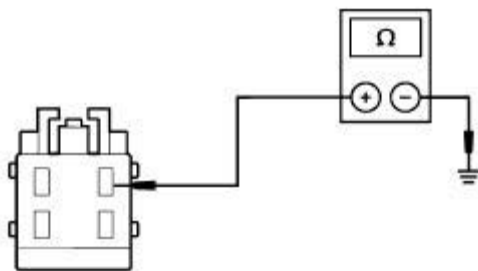


2



FEM C201d

3



A0003157

- 3 Measure the resistance between FEM C201d pin 4, circuit 31-AJ71 (BK/YE), harness side and ground.

- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new passenger front window regulator electric drive. REFER to Motor and Window Regulator—Front Door. CLEAR the DTCs. REPEAT the self-test.

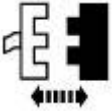
→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

G9 CHECK POWER TO THE FEM

1



2

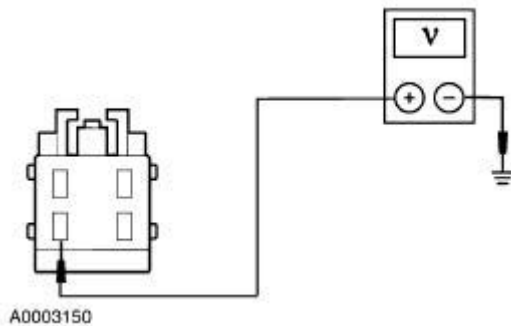


FEM C201d

3



4



4 Measure the voltage between FEM C201d pin 3, circuit 30-AJ71 (RD/YE), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to G10.

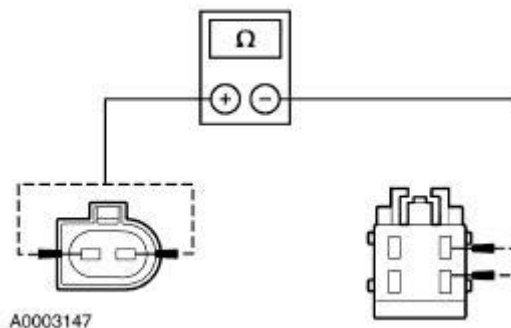
→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

G10 CHECK CIRCUIT 32-AJ27 (WH/VT) AND CIRCUIT 33-AJ27 (YE/VT) FOR AN OPEN

1




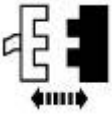
2



2 Measure the resistance between passenger front window electric drive C608, circuit 32-AJ27 (WH/VT), harness side and FEM C201d pin 2, circuit 32-AJ27 (WH/VT), harness side; and between passenger front window electric drive C608, circuit 33-AJ27 (YE/VT), harness side and FEM C201d pin 1, circuit 33-AJ27 (YE/VT), harness side.

	<ul style="list-style-type: none"> ● Are the resistances less than 5 ohms? <p>→ Yes INSTALL a new FEM. REFER to <u>Section 419-10</u> . CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</p>
--	--

PINPOINT TEST H: A SINGLE POWER WINDOW IS INOPERATIVE — PASSENGER FRONT FROM THE MASTER WINDOW REGULATOR CONTROL SWITCH ONLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK THE DDM DTCS	
	<p>1 Retrieve the recorded results from the DDM self-test.</p> <ul style="list-style-type: none"> ● Were any DDM DTCs retrieved? <p>→ Yes If DTC B1420 was retrieved, GO to <u>H2</u> .</p> <p>For all other DDM DTCs, REFER to the FEM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>H4</u> .</p>
H2 CHECK THE MASTER WINDOW REGULATOR CONTROL SWITCH	
<p>1</p>  <p>2</p>  <p>Master Window Regulator Control Switch C504</p>	<p>3 Check the master window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.</p> <ul style="list-style-type: none"> ● Did the master window regulator control switch pass the component test?

→ **Yes**
GO to H3.

→ **No**
INSTALL a new master window regulator control switch; REFER to Switch—Master Window Regulator Control . CLEAR the DTCs. REPEAT the self-test.

H3 CHECK CIRCUIT 7S-AJ48 (YE/VT) AND CIRCUIT 7S-AJ47 (YE/BK) FOR A SHORT TO BATTERY

1

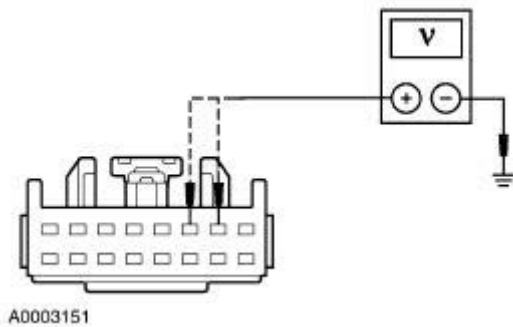


DDM C501d

2



3



3 Measure the voltage between master window regulator control switch C504 pin 3, circuit 7S-AJ48 (YE/VT), harness side and ground; and between master window regulator control switch C504 pin 2, circuit 7S-AJ47 (YE/BK), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

→ **No**
INSTALL a new DDM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.

H4 CHECK THE DDM PIDS P_UP_SW AND P_DN_SW

1



2



3



4



4

Monitor the DDM PIDS P_UP_SW and P_DN_SW while operating the passenger front window from the master window regulator control switch in the UP and DOWN positions.

- **Did the DDM PIDS P_UP_SW and P_DN_SW agree with the master window regulator control switch positions?**

→ **Yes**

INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

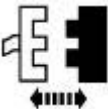
GO to [H5](#).

H5 CHECK THE WINDOW REGULATOR CONTROL SWITCH

1



2



Master Window Regulator Control Switch C504

3

Check the master window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.

- **Did the master window regulator control switch pass the component test?**

→ **Yes**

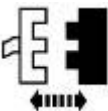
GO to [H6](#).

→ **No**

INSTALL a new master window regulator control switch. REFER to [Switch—Master Window Regulator Control](#) in this section. CLEAR the DTCs. REPEAT the self-test.

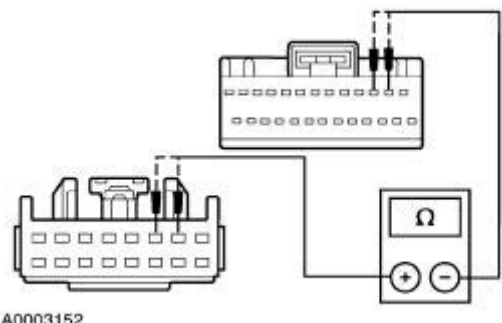
H6 CHECK CIRCUITS 7S-AJ48 (YE/VT) AND 7S-AJ41 (YE/BK) FOR AN OPEN

1



DDM C501d

2



A0003152

2

Measure the resistance between master window regulator control switch C504 pin 3, circuit 7S-AJ48 (YE/VT), harness side and DDM C501d pin 3 circuit 7S-AJ48 (YE/VT), harness side; and between master window regulator control switch C504 pin 2, circuit 7S-AJ47 (YE/BK), harness side and DDM C501d pin 2 circuit 7S-AJ41 (YE/BK), harness side.

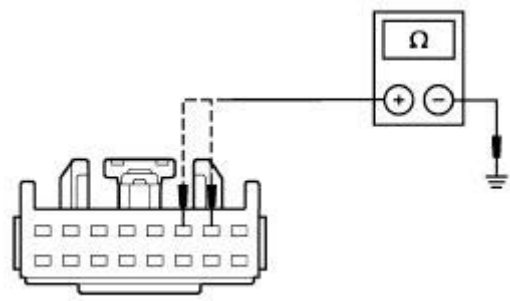
- Are the resistances less than 5 ohms?

→ Yes
GO to H7.

→ No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

H7 CHECK CIRCUITS 7S-AJ48 (YE/VT) AND 7S-AJ47 (YE/BK) FOR A SHORT TO GROUND

1



A0003153

1

Measure the resistance between master window regulator control switch C504 pin 3, circuit 7S-AJ48 (YE/VT), harness side and ground; and between master window regulator control switch C504 pin 2, circuit 7S-AJ47 (YE/BK), harness side and ground.

- Are the resistances greater than 10,000 ohms?

→ Yes
INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST I: A SINGLE POWER WINDOW IS INOPERATIVE — PASSENGER FRONT FROM THE PASSENGER FRONT WINDOW REGULATOR CONTROL SWITCH ONLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
------------	-------------------------

I1 CHECK THE FEM DTCS

1 Retrieve the recorded results from the FEM self-test.

- **Were any FEM DTCS retrieved that are related to the concern?**

→ **Yes**
REFER to the FEM Diagnostic Trouble Code (DTC) Index.

→ **No**
GO to I2.

I2 CHECK THE FEM PIDS P_UP_SW AND P_DN_SW

NOTE: Cycle the ignition switch to enable the switched system power feature.

1



2



3



4



4 Monitor the FEM PIDS P_UP_SW and P_DN_SW while operating the passenger front window regulator control switch in the UP and DOWN positions.

- **Did the FEM PIDS P_UP_SW and P_DN_SW PIDs agree with the passenger front window regulator control switch positions?**

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

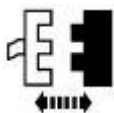
→ **No**
GO to I3.

I3 CHECK THE PASSENGER FRONT WINDOW REGULATOR CONTROL SWITCH

1



2



Passenger Front Window Regulator Control Switch C604

3 Check the passenger front window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.

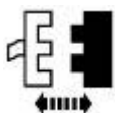
- **Did the passenger front window regulator control switch pass the component test?**

→ **Yes**
GO to 14.

→ **No**
INSTALL a new passenger front window regulator control switch. CLEAR the DTCs. REPEAT the self-test.

14 CHECK THE POWER TO THE PASSENGER FRONT WINDOW REGULATOR CONTROL SWITCH

1

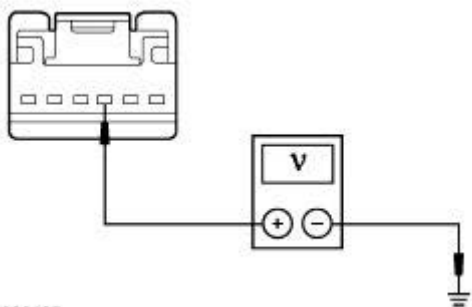


Passenger Front Window Switch C604

2



3



3 Measure the voltage between passenger front window regulator control switch C604 pin 3, circuit 7-AJ18 (YE/VT), harness side and ground.


- **Is the voltage greater than 10 volts?**

→ **Yes**
GO to 15.

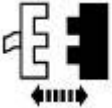
→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

15 CHECK CIRCUITS 8-AJ18 (WH/VT) AND 8-AJ18 (GY/WH) FOR AN OPEN

1

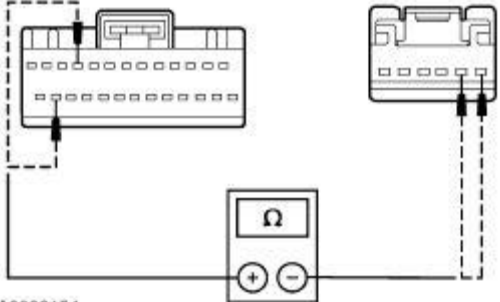


2



FEM C201e

3



A0003154

3 Measure the resistance between passenger front window regulator control switch C604 pin 1, circuit 8-AJ18 (WH/VT), harness side and FEM C201e pin 25 circuit 8-AJ18 (WH/VT), harness side; and between passenger front window regulator control switch C604 pin 2, circuit 8-AJ18 (GY/WH), harness side and FEM C201e pin 10 circuit 10-AJ18 (GY/WH), harness side.

- **Are the resistances less than 5 ohms?**

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST J: A SINGLE POWER WINDOW IS INOPERATIVE — RIGHT REAR FROM MASTER AND REMOTE WINDOW REGULATOR CONTROL SWITCHES

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 CHECK THE DDM DTCS	<p>1 Retrieve the recorded results from the DDM self-test.</p> <ul style="list-style-type: none"> ● Were any DDM DTCs retrieved? <p>→ Yes REFER to the DDM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to J2.</p>

J2 CHECK THE REM DTCS

1 Retrieve the recorded results from the REM self-test.

- **Were any REM DTCs retrieved that are related to the concern?**

→ **Yes**
If DTC B2190 or B2194 were retrieved, GO to J3.

For all other REM DTCs; REFER to the REM Diagnostic Trouble Code (DTC) Index.

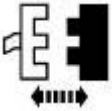
→ **No**
GO to J5.

J3 CHECK THE RR WINDOW REGULATOR CONTROL SWITCH

1



2



RR Window Regulator Control Switch C801

3 Check the RR window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.

- **Did the RR window regulator control switch pass the component test?**

→ **Yes**
GO to J4.

→ **No**
INSTALL a new RR window regulator control switch. CLEAR the DTCs. REPEAT the self-test.

J4 CHECK CIRCUIT 10-AJ24 (GY/WH) AND CIRCUIT 8-AJ24 (WH) FOR A SHORT TO BATTERY

1



2

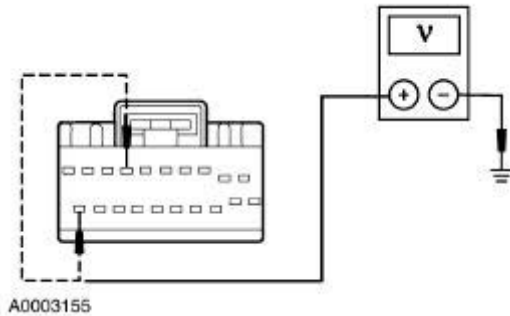


REM C420d

3



4



4

Measure the voltage between REM C420d pin 7, circuit 8-AJ24 (WH), harness side and ground; and between REM C420d pin 20, circuit 10-AJ24 (GY/WH), harness side and ground.

● Is the voltage greater than 10 volts?

→ Yes

REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

→ No

INSTALL a new REM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

J5 CHECK THE REM OUTPUT

NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.

1



2



3



4



4

Select REM active command REAR WINDOW CONTROL.

5

Trigger RR UP to ON then OFF. Then trigger RR DOWN to ON then OFF.

● Did the right rear window raise and lower?

→ **Yes**
INSTALL a new REM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

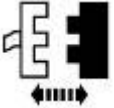
→ **No**
GO to [J6](#).

J6 CHECK POWER TO BJB FUSE 430 (20A)

1



2

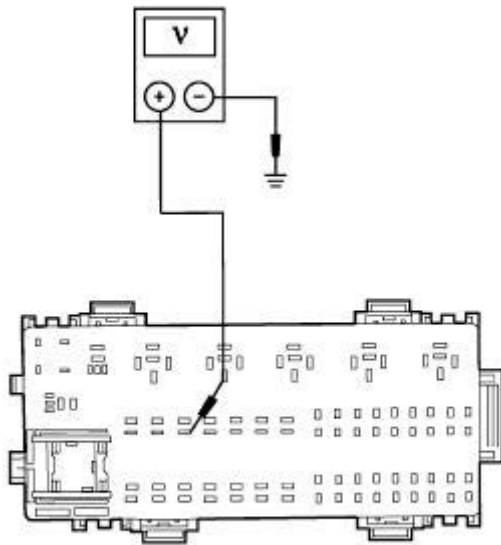


BJB Fuse 430 (20A)

3



4



A0008637

4 Measure the voltage between BJB fuse 430 (20A), input terminal and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to [J7](#).

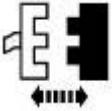
→ **No**
REPAIR the BJB input circuit. CLEAR the DTCs. REPEAT the self-test.

J7 CHECK THE REM OUTPUTS

1



2



RR Window Regulator Electric Drive C803

3



BJB Fuse 430 (20A)

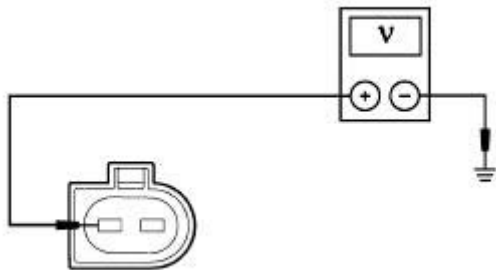
4



5

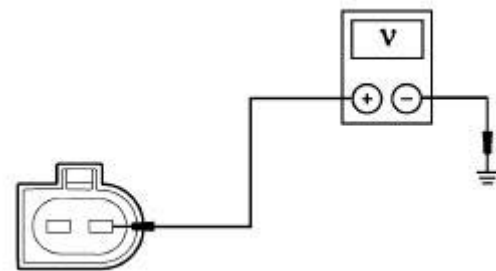


6



A0003144

7



A0003143

5 Select REM active command REAR WINDOW CONTROL.

6 Measure the voltage between RR window regulator electric drive C803, circuit 35-AJ23 (VT/WH), harness side and ground while triggering the REM active command RR DOWN to ON.

7 Measure the voltage between RR window regulator electric drive C803, circuit 34-AJ23 (BU/OG), harness side and ground while triggering the REM active command RR UP to ON.

- Are the voltages greater than 10 volts when the REM active commands are triggered to ON?

→ **Yes**
GO to J8.

→ **No**
GO to J9.

J8 CHECK CIRCUIT 31-DK30B (RD) FOR AN OPEN

1

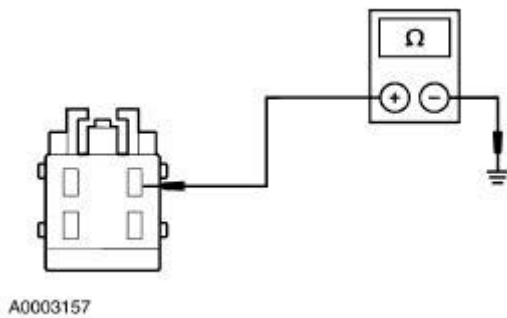


2



REM C420g

3



3 Measure the resistance between REM C420g pin 1, circuit 31-DK30B (RD), harness side and ground.

● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new RR window regulator electric drive. REFER to Motor and Window Regulator—Rear Door. CLEAR the DTCs. REPEAT the self-test.

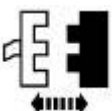
→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

J9 CHECK WINDOW POWER TO THE REM

1



2

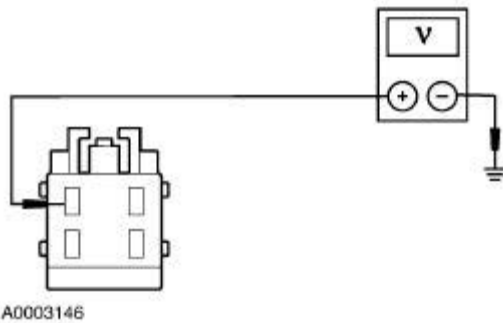


REM C420g

3



4



4 Measure the voltage between REM C420g pin 2, circuit 30-DK30 (RD), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to J10.

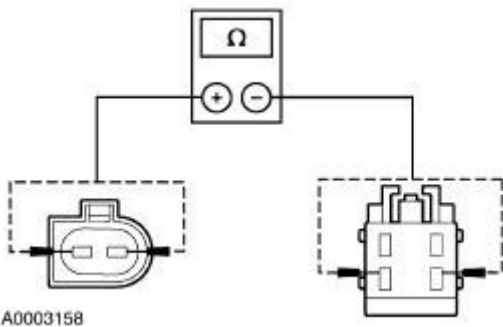
→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

J10 CHECK CIRCUIT 35-AJ23 (VT/WH) AND CIRCUIT 34-AJ23 (BU/OG) FOR AN OPEN

1



2




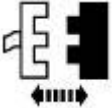
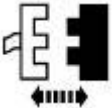
2 Measure the resistance between RR window regulator electric drive C803, circuit 34-AJ23 (BU/OG), harness side and REM C420g pin 3, circuit 34-AJ23 (BU/OG), harness side; and between RR window regulator electric drive C803, circuit 35-AJ23 (VT/WH), harness side and REM C420g pin 4, circuit 35-AJ23 (VT/WH), harness side.

• Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new REM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

PINPOINT TEST K: A SINGLE POWER WINDOW IS INOPERATIVE — RIGHT REAR FROM THE MASTER WINDOW REGULATOR CONTROL SWITCH ONLY

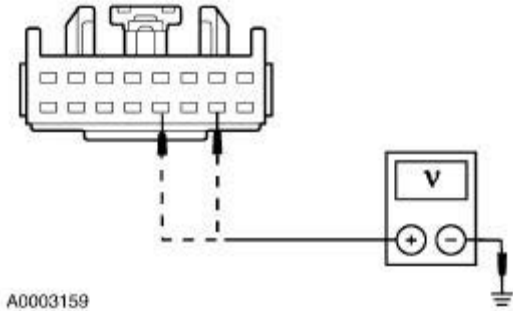
CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 CHECK THE DDM DTCS	
	<p>1 Retrieve the recorded results from the DDM self-test.</p> <ul style="list-style-type: none"> ● Were any DDM DTCs retrieved? <p>→ Yes If DTC B1424 was retrieved, GO to <u>K2</u>. For all other DDM DTCs; REFER to the DDM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>K4</u>.</p>
K2 CHECK THE MASTER WINDOW REGULATOR CONTROL SWITCH	
<p>1</p>  <p>2</p>  <p style="text-align: center;">Master Window Regulator Control Switch C504</p>	<p>3 Check the master window regulator control switch. Refer to Wiring Diagrams Section 700-09, Component Testing.</p> <ul style="list-style-type: none"> ● Did the master window regulator control switch pass the component test? <p>→ Yes GO to <u>K3</u>.</p> <p>→ No INSTALL a new master window regulator control switch. REFER to <u>Switch—Master Window Regulator Control</u> in this section. CLEAR the DTCs. REPEAT the self-test.</p>
K3 CHECK CIRCUIT 7S-AJ52 (YE) AND CIRCUIT 7S-AJ51 (YE/RD) FOR A SHORT TO BATTERY	
<p>1</p> 	

DDM C501d

2



3



3

Measure the voltage between master window regulator control switch C504 pin 10, circuit 7S-AJ52 (YE), harness side and ground; and between master window regulator control switch C504 pin 12, circuit 7S-AJ51 (YE/RD), harness side and ground.

● Is the voltage greater than 10 volts?

→ Yes

REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

→ No

INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

K4 CHECK THE DDM PIDS RRUP_SW AND RRDN_SW

1



2



3



3

Monitor the DDM PIDs RRUP_SW and RRDN_SW while operating the right rear window from the master window regulator control switch to the UP and DOWN positions.

● Did the DDM PIDs RRUP_SW and RRDN_SW agree with the master window regulator control switch positions?

→ Yes

INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ No

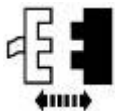
GO to K5.

K5 CHECK THE WINDOW REGULATOR CONTROL SWITCH

1



2



Master Window Regulator Control Switch C504

3

Check the master window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.

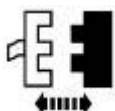
- **Did the master window regulator control switch pass the component test?**

→ **Yes**
GO to K6.

→ **No**
INSTALL a new master window regulator control switch. REFER to Switch—Master Window Regulator Control in this section. CLEAR the DTCs. REPEAT the self-test.

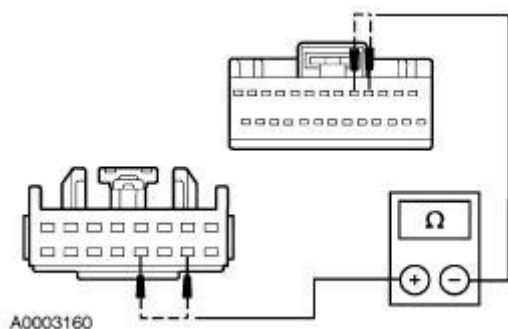
K6 CHECK CIRCUITS 7S-AJ52 (YE) AND 7S-AJ51 (YE/RD) FOR AN OPEN

1



DDM C501c

2



2

Measure the resistance between master window regulator control switch C504 pin 10, circuit 7S-AJ52 (YE), harness side and DDM C501c pin 5 circuit 7S-AJ52 (YE), harness side; and between master window regulator control switch C504 pin 12, circuit 7S-AJ51 (YE/RD), harness side and DDM C501d pin 4 circuit 7S-AJ51 (YE/RD), harness side.

- **Are the resistances less than 5 ohms?**

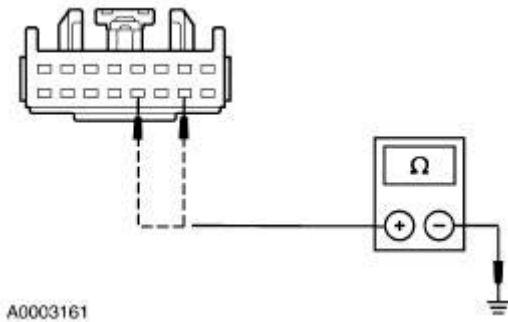
→ **Yes**
GO to K7.

→ **No**

REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

K7 CHECK CIRCUITS 7S-AJ52 (YE) AND 7S-AJ51 (YE/RD) FOR A SHORT TO GROUND

1



1

Measure the resistance between master window regulator control switch C504 pin 10, circuit 7S-AJ52 (YE), harness side and ground; and between master window regulator control switch C504 pin 12, circuit 7S-AJ51 (YE/RD), harness side and ground.

- Are the resistances greater than 10,000 ohms?

→ **Yes**

INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST L: A SINGLE POWER WINDOW IS INOPERATIVE — RIGHT REAR FROM RR WINDOW REGULATOR CONTROL SWITCH ONLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1 CHECK THE FEM DTCS	
	<p>1 Retrieve the recorded results from the REM self-test.</p> <ul style="list-style-type: none"> • Were any REM DTCs retrieved that are related to the concern? <p>→ Yes REFER to the REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to L2.</p>
L2 CHECK THE REM PIDS RRUP_SW AND RRDN_SW	
NOTE: Cycle the ignition switch to enable the switched system power feature.	
1	



2



3



4



4 Monitor the REM PIDS RRUP_SW and RRDN_SW while operating the RR window regulator control switch to the UP and DOWN positions.

- Did the REM PIDS RRUP_SW and RRDN_SW agree with the RR window regulator control switch positions?

→ **Yes**
INSTALL a new REM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

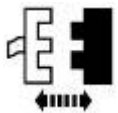
→ **No**
GO to [L3](#).

L3 CHECK THE RR WINDOW REGULATOR CONTROL SWITCH

1



2



RR Window Regulator Control Switch C801

3 Check the RR window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.

- Did the RR window regulator control switch pass the component test?

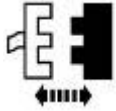
→ **Yes**
GO to [L4](#).

→ **No**
INSTALL a new RR window regulator

control switch. CLEAR the DTCs.
REPEAT the self-test.

L4 CHECK THE POWER TO THE RR WINDOW REGULATOR CONTROL SWITCH

1

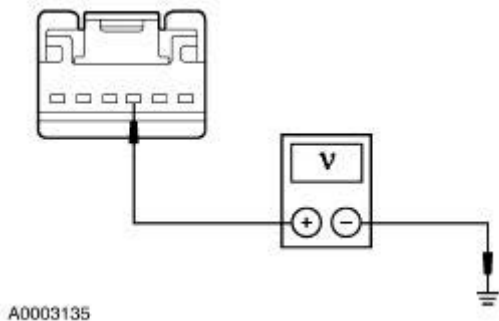


RR Window Regulator Control Switch C801

2



3



3 Measure the voltage between RR window regulator control switch C801 pin 3, circuit 7-AJ24 (YE), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to L5.

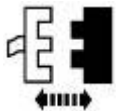
→ **No**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.

L5 CHECK CIRCUITS 8-AJ24 (GYWH) AND 10-AJ24 (GY) FOR AN OPEN

1



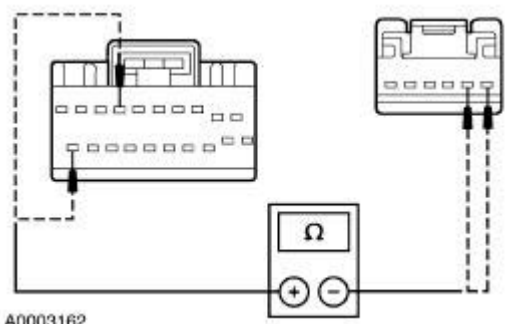
2



REM C420d

3

3 Measure the resistance between RR window regulator control switch C801 pin 7, circuit 8-AJ24 (WH), harness side and REM C420d pin 7 circuit 8-AJ24 (WH), harness side; and between RR window regulator control switch C801 pin 2, circuit 10-AJ24 (GY/WH), harness side and REM C420d pin 20 circuit 10-AJ24 (GY/WH), harness side.



A0003162

- **Are the resistances less than 5 ohms?**

→ **Yes**
 INSTALL a new REM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
 REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST M: A SINGLE POWER WINDOW IS INOPERATIVE — LEFT REAR FROM ALL WINDOW REGULATOR CONTROL SWITCHES

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1 CHECK THE DDM DTCS	<p>1 Retrieve the recorded results from the DDM self-test.</p> <ul style="list-style-type: none"> ● Were any DDM DTCs retrieved? <p>→ Yes REFER to the DDM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to M2.</p>
M2 CHECK THE REM DTCS	<p>1 Retrieve the recorded results from the REM self-test.</p> <ul style="list-style-type: none"> ● Were any REM DTCs retrieved that are related to the concern? <p>→ Yes If DTC B2174 or B2178 were retrieved, GO to M3.</p>

For all other REM DTCs, REFER to the REM Diagnostic Trouble Code (DTC) Index.

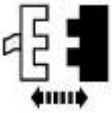
→ **No**
GO to M5.

M3 CHECK THE LR WINDOW REGULATOR CONTROL SWITCH

1



2



LR Window Regulator Control Switch C701

3 Check the LR window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.

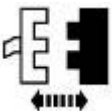
- **Did the LR window regulator control switch pass the component test?**

→ **Yes**
GO to M4.

→ **No**
INSTALL a new LR window regulator control switch. CLEAR the DTCs. REPEAT the self-test.

M4 CHECK CIRCUIT 10-AJ14 (GY/VT) AND CIRCUIT 8-AJ14 (WH/BU) FOR A SHORT TO BATTERY

1



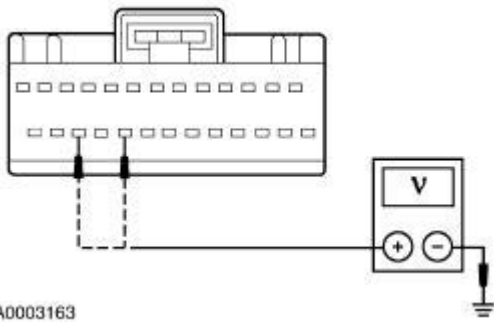
REM C420c

2



3

3 Measure the voltage between REM C420c pin 24, circuit 8-AJ14 (WH/BU), harness side and ground; and between REM C420c pin 22, circuit 10-AJ14 (GY/VT), harness side and ground.



A0003163

- Is the voltage greater than 10 volts?

→ **Yes**

REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

→ **No**

INSTALL a new REM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

M5 CHECK THE REM OUTPUT

NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.

1



2



3



4



- 4 Trigger the REM active commands LR UP and LR DOWN to ON then OFF.

- Did the left rear window raise and lower?

→ **Yes**

INSTALL a new REM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

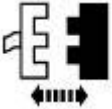
GO to [M6](#).

M6 CHECK POWER TO BJB FUSE 419 (20A)

1



2

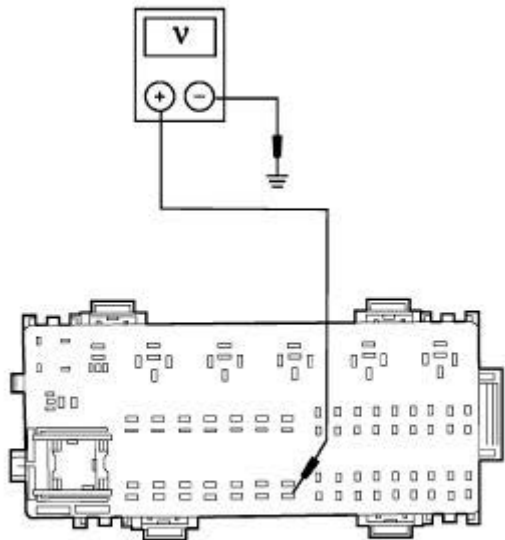


BJB Fuse 419 (20A)

3



4



A0003164

4 Measure the voltage between BJB fuse 419 (20A), input terminal and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to M7.

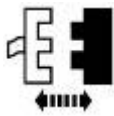
→ No
REPAIR the BJB input circuit. CLEAR the DTCs. REPEAT the self-test.

M7 CHECK THE REM OUTPUTS

1



2



LR Window Regulator Electric Drive C703

3



BJB Fuse 419 (20A)

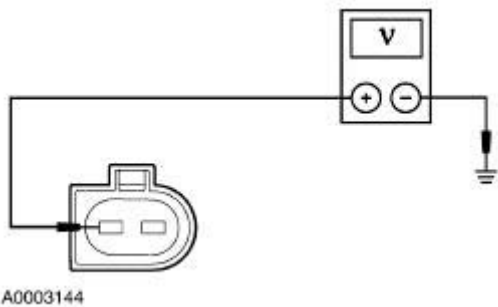
4



5

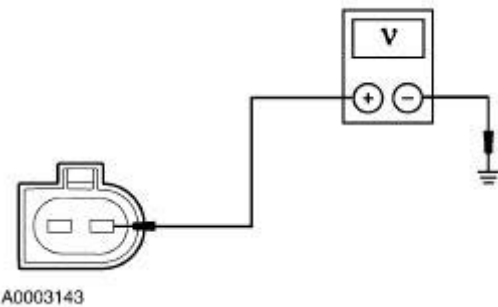


6



6 Measure the voltage between LR window regulator electric drive C703, circuit 35-AJ13 (VT/BU), harness side and ground while triggering the REM active command LR DOWN to ON.

7



7 Measure the voltage between LR window regulator electric drive C703, circuit 34-AJ13 (BU/RD), harness side and ground while triggering the REM active command LR UP to ON.

- Are the voltages greater than 10 volts when the REM active commands LR DOWN and LR UP are triggered to ON?

→ **Yes**
GO to M8.

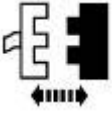
→ **No**
GO to M9.

M8 CHECK CIRCUIT 31-DK30A (BK/OG) FOR AN OPEN

1

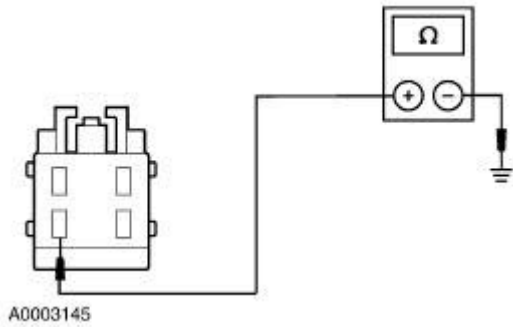


2



REM C420f

3



3 Measure the resistance between REM C420f pin 3, circuit 31-DK30A (BK/OG), harness side and ground.

• Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new LR window regulator electric drive. REFER to Motor and Window Regulator—Rear Door in this section. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

M9 CHECK WINDOW POWER TO THE REM

1



2



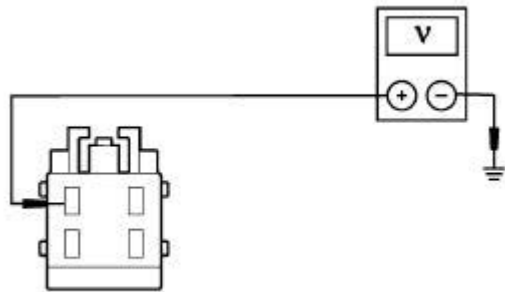
REM C420f

3



4

4 Measure the voltage between REM C420f pin 2, circuit 30-DK30A (RD), harness side and ground.



A0003146

- Is the voltage greater than 10 volts?

→ **Yes**

GO to M10.

→ **No**

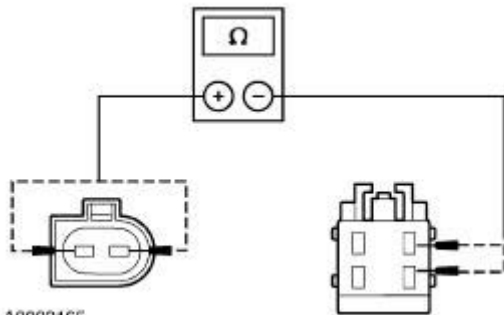
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

M10 CHECK CIRCUIT 35-AJ13 (VT/BU) AND CIRCUIT 34-AJ13 (BU/RD) FOR AN OPEN

1



2



A0003165

2

Measure the resistance between LR window regulator electric drive C703, circuit 34-AJ13 (BU/RD), harness side and REM C420f pin 1, circuit 34-AJ13 (BU/RD), harness side; and between LR window regulator electric drive C703, circuit 35-AJ13 (VT/BU), harness side and REM C420f pin 3, circuit 35-AJ13 (VT/BU), harness side.

- Are the resistances less than 5 ohms?


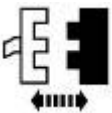
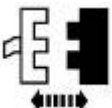
→ **Yes**

INSTALL a new REM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**

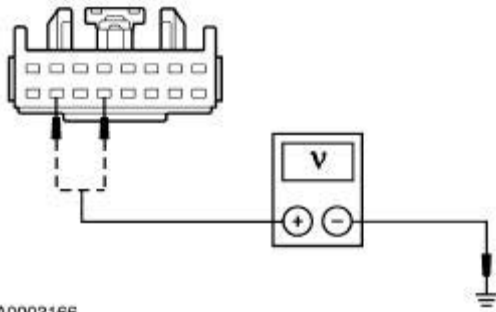
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST N: A SINGLE POWER WINDOW IS INOPERATIVE — LEFT REAR FROM THE MASTER WINDOW REGULATOR CONTROL SWITCH ONLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
N1 CHECK THE DDM DTCS	
	<p>1 Retrieve the recorded results from the DDM self-test.</p> <ul style="list-style-type: none"> ● Were any DDM DTCs retrieved? <p>→ Yes If DTC B1416 was retrieved, GO to <u>N2</u>.</p> <p>For all other DDM DTCs, REFER to the DDM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>N4</u>.</p>
N2 CHECK THE MASTER WINDOW REGULATOR CONTROL SWITCH	
<p>1</p>  <p>2</p>  <p>Master Window Regulator Control Switch C504</p>	<p>3 Check the master window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.</p> <ul style="list-style-type: none"> ● Did the master window regulator control switch pass the component test? <p>→ Yes GO to <u>N3</u>.</p> <p>→ No INSTALL a new master window regulator control switch. REFER to <u>Switch—Master Window Regulator Control</u> in this section. CLEAR the DTCs. REPEAT the self-test.</p>
N3 CHECK CIRCUIT 7S-AJ50 (YE/BU) AND CIRCUIT 7S-AJ49 (YE/GN) FOR A SHORT TO BATTERY	
<p>1</p>  <p>DDM C501d</p> <p>2</p>	



3



A0003166

3

Measure the voltage between master window regulator control switch C504 pin 15, circuit 7S-AJ50 (YE/BU), harness side and ground; and between master window regulator control switch C504 pin 13, circuit 7S-AJ49 (YE/GN), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**

REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

→ **No**

INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

N4 CHECK THE DDM PIDS LRUP_SW AND LRDN_SW

1



2



3



4



4

Monitor the DDM PIDS LRUP_SW and LRDN_SW while operating the left rear window to the UP and DOWN positions from the master window regulator control switch.

● Did the DDM PIDS LRUP_SW and LRDN_SW agree with the master window regulator control switch positions?

→ **Yes**

INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the

self-test.

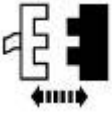
→ **No**
GO to N5.

N5 CHECK THE WINDOW REGULATOR CONTROL SWITCH

1



2



Master Window Regulator Control Switch C504

3 Check the master window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.

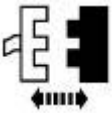
- **Did the master window regulator control switch pass the component test?**

→ **Yes**
GO to N6.

→ **No**
INSTALL a new master window regulator control switch. REFER to Switch—Master Window Regulator Control in this section. CLEAR the DTCs. REPEAT the self-test.

N6 CHECK CIRCUITS 7S-AJ50 (YE/BU) AND 7S-AJ49 (YE/GN) FOR AN OPEN

1



DDM C501c

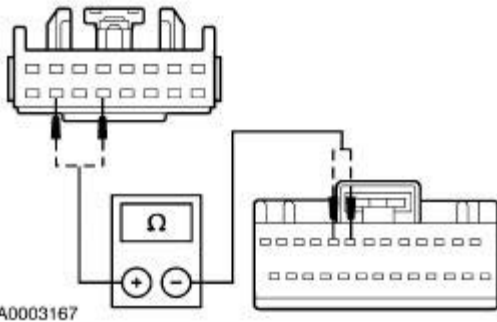
2



Master Window Regulator Control Switch C504

3

3 Measure the resistance between master window regulator control switch C504 pin 15, circuit 7S-AJ50 (YE/BU), harness side and DDM C501c pin 9 circuit 7S-AJ50 (YE/BU), harness side; and between master window regulator control switch C504 pin 13, circuit 7S-AJ49 (YE/GN), harness side and DDM C501c pin 8 circuit 7S-AJ49 (YE/GN), harness side.



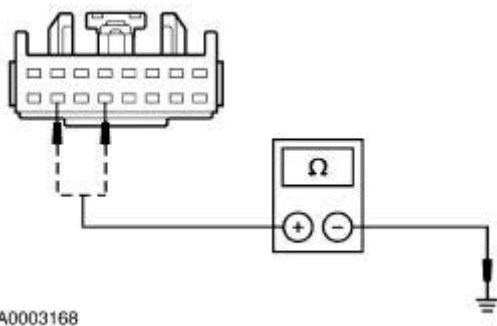
- Are the resistances less than 5 ohms?

→ **Yes**
GO to N7.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

N7 CHECK CIRCUITS 7S-AJ50 (YE/BU) AND 7S-AJ49 (YE/GN) FOR A SHORT TO GROUND

1



1

Measure the resistance between master window regulator control switch C504 pin 15, circuit 7S-AJ50 (YE/BU), harness side and ground; and between master window regulator control switch C504 pin 13, circuit 7S-AJ49 (YE/GN), harness side and ground.

- Are the resistances greater than 10,000 ohms?

→ **Yes**
INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST O: A SINGLE POWER WINDOW IS INOPERATIVE — LEFT REAR FROM THE LR WINDOW REGULATOR CONTROL SWITCH ONLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
O1 CHECK THE REM DTCS	

1 Retrieve the recorded results from the REM self-test.

- Were any REM DTCs retrieved that are related to the concern?

→ **Yes**
REFER to the REM Diagnostic Trouble Code (DTC) Index.

→ **No**
GO to Q2.

Q2 CHECK THE REM PIDS LRUP_SW AND LRDN_SW

NOTE: Cycle the ignition switch to enable the switched system power feature.

1



2



3



4



4 Monitor the REM PIDS LRUP_SW and LRDN_SW while operating the LR window regulator control switch to the UP and DOWN positions.

- Did the REM PIDS LRUP_SW and LRDN_SW agree with the LR window regulator control switch positions?

→ **Yes**
INSTALL a new REM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

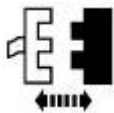
→ **No**
GO to Q3.

Q3 CHECK THE LR WINDOW REGULATOR CONTROL SWITCH

1



2



LR Window Regulator Control Switch C701

3 Check the LR window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.

- Did the LR window regulator control switch pass the component test?

→ Yes
GO to O4.

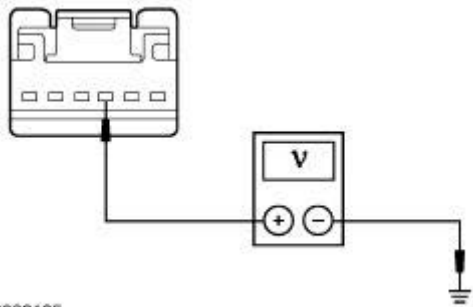
→ No
INSTALL a new LR window regulator control switch. CLEAR the DTCs. REPEAT the self-test.

O4 CHECK THE POWER TO THE LR WINDOW REGULATOR CONTROL SWITCH

1



2



A0003135

2 Measure the voltage between LR window regulator control switch C701 pin 3, circuit 7-AJ14A (YE/BU), harness side and ground.

- Is the voltage greater than 10 volts?

→ Yes
GO to O5.

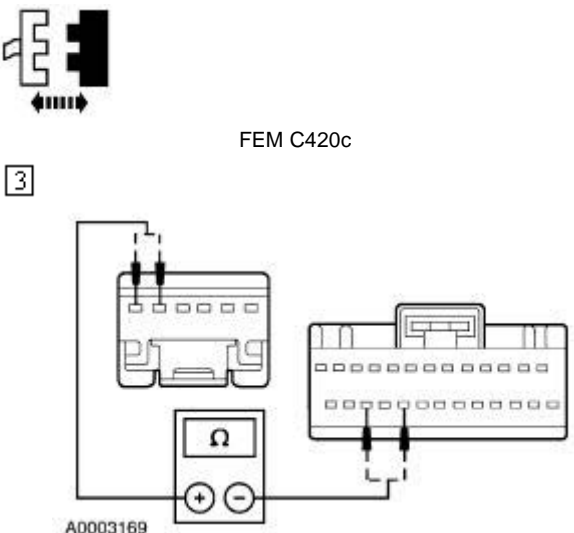
→ No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

O5 CHECK CIRCUITS 8-AJ14A (WH/BU) AND 10-AJ14 (GY/VT) FOR AN OPEN

1



2



FEM C420c

3

3


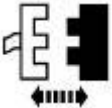
Measure the resistance between LR window regulator control switch C701 pin 1, circuit 8-AJ14A (WH/BU), harness side and REM C420c pin 24 circuit 8-AJ14A (WH/BU), harness side; and between LR window regulator control switch C701 pin 2, circuit 10-AJ14 (GY/VT), harness side and REM C420c pin 22 circuit 10-AJ14 (GY/VT), harness side.

- Are the resistances less than 5 ohms?

→ Yes
INSTALL a new REM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST P: ALL/SINGLE PASSENGER POWER WINDOWS ARE INOPERATIVE — PASSENGER WINDOW LOCK-OUT NOT OPERATING CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
P1 CHECK THE MASTER WINDOW REGULATOR CONTROL SWITCH	
<p>1</p>  <p>2</p>  <p>Master Window Regulator Control Switch C504</p>	<p>3</p> <p>Check the master window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.</p> <ul style="list-style-type: none"> • Did the master window regulator control switch pass the component test?

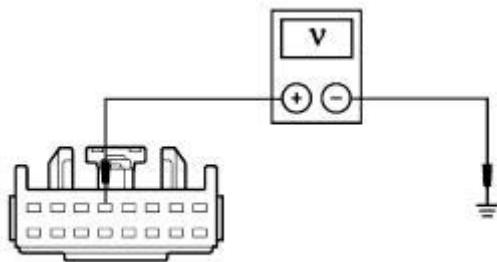
- **Yes**
GO to P2.
- **No**
INSTALL a new master window regulator control switch. REFER to Switch—Master Window Regulator Control in this section. CLEAR the DTCs. REPEAT the self-test.

P2 CHECK CIRCUIT 7S-AJ20 (YE/BU) FOR A SHORT TO BATTERY

1



2



A0003170

- 2 Measure the voltage between master window regulator control switch C504 pin 5, circuit 7S-AJ20 (YE/BU), harness side and ground.

● Is the voltage greater than 10 volts?

- **Yes**
GO to P3.

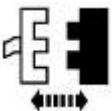
- **No**
GO to P4.

P3 CHECK THE DDM FOR AN INTERNAL SHORT TO BATTERY

1



2



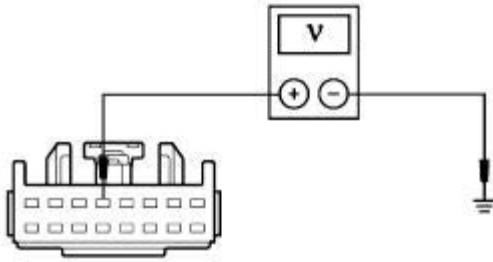
DDM C501d

3



4

- 4 Measure the voltage between master window regulator control switch C504 pin 5, circuit 7S-AJ20 (YE/BU), harness side and ground.



A0003170

- Is the voltage greater than 10 volts?

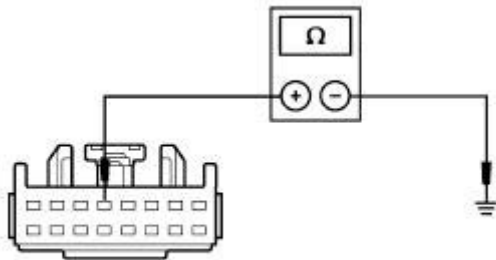
- **Yes**
REPAIR the circuit. CLEAR the DTCs.
REPEAT the self-test.
- **No**
INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

P4 CHECK CIRCUIT 7S-AJ20 (YE/BU) FOR A SHORT TO GROUND

1



2



A0003171

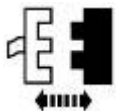
- 2 Measure the resistance between master window regulator control switch C504 pin 5, circuit 7S-AJ20 (YE/BU), harness side and ground.

- Is the resistance greater than 10,000 ohms?

- **Yes**
GO to [P6](#).
- **No**
GO to [P5](#).

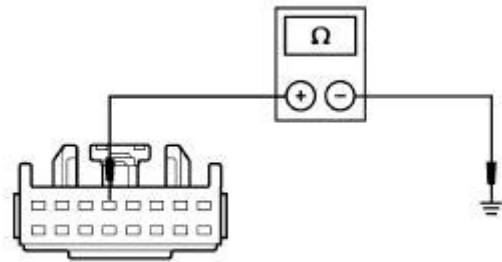
P5 CHECK THE DDM FOR AN INTERNAL SHORT TO GROUND

1



DDM C501d

2



A0003171

2

Measure the resistance between master window regulator control switch C504 pin 5, circuit 7S-AJ20 (YE/BU), harness side and ground.

● Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

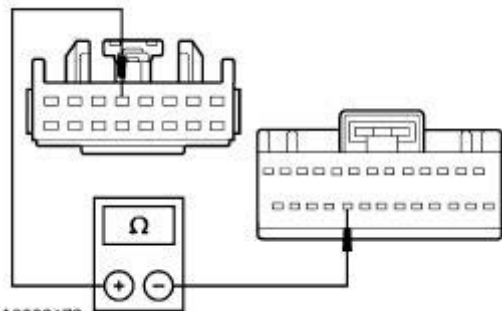
P6 CHECK CIRCUIT 7S-AJ20 (YE/BU) FOR AN OPEN

1



DDM C501c

2



A0003172

2

Measure the resistance between master window regulator control switch C504 pin 5, circuit 7S-AJ20 (YE/BU), harness side and DDM C501c pin 22, circuit 7S-AJ20 (YE/BU), harness side.


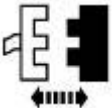
● Is the resistance less than 5 ohms?

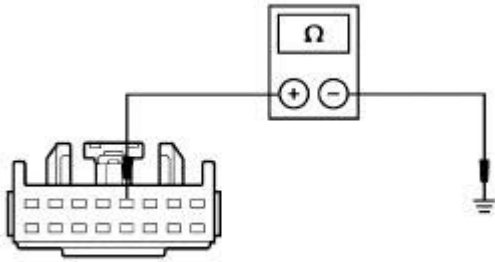
→ **Yes**
INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST Q: THE ONE TOUCH DOWN FEATURE IS

INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
Q1 CHECK THE DDM DTCS	
	<p>1 Retrieve the recorded results from the DDM self-test.</p> <ul style="list-style-type: none"> ● Were any DDM DTCs retrieved? <p>→ Yes If DTC B1400 was retrieved, GO to <u>Q6</u>.</p> <p>For all other DTCs, REFER to the DDM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>Q2</u>.</p>
Q2 CHECK THE MASTER WINDOW REGULATOR CONTROL SWITCH	
<p>1</p>  <p>2</p>  <p>Master Window Regulator Control Switch C504</p>	<p>3 Check the master window regulator control switch; Refer to Wiring Diagrams Section 700-09, Component Testing.</p> <ul style="list-style-type: none"> ● Did the master window regulator control switch pass the component test? <p>→ Yes GO to <u>Q3</u>.</p> <p>→ No INSTALL a new master window regulator control switch. REFER to <u>Switch—Master Window Regulator Control</u> in this section. CLEAR the DTCs. REPEAT the self-test.</p>
Q3 CHECK CIRCUIT 7S-AJ16 (YE/BK) FOR A SHORT TO GROUND	
<p>1</p>	<p>1 Measure the resistance between master window regulator control switch C504 pin 4, circuit 7S-AJ16 (YE/BK), harness side and ground.</p>



A0003173

- Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to Q5.

→ **No**
GO to Q4.

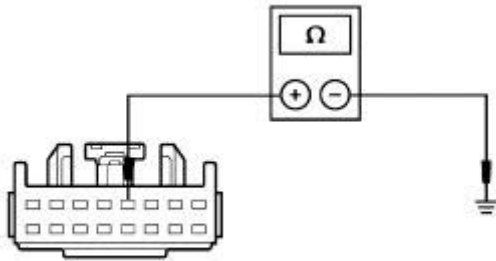
Q4 CHECK THE DDM FOR AN INTERNAL SHORT TO GROUND

1



DDM C501d

2



A0003173

- 2 Measure the resistance between master window regulator control switch C504 pin 4, circuit 7S-AJ16 (YE/BK), harness side and ground.

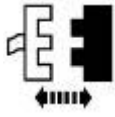
- Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

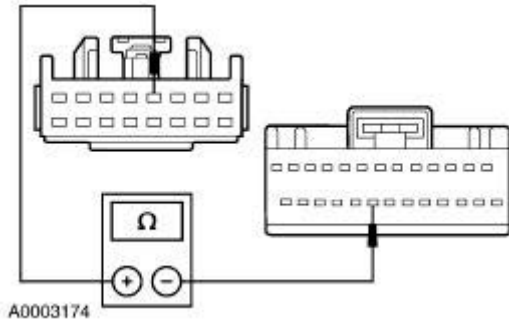
Q5 CHECK CIRCUIT 7S-AJ16 (YE/BK) FOR AN OPEN

1



DDM C501c

2



2

Measure the resistance between master window regulator control switch C504 pin 4, circuit 7S-AJ16 (YE/BK), harness side and DDM C501c pin 21, circuit 7S-AJ16 (YE/BK), harness side.

● Is the resistance less than 5 ohms?

→ Yes

INSTALL a new DDM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ No

REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Q6 CHECK THE MASTER WINDOW REGULATOR CONTROL SWITCH FOR AN INTERNAL SHORT

1



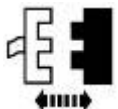
2



3



4



Master Window Regulator Control Switch C504

3

Monitor the DDM PID OTD_SW.

● Did the DDM PID OTD_SW change when the master window regulator control switch C504 was disconnected?

→ **Yes**
 INSTALL a new master window regulator control switch. REFER to Switch—Master Window Regulator Control in this section. CLEAR the DTCs. REPEAT the self-test.

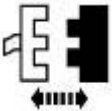
→ **No**
 GO to Q7.

Q7 CHECK CIRCUIT 7S-AJ16 (YE/BK) FOR A SHORT TO BATTERY

1



2

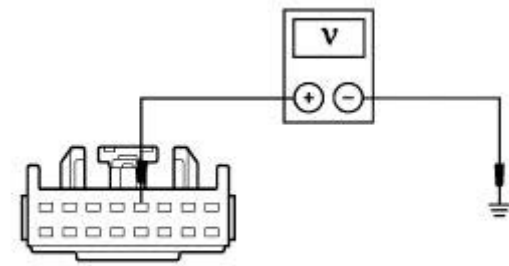


DDM C501d

3



4



A0003175

4 Measure the voltage between master window regulator control switch C504 pin 4, circuit 7S-AJ16 (YE/BK), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
 REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

→ **No**
 INSTALL a new DDM. REFER to Section 419-10. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST R: THE DEFROST SYSTEM IS INOPERATIVE — REAR WINDOW DEFROST

CONDITIONS	DETAILS/RESULTS/ACTIONS
R1 CHECK THE REM DTCS	

1 Retrieve the recorded results from the REM self-test.

● Are any REM DTCs retrieved?

→ **Yes**
REFER to the REM Diagnostic Trouble Code (DTC) Index.

→ **No**
GO to R2.

R2 CHECK THE REM OUTPUT

1



2



3



3 Trigger the REM active command R DEF RLY to ON then OFF while listening for the rear window defrost relay to click.

● Did the rear window defrost relay click when activated ON and OFF?

→ **Yes**
GO to R3.

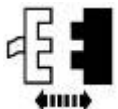
→ **No**
GO to R6.

R3 CHECK THE REAR WINDOW DEFROST POWER

1



2



Rear Window Defrost Power Connector

3

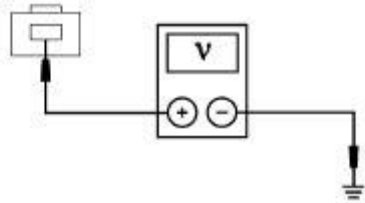


4

4 Trigger the REM active command R DEF RLY to ON.



5



A0003178

5

Measure the voltage between rear window defrost power connector, circuit (BK), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to R4.

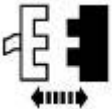
→ **No**
GO to R10.

R4 CHECK THE REAR WINDOW DEFROST GROUND CIRCUIT

1

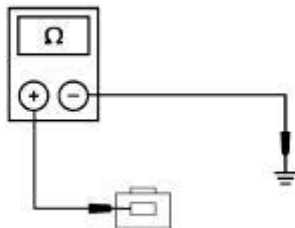


2



Rear Window Defrost Ground Connector

3



A0003179

3

Measure the resistance between rear window defrost ground connector, circuit (BK), harness side and ground.

• Is the resistance less than 5 ohms?

→ **Yes**
GO to R5.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

R5 CHECK THE REAR WINDOW DEFROST GRID

1 Carry out the grid wire component test. Refer to Component Tests.

- **Did the rear window defrost grid pass the component test?**

→ **Yes**

INSTALL a new DATC module; REFER to [Section 412-04](#) . CLEAR the DTCs.

REPEAT the self-test. If the rear window defrost is still inoperative, INSTALL a new REM, REFER to [Section 419-10](#) . CLEAR the DTCs. REPEAT the self-test.

→ **No**

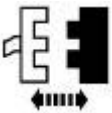
REPAIR the rear window defrost grid. For additional information, REFER to [Lead Terminal Repair](#) in this section. TEST the system for normal operation.

R6 CHECK THE POWER SUPPLY TO THE REAR WINDOW DEFROST RELAY

1



2



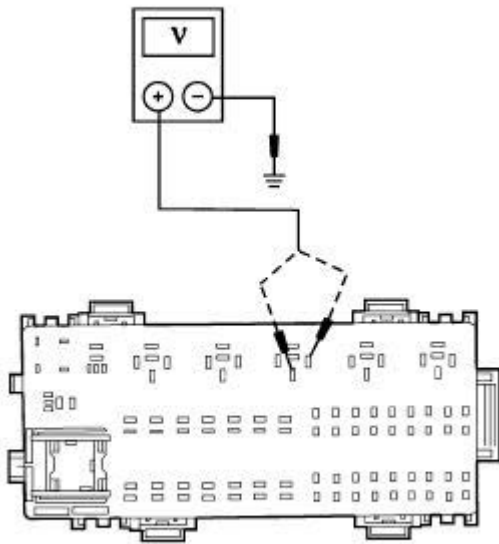
Rear Window Defrost Relay C443

3



4

4 Measure the voltage between the rear window defrost relay C443 pin 86, circuit 30-HB23A (RD/WH), harness side and ground; and between rear window defrost relay C443 pin 30, circuit 30-HB23A (RD/WH), harness side and ground.



A0003176

- Are the voltages greater than 10 volts?

→ **Yes**
GO to R7.

→ **No**
GO to R9.

R7 CHECK THE REAR WINDOW DEFROST RELAY

- 1 Check the rear window defrost relay. Refer to Wiring Diagrams Section 700-09, Component Testing.

- Did the rear window defrost relay pass the component test?

→ **Yes**
GO to R8.

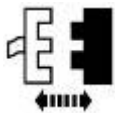
→ **No**
INSTALL a new rear window defrost relay. TEST the system for normal operation.

R8 CHECK CIRCUIT 91S-HB23 (BN/WH) FOR AN OPEN

1

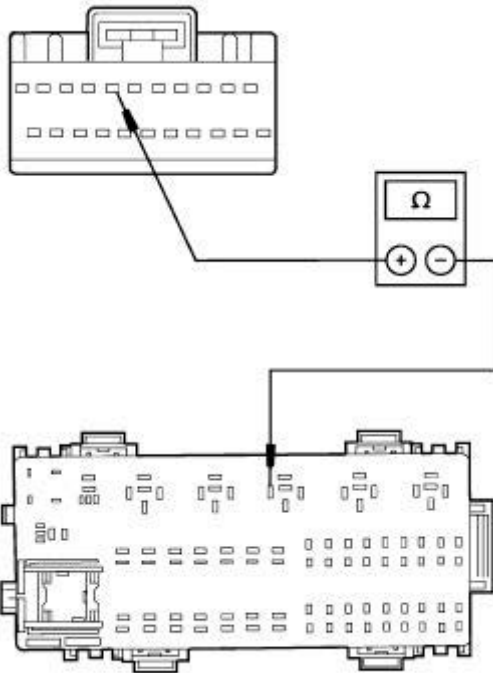


2



REM C420b

3



A0003177

3

Measure the resistance between REM C420b pin 7, circuit 91S-HB23 (BN/WH), harness side and rear window defrost relay C443 pin 85, circuit 91S-HB23 (BN/WH), harness side.

● Is the resistance less than 5 ohms?

→ Yes

INSTALL a new DATC module; REFER to Section 412-04 . CLEAR the DTCs. REPEAT the self-test.

If rear window defrost is still inoperative, INSTALL a new REM, REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.

→ No

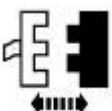
REPAIR the circuit. TEST the system for normal operation.

R9 CHECK CIRCUIT 30-HB23 (RD/WH) FOR OPEN

1

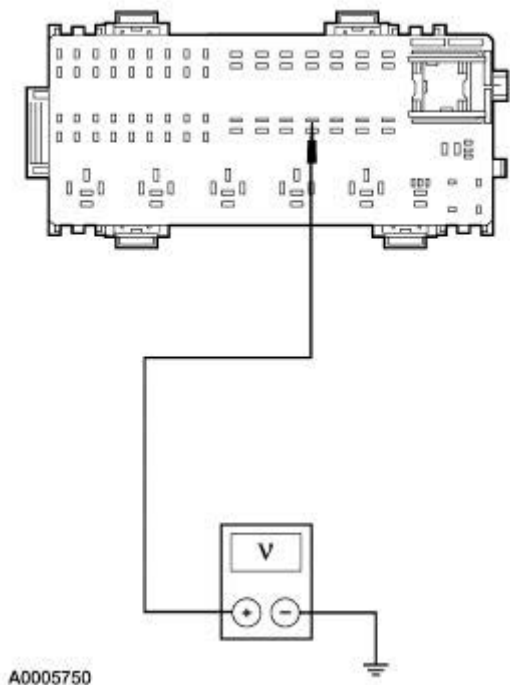


2



BJB Fuse 429 (30A)

3



3

Measure the voltage between BJB fuse 429 (30A) pin 1, circuit 30-HB23 (RD/WH), harness side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
REPAIR circuit 30-HB23 (RD/WH). TEST the system for normal operation.

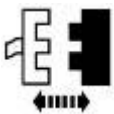
→ **No**
REPAIR the BJB input circuit. TEST the system for normal operation.

R10 CHECK THE OUTPUT TO THE ANTENNA ISOLATOR MODULE

1



2



Antenna Isolator Module C301

3



4



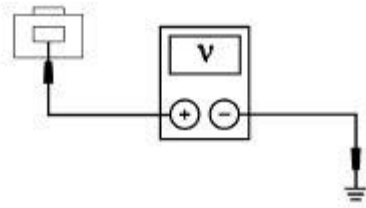
5

4

Trigger the REM active command R DEF RLY to ON.

5

Measure the voltage between antenna



A0003178

isolator module C301, circuit 15S-HB19 (GN/BU), harness side and ground.

- Is the voltage greater than 10 volts?

→ **Yes**
 INSTALL a new antenna isolator module. REFER to [Section 415-02](#). TEST the system for normal operation.

→ **No**
 GO to [R11](#).

R11 CHECK CIRCUIT 15S-HB19 (GN/BU) FOR AN OPEN

1

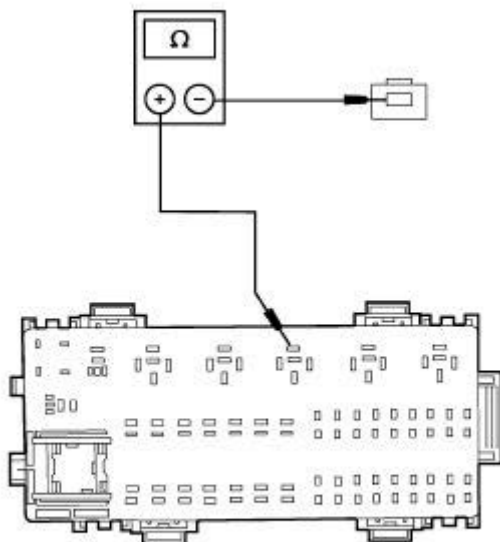


2



Rear Window Defrost Relay C443

3


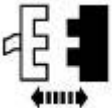


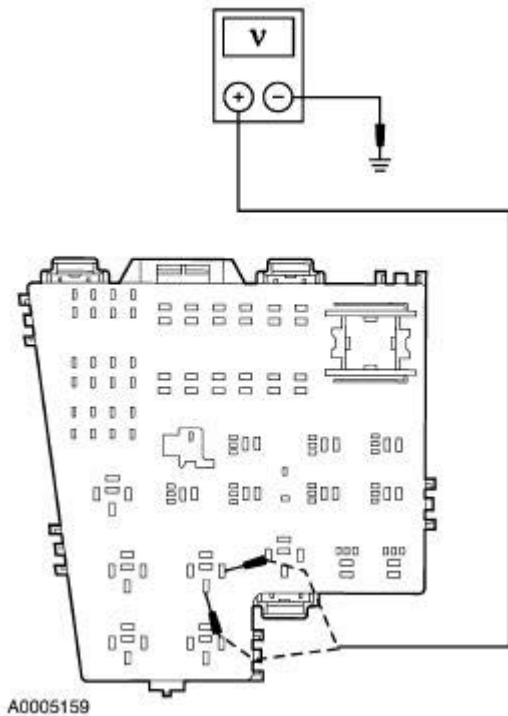
A0003180

3 Measure the resistance between antenna isolator module C301, circuit 15S-HB19 (GN/BU), harness side and rear window defrost relay C443 pin 87, circuit 15S-DA13 (GN/YE), harness side.

	<ul style="list-style-type: none"> ● Is the resistance less than 5 ohms? <p>→ Yes GO to <u>R12</u>.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
R12 CHECK THE REAR WINDOW DEFROST RELAY	
	<p>1 Check the rear window defrost relay. Refer to Wiring Diagrams Section 700-09, Component Testing.</p> <ul style="list-style-type: none"> ● Did the rear window defrost relay pass the component test? <p>→ Yes REPAIR circuit 30-HB23 (RD/WH). TEST the system for normal operation.</p> <p>→ No INSTALL a new rear window defrost relay. TEST the system for normal operation.</p>

PINPOINT TEST S: THE DEFROST SYSTEM IS INOPERATIVE — HEATED WIPER PARK

CONDITIONS	DETAILS/RESULTS/ACTIONS
S1 CHECK THE POWER TO THE HEATED WIPER PARK RELAY	
<p>1</p>  <p>2</p>  <p>Heated Wiper Park Relay C1014</p> <p>3</p>	<p>3 Measure the voltage between heated wiper park relay C1014 pin 86, circuit 30-HB8A (RD/OG), harness side and ground; and between heated wiper park relay C1014 pin 30, circuit 30-HB8 (RD/OG), harness side and ground.</p>



- Are both voltages greater than 10 volts?

→ **Yes**
GO to S2.

→ **No**
GO to S6.

S2 CHECK THE SWITCHED GROUND FROM THE DATC MODULE

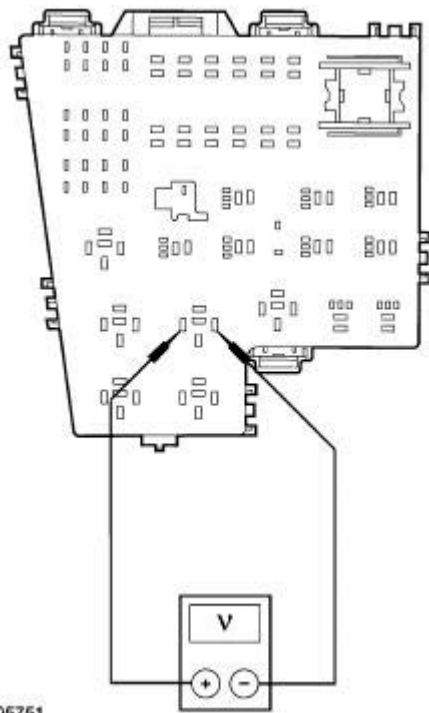
1



3

2 Depress the heated wiper park switch to the ON position.

3 Measure the voltage between heated wiper park relay C1014 pin 85, circuit 91S-HB7 (BN/RD), harness side and heated wiper park relay C1014 pin 86, circuit 30-HB8A (RD/OG), harness side.



A0005751

● Is the voltage greater than 10 volts?

→ **Yes**
GO to S3.

→ **No**
GO to S7.

S3 CHECK THE HEATED WIPER PARK RELAY OUTPUT

1

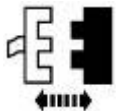


2



Heated Wiper Park Relay C1014

3



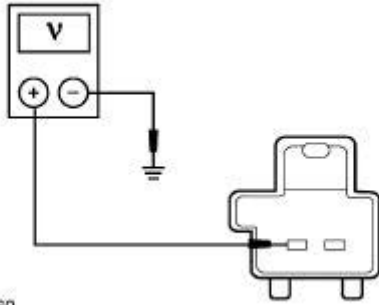
Heated Wiper Park C247

4



5 Operate the heated wiper park switch to the ON position.

6



A0005160

6

Measure the voltage between heated wiper park C247 pin 1, circuit 30S-HB42 (BK), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to S5.

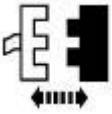
→ **No**
GO to S4.

S4 CHECK CIRCUIT 30S-HB42 (BK) FOR AN OPEN

1

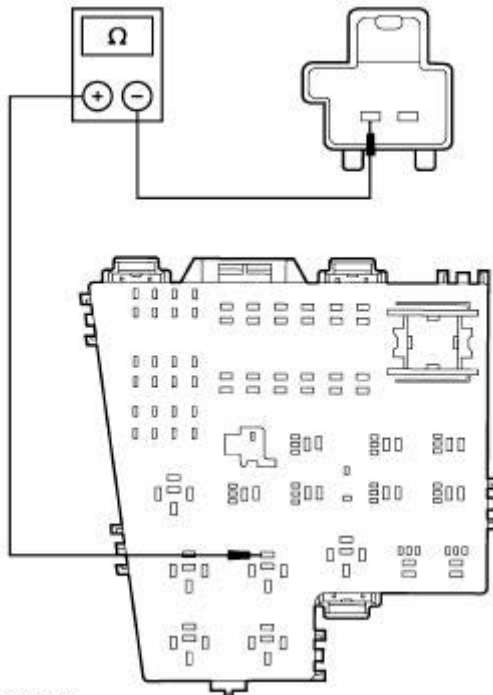


2



Heated Wiper Park Relay C1014

3



A0005162

3

Measure the resistance between heated wiper park relay C1014 pin 87, circuit 30S-HB42 (RD/YE), harness side and heated wiper park C247 pin 1, circuit 30S-HB42 (BK), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new heated wiper park relay.
TEST the system for normal operation.

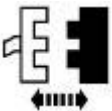
→ **No**
REPAIR the circuit. TEST the system for normal operation.

S5 CHECK THE HEATED WIPER PARK GROUND

1



2

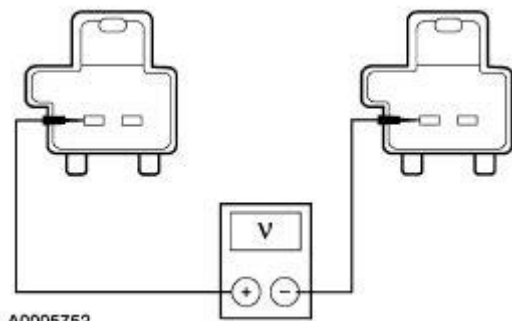


Heated Wiper Park C246

3



5



4 Operate the heated wiper park switch to the ON position.

5 Measure the voltage between heated wiper park C247 pin 1, circuit 30S-HB42 (BK), harness side and heated wiper park C246 pin 1, circuit 31-HB42 (BK), harness side.

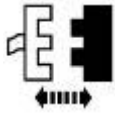
● Is the voltage greater than 10 volts?

→ **Yes**
INSTALL a new windshield. REFER to [Windshield Glass](#) in this section. TEST the system for normal operation.

→ **No**
REPAIR circuit 31-HB42 (BK). TEST the system for normal operation.

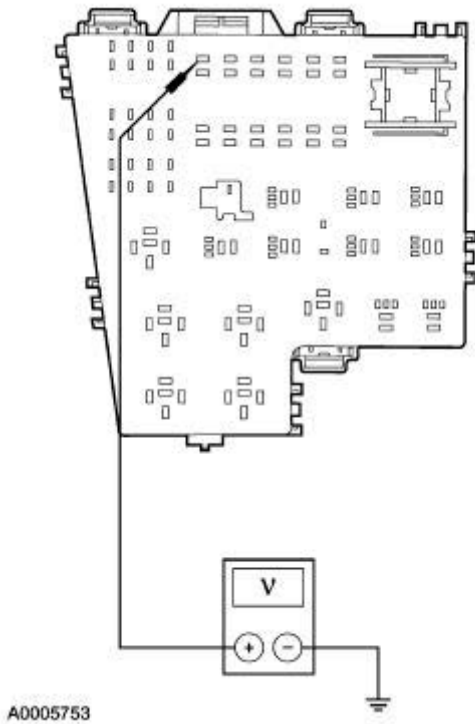
S6 CHECK THE UNDERHOOD AJB FOR POWER

1



Underhood AJB Fuse 113 (30A)

2



2

Measure the voltage between underhood AJB fuse 113 (30A) pin 1 (input circuit), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
REPAIR circuit 30-HB8. TEST the system for normal operation.

→ **No**
REPAIR the underhood AJB input circuit. TEST the system for normal operation.

S7 CHECK CIRCUIT 91S-HB7 (BN/RD) FOR AN OPEN

1



2

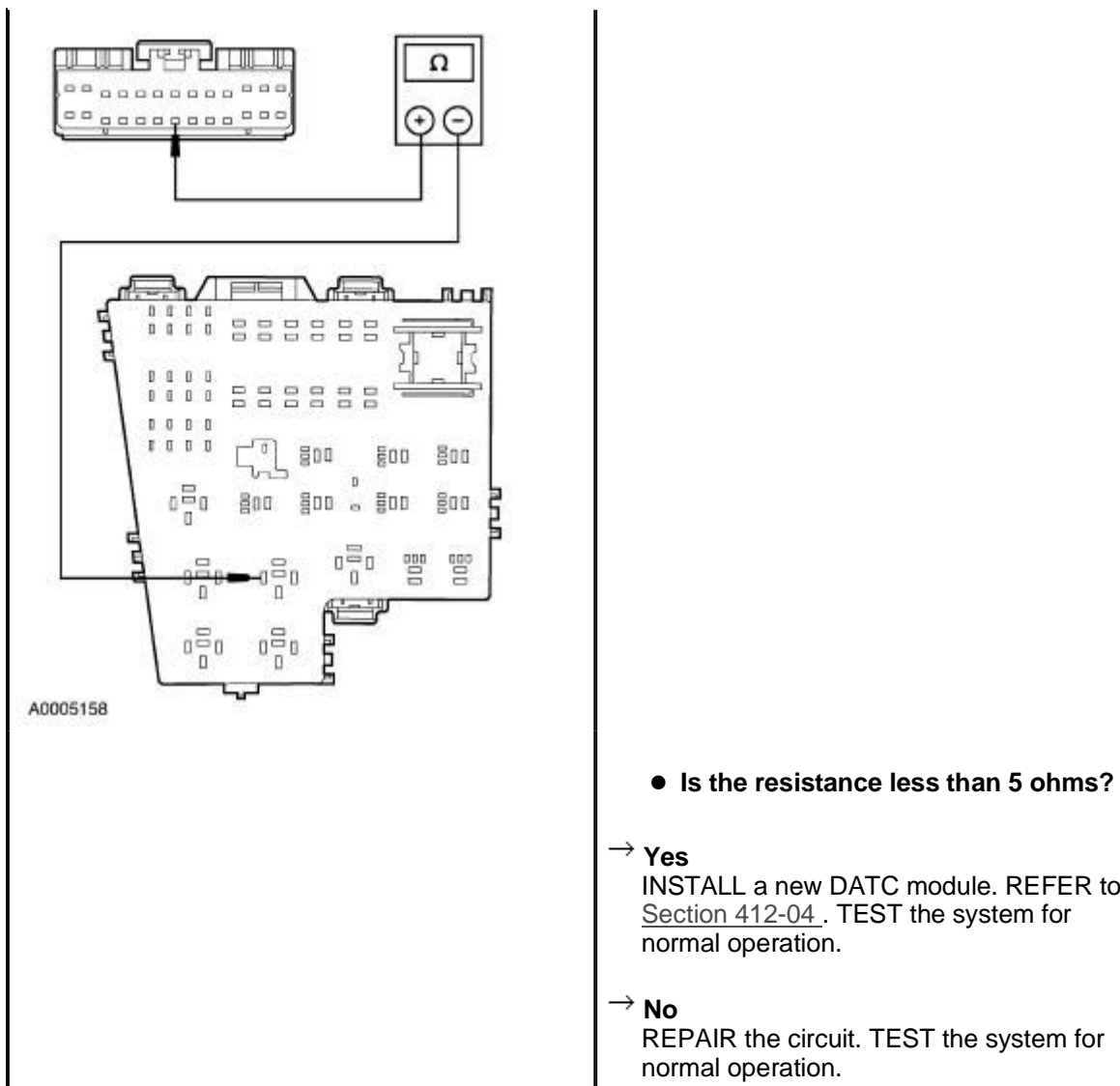


DATC Module C228b

3

3

Measure the resistance between heated wiper park relay C1014 pin 85, circuit 91S-HB7 (BN/RD), harness side and DATC module C228b pin 20, circuit 91S-HB7 (BN/RD), harness side.

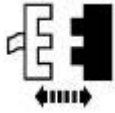


PINPOINT TEST T: THE DEFROST SYSTEM WILL NOT SHUT OFF AUTOMATICALLY — REAR WINDOW DEFROST

CONDITIONS	DETAILS/RESULTS/ACTIONS
T1 CHECK THE REM DTCS	<p>1 Retrieve the recorded results from the REM self-test.</p> <ul style="list-style-type: none"> ● Are any REM DTCs retrieved? <p>→ Yes REFER to the REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to T2.</p>
T2 CHECK FOR A STUCK OR STICKING REAR WINDOW DEFROST RELAY	
1	



2



Rear Window Defrost Relay C443

3



● Is the rear window defrost defroster off?

→ Yes
GO to T3.

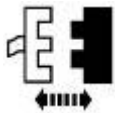
→ No
GO to T5.

T3 CHECK THE REAR WINDOW DEFROST RELAY

1



2



Rear Window Defrost Relay C443

3 Check the rear window defrost relay; refer to Wiring Diagrams Section 700-09, Component Testing.

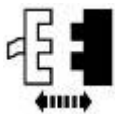
● Did the rear window defrost relay pass the component test?

→ Yes
GO to T4.

→ No
INSTALL a new rear window defrost relay. TEST the system for normal operation.

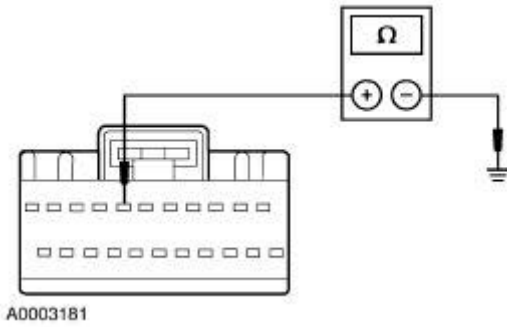
T4 CHECK CIRCUIT 91S-HB23 (BN/WH) FOR A SHORT TO GROUND

1



REM C420b

2



2

Measure the resistance between REM C420b pin 7, circuit 91S-HB23 (BN/WH), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**

INSTALL a new REM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR the circuit. TEST the system for normal operation.

T5 CHECK CIRCUITS 15S-DC1 (GN/YE) AND 29S-HB1 (OG/YE) FOR SHORT TO POWER

1



2



BJB Fuse 409 (5A)

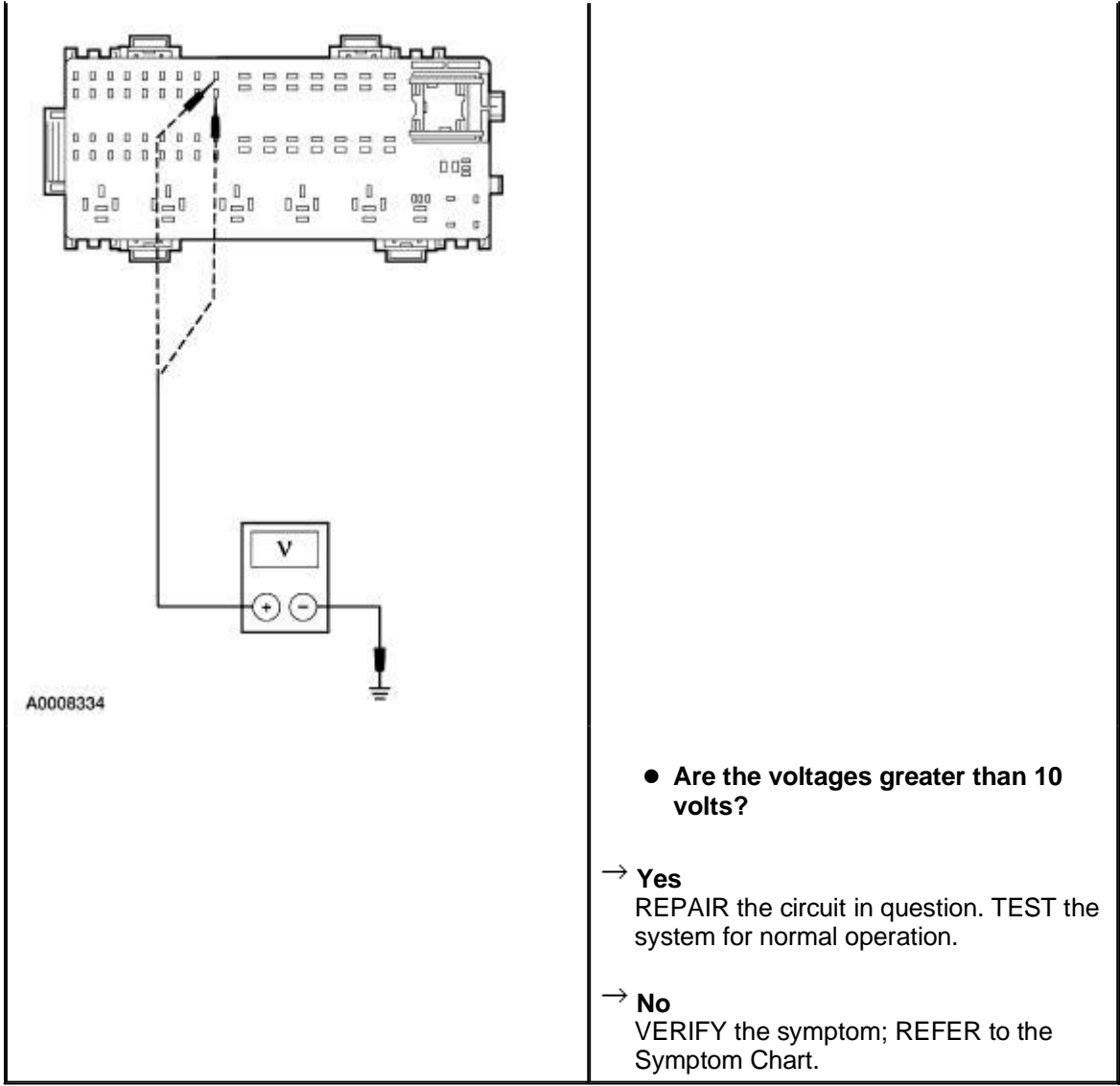
3



4

4

Measure voltage between BJB fuse 409 (5A) pin 1, circuit 15S-DC1 (GN/YE), harness side and ground and between BJB fuse 409 (5A) pin 2, circuit 29S-HB1 (OG/YE), harness side and ground.


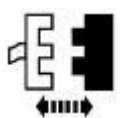


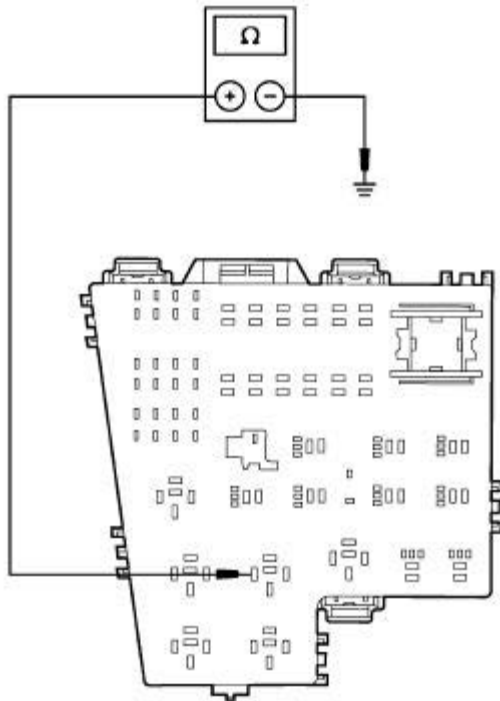
● Are the voltages greater than 10 volts?

→ **Yes**
REPAIR the circuit in question. TEST the system for normal operation.

→ **No**
VERIFY the symptom; REFER to the Symptom Chart.

PINPOINT TEST U: THE DEFROST SYSTEM WILL NOT SHUT OFF AUTOMATICALLY — HEATED WIPER PARK

CONDITIONS	DETAILS/RESULTS/ACTIONS
U1 CHECK FOR A SHORTED CONTROL CIRCUIT	
<p>1 </p> <p>2  Heated Wiper Park Relay C1014</p> <p>3</p>	<p>3 Measure the resistance between heated wiper park relay C1014 pin 85, circuit 91S-HB7 (BN/RD), harness side and ground.</p>



A0005157

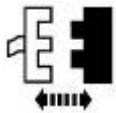
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to U3.

→ **No**
GO to U2.

U2 CHECK CIRCUIT 91S-HB7 (BN/RD) FOR A SHORT TO GROUND

1

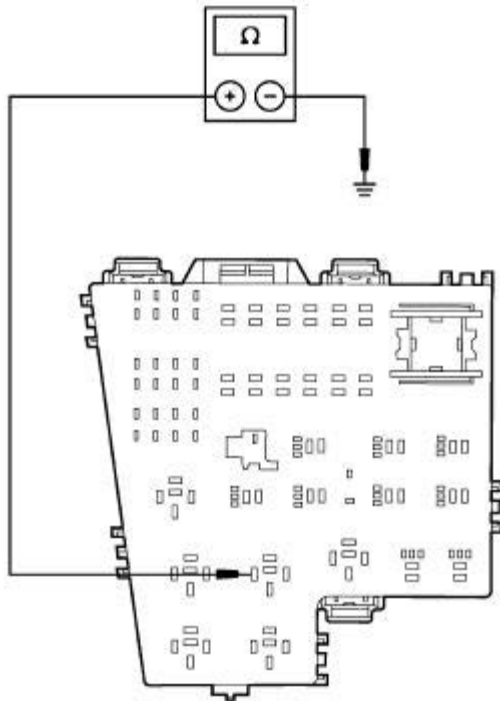


DATC Module C228b

2

2

Measure the resistance between heated wiper park relay C1014 pin 85, circuit 91S-HB7 (BN/RD), harness side and ground.



A0005157

- Is the resistance greater than 10,000 ohms?

- **Yes**
INSTALL a new DATC module. REFER to [Section 412-04](#). TEST the system for normal operation.
- **No**
REPAIR the circuit. TEST the system for normal operation.

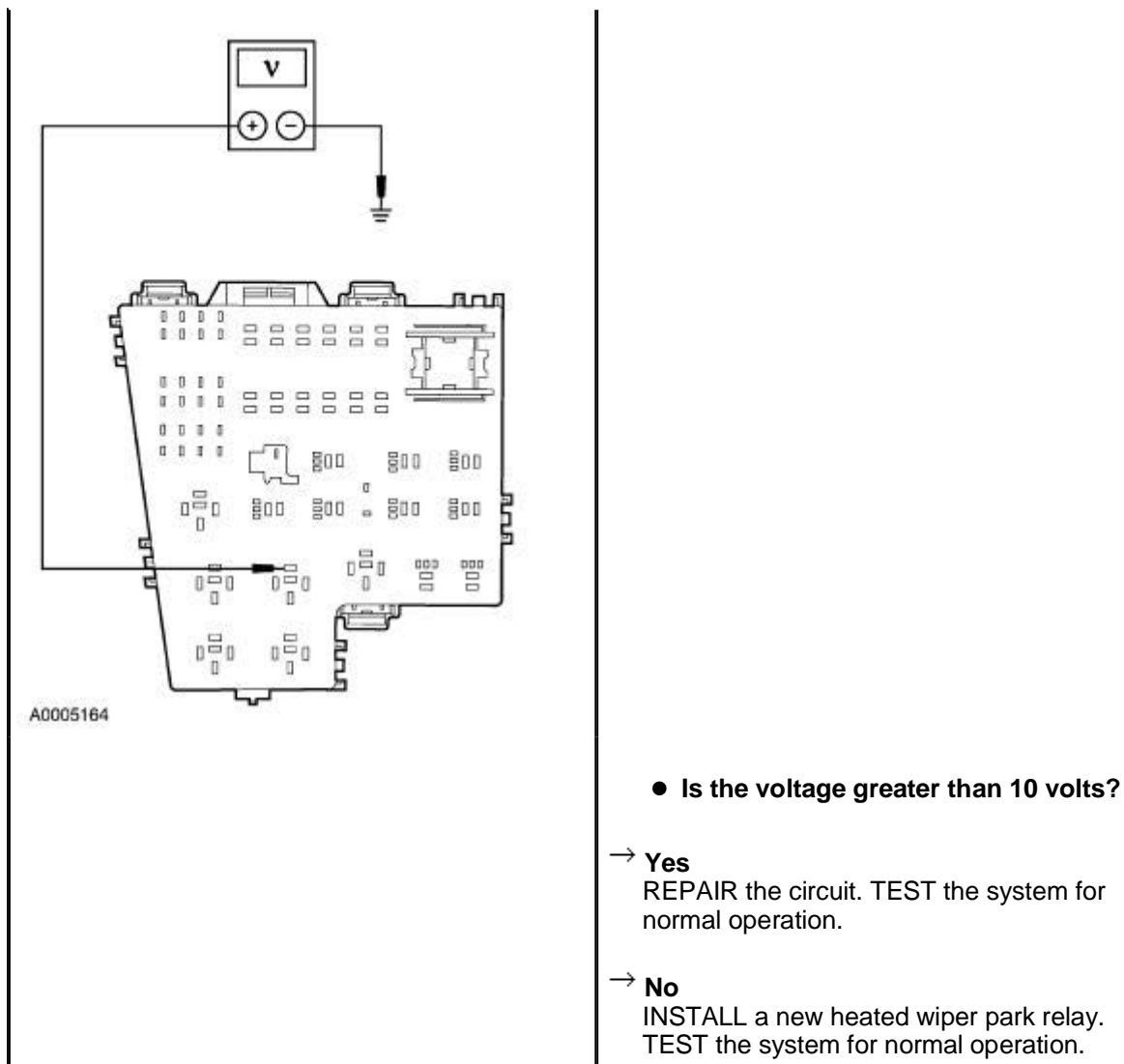
U3 CHECK CIRCUIT 30S-HB42 (RD/YE) FOR A SHORT TO BATTERY

1



2

- 2 Measure the voltage between heated wiper park relay C1014 pin 87, circuit 30S-HB42 (RD/YE), harness side and ground.




Component Test

Grid Wire Test

1. Using a bright lamp in the vehicle, inspect the wire grid from the exterior. A broken grid wire will appear as a brown spot.
2. Run the engine at idle. Set the rear window defrost switch to ON. The indicator light should come on.
3. Working in the vehicle with a voltmeter, contact the broad red-brown stripes of the rear glass window positive lead to battery side and the negative lead to ground side. The meter should read 10-13 volts. A lower voltage reading indicates a loose ground connection.
4. Contact a good ground point with the negative lead of the meter. The voltage reading should remain the same.
5. With the negative lead of the meter grounded, touch each grid line of the rear window defrost glass (42006) at its midpoint with the positive lead. A reading of approximately six volts indicates that the line is good. A reading of zero volts indicates that the line is broken between the midpoint and the B+ side of the grid line. A reading of 12 volts indicates that the circuit is broken between the midpoint of the grid line and ground.

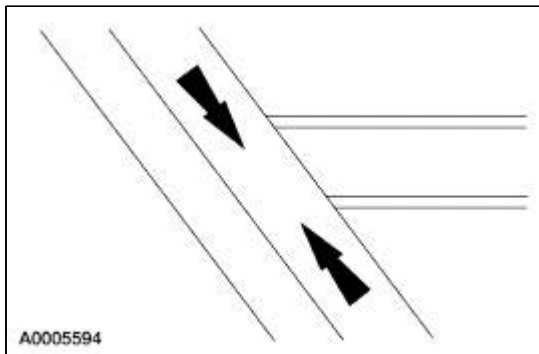
Lead Terminal Repair

Special Tool(s)

 ST1110-A	Heat Gun 107-R0300 or equivalent
---	-------------------------------------

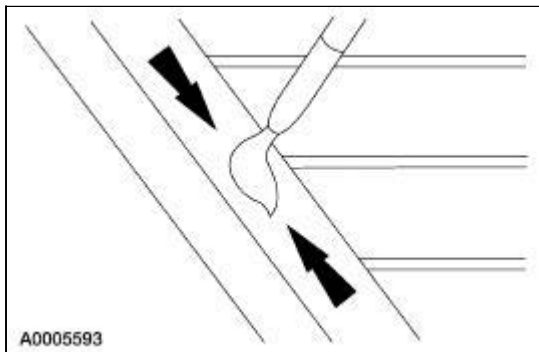
1. **NOTE:** The rear window glass (42006) must be at room temperature at the time of the repair.


Clean the bus bar in the area to be repaired with steel wool (3/0 to 4/0 grade).



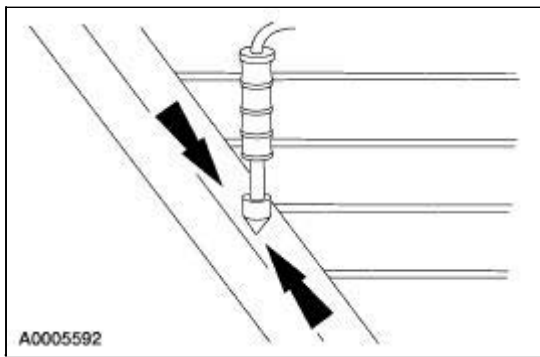
2. **NOTE:** Allow 10 minutes of drying time between the coats.

Apply three coats of Rear Window Defroster Repair D8AZ-19562-AA or equivalent meeting Ford specification ESB-M4J58-A to the surface.



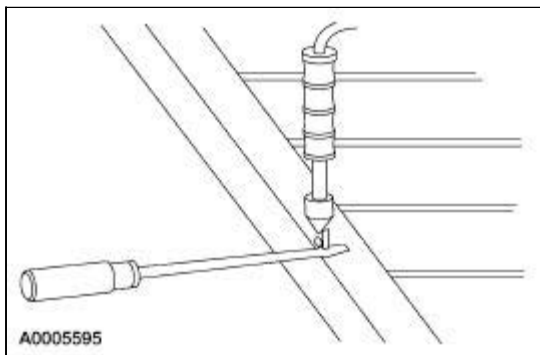
3.  **CAUTION:** Do not overheat the rear window glass or damage to the rear window glass may occur.

Tin the bus bar repair area with solder.



4.  **CAUTION:** To prevent overheating the rear window glass, remove the soldering gun as soon as the solder flows.

Preheat the rear window glass in the area to be repaired using the special tool and solder the terminal to the bus bar.



5. **NOTE:** Turn the heated back window switch ON for five minutes prior to the final inspection of the repair.

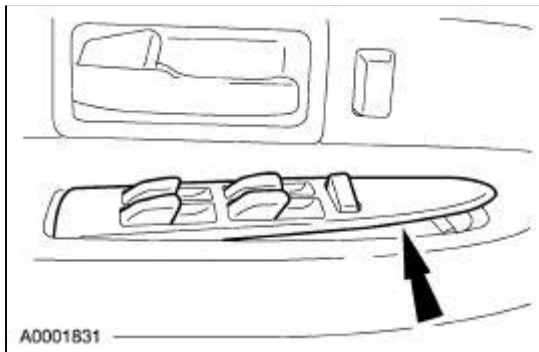
Apply Rear Window Defroster Repair D8AZ-19562-AA or equivalent meeting Ford specification ESB-M4J58-A to the repair area as needed.

Switch —Master Window Regulator Control

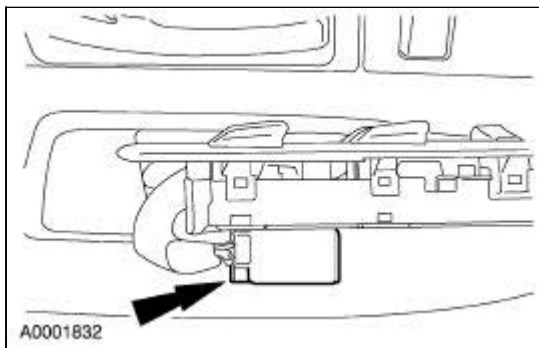
Removal and Installation

1.  **CAUTION:** Carefully lift out the master control regulator switch from the front of the door panel to avoid breaking the tab.

Remove the master window control regulator switch.






2. Disconnect the electrical connector.




3. To install, reverse the removal procedure.

Window Glass —Back

Special Tool(s)

 ST1320-A	Rotunda Interior Auto Glass Cut-Out Knife Kit 164-R2450 or equivalent
 ST1109-A	Rotunda Pneumatic Knife with Offset Blade 107-R1511 or equivalent
 ST2085-A	The Pumper 164-R2459 or equivalent

Removal

 **WARNING:** To prevent glass splinters from entering the eyes or cutting the hands, wear safety glasses and heavy gloves when cutting the glass from the vehicle.

 **CAUTION:** Do not scratch the pinch weld.

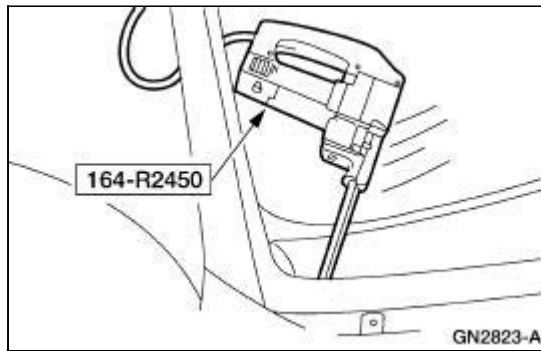
1. Remove the package tray trim panel. For additional information, refer to [Section 501-05](#).
2. Disconnect the three back window glass electrical connectors:
 - two rear defrost electrical connectors.
 - FM antenna electrical connector.
3. If equipped, disconnect the cellular phone antenna connector.
4. Lower the rear portion of the headliner.
5. Using a soft brush or vacuum, remove the dirt and foreign material from the pinch weld.

6.  **CAUTION:** Care must be taken to avoid scratching the pinch weld.

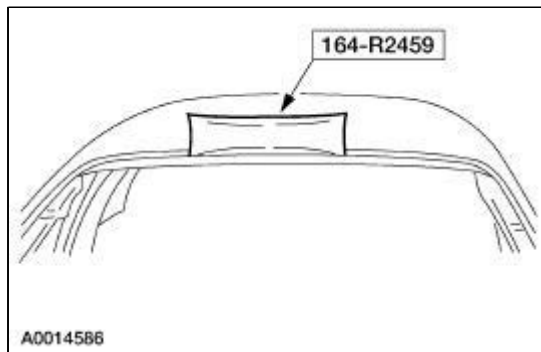
NOTE: Lubricate the existing urethane adhesive with water to aid the special tool while cutting.

Using the special tool, starting at the top center of the back window glass, cut the adhesive

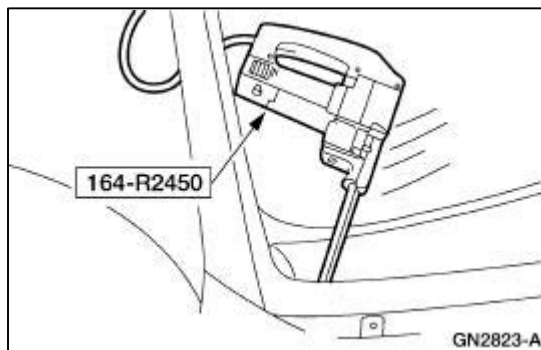
away from the glass and work down the sides.



7. Using the special tool, distance the back window glass from the body.



8. Using the special tool, cut the remaining urethane adhesive and remove the back window glass.



9. Using a soft brush or vacuum, remove the dirt and foreign material from the pinch weld.

Installation

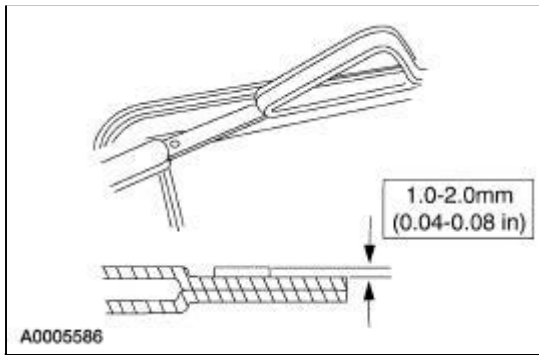
⚠ CAUTION: After installing the new urethane-installed glass, the vehicle should not be driven until the urethane adhesive has cured. The curing time at temperatures above 13° C (55° F) and relative humidity above 50% is 12-24 hours. (Refer to the Essex drive away chart for the cure times as the temperatures and humidity vary). Inadequate curing of the urethane adhesive may adversely affect the strength of the urethane adhesive bond.


1. Dry fit the replacement back window glass to the existing urethane bed on the body pinch weld. Align the back window glass in the opening for uniform fit.
2. Use tape or non-permanent marking pencil to make alignment marks on the back window glass (preferably at the setting blocks), and the body to aid in the installation alignment of the replacement back window glass.

3. After alignment, remove the back window glass and molding assemblies from the vehicle and place on a stable work surface.

4.  **CAUTION: Care must be taken to avoid scratching the pinch weld.**

Trim the remaining urethane adhesive on the pinch weld using only the full-cut method. In this method, most of the existing urethane adhesive is removed leaving a level bead around the entire pinch weld.



5.  **WARNING: All rust found on the pinch weld must be removed and the pinch weld restored to OEM specifications. If surface rust is found, remove completely down to clean, bare metal. Prime pinch weld metal with an OEM recommended curing automotive paint primer and allow to cure properly. If rust has penetrated through the pinch weld metal, repair the pinch weld sheet metal at a body shop before proceeding.**

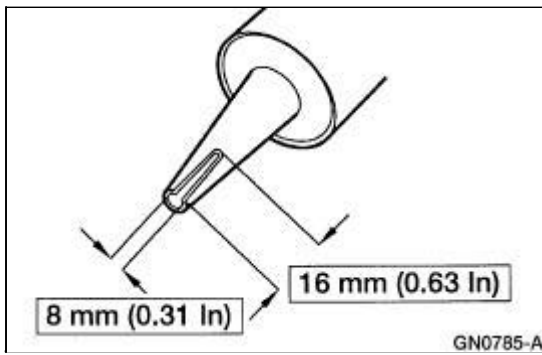
Check the pinch weld for damaged sheet metal, raised sheet metal at the spot welds, rust or foreign material that may cause glass breakage. Clean or repair surface as necessary.


6. Use the wool applicator to apply Urethane Metal Primer Essex U-413 meeting Ford specification WSB-M2G234-C to any exposed metal on the pinch weld. Allow six to ten minutes to dry.
7. If reinstalling the original back window glass, remove any excess urethane adhesive.
8. Clean the inside of the glass surface with an alcohol-free cleaner to make sure the ceramic-coated area is clean.

9.  **CAUTION: Wipe off the urethane glass prep immediately after each application because it flash dries. Apply deliberate strokes, making sure not to overlap the applied area.**

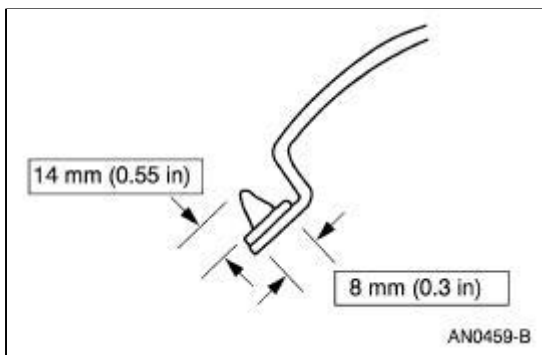
If installing a new back window glass, apply Urethane Glass Prep Essex U-401 meeting Ford specification WSB-M2G314-B twice around the glass surface to be prepped.

10. If installing a new back window glass, apply Urethane Glass Primer Essex U-402 meeting Ford specification WSB-M5B280-C to the same area that was prepped in the previous step. Allow five minutes to dry.
11. Cut the urethane adhesive applicator tip to specification.



12.  **CAUTION:** If the vehicle is to be driven within 24 hours of urethane adhesive application, Urethane Adhesive Essex U-216 meeting Ford specification WSB-M2G316-B must be used due to its one-hour cure time.

Apply a bead of Urethane Adhesive Essex 400-HV or Essex U-216, meeting Ford specification WSB-M2G316-B to the pinch weld.



13.  **CAUTION:** Open the windows to prevent the back window glass from being pushed out by air pressure if a door is closed.

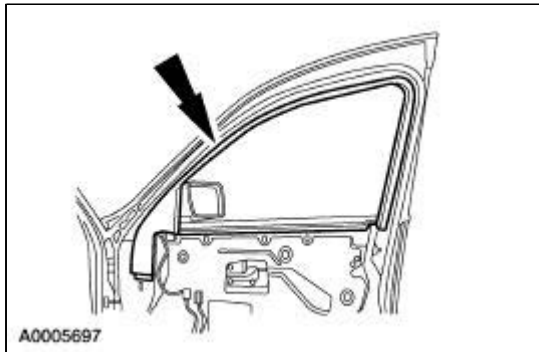
Install the back window glass on the pinch weld. Align the back window glass to the body using the alignment marks while pushing downward to set the stops.

14. Inspect the back window glass for air or water leaks and add urethane adhesive where needed.
15. If equipped, install the cellular phone antenna. For additional information, refer to [Section 419-05](#).
16. Connect the three back window electrical connectors:
- two rear defroster connectors.
 - FM antenna electrical connector.
17. Install the package tray trim panel. For additional information, refer to [Section 501-05](#).
-

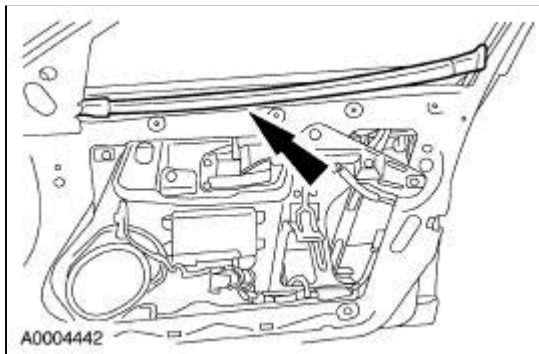
Window Glass —Front Door

Removal and Installation

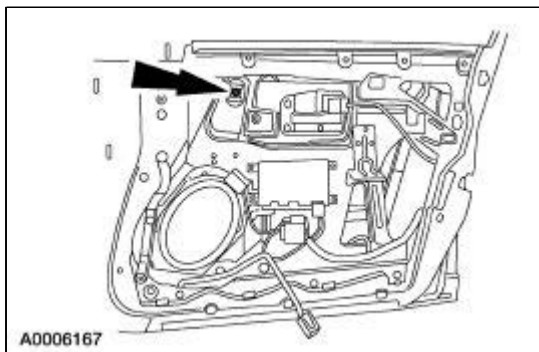
1. Remove the door trim panel. For additional information; refer to [Section 501-05](#).
2. Remove the interior garnish moulding.



3. Remove the watershield.
4. Remove the interior weatherstrip.

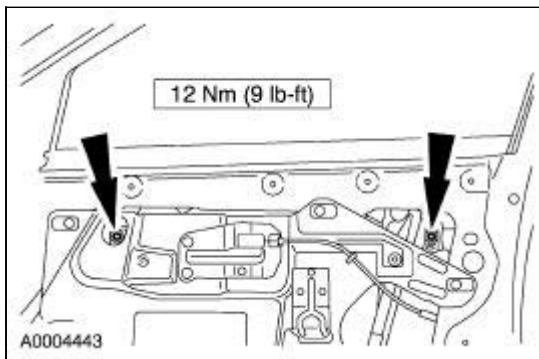


5. Position the forward front window regulator to glass bolt to the bottom of the access hole.



6. **NOTE:** Do not remove the bolts.

Loosen the front window regulator to glass bolts.



7. Hold the glass in place and lower the window regulator to the bottom of the door panel.
8. Remove the front door window glass.

9.  **CAUTION: Make sure the front door window glass correctly seats in the glass mounting brackets as the front door window glass is raised.**

NOTE: Position the front door window glass against the B-pillar.

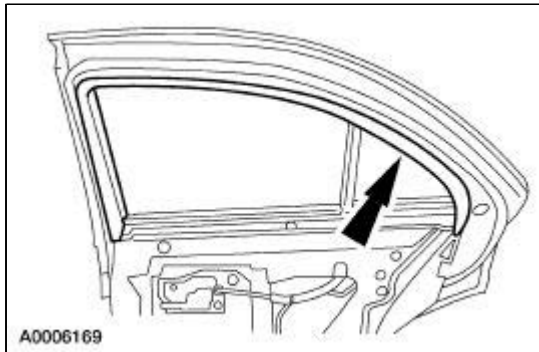
NOTE: Support the front door window glass and raise the window regulator to the full upright position.

To install, reverse the removal procedure.

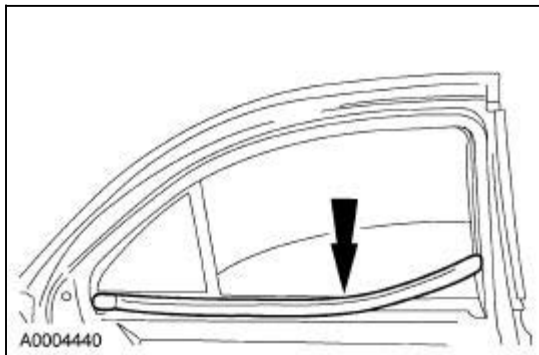
Window Glass —Rear Door

Removal and Installation

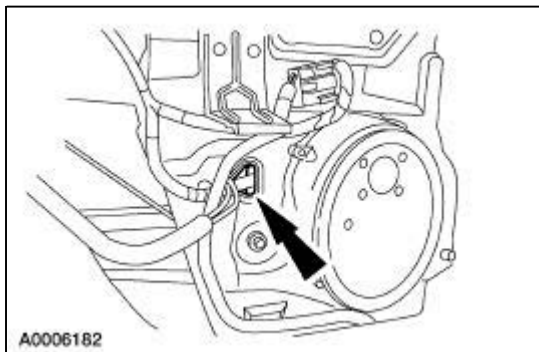
1. Remove the rear door trim panel. For additional information, refer to [Section 501-05](#).
2. Remove the interior garnish molding.



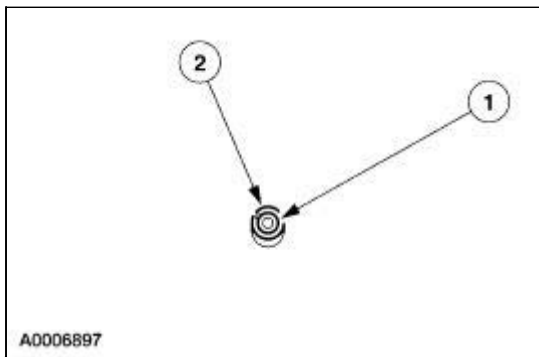
3. Remove the interior weather strip.



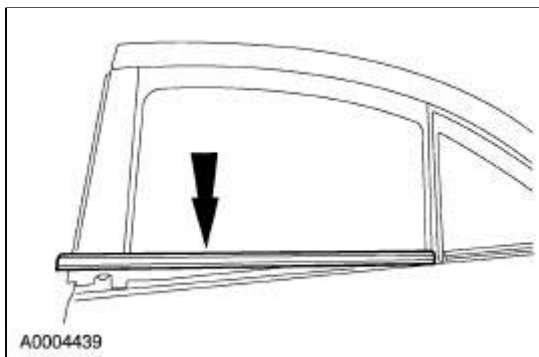
4. Lower the rear door window glass until the glass spacer bracket is visible in the access hole.



5. Remove the rear door window glass spacer bracket.
 1. Using a punch, remove the center portion of the spacer bracket.
 2. Remove the outer portion of the spacer bracket.

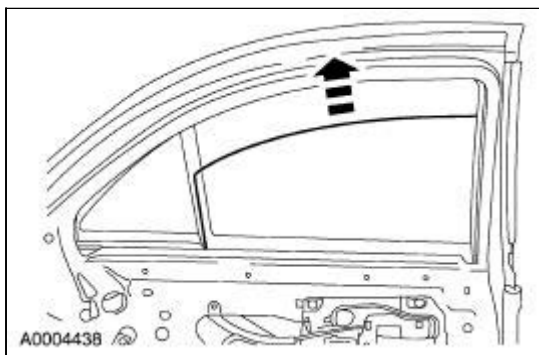


6. Remove the exterior weatherstrip.



7. Remove the rear door window glass.

- Lift the rear door window glass out of the window regulator.
- Lower the rear door window glass out of the channel.
- Lift the rear door window glass through the belt opening to the outside of the channel.



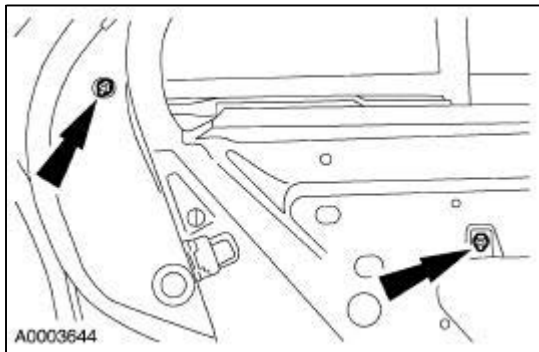
8. **NOTE:** Prior to the installation of the window, reinstall the outer and center portion of the spacer bracket into the rear door window glass. The spacer bracket should protrude equal distances on both sides of the window glass.

To install, reverse the removal procedure.

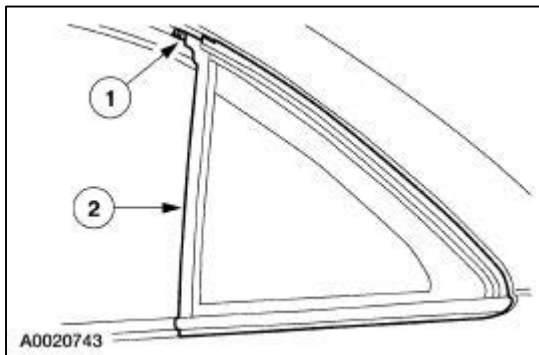
Window Glass —Rear Quarter

Removal and Installation

1. Remove the rear door window glass. For additional information, refer to [Window Glass—Rear Door](#) .
2. Remove the rear door glass run and the exterior moulding at the top of the glass.
3. Remove the quarter window glass nuts.



4. Remove the quarter window glass.
 1. Remove the screw.
 2. Remove the quarter window glass.



5. **NOTE:** If reinstalling the original quarter glass, clean off any remaining butyl prior to installation.

NOTE: Clean the area of any remaining foam or residue prior to installation of the quarter window glass.

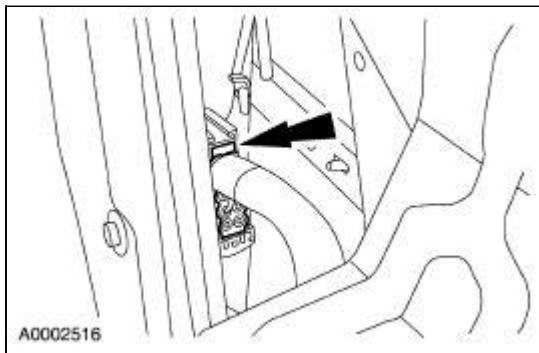
NOTE: Apply the new butyl to the installation area.

To install, reverse the removal procedure.

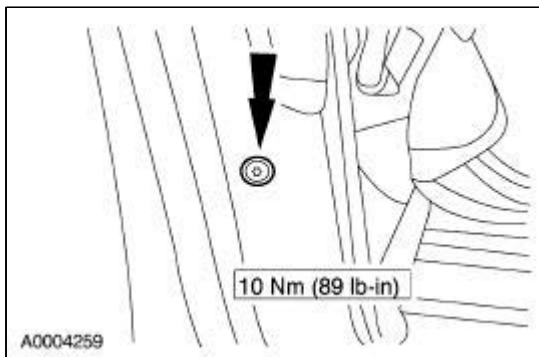
Window Regulator —Front Door

Removal and Installation

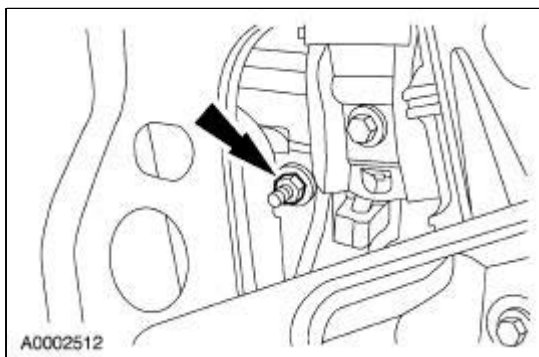
1. Remove the front door window glass. For additional information, refer to [Window Glass—Front Door](#).
2. Disconnect the door latch electrical connector.



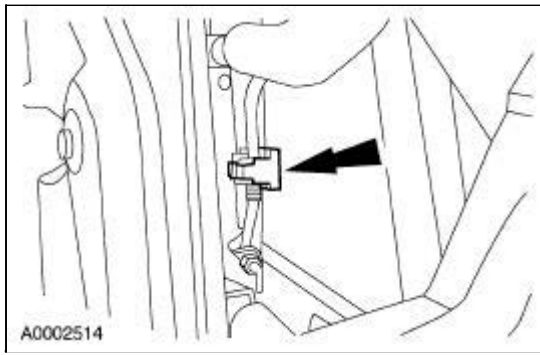
3. Remove the anti-theft shield screw.



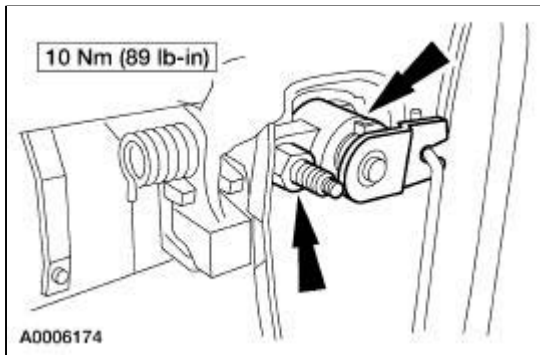
4. Remove the nut and position the anti-theft shield aside.



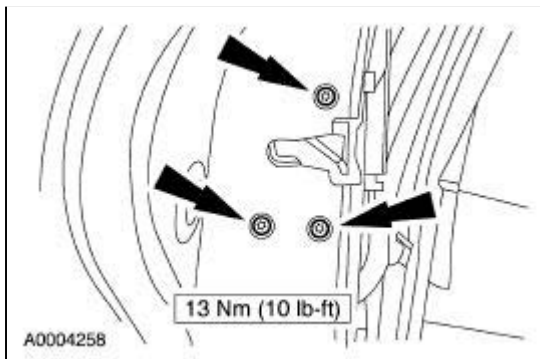
5. Release the clip and disconnect the exterior door handle actuating rod.



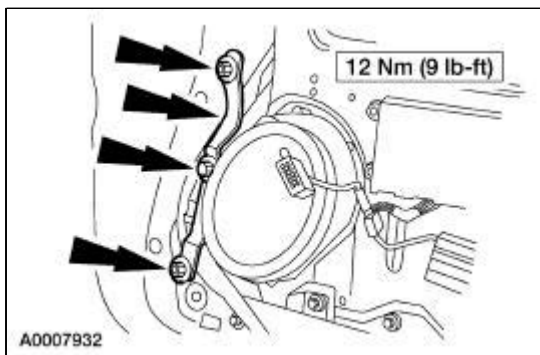
6. Remove the nut and the door lock cylinder (driver door only).



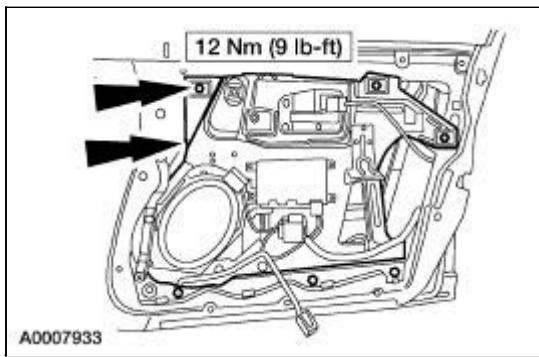
7. Remove the latch screws.



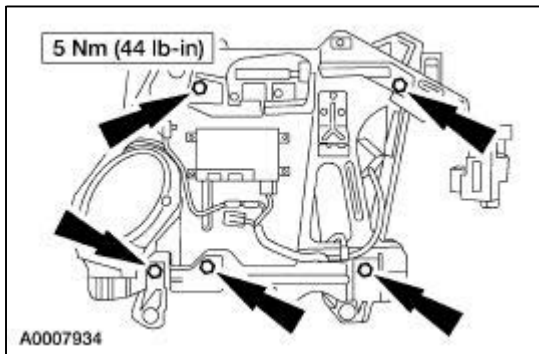
8. Remove the two nuts, the bolt and the inner front door support bracket.



9. Remove the bolts and the front door inner support.



10. Remove the bolts and the window regulator assembly.
 - Disconnect the harness locators and reposition the harness.

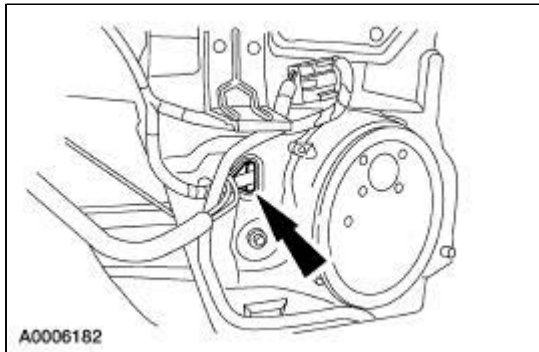


11. To install, reverse the removal procedure.
-

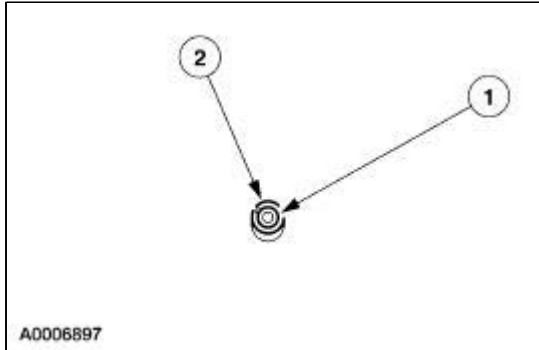
Window Regulator —Rear Door

Removal

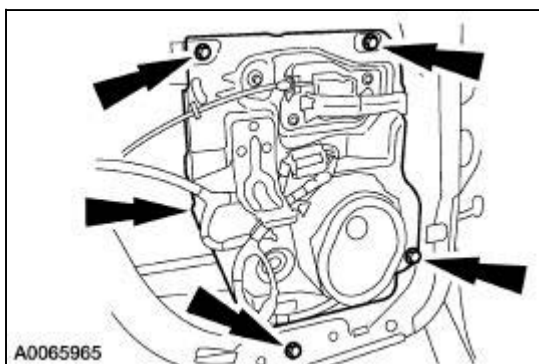
1. Remove the rear door trim panel. For additional information, refer to [Section 501-05](#).
2. Lower the rear door window glass until the glass spacer bracket is visible in the access hole.



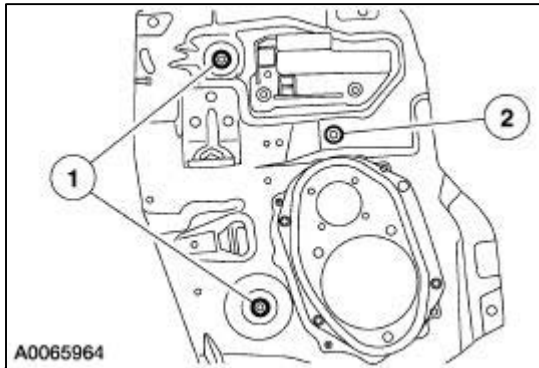
3. Remove the rear door window glass spacer bracket.
 1. Using a punch, remove the center portion of the spacer bracket.
 2. Remove the outer portion of the spacer bracket.



4. Position the rear window glass to the top of the window opening and tape around the door frame to hold in place.
5. Position the inner door module assembly aside.
 1. Remove the bolts.
 2. Position the support aside.



6. Remove the rear door window regulator.
 1. Remove the two nuts.
 2. Remove the bolt.
 3. Remove the rear door window regulator.
 - Disconnect the electrical connector.

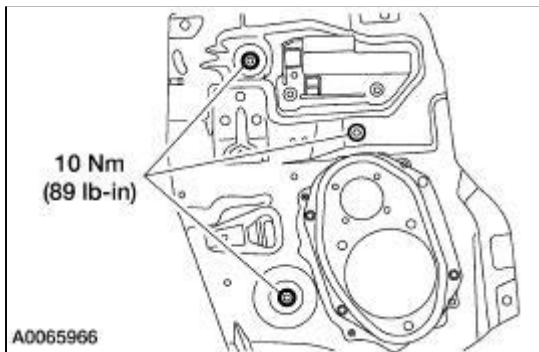


Installation

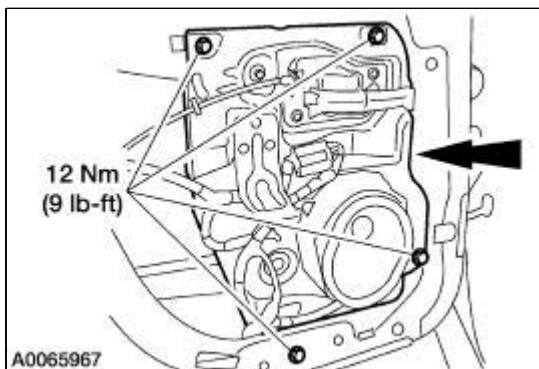
1. **NOTE:** Prior to the attaching the window to the regulator, reinstall the outer and center portions of the spacer bracket into the rear door window glass. The spacer bracket should protrude equal distances on both sides of the window glass.

Install the spacer bracket into the rear door window glass.

2. Install the rear door window regulator.
 1. Position the window regulator.
 2. Install the two nuts and one bolt.
 - Connect the electrical connector.



3. Position the inner door module assembly to the door and install the bolts.

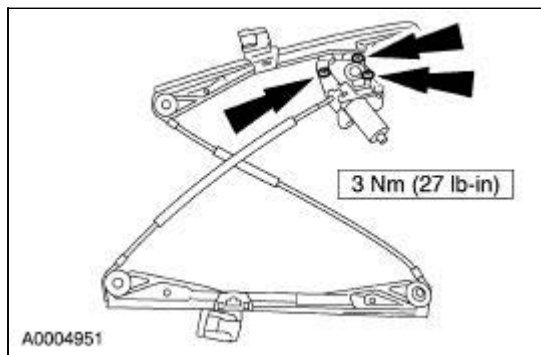


4. Operate the rear door window regulator to the full up position until the rear window glass spacer bracket is engaged with the regulator.
 - An audible click should be heard when the spacer bracket is engaged.
 5. Install the rear door trim panel. For additional information, refer to Section 501-05.
 6. Check the rear door window glass for proper operation.
-

Motor and Window Regulator —Front Door

Removal and Installation

1. Remove the front door window regulator. For additional information, refer to [Window Regulator—Front Door](#).
2. Remove the screws and the motor from the front door window regulator.

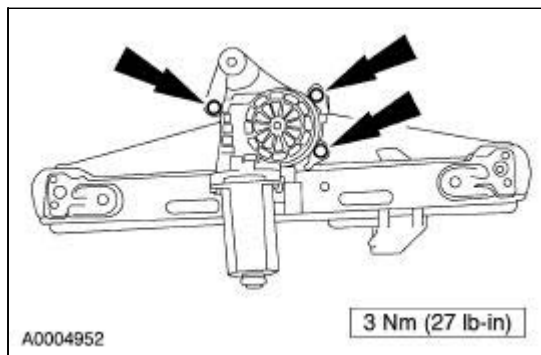


3. To install, reverse the removal procedure.
-

Motor and Window Regulator —Rear Door

Removal and Installation




1. Remove the rear door window regulator. For additional information, refer to [Window Regulator—Rear Door](#) .
2. Remove the screws and the motor from the rear door window regulator.



3. To install, reverse the removal procedure.
-

Windshield Glass

Special Tool(s)

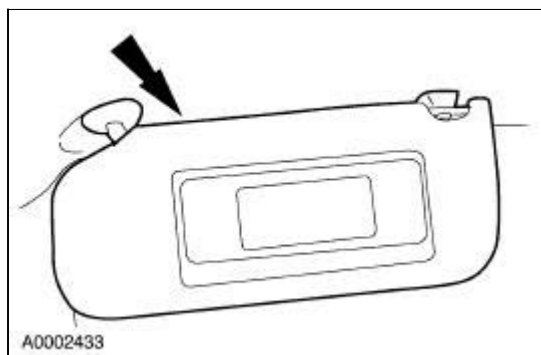
 ST1109-A	Pneumatic Knife with Offset Blade 107-R1511 or equivalent
 ST1320-A	Interior Auto Glass Cut-Out Knife Kit 164-R2450 or equivalent
 ST2085-A	The Pumper 164-R2459 or equivalent

Removal

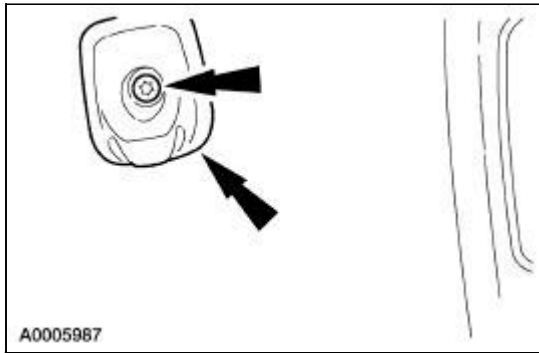


WARNING: To prevent glass splinters from entering the eyes or cutting the hands, wear safety glasses and heavy gloves when cutting the glass from the vehicle.

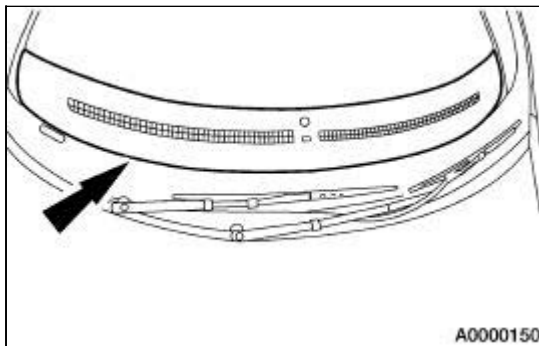
1. Remove the cowl vent screen. For additional information, refer to [Section 501-02](#).
2. Remove the interior rear view mirror. For additional information, refer to [Section 501-09](#).
3. Remove the rain sensor module (if equipped). For additional information, refer to [Section 501-16](#).
4. Remove the screws and the sun visors.
 - Disconnect the electrical connectors.




5. Remove the screws and the sun visor clips.



6. Remove the LH and RH windshield side garnish mouldings. For additional information, refer to [Section 501-05](#).
7. Partially remove the front door weatherstrip.
8. Partially drop the headliner near the windshield glass opening and block with suitable material.
9. Disconnect the two heated wiper park grid electrical connectors.
10. Remove the instrument panel defroster opening grille assembly.
 - Disconnect the electrical connectors.



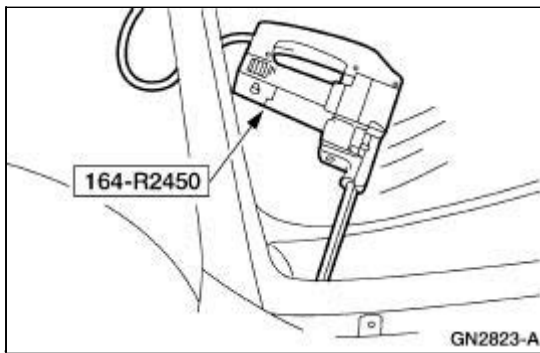
11. Remove the eight screws and the windshield drip mouldings.
12. Using a soft brush or vacuum, remove dirt and foreign material from the pinch weld.
13.  **CAUTION: Cover the instrument panel in order to prevent possible damage.**

 **CAUTION: Care must be used to avoid scratching the pinch weld.**

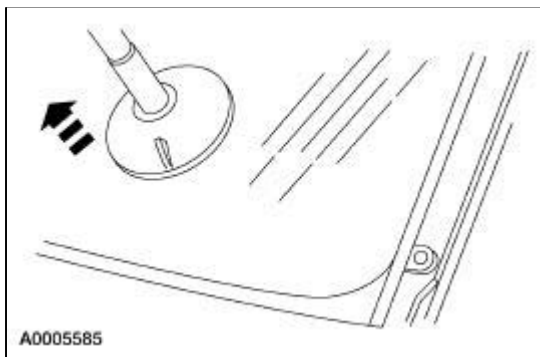
NOTE: Lubricate the existing urethane adhesive with water to aid the special tool while cutting.

NOTE: When cutting foam inside, first cut foam dam to access urethane adhesive.

Using the special tool, starting at the top center of the windshield glass, cut the urethane adhesive away from the glass and work down the sides.



14. Remove the windshield glass and mouldings assembly using a suitable suction tool.




15. Remove the dual lock windshield glass stops from the sheet metal frame.
16. Using a soft brush or vacuum, remove dirt and foreign material from the pinch weld.

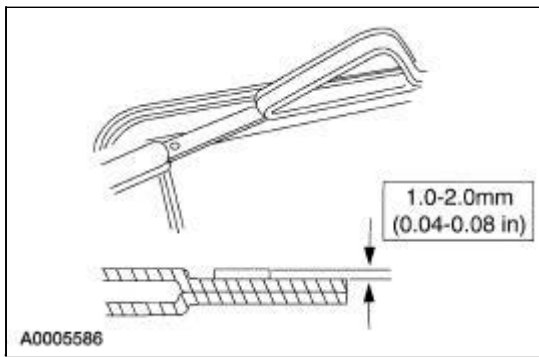
Installation




CAUTION: After installing the new urethane-installed glass, the vehicle should not be driven until the urethane adhesive has cured. The curing time at temperatures above 13° C (55° F) and relative humidity above 50% is 12-24 hours. (Refer to the Essex drive away chart for the cure times as the temperatures and humidity vary). Inadequate curing of the urethane adhesive may adversely affect the strength of the urethane adhesive bond.

1. Dry fit the replacement windshield glass to the existing urethane bed on the body pinch weld. Align the windshield in the opening for uniform fit and adjust setting blocks as needed for best fit.
2. Use tape or non-permanent marking pencil to make alignment marks on the windshield (preferably at the setting blocks), and the body to aid in the installation alignment of the replacement windshield.
3. After alignment, remove the windshield glass and moulding assemblies from the vehicle and place on a stable work surface.
4.  **CAUTION:** Care must be taken to avoid scratching the pinch weld.

Trim the remaining urethane adhesive on the pinch weld. The urethane must be smooth and free of cuts and contamination after trimming. Avoid touching the urethane surface after preparation.



5.  **CAUTION: All rust found on the pinch weld must be removed and the pinch weld restored to OEM specifications. If surface rust is found, remove completely down to clean, bare metal. Prime pinch weld metal with an OEM recommended curing automotive paint primer and allow to cure properly. If rust has penetrated through the pinch weld metal, repair the pinch weld sheet metal at a body shop before proceeding.**

Check the pinch weld for damaged sheet metal, raised sheet metal at the spot welds, rust or foreign material that may cause glass breakage. Clean or repair surface as necessary.

6. Use the wool applicator to apply Urethane Metal Primer Essex U-413 meeting Ford specification WSB-M2G234-C to any exposed metal on the pinch weld. Allow six to ten minutes to dry.
7. If re-installing the same windshield glass that was removed, trim the remaining urethane adhesive from the windshield surface, leaving a thin layer for adhering to the new urethane bead.
8. Clean the inside of the glass surface with an alcohol-free cleaner to make sure the ceramic-coated area is clean.
9. **NOTE:** If the moulding is already on the windshield glass, proceed to the next step.

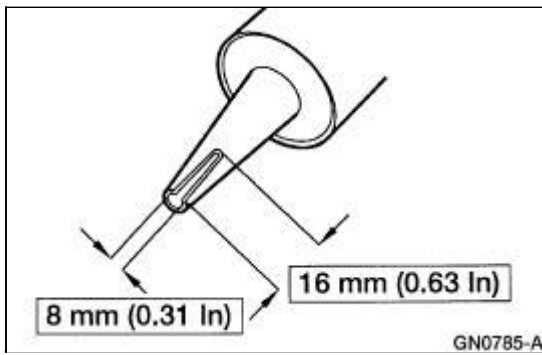
Align the "V" notch in the ceramic paint and windshield outside molding at top center. Fully seat the windshield outside molding along the top edge of the windshield glass and along the sides and bottom edges of the windshield glass.


10. Remove the dual lock windshield glass stop adhesive backing.

11.  **CAUTION: Wipe off the urethane glass prep immediately after each application because it flash dries. Apply deliberate strokes, making sure not to overlap the applied area.**

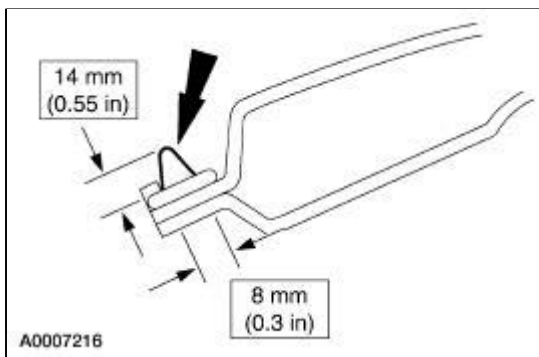
If installing a new windshield glass, apply Urethane Glass Prep Essex U-401 meeting Ford specification WSB-M2G314-B twice around the glass surface to be prepped.

12. If installing a new windshield glass, apply Urethane Glass Primer Essex U-402 meeting Ford specification WSB-M5B280-C to the same area that was prepped in the previous step. Allow five minutes to dry.
13. Cut the urethane adhesive applicator tip to specification.



14.  **CAUTION:** If the vehicle is to be driven within 24 hours of urethane adhesive application, Urethane Adhesive Essex U-216 meeting Ford specification WSB-M2G316-B must be used due to its one-hour cure time.

Apply a bead of Urethane Adhesive Essex 400-HV or Essex U-216 meeting Ford specification WSB-M2G316-B to the pinch weld just outside the foam dam.

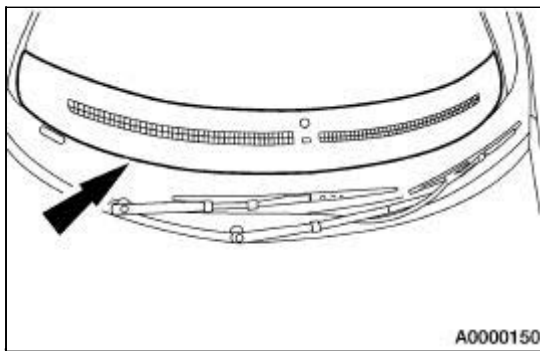


15.  **CAUTION:** Before installing the windshield glass, open the windows slightly to prevent the windshield from being pushed out by air pressure as the door is closed.

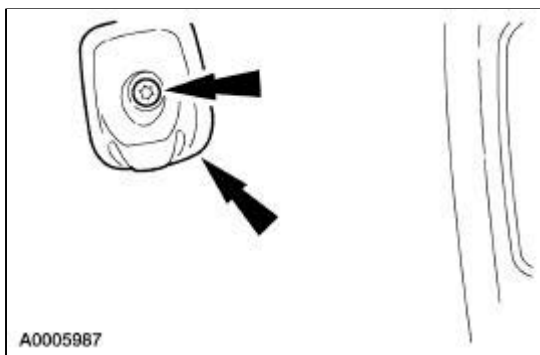
NOTE: The windshield glass must be positioned within 10 minutes of applying the urethane adhesive.

Install the windshield glass on the vehicle, aligning it with marks made previously.

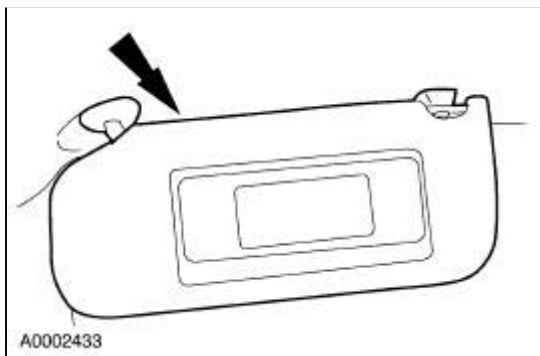
16. Check the windshield installation for air or water leaks through the urethane bead and add urethane adhesive where needed.
17. Place two strips of duct tape onto the windshield glass and secure it to the roof panel. This will help avoid misalignment while the urethane cures.
18. Install the windshield drip mouldings.
- Install the eight screws.
19. Install the instrument panel defrost opening grille assembly.
- Connect the electrical connector.



20. Connect the two heated wiper park grid electrical connectors.
21. Position the headliner.
22. Install the weatherstrips.
23. Install the LH and RH windshield side garnish mouldings. For additional information, refer to [Section 501-05](#).
24. Install the sun visor clips and screws.



25. Install the sun visors and screws.
 - Connect the electrical connectors.



26. Install the rain sensor module. For additional information, refer to [Section 501-16](#).
27. Install the rear view mirror. For additional information, refer to [Section 501-09](#).
28. Install the cowl vent screen. For additional information, refer to [Section 501-02](#).

Torque Specifications

Description	Nm	lb-ft	lb-in
Bulkhead electrical connector bolt	3	—	27
Floor console assembly rear screws	8	—	71
Floor console air conditioning duct mounting screw	2	—	18
Floor console assembly front screws	1	—	9
Glove compartment bin screws	1	—	9
Glove compartment door bolts	6	—	53
Hood release handle screws	2	—	18
Instrument panel cowl side bolts	20	15	—
Instrument panel cowl side nuts	20	15	—
Instrument panel cowl top screws	3	—	27
Instrument panel reinforcement bolts	20	15	—
Instrument panel tunnel brace bolts	20	15	—
Intermediate shaft to steering column pinch bolt	35	26	—

Instrument Panel

The instrument panel consists of the following components:

- passenger air bag module
 - instrument panel cluster finish panel
 - glove compartment
 - instrument cluster
 - audio unit
 - climate control head
 - instrument panel finish panels
 - instrument panel defroster opening grille
 - instrument panel steering column opening cover reinforcement
 - instrument panel steering column cover
-

Console —Floor

The floor console consists of the following components:

- console air condition duct
- console base assembly (automatic transmission)
- console base assembly (manual transmission)
- console rear finish panel assembly
- console finish panel assembly

The console finish panel assembly consists of the following components:

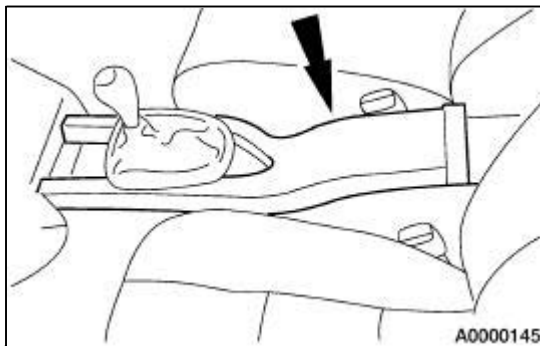
- armrest assembly
 - single cupholder assembly (manual transmission)
 - dual cupholder assembly (automatic transmission)
 - phone presenter assembly
-

Instrument Panel

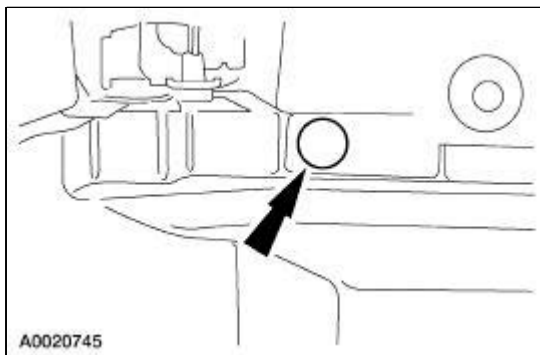
Removal

 **CAUTION:** Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

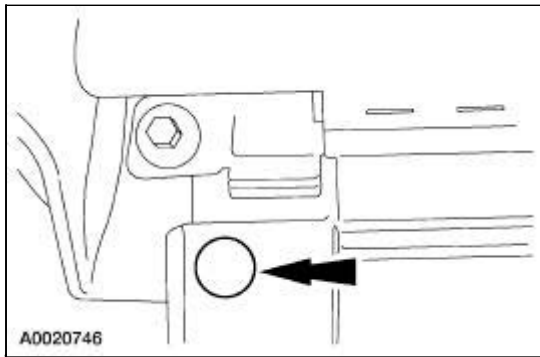
1. Position the steering wheel in the straight ahead position.
2. Remove the driver air bag module. For additional information, refer to [Section 501-20B](#).
3. Remove the floor console. For additional information, refer to [Console—Floor](#) in this section.
4. Remove the console A/C duct.



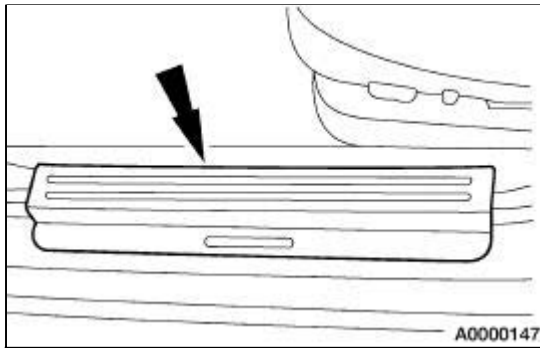
5. If equipped, remove the automatic transmission selector lever assembly. For additional information, refer to [Section 307-05](#).
6. Remove the three pin-type retainers and the LH instrument panel insulator.
 - Disconnect the courtesy lamp.



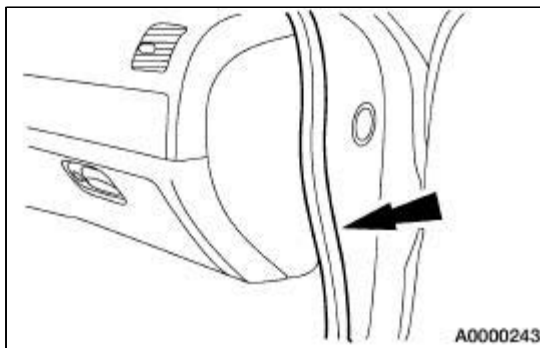
7. Remove the two pin-type retainers and the RH instrument panel insulator.
 - Disconnect the courtesy lamp.



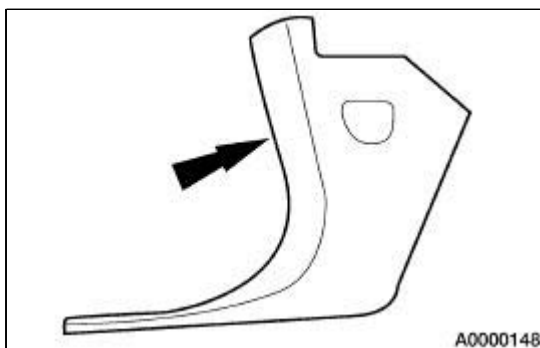
8. Remove the LH and RH scuff plates.



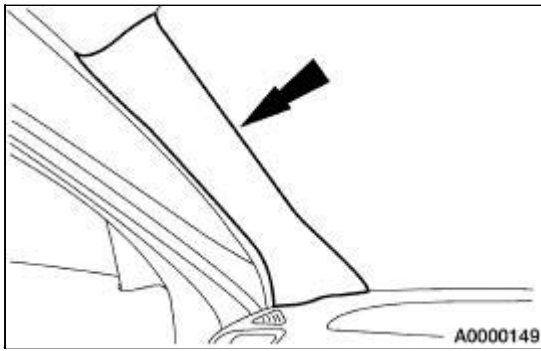
9. Position the LH and RH door weatherstrips aside.



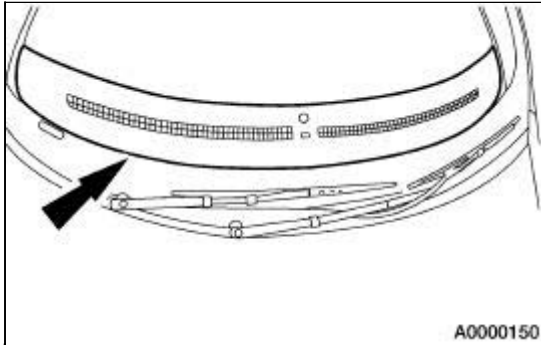
10. Remove the LH and RH A-pillar lower trim panels.



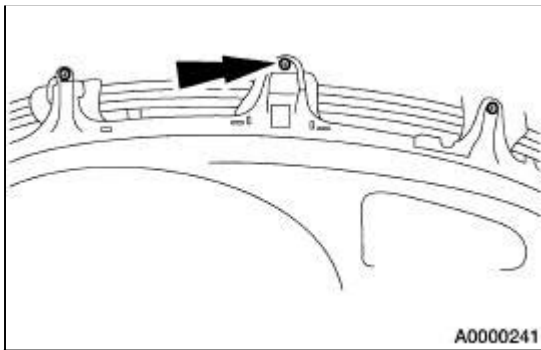
11. Remove the LH and RH windshield side garnish mouldings.



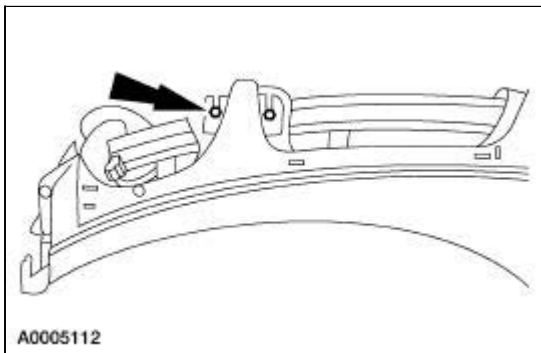
12. Remove the instrument panel defroster opening grille assembly.
 - Disconnect the electrical connector.



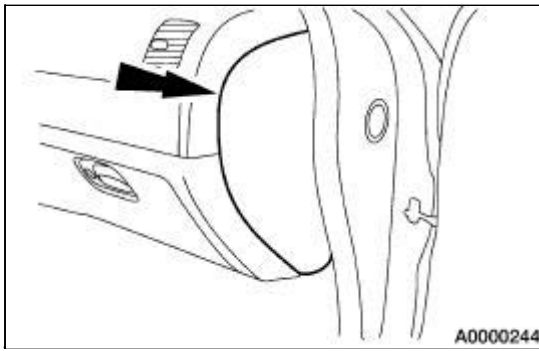
13. Remove the instrument panel cowl top screws.



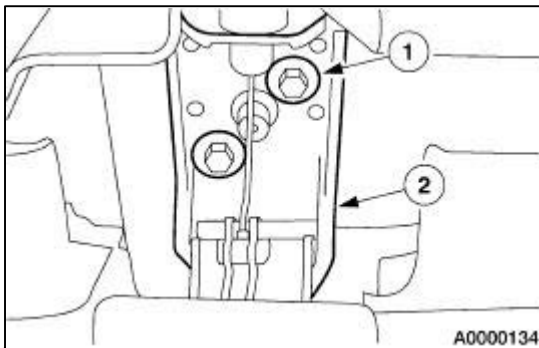
14. Loosen the instrument panel upper reinforcement bolts.



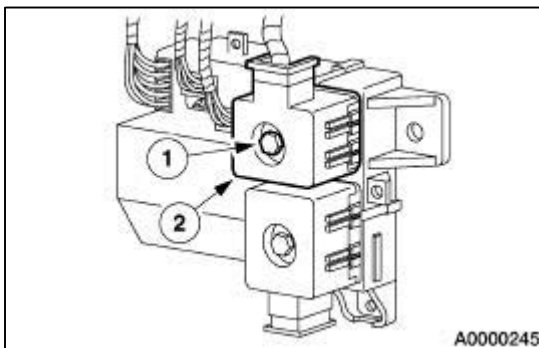
15. Remove the LH and RH instrument panel side finish panels.



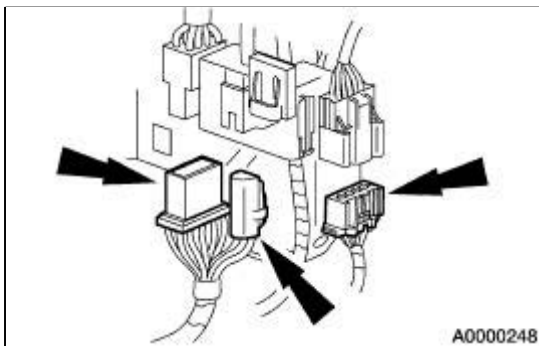
16. Position the hood release handle and cable aside.
 1. Remove the screws.
 2. Position the hood release handle and cable aside.



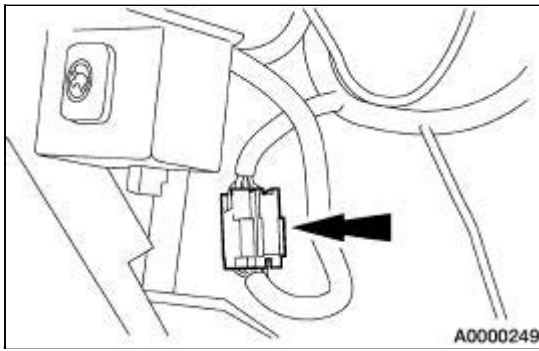
17. Disconnect the upper RH bulkhead electrical connector.
 1. Loosen the bolt.
 2. Disconnect the upper RH bulkhead electrical connector.



18. Disconnect the RH electrical connectors through the instrument panel side opening.



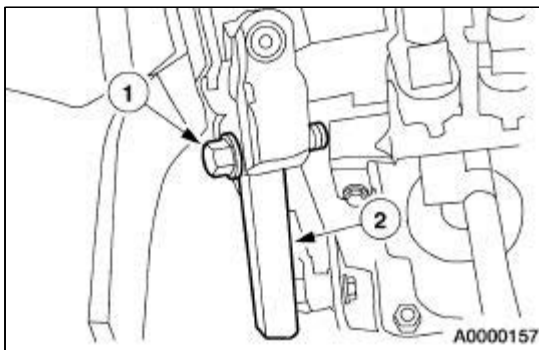
19. Disconnect the passenger side tunnel electrical connector.



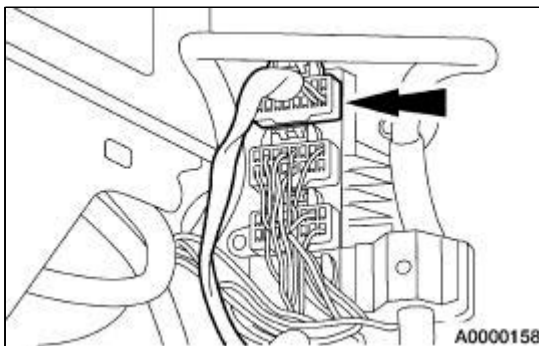
20.  **CAUTION: Secure the steering wheel to prevent any rotation or damage to the air bag sliding contact.**

Separate the intermediate shaft from the steering column.

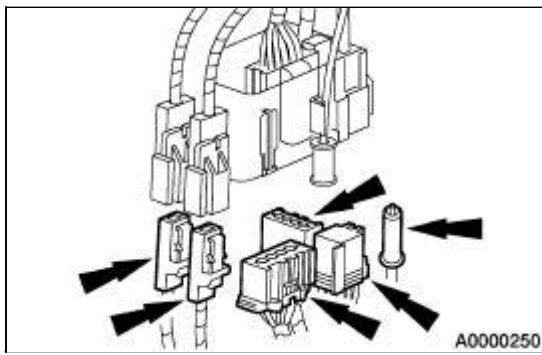
1. Remove the pinch bolt.
2. Separate the intermediate shaft from the steering column.



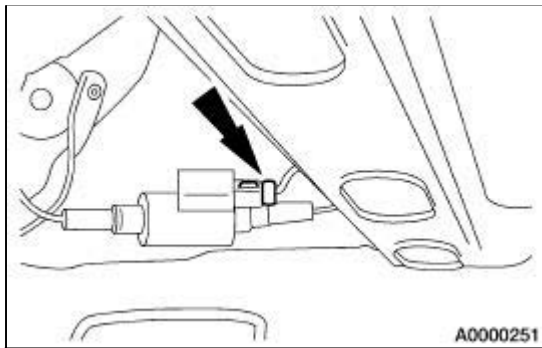
21. Disconnect the LH junction box electrical connector.
- Position the carpet aside to gain access to the connector.



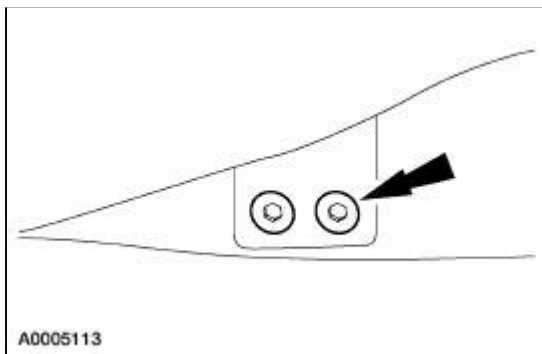
22. Disconnect the LH electrical connectors through the instrument panel side opening.



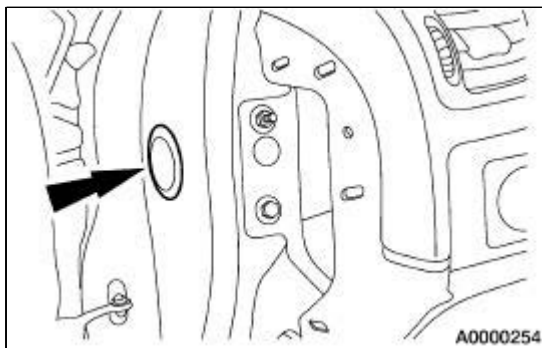
23. If equipped, disconnect the ignition shift interlock electrical connector.



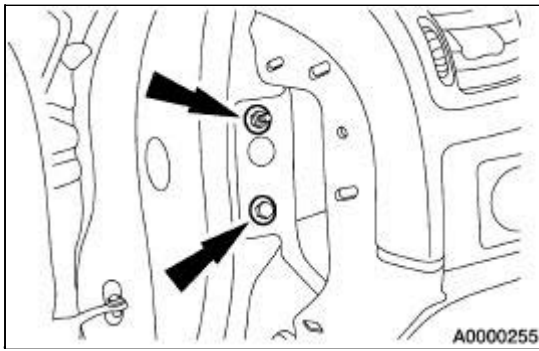
24. Remove the four instrument panel tunnel brace bolts.
● Position the carpet aside to gain access to the bolts.



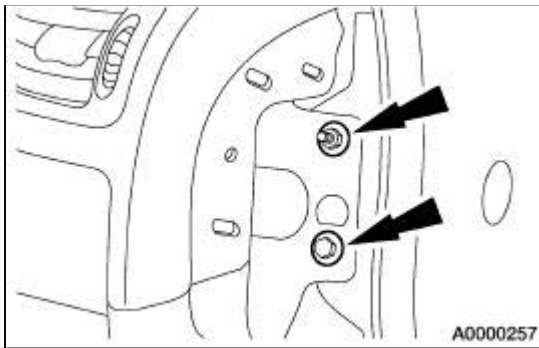
25. Remove the driver side outer instrument panel cowl side cover and reinforcement bolt.



26. Remove the LH instrument panel cowl side bolt and nut.



27. Remove the RH instrument panel cowl side bolt and nut.



28. **NOTE:** Two technicians are required to carry out this step.

Remove the instrument panel.

Installation

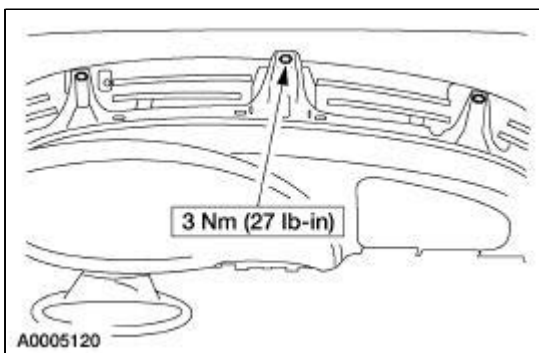


CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

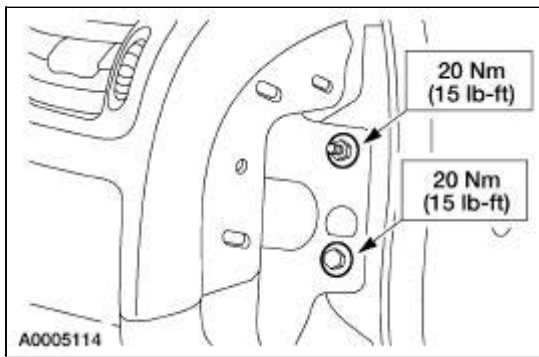
1. **NOTE:** Two technicians are required to carry out this step.

Install the instrument panel.

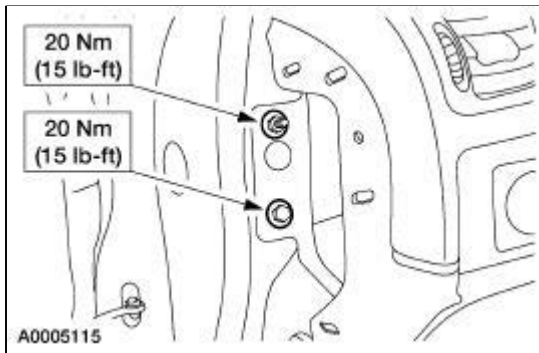
2. Install the instrument panel cowl top screws.



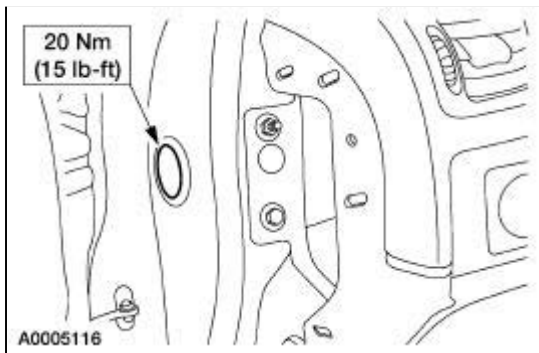
3. Install the RH instrument panel cowl side bolt and nut.



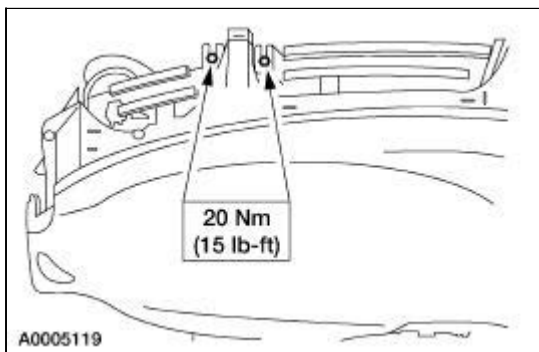
4. Install the LH instrument panel cowl side bolt and nut.



5. Install the driver side outer instrument panel cowl side reinforcement bolt and cover.



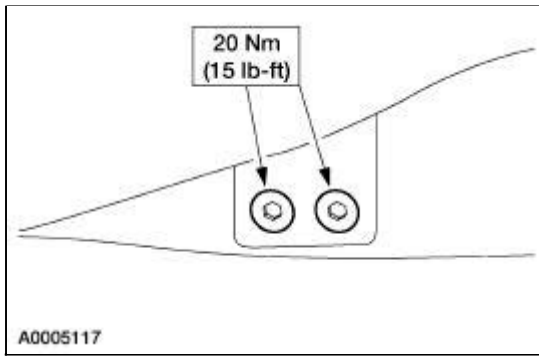
6. Tighten the instrument panel upper reinforcement bolts.



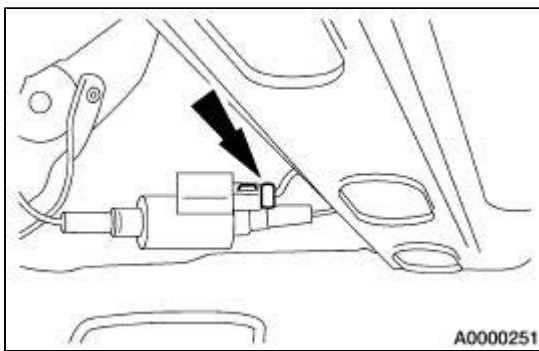
7.  **CAUTION:** Be sure the steering column cover reinforcement is in place before completing this step.

Install the four instrument panel tunnel brace bolts.

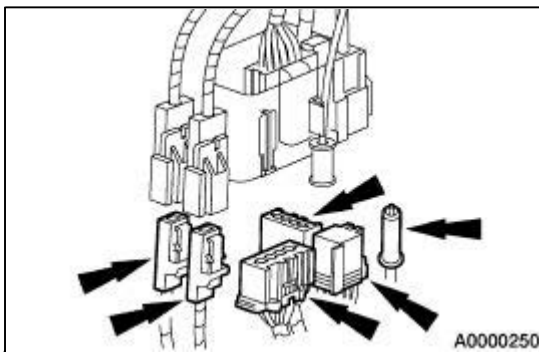
- Reposition the carpet.



8. If equipped, connect the ignition shift interlock electrical connector.

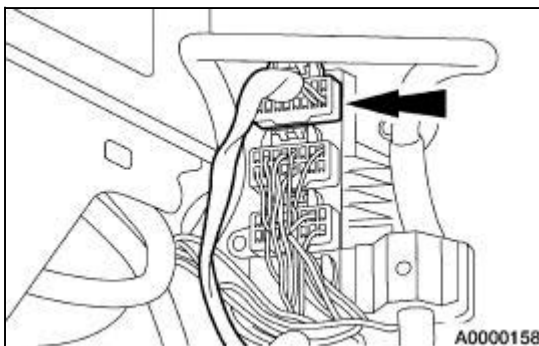


9. Connect the LH electrical connectors through the instrument panel side opening.



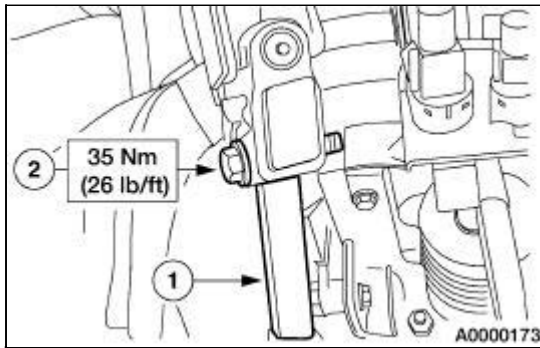
10. Connect the LH junction box electrical connector.

- Reposition the carpet.

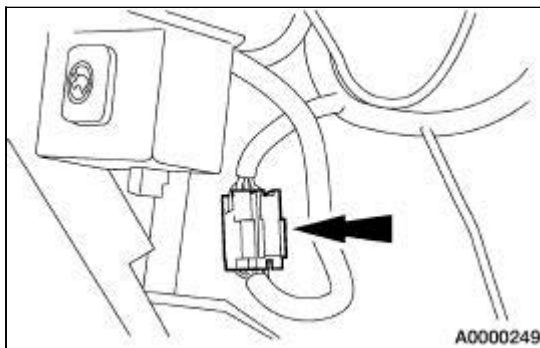


11. Connect the intermediate shaft to the steering column.

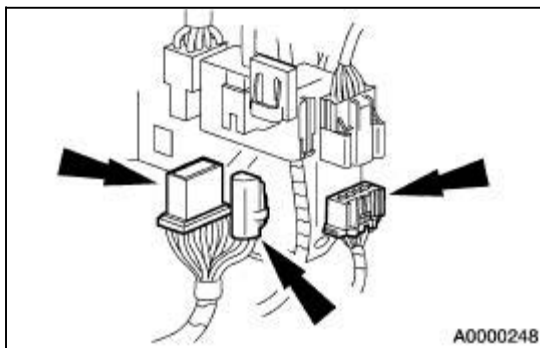
1. Connect the intermediate shaft to the steering column.
2. Install the pinch bolt.



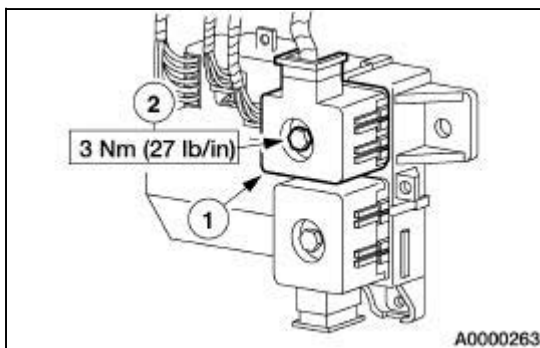
12. Connect the passenger side tunnel electrical connector.



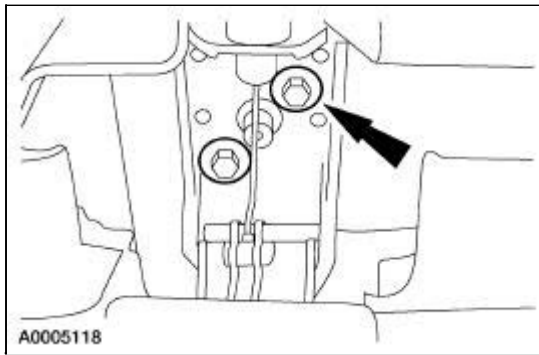
13. Connect the RH electrical connectors through the instrument panel side opening.



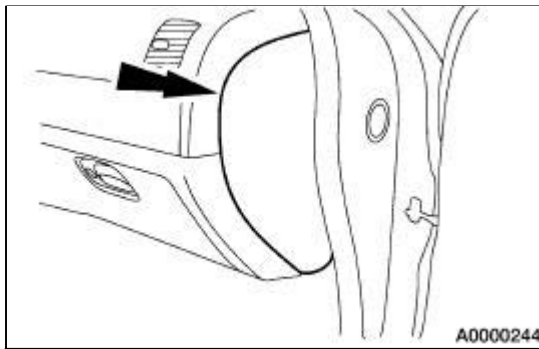
14. Connect the RH bulkhead electrical connector.
 1. Connect the RH bulkhead electrical connector.
 2. Tighten the bolt.



15. Position the hood release handle and cable and install the screws.

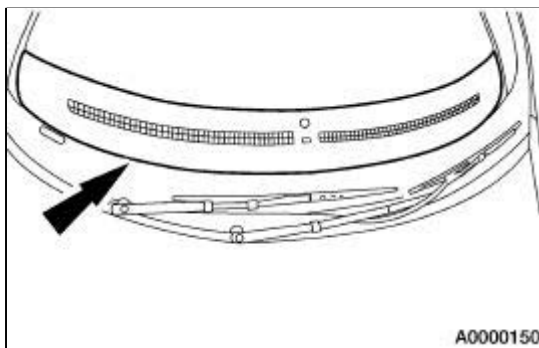


16. Install the LH and RH instrument panel side finish panels.

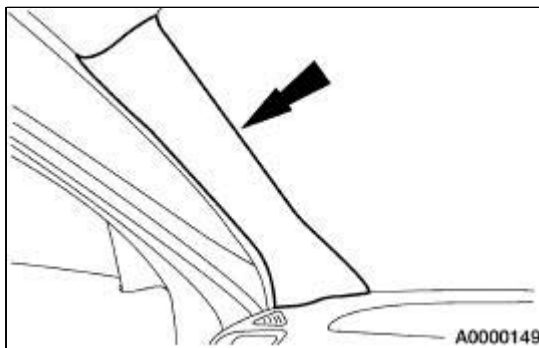


17. Install the instrument panel defroster opening grille assembly.

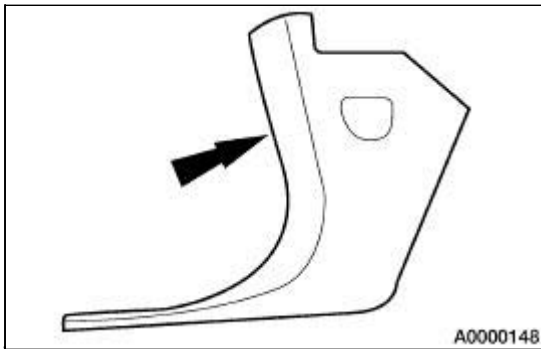
- Connect the electrical connector.



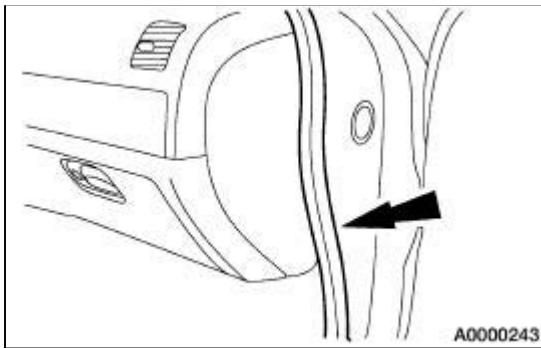
18. Install the LH and RH windshield side garnish mouldings.



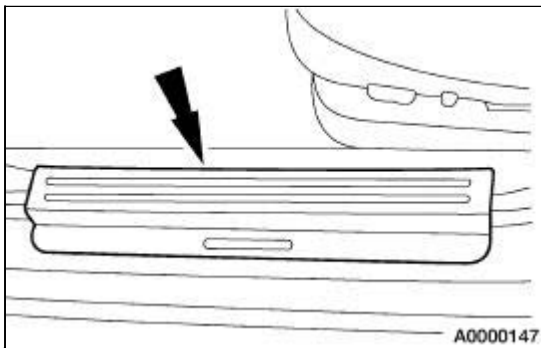
19. Install the LH and RH A-pillar lower trim panels.



20. Install the LH and RH door weatherstrips.

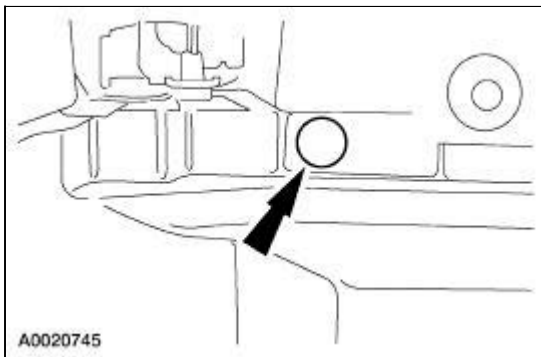


21. Install the LH and RH scuff plates.



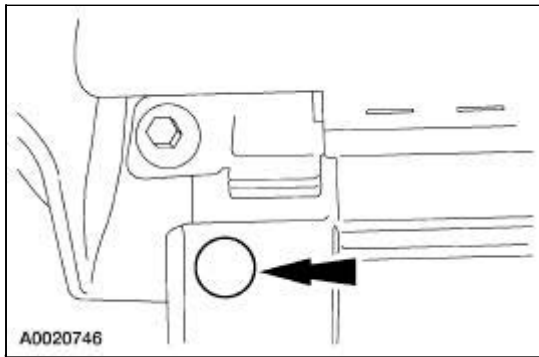
22. Position the LH instrument panel insulator and install the three pin-type retainers.

- Connect the courtesy lamp.

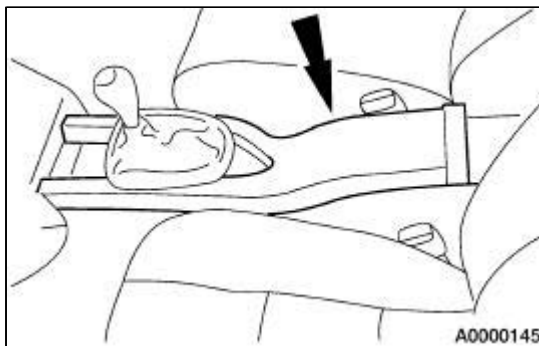


23. Position the RH instrument panel insulator and install the two pin-type retainers.

- Connect the courtesy lamp.



24. If equipped, install the automatic transmission selector lever assembly. For additional information, refer to [Section 307-05](#).
25. Install the console A/C duct.

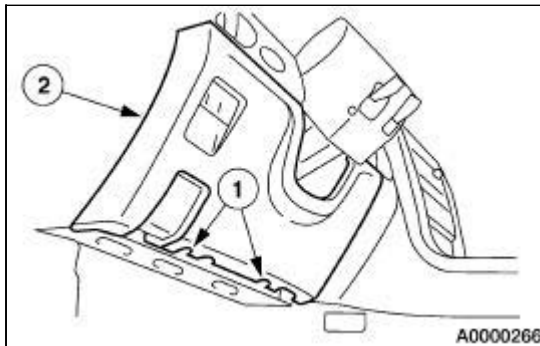


26. Install the floor console. For additional information, refer to [Console—Floor](#) in this section.
 27. Install the driver air bag module. For additional information, refer to [Section 501-20B](#).
-

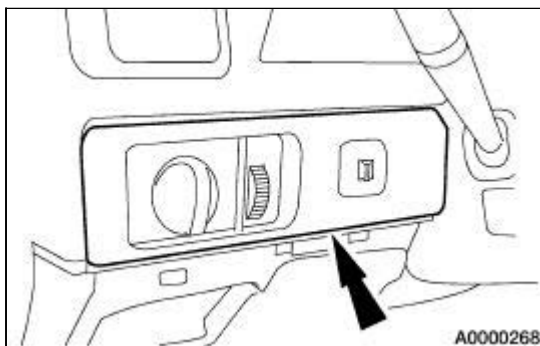
Instrument Panel —Cluster Finish Panel

Removal and Installation

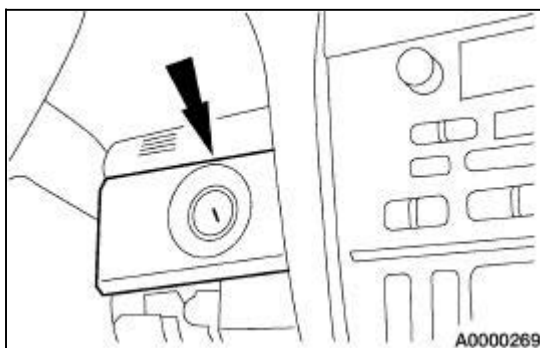
1. Adjust the steering column to the full tilt down and full extended position.
2. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
3. Remove the instrument panel steering column cover.
 1. Remove the pin-type retainers.
 2. Remove the instrument panel steering column cover.
 - Disconnect the electrical connectors.



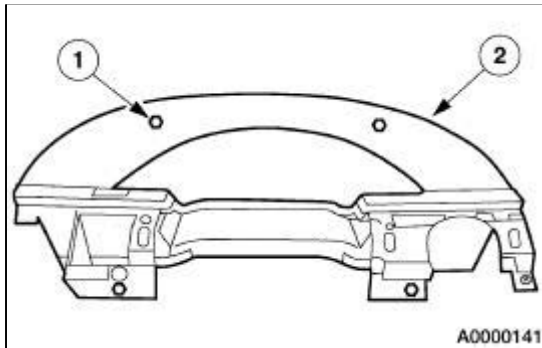
4. Remove the outer instrument panel finish panel.
 - Disconnect the electrical connectors.



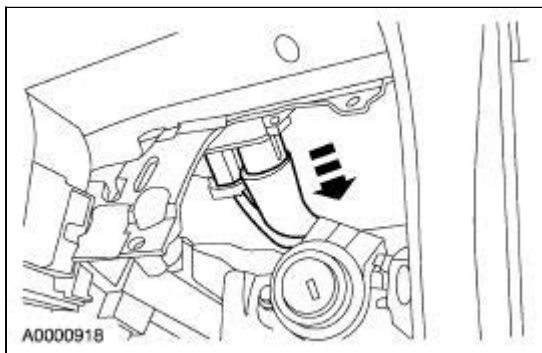
5. Remove the inner instrument panel finish panel.



6. Position the instrument panel cluster finish panel aside.
 1. Remove the screws.
 2. Position the instrument panel cluster finish panel aside.



7. Disconnect the in-car air temperature sensor and remove the instrument panel cluster finish panel.

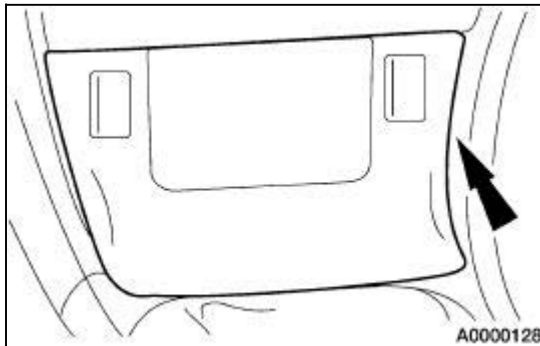


8. To install, reverse the removal procedure.
-

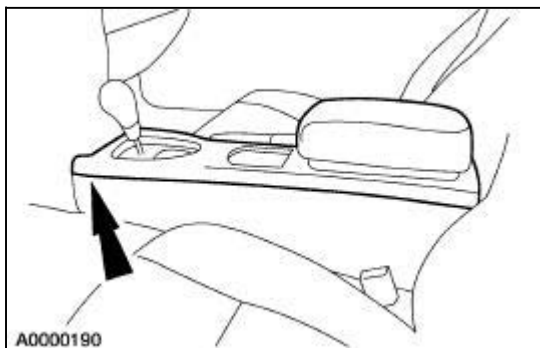
Console —Floor

Removal and Installation

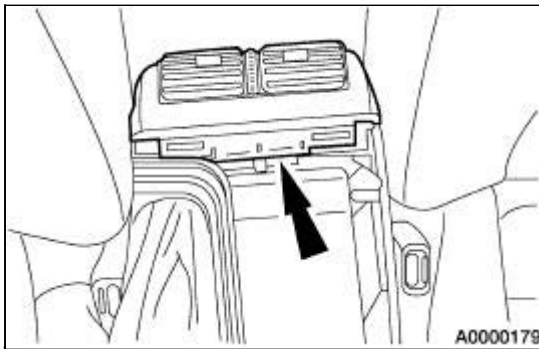
1. Apply the parking brake.
2. If equipped with a manual transmission, place the selector lever in fourth gear.
3. If equipped with an automatic transmission, place the selector lever in neutral.
4. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
5. Remove the ashtray finish panel.
 - Disconnect the electrical connectors.



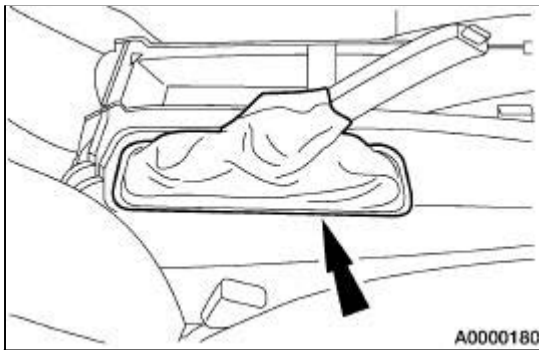
6. If equipped with a manual transmission, remove the gearshift lever knob.
7. If equipped, disconnect the cellular phone electrical connectors.
8. Remove the console finish panel assembly by pulling upward from the front first.
 - If equipped, disconnect the traction control switch electrical connector.
 - If equipped, release the cellular phone wiring harness from the console finish panel assembly.



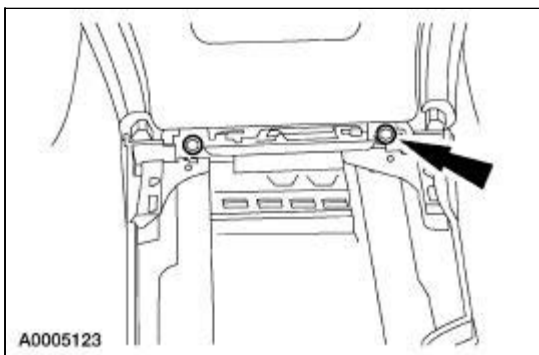
9. Remove the console rear finish panel assembly.
 - Unclip by pulling rearward.



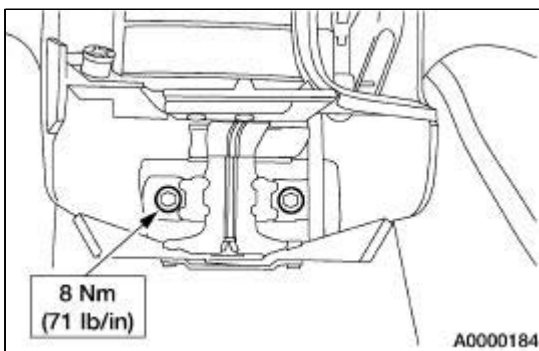
10. Unclip the parking brake boot from the console base.



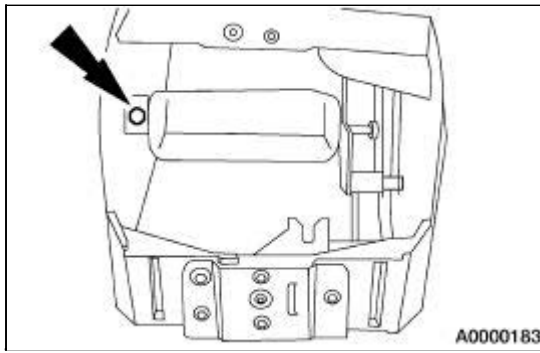
11. Remove the console assembly front screws.



12. Remove the console assembly rear screws.



13. Remove the console air condition duct mounting screw.

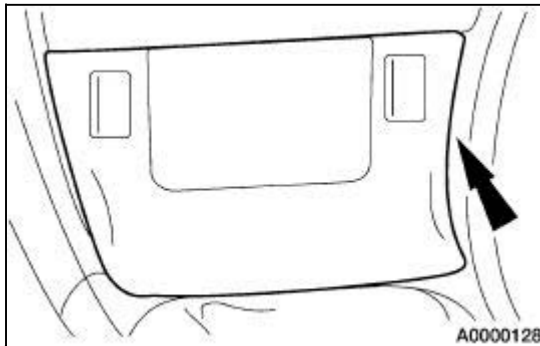


14. Remove the console assembly by sliding rearward.
 15. To install, reverse the removal procedure.
-

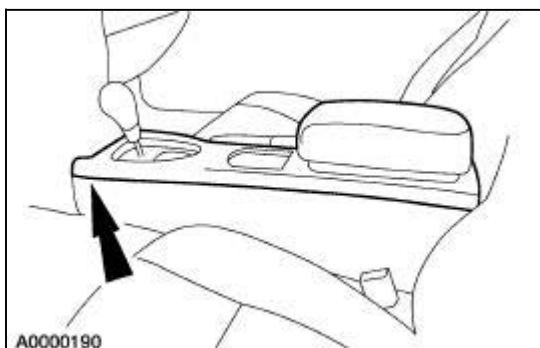
Console —Floor, Finish Panel Assembly

Removal and Installation

1. Apply the parking brake.
2. If equipped with a manual transmission, place the selector lever in fourth gear.
3. If equipped with an automatic transmission, place the selector lever in neutral.
4. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
5. Remove the ashtray finish panel.
 - Disconnect the electrical connectors.



6. If equipped with a manual transmission, remove the gearshift lever knob.
7. If equipped, disconnect the cellular phone electrical connectors.
8. Remove the console finish panel assembly by pulling upward from the front first.
 - If equipped, disconnect the traction control switch electrical connector.
 - If equipped, release the cellular phone wiring harness from the console finish panel assembly.

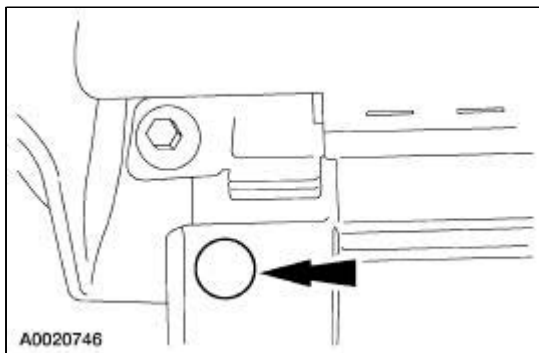


9. To install, reverse the removal procedure.

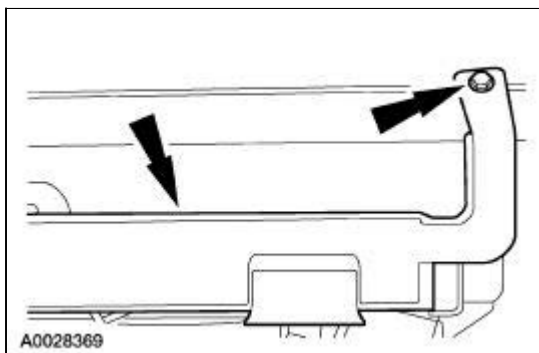
Glove Compartment

Removal and Installation

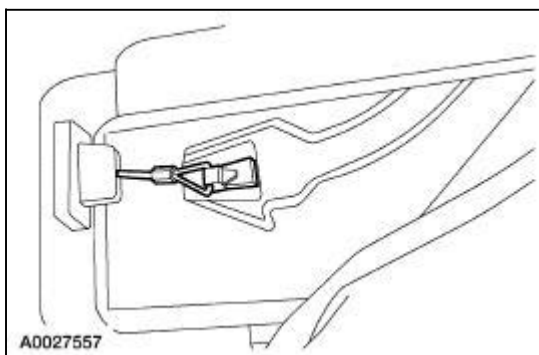
1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Remove the two pin-type retainers and the instrument panel insulator.
 - Disconnect the courtesy lamp.



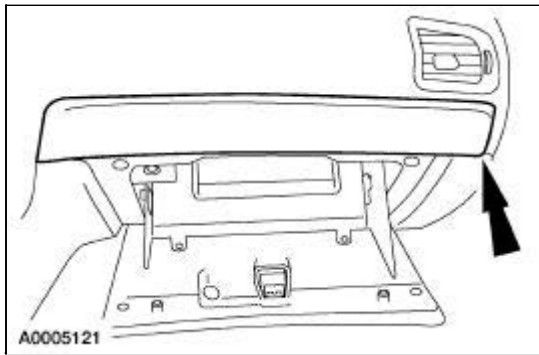
3. Remove the screw and the floor heat duct.



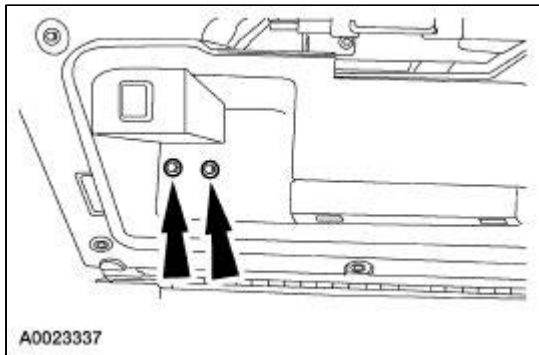
4. From under the instrument panel, release the assist cable from the glove compartment door arm.



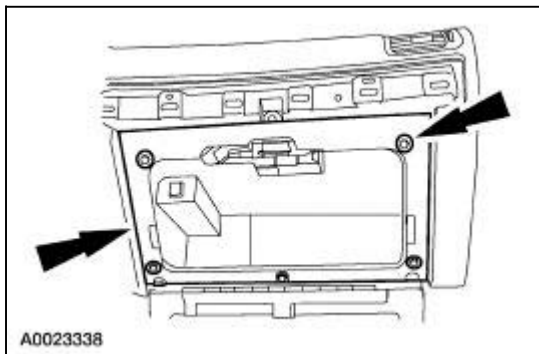
5. Open the glove compartment.
6. Remove the instrument panel finish panel.



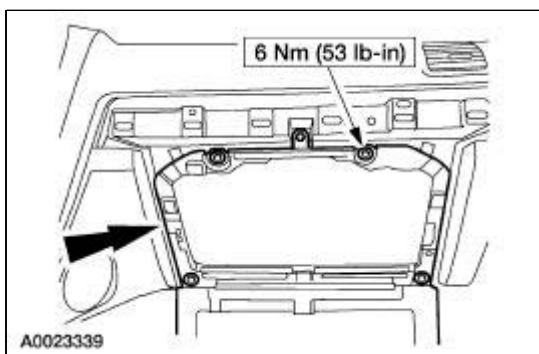
7. Pull up on the glove compartment door arms and lower the glove compartment door.
8. Remove the assist cable bracket screws.



9. Remove the screws and the glove compartment bin.
 - Disconnect the electrical connector.



10. Remove the bolts and the glove compartment door.
 - Disconnect the electrical connector.



11. To install, reverse the removal procedure.

General Specifications

Item	Specification
Lubricants	
Multi-Purpose Grease Spray F5AZ-19G209-AA	ESR-M1C159-A
Penetrating and Lock Lubricant E8AZ-19A501-B	—

Torque Specifications

Description	Nm	lb-ft	lb-in
Theft shield screw	10	—	89
Door latch screw	13	10	—
Exterior door handle nuts, rear door	11	8	—
Exterior door handle nut, front door	10	—	89
Lock cylinder nut	10	—	89

**LOCK REPAIR/REPLACEMENT
 SPECIFICATIONS**

Part Number	Lock Repair Package Name
11582	Ignition Cylinder
5421990	Door Lock
5443262	Luggage Compartment Lid
5406082	Glove Box
5421970	Lock Lever Kit

Handles, Locks, Latches and Mechanisms

Actuator

The actuator is not repairable and is a part of the latch assembly.

Fuel Filler Door Lock Switch

The fuel filler door lock switch actuates a solenoid integral to the fuel filler door latch to release the fuel tank filler door.

Global Window Open/Close



WARNING: Disconnect the battery ground cable when working on or near the driver side door cylinder lock rod or door latch. Failure to follow these instructions may result in personal injury.

This vehicle is equipped with a global window open/close feature activated by turning the key to either the lock or unlock position and holding it there for at least three seconds. Turning the key to the lock position will close all of the windows. Turning the key to the unlock position will open all of the windows. This function can accidentally be activated when working around or with the driver side door cylinder lock rod or door latch causing the windows to abruptly open or close. To avoid personal injury, always disconnect the battery ground cable when working on or near the driver side door cylinder lock rod or door latch.

Lock Cylinder Repair

Individual lock cylinders are repaired by discarding the inoperative cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

Luggage Compartment Remote Control Lock Switch

Refer to [Section 501-14B](#) for diagnostics.

Power Locks

The door lock system consists of:

- interior front door latch remote control assembly
- front door latch and cable assembly
- exterior door handle and front door latch actuating rod
- lock cylinder rod
- door latch striker plate

- door lock cylinder
- adjunct actuator
- circuit wiring and circuit protection
- front door lock switch

Refer to [Section 501-14B](#) for diagnostics.

Theft Shield

The theft shield is:

- located inside the driver door panel.
- fastened near the bottom of the door and the door handle.

Trunk Release Lockout Switch

The trunk release lockout switch is:

- located within the glove compartment.
 - disables the trunk release switch.
-

Locks, Latches and Mechanisms

Refer to [Section 501-14B](#) for power door lock diagnostics.

Refer to [Section 501-14B](#) for luggage compartment lid remote control lock switch diagnostics.

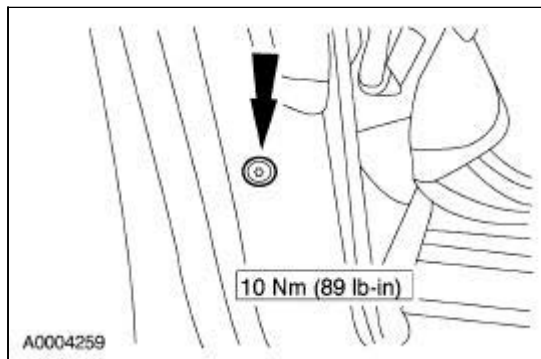
Latch —Front Door

Removal and Installation

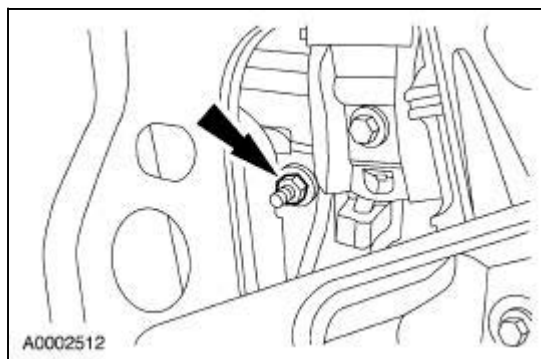
 **WARNING:** Disconnect the battery ground cable when working on or near the driver side door cylinder lock rod or door latch. Failure to follow these instructions may result in personal injury.

Driver and Passenger Front Door

1. Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).
2. Remove the front door trim panel. For additional information, refer to [Section 501-05](#).
3. Remove the lower theft shield screw.

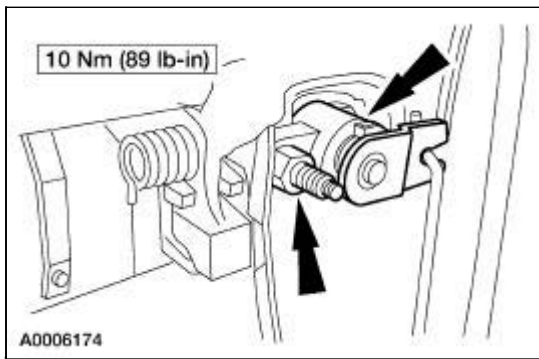


4. Remove the nut and position the theft shield aside .



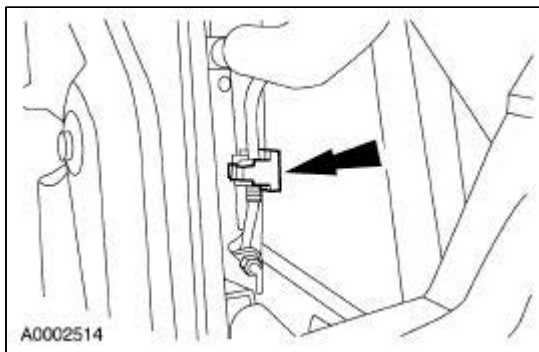
Driver Door Only

5. Remove the nut and the lock cylinder.

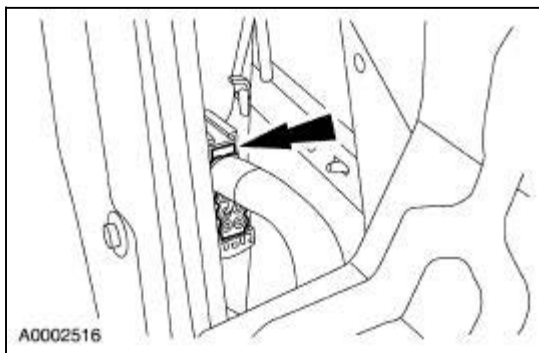


Driver and Passenger Front Door

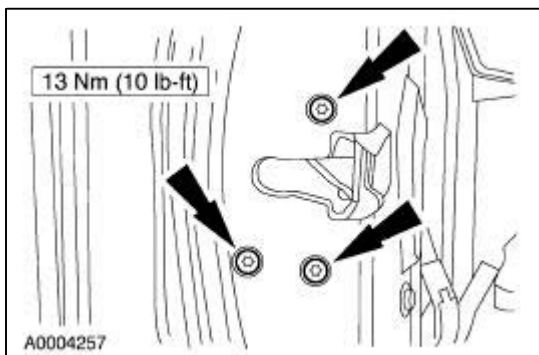
6. Release the clip and disconnect the exterior door handle actuator rod.
 - If equipped, disconnect the door lock cylinder switch electrical connector.



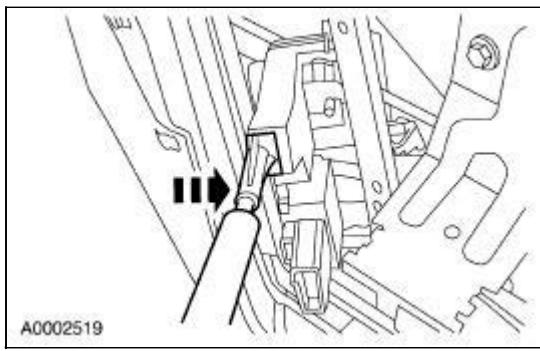
7. Disconnect the electrical connector.



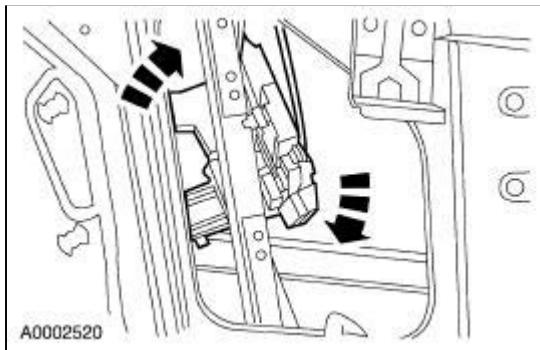
8. Remove the door latch screws.



9. Remove the interior handle actuating cable.



10. Remove the door latch.

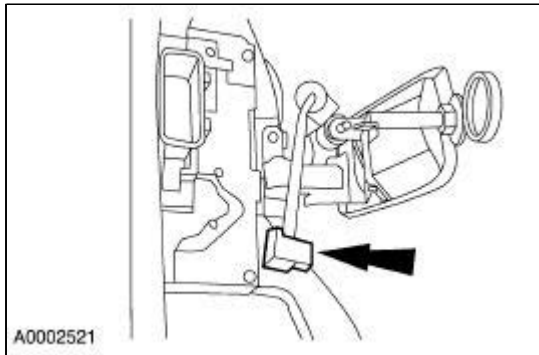


11. To install, reverse the removal procedure.

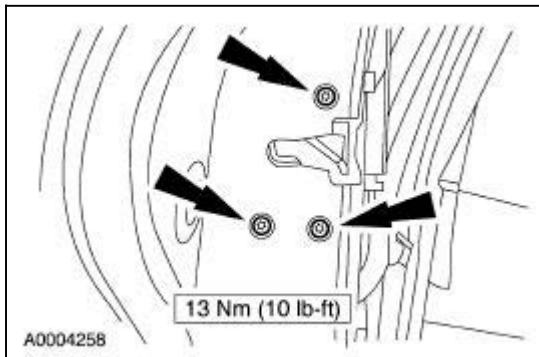
Latch —Rear Door

Removal and Installation

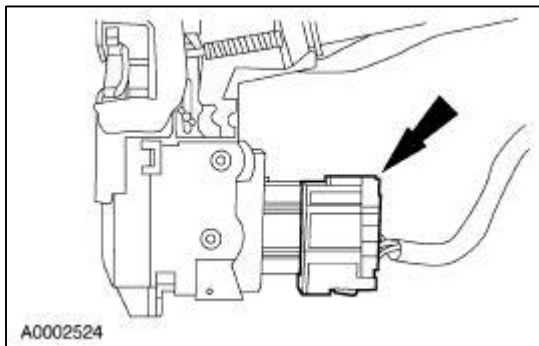
1. Remove the rear door trim panel. For additional information, refer to [Section 501-05](#).
2. Release the clip and disconnect the exterior door handle actuating rod.



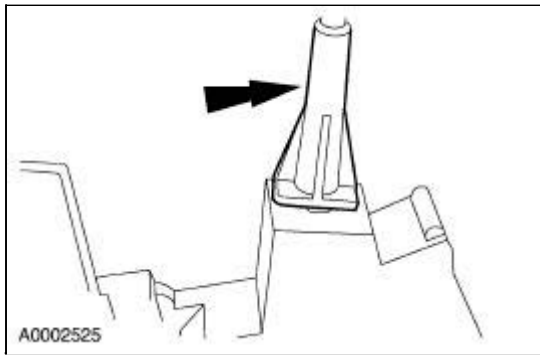
3. Remove the door latch screws.



4. Disconnect the electrical connector.



5. Remove the interior door handle release cable and remove the rear door latch.



6. To install, reverse the removal procedure.

Handle —Exterior Front Door

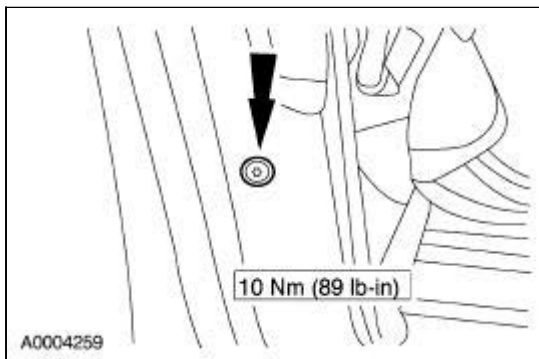
Removal and Installation

Driver and Passenger Front Door

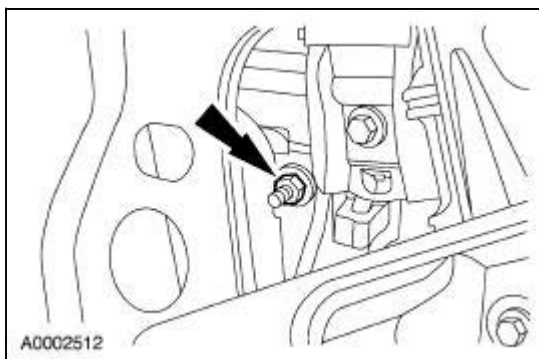


WARNING: Disconnect the battery ground cable when working on or near the driver side door cylinder lock rod or door latch. Failure to follow these instructions may result in personal injury.

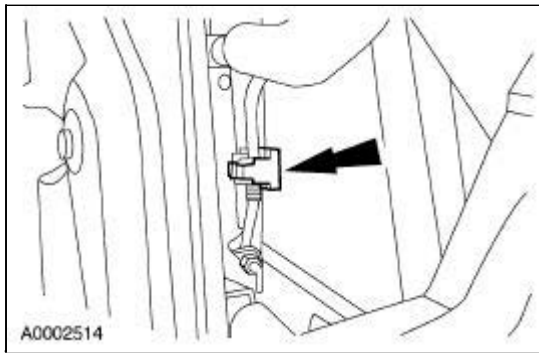
1. Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).
2. Remove the front door trim panel. For additional information, refer to [Section 501-05](#).
3. Remove the lower theft shield screw.



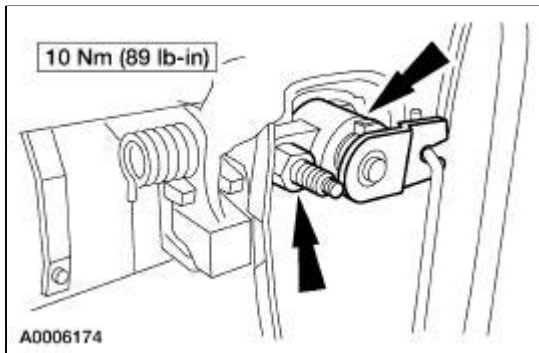
4. Remove the nut and position the theft shield aside.



5. Release the clip and disconnect the exterior door handle actuating rod.
 - If equipped, disconnect the door lock cylinder switch electrical connector.

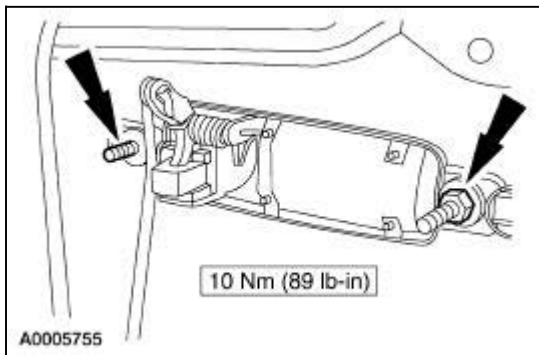


6. Remove the nut and position the door lock cylinder aside.



Driver and Passenger Front Door

7. Remove the nut and the exterior door handle.

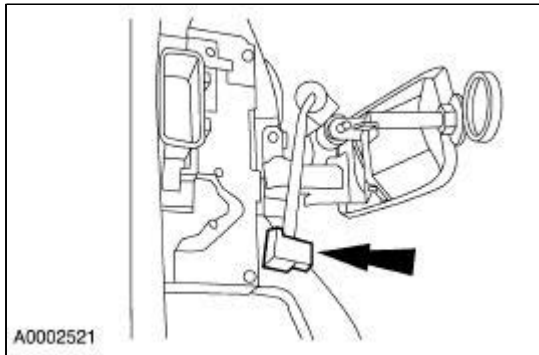


8. To install, reverse the removal procedure.
-

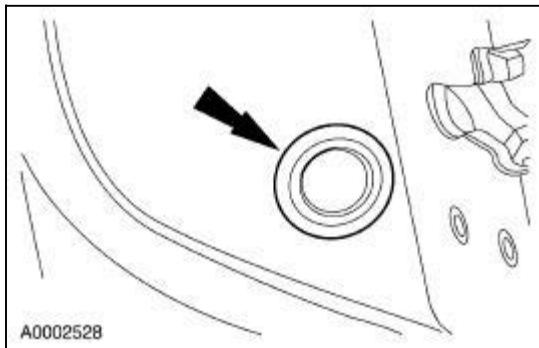
Handle —Exterior Rear Door

Removal and Installation

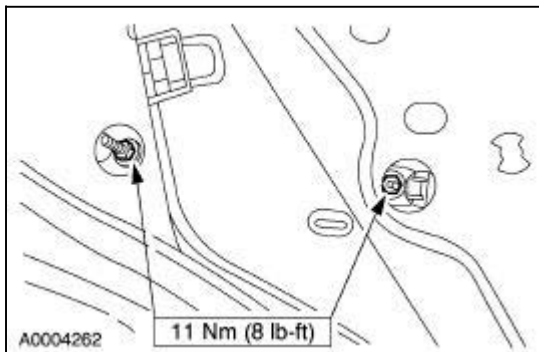
1. Remove the rear door trim panel. For additional information, refer to [Section 501-05](#).
2. Release the clip and disconnect the exterior door handle actuator rod.



3. Remove the grommet.



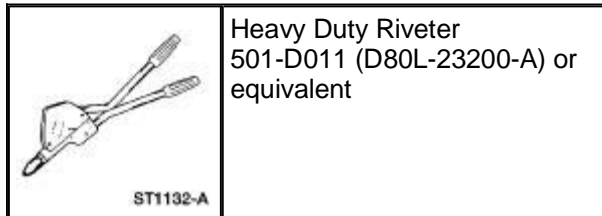
4. Remove the nuts and exterior door handle.



5. To install, reverse the removal procedure.

Handle —Interior Door

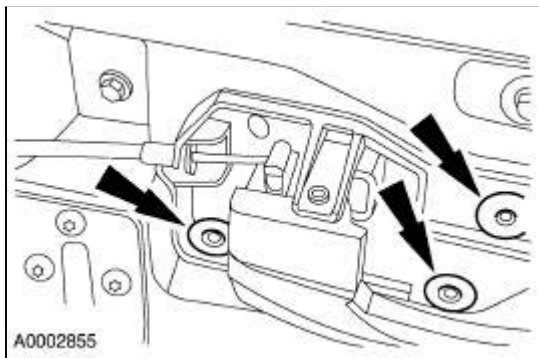
Special Tool(s)



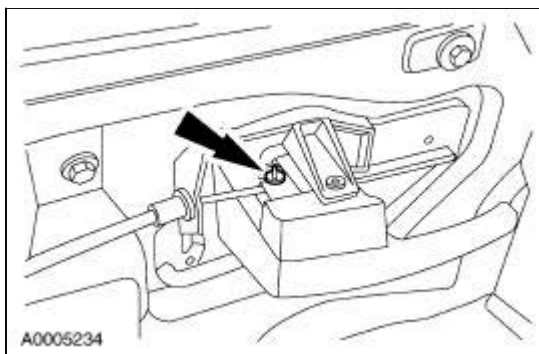
Removal and Installation

1. Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).
2. Remove the door trim panel. For additional information, refer to [Section 501-05](#).
3. **NOTE:** Using the special tool is required to install the rivets.

Remove the rivets.



4. Release the cable and remove the interior door handle.



5. To install, reverse the removal procedure.

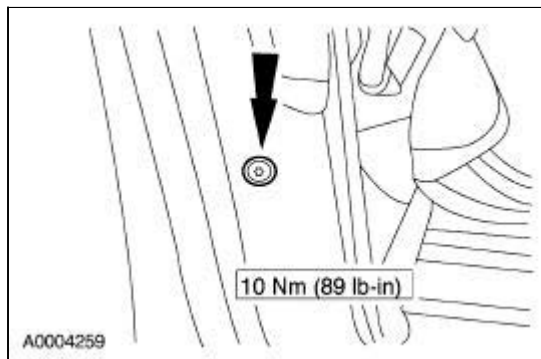
Lock Cylinder —Door

Removal and Installation

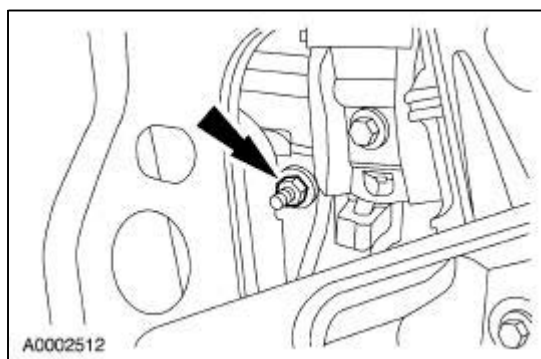
 **WARNING:** Disconnect the battery ground cable when working on or near the driver side door cylinder lock rod or door latch. Failure to follow these instructions may result in personal injury.

NOTE: Individual lock cylinders are repaired by discarding the inoperative cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

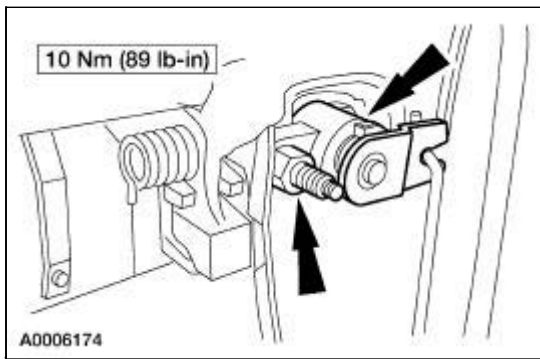
1. Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).
2. Remove the front door trim panel. For additional information, refer to [Section 501-05](#).
3. Remove the lower theft shield screw.



4. Remove the nut and the theft shield.



5. Remove the lock cylinder nut and remove the lock cylinder.
 - If equipped, disconnect the door lock cylinder switch electrical connector.

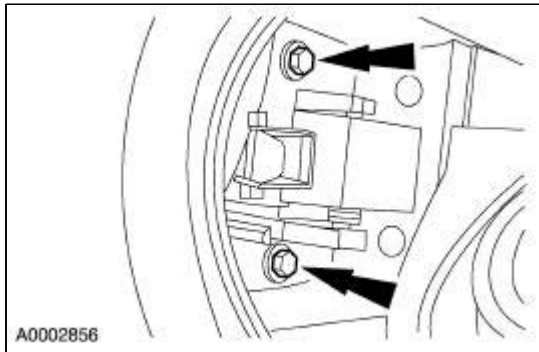


6. To install, reverse the removal procedure.

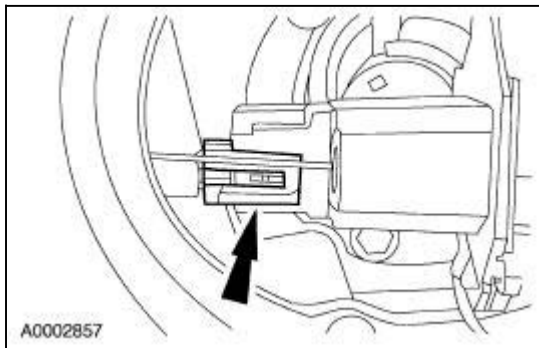
Latch Remote Control —Fuel Door Release

Removal and Installation

1. Remove the fuel filler cap.
2. Remove the bolts and position the fuel door release latch remote control aside.



3. Disconnect the electrical connector and remove the latch remote control.

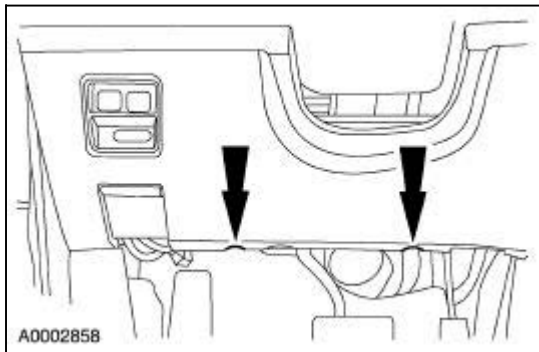


4. To install, reverse the removal procedure.
-

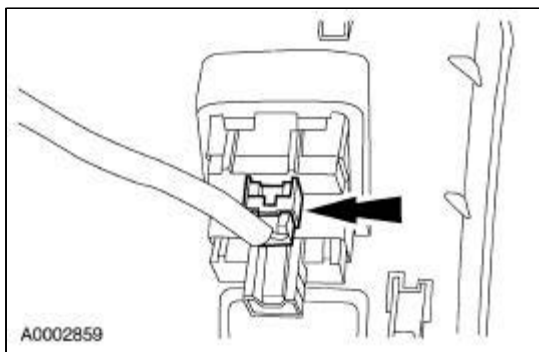
Switch —Fuel and Luggage Compartment Lid Release

Removal and Installation

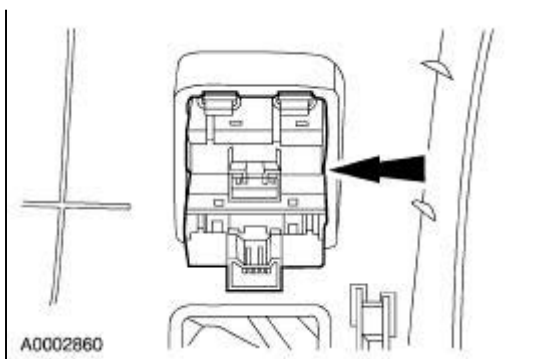
1. Remove the instrument panel steering column cover.



2. Disconnect the electrical connector.



3. Remove the fuel luggage compartment lid release switch.

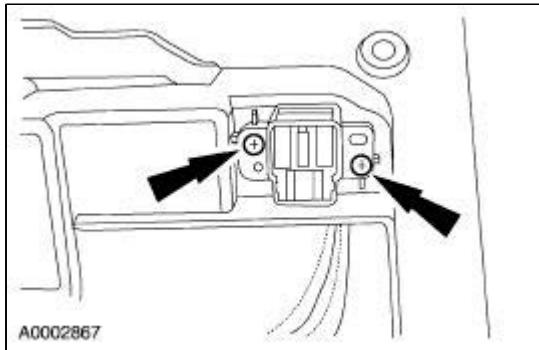


4. To install, reverse the removal procedure.

Switch —Luggage Compartment Lid Lockout

Removal and Installation

1. Remove the glove compartment. For additional information, refer to [Section 501-12](#).
2. Remove the screws and the luggage compartment lid lockout switch.



3. To install, reverse the removal procedure.
-

Keyless Entry

The keyless entry system consists of the following:

- driver door module (DDM)
- four button remote transmitter
- front electronic module (FEM)
- rear electronic module (REM)

For removal and installation of the actuator, refer to [Section 501-14A](#) .

For removal and installation of the driver door module (DDM), refer to [Section 419-10](#) .

For removal and installation of the rear electronic module (REM), refer to [Section 419-10](#) .

For removal and installation of the front electronic module (FEM), refer to [Section 419-10](#) .

Keyless Entry

Refer to Wiring Diagrams Section [501-14B](#) for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter or equivalent 105-R0057

Principles of Operation

The rear electronics module (REM) controls the output functions of the door locks for the following:

- Passenger front door lock actuator
- Passenger rear door lock actuator
- Driver rear door lock actuator

The REM controls the input functions of the door locks for the following:

- Passenger door lock and unlock switch

The driver door module (DDM) controls the output functions of the door locks for the following:

- Driver door lock actuator

The DDM controls the input functions of the door locks for the following:

- Driver door lock and unlock switch

Operating commands for the passenger front, passenger rear and driver rear lock actuators are received in two forms: the standard corporate protocol (SCP) communication network from the DDM or directly from the passenger door lock and unlock switch, which is hardwired to the REM. The driver door lock and unlock switch is hardwired to the DDM. When the driver switch is activated, the DDM will activate the driver door lock actuator and also sends a message through the SCP network. In turn, the REM will output the desired command to the appropriate lock actuators. When the passenger door lock and unlock switch is activated, the REM will activate the lock actuators, which it controls, and it

will also send a message through the SCP network to the DDM to activate the driver door lock actuator.

Operating commands for the driver actuator are received in two forms: through the SCP communication network from the REM or directly from the driver door lock and unlock switch, which is hardwired to the DDM. The passenger door lock and unlock switch is hardwired to the REM. When the passenger switch is activated, the REM will activate the passenger front, passenger rear, and driver rear door lock actuators and also send a message through the SCP network. In turn, the DDM will output the desired command to the driver front door lock actuator. When the driver door lock and unlock switch is activated, the DDM will activate the driver lock actuator, which it controls, and it will also send a message through the SCP network to the REM to activate the appropriate door lock actuators.

Operating commands for the luggage compartment release lock motor are received in two forms: directly from the luggage compartment release switch which is hardwired to the REM, or through the SCP network from the DDM. When the luggage compartment release switch is activated, the REM will activate the luggage compartment lock actuator, which is hardwired to the REM. The luggage compartment unlock operation is also possible when activated from the remote transmitter through the DDM, with the DDM sending a message over the SCP network. The REM will then activate the luggage compartment release motor.

The DDM receives inputs from the remote transmitter(s) and delivers outputs enabling the driver to lock and unlock the vehicle's power lock system, or to arm and disarm the perimeter alarm. The DDM can be programmed to accept up to four transmitter ID codes from four remote transmitters.

Remote locking and unlocking of the doors is accomplished by the DDM receiving a command message from the remote transmitter. The DDM then processes the command and sends a signal directly to the driver door lock actuator, and sends a message through the SCP network, to the REM which will drive the appropriate passenger door lock actuators. Fault management will disable the remote locking and unlocking feature in the event of an ignition switch or PRNDL invalid or missing message to the front electronic module (FEM).

All power door locks and the luggage compartment release motor are powered by the switched system power (SSP) feature. A failure of any or all of the SSP features could cause inoperative power door locks. When diagnosing power door locks, it is essential to determine if all the related symptoms and DTCs are controlled by the SSP feature.

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Door lock mechanisms 	<ul style="list-style-type: none"> ● Central junction box (CJB) Fuses: <ul style="list-style-type: none"> ■ 222 (10A) ■ 207 (5A) ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 401 (15A) ■ 422 (20A) ■ 425 (40A) ● DDM ● REM

- FEM
- Circuitry
- Remote transmitter

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTICS. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for DDM, go to Pinpoint Test A.
 - NO RESP/NOT EQUIP for REM, go to Pinpoint Test B.
 - NO RESP/NOT EQUIP for FEM, go to Pinpoint Test R.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs, and carry out self-test diagnostics for the DDM, FEM or REM.
6. If the DTCs retrieved are related to the concern, go to DDM Diagnostic Trouble Code (DTC) Index, REM Diagnostic Trouble Code (DTC) Index, FEM Diagnostic Trouble Code (DTC) Index, or SSP Relay Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1309	Power Door Lock Circuit Short to Ground	DDM	GO to Pinpoint Test C .
B1341	Power Door Unlock Circuit Short to Ground	DDM	GO to Pinpoint Test C .
B1342	ECU Is Defective	DDM	INSTALL a new DDM. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs.
B1400	Driver Power Window One Touch Window Relay Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1405	Driver Power Window Down Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1408	Driver Power Window Up Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1416	Power Window LR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .

B1420	Passenger Power Window Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1424	Power Window RR Motor Circuit Short to Battery	DDM	REFER to Section 501-11 .
B1530	Memory Set Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1534	Memory 1 Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1538	Memory 2 Switch Circuit Short to Ground	DDM	REFER to Section 501-09 .
B1676	Battery Pack Voltage Out of Range	DDM	REFER to Section 414-00 .
B2112	Door Driver Set Switch Stuck Failure	DDM	GO to Pinpoint Test E .
B2116	Door Driver Reset Switch Stuck Failure	DDM	GO to Pinpoint Test E .
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	DDM	REFER to Section 501-09 .
B2336	Mirror Switch Assembly Circuit Failure	DDM	REFER to Section 501-09 .
B2425	Remote Keyless Entry Out of Synchronization	DDM	GO to Pinpoint Test L .
B2477	Module Configuration Failure	DDM	REFER to Section 418-01 .

Parameter Identification (PID) Index

PID	Description	Expected Value
D_DN_SW	Driver Window Down Switch	OFF, DOWN
D_PWPK	Driver Power Window Peak Current	AMP
D_UP_SW	Driver Window Up Switch	OFF, UP
DMIR_H	Driver Side Mirror Horizontal Motor	notSEN, SENSED
DMIR_V	Driver Mirror Vertical	notSEN, SENSED
DR_LOCK	Driver Door Lock Output State	NO, YES
DR_UNLK	All Doors Unlock Output State	NO, YES
DRLKCYL	Door Lock Cylinder	notACT, ACTIVE
MEM1_SW	Memory Recall Switch #1	notACT, ACTIVE
MEM2_SW	Memory Recall Switch #2	notACT, ACTIVE
MEMS_SW	Memory Set Switch	notACT, ACTIVE
MIR_SEL	Power Mirror Select Switch	DRVMIR, PSGMIR, OFF
MIRH_SW	Pow Mir Position Switch - Horizontal	SHORT, RIGHT, LEFT, OFF
OTD_SW	One Touch Down Switch	OFF, DOWN
VBAT	Battery Voltage	Volts

Active Command Index

Active Command	Display	Action
DOOR LOCK CONTROL	DD LOCK	OFF, ON
DOOR LOCK CONTROL	DD UNLOCK	OFF, ON
FRONT WINDOW CONTROL	DR DOWN	OFF, ON
FRONT WINDOW CONTROL	DR UP	OFF, ON
ONE TOUCH WINDOW DOWN & ACCY DELAY	ONE TOUCH	OFF, ON
DRIVER POWER MIRROR CONTROL	DR DOWN	OFF, ON
DRIVER POWER MIRROR CONTROL	DR LEFT	OFF, ON
DRIVER POWER MIRROR CONTROL	DR RIGHT	OFF, ON
DRIVER POWER MIRROR CONTROL	DR UP	OFF, ON

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1342	ECU Is Defective	FEM	INSTALL a new FEM. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs.
B1438	Wiper Mode Select Switch Circuit Failure	FEM	REFER to Section 501-16 .
B1446	Wiper Park Sense Circuit Failure	FEM	REFER to Section 501-16 .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to Section 413-01 .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1567	Lamp Headlamp High Beam Circuit Failure	FEM	REFER to Section 417-01 .
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B1794	Lamp Headlamp Low Beam Circuit Failure	FEM	REFER to Section 417-01 .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	REFER to Section 501-11 .
B2215	Window Passenger Front Down Switch Short to Battery	FEM	REFER to Section 501-11 .
B2312	Mirror Passenger Horizontal	FEM	REFER to Section 501-09 .

	Feedback Potentiometer Circuit Failure		
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
C1284	Oil Pressure Switch Failure	FEM	REFER to Section 413-01 .
C1446	Brake Switch Circuit Failure	FEM	REFER to Section 413-01 .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to Section 211-00 .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to Section 211-00 .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test. REFER to Section 206-09A .
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR
FLUID_1	Brake Fluid Level Switch #1	OFF, ON
IGN_R	Ignition Switch -RUN Position	NO, YES
L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position	#####

	Sensor (Left/Right)	
PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%
R_HIGH	Right High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RADIOSW	Security Input Switch Status	OFF, ON
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-
STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	Volts
WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKS	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%
BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON
FRONT WINDOW CONTROL	PR DOWN	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
PASSENGER POWER MIRROR CONTROL	PR DOWN	OFF, ON
PASSENGER POWER MIRROR CONTROL	PR LEFT	OFF, ON
PASSENGER POWER MIRROR CONTROL	PR RIGHT	OFF, ON
PASSENGER POWER MIRROR CONTROL	PR UP	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON
VAPS II OUTPUT PULSE CONTROL	VAPSIIOUT	%

REM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	REM	REFER to Section 413-01 .
B1300	Power Door Lock Circuit Failure	REM	GO to Pinpoint Test D .
B1310	Power Door Unlock Circuit Failure	REM	GO to Pinpoint Test D .
B1331	Decklid Ajar Rear Door Circuit Failure	REM	REFER to Section 417-02 .
B1335	Door Ajar RR Circuit Failure	REM	REFER to Section 417-02 .
B1342	ECU Is Defective	REM	INSTALL a new REM. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs.
B1483	Brake Pedal Input Circuit Failure	REM	REFER to Section 417-01 .
B1499	Lamp Turn Signal Left Circuit Failure	REM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	REM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	REM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	REM	REFER to Section 417-01 .
B1551	Decklid Release Circuit Failure	REM	GO To Pinpoint Test J .
B1571	Door Ajar LR Circuit Failure	REM	REFER to Section 417-02 .
B1676	Battery Pack Voltage Out of Range	REM	REFER to Section 414-00 .
B2172	Inertia Switch input Circuit Open	REM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
U1059	SCP (J1850) Invalid or missing Data for Transmission/Transaxle/ PRNDL	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test. REFER to Section 206-09A .
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the Instrument Cluster self-test. REFER to Section 413-01 .

REM Parameter Identification (PID) Index

PID	Description	Expected Value
BOO	Brake Switch Input	OFF, ON

DECKLID	Decklid Ajar Switch	CLOSED, AJAR
DL_DSRM	Decklid Disarm	NO, YES
DLIDOUT	Decklid Driver	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
DLIDRLS	Decklid Release	OFF, ON
L_TAIL	Left and Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LMRKOUT	Left Marker Lamp Driver Output State	OFF, ON
LMRKSTB	Left Marker Lamp Driver Short To Battery	NO, YES
LR_TURN	Left and Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LRDN_SW	Left Rear Window Down Switch	OFF, UP
LRDR_SW	Left Rear Door Ajar Switch	CLOSED, AJAR
LRUP_SW	Left Rear Window Up Switch	OFF, DOWN
PD_LOCK	Passenger Door Lock	NO, YES
PD_UNLK	Passenger Door Unlock	NOTLOC, LOCK
R_TAIL	Left and Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RR_TURN	Left and Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RRDN_SW	Right Rear Window Down Switch	OFF, UP
RRDR_SW	Right Rear Door Ajar Switch	CLOSED, AJAR
RRUP_SW	Right Rear Window Up Switch	OFF, DOWN

REM Active Command Index

Active Command	Display	Action
EXTERIOR LAMP CONTROL	BACKUPLMP	OFF, ON
EXTERIOR LAMP CONTROL	H MNT STP	OFF, ON
EXTERIOR LAMP CONTROL	L STOP	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
EXTERIOR LAMP CONTROL	R DEF RLY	OFF, ON
EXTERIOR LAMP CONTROL	R FOG LMP	OFF, ON

EXTERIOR LAMP CONTROL	R STOP	OFF, ON
POWER WINDOW ENABLE COMMAND	PSGR RLY	OFF, ON
REAR DOOR LOCK CONTROL	LR LOCK	OFF, ON
REAR DOOR LOCK CONTROL	LR UNLOCK	OFF, ON
REAR DOOR LOCK CONTROL	RELEASE	OFF, ON
REAR WINDOW CONTROL	LR DOWN	OFF, ON
REAR WINDOW CONTROL	RR DOWN	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

SSP Relay Index

Relay	Fuse	Controlled System(s)
SSP1	BJB Fuse 430 (30A)	<ul style="list-style-type: none"> • • Driver power door lock (FEM) • LH and RH high beam headlamps (FEM) • RF park, turn, and side marker lamps (FEM) <ul style="list-style-type: none"> • RH low beam headlamp • Driver power mirror
SSP2	BJB Fuse 431 (30A)	<ul style="list-style-type: none"> • • LH low beam headlamp (FEM) • LF park, turn, and sidemarker lamps (FEM) <ul style="list-style-type: none"> • Interior courtesy and demand lighting • Windshield wiper washer pump • Switch illumination backlighting
SSP3	BJB Fuse 424 (30A)	<ul style="list-style-type: none"> • • High mounted stoplamp (REM) • RR park and stoplamps (REM) <ul style="list-style-type: none"> • Reversing lamps (REM) • LR turn signals (REM) • Passenger power mirror • Trailer stoplamps and turn signals (if equipped with trailer tow)
SSP4	BJB Fuse 423 (30A)	<ul style="list-style-type: none"> • • LR park and stoplamps (REM) <ul style="list-style-type: none"> • RR turn signals (REM) • Passenger door and side locks (REM) <ul style="list-style-type: none"> • License lamps • Trunk release solenoid and switch • Fuel door release solenoid and switch <ul style="list-style-type: none"> • Trunk lamp • Trailer park lamps (if equipped with trailer tow)

When diagnosing an SSP relay, check that all systems for that relay are inoperative. Refer to [Section 417-01](#) if:

- all systems for one SSP relay are inoperative
- all systems for all SSP relays are inoperative

Symptom Chart


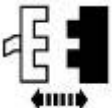

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the driver door module (DDM) 	<ul style="list-style-type: none"> BJB Fuse 425 (40A). Circuitry. DDM. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> No communication with the rear electronic module (REM) 	<ul style="list-style-type: none"> BJB Fuse 425 (40A). CJB Fuse 207 (5A). Circuitry. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
<ul style="list-style-type: none"> All door locks are inoperative — from driver door switch 	<ul style="list-style-type: none"> Switch. Circuitry. DDM. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> All door locks are inoperative — from passenger door switch 	<ul style="list-style-type: none"> Switch. Circuitry. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test D.
<ul style="list-style-type: none"> All door locks are inoperative — from driver door lock cylinder 	<ul style="list-style-type: none"> Door lock cylinder. Circuitry. DDM. 	<ul style="list-style-type: none"> GO to Pinpoint Test E.
<ul style="list-style-type: none"> A single door lock is inoperative — driver door 	<ul style="list-style-type: none"> CJB Fuse 222 (10A). Actuator. Circuitry. DDM. 	<ul style="list-style-type: none"> GO to Pinpoint Test F.
<ul style="list-style-type: none"> More than one door lock is inoperative — passenger door, right rear door, and left rear door 	<ul style="list-style-type: none"> BJB Fuse 401 (15A). Circuitry. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test G.
<ul style="list-style-type: none"> More than one door lock is inoperative — passenger door and rear door 	<ul style="list-style-type: none"> Actuators. Circuitry. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test H.
<ul style="list-style-type: none"> A single door lock is inoperative — left rear door 	<ul style="list-style-type: none"> Actuator. Circuitry. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test I.
<ul style="list-style-type: none"> The luggage compartment door is inoperative — from release switch 	<ul style="list-style-type: none"> Release switch. Circuitry. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test J.
<ul style="list-style-type: none"> The luggage compartment door is inoperative — from release switch and remote transmitter 	<ul style="list-style-type: none"> Solenoid. Circuitry. REM. DDM. 	<ul style="list-style-type: none"> GO to Pinpoint Test K.
<ul style="list-style-type: none"> The doors do not lock or unlock using the remote transmitter 	<ul style="list-style-type: none"> Battery. Remote transmitter. DDM. 	<ul style="list-style-type: none"> GO to Pinpoint Test L.
<ul style="list-style-type: none"> The memory seat does not operate correctly using the remote transmitter 	<ul style="list-style-type: none"> Battery. Remote 	<ul style="list-style-type: none"> GO to Pinpoint

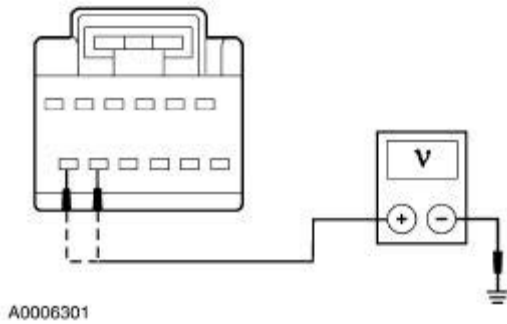
	<ul style="list-style-type: none"> transmitter. ● DDM. 	<ul style="list-style-type: none"> <u>Test M.</u>
<ul style="list-style-type: none"> ● The auto-lock does not operate correctly 	<ul style="list-style-type: none"> ● Door ajar switch. ● DDM. ● Shifter. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test N.</u>
<ul style="list-style-type: none"> ● The smart lock does not operate correctly 	<ul style="list-style-type: none"> ● DDM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test O.</u>
<ul style="list-style-type: none"> ● Panic feature is inoperative 	<ul style="list-style-type: none"> ● Battery. ● Remote transmitter. ● FEM. ● DDM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test P.</u>
<ul style="list-style-type: none"> ● The luggage compartment door is inoperative using the remote transmitter 	<ul style="list-style-type: none"> ● Battery. ● Remote transmitter. ● DDM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test Q.</u>
<ul style="list-style-type: none"> ● No communication with the front electronic module (FEM) 	<ul style="list-style-type: none"> ● BJB Fuses: <ul style="list-style-type: none"> ■ 425 (40A). ■ 422 (20A). ● CJB Fuse 207 (5A). ● Circuitry. ● FEM. 	<ul style="list-style-type: none"> ● GO to <u>Pinpoint Test R.</u>

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE DRIVER DOOR MODULE (DDM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK CIRCUITS 29-AJ80 (OG) AND 29S-AJ86 (OG/BU) FOR VOLTAGE	
NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>2</p>  <p>DDM C501a</p> <p>3</p> 	

4



4

Measure the voltage between DDM C501a pin 11, circuit 29-AJ80 (OG), harness side and ground; and between DDM C501a pin 12, circuit 29S-AJ86 (OG/BU), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to A2.

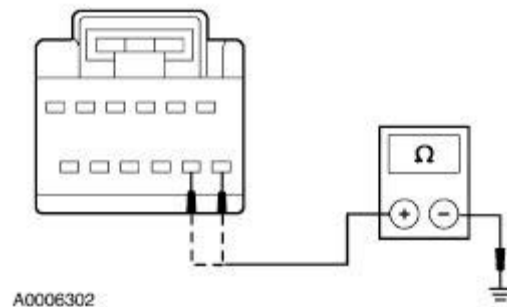
→ **No**
REPAIR the circuit. TEST the system for normal operation.

A2 CHECK CIRCUITS 31-AJ80B (BK/OG) AND 91-AJ80 (BN/BU) FOR OPENS

1



2



2

Measure the resistance between DDM C501a pin 7, circuit 91-AJ80 (BN/BU), harness side and ground; and between DDM C501a pin 8, circuit 31-AJ80B (BK/OG), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
REFER to Section 418-00.

→ **No**
REPAIR the circuits in question. TEST the system for normal operation.

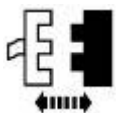
PINPOINT TEST B: NO COMMUNICATION WITH THE REAR ELECTRONIC MODULE (REM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK CIRCUIT 29-DK31 (OG/BK) FOR VOLTAGE	

1

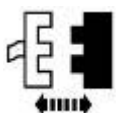


2



REM C420d

3

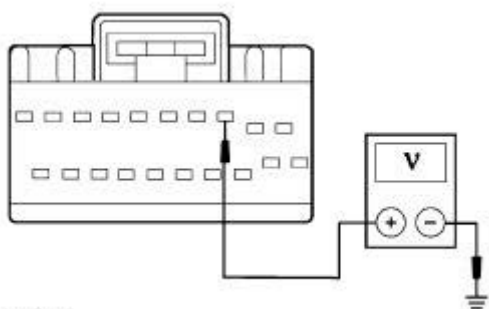


REM C420c

4



5



A0006299

5 Measure the voltage between REM C420d pin 3, circuit 29-DK31 (OG/BK), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to B2.

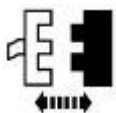
→ No
REPAIR the circuit. TEST the system for normal operation.

B2 CHECK CIRCUITS 29S-DK31 (OG/BK), 31-DK30D (BK), 31-DK30E (BK), 31-DK30F (BK), 31-DK30G (BK) AND 31-DK30H (BK/OG), FOR OPENS

1



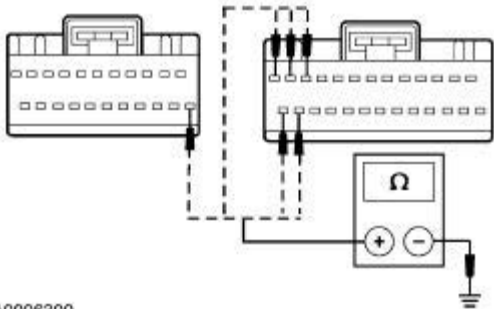
2



REM C420b

3

3 Using the following table, measure the



resistance between REM connectors, harness side and ground:

REM	Pin	Circuit
C420c	13	29S-DK31 (OG/BK)
C420c	12	31-DK30E (BK)
C420c	11	31-DK30D (BK)
C420c	26	31-DK30G (BK)
C420c	25	31-DK30F (BK)
C420b	12	31-DK30H (BK/OG)

● **Is the resistance less than 5 ohms?**


→ **Yes**

REFER to [Section 418-00](#).

→ **No**

REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST C: ALL DOOR LOCKS ARE INOPERATIVE — FROM DRIVER DOOR SWITCH

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — DDM	<p>1 Use the recorded DDM DTCs from the continuous and on-demand self-test.</p> <p>● Are any DDM DTCs recorded?</p> <p>→ Yes If DTC B1309 or DTC B1341, GO to C4.</p> <p>For all other DDM DTCs, REFER to the DDM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to C2.</p>
C2 CHECK DRIVER DOOR LOCK SWITCH AND CIRCUITS — MONITOR THE DDM PID DR_LOCK AND DR_UNLK	
NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>2</p>	



Diagnostic Tool

3



4



4

Monitor the DDM PIDs DR_LOCK and DR_UNLK, while locking and unlocking the driver door using the driver power door lock switch.

- Do the DDM PID values agree with the driver power door lock switch positions?

→ Yes

INSTALL a new DDM. For additional information, REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

→ No

If the PID(s) read YES at all times GO to C3.

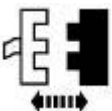
If the PID(s) read NO at all times GO to C5.

C3 CHECK DRIVER POWER DOOR LOCK SWITCH

1



2



Driver Power Door Lock Switch C505

3

Carry out the driver power door lock switch component test. Refer to Wiring Diagrams Section 700-09-00, Component Testing.

- Is the driver power door lock switch OK?

→ Yes

GO to C4.

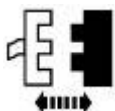
→ No

INSTALL a new driver power door lock switch. REFER to Section 501-14A.

REPEAT the self-test. CLEAR the DTCs.

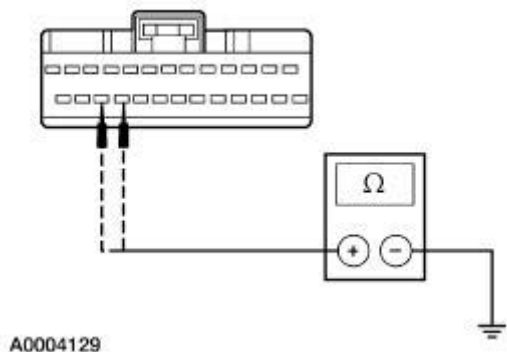
C4 CHECK CIRCUITS 8-AA10 (WH/BK) AND 8-AA11 (WH/VT) FOR SHORT TO GROUND

1



DDM C501d

2



2

Measure the resistance between DDM C501d pin 23, circuit 8-AA10 (WH/BK), harness side and ground; and between DDM C501d pin 24, circuit 8-AA11 (WH/VT), harness side and ground.

- Are the resistances greater than 10,000 ohms?

→ **Yes**
INSTALL a new DDM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.

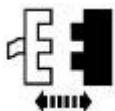
→ **No**
REPAIR the circuit(s) in question. REPEAT the self-test. CLEAR the DTCs.

C5 CHECK DRIVER POWER DOOR LOCK SWITCH

1



2



Driver Power Door Lock Switch C505

3

Carry out the driver power door lock switch component test. Refer to Wiring Diagrams Section 700-09-00, Component Testing.

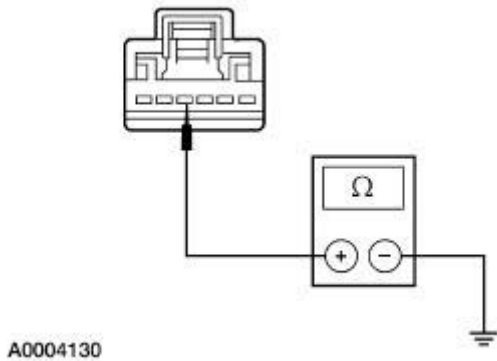
- Is the driver power door lock switch OK?

→ **Yes**
GO to [C6](#).

→ **No**
INSTALL a new driver power door lock switch. REFER to [Section 501-14A](#) .
REPEAT the self-test. CLEAR the DTCs.

C6 CHECK CIRCUIT 31-LH28 (BK) FOR OPEN

1



1 Measure the resistance between driver power door lock switch C505 pin 4, circuit 31-LH28 (BK), harness side and ground.

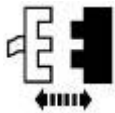
● Is the resistance less than 5 ohms?

→ **Yes**
GO to [C7](#) .

→ **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

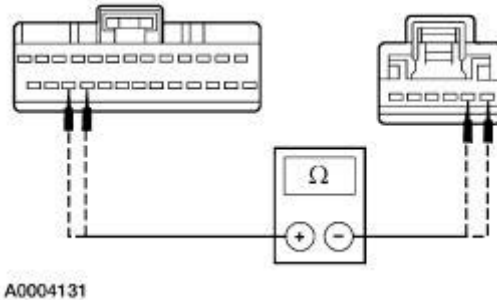
C7 CHECK CIRCUITS 8-AA10 (WH/BK) AND 8-AA11 (WH/VT) FOR OPEN

1



DDM C501d

2



2 Measure the resistance between DDM C501d pin 23, circuit 8-AA10 (WH/BK), harness side and driver power door lock switch C505 pin 1, circuit 8-AA10 (WH/BK), harness side; and between DDM C501d pin 24, circuit 8-AA11 (WH/VT), harness side and driver power door lock switch C505 pin 2, circuit 8-AA11 (WH/VT), harness side.





● Are the resistances less than 5 ohms?

→ **Yes**
INSTALL a new DDM. REFER to [Section 419-10](#) . REPEAT the self-test. CLEAR the DTCs.

→ **No**

REPAIR the circuit(s) in question.
 REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST D: ALL DOOR LOCKS ARE INOPERATIVE — FROM PASSENGER DOOR SWITCH

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>D1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — REM</p>	<p>1 Use the recorded REM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any REM DTCs recorded? <p>→ Yes For DTC B1300 or B1310, GO to <u>D3</u>.</p> <p>For all other REM DTCs, REFER to the REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>D2</u>.</p>
<p>D2 CHECK PASSENGER DOOR LOCK SWITCH AND CIRCUITS — MONITOR THE REM PID PD_LOCK AND PD_UNLK</p>	<p>NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.</p>
<p>1</p>  <p>2</p>  <p>Diagnostic Tool</p> <p>3</p>  <p>4</p> 	<p>4 Monitor the REM PIDs PD_LOCK and PD_UNLK, while locking and unlocking the passenger door using the passenger power door lock switch.</p> <ul style="list-style-type: none"> ● Do the REM PID values agree with the passenger power door lock switch positions? <p>→ Yes INSTALL a new REM. REFER to <u>Section</u></p>

419-10. REPEAT the self-test. CLEAR the DTCs.

→ **No**
If the PID(s) read YES at all times GO to D3.

If the PID(s) read NO at all times GO to D5.

D3 CHECK PASSENGER POWER DOOR LOCK SWITCH

1



2



Passenger Power Door Lock Switch C605

3 Carry out the passenger power door lock switch component test. Refer to Wiring Diagrams Section 700-09-00, Component Testing.

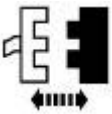
● **Is the passenger power door lock switch OK?**

→ **Yes**
GO to D4.

→ **No**
INSTALL a new passenger power door lock switch. REFER to Section 501-14A. REPEAT the self-test. CLEAR the DTCs.

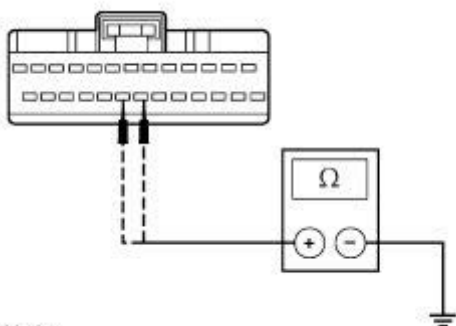
D4 CHECK CIRCUITS 8-AA20 (WH/BU) AND 8-AA21 (WH/GN) FOR SHORT TO GROUND

1



REM C420c

2



A0004041

2 Measure the resistance between REM C420c pin 20, circuit 8-AA20 (WH/BU), harness side and ground; and between REM C420c pin 21, circuit 8-AA21 (WH/GN), harness side and ground.

- Are the resistances greater than 10,000 ohms?

→ **Yes**
 INSTALL a new REM. REFER to [Section 419-10](#) . REPEAT the self-test. CLEAR the DTCs.

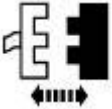
→ **No**
 REPAIR the circuit(s) in question. REPEAT the self-test. CLEAR the DTCs.

D5 CHECK PASSENGER POWER DOOR LOCK SWITCH

1



2



Passenger Power Door Lock Switch C605

3 Carry out the passenger power door lock switch component test. Refer to Wiring Diagrams Section 700-09-00, Component Testing.

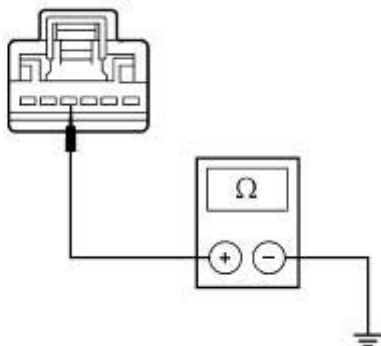
- Is the passenger power door lock switch OK?

→ **Yes**
 GO to [D6](#) .

→ **No**
 INSTALL a new passenger power door lock switch. REFER to [Section 501-14A](#) . REPEAT the self-test. CLEAR the DTCs.

D6 CHECK CIRCUIT 31-LH42 (BK) FOR OPEN

1



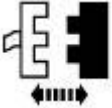
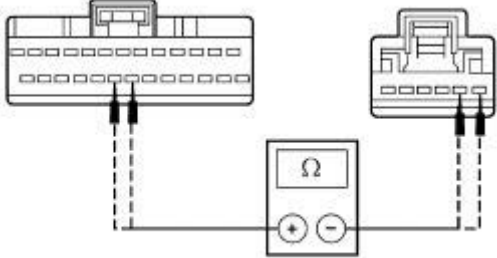
A0004130

1 Measure the resistance between passenger power door lock switch C605 pin 4, circuit 31-LH42 (BK), harness side and ground.

- Is the resistance less than 5 ohms?

	<p>→ Yes GO to <u>D7</u>.</p> <p>→ No REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.</p>
--	---

D7 CHECK CIRCUITS 8-AA20 (WH/BU) AND 8-AA21 (WH/GN) FOR OPEN

<p>1</p>  <p>REM C420c</p> <p>2</p>  <p>A0004113</p>	<p>2 Measure the resistance between REM C420c pin 20, circuit 8-AA20 (WH/BU), harness side and passenger power door lock switch C605 pin 1, circuit 8-AA20 (WH/BU), harness side; and between REM C420c pin 21, circuit 8-AA21 (WH/GN), harness side and passenger power door lock switch C605 pin 2, circuit 8-AA21 (WH/GN), harness side.</p> <p>● Are the resistances less than 5 ohms?</p> <p>→ Yes INSTALL a new REM. REFER to <u>Section 419-10</u>. REPEAT the self-test. CLEAR the DTCs.</p> <p>→ No REPAIR the circuit(s) in question. REPEAT the self-test. CLEAR the DTCs.</p>
--	---

PINPOINT TEST E: ALL DOOR LOCKS ARE INOPERATIVE — FROM DRIVER DOOR LOCK CYLINDER

CONDITIONS	DETAILS/RESULTS/ACTIONS
<p>E1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — DDM</p>	<p>1 Use the recorded DDM DTCs from the continuous and on-demand self-test.</p> <p>● Are any DDM DTCs recorded?</p> <p>→ Yes For DTC B2112 or DTC B2116, GO to <u>E3</u>.</p> <p>For all other DDM DTCs, REFER to the</p>

DDM Diagnostic Trouble Code (DTC) Index.

→ **No**
GO to E2.

E2 CHECK DRIVER DOOR LOCK CYLINDER AND CIRCUITS — MONITOR THE DDM PID DRLKCYL AND DR_DSRM

NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.

1



2



Diagnostic Tool

3



4



4 Monitor the DDM PIDs DRLKCYL AND DR_DSRM, while locking and unlocking the driver door using the driver door lock cylinder.

5

• **Do the DDM PID values agree with the driver door lock cylinder positions?**

→ **Yes**
INSTALL a new DDM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

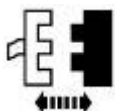
→ **No**
GO to E3.

E3 CHECK CIRCUITS 31S-AA78 (BK/BU) AND 31S-AA79 (BK/WH) FOR SHORT TO GROUND

1



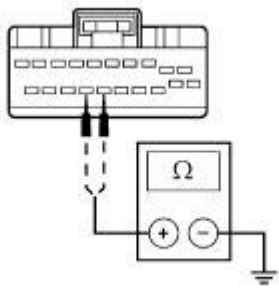
2



DDM C501c

3

3 Measure the resistance between DDM



A0003773

C501c pin 16, circuit 31S-AA78 (BK/BU), harness side and ground; and between DDM C501c pin 17, circuit 31S-AA79 (BK/WH), harness side and ground.

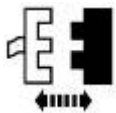
- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to E5.

→ **No**
GO to E4.

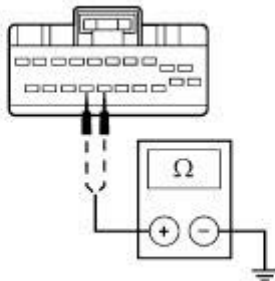
E4 CHECK DRIVER DOOR LOCK ACTUATOR FOR SHORT TO GROUND

1



Driver Door Lock Actuator C525

2



A0003773

2 Measure the resistance between DDM C501c pin 16, circuit 31S-AA78 (BK/BU), harness side and ground; and between DDM C501c pin 17, circuit 31S-AA79 (BK/WH), harness side and ground.

- Are the resistances greater than 10,000 ohms?

→ **Yes**
INSTALL a new driver door lock actuator. REFER to Section 501-14A. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit(s) in question. REPEAT the self-test. CLEAR the DTCs.

E5 CHECK DDM FOR INTERNAL SHORT TO GROUND

1

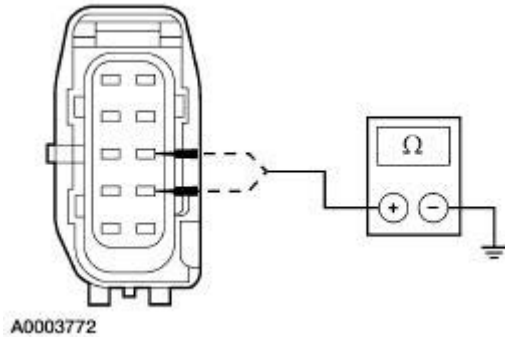


2



Driver Door Lock Actuator C525

3



3

Measure the resistance between driver door lock actuator C525 pin 7, circuit 31S-AA78 (BK/BU), harness side and ground; and between driver door lock actuator C525 pin 5, circuit 31S-AA79 (BK/WH), harness side and ground.

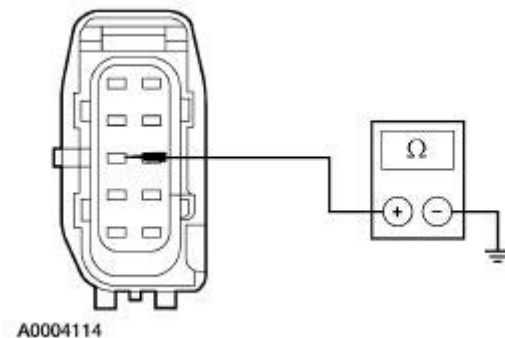
- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to E6.

→ **No**
INSTALL a new DDM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

E6 CHECK CIRCUIT 31-AA58 (BK) FOR OPEN

1



1

Measure the resistance between driver door lock actuator C525 pin 6, circuit 31-AA58 (BK), harness side and ground.

- Is the resistance less than 5 ohms?

→ **Yes**
GO to E7.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

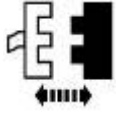
E7 CHECK DRIVER SET AND RESET SWITCH

1



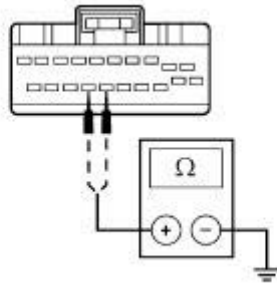
Driver Door Lock Actuator C525

2



DDM C501c

3



A0003773

3

Measure the resistance between DDM C501c pin 16, circuit 31S-AA78 (BK/BU), harness side and ground, while turning the key cylinder to the SET position; and between DDM C501c pin 17, circuit 31S-AA79 (BK/WH), harness side and ground, while turning the key cylinder to the RESET position.

- Are the resistances less than 5 ohms?

→ Yes

INSTALL a new DDM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.

→ No

GO to [E8](#).

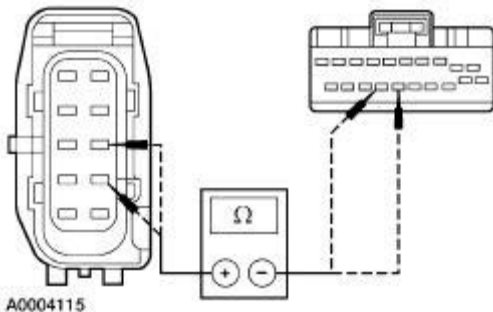
E8 CHECK CIRCUITS 31S-AA78 (BK/BU) AND 31S-AA79 (BK/WH) FOR OPEN

1



Driver Door Lock Actuator C525

2



A0004115

2

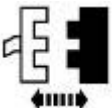
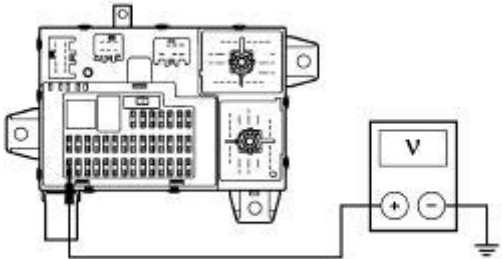

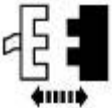
Measure the resistance between DDM C501c pin 16, circuit 31S-AA78 (BK/BU), harness side and driver door lock actuator C525 pin 7, circuit 31S-AA78 (BK/BU), harness side; and between DDM C501c pin 17, circuit 31S-AA79 (BK/WH), harness side and driver door lock actuator C525 pin 5, circuit 31S-AA79 (BK/WH), harness side.

- Are the resistances less than 5 ohms?

→ **Yes**
 INSTALL a new driver door lock actuator.
 REFER to Section 501-14A . REPEAT
 the self-test. CLEAR the DTCs.

→ **No**
 REPAIR the circuit(s) in question.
 REPEAT the self-test. CLEAR the DTCs.

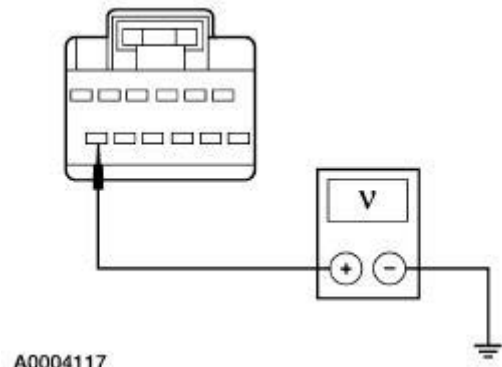
PINPOINT TEST F: A SINGLE DOOR LOCK IS INOPERATIVE — DRIVER DOOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK CENTRAL JUNCTION BOX FUSE (CJB) 222 (10A) FOR VOLTAGE	
NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>CJB Fuse 222 (10A)</p> <p>2</p>  <p>A0004116</p>	<p>2</p> <p>Measure the voltage between CJB Fuse 222 (10A) pin 1, circuit 30-DD3 (RD/OG), component side and ground.</p> <ul style="list-style-type: none"> ● Is the voltage greater than 10 volts? <p>→ Yes RECONNECT the CJB Fuse 222 (10A).GO to <u>F2</u>.</p> <p>→ No REPAIR circuit 30-DD3 (RD/OG). REPEAT the self-test. CLEAR the DTCs.</p>
F2 CHECK CIRCUIT 29S-AJ86 (OG/BU) FOR OPEN	
<p>1</p>  <p>2</p>  <p>DDM C501a</p>	

3



4



4 Measure the voltage between DDM C501a pin 12, circuit 29S-AJ86 (OG/BU), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to F3.

→ No
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

F3 CHECK DRIVER DOOR LOCK OPERATION USING ACTIVE COMMANDS

1



2



DDM C501a

3



Diagnostic Tool

4



5



5 Trigger the DDM active commands DD LOCK and DD UNLOCK ON and OFF.

• Do the DDM active commands DD

LOCK and DD UNLOCK operate correctly?

→ **Yes**

INSTALL a new DDM. REFER to [Section 419-10](#) . REPEAT the self-test. CLEAR the DTCs.

→ **No**

GO to [F4](#) .

F4 CHECK DDM LOCK AND UNLOCK OUTPUTS USING ACTIVE COMMANDS

1



2

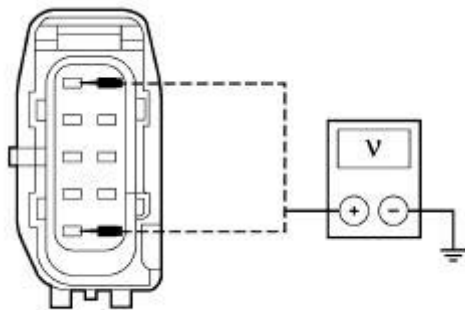


Driver Door Lock Actuator C525

3



4



A0004118

4

Measure the voltage between driver power door lock actuator C525 pin 2, circuit 33-AA10 (YE/BK), harness side and ground, while triggering the DDM active command DD LOCK to ON; and measure the voltage between driver power door lock actuator C525 pin 10, circuit 32-AA11 (WH/VT), harness side and ground, while triggering the DDM active command DD UNLOCK to ON.

● **Are the voltages greater than 10 volts?**

→ **Yes**

INSTALL a new door lock actuator. REFER to [Section 501-14A](#) . REPEAT the self-test. CLEAR the DTCs.

→ **No**

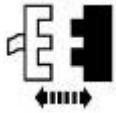
GO to [F5](#) .

F5 CHECK CIRCUITS 33-AA10 (YE/BK) AND 32-AA11 (WH/VT) FOR OPEN

1

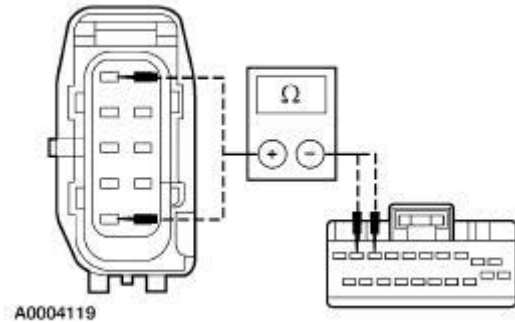


2



DDM C501c

3



A0004119

3

Measure the resistance between driver power door lock actuator C525 pin 2, circuit 33-AA10 (YE/BK), harness side and DDM C501c pin 8, circuit 33-AA10 (YE/BK) harness side; and between driver power door lock actuator C525 pin 10, circuit 32-AA11 (WH/VT) harness side and DDM C501c pin 9, circuit 32-AA11 (WH/VT) harness side.

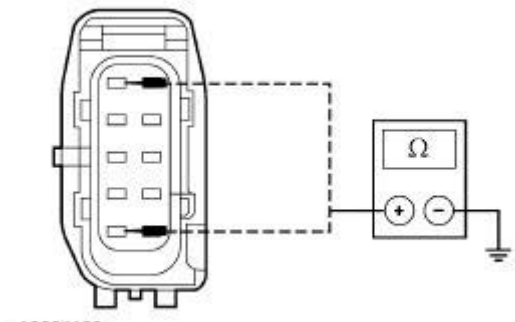
- Are the resistances less than 5 ohms?

→ **Yes**
GO to F6.

→ **No**
REPAIR the circuit(s) in question.
REPEAT the self-test. CLEAR the DTCs.

F6 CHECK CIRCUITS 33-AA10 (YE/BK) AND 32-AA11 (WH/VT) FOR SHORT TO GROUND

1



A0004120

1

Measure the resistance between driver power door lock actuator C525 pin 2, circuit 33-AA10 (YE/BK), harness side and ground; and between driver power door lock actuator C525 pin 10, circuit 32-AA11 (WH/VT), harness side and ground.

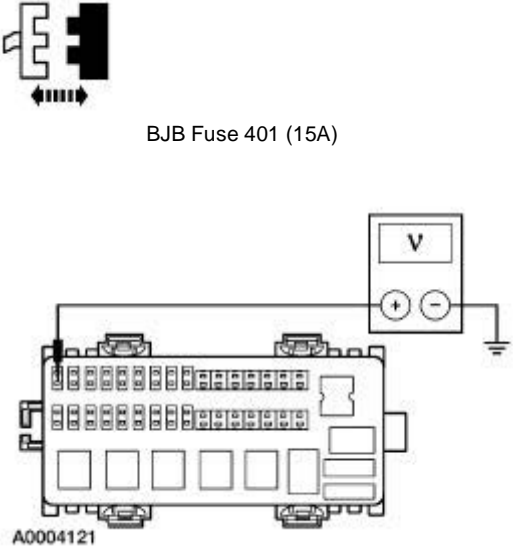
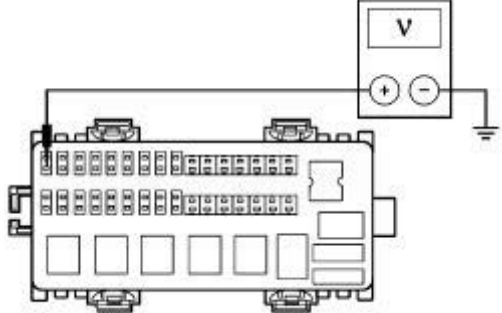

- Are the resistances greater than 10,000 ohms?

→ **Yes**
INSTALL a new DDM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

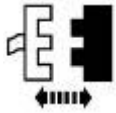
→ **No**
REPAIR the circuit(s) in question.
REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST G: MORE THAN ONE DOOR LOCK IS INOPERATIVE

— PASSENGER DOOR, RIGHT REAR DOOR, AND LEFT REAR DOOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — REM	
	<p>1 Use the recorded REM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> • Are any DTCs recorded? <p>→ Yes REFER to the REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>G2</u>.</p>
G2 CHECK BATTERY JUNCTION BOX (BJB) FUSE 401 (15A) FOR VOLTAGE	
NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>BJB Fuse 401 (15A)</p> <p>2</p>  <p>A0004121</p>	<p>2 Measure the voltage between BJB Fuse 401 (15A) pin 1, component side and ground.</p> <ul style="list-style-type: none"> • Is the voltage greater than 10 volts? <p>→ Yes RECONNECT the BJB Fuse 401 (15A). GO to <u>G3</u>.</p> <p>→ No REPAIR the BJB. REPEAT the self-test. CLEAR the DTCs.</p>
G3 CHECK CIRCUIT 29S-DK31 (OG/BK) FOR OPEN	
<p>1</p> 	

2

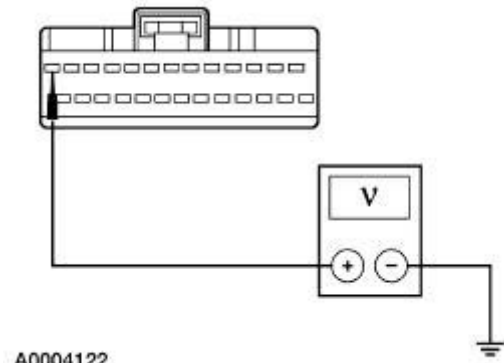


REM 420c

3



4



A0004122

4

Measure the voltage between REM C420c pin 13, circuit 29S-DK31 (OG/BK), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to G4.

→ **No**
REPAIR circuit 29S-DK31 (OG/BK).
REPEAT the self-test. CLEAR the DTCs.

G4 CHECK REM OUTPUT USING ACTIVE COMMANDS

1



2



REM 420c

3



Diagnostic Tool

4



5



5

Trigger the REM active commands LR LOCK and LR UNLOCK ON and OFF while observing the passenger, right rear and left rear lock actuators.

- Do the REM active commands LR LOCK and LR UNLOCK operate correctly?

→ Yes

INSTALL a new REM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.

→ No

If only an individual lock does not operate, REFER to Symptom Chart.

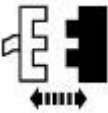
If two or more do not operate, GO to [G5](#).

G5 CHECK CIRCUITS 33-AA2 (YE/RD), 32-AA1 (WH/RD), 33-AA15 (YE/GN) AND 32-AA16 (WH/BK) FOR SHORT TO GROUND

1

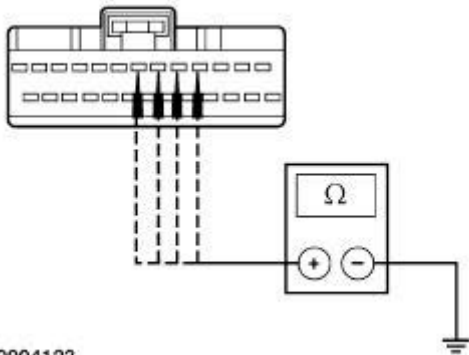


2



REM C420c

3



A0004123

3

Measure the resistance between the REM connector, harness side and ground as follows:

Connector Pin	Circuit
C420c Pin 5	33-AA2 (YE/RD)
C420c Pin 6	32-AA1 (WH/RD)
C420c Pin 4	33-AA15 (YE/GN)
C420c Pin 7	32-AA16 (WH/BK)

- Are the resistances greater than 10,000 ohms?

→ Yes





INSTALL a new REM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.

→ No

REPAIR the circuit(s) in question.

REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST H: MORE THAN ONE DOOR LOCK IS INOPERATIVE — PASSENGER DOOR AND RIGHT REAR DOOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 RETRIEVE THE RECORDED DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — REM	
	<p>1 Use the recorded REM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none">● Are any DTCs recorded? <p>→ Yes REFER to the REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>H2</u>.</p>
H2 CHECK REM OUTPUT USING ACTIVE COMMANDS	
<p>1</p>  <p>2</p>  <p>Diagnostic Tool</p> <p>3</p>  <p>4</p> 	<p>4 Trigger the REM active commands LR LOCK and LR UNLOCK ON and OFF while observing the passenger and right rear lock actuators.</p> <ul style="list-style-type: none">● Do the REM active commands LR LOCK and LR UNLOCK operate correctly? <p>→ Yes INSTALL a new REM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.</p> <p>→ No GO to <u>H3</u>.</p>

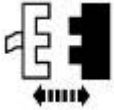
H3 CHECK REM OUTPUT TO PASSENGER AND RIGHT REAR LOCK ACTUATORS

NOTE: Disconnect the inoperative lock actuator. If both actuators are inoperative you must disconnect both actuators.

1

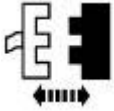


2



Right Rear Door Lock Actuator C804

3

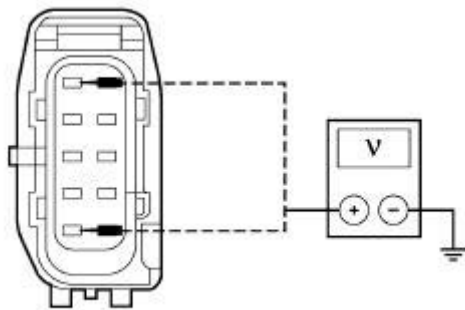


Passenger Door Lock Actuator C609

4

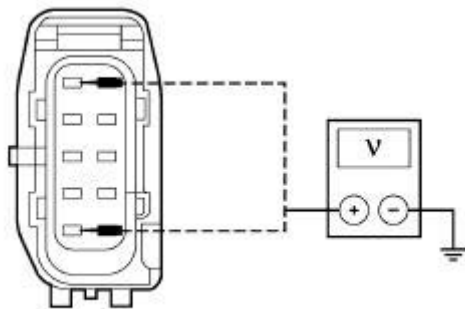


5



A0004118

6



A0004118

5 Measure the voltage between passenger door lock actuator C609 pin 2, circuit 33-AA20 (YE/BU), harness side and ground, while triggering the REM active command LR LOCK to ON; and measure the voltage between passenger door lock actuator C609 pin 10, circuit 32-AA21 (WH/GN), harness side and ground, while triggering the REM active command LR UNLOCK to ON.

6 Measure the voltage between right rear door lock actuator C804 pin 2, circuit 33-AA25 (YE/RD), harness side and ground, while triggering the REM active command LR LOCK to ON; and measure the voltage between right rear door lock actuator C804 pin 10, circuit 32-AA26 (WH/BU), harness side and ground, while triggering the REM active command LR UNLOCK to ON.

- Are the voltages greater than 10 volts?

→ **Yes**
INSTALL a new door lock actuator(s).
REFER to Section 501-14A. REPEAT

the self-test. CLEAR the DTCs.

→ **No**
GO to H4.

H4 CHECK CIRCUITS 33-AA20 (YE/BU), 32-AA21 (WH/GN), 33-AA25 (YE/RD) AND 32-AA26 (WH/BU) FOR OPEN

NOTE: Disconnect the inoperative lock actuator. If both actuators are inoperative you must disconnect both actuators.

1

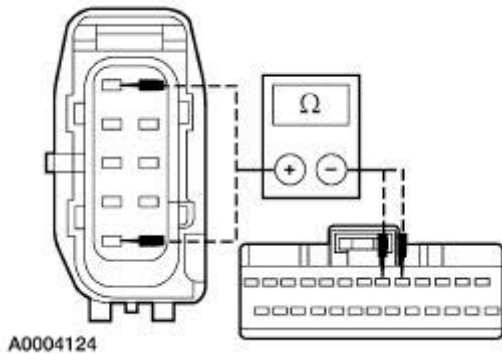


2



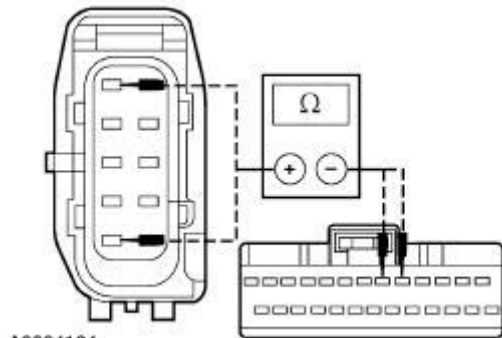
REM C420c

3



A0004124

4



A0004124

3 Measure the resistance between passenger door lock actuator C609 pin 2, circuit 33-AA20 (YE/BU), harness side and REM C420c pin 5, circuit 33-AA25 (YE/RD), harness side; and between passenger door lock actuator C609 pin 10, circuit 32-AA21 (WH/GN), harness side and REM C420c pin 6, circuit 32-AA26 (WH/BU), harness side.

4 Measure the resistance between right rear door lock actuator C804 pin 2, circuit 33-AA25 (YE/RD), harness side and REM C420c pin 5, circuit 33-AA25 (YE/RD), harness side; and between rear door lock actuator C804 pin 10, circuit 32-AA26 (WH/BU), harness side and REM C420c pin 6, circuit 32-AA26 (WH/BU), harness side.

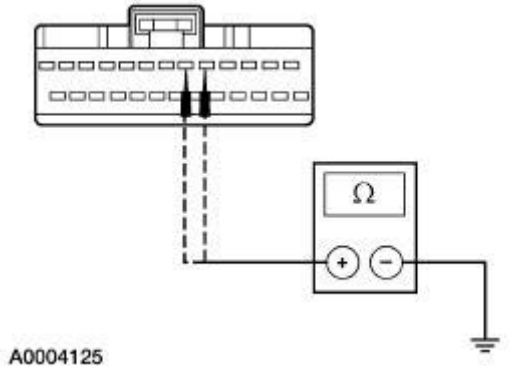
● **Are the resistances less than 5 ohms?**

→ **Yes**
GO to H5.


→ **No**
REPAIR the circuit(s) in question.
REPEAT the self-test. CLEAR the DTCs.

H5 CHECK CIRCUITS 33-AA25 (YE/RD) AND 32-AA26 (WH/BU) FOR SHORT TO GROUND

NOTE: Disconnect the inoperative lock actuator. If both actuators are inoperative you must disconnect both actuators.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">1</div>  <p style="margin-top: 20px;">A0004125</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">1</div> <p>Measure the resistance between REM C420c pin 5, circuit 33-AA25 (YE/RD) harness side and ground; and between REM C420c pin 6, circuit 32-AA26 (WH/BU), harness side and ground.</p> <ul style="list-style-type: none"> ● Are the resistances greater than 10,000 ohms? <p>→ Yes INSTALL a new REM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.</p> <p>→ No REPAIR the circuit(s) in question. REPEAT the self-test. CLEAR the DTCs.</p>
--	--

PINPOINT TEST I: A SINGLE DOOR LOCK IS INOPERATIVE — LEFT REAR DOOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — REM	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">1</div> <p>Use the recorded REM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes REFER to the REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to I2.</p>
I2 CHECK REM OUTPUT USING ACTIVE COMMANDS	
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">1</div> 	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">2</div>



Diagnostic Tool

3



4



4

Trigger the REM active commands LR LOCK and LR UNLOCK ON and OFF while observing the left rear lock actuator.

- Do the REM active commands LR LOCK and LR UNLOCK operate correctly?

→ Yes

INSTALL a new REM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.

→ No

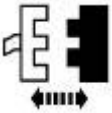
GO to [I3](#).

I3 CHECK REM OUTPUT TO LEFT REAR LOCK ACTUATOR

1



2

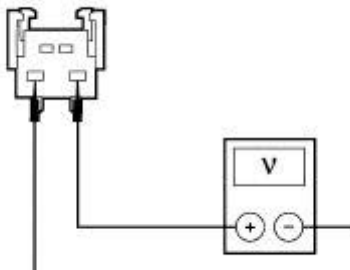


Left Rear Door Lock Actuator C704

3



4



A0005708

4

Measure the voltage between left rear door lock actuator C704 pin 2, circuit 33-AA15 (YE/GN), harness side and ground, while triggering the REM active command LR LOCK to ON; and measure the voltage between left rear door lock actuator C704 pin 10, circuit 32-AA16 (WH/BK), harness side and ground, while triggering the REM active command LR UNLOCK to ON.

- Are the voltages greater than 10

volts?

→ **Yes**
INSTALL a new door lock actuator.
REFER to [Section 501-14A](#). REPEAT
the self-test. CLEAR the DTCs.

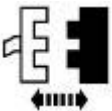
→ **No**
GO to [I4](#).

I4 CHECK CIRCUITS 33-AA15 (YE/GN) AND 32-AA16 (WH/BK) FOR OPEN

1

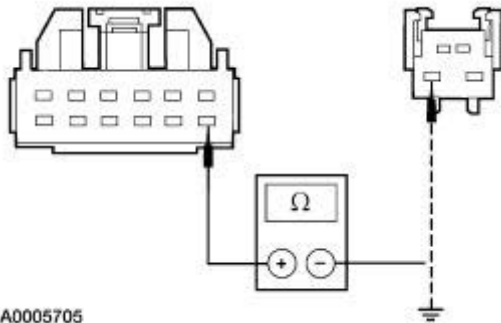


2



REM C420c

3



3 Measure the resistance between left rear door lock actuator C704 pin 2, circuit 33-AA15 (YE/GN), harness side and REM C420c pin 4, circuit 33-AA15 (YE/GN), harness side; and between left rear door lock actuator C704 pin 10, circuit 32-AA16 (WH/BK), harness side and REM C420c pin 7, circuit 32-AA16 (WH/BK), harness side.

● **Are the resistances less than 5 ohms?**

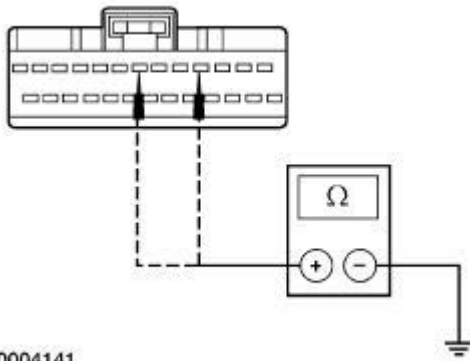
→ **Yes**
GO to [I5](#).

→ **No**
REPAIR the circuit(s) in question.
REPEAT the self-test. CLEAR the DTCs.

I5 CHECK CIRCUITS 33-AA15 (YE/GN) AND 32-AA16 (WH/BK) FOR SHORT TO GROUND

1

1 Measure the resistance between REM C420c pin 4, circuit 33-AA15 (YE/GN), harness side and ground; and between REM C420c pin 7, circuit 32-AA16 (WH/BK), harness side and ground.



A0004141

- Are the resistances greater than 10,000 ohms?

- **Yes**
 INSTALL a new REM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.
- **No**
 REPAIR the circuit(s) in question. REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST J: THE LUGGAGE COMPARTMENT DOOR IS INOPERATIVE — FROM RELEASE SWITCH

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 RETRIEVE THE RECORDED DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — REM	<p>1 Use the recorded REM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> • Are any DTCs recorded? <p>→ Yes For DTC B1551, GO to J3.</p> <p>For all other DTCs, REFER to the REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to J2.</p>
J2 CHECK REM OUTPUT USING ACTIVE COMMANDS	
NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p> <p>2</p>	



Diagnostic Tool

3



4



4 Trigger the REM active command RELEASE ON.

● Does the REM active command RELEASE operate correctly?

→ Yes
GO to J3.

→ No
GO to the Symptom Chart.

J3 CHECK LUGGAGE COMPARTMENT RELEASE SWITCH INPUT TO REM

NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.

1



2



Diagnostic Tool

3



4



4 Monitor the REM PID DLIDRLS.

5 Depress and release the luggage compartment release switch.

● Does the REM PID DLIDRLS agree with the luggage compartment release switch position?

→ Yes
INSTALL a new REM. REFER to Section

419-10. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REM PID DLIDRLS indicates ON GO to J4.

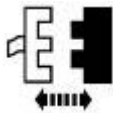
REM PID DLIDRLS indicates OFF GO to J6.

J4 CHECK LUGGAGE COMPARTMENT RELEASE SWITCH

1



2



Luggage Compartment Release Switch C207

1 Monitor the REM PID DLIDRLS.

- Did the REM PID DLIDRLS change from ON to OFF?

→ **Yes**
INSTALL a new luggage compartment release switch. REPEAT the self-test. CLEAR the DTCs.

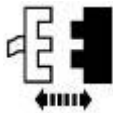
→ **No**
GO to J5.

J5 CHECK CIRCUIT 8-AA30 (WH) FOR SHORT TO GROUND

1



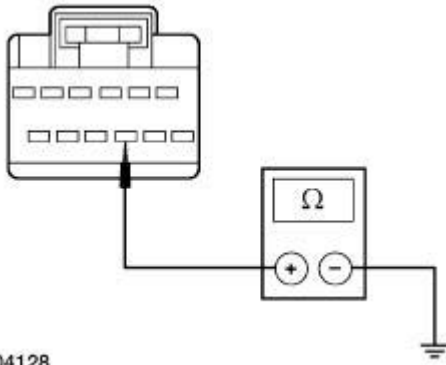
2



REM C420a

3

3 Measure the resistance between REM C420a pin 9, circuit 8-AA30 (WH), harness side and ground.



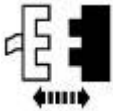
A0004128

- Is the resistance greater than 10,000 ohms?

- **Yes**
INSTALL a new REM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.
- **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

J6 CHECK CIRCUIT 8-AA30 (WH) FOR OPEN

1

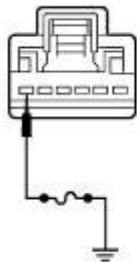


Luggage Compartment Release Switch C207

2



3



A0004135

- 2 Monitor the REM PID DLIDRLS.
- 3 Connect a 10A fused jumper between luggage compartment release switch C207 pin 6, circuit 8-AA30 (WH), harness side and ground, while monitoring the REM PID DLIDRLS.

- Did the REM PID DLIDRLS change from OFF to ON?

- **Yes**
GO to [J7](#).
- **No**
REPAIR the circuit. REPEAT the self-test.

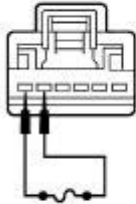
CLEAR the DTCs.

J7 CHECK LUGGAGE COMPARTMENT RELEASE SWITCH

1



2



A0004136

1

Monitor the REM PID DLIDRLS.

2

Connect a 10A fused jumper between luggage compartment release switch C207 pin 6, circuit 8-AA30 (WH), harness side and luggage compartment release switch C207 pin 5, circuit 31-AA30 (BK), harness side, while monitoring the REM PID DLIDRLS.

- Did the REM PID DLIDRLS change from OFF to ON?

→ Yes

INSTALL a new luggage compartment release switch. REPEAT the self-test. CLEAR the DTCs.

→ No

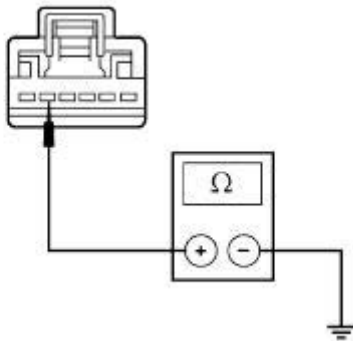
GO to J8.

J8 CHECK CIRCUIT 31-AA30 (BK) FOR OPEN

1



2



A0004137

2

Measure the resistance between luggage compartment release switch C207 pin 5, circuit 31-AA30 (BK), harness side and ground.





- Is the resistance less than 5 ohms?

→ Yes

INSTALL a new REM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test.
CLEAR the DTCs.

PINPOINT TEST K: THE LUGGAGE COMPARTMENT DOOR IS INOPERATIVE — FROM RELEASE SWITCH AND REMOTE TRANSMITTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 RETRIEVE THE RECORDED DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — REM	
	<p>1 Use the recorded REM DTCs from the continuous and on-demand self-test.</p> <ul style="list-style-type: none"> • Are any DTCs recorded? <p>→ Yes REFER to the REM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to <u>K2</u>.</p>
K2 CHECK REM OUTPUT USING ACTIVE COMMANDS	
NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>2</p>  <p>Diagnostic Tool</p> <p>3</p>  <p>4</p> 	<p>4 Trigger the REM active command RELEASE ON.</p> <ul style="list-style-type: none"> • Does the luggage compartment unlock? <p>→ Yes INSTALL a new REM. REFER to <u>Section 419-10</u>. REPEAT the self-test. CLEAR</p>

the DTCs.

→ **No**
GO to K3.

K3 CHECK LUGGAGE COMPARTMENT RELEASE SWITCH INPUT TO REM

NOTE: Cycle the ignition switch from OFF to RUN to enable the switched system power feature.

1



1 Monitor the REM PID DLIDRLS.

2 Depress and release the luggage compartment release switch.

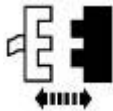
- **Does the REM PID DLIDRLS agree with the luggage compartment release switch position?**

→ **Yes**
GO to K4.

→ **No**
INSTALL a new REM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

K4 CHECK LUGGAGE COMPARTMENT RELEASE SWITCH INPUT TO REM

1

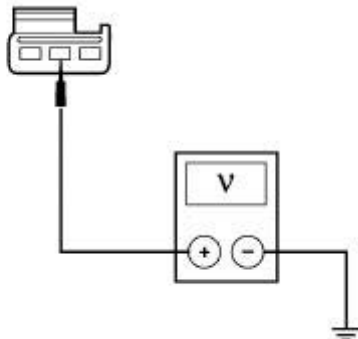


Luggage Compartment Release Solenoid C430

2



3



A0004138

2 Trigger the REM active command RELEASE ON.

3 Measure the voltage between the luggage compartment release solenoid C430 pin 2, circuit 29S-AA83 (OG), harness side and ground.

- **Is the voltage greater than 10 volts?**

→ **Yes**
GO to K5.

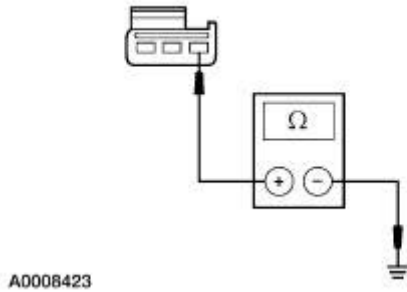
→ **No**
GO to K6.

K5 CHECK CIRCUIT 31-AA83 (BK/OG) FOR OPEN

1



2



2 Measure the resistance between the luggage compartment release solenoid C430 pin 1, circuit 31-AA83 (BK/OG), harness side and ground.

● **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new luggage compartment release solenoid. REPEAT the self-test. CLEAR the DTCs.

→ **No**
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

K6 CHECK CIRCUIT 29S-AA83 (OG) FOR OPEN

1

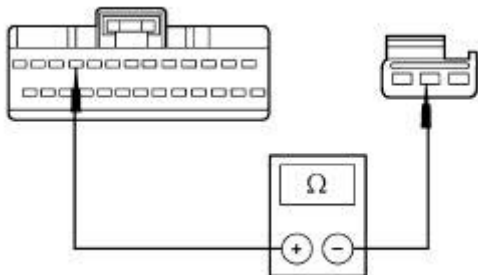


2



REM C420c


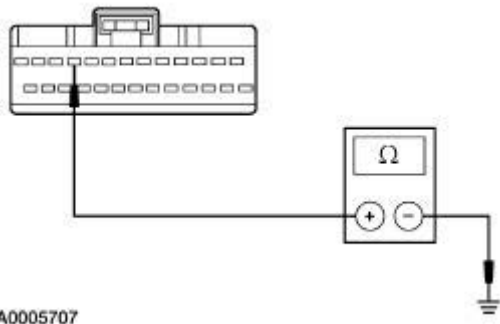
3



3 Measure the resistance between REM C420c pin 10, circuit 29S-AA83 (OG) harness side and luggage compartment release solenoid C430 pin 2, circuit 29S-AA83 (OG), harness side.

	<ul style="list-style-type: none"> ● Is the resistance less than 5 ohms? <p>→ Yes GO to <u>K7</u>.</p> <p>→ No REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.</p>
--	---

K7 CHECK CIRCUIT 29S-AA83 (OG) FOR SHORT TO GROUND

<p>1</p>  <p>2</p>  <p>A0005707</p>	<p>2</p> <p>Measure the resistance between REM C420c pin 10, circuit 29S-AA83 (OG) harness side and ground.</p> <ul style="list-style-type: none"> ● Is the resistance greater than 10,000 ohms? <p>→ Yes INSTALL a new REM. REFER to <u>Section 419-10</u>. REPEAT the self-test. CLEAR the DTCs.</p> <p>→ No REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.</p>
--	---

PINPOINT TEST L: THE DOORS DO NOT LOCK AND UNLOCK USING THE REMOTE TRANSMITTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
	<p>L1 CHECK THE DOOR LOCKS AT THE DRIVER DOOR LOCK SWITCH</p> <p>1</p> <p>Check the locks from the driver door lock switch.</p> <ul style="list-style-type: none"> ● Do the doors lock and unlock? <p>→ Yes GO to <u>L2</u>.</p> <p>→ No</p>

GO to Pinpoint Test C.

L2 CHECK REMOTE TRANSMITTER BUTTONS WITH DIAGNOSTIC TOOL

1



2



Diagnostic Tool

3



4



4 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the lock, then the unlock button on the remote transmitter.

● Does the data received indicate LOCK, then UNLOCK?

→ **Yes**
INSTALL a new DDM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to L3.

L3 CHECK THE BATTERY IN REMOTE TRANSMITTER

2



1 Install a new battery in the remote transmitter.

2 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the lock, then the unlock button on the remote transmitter.

● Does the data received indicate LOCK, then UNLOCK?

→ **Yes**
TEST all remote transmitter functions. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to L4.

L4 CHECK THE PROGRAMMING OF THE REMOTE TRANSMITTER

2

1 Reprogram the remote transmitter; REFER to Programming—Remote Keyless Entry Transmitter.

2 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the lock, then the unlock button on the remote transmitter.



- Does the data received indicate LOCK, then UNLOCK?





→ **Yes**



Fault found as remote transmitter not programmed. REPEAT the self-test. CLEAR the DTCs.

→ **No**

PROGRAM a new remote transmitter to the vehicle. REFER to Programming—Remote Keyless Entry Transmitter . REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST M: THE MEMORY SEAT DOES NOT OPERATE CORRECTLY USING THE REMOTE TRANSMITTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1 CHECK THE MEMORY SET SWITCH	
	<p>1 Operate the memory seat using the memory set switch.</p> <ul style="list-style-type: none"> ● Does the memory seat operate correctly? <p>→ Yes GO to <u>M2</u> .</p> <p>→ No REFER to <u>Section 501-10</u> .</p>
M2 CHECK REMOTE TRANSMITTER BUTTONS WITH DIAGNOSTIC TOOL	
<p>1 </p> <p>2 </p> <p>Diagnostic Tool</p> <p>3 </p> <p>4 </p>	<p>4 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the lock, then the unlock button on the remote transmitter.</p>

	<ul style="list-style-type: none"> ● Does the data received indicate LOCK, then UNLOCK? <p>→ Yes INSTALL a new DDM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.</p> <p>→ No GO to M3.</p>
M3 CHECK THE BATTERY IN REMOTE TRANSMITTER	
<p>2</p> 	<p>1 Install a new battery in the remote transmitter.</p> <p>2 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the lock, then the unlock button on the remote transmitter.</p> <ul style="list-style-type: none"> ● Does the data received indicate LOCK, then UNLOCK? <p>→ Yes TEST all the remote transmitter functions. REPEAT the self-test. CLEAR the DTCs.</p> <p>→ No GO to M4.</p>
M4 CHECK THE PROGRAMMING OF THE REMOTE TRANSMITTER	
<p>2</p> 	<p>1 Reprogram the remote transmitter; refer to Programming—Remote Keyless Entry Transmitter.</p> <p>2 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the lock, then the unlock button on the remote transmitter.</p> <ul style="list-style-type: none"> ● Does the data received indicate LOCK, then UNLOCK? <p>→ Yes The remote transmitter was not programmed. REPEAT the self-test. CLEAR the DTCs.</p> <p>→ No PROGRAM a new remote transmitter to the vehicle. REFER to Programming—Remote Keyless Entry Transmitter. REPEAT the self-test. CLEAR the DTCs.</p>

PINPOINT TEST N: THE AUTO-LOCK DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
N1 RETRIEVE THE RECORDED DTCS FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TEST — FEM	
	<p>1 Use the recorded FEM DTCs from the continuous and on-demand self-test.</p>

● Are any FEM DTCs recorded?

→ **Yes**

For DTC U1041, carry out the ABS self-test. REFER to [Section 206-09A](#).

For DTC U1059, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual Section 3.

For all other FEM DTCs, REFER to the FEM Diagnostic Trouble Code (DTC) Index.

→ **No**

GO to [N2](#).

N2 CHECK DRIVER DOOR AJAR PID D_DOOR

1



2



Diagnostic Tool

3



5



4 Close all doors and luggage compartment.

5 Monitor the FEM driver door ajar PID D_DOOR.

● Does the PID read AJAR?

→ **Yes**

REFER to [Section 417-02](#).

→ **No**

GO to [N3](#).

N3 CHECK PASSENGER DOOR AJAR PID P_DOOR

1



1 Monitor the FEM passenger door ajar PID P_DOOR.

● Does the PID read AJAR?

→ **Yes**

REFER to [Section 417-02](#).

→ **No**
GO to N4.

N4 CHECK LR DOOR AJAR PID LRDR_SW

1



1 Monitor the REM LR door ajar PID LRDR_SW.

● **Does the PID read AJAR?**

→ **Yes**
REFER to Section 417-02.

→ **No**
GO to N5.

N5 CHECK RIGHT REAR DOOR AJAR PID RRDR_SW

1



1 Monitor the REM RR door ajar PID RRDR_SW.

● **Does the PID read AJAR?**

→ **Yes**
REFER to Section 417-02.

→ **No**
GO to N6.

N6 CHECK LUGGAGE COMPARTMENT AJAR PID DECKLID

1



1 Monitor the REM luggage compartment ajar PID DECKLID.

● **Does the PID read AJAR?**

→ **Yes**
REFER to Section 417-02.

→ **No**
GO to N7.

N7 CHECK IGNITION SWITCH STATUS

1




1 Monitor the FEM ignition switch PID IGN_R.


● **Does the PID read YES?**

	<p>→ Yes INSTALL a new DDM. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs.</p> <p>→ No REFER to Section 211-05 .</p>
--	---

PINPOINT TEST O: THE SMART LOCK DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
O1 CHECK COURTESY LIGHTS	
	<p>1 Open the driver door.</p> <ul style="list-style-type: none"> ● Do the courtesy lights illuminate? <p>→ Yes GO to O2 .</p> <p>→ No REFER to Section 417-02 .</p>
O2 CHECK WARNING CHIMES	
<p>1</p> 	<p>1 Open the driver door.</p> <ul style="list-style-type: none"> ● Do the warning chimes operate? <p>→ Yes INSTALL a new DDM. REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs</p> <p>→ No REFER to Section 413-09 .</p>

PINPOINT TEST P: PANIC FEATURE IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
P1 CHECK FEM INPUT	
<p>1</p>  <p>2</p>	



Diagnostic Tool

3



4



4 Monitor the FEM PID AL_1.

5 Press the PANIC button.

● Does the FEM PID indicate PANIC?

→ Yes
REFER to [Section 419-01A](#).

→ No
GO to [P2](#).

P2 CHECK THE REMOTE TRANSMITTER LUGGAGE COMPARTMENT RELEASE BUTTON WITH DIAGNOSTIC TOOL

1



1 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the luggage compartment release button on the remote transmitter.

● Does last received data indicate TRUNK?

→ Yes
INSTALL a new DDM. REFER to [Section 419-10](#). REPEAT the self-test. CLEAR the DTCs.

→ No
GO to [P3](#).

P3 CHECK THE BATTERY IN THE REMOTE TRANSMITTER

2



1 Install a new battery in the remote transmitter.

2 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the luggage compartment release button on the remote transmitter.

● Does last received data indicate TRUNK?

→ Yes
TEST all remote transmitter functions. REPEAT the self-test. CLEAR the DTCs.

→ No

GO to P4.

P4 CHECK THE PROGRAMMING OF THE REMOTE TRANSMITTER

2



1 Reprogram the remote transmitter. Refer to Programming—Remote Keyless Entry Transmitter.

2 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the decklid release button on the remote transmitter.

● **Does last received data indicate TRUNK?**



→ **Yes**

The remote transmitter was not programmed. REPEAT the self-test. CLEAR the DTCs.

→ **No**

PROGRAM a new remote transmitter to the vehicle. REFER to Programming—Remote Keyless Entry Transmitter. REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST Q: THE LUGGAGE COMPARTMENT DOOR IS INOPERATIVE USING THE REMOTE TRANSMITTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
Q1 TEST LUGGAGE COMPARTMENT RELEASE AT THE LUGGAGE COMPARTMENT RELEASE SWITCH	
	<p>1 Press the luggage compartment release switch.</p> <p>● Did the decklid open?</p> <p>→ Yes GO to <u>Q2</u>.</p> <p>→ No GO to <u>Pinpoint Test K</u>.</p>
Q2 CHECK THE REMOTE TRANSMITTER LUGGAGE COMPARTMENT RELEASE BUTTON WITH DIAGNOSTIC TOOL	
<p>1</p>  <p>2</p>  <p>Diagnostic Tool</p> <p>3</p>	



4



4 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the luggage compartment release button on the remote transmitter.

● **Does last received data indicate TRUNK?**

→ **Yes**
INSTALL a new DDM. REFER to Section 419-10. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to Q3.

Q3 CHECK THE BATTERY IN THE REMOTE TRANSMITTER

2



1 Install a new battery in the remote transmitter.

2 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the luggage compartment release button on the remote transmitter.

● **Does last received data indicate TRUNK?**

→ **Yes**
TEST all remote transmitter functions. REPEAT the self-test. CLEAR the DTCs.

→ **No**
GO to Q4.

Q4 CHECK THE PROGRAMMING OF THE REMOTE TRANSMITTER

2



1 Reprogram the remote transmitter. Refer to Programming—Remote Keyless Entry Transmitter.


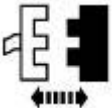
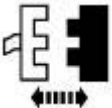

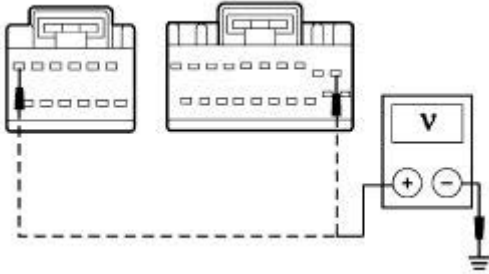
2 Monitor the DDM FUNCTION TEST TIC/DATA, while pressing the luggage compartment release button on the remote transmitter.

● **Does last received data indicate TRUNK?**

→ **Yes**
The remote transmitter was not programmed. REPEAT the self-test. CLEAR the DTCs.

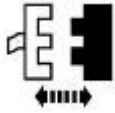
→ **No**
PROGRAM a new remote transmitter to the vehicle. REFER to Programming—Remote Keyless Entry Transmitter. REPEAT the self-test. CLEAR the DTCs.

PINPOINT TEST R: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE (FEM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
R1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK22 (OG/YE) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"> 1  </div> <div style="margin-bottom: 10px;"> 2  <p style="margin-left: 100px;">FEM C201c</p> </div> <div style="margin-bottom: 10px;"> 3  <p style="margin-left: 100px;">FEM C201f</p> </div> <div style="margin-bottom: 10px;"> 4  </div> <div> 5  <p style="margin-left: 20px;">A0006297</p> </div> </div>	<div style="margin-top: 20px;"> 5 Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22 (OG/YE) harness side and ground. </div> <div style="margin-top: 20px;"> <ul style="list-style-type: none"> ● Are the voltages greater than 10 volts? </div> <div style="margin-top: 10px;"> <p>→ Yes GO to <u>R2</u>.</p> </div> <div style="margin-top: 10px;"> <p>→ No REPAIR the circuit(s) in question. TEST the system for normal operation.</p> </div>
R2 CHECK CIRCUITS 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS	
1	

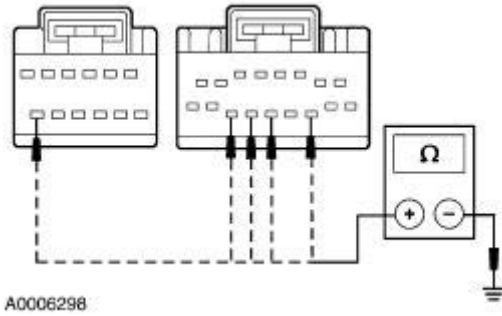


2



FEM C201a

3



3 Using the following table, measure the resistance between FEM connectors, harness side and ground:

FEM	Pin	Circuit
C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)
C201a	15	31-DK20D (BK/RD)


● Is the resistance less than 5 ohms?

→ **Yes**
REFER to [Section 418-00](#) .

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

Programming —Remote Keyless Entry Transmitter

Special Tool(s)

	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent
---	--

NOTE: All remote transmitters are programmable and must be set at the same time.

NOTE: To program (or reprogram) the remote transmitters into the driver door module (DDM), carry out the following steps:

1. Connect the New Generation STAR/Service Bay Diagnostic System (diagnostic tool/SBDS) tester. Turn the ignition from OFF to RUN.
2. From diagnostic tool/SBDS: Using the Ford Service Function (FSF) card, select SERVICE BAY FUNCTION.
3. Select DDM.
4. Select KEY FOB PROGRAMMING.
5. Press any button on the remote transmitter.
6. Select the FOB 1, 2, 3, or 4, and select STORE. It may be necessary to select CANCEL more than once to exit the menu.
7. Repeat steps five and six for additional transmitters.
8. **NOTE:** It may be necessary to select CANCEL more than once to exit the menu.

Select CANCEL to exit the menu.

General Specifications

Item	Specification
RH wiper blade adjustment tolerance	12mm (.47in)
LH wiper blade adjustment tolerance	10mm (.39in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Battery ground cable	10	—	89
Degas bottle bolts	10	—	89
Mounting arm and pivot shaft bolts	12	9	—
Pivot arm nuts	25	18	—
Strut support brace bolts	20	15	—
Windshield washer fluid reservoir bolt	6	—	53
Windshield wiper motor bolts	12	9	—
Windshield wiper motor crank bolt	12	9	—

Wipers And Washers




The wiper and washer system consists of:

- pivot arms
 - mounting arm and pivot shaft
 - windshield wiper motor
 - windshield washer fluid pump
 - headlamp washer fluid pump (if equipped)
 - windshield washer fluid reservoir
 - front electronic module (FEM)
 - rear electronic module (REM)
 - rain sensor module (RSM) (if equipped)
-

Wipers And Washers

Refer to Wiring Diagrams Section [501-16](#) for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent diagnostic tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST1453-A	Alternator, Regulator, Battery and Starter Tester (ARBST) 010-00725 or equivalent

Principles of Operation

Wipers and Washers

The wiper and washer systems are controlled by the front electronic module (FEM). The wiper/washer portion of the multifunction switch is hardwired to the FEM. When the switch is moved to the desired position, the FEM processes this information and outputs the appropriate command(s) to one of three relays. The relays control the wiper high and low motor speeds and washer pump actuation.

Intermittent wiper speed control can vary dependent upon vehicle speed. This is accomplished by the FEM receiving vehicle speed information from the anti-lock brake control module and throttle position status from the powertrain control module (PCM). When the wiper switch is in any of the intermittent positions, the FEM will process the information from the PCM and anti-lock brake control module and decrease the wiper delay time as vehicle speed increases.

Rain Sensor Wiper Function—Rain Sensor Module

The rain sensor module (RSM) is located on the inside of the windshield below the interior rear view mirror and the direct pattern of the wiper blades, if equipped. When the ignition switch is turned to the RUN position, the RSM starts monitoring both the DELAY/WASH and the wiper mode circuits. When the multifunction switch is placed into the INT and AUTO positions, the rain sensor takes control of the mode circuit. In dry conditions the RSM keeps the mode circuit at the correct voltage for the OFF position. In the presence of moisture the RSM directs the mode circuit into individual low pulse, or continuous LOW or HIGH operation, based on the amount of moisture.

Low Washer Fluid Level Lamp/Indicator

The low washer fluid lamp/indicator feature is controlled by the FEM and instrument cluster. The low washer fluid switch is hardwired to the FEM. If fluid is low, the FEM will send a message via the standard corporate protocol (SCP) communication network to the instrument cluster. The instrument cluster will then process the message and output an audible and visual warning. If equipped with a message center, a warning message will be displayed. For additional information, refer to [Section 413-08](#).

Heated Wiper Park

The heated wiper park feature is controlled by the dual automatic temperature control (DATC) module. For additional information, refer to [Section 501-11](#).

Inspection and Verification

1. Verify the customer concern by operating the windshield wiper and washer system to duplicate the condition.
2. Visually inspect for the obvious signs of mechanical or electrical damage; refer to the following chart.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Wiper blade ● Binding wiper pivot arm ● Binding wiper mounting arm and pivot shaft ● Empty washer reservoir ● Washer hoses 	<ul style="list-style-type: none"> ● Underhood auxiliary junction box (AJB) Fuses: <ul style="list-style-type: none"> ■ 102 (10A) ■ 120 (30A) ● Battery junction box (BJB) Fuses: <ul style="list-style-type: none"> ■ 422 (20A) ■ 423 (30A) ■ 424 (30A) ■ 425 (40A) ■ 427 (30A) ■ 432 (30A) ● Central junction box (CJB) Fuse 205 (5A) ● Wiper motor ● Washer pump ● Connectors or connections ● Circuitry ● Multifunction switch ● Wire harness routing ● FEM ● Instrument cluster

3. If the fault is not visually evident, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.

4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTICS test. If the diagnostic tool responds with:
 - CKT914, CKT915, or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for FEM, go to Pinpoint Test A.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the generic electronic module.
6. If the DTCs retrieved are related to the concern, go to FEM Diagnostic Trouble Code (DTC) Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart.

FEM Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1319	Driver Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1327	Passenger Door Ajar Circuit Failure	FEM	REFER to Section 417-02 .
B1342	ECU Is Defective	FEM	CLEAR the DTC. REPEAT the FEM self-test. If DTC B1342 is retrieved, INSTALL a new FEM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test.
B1438	Wiper Mode Select Switch Circuit Failure	FEM	GO to Pinpoint Test D .
B1446	Wiper Park Sense Circuit Failure	FEM	GO to Pinpoint Test B .
B1479	Wiper Washer Fluid Level Sensor Circuit Failure	FEM	REFER to Section 413-01 .
B1499	Lamp Turn Signal Left Circuit Failure	FEM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	FEM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	FEM	REFER to Section 417-01 .
B1519	Hood Switch Circuit Failure	FEM	REFER to Section 419-01A .
B1567	Lamp Headlamp High-Beam Circuit Failure	FEM	REFER to Section 417-01 .
B1676	Battery Pack Voltage Out of Range	FEM	REFER to Section 414-00 .
B1794	Lamp Headlamp Low-Beam Circuit Failure	FEM	REFER to Section 417-01 .
B2214	Window Passenger Front Up Switch Short to Battery	FEM	REFER to Section 501-11 .

B2215	Window Passenger Front Down Switch Short to Battery	FEM	REFER to Section 501-11 .
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	FEM	REFER to Section 501-09 .
B2443	Powertrain Performance Mode Switch Circuit Failure	FEM	Not Used
B2477	Module Configuration Failure	FEM	REFER to Section 418-01 .
C1284	Oil Pressure Switch Failure	FEM	REFER to Section 413-01 .
C1446	Brake Switch Circuit Failure	FEM	REFER to Section 413-01 .
C1924	VAPS Solenoid Actuator Output Circuit Short to Ground	FEM	REFER to Section 211-00 .
C1925	VAPS Solenoid Actuator Return Circuit Failure	FEM	REFER to Section 211-00 .
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the ABS self-test. REFER to Section 206-09A .
U1059	SCP (J1850) Invalid or Missing Data for Transmission / Transaxle / PRNDL	PCM	CARRY OUT the PCM self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .
U1222	SCP (J1850) Invalid or Missing Data for Interior Lamps	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .
U1227	SCP (J1850) Invalid or Missing Data for Body Status Request	ICM	CARRY OUT the ICM self-test. REFER to Section 413-01 .

FEM Parameter Identification (PID) Index

PID	Description	Expected Value
AL_EVT1	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT2	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT3	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS,

		NOEVNT, BB_SND
AL_EVT4	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT5	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT6	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT7	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
AL_EVT8	Last 8 Alarm Events	DROPEN, HOODTR, IGNTAM, PANIC, T_AJAR, RR_SD, LR_SD, P_DOOR, D_DOOR, RADIO, WINDO, ULTRS, NOEVNT, BB_SND
CCNT	Number Of Continuous DTCs In Module	one count per bit
D_DOOR	Left Front Door Ajar Switch	CLOSED, AJAR
FLUID_1	Brake Fluid Level Switch #1	OFF, ON
HOOD_SW	Hood Ajar Switch	CLOSED, AJAR
IGN_R	Ignition Switch -RUN Position	NO, YES
L_HIGH	Left High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
L_LOW	Left Low Beam Lamp	Off---, Off-B-, On---, On-B-
LF_TURN	Left Front Turn Lamp	Off---, Off-B-, On---, On-B-
LMRKOUT	Left Front Marker Lamp	Off---, Off-B-, On---, On-B-
OILWRN	Oil Level Warning Lamp	Off---, On---
P_DN_SW	Passenger Down Activated	OFF, DOWN
P_DOOR	Passenger Door Ajar Switch	CLOSED, AJAR
P_UP_SW	Passenger Up Activated	OFF, UP
PRK_BRK	Parking Brake Switch Input	OFF, ON
PSMRPSH	Passenger Mirror Position Sensor (Left/Right)	#####
PSMRPSV	Passenger Mirror Position	#####
PSPWAMP	Power Window Passenger's Peak Motor Current	#####
PWM_DC1	PWM Duty Cycle #1	%
R_HIGH	Right High Beam Lamp Driver	Off---, Off-B-, On---, On-B-
R_LOW	Right Low Beam Lamp	Off---, Off-B-, On---, On-B-
RADIO_SW	Security Input Switch	OFF, ON

	Status	
RF_TURN	Right Front Turn Lamp	Off---, Off-B-, On---, On-B-
RMRKSTB	Right Front Marker Lamp	Off---, Off-B-, On---, On-B-
STLKOUT	Steering Column Lock Ground Output	OFF, ON
VBAT	Battery Voltage	Volts
WFLUID	Washer Fluid Level	LOW, OK
WPMODE	Wiper Control Mode Select	WASH, OPEN, INVLD, OFF, INTVL1, INTVL2, INTVL3, INTVL4, INTVL5, INTVL6, INTVL7, LOW, HIGH
WPPRKS	Windshield Wiper Park Sense	notPRK, PARKED

FEM Active Command Index

Active Command	Display	Action
BACKLIGHTING INTENSITY CONTROL COMMAND	ILLUM	%
BRAKE SYSTEM CONTROL COMMAND	SHFT LOCK	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
FRONT WINDOW CONTROL	RR UP	OFF, ON
FRONT WINDOW CONTROL	PR DOWN	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	SPEED RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WASH RLY	OFF, ON
FRONT WINDSHIELD WIPER/WASHER	WIPER RLY	OFF, ON
HEAD/CORNERING LAMP CONTROL	HIGH BEAM	OFF, ON
HEAD/CORNERING LAMP CONTROL	LOW BEAM	OFF, ON
INDICATOR LAMP CONTROL	NON MIL	OFF, ON
LAMP CONTROL COMMAND	HDLMPWSH	OFF, ON
POWER MIRROR CONTROL	PR DOWN	OFF, ON
POWER MIRROR CONTROL	PR LEFT	OFF, ON
POWER MIRROR CONTROL	PR RIGHT	OFF, ON
POWER MIRROR CONTROL	PR UP	OFF, ON
STEERING COLUMN CONTROL COMMAND	LOCK_GND	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON
VAPS II OUTPUT PULSE CONTROL	VAPSIIOUT	%

SSP Relay Index

Relay	Fuse	Controlled System(s)
SSP1	BJB Fuse 427 (30A)	<ul style="list-style-type: none"> ● Driver power door lock (FEM) ● LH high beam headlamps (FEM) ● RF park/turn/side marker lamps (FEM)

		<ul style="list-style-type: none"> ● RH low beam headlamp ● Driver exterior rear view mirror ● LF park/turn/side marker lamps (FEM)
SSP2	BJB Fuse 432 (30A)	<ul style="list-style-type: none"> ● LH low beam headlamp (FEM) ● RH high beam headlamps (FEM) ● Passenger exterior rear view mirror (FEM) ● Switch illumination backlighting
SSP3	BJB Fuse 424 (30A)	<ul style="list-style-type: none"> ● High mounted stoplamp (REM) ● RR park/stoplamps (REM) ● Reversing lamps (REM) ● LR turn signals (REM) ● Interior courtesy and demand lighting (FEM)
SSP4	BJB Fuse 423 (30A)	<ul style="list-style-type: none"> ● LR park/stoplamps (REM) ● RR turn signals (REM) ● All passenger door locks (REM) ● License lamps ● Luggage compartment release solenoid/switch ● Fuel door release solenoid/switch ● Luggage compartment lamp

When diagnosing an SSP relay, check that all systems for that relay are inoperative. REFER to [Section 417-01](#).

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● No communication with the front electronic module (FEM) 	<ul style="list-style-type: none"> ● BJB Fuses 425 (40A) and 422 (20A). ● Front electronic module (FEM). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test A.
<ul style="list-style-type: none"> ● The wipers are inoperative 	<ul style="list-style-type: none"> ● Underhood AJB Fuse 120 (30A). ● CJB Fuse 226 (3A). ● Windshield wiper relay. ● Wiper park relay. ● Wiper high/low relay. ● Multifunction switch. ● Circuitry. ● Wiper motor. ● FEM. ● Rain sensor module (If equipped). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test B.
<ul style="list-style-type: none"> ● The wipers stay on continuously 	<ul style="list-style-type: none"> ● Wiper park relay. ● Wiper high/low relay. ● Multifunction switch. ● Circuitry. ● Wiper motor. ● FEM. ● Rain sensor module (If equipped). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test C.
<ul style="list-style-type: none"> ● The high/low wiper speeds do not operate correctly 	<ul style="list-style-type: none"> ● Wiper high/low relay. ● Multifunction switch. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test D.


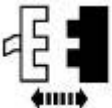
	<ul style="list-style-type: none"> ● FEM. ● Rain sensor module (If equipped). 	
<ul style="list-style-type: none"> ● The wash and wipe function does not operate correctly 	<ul style="list-style-type: none"> ● Multifunction switch. ● Circuitry. ● FEM ● Rain sensor module (If equipped). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test E.
<ul style="list-style-type: none"> ● The washer pump is inoperative/on continuously 	<ul style="list-style-type: none"> ● Underhood AJB Fuse 102 (10A). ● Washer pump relay. ● Circuitry. ● Pump motor. ● FEM. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test F.
<ul style="list-style-type: none"> ● The speed dependent interval mode does not operate correctly 	<ul style="list-style-type: none"> ● Wiper park relay. ● Multifunction switch. ● Circuitry. ● Wiper motor. ● FEM. ● Rain sensor module (If equipped). 	<ul style="list-style-type: none"> ● GO to Pinpoint Test G.
<ul style="list-style-type: none"> ● The low washer fluid indicator does not operate correctly 	<ul style="list-style-type: none"> ● Multifunction switch. ● Circuitry. ● FEM. 	<ul style="list-style-type: none"> ● REFER to Section 413-01.
<ul style="list-style-type: none"> ● The rain moisture sensitive function does not operate correctly 	<ul style="list-style-type: none"> ● CJB Fuse 216 (5A). ● Multifunction switch. ● Circuitry. ● Rain sensor module. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test H.

Pinpoint Tests

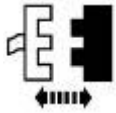


CAUTION: Electronic modules are sensitive to electrical charges. If exposed to these charges, damage may result.

PINPOINT TEST A: NO COMMUNICATION WITH THE FRONT ELECTRONIC MODULE (FEM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK CIRCUITS 29-DK20 (OG/GN) AND 29S-DK22 (OG/YE) FOR VOLTAGE	
NOTE: Cycle ignition switch from OFF to RUN to enable the switched system power feature.	
<p>1</p>  <p>2</p>  <p>FEM C201c</p>	

3

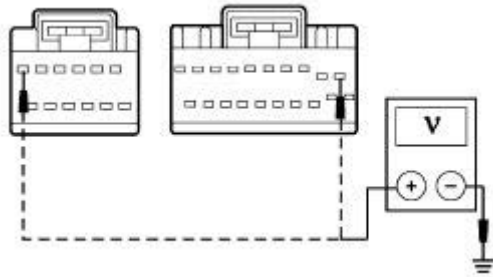


FEM C201f

4



5



A0006297

5

Measure the voltage between FEM C201c pin 6, circuit 29-DK20 (OG/GN), harness side and ground; and between FEM C201f pin 1, circuit 29S-DK22 (OG/YE) harness side and ground.

• Are the voltages greater than 10 volts?

→ **Yes**
GO to A2.

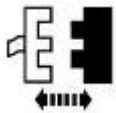
→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

A2 CHECK CIRCUITS 31-DK20 (BK/RD), 31-DK20A (BK/RD), 31-DK20B (BK/RD), 31-DK20C (BK/RD) AND 31-DK20D (BK/RD) FOR OPENS

1



2



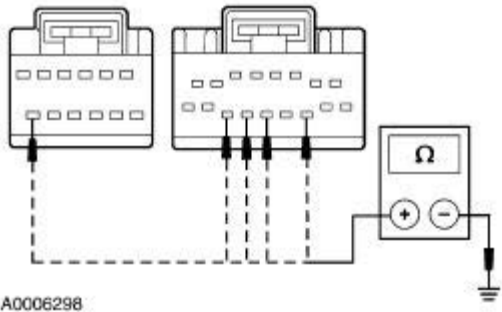
FEM C201a

3

3

Using the following table, measure the resistance between FEM connectors, harness side and ground:

FEM	Pin	Circuit
C201c	12	31-DK20 (BK/RD)
C201a	11	31-DK20A (BK/RD)
C201a	13	31-DK20B (BK/RD)
C201a	14	31-DK20C (BK/RD)



C201a | 15 | 31-DK20D (BK/RD)

- Is the resistance less than 5 ohms?



→ **Yes**

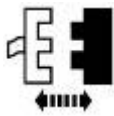
REFER to Section 418-00.

→ **No**

REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST B: THE WIPERS ARE INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK THE FEM PID WPMODE	
<p>1</p> 	<p>2</p> <p>Monitor the FEM PID WPMODE, while activating the multifunction switch to the OFF, Low, High, Pulse, Intermittent, and Positions 1 through 7.</p> <ul style="list-style-type: none"> ● Do the FEM PID WPMODE values agree with the multifunction switch position? <p>→ Yes GO to <u>B10</u>.</p> <p>→ No If equipped with rain sensor module, GO to <u>B2</u>. Otherwise GO to <u>B3</u>.</p>
B2 CHECK THE RAIN SENSOR MODULE	
<p>1</p>  <p>2</p>	



Rain Sensor Module C914 (If equipped)

3



4 Monitor the FEM PID WPMODE, while activating the multifunction switch to the OFF, Low, Medium, High, Pulse, intermittent, and positions 1 through 7.

- Do the wiper FEM PID WPMODE values agree with the multifunction switch?

→ Yes
INSTALL a new rain sensor module. REFER to Module—Rain Sensor in this section. TEST the system for normal operation.

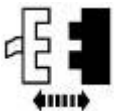
→ No
GO to B3.

B3 CHECK THE MULTIFUNCTION SWITCH OPERATION

1



2



Multifunction Switch C202

3 Carry out the multifunction switch component test. Refer to Wiring Diagrams Section 700–09.

- Is the multifunction switch OK?

→ Yes
GO to B4.

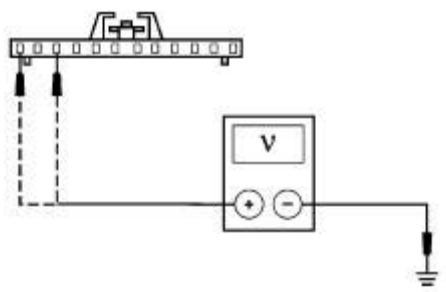
→ No
INSTALL a new multifunction switch. REFER to Section 211-05. TEST the system for normal operation.

B4 CHECK VOLTAGE TO THE MULTIFUNCTION SWITCH

1



2



A0006307

2

Measure the voltage between multifunction switch C202 pin1, circuit (OG/GN) harness side and ground; and between multifunction switch C202 pin 3, circuit (BU/WH), harness side and ground.

• Are the voltages greater than 10 volts?

→ Yes
GO to B5.

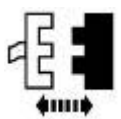
→ No
GO to B8.

B5 CHECK THE MULTIFUNCTION SWITCH FOR SHORT TO POWER

1



2

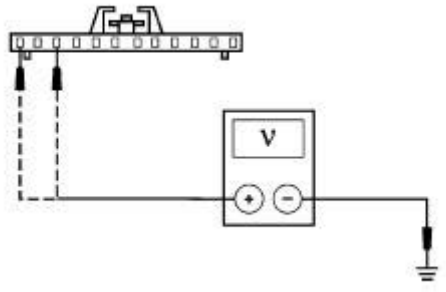


FEM C201f

3



4



A0006307

4

Measure the voltage between multifunction switch C202 pin1, circuit (OG/GN) harness side and ground; and between multifunction switch C202 pin 3, circuit (BU/WH), harness side and ground.

• Are the voltages greater than 10 volts?

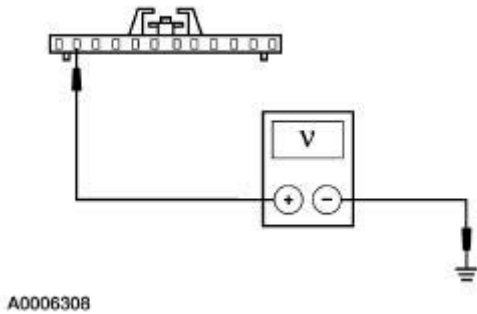
→ **Yes**

REPAIR the circuit(s) in question. TEST the system for normal operation.

→ **No**
GO to B6.

B6 CHECK CIRCUIT 7-KA19 (YE/BK) FOR SHORT TO POWER

1



1 Measure the voltage between multifunction switch C202 pin 2, circuit (BN/WH), harness side and ground.

• **Is the voltage greater than 10 volts?**

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

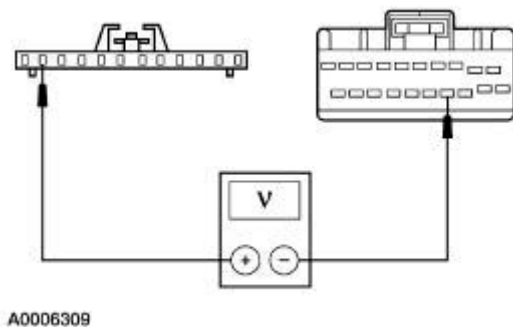
→ **No**
GO to B7.

B7 CHECK CIRCUIT 7-KA19 (YE/BK) AND CIRCUIT 7-KA1 (YE/RD) FOR AN OPEN

1



2



2 Measure the resistance between multifunction switch C202 pin 2, circuit (BN/WH), harness side and FEM C201 pin 14, circuit 7-KA1 (YE/RD), harness side.

• **Is the resistance less than 5 ohms?**

→ **Yes**
INSTALL a new FEM. REFER to Section 419-10. TEST the system for normal operation.

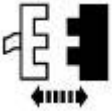
→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

B8 CHECK CIRCUITS 7-KA1 (YE/BK), 8-KA2 (WH/RD) AND 10-KA3 (GY/VT) FOR OPENS

1



2



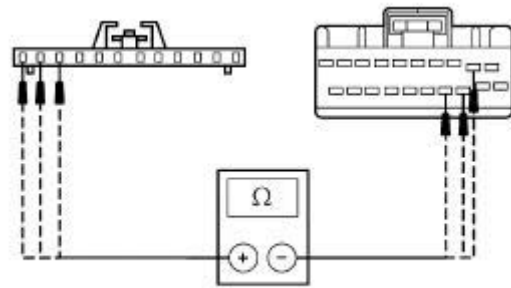
FEM C201f

3



Multifunction Switch C202

4



A0006310

4 Using the following table measure the resistance between multifunction switch C202 harness side and FEM C201f harness side:

Multifunction Switch C202	FEM C201f
pin 1, circuit (OG/GN)	pin 2, circuit 8-KA2 (WH/RD)
pin 2, circuit (BN/WH)	pin 14, circuit 7-KA1 (YE/BK)
pin 3, circuit (BU/WH)	pin 13, circuit 10-KA3 (GY/VT)

● **Is the resistance less than 5 ohms?**

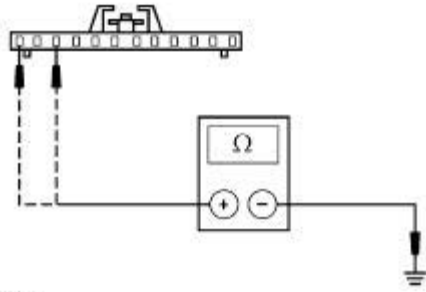
→ **Yes**
GO to B9.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

B9 CHECK WIPER DELAY AND WIPER MODE CIRCUITS FOR SHORTS TO GROUND

1

1 Measure the resistance between multifunction switch C202 pin 1, (OG/GN) harness side and ground; and between multifunction switch C202 pin 3, (BU/WH) harness side and ground.



A0006315

- Is the resistance greater than 10,000 ohms?

→ **Yes**

INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

B10 CHECK CIRCUIT 91S-KA39 (BN/YE) FOR VOLTAGE

1



2

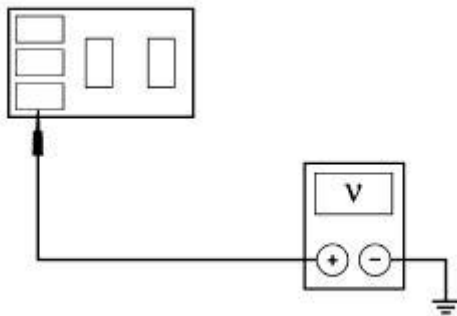


Underhood AJB Wiper Park Relay

3



4



A0003784

- 4 Measure the voltage between wiper park relay C1002 pin 2, Circuit 91S-KA39 (BN/YE), harness side and ground.

- Is the voltage greater than 10 volts?

→ **Yes**

GO to B11.

→ **No**
GO to B12.

B11 CHECK CIRCUIT 91S-KA39 (BN/YE) FOR SHORT TO POWER

1



2

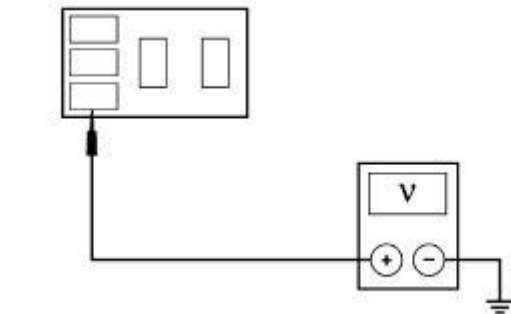


FEM C201b

3



4



A0003784

4 Measure the voltage between wiper park relay C1002 Pin 2, Circuit 91S-KA39 (BN/YE), harness side and ground.

● **Is the voltage greater than 10 volts?**

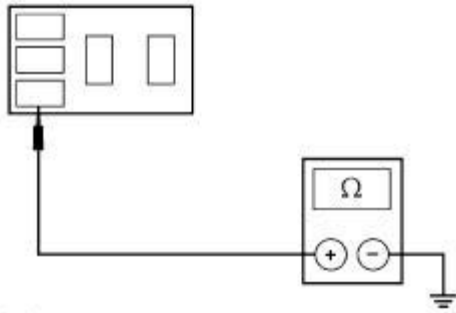
→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
INSTALL a new FEM. REFER to Section 419-10. TEST the system for normal operation.

B12 ACTIVATE WIPER PARK RELAY COMMAND AND TEST FOR GROUNDING FROM FEM

1

1 Trigger the FEM active command WIPER RLY to ON, while measuring the resistance between wiper park relay C1002 Pin 2, Circuit 91S-KA39 (BN/YE), harness side and ground.



A0003785

● Is the resistance less than 5 ohms?

→ **Yes**
GO to B14.

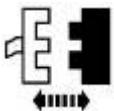
→ **No**
GO to B13.

B13 CHECK CIRCUIT 91S-KA39 (BN/YE) FOR AN OPEN

1

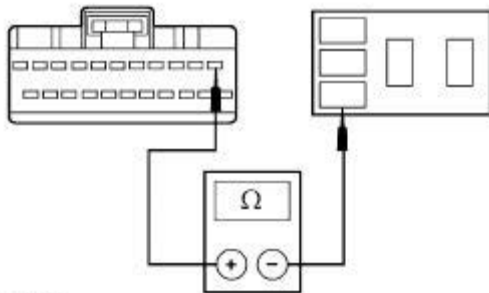


2



FEM C201b

3



A0003786

3 Measure the resistance between wiper park relay C1002 Pin 2, Circuit 91S-KA39 (BN/YE), harness side and FEM C201b Pin 1, Circuit 91S-KA39 (BN/YE), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new FEM. REFER to Section 419-10. TEST the system for normal operation.

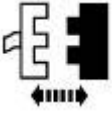
→ **No**
REPAIR the circuit. TEST the system for normal operation.

B14 CHECK UNDERHOOD AJB FUSE 120 (30A) FOR VOLTAGE

1



2

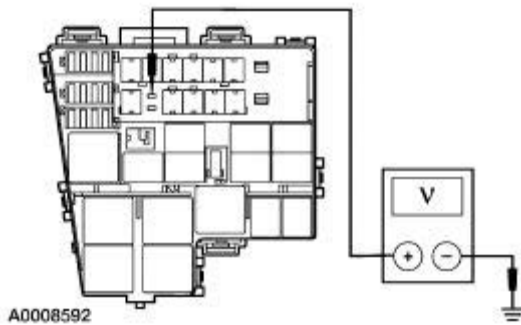


Underhood AJB Fuse 120 (30A)

3



4



4 Measure the voltage between underhood AJB Fuse 120 (30 A) input side and ground.

• Is the voltage greater than 10 volts?

→ **Yes**
GO to B15.

→ **No**
REPAIR the power source. TEST the system for normal operation.

B15 CHECK BETWEEN UNDERHOOD AJB FUSE 120 (30A) AND WIPER PARK RELAY FOR OPENS

1



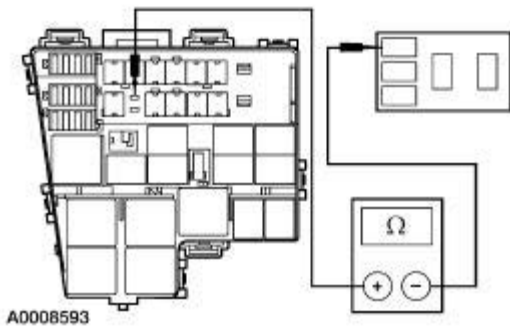
2



Underhood AJB Wiper Park Relay

3

3 Measure the resistance between underhood AJB Fuse 120 (30A), input side, and wiper park relay C1002 Pin 1.



● Is the resistance less than 5 ohms?

→ **Yes**
 INSTALL a new underhood AJB Fuse 120 (30A), GO to B16.

→ **No**
 INSTALL a new underhood AJB. TEST the system for normal operation.

B16 CHECK CIRCUIT 75-KA39 (YE/BK) FOR VOLTAGE

1

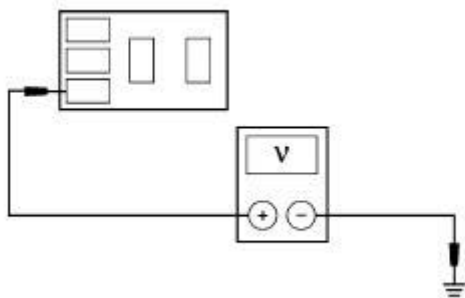


Windshield Wiper Relay C1009

2



3



3 Measure the voltage between windshield wiper relay C1009 pin 2, circuit 75-KA39 (YE/BK) and ground.

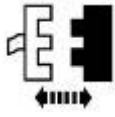
● Is the voltage greater than 10 volts?

→ **Yes**
 GO to B20.

→ **No**
 GO to B17.

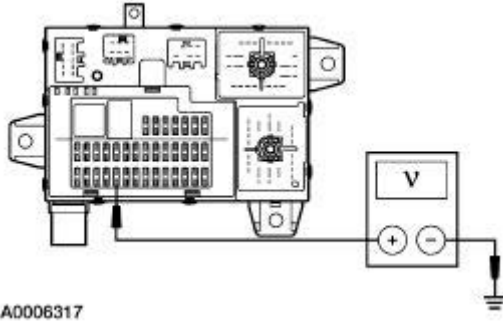
B17 CHECK CIRCUIT 75-DD1 (YE) FOR VOLTAGE

1



CJB Fuse 226 (3A)

2



2

Measure the voltage between CJB fuse 226 (3A) input side and ground.

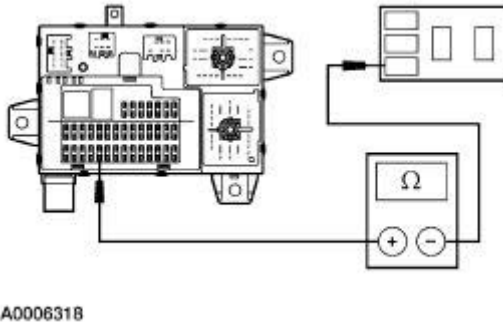
• Is the voltage greater than 10 volts?

→ **Yes**
GO to B18.

→ **No**
GO to B19.

B18 CHECK CIRCUIT 75-KA39 (YE/BK) FOR OPENS

1



1

Measure the resistance between windshield wiper relay C1009 pin 3, circuit 75-KA39 (YE/BK), and CJB fuse 226 (3A), circuit 75-KA39 (YE/BK) output side.

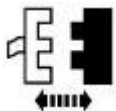
• Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new AJB. TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

B19 CHECK CIRCUIT 75-DD1 (YE) FOR OPENS

1

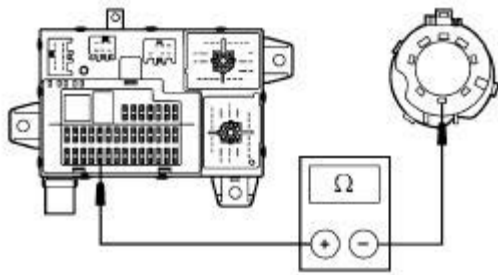


Ignition Switch C250

2

2

Measure the resistance between ignition



A0008595

switch C250 pin 4, circuit 75-DD1 (YE), harness side and CJB fuse 226 (3A), circuit 75-DD1 (YE) input side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new CJB. TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

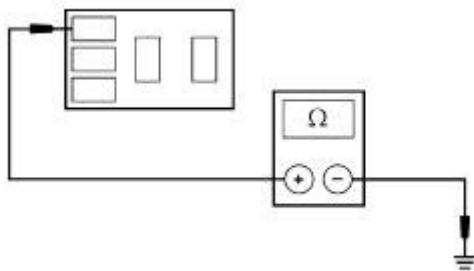
B20 CHECK CIRCUIT 31-KA39 (BK/RD) FOR OPENS

1



Windshield Wiper Relay C1009

2



A0006326

2 Measure the resistance between windshield wiper relay C1009 pin 1, circuit 31-KA39 (BK/RD), harness side and ground.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to B21.

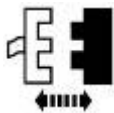
→ **No**
REPAIR the circuit. TEST the system for normal operation.

B21 CHECK WIPER PARK AND WIPER HIGH/LOW RELAYS

1



2



Underhood AJB Wiper High/Low Relay C1001

3 Carry out the wiper park and wiper high/low relay component tests. Refer to the Wiring Diagrams Section 700–09.

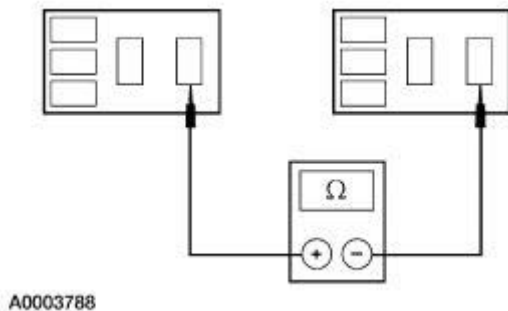
- Are the wiper park and wiper high/low relays OK?

→ **Yes**
GO to B22.

→ **No**
INSTALL a new relay(s) as necessary.
TEST the system for normal operation.

B22 CHECK CIRCUIT 75S-KA12 (YE/VT) FOR OPENS

1



1 Measure the resistance between wiper park relay C1002 pin 3, circuit 75S-KA12 (YE/VT), harness side and wiper high/low relay C1001 pin 3, circuit 75S-KA12 (YE/VT), harness side.

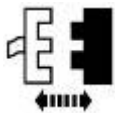
- Is the resistance less than 5 ohms?

→ **Yes**
GO to B23.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

B23 CHECK AJB FOR OPENS

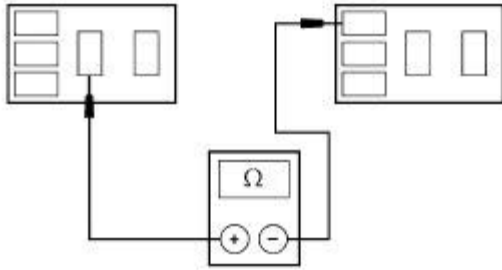
1



Wiper Run/Park Relay C1002

2

2 Measure the resistance between wiper run/park relay C1002 pin 1, harness side and wiper run/park relay C1002 pin 5, harness side



A0006320

● Is the resistance less than 5 ohms?

→ **Yes**
GO to B24.

→ **No**
INSTALL a new AJB. TEST the system for normal operation.

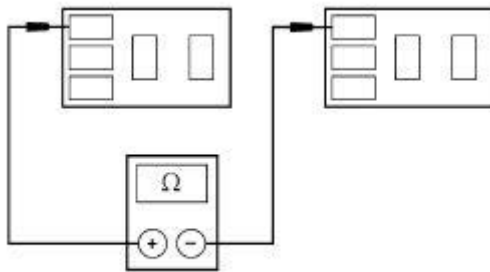
B24 CHECK AJB BETWEEN WIPER PARK AND WIPER HIGH/LOW RELAYS FOR OPENS

1



Wiper Run/Park Relay C1002

2



A0006321

2 Measure the resistance between wiper run/park relay C1002 pin 1, harness side and wiper high/low relay C1001 pin 1, harness side

● Is the resistance less than 5 ohms?

→ **Yes**
GO to B25.

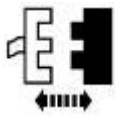
→ **No**
INSTALL a new AJB. TEST the system for normal operation.

B25 CHECK CIRCUIT 31S-KA12 (BK/WH) FOR VOLTAGE

1



2

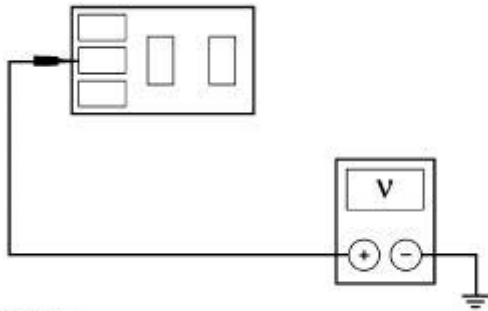


Wiper Motor C125

3



4



A0003790

4 Measure the voltage between wiper park relay C1002 Pin 4, Circuit 31S-KA12 (BK/WH), harness side and ground.

• Is the voltage greater than 10 volts?

→ Yes
GO to B26.

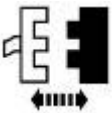
→ No
GO to B27.

B26 CHECK CIRCUITS 31S-KA12 (BK/WH), 31S-KA1 (BK/YE), AND 31S-KA8 (BK/BU) FOR SHORTS TO POWER

1



2



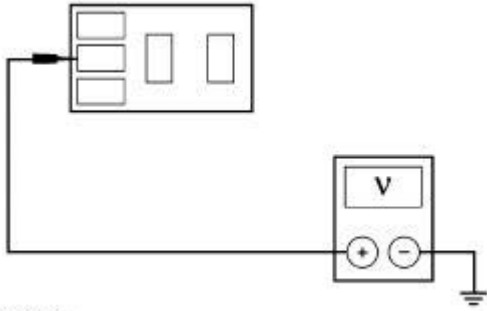
FEM C201b

3



4

4 Measure the voltage between wiper park relay C1002 Pin 4, Circuit 31S-KA12 (BK/WH), harness side and ground.



A0003790

● Is the voltage greater than 10 volts?

→ **Yes**
REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

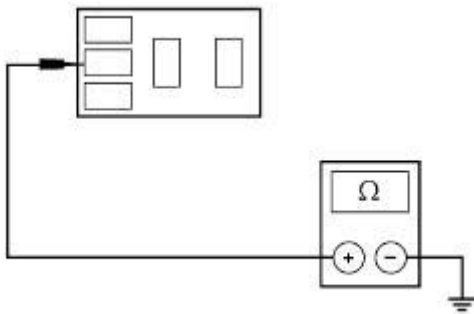
→ **No**
INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

B27 CHECK CIRCUIT 31S-KA12 (BK/WH) FOR CONTINUITY

1



2



A0003791

2 Measure the resistance between wiper park relay C1002 Pin 4, Circuit 31S-KA12 (BK/WH), harness side and ground.

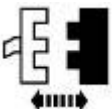
● Is the resistance greater than 10,000 ohms?

→ **Yes**
GO to [B29](#).

→ **No**
GO to [B28](#).

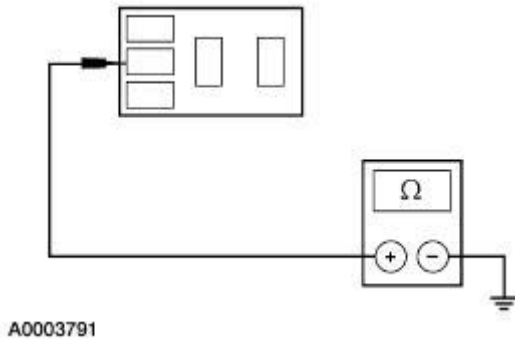
B28 CHECK CIRCUIT 31S-KA12 (BK/WH), 31S-KA1 (BK/YE) AND 31S-KA8 (BK/BU) FOR SHORTS TO GROUND

1



FEM C201b

2



2

Measure the resistance between wiper park relay C1002 Pin 4, Circuit 31S-KA12 (BK/WH), harness side and ground.

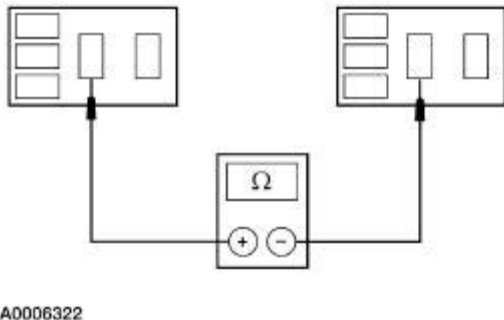
● Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
REPAIR Circuit 31S-KA12 (BK/WH), Circuit 31S-KA1 (BK/YE) or Circuit 31S-KA8 (BK/BU). CLEAR the DTCs. REPEAT the self-test.

B29 CHECK CIRCUIT 75S-KA2 (YE/RD) BETWEEN WIPER RUN/PARK AND WINDSHIELD WIPER RELAYS FOR OPENS

1



1

Measure the resistance between wiper run/park relay C1002 pin 5, circuit 75S-KA2 (YE/RD) harness side and windshield wiper relay C1009 pin 5, circuit 75S-KA1 (YE/BK) harness side.

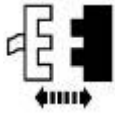
● Is the resistance less than 5 ohms?

→ **Yes**
GO to [B30](#).

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

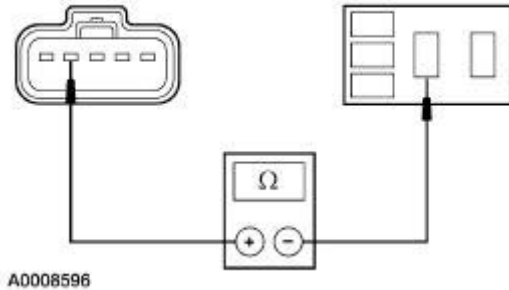
B30 CHECK CIRCUITS 75S-KA2 (YE/RD) AND 30-KA9 (RD/OG) BETWEEN WIPER MOTOR AND WINDSHIELD WIPER RELAYS FOR OPENS

1



Wiper Motor C125

2



2

Measure the resistance between wiper run/park relay C1002 pin 5, circuit 75S-KA2 (YE/RD), harness side and windshield wiper motor C125 pin 4, circuit 30-KA9 (RD/OG), harness side.

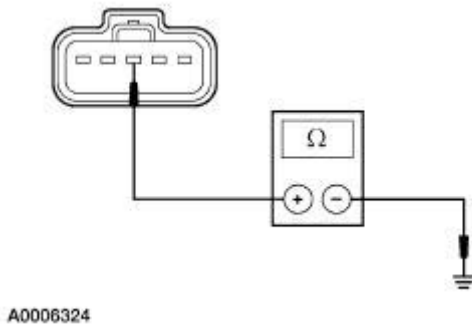
● Is the resistance less than 5 ohms?

→ **Yes**
GO to B31.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

B31 CHECK CIRCUIT 31-KA9 (BK) FOR OPENS

1



1


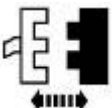
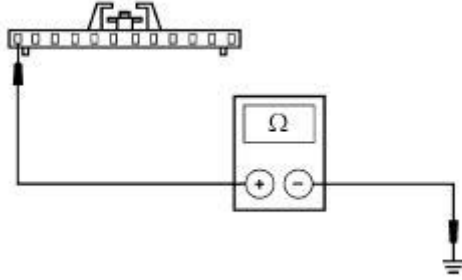
Measure the resistance between wiper motor C125 Pin 3, Circuit 31-KA9 (BK), harness side and ground.

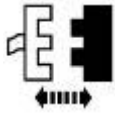
● Is the resistance less than 5 ohms?

→ **Yes**
CHECK the wiper motor; REFER to Component Test in this section. If the wiper motor does not pass the test, INSTALL a new wiper motor, REFER to Windshield Wiper Motor in this section. TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

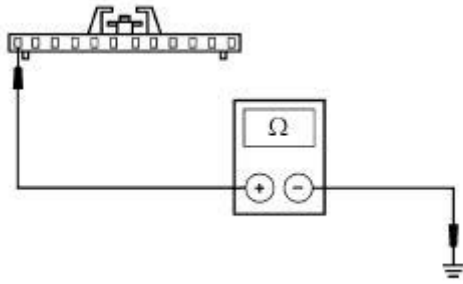
PINPOINT TEST C: THE WIPERS STAY ON CONTINUOUSLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE MULTIFUNCTION SWITCH OPERATION	
<p>1 </p> <p>2 </p> <p>Multifunction Switch C202</p>	<p>3 Carry out the multifunction switch component test. Refer to Wiring Diagrams Section 700-09.</p> <ul style="list-style-type: none"> ● Is the multifunction switch OK? <p>→ Yes GO to <u>C2</u>.</p> <p>→ No INSTALL a new multifunction switch. REFER to <u>Section 211-05</u>. TEST the system for normal operation.</p>
C2 CHECK CIRCUIT 8-KA41 (WH/GN), 8-KA19 (WH/BK) AND 8-KA2 (WH/RD) FOR SHORTS TO GROUND	
<p>1 </p> <p>A0006327</p>	<p>1 Measure the resistance between multifunction switch C202 pin 1, (OG/GN), harness side and ground.</p> <ul style="list-style-type: none"> ● Is the resistance greater than 10,000 ohms? <p>→ Yes GO to <u>C5</u>.</p> <p>→ No If equipped with moisture sensitive wipers GO to <u>C3</u>. All others GO to <u>C4</u>.</p>
C3 CHECK FOR A FAULTY RAIN SENSOR MODULE	
<p>1</p>	



Rain Sensor Module C914

2



A0006327

2

Measure the resistance between multifunction switch C202 pin 1, (OG/GN), harness side and ground.

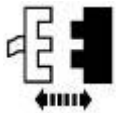
● Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new rain sensor module. REFER to Module—Rain Sensor in this section.

→ **No**
GO to C4.

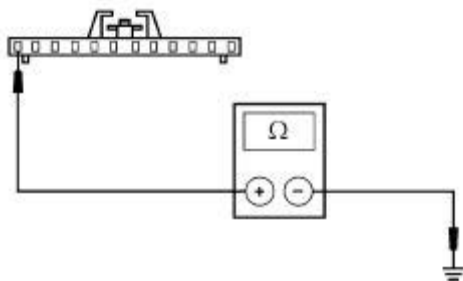
C4 CHECK CIRCUITS 8-KA2 (WH/RD), 8-KA19 (WH/BK) AND 8-KA41 (WH/GN) FOR SHORTS TO GROUND

1



FEM C201f

2



A0006327

2

Measure the resistance between multifunction switch C202 pin 1, (OG/GN), harness side and ground.

● Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new FEM. REFER to Section 419-10. TEST the system for normal operation.

→ **No**
REPAIR circuit(s) in question. TEST the system for normal operation.

C5 CHECK WIPER PARK AND WIPER HIGH/LOW RELAYS

- 1 Remove the AJB wiper park and wiper high/low relays.
- 2 Carry out the relay component test. Refer to Wiring Diagrams Section 700–09.

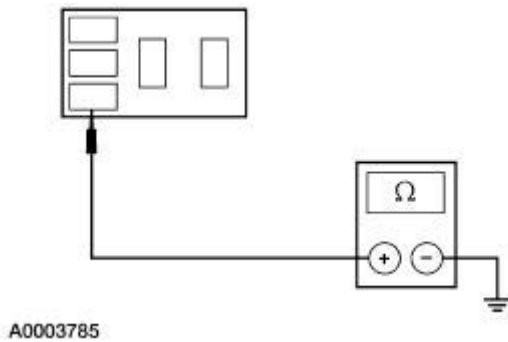
● **Are both relays OK?**

→ **Yes**
GO to C6.

→ **No**
INSTALL a new relay(s). TEST the system for normal operation.

C6 CHECK CIRCUIT 91S-KA39 (BN/YE) FOR CONTINUITY

1



- 1 Measure the resistance between wiper park relay C1002 Pin 2, Circuit 91S-KA39 (BN/YE), harness side and ground.

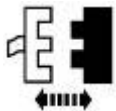
● **Is the resistance greater than 10,000 ohms?**

→ **Yes**
GO to C8.

→ **No**
GO to C7.

C7 CHECK CIRCUIT 91S-KA39 (BN/YE) FOR SHORTS TO GROUND

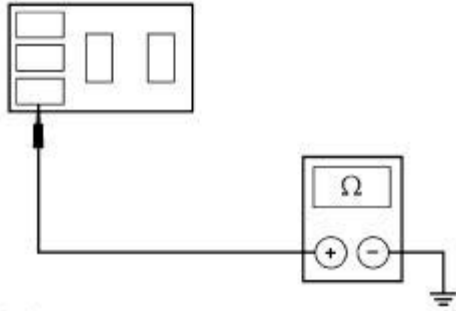
1



FEM C201b

2

- 2 Measure the resistance between wiper park relay C1002 Pin 2, Circuit 91S-KA39 (BN/YE), harness side and ground.



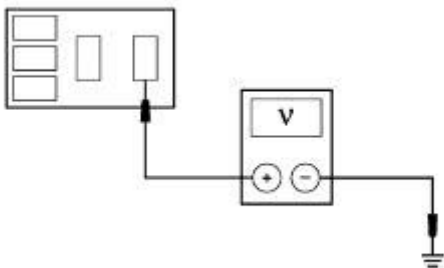
A0003785

- Is the resistance greater than 10,000 ohms?

- **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.
- **No**
REPAIR the circuit. TEST the system for normal operation.

C8 CHECK CIRCUIT 75S-KA12 (YE/VT) FOR SHORTS TO BATTERY

1



A0006325

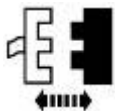
- 1 Measure the voltage between wiper park relay C1002 pin 3, circuit 75S-KA12 (YE/VT) and ground.

- Is the voltage greater than 10 volts?

- **Yes**
REPAIR the circuit. TEST the system for normal operation.
- **No**
GO to [C9](#).

C9 CHECK CIRCUIT 75S-KA11 (YE/BK) AND CIRCUIT 75S-KA10 (YE/GN) FOR SHORT TO BATTERY

1

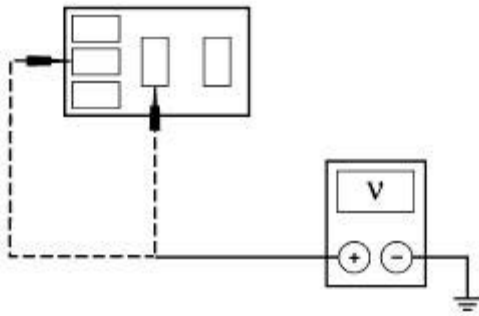


Wiper Motor C125

2



3



A0003793

3

Measure the voltage between wiper high/low relay C1001 pin 4, circuit 75S-KA10 (YE/GN), harness side and ground; and between wiper high/low relay C1001 pin 5, circuit 75S-KA11 (YE/BK), harness side and ground.

● Is the voltage greater than 10 volts?


→ **Yes**

REPAIR circuit(s) in question. TEST the system for normal operation.

→ **No**

INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

PINPOINT TEST D: THE HIGH/LOW WIPER SPEEDS DO NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK THE FEM PID WPMODE	
	<p>1 Monitor the FEM PID WPMODE, while activating the multifunction switch to the high and low positions.</p> <p>● Do the FEM PID WPMODE values agree with the multifunction switch positions?</p> <p>→ Yes GO to D2.</p> <p>→ No GO to D3.</p>
D2 ACTIVATE THE FRONT WINDSHIELD WIPER/WASHER COMMAND	
<p>1</p> 	<p>2 Trigger the FEM active command</p>

SPEED RLY to the LOW and HIGH speeds.

- **Do the wipers work in LOW and HIGH?**

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
GO to [D6](#).

D3 CHECK THE MULTIFUNCTION SWITCH OPERATION

1



2



Multifunction Switch C202

3 Carry out the multifunction switch component test. Refer to Wiring Diagrams Section 700–09.

- **Is the multifunction switch OK?**

→ **Yes**
If equipped with moisture sensitive wipers. GO to [D4](#).

All others GO to [D5](#).

→ **No**
INSTALL a new multifunction switch. REFER to [Section 211-05](#). TEST the system for normal operation.

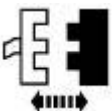
D4 CHECK RAIN SENSOR MODULE

1



Multifunction Switch C202

2



Rain Sensor Module C914

3



4



4

Monitor the FEM PID WPMODE while activating the multifunction switch to the high and low positions.

- Does the FEM PID WPMODES agree with the multifunction switch positions?

→ Yes

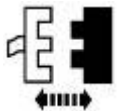
INSTALL a new rain sensor module. REFER to Module—Rain Sensor in this section. TEST the system for normal operation.

→ No

GO to D5.

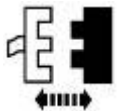
D5 CHECK CIRCUITS 8-KA2 (WH/RD), 8-KA19 (WH/GN) AND 8-KA41 (WH/GN) FOR SHORTS TO GROUND

1



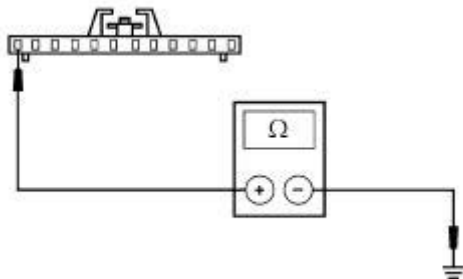
FEM C201f

2



Multifunction Switch C202

3



A0006327

3

Measure the resistance between multifunction switch C202 pin 1, circuit (OG/GN), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ Yes

INSTALL a new FEM. REFER to Section 419-10. TEST the system for normal operation.

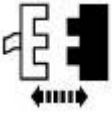
→ **No**
REPAIR circuit(s) in question. TEST the system for normal operation.

D6 CHECK WIPER HIGH/LOW RELAY PIN 2 FOR VOLTAGE

1



2

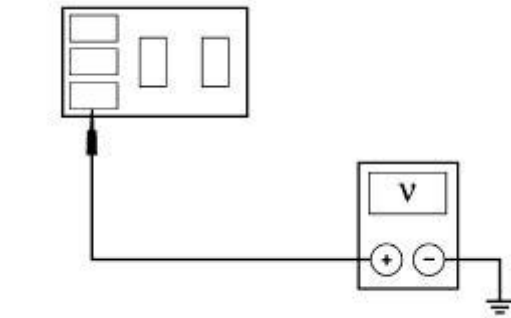


Underhood AJB Wiper HIGH/LOW Relay

3



4



A0003784

4 Measure the voltage between wiper high/low relay C1001 pin 2, circuit 91S-KA16 (BN/GN), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
GO to D7.

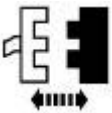
→ **No**
GO to D8.

D7 CHECK CIRCUIT 91S-KA16 (BN/GR) FOR SHORTS TO POWER

1



2

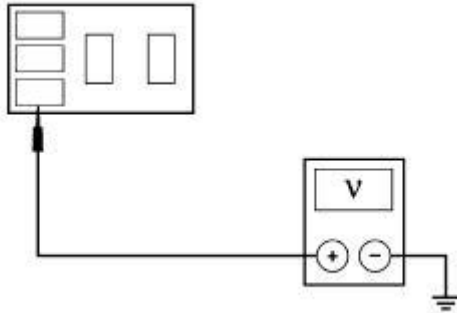


FEM C201b

3



4



A0003784

- 4 Measure the voltage between wiper high/low relay C1001 pin 2, circuit 91S-KA16 (BN/GN), harness side and ground.

● Is the voltage greater than 10 volts?

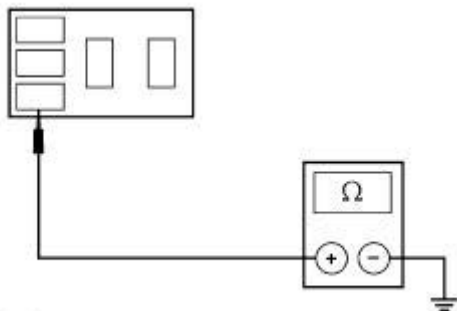
- **Yes**
REPAIR the circuit. TEST the system for normal operation.
- **No**
INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

D8 CHECK WIPER HIGH/LOW RELAY PIN 2 FOR CONTINUITY TO GROUND

1



2



A0003785

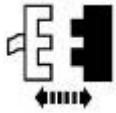
- 2 Measure the resistance between wiper high/low relay C1001 pin 2, circuit 91S-KA16 (BN/GN), harness side and ground.

● Is the resistance greater than 10,000 ohms?

- **Yes**
GO to [D10](#).
- **No**
GO to [D9](#).

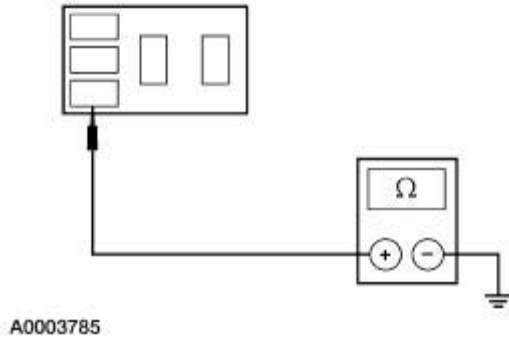
D9 CHECK CIRCUIT 91S-KA16 (BN/GN) FOR SHORTS TO GROUND

1



FEM C201b

2



2

Measure the resistance between wiper high/low relay C1001 pin 2, circuit 91S-KA16 (BN/GN), harness side and ground.

● Is the resistance greater than 10,000 ohms?

→ Yes

INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ No

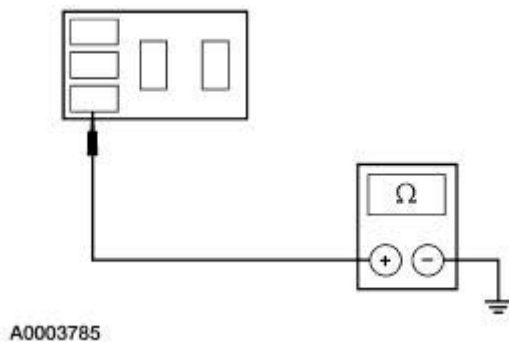
REPAIR the circuit. TEST the system for normal operation.

D10 ACTIVATE WIPER HIGH/LOW RELAY

1



2



2

Trigger the FEM active command SPEED RLY to ON, while measuring the resistance between wiper high/low relay C1001 Pin 2, Circuit 91S-KA16 (BN/GN) and ground.

● Is the resistance less than 5 ohms?

→ Yes

GO to [D11](#).

→ No

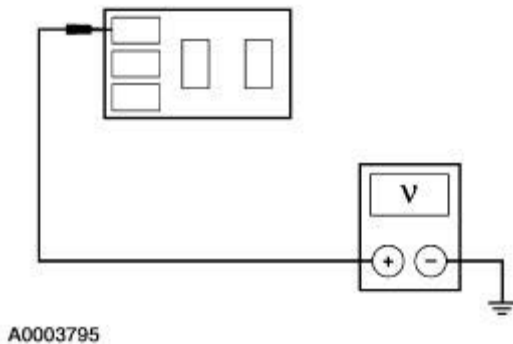
GO to [D14](#).

D11 CHECK UNDERHOOD AJB WIPER HIGH/LOW RELAY

- 1 Carry out the wiper high/low relay component test. Refer to Wiring Diagrams Section 700–09.
- Is the wiper high/low relay OK?
- **Yes**
GO to D12.
- **No**
INSTALL a new wiper high/low relay.
TEST the system for normal operation.

D12 CHECK WIPER HIGH/LOW RELAY PIN 1 FOR VOLTAGE

1



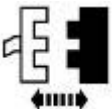
- 1 Measure the voltage between wiper high/low relay C1001 Pin 1, harness side and ground.
- Is the voltage greater than 10 volts?
- **Yes**
GO to D13.
- **No**
INSTALL a new underhood AJB. TEST the system for normal operation.

D13 CHECK CIRCUITS 75S-KA10 (YE/GN) AND 75S-KA11 (YE/BK) FOR OPENS

1



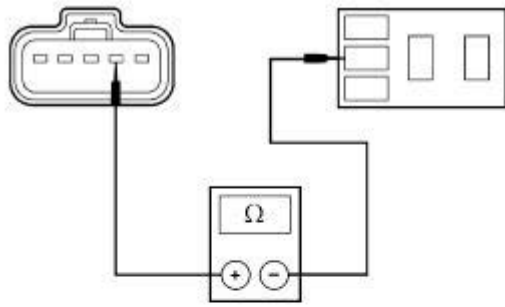
2



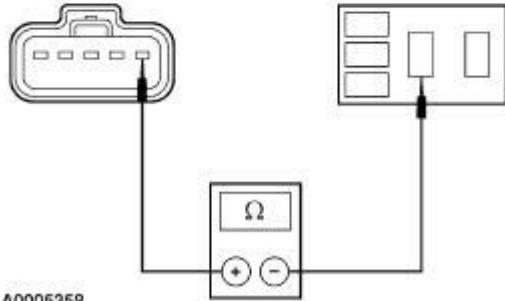
Wiper Motor C125

3

- 3 Measure the resistance between wiper high/low relay C1001 pin 4, circuit 75S-KA10 (YE/GN), harness side and wiper motor C125 pin 4, circuit 75S-KA10 (YE/GN), harness side; and between wiper high/low relay C1001 pin 5, circuit 75S-KA11 (YE/BK), harness side and wiper motor C125 Pin 5, circuit 75S-



A0005358



KA11 (YE/BK), harness side.

- Is the resistance greater than 10,000 ohms?

→ Yes

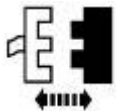
CHECK the wiper motor; REFER to Component Test. If the wiper motor does not pass the test, INSTALL a new wiper motor, REFER to [Windshield Wiper Motor](#) in this section. TEST the system for normal operation.

→ No

REPAIR circuit(s) in question. TEST the system for normal operation.

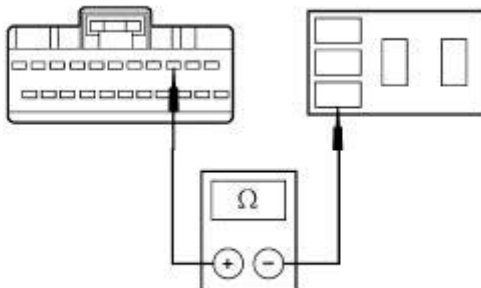
D14 CHECK CIRCUIT 91S-KA16 (BN/GN) FOR OPENS

1



FEM C201b

2





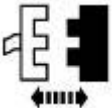
A0003796

2

Measure the resistance between wiper high/low relay C1001 pin 2, circuit 91S-KA16 (BN/GN), harness side and FEM C201b pin 3, circuit 91S-KA16 (BN/GN), harness side.

	<ul style="list-style-type: none"> ● Is the resistance less than 5 ohms? <p>→ Yes INSTALL a new FEM. REFER to Section 419-10. TEST the system for normal operation.</p> <p>→ No REPAIR the circuit. TEST the system for normal operation.</p>
--	--

PINPOINT TEST E: THE WASH AND WIPE FUNCTION DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 MONITOR THE FEM PID WPMODE	
<p>1</p> 	<p>2</p> <p>Monitor the FEM PID WPMODE while activating the wash and wipe functions.</p> <ul style="list-style-type: none"> ● Do the FEM PID WPMODE values agree with the multifunction switch positions? <p>→ Yes GO to E6.</p> <p>→ No If equipped with moisture sensitive wipers GO to E2. All others GO to E3.</p>
E2 CHECK RAIN SENSOR MODULE	
<p>1</p>  <p>2</p>  <p style="text-align: center;">Rain Sensor Module C914</p>	<p>3</p> <p>Monitor the FEM PID WPMODE while activating the wash and wipe functions.</p> <ul style="list-style-type: none"> ● Do the FEM PID WPMODE values

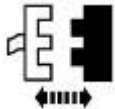
agree with the multifunction switch positions?

→ **Yes**
INSTALL a new rain sensor module.
REFER to Module—Rain Sensor in this section. TEST the system for normal operation.

→ **No**
GO to E3.

E3 CHECK THE MULTIFUNCTION SWITCH OPERATION

1



Multifunction Switch C202

2 Carry out the multifunction switch component test. Refer to Wiring Diagrams Section 700-09.

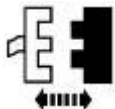
● **Is the multifunction switch OK?**

→ **Yes**
GO to E4.

→ **No**
INSTALL a new multifunction switch.
REFER to Section 211-05. TEST the system for normal operation.

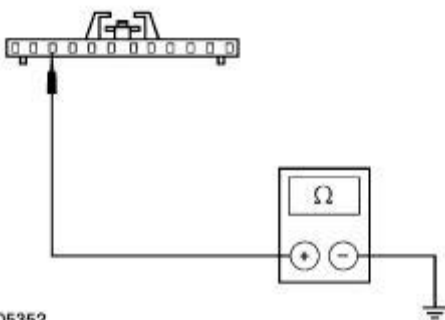
E4 CHECK CIRCUITS 10-KA3 (GY/VT), 10-KA19 (GY/BK) AND 10-KA41 (GY/OG) FOR SHORTS TO GROUND

1



FEM C201f

2



A0005352

2 Measure the resistance between multifunction switch C202 pin 3, circuit (BU/WH), harness side and ground.

● **Is the resistance greater than 10,000 ohms?**

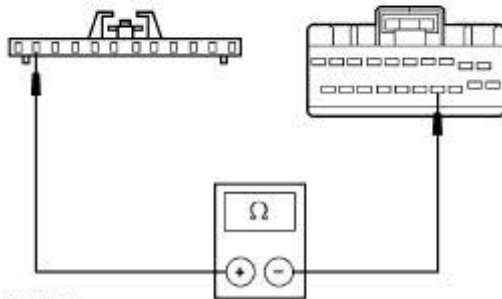
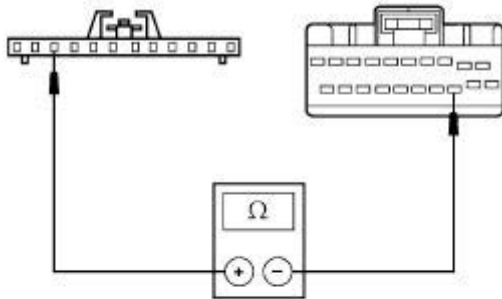
→ **Yes**

GO to E5.

→ **No**
REPAIR circuit(s) in question. TEST the system for normal operation.

E5 CHECK CIRCUITS 10-KA3 (GY/VT), 10-KA19 (GY/BK) AND 10-KA41 (GY/OG) FOR OPENS

1



A0006686

1

Measure the resistance between multifunction switch C202 pin 3, circuit (BU/WH), harness side and FEM C201f pin 13, circuit 10-KA3 (GY/VT); and between multifunction switch C202 pin 2, circuit (BN/WH), harness side and FEM C201f pin 14, circuit 7-KA1 (YE), harness side.

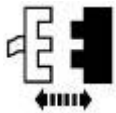
● **Is the resistance less than 5 ohms?**

→ **Yes**
GO to E6.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

E6 CHECK CIRCUITS 31S-KA8 (BK/BU) AND 31S-KA1 (BK/YE) FOR OPENS

1

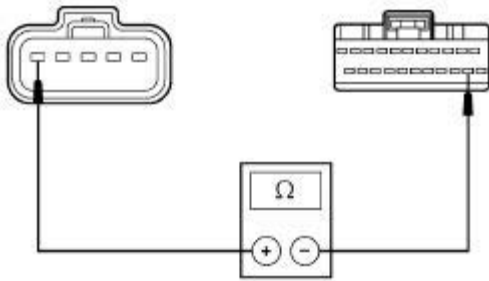


FEM C201b

2

2

Measure the resistance between wiper motor C125 pin 5, circuit 31S-KA1 (BK/YE), and FEM C201b pin 13, circuit 31S-KA8 (BK/BU).



A0008597

- Is the resistance less than 5 ohms?


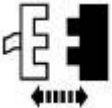

→ **Yes**

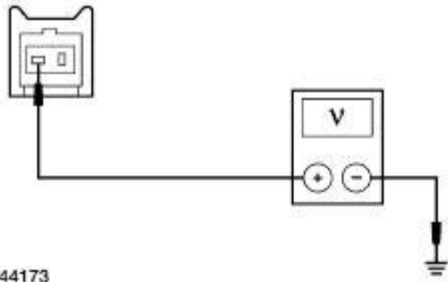
INSTALL a new FEM. REFER to [Section 419-10](#). CLEAR the DTCs. REPEAT the self-test.

→ **No**

REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST F: THE WASH AND WIPE FUNCTION DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK POWER TO THE WASHER PUMP	
<p>1 </p> <p>2  Washer Pump C137</p> <p>3 </p> <p>4</p>	<p>4 Measure the voltage at washer pump C137 pin 2, Circuit 75-KA7 (YE/VT).</p>



A0044173

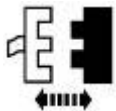
● Is the voltage greater than 10 volts?

→ **Yes**
GO to F2.

→ **No**
REPAIR the power supply circuit(s).
RESTORE the system and TEST the system for correct operation.

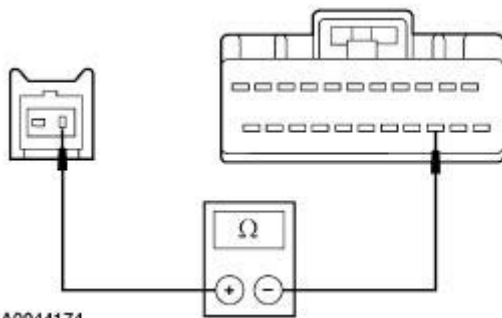
F2 CHECK CIRCUIT 31S-KA7 (BK/WH) FOR AN OPEN

1



FEM C201b

2



A0044174

2 Measure the resistance between washer pump C137 pin 1, Circuit 31S-KA7 (BK/WH) harness side and FEM C201b pin 14, Circuit 31S-KA7 (BK/WH) harness side.

● Is resistance less than 5 ohms?

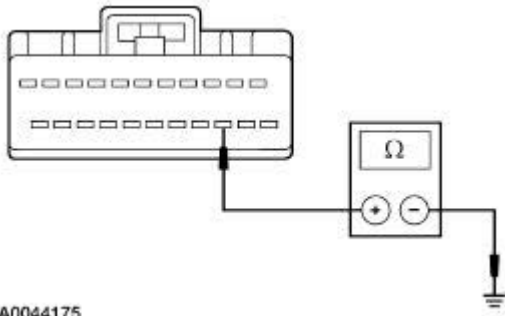
→ **Yes**
GO to F3.

→ **No**
REPAIR circuit 31S-KA7 (BK/WH).
RESTORE the system and TEST for correct operation.

F3 CHECK CIRCUIT 31S-KA7 (BK/WH) FOR A SHORT TO GROUND

1

1 Measure the resistance between FEM C201b pin 14, Circuit 31S-KA7 (BK/WH), harness side and ground.



A0044175

- Is the resistance greater than 10,000 ohms?

- **Yes**
GO to F4.
- **No**
REPAIR circuit 31S-KA7 (BK/WH).
RESTORE the system and TEST the system for normal operation.

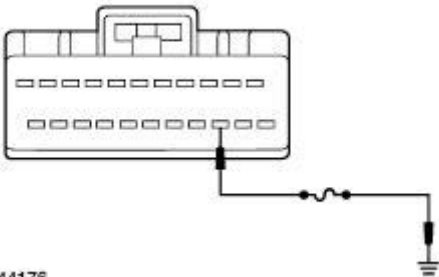
F4 CHECK WASHER PUMP

1



Washer Pump C137

2



A0044176

- 2 Connect a 10A fused jumper wire between FEM C201b pin 1, Circuit 31S-KA7 (BK/WH), harness side and ground.

- Does the washer pump operate?

- **Yes**
GO to F5.
- **No**
INSTALL a new washer pump.
RESTORE the system and TEST the system for normal operation.



F5 CHECK FOR CORRECT MODULE OPERATION

- 1 Connect any disconnected connectors.

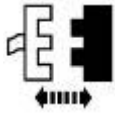
- check for corrosion
- check for pushed-out pins

	<ul style="list-style-type: none"> ■ check that connector seats correctly <p>2 Make sure all other system connectors are fully seated.</p> <p>3 Operate the system and verify the concern is still present.</p> <p>● Is the concern still present?</p> <p>→ Yes INSTALL a new FEM. REFER to <u>Section 419-10</u>. CLEAR the DTCs. REPEAT the self-test.</p> <p>→ No The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.</p>
--	---

PINPOINT TEST G: THE SPEED DEPENDENT INTERVAL MODE DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE FEM PID WPMODE	
<p>1</p> 	<p>2 Monitor the FEM PID WPMODE, while activating the intermittent washers through all speeds (positions) at the multifunction switch.</p> <p>● Do the FEM PID WPMODE values agree with the multifunction switch position?</p> <p>→ Yes GO to <u>G7</u>.</p> <p>→ No If equipped with moisture sensitive wipers. GO to <u>G2</u>. All others GO to <u>G3</u>.</p>
G2 CHECK THE RAIN SENSOR MODULE	
<p>1</p> 	

2



Rain Sensor Module C914

3



4 Monitor the FEM PID WPMODE, while activating the intermittent washers through all speeds (positions) at the multifunction switch.

- Do the FEM PID WPMODE values agree with the multifunction switch position?

→ **Yes**
INSTALL a new rain sensor module. REFER to Module—Rain Sensor in this section. TEST the system for normal operation.

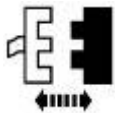
→ **No**
GO to G3.

G3 CHECK THE MULTIFUNCTION SWITCH OPERATION

1



2



Multifunction Switch C202

3



4 Carry out the multifunction switch component test. Refer to the Wiring Diagrams Section 700–09.

- Is the multifunction switch OK?

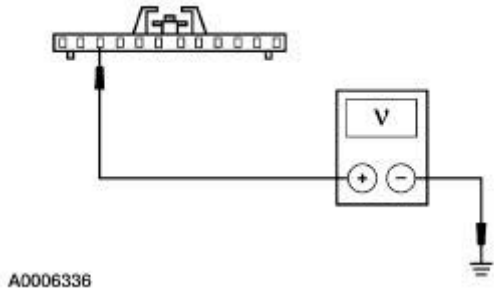
→ **Yes**
GO to G4.

→ **No**
INSTALL a new multifunction switch. REFER to Section 211-05. TEST the

system for normal operation.

G4 CHECK CIRCUITS 10-KA3 (GY/VT), 10-KA19 (GY/BK) AND 10-KA41 (GY/OG) FOR VOLTAGE

1



1

Measure the voltage between multifunction switch C202 pin 3, (BU/WH), harness side and ground.

● Is the voltage greater than 10 volts?

→ Yes
GO to G5.

→ No
GO to G6.

G5 CHECK CIRCUITS 10-KA3 (GY/VT), 10-KA19 (GY/BK) AND 10-KA41 (GY/OG) FOR SHORTS TO POWER

1



2

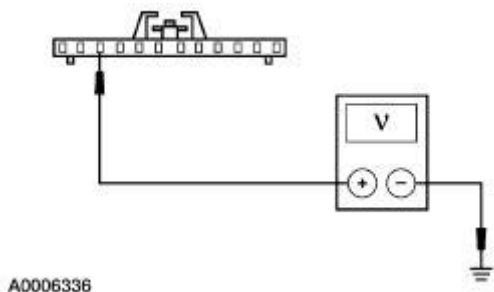


FEM C201f

3



4



4

Measure the voltage between multifunction switch C202 pin 3, circuit (BU/WH), harness side and ground.

● Is the voltage greater than 10 volts?

→ **Yes**
REPAIR the circuit(s) in question. TEST the system for normal operation.

→ **No**
INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

G6 CHECK CIRCUITS 10-KA3 (GY/VT), 10-KA19 (GY/BK) AND 10-KA41 (GY/OG) FOR OPENS

1

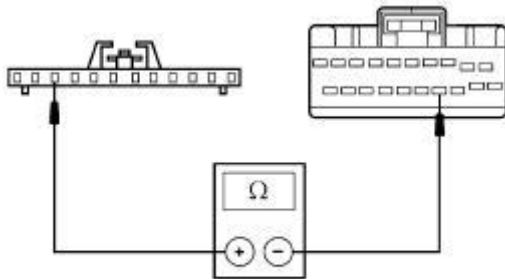


2



FEM C201f

3



A0006680

3 Measure the resistance between multifunction switch pin 3, circuit (BU/WH), harness side and FEM C201f pin 13, circuit 10-KA3 (GY/VT), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

G7 MONITOR THE FEM PID WPPRKS

1



2 Trigger the FEM active command WIPER RLY ON and OFF while monitoring the FEM PID WPPRKS.

● Did the PID change from PARKED to notPRK?

→ **Yes**
INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
GO to [G8](#).

G8 CHECK WIPER PARK RELAY

1 Remove the underhood AJB wiper park relay.

2 Carry out the relay component test. Refer to the Wiring Diagrams Section 700-09.

● **Is the wiper park relay OK?**

→ **Yes**
GO to [G9](#).

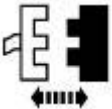
→ **No**
INSTALL a new wiper park relay. TEST the system for normal operation.

G9 CHECK THE WIPER MOTOR

1



2

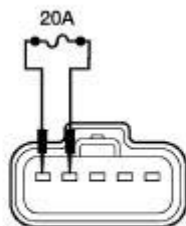


Wiper Motor C125

3



4



A0003780

4 Monitor the FEM PID WPPRKS while connecting a (20 A) fused jumper wire between wiper motor C125 pin 5, circuit 31S-KA1 (BK/YE), harness side and wiper motor C125 pin 4, circuit 75S-KA9 (YE/BU), harness side.

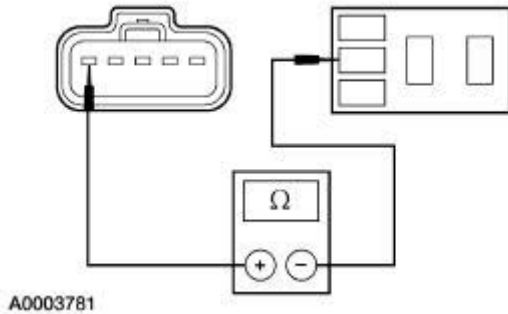
● **Did the PID change from notPRK to PARKED?**

→ **Yes**
INSTALL a new wiper motor. REFER to Windshield Wiper Motor in this section.
TEST the system for normal operation.

→ **No**
GO to G10.

G10 CHECK CIRCUITS 31S-KA1 (BK/YE) AND 31S-KA12 (BK/WH) FOR OPENS

1



1 Measure the resistance between the wiper park relay C1002 Pin 4, Circuit 31S-KA12 (BK/WH), harness side and wiper motor C125 pin 5, circuit 31S-KA1 (BK/YE), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
GO to G11.

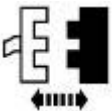
→ **No**
REPAIR the circuit(s) in question. TEST the system for normal operation.

G11 CHECK CIRCUIT 31S-KA8 (BK/BU) FOR OPENS

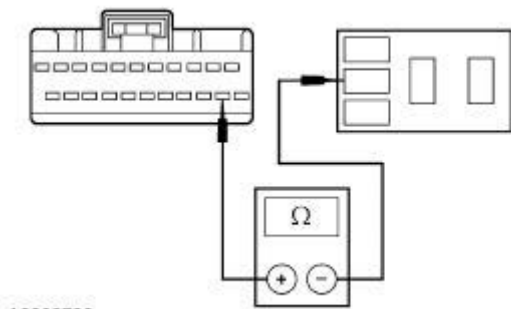
1



2



3



3 Measure the resistance between the wiper park relay C1002 pin 4, circuit 31S-KA12 (BK/WH), harness side and FEM C201b pin 13, circuit 31S-KA8 (BK/BU), harness side.

● Is the resistance less than 5 ohms?

→ **Yes**
 INSTALL a new FEM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ **No**
 REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST H: THE RAIN MOISTURE SENSITIVE FUNCTION DOES NOT OPERATE CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 RETRIEVE THE FEM DIAGNOSTIC TROUBLE CODES	
	<p>1 Using recorded results from the FEM self-test.</p> <ul style="list-style-type: none"> ● Are any DTCs recorded? <p>→ Yes GO to the FEM Diagnostic Trouble Code (DTC) Index.</p> <p>→ No GO to H2.</p>
H2 QUICK VISUAL CHECKS	
	<p>1 Check if the rain sensor module is mounted correctly.</p> <ul style="list-style-type: none"> ■ Interior side of the windshield. ■ Near and behind the mirror. ■ The optical windows must be within the wiper pattern. <p>2 Check if the rain sensor module connector is in place.</p> <p>3 Check if the green slides are fully closed.</p> <p>4 Check presence and proper coupling of silicon pads (About 80% of pad area should form a seal to the glass).</p> <p>5 Check if brackets are in place (not broken off the windscreen).</p> <p>6 Check windscreen, over the optical windows, for cracks, scratches, covered, etc.</p> <p>7 Make sure multifunction switch was set in AUTO, in order for the moisture sensitive wiper function to work.</p>

	<ul style="list-style-type: none"> ● Does everything check out OK? <p>→ Yes GO to <u>H3</u>.</p> <p>→ No REPAIR as necessary. TEST the system for normal operation.</p>
--	---


H3 VERIFY WIPER AUTO FUNCTION

	<p>1 Verify the moisture sensitive wiper system is continuously wiping when the multifunction switch is placed in AUTO.</p> <ul style="list-style-type: none"> ● Do wipers wipe continuously when switch is placed in AUTO? <p>→ Yes GO to <u>H10</u>.</p> <p>→ No GO to <u>H4</u>.</p>
--	--

H4 VERIFY SYMPTOM

	<p>1 Verify if the wipers are totally inoperative or working erratically.</p> <ul style="list-style-type: none"> ● Are the wipers totally inoperative? <p>→ Yes GO to <u>H5</u>.</p> <p>→ No REMOVE rain sensor module, clean the interior windshield glass and RE-INSTALL. For additional information, refer to <u>Module—Rain Sensor</u> in this section. TEST system for normal operation.</p>
--	--

H5 CHECK THE FEM PID WPMODE

<p>1</p> 	<p>2 Monitor the FEM PID WPMODE, while activating the multifunction switch to the AUTO position.</p> <ul style="list-style-type: none"> ● Do the wiper FEM PID WPMODE values agree with the multifunction switch? <p>→ Yes GO to <u>H7</u>.</p> <p>→ No</p>
---	--

GO to H6.

H6 CHECK THE FEM PID WPMODE WHILE SELECTING OTHER POSITIONS WITH THE MULTIFUNCTION SWITCH

1 Monitor the FEM PID WPMODE, while activating the multifunction switch positions 2 through 7.

- Do the wiper FEM PID WPMODE values agree with the multifunction switch?

→ **Yes**
INSTALL a new multifunction switch. REFER to Section 211-05. TEST the system for normal operation.

→ **No**
GO to the Symptom Chart for further diagnosis.

H7 CHECK RAIN SENSOR MODULE CIRCUIT 20-AD15 (PK) FOR VOLTAGE

1

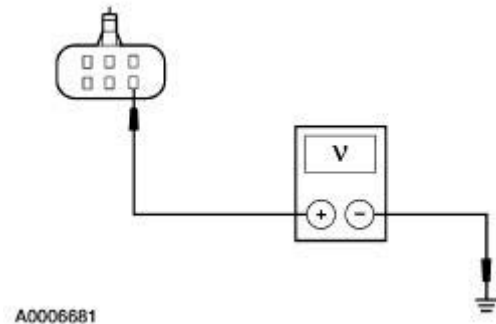


Rain Sensor Module C914

2



3



3 Measure the voltage between the rain sensor module C914 pin 6, circuit 20-AD15 (PK), harness side and ground.

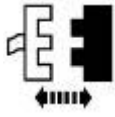
- Is the voltage greater than 10 volts?

→ **Yes**
GO to H9.

→ **No**
GO to H8.

H8 CHECK CJB FUSE 216 (5A) VOLTAGE SUPPLY

1

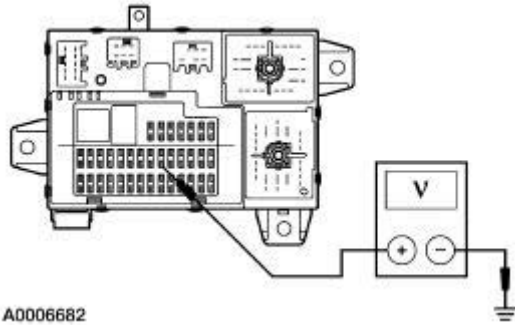


CJB Fuse 216 (5A)

2



3



A0006682

3 Measure the voltage between CJB Fuse 216 (5A) input side and ground.

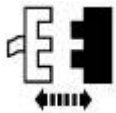
● Is the voltage greater than 10 volts?

→ **Yes**
REPAIR the circuit(s) in question. TEST the system for normal operation.

→ **No**
INSTALL a new CJB power supply. TEST the system for normal operation.

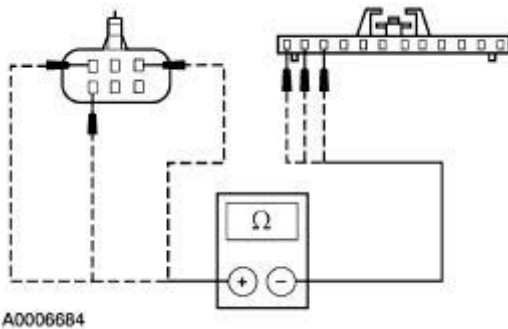
H9 CHECK CIRCUITS 7-KA41 (YE/GN), 8-KA41 (WH/GN) AND 10-KA41 (GY/OG) FOR AN OPEN

1



Multifunction Switch C202

2


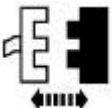


A0006684

2 Using the following table measure the resistance between multifunction switch C202 harness side and rain sensor module C914 harness side:

Multifunction Switch C202	Rain Sensor Module C914
pin 1, circuit (OG/GN)	pin 1, circuit 8-KA41 (WH/GN)
pin 2, circuit (BN/WH)	pin 4, circuit 7-KA41 (YE/GN)
pin 3, circuit (BU/WH)	pin 3, circuit 10-KA41 (GY/OG)

● Is the resistance less than 5 ohms?

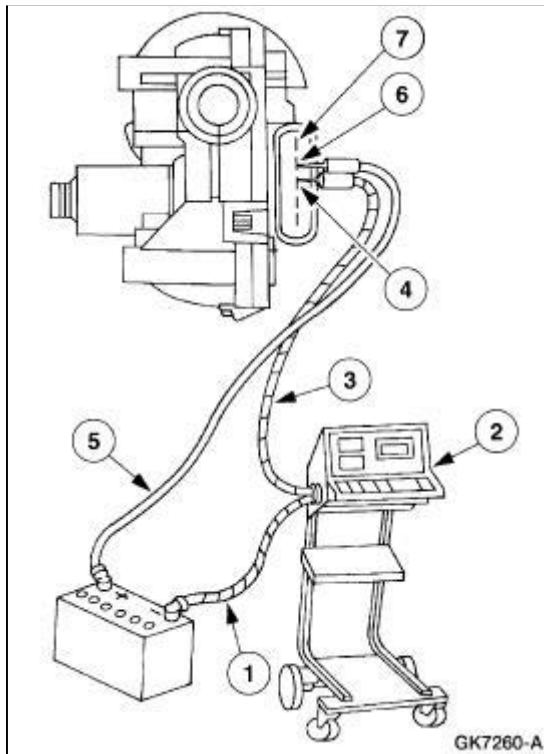
	<p>→ Yes INSTALL a new rain sensor module. For additional information, refer to Module—Rain Sensor in this section .</p> <p>→ No REPAIR the circuit(s) in question. TEST the system for normal operation.</p>
<p>H10 VERIFY CONTINUOUSLY RUNNING WIPERS</p>	
	<p>1 Verify if the moisture sensitive wipers system is continuously wiping in interval #1 speed (longest delay time) or running in a higher speed when in AUTO.</p> <ul style="list-style-type: none"> ● Are wipers running in a higher speed? <p>→ Yes GO to H11 .</p> <p>→ No INSTALL a new rain sensor module. For additional information, refer to Module—Rain Sensor in this section.</p>
<p>H11 CHECK THE RAIN SENSOR MODULE</p>	
<p>1</p>  <p>3</p>  <p>Rain Sensor Module C914</p>	<p>2 Select AUTO with the multifunction switch.</p> <ul style="list-style-type: none"> ● Did the wipers turn off? <p>→ Yes INSTALL a new rain sensor module. REFER to Module—Rain Sensor in this section. TEST the system for normal operation.</p> <p>→ No GO to Pinpoint Test C .</p>

Component Test

Windshield Wiper Motor

⚠ CAUTION: Do not handle the wiper motor abusively when diagnosing the wiper operations. Failure to follow this caution may result in damage to the motor magnets and will make the wiper motor inoperative. Rough handling of new replacement wiper motors may also damage the motor magnets.

Use Alternator, Regulator, Battery and Starter Tester (ARBST) to test the wiper motor on the vehicle.



To test the wiper motor, disconnect the windshield wiper mounting arm and pivot shaft from the windshield wiper motor; refer to [Pivot Arm](#).

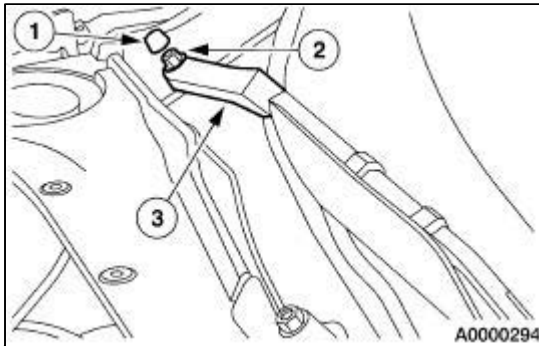
Disconnect the wiper motor. Connect the (1) green lead from (2) (ARBST) to the battery negative (-) post. Connect the (3) red lead from ARBST to the wiper motor (4) common brush terminal (terminal 3).

Test the low speed mode by connecting a (5) cable from the battery positive (+) post to the (6) low speed brush terminal (terminal 4) and measure the current draw. If the current draw is greater than 3.5 amperes, install a new windshield wiper motor.

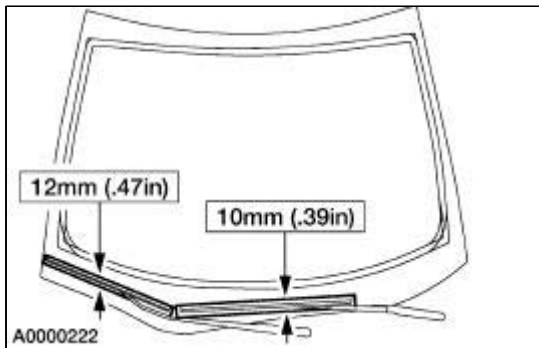
Test the high speed mode by connecting a cable from the battery positive (+) post to the (7) high speed brush terminal (terminal 5) and measure the current draw. If the current draw is greater than 5.5 amperes, install a new wiper motor.

Wiper Blade and Pivot Arm Adjustment

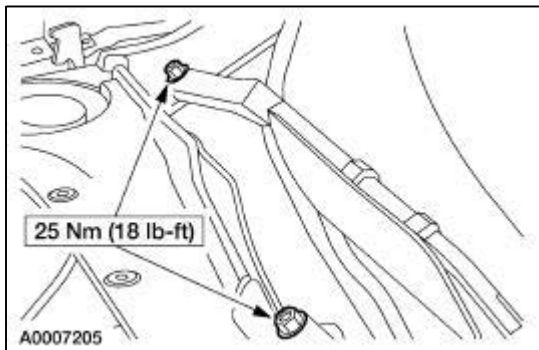
1. Cycle and park the windshield wipers.
2. Remove the pivot arm(s).
 1. Remove the pivot arm nut cover(s).
 2. Remove the nut(s).
 3. Remove the pivot arm(s).



3. Install the wiper blade and pivot arm onto the pivot shaft and align the blade to the silver dots in the windshield.



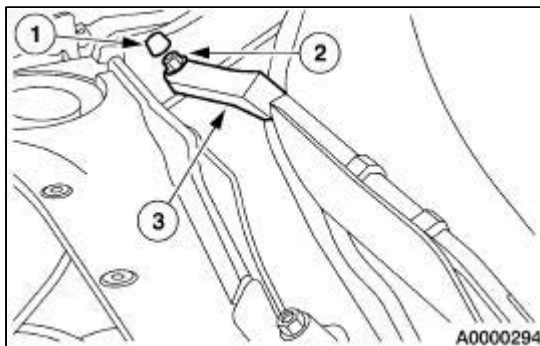
4. Tighten the windshield wiper pivot arm nut(s).
 - Install the pivot arm nut cover(s).



Pivot Arm

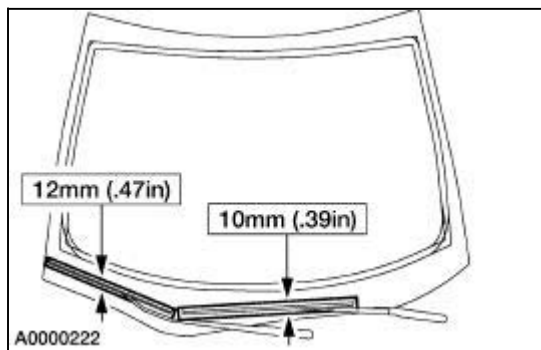
Removal

1. Remove the pivot arm (RH shown, LH similar).
 1. Remove the pivot arm nut cover.
 2. Remove the nut.
 3. Remove the pivot arm.

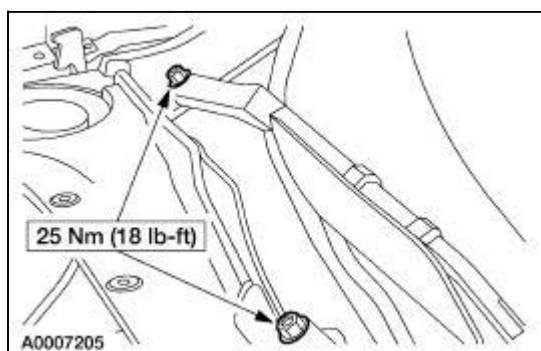


Installation

1. Cycle and park the windshield wipers.
2. Install the wiper blade and pivot arm onto the pivot shaft and align the blade to the silver dots in the windshield.




3. Tighten the windshield pivot arm nuts.
 - Install the pivot arm nut covers.



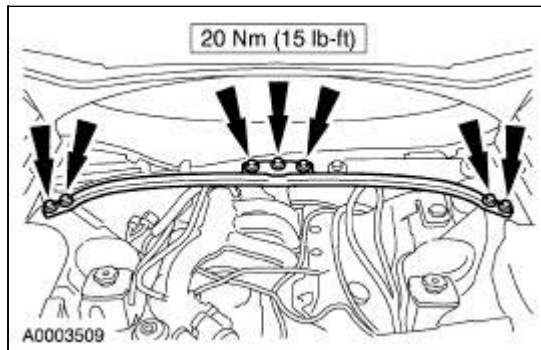
Mounting Arm and Pivot Shaft

Removal and Installation

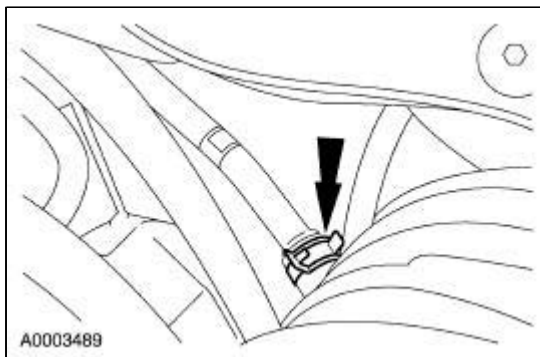
1.  **CAUTION:** The windshield wiper system has an auto park feature. It is necessary to disconnect the battery.

Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).

2. Remove the cowl top vent panels. For additional information, refer to [Section 501-02](#).
3. Remove the bolts and the strut tower support brace.

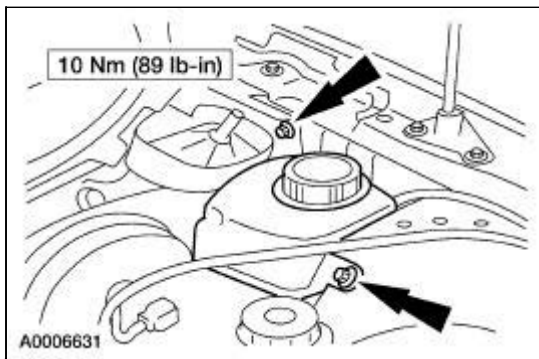


4. Partially drain the engine cooling system. For additional information, refer to [Section 303-03](#).
5. Disconnect the degas return hose from the degas return tube.

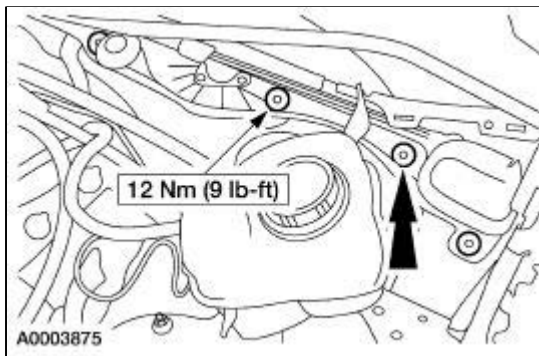


6. **NOTE:** When positioning the degas bottle aside it will be necessary to reroute the degas bottle lower hose in front of the brake booster.

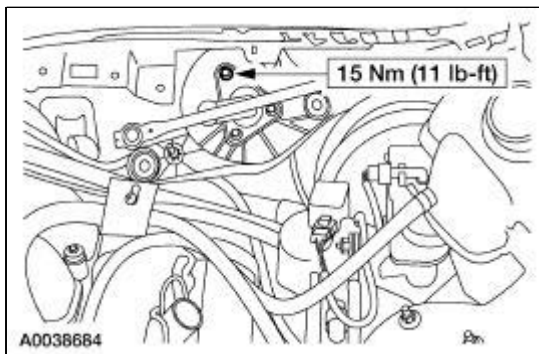
Remove the bolts and position the degas bottle aside.



7. Remove the windshield wiper mounting arm and pivot shaft bolts.



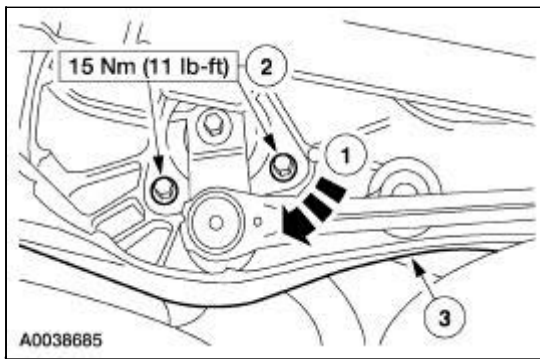
8. Disconnect the drain boot from the windshield wiper mounting arm and pivot shaft assembly.
9. Position the windshield wiper mounting arm and pivot shaft assembly aside, and loosen the upper windshield wiper motor bolt.



10. Remove the windshield wiper mounting arm and pivot shaft assembly.
 1. Rotate wiper output arm to the six o'clock position.
 2. Remove the lower wiper motor bolts.
 3. **NOTE:** It is necessary to rotate the bottom of the windshield wiper mounting arm and pivot shaft assembly upward.

Remove the windshield wiper mounting arm and pivot shaft assembly.

- Disconnect the electrical connector.

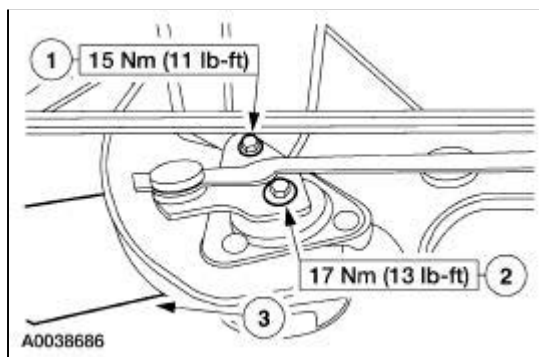


11. To install, reverse the removal procedure.

Windshield Wiper Motor

Removal and Installation

1. Remove the windshield wiper mounting arm and pivot shaft (17566) assembly; refer to Mounting Arm and Pivot Shaft in this section.
2. Remove the windshield wiper motor (17508).
 1. Remove the bolt.
 2. Remove the windshield wiper motor crank bolt.
 3. Remove the windshield wiper motor.



3. To install, reverse the removal procedure.

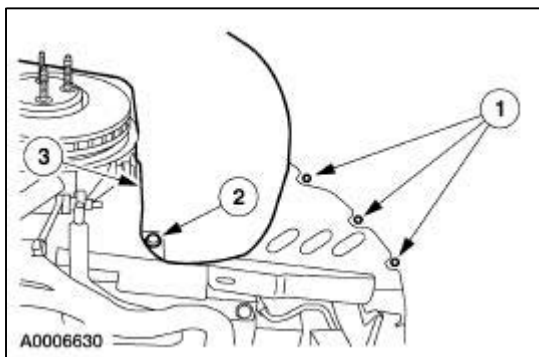
Washer Pump and Reservoir

Removal and Installation

1.  **CAUTION:** Do not make electrical connections prior to filling the windshield washer reservoir. Do not operate the windshield washer pump prior to filling the windshield washer reservoir.

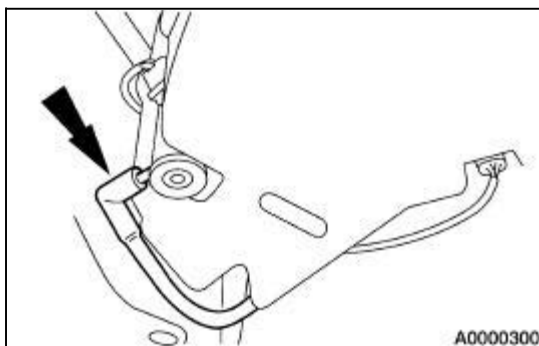
Disconnect the battery ground cable. Refer to [Section 414-01](#).

2. Remove the RF wheel and tire assembly. For additional information, refer to [Section 204-04](#).
3. Position RF fender splash shield aside.
 1. Remove the screws.
 2. Remove the pin-type retainers.
 3. Position the RF splash shield aside.

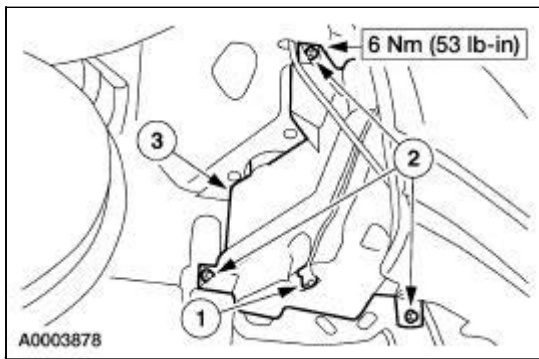


4. **NOTE:** Windshield washer fluid should be collected in a container after the windshield washer hose is disconnected.

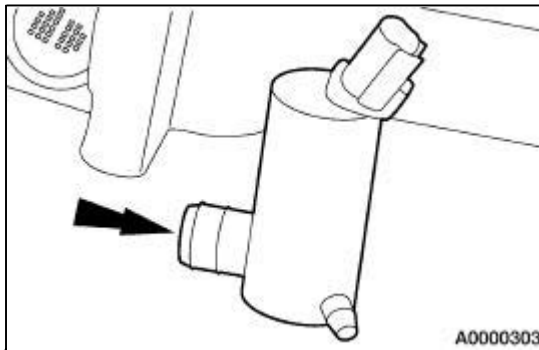
Disconnect the washer hose.



5. Remove the washer fluid reservoir.
 1. Disconnect the two electrical connectors.
 2. Remove the bolts.
 3. Remove the washer reservoir.



6. If necessary remove the windshield washer pump and if equipped remove the headlamp washer pump.



7. To install, reverse the removal procedure.
-

Module —Rain Sensor

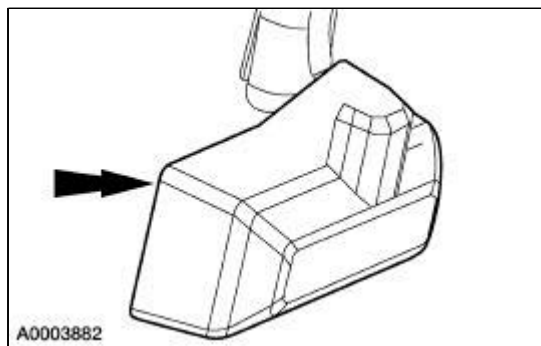
Removal and Installation

1. **NOTE:** To avoid damage to the rain sensor module cover, push up on the cover while rotating the top of the cover toward the rear of the vehicle.

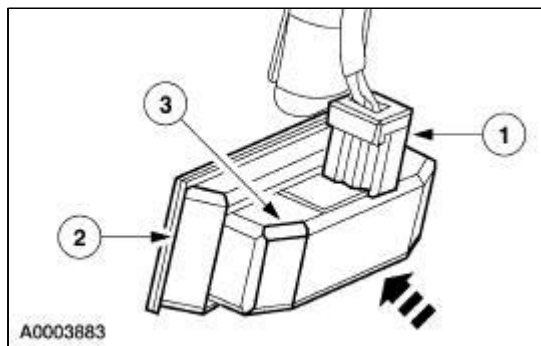
NOTE: Prior to installing the rain sensor module, the windshield glass area between the rain sensor module brackets must be cleaned.

NOTE: When installing the rain sensor module, it is necessary to apply inward pressure on the module prior to locking the rain sensor module retaining slides in place.

Remove the rain sensor module cover (17D550).



2. Remove the rain sensor module 17D547.
 1. Pull the latch on the connector away from the harness and disconnect the electrical connector.
 2. **NOTE:** When removing the rain sensor module, it is necessary to apply inward pressure on the module prior to releasing the rain sensor module retaining slides.
- Release the rain sensor module retaining slides.
3. Remove the rain sensor module.



3. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-in
Roof opening panel assembly bolts	10	89
Roof opening glass assembly screws	4	35
Roof opening panel control module bolts	3	27
Roof opening panel motor assembly bolts	6	53

Roof Opening Panel

The roof opening panel consists of the following components:

- Left sight shield
- Right sight shield
- Water trough
- Roof opening panel opening shield
- Roof opening panel assembly
- Roof opening panel track and rail assembly
- Roof opening panel control module
- Roof opening panel motor assembly
- Roof opening glass assembly
- Roof opening glass seal

The roof opening panel is available as an option. The roof opening panel control module controls the roof opening panel. The roof opening panel may be operated from the roof opening panel switch or the global open and close function.

Roof Opening Panel

Refer to Wiring Diagrams Section 501-17, Roof Opening Panel for schematic and connector information.

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052 or equivalent diagnostic tool

Principles of Operation

Roof Opening Panel Control Module

Battery power is continuously supplied to the roof opening panel control module. However, the roof opening panel will only operate from the roof opening panel switch with the ignition switch in the RUN or ACCY position. The global open and close feature is controlled by two circuits from the rear electronic module (REM). The two circuits must be at ground potential before the roof opening panel control module will acknowledge the roof opening panel switch. When the ignition switch is turned to RUN or ACCY, the REM provides ground to these circuits.

The roof opening panel control module incorporates soft stops at the end of all travel positions. The roof opening panel control module monitors the internal switches to determine the roof opening glass position and the soft stops. The internal switches are activated by the roof opening panel motor rotation.

The roof opening panel control module supplies the power and ground to the roof opening panel motor depending on the ordered function. Power is supplied to the roof opening panel motor for a maximum of 12 seconds. Under normal operation, position is monitored by the roof opening panel control module and power is removed from the roof opening panel motor as soon as the roof opening panel reaches the commanded position.

Roof Opening Panel Switch

Four circuits connect the roof opening panel switch to the roof opening panel control module. One circuit is the common return. The other three are the control circuits open, close and tilt. The roof opening panel control module monitors these lines for voltage fluctuation to determine which function was selected.

With the ignition switch in the RUN or ACCY position, the roof opening panel supplies a five volt

reference voltage to the three control lines. Activation of the roof opening panel switch connects one or more of these lines to the common return which pulls the line low. The roof opening panel control module will sense the line or lines being connected to the common line and carry out the appropriate function.

The express open function connects the open and tilt circuits to the common return when the roof opening panel switch is moved rearward to the second detent position. The operator-controlled open function connects the open circuit to the common return. The close function connects the close circuit to the common causing the roof opening panel to close from a slide or vent position.

Global Open and Close

Two circuits connect the REM to the roof opening panel control module for these functions. Global open and close operation for the roof opening panel is controlled by one of these two circuits being grounded by the REM.

Global open and close operation is only available with the ignition in the OFF position and the ignition key removed.

When the ignition switch is in the RUN or ACCY position, the REM grounds both of these circuits allowing normal operation of the roof opening panel from the roof opening panel switch.

When global open or close operation is selected, the roof opening panel switch is not recognized by the roof opening panel control module throughout the operation and five seconds after the operation is completed.

With the ignition switch in the OFF position, the roof opening panel control module supplies a constant voltage to these two circuits. The roof opening panel control module monitors these lines for a low state, caused by the REM grounding the line, to determine the ordered global function by the REM.

Global open is commanded by the REM grounding control line two. Line one will remain at previous voltage.

Global close is commanded by the REM grounding control line one. Line two will remain at previous voltage.

If both lines have voltage, the roof opening panel will be inoperative.

The global open function is activated by:

- unlocking the driver door using the remote keyless entry transmitter. Within five seconds, press and hold the unlock button.
- unlocking the driver door using the driver door lock cylinder and the key. Hold the key in the unlock position.

The global close function is activated by:

- turning the driver door lock cylinder to the lock position and holding.

Global open and close operates as follows:

- With the roof opening glass in the flush position, activating global open will operate the roof opening glass to the full open position.
- With the roof opening glass in the open position, activating global close will close the roof opening glass to the flush position.
- If a global open is commanded within five seconds of a completed global operation, the roof

opening panel control module will reverse the previous completed global operation. If the roof opening glass was globally closed from the vent position, a global open within five seconds would tilt the roof opening glass back up.

- If the roof opening glass was globally closed from the slide open position, a global open within five seconds would slide the roof opening glass back open.

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Roof opening panel track and rail assembly ● Roof opening glass seal ● Roof opening glass adjustment ● Roof opening panel assembly timing 	<ul style="list-style-type: none"> ● Battery junction box (BJB) Fuse 416 (20A) ● Central junction box (CJB) Mini Fuse 207 (5A) ● Roof opening panel switch ● Roof opening panel motor assembly ● Rear electronics module (REM) ● Roof opening panel control module ● Wiring harness ● Loose or corroded connections

3. If the concern remains after the inspection, connect the diagnostic tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
4. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool manual.
5. Carry out the DATA LINK DIAGNOSTIC TEST. If the diagnostic tool responds with:
 - CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to [Section 418-00](#).
 - NO RESP/NOT EQUIP for REM, go to Pinpoint Test A.
 - SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the REM.
6. If the DTCs retrieved are related to the concern, go to REM Diagnostic Trouble Code (DTC) Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

REM Diagnostic Trouble Code (DTC) Index

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DTC	Description	Source	Action
B1201	Fuel Sender Circuit Failure	REM	REFER to Section 413-01 .
B1300	Power Door Lock Circuit Failure	REM	REFER to Section 501-14B .
B1310	Power Door Unlock Circuit Failure	REM	REFER to Section 501-14B .
B1331	Decklid Ajar Rear Door Circuit Failure	REM	REFER to Section 417-02 .
B1335	Door Ajar RR Circuit Failure	REM	REFER to Section 417-02 .
B1342	ECU Is Defective	REM	CLEAR the DTC. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new REM. REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self test.
B1483	Brake Pedal Input Circuit Failure	REM	REFER to Section 417-01 .
B1499	Lamp Turn Signal Left Circuit Failure	REM	REFER to Section 417-01 .
B1501	Lamp Turn Signal Left Circuit Short to Battery	REM	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	REM	REFER to Section 417-01 .
B1505	Lamp Turn Signal Right Circuit Short to Battery	REM	REFER to Section 417-01 .
B1551	Decklid Release Circuit Failure	REM	REFER to Section 501-14B .
B1571	Door Ajar LR Circuit Failure	REM	REFER to Section 417-02 .
B1676	Battery Pack Voltage Out of Range	REM	REFER to Section 414-00 .
B2172	Inertia Switch Input Circuit Open	REM	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B2174	Window Driver Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2178	Window Driver Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2190	Window Passenger Rear Remote Up Switch Short to Battery	REM	REFER to Section 501-11 .
B2194	Window Passenger Rear Remote Down Switch Short to Battery	REM	REFER to Section 501-11 .
B2477	Module Configuration Failure	REM	REFER to Section 418-01 .
U1041	SCP (J1850) Invalid or Missing Data for Vehicle Speed	ABS	CARRY OUT the Anti-lock Brake Control Module (ABS) self-test. REFER to Section 206-09A , Section 206-09B , or Section 206-09C .
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	PCM	CARRY OUT the Powertrain Control Module (PCM) self-test. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U1218	SCP (J1850) Invalid or Missing Data for External Lamps	ICM	CARRY OUT the Instrument Cluster self-test. REFER to Section 413-01 .

REM Parameter Identification (PID) Index

PID	Description	Expected Value
-----	-------------	----------------

BOO	Brake Switch Input	OFF, ON
DECKLID	Decklid Ajar Switch	CLOSED, AJAR
DL_DSRM	Decklid Disarm	NO, YES
DLIDOUT	Decklid Driver	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
DLIDRLS	Deck Lid Release	OFF, ON
L_TAIL	Left and Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LMRKOUT	Left Marker Lamp Driver Output State	OFF, ON
LMRKSTB	Left Marker Lamp Driver Short To Battery	NO, YES
LR_TURN	Left and Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
LRDN_SW	Left Rear Window Down Switch	OFF, UP
LRDR_SW	Left Rear Door Ajar Switch	CLOSED, AJAR
LRUP_SW	Left Rear Window Up Switch	OFF, DOWN
PD_LOCK	Passenger Door Lock	NO, YES
PD_UNLK	Passenger Door Unlock	NOTLOC, LOCK
R_TAIL	Left and Right Tail Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RR_TURN	Left and Right Rear Turn Lamp	Off---, Off--G, Off-B-, Off-BG, OffO--, OffO-G, OffOB-, OffOBG, On---, On--G, On-B-, On-BG, OnO--, OnO-G, OnOB-, OnOBG
RRDN_SW	Right Rear Window Down Switch	OFF, UP
RRDR_SW	Right Rear Door Ajar Switch	CLOSED, AJAR
RRUP_SW	Right Rear Window Up Switch	OFF, DOWN

REM Active Command Index

Active Command	Display	Action
EXTERIOR LAMP CONTROL	BACKUPLMP	OFF, ON
EXTERIOR LAMP CONTROL	H MNT STP	OFF, ON
EXTERIOR LAMP CONTROL	L STOP	OFF, ON
EXTERIOR LAMP CONTROL	PARKLAMPS	OFF, ON
EXTERIOR LAMP CONTROL	R DEF RLY	OFF, ON

EXTERIOR LAMP CONTROL	R FOG LMP	OFF, ON
EXTERIOR LAMP CONTROL	R STOP	OFF, ON
POWER WINDOW ENABLE COMMAND	PSGR RLY	OFF, ON
REAR DOOR LOCK CONTROL	LR LOCK	OFF, ON
REAR DOOR LOCK CONTROL	LR UNLOCK	OFF, ON
REAR DOOR LOCK CONTROL	RELEASE	OFF, ON
REAR WINDOW CONTROL	LR DOWN	OFF, ON
REAR WINDOW CONTROL	RR DOWN	OFF, ON
TURN SIGNAL AND MARKER LAMPS	HAZARD	OFF, ON

Symptom Chart


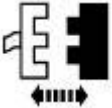
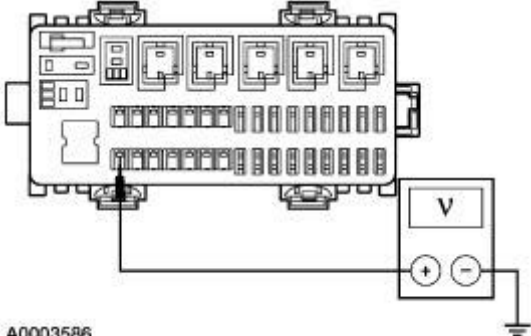
Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the rear electronic module (REM) 	<ul style="list-style-type: none"> BJB Fuse 425 (40A). CJB Mini Fuse 207 (5A). Circuitry. REM. 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> The roof opening panel leaks 	<ul style="list-style-type: none"> Incorrect adjustment. Roof opening panel frame drain hoses. Roof opening glass seal. 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
<ul style="list-style-type: none"> The roof opening panel is noisy during operation 	<ul style="list-style-type: none"> Roof opening glass assembly. Roof opening panel assembly. Roof opening panel motor assembly. 	<ul style="list-style-type: none"> GO to Pinpoint Test C.
<ul style="list-style-type: none"> The roof opening panel does not open or close 	<ul style="list-style-type: none"> BJB Fuse 416 (20A). Roof opening panel assembly. Roof opening panel control module. Roof opening panel motor assembly. REM. Roof opening panel switch. Circuitry. 	<ul style="list-style-type: none"> GO to Pinpoint Test D.
<ul style="list-style-type: none"> The roof opening panel does not open or close in vent position 	<ul style="list-style-type: none"> Roof opening panel control module. Roof opening panel switch. Circuitry. 	<ul style="list-style-type: none"> GO to Pinpoint Test E.
<ul style="list-style-type: none"> The roof opening panel does not stop in flush from any position 	<ul style="list-style-type: none"> Roof opening panel adjustment. Roof opening glass seal. Roof opening panel 	<ul style="list-style-type: none"> GO to Pinpoint Test F.

	control module.	
<ul style="list-style-type: none"> ● The express open is inoperative 	<ul style="list-style-type: none"> ● Roof opening panel control module. ● Roof opening panel switch. ● Circuitry. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test G.
<ul style="list-style-type: none"> ● The roof opening panel has excessive wind noise 	<ul style="list-style-type: none"> ● Incorrect adjustment. ● Roof opening glass seal. 	<ul style="list-style-type: none"> ● GO to Pinpoint Test H.

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE REAR ELECTRONIC MODULE (REM)

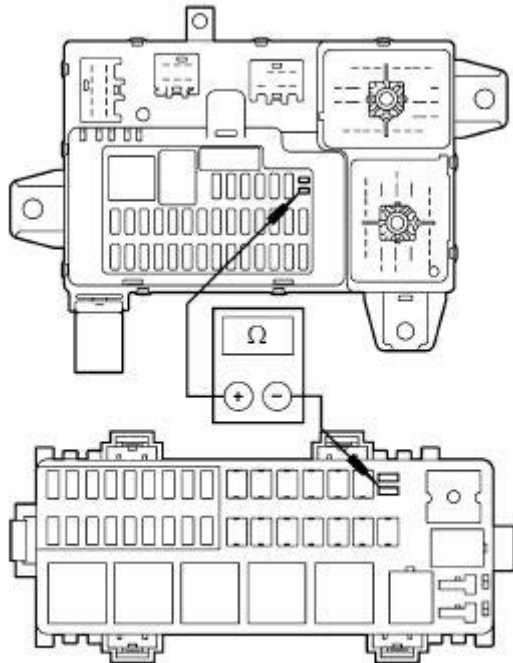
CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK BJB FUSE 425 (40A) FOR POWER	
<p>1</p>  <p>2</p>  <p>BJB Fuse 425 (40A)</p> <p>3</p>  <p>A0003586</p>	<p>3</p> <p>Measure the voltage between BJB Fuse 425 (40A) pin 1, and ground.</p> <ul style="list-style-type: none"> ● Is the voltage greater than 10 volts? <p>→ Yes GO to A2.</p> <p>→ No REPAIR the power supply to BJB Fuse 425 (40A). TEST the system for normal operation.</p>
A2 CHECK CIRCUIT 30-DD1 (RD/YE) FOR AN OPEN	

1



CJB Mini Fuse 207 (5A)

2



A0003615

2

Measure the resistance between BJB Fuse 425 (40A) pin 2, circuit 30-DD1 (RD/YE), and CJB Mini Fuse 207 (5A) pin 1, circuit 30-DD1 (RD/YE).

● Is the resistance less than 5 ohms?

→ Yes

REFER to [Section 418-00](#). TEST the system for normal operation.

→ No

REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST B: THE ROOF OPENING PANEL LEAKS

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK THE ROOF OPENING PANEL OPERATION	
	<p>1 Cycle the roof opening glass from the full-open position to the full-closed position.</p> <p>● Does the roof opening glass operate smoothly and close tightly?</p> <p>→ Yes GO to B2.</p> <p>→ No</p>

	CHECK the roof opening glass adjustment. REFER to Height Adjustment . If the roof opening glass closes unevenly, CHECK the roof opening panel timing. REFER to Timing Adjustment . TEST the system for normal operation.
B2 CHECK THE ROOF OPENING PANEL FRAME DRAIN TUBES	
	<p>1 Gain access to the roof opening panel frame drain tubes.</p> <ul style="list-style-type: none"> ● Is there blockage or damage to the roof opening panel frame drain tubes? <p>→ Yes CLEAR the blockage or if necessary, INSTALL a new drain tube. TEST the system for normal operation.</p> <p>→ No GO to B3 .</p>
B3 CHECK THE ROOF OPENING GLASS SEAL	
	<p>1 Actuate the roof opening glass to the full-open position.</p> <ul style="list-style-type: none"> ● Is the roof opening glass seal damaged? <p>→ Yes INSTALL a new roof opening glass seal. REFER to Glass—Roof Opening Assembly . TEST the system for normal operation.</p> <p>→ No REPAIR as necessary. TEST the system for normal operation.</p>

PINPOINT TEST C: THE ROOF OPENING PANEL IS NOISY DURING OPERATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK THE OPERATION OF THE ROOF OPENING GLASS	
	<p>1 Cycle the roof opening glass from the full-open to the full-closed position.</p> <ul style="list-style-type: none"> ● Is the roof opening glass loose? <p>→ Yes ADJUST the roof opening glass. REFER to Height Adjustment . TEST the system for normal operation.</p> <p>→ No GO to C2 .</p>
C2 CHECK FOR OBSTRUCTIONS	
	<p>1 Check the roof opening panel track and rail assembly for foreign material, damage or looseness.</p> <ul style="list-style-type: none"> ● Is the roof opening panel obstructed or damaged? <p>→ Yes</p>

REMOVE the obstruction. If necessary, INSTALL a new roof opening panel track and rail assembly. REFER to Panel—Roof Opening Assembly. TEST the system for normal operation.

→ **No**
GO to C3.

C3 CHECK THE ROOF OPENING PANEL MOTOR

1 Cycle the roof opening glass from the full-open to the full-closed position.

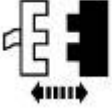
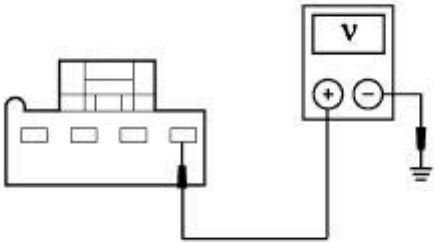
● **Does the roof opening panel motor make excessive noise?**

→ **Yes**
CHECK the roof opening panel motor for the correct mounting. If necessary, INSTALL a new roof opening panel motor assembly. REFER to Motor—Roof Opening Panel Assembly. TEST the system for normal operation.

If the roof opening panel opens or closes unevenly, ADJUST the roof opening panel timing. REFER to Timing Adjustment. TEST the system for normal operation.

→ **No**
CHECK the flushness. REFER to Height Adjustment. ADJUST the roof opening panel glass as necessary. TEST the system for normal operation.

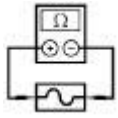
PINPOINT TEST D: THE ROOF OPENING PANEL DOES NOT OPEN OR CLOSE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK THE POWER SUPPLY TO THE ROOF OPENING PANEL CONTROL MODULE	
<p>1</p>  <p>Roof Opening Panel Module C921b</p> <p>2</p>  <p>A0001447</p>	<p>2 Measure the voltage between roof opening panel control module C921b pin 1, circuit 30-AG12 (RD), harness side and ground.</p> <p>● Is the voltage between 9 and 16 volts?</p> <p>→ Yes GO to <u>D4</u>.</p>

→ **No**
GO to D2.

D2 CHECK CIRCUIT 30-AG12 (RD) FOR AN OPEN

1



BJB Fuse 416 (20A)

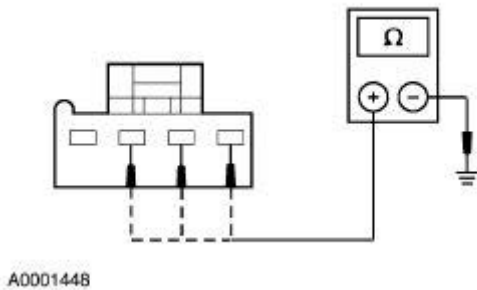
● **Is BJB Fuse 416 (20A) OK?**

→ **Yes**
REPAIR the circuit. TEST the system for normal operation.

→ **No**
GO to D3.

D3 CHECK CIRCUITS 30-AG12 (RD), 32-AG6 (WH) AND 33-AG6 (YE) FOR A SHORT TO GROUND

1



1 Using the following table, measure the resistance between roof opening panel control module C921b pins, harness side and ground:

Pin	Circuit
1	30-AG12 (RD)
2	33-AG6 (YE)
3	32-AG6 (WH)

● **Are the resistances greater than 10,000 ohms?**

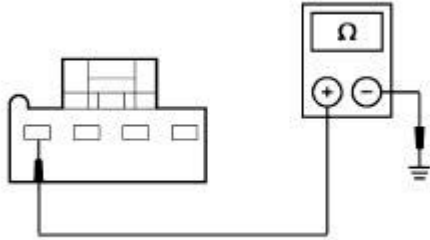
→ **Yes**
INSTALL a new BJB Fuse 416 (20A). TEST the system for normal operation. If BJB Fuse 416 (20A) opens again, INSTALL a new roof opening panel control module. REFER to Module—Roof Opening Panel Control. TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

D4 CHECK THE ROOF OPENING PANEL CONTROL MODULE GROUND

1

1 Measure the resistance between roof opening panel control module C921b pin 4, circuit 31-AG12 (BK/GN), harness side and ground.



A0001449

● Is the resistance less than 5 ohms?

→ **Yes**
GO to D5.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

D5 CHECK THE REM INPUT TO THE ROOF OPENING PANEL CONTROL MODULE

1

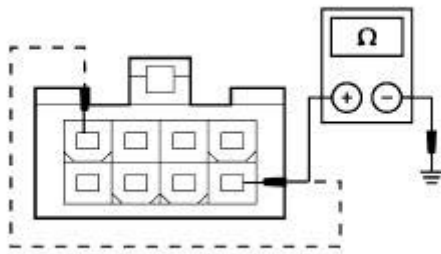


Roof Opening Panel Control Module C921a

2



3



A0001450

3 Measure the resistance between roof opening panel control module C921a pin 5, circuit 5-AG12 (BU/BK), harness side and ground; and between roof opening panel control module C921a pin 6, circuit 4-AG12 (GY/OG), harness side and ground.

● Are the resistances less than 5 ohms?

→ **Yes**
GO to D7.

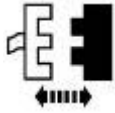
→ **No**
GO to D6.

D6 CHECK CIRCUIT 5-AG12 (BU/BK) AND 4-AG12 (GY/OG) FOR AN OPEN

1

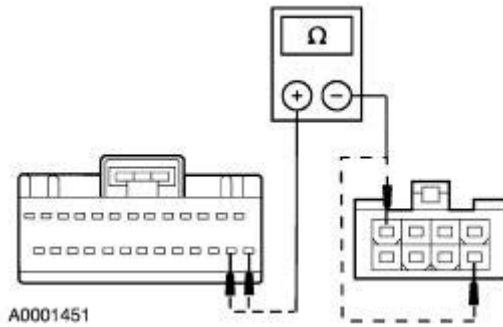


2



REM C420c

3



3

Measure the resistance between roof opening panel control module C921a pin 5, circuit 5-AG12 (BU/BK), harness side and REM C420c pin 14, circuit 5-AG12 (BU/BK), harness side; and between roof opening panel control module C921a pin 6, circuit 4-AG12 (GY/OG), harness side and REM C420c pin 15, circuit 4-AG12 (GY/OG), harness side.

- Are the resistances less than 5 ohms?

→ Yes

INSTALL a new REM. REFER to [Section 419-10](#). TEST the system for normal operation.

→ No

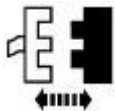
REPAIR the circuit. TEST the system for normal operation.

D7 CHECK CIRCUIT 5-AG12 (BU/BK) AND 4-AG12 (GY/OG) FOR A SHORT TO GROUND

1

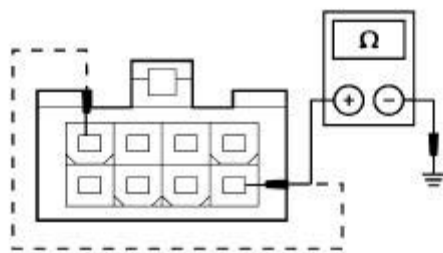


2



REM C420c

3



A0001450

3

Measure the resistance between roof opening panel control module C921a pin 5, circuit 5-AG12 (BU/BK), harness side and ground; and between roof opening panel control module C921a pin 6, circuit 4-AG12 (GY/OG), harness side and ground.

- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to D8.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

D8 CHECK THE ROOF OPENING PANEL CONTROL MODULE FOR REFERENCE VOLTAGE OUTPUT

1



2



REM C420c

3



Roof Opening Panel Control Module C921a

4

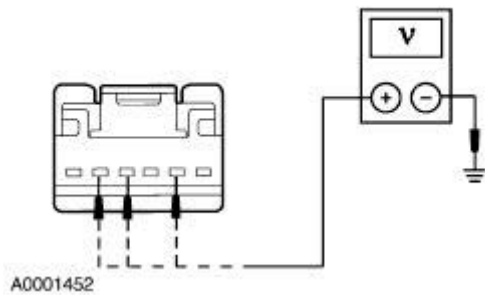


Roof Opening Panel Switch C912

5



6



6 Using the following table, measure the voltage between roof opening panel switch C912 pins, harness side and ground:

Pin	Circuit
4	32-AG12 (WH/GN)
2	32-AG10 (WH/BU)
5	33-AG10 (YE/BU)

- Are the voltages approximately 5 volts?

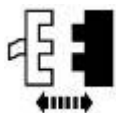
→ **Yes**

GO to D9.

→ **No**
GO to D10.

D9 CHECK THE ROOF OPENING PANEL SWITCH INPUT

1



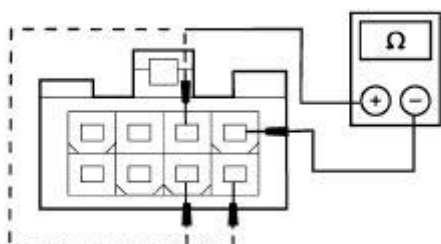
Roof Opening Panel Control Module C921a

2



Roof Opening Panel Switch C912

3



A0001453

3 Using the following table, measure the resistance between roof opening panel control module C921a pin 8, circuit 9-AG7 (BN/RD), harness side and roof opening panel control module pins, harness side, while the roof opening panel switch is activated to each position.

Pin	Circuit	Switch Position
4	32-AG10 (WH/BU)	Depress the switch to open (first detent position)
4	32-AG10 (WH/BU)	Depress the switch to express open (second detent position)
7	32-AG12 (WH/GN)	Depress the switch to tilt
7	32-AG12 (WH/GN)	Depress the switch to express open (second detent position)
3	33-AG10 (YE/BU)	Depress the switch to close

- Are the resistances greater than 10,000 ohms with the switch in the resting state and less than 5 ohms when activated?

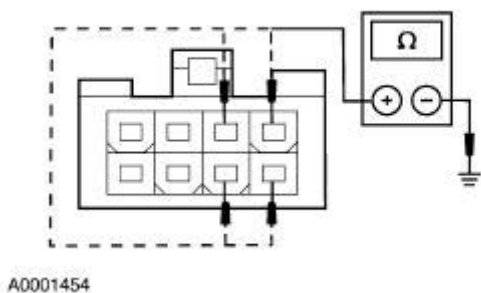
→ **Yes**
GO to D12.

→ **No**
INSTALL a new roof opening panel switch. REFER to Switch—Roof Opening Panel. TEST the system for normal

operation.

D10 CHECK CIRCUITS 9-AG7 (BN/RD), 32-AG12 (WH/GN), 32-AG10 (WH/BU) AND 33-AG10 (YE/BU) FOR A SHORT TO GROUND

1



1

Using the following table, measure the resistance between roof opening panel control module C921a pins, harness side and ground:

Pin	Circuit
3	33-AG10 (YE/BU)
4	32-AG10 (WH/BU)
7	32-AG12 (WH/GN)
8	9-AG7 (BN/RD)

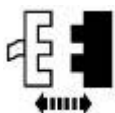
- Are the resistances greater than 10,000 ohms?

→ **Yes**
GO to D11.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

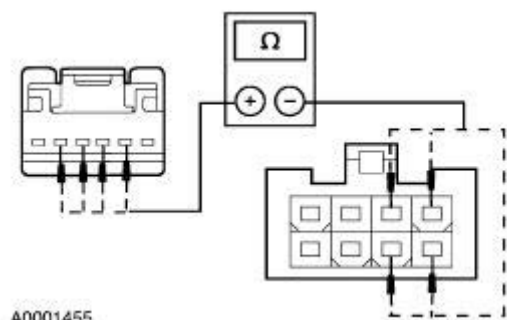
D11 CHECK CIRCUITS 9-AG7 (BN/RD), 32-AG12 (WH/G), 32-AG10 (WH/BU) AND 33-AG10 (YE/BU) FOR AN OPEN

1



Roof Opening Panel Switch C912

2



2

Using the following table, measure the resistance between roof opening panel control module C921a pins, harness side and the roof opening panel switch C912 pins, harness side:

Roof Opening Panel Control Module C921a Pin	Circuit	Roof Opening Panel Switch C912 Pin
3	33-AG10 (YE/BU)	5
4	32-AG10 (WH/BU)	2
7	32-AG12 (WH/GN)	4
8	9-AG7 (BN/RD)	3

- Are the resistances less than 5 ohms?

→ **Yes**

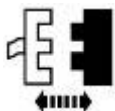
INSTALL a new roof opening panel switch. REFER to Switch—Roof Opening Panel. TEST the system for normal operation.

→ **No**

REPAIR the circuit. TEST the system for normal operation.

D12 CHECK THE OUTPUT TO THE ROOF OPENING PANEL MOTOR ASSEMBLY

1



Roof Opening Panel Motor Assembly C920

2

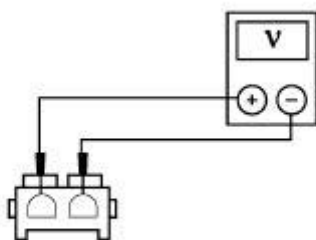


Roof Opening Panel Control Module C921a

3



4



A0001456

4

Measure the voltage between roof opening panel motor assembly C920 pin 1, circuit 32-AG6 (WH), harness side and roof opening panel motor assembly C920 pin 2, circuit 33-AG6 (YE), harness side.

5

Depress the roof opening panel switch to the open position; then the closed position.

- Is the voltage greater than 9 volts in both directions?

→ **Yes**

GO to D14.

→ **No**

GO to D13.

D13 CHECK CIRCUIT 32-AG6 (WH) AND 33-AG6 (YE) FOR AN OPEN

1

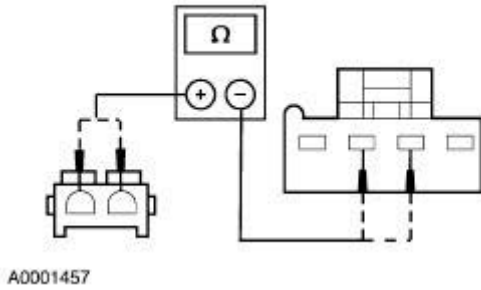


2



Roof Opening Panel Control Module C921b

3



3

Measure the resistance between roof opening panel control module C921b pin 3, circuit 32-AG6 (WH), harness side and roof opening panel motor assembly C920 pin 1, circuit 32-AG6 (WH), harness side; and between roof opening panel control module C921b pin 2, circuit 33-AG6 (YE), harness side and roof opening panel motor assembly C920 pin 2, circuit 33-AG6 (YE), harness side.

- Are the resistances less than 5 ohms?

→ Yes

INSTALL a new roof opening panel control module. REFER to [Module—Roof Opening Panel Control](#). TEST the system for normal operation.

→ No

REPAIR the circuit. TEST the system for normal operation.

D14 CHECK THE ROOF OPENING PANEL MOTOR ASSEMBLY

1



3



Roof Opening Panel Motor Assembly C920

4



2



Remove the roof opening panel motor assembly. For additional information, refer to [Motor—Roof Opening Panel Assembly](#).

5

Firmly hold the roof opening panel motor

	<p>making sure not to make contact with the motor gear.</p> <p>6 Depress the roof opening panel switch to the open position.</p> <ul style="list-style-type: none"> ● Does the roof opening panel motor operate? <p>→ Yes CHECK the roof opening panel for obstructions. If no obstructions are found, Install a new roof opening panel assembly. REFER to <u>Panel—Roof Opening Assembly</u>. TEST the system for normal operation.</p> <p>→ No INSTALL a new roof opening panel motor assembly. REFER to <u>Motor—Roof Opening Panel Assembly</u>. TEST the system for normal operation.</p>
--	---

PINPOINT TEST E: THE ROOF OPENING PANEL DOES NOT OPEN OR CLOSE IN VENT POSITION

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK THE ROOF OPENING PANEL OPEN/CLOSE OPERATION	
<p>1</p> 	<p>2 Depress the roof opening panel switch rearward and then forward.</p> <ul style="list-style-type: none"> ● Did the roof opening panel open and close? <p>→ Yes GO to <u>E2</u>.</p> <p>→ No GO to <u>Pinpoint Test D</u>.</p>
E2 CHECK THE ROOF OPENING PANEL VENT UP OPERATION	
<p>1</p> 	<p>2 Make sure the roof opening panel is in the flush position.</p> <p>3 Depress the roof opening panel switch</p>

up to the vent position.

- **Did the roof opening panel vent up?**

→ **Yes**

VERIFY the symptom. Circuit 33-AG10 (YE/BU) is used for close and vent down operation. If the roof opening panel is still inoperative in the vent down position, CHECK for loose connections, a binding roof opening panel track, a sticking switch or intermittent operation of the roof opening panel control module.

→ **No**

GO to E3.

E3 CHECK THE ROOF OPENING PANEL EXPRESS OPERATION

1 Depress the roof opening panel switch rearward to the second detent position and release.

- **Did the roof opening panel express operation work correctly?**

→ **Yes**

INSTALL a new roof opening panel switch. REFER to Switch—Roof Opening Panel. TEST the system for normal operation.

→ **No**

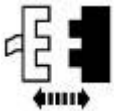
GO to E4.

E4 CHECK FOR REFERENCE VOLTAGE TO THE ROOF OPENING PANEL SWITCH

1



2



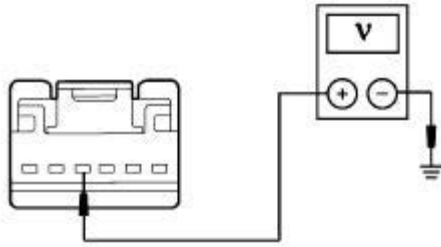
Roof Opening Panel Switch C912

3



4

4 Measure the voltage between roof opening panel switch C912 pin 4, circuit 32-AG12 (WH/GN), harness side and ground.



A0001458

● Is the voltage approximately 5 volts?

→ **Yes**
GO to E7.

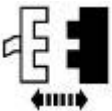
→ **No**
GO to E5.

E5 CHECK CIRCUIT 32-AG12 (WH/GN) FOR AN OPEN

1

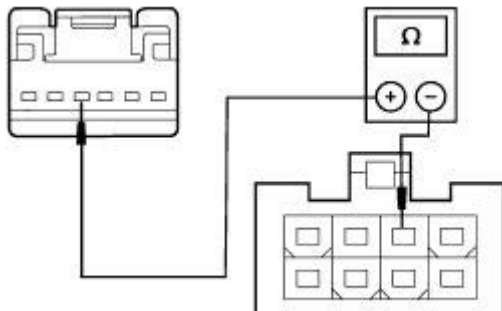


2



Roof Opening Panel Module C921a

3



A0001459

3 Measure the resistance between roof opening panel control module C921a pin 7, circuit 32-AG12 (WH/GN), harness side and roof opening panel switch C912 pin 4, circuit 32-AG12 (WH/GN), harness side.

● Is the resistance less than 5 ohms?

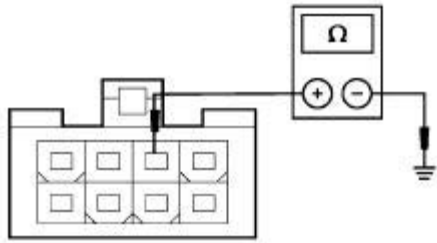
→ **Yes**
GO to E6.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

E6 CHECK CIRCUIT 32-AG12 (WH/GN) FOR A SHORT TO GROUND

1

1 Measure the resistance between roof opening panel control module C921a pin



A0001460

7, circuit 32-AG12 (WH/GN), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
 INSTALL a new roof opening panel control module. REFER to Module—Roof Opening Panel Control. TEST the system for normal operation.

→ **No**
 REPAIR the circuit. TEST the system for normal operation.

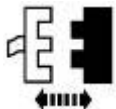
E7 CHECK THE INPUT TO THE ROOF OPENING PANEL CONTROL MODULE

1



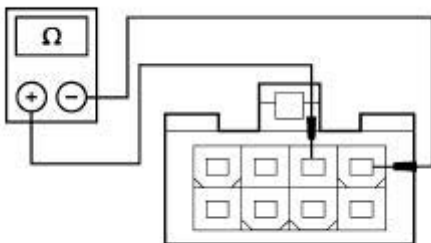
Roof Opening Panel Switch C912

2



Roof Opening Panel Control Module C921a

3



A0001461

3 Measure the resistance between roof opening panel control module C921a pin 7, circuit 32-AG12 (WH/GN), harness side and roof opening panel control module C921a pin 8, circuit 9-AG7 (BU/RD), harness side.

4 Depress the roof opening panel switch to the VENT position.

- Is the resistance less than 5 ohms?




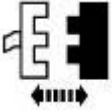
→ **Yes**
 INSTALL a new roof opening panel control module. REFER to Module—Roof

	<p><u>Opening Panel Control</u> . TEST the system for normal operation.</p> <p>→ No INSTALL a new roof opening panel switch. REFER to <u>Switch—Roof Opening Panel</u> . TEST the system for normal operation.</p>
--	--

PINPOINT TEST F: THE ROOF OPENING PANEL DOES NOT STOP IN FLUSH FROM ANY POSITION

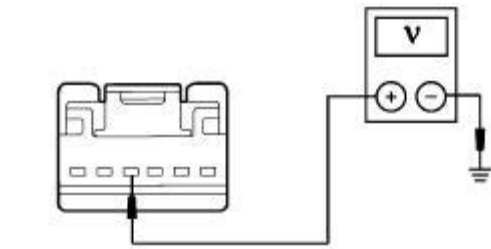
CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE ROOF OPENING GLASS ADJUSTMENT	
	<p>1 Check the roof opening glass adjustment. Refer to <u>Height Adjustment</u> .</p> <p style="text-align: center;">● Is the roof opening glass adjusted correctly?</p> <p>→ Yes GO to <u>F2</u> .</p> <p>→ No ADJUST the roof opening glass as necessary. TEST the system for normal operation.</p>
F2 CHECK THE ROOF OPENING GLASS SEAL	
	<p>1 Inspect the roof opening glass seal for looseness, damage and correct installation.</p> <p style="text-align: center;">● Is the roof opening glass seal OK and installed correctly?</p> <p>→ Yes GO to <u>F3</u> .</p> <p>→ No REPAIR or INSTALL a new roof opening glass seal as necessary. REFER to <u>Glass—Roof Opening Assembly</u> . TEST the system for normal operation.</p>
F3 CHECK FOR OBSTRUCTION IN THE ROOF OPENING PANEL	
	<p>1 Inspect the roof opening panel assembly for obstructions in the track.</p> <p style="text-align: center;">● Are any obstructions found?</p> <p>→ Yes REMOVE the obstruction. If necessary, INSTALL a new roof opening panel track and rail assembly. REFER to <u>Panel—Roof Opening Assembly</u> . TEST the system for normal operation.</p> <p>→ No INSTALL a new roof opening panel control module. REFER to <u>Module—Roof Opening Panel Control</u> . TEST the system for normal operation.</p>

PINPOINT TEST G: THE EXPRESS OPEN IS INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE ROOF OPENING PANEL OPEN/CLOSE OPERATION	
<p>1</p> 	<p>2 Depress the roof opening panel switch rearward and then forward.</p> <ul style="list-style-type: none"> ● Did the roof opening panel open and close? <p>→ Yes GO to <u>G2</u>.</p> <p>→ No GO to <u>Pinpoint Test D</u>.</p>
G2 CHECK THE ROOF OPENING PANEL VENT UP OPERATION	
<p>1</p> 	<p>2 Make sure the roof opening panel is in the flush position.</p> <p>3 Depress the roof opening panel switch up to the vent position.</p> <ul style="list-style-type: none"> ● Did the roof opening panel vent up? <p>→ Yes GO to <u>G7</u>.</p> <p>→ No GO to <u>G3</u>.</p>
G3 CHECK FOR REFERENCE VOLTAGE TO THE ROOF OPENING PANEL SWITCH	
<p>1</p>  <p>2</p>  <p>Roof Opening Panel Switch C912</p> <p>3</p>	



4



A0001458

4

Measure the voltage between roof opening panel switch C912 pin 4, circuit 32-AG12 (WH/GN), harness side and ground.

● Is the voltage approximately 5 volts?

→ Yes
GO to G6.

→ No
GO to G4.

G4 CHECK CIRCUIT 32-AG12 (WH/GN) FOR AN OPEN

1

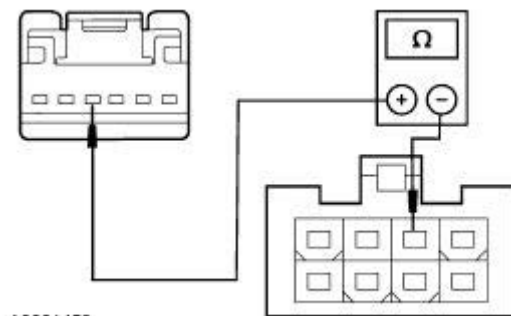


2



Roof Opening Panel Module C921a

3



A0001459

3

Measure the resistance between roof opening panel control module C921a pin 7, circuit 32-AG12 (WH/GN), harness side and roof opening panel switch C912 pin 4, circuit 32-AG12 (WH/GN), harness side.

● Is the resistance less than 5 ohms?

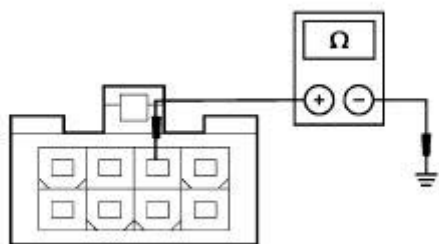
→ Yes
GO to G5.

→ No
REPAIR the circuit. TEST the system for

normal operation.

G5 CHECK CIRCUIT 32-AG12 (WH/GN) FOR A SHORT TO GROUND

1



A0001460

1

Measure the resistance between roof opening panel control module C921a pin 7, circuit 32-AG12 (WH/GN), harness side and ground.

- Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new roof opening panel control module. REFER to Module—Roof Opening Panel Control . TEST the system for normal operation.

→ **No**
REPAIR the circuit. TEST the system for normal operation.

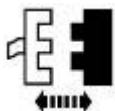
G6 CHECK THE INPUT TO THE ROOF OPENING PANEL CONTROL MODULE

1



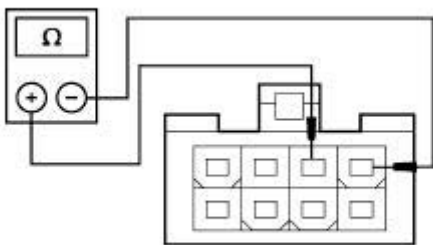
Roof Opening Panel Switch C912

2



Roof Opening Panel Control Module C921a

3



A0001461

3

Measure the resistance between roof opening panel control module C921a pin 7, circuit 32-AG12 (WH/GN), harness side and roof opening panel control module C921a pin 8, circuit 9-AG7 (BU/RD), harness side.

4 Depress the roof opening panel switch to the vent position.

- Is the resistance less than 5 ohms?

→ **Yes**
INSTALL a new roof opening panel control module. REFER to Module—Roof Opening Panel Control . TEST the system for normal operation.

→ **No**
INSTALL a new roof opening panel switch. REFER to Switch—Roof Opening Panel . TEST the system for normal operation.

G7 CHECK FOR AN INTERMITTENT OPEN SIGNAL

1

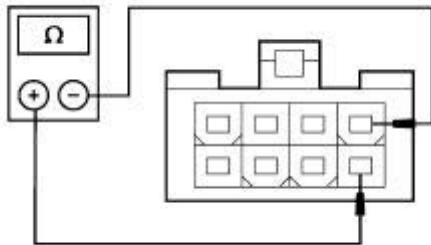


2



Roof Opening Panel Control Module C921a

3



A0001462

3 Measure the resistance between roof opening panel control module C921a pin 4, circuit 32-AG10 (WH/BU), harness side and roof opening panel control module C921a pin 8, circuit 9-AG7 (BU/RD), harness side.

4 Monitor the resistance as the roof opening panel is moved to the open (first detent) position, then express open (second detent) position.

- **Is the resistance continuously less than 5 ohms through the open position to the express open position?**

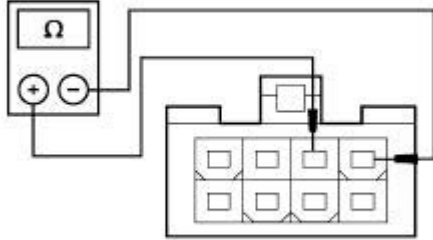
→ **Yes**
GO to G8 .

→ **No**
INSTALL a new roof opening panel switch. REFER to Switch—Roof Opening Panel . TEST the system for normal operation.

G8 CHECK FOR AN INTERMITTENT EXPRESS OPEN SIGNAL

1

1 Measure the resistance between roof opening panel control module C921a pin



A0001461

7, circuit 32-AG12 (WH/GN), harness side and roof opening panel control module C921a pin 8, circuit 9-AG7 (BU/RD), harness side.

2 Monitor the resistance as the roof opening panel is moved to the open (first detent) position, then express open (second detent) position.

- Is the resistance greater than 10,000 ohms in the open position and continuously less than 5 ohms in the express open position?

→ **Yes**
 INSTALL a new roof opening panel control module. REFER to Module—Roof Opening Panel Control. TEST the system for normal operation.

→ **No**
 INSTALL a new roof opening panel switch. REFER to Switch—Roof Opening Panel. TEST the system for normal operation.

PINPOINT TEST H: THE ROOF OPENING PANEL HAS EXCESSIVE WIND NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK THE ROOF OPENING GLASS FIT	
	<p>1 Cycle the roof opening glass from the full-open to the full-closed position.</p> <p>2 Inspect the roof opening glass seal for correct fit or damage.</p> <ul style="list-style-type: none"> ● Is the roof opening glass seal OK? <p>→ Yes GO to <u>H2</u>.</p> <p>→ No INSTALL a new roof opening glass seal. REFER to <u>Glass—Roof Opening Assembly</u>. TEST the system for normal operation.</p>
H2 CHECK THE ROOF OPENING GLASS OPERATION	
	<p>1 Cycle the roof opening glass from the full-open to the full-closed position.</p>

- **Does the roof opening glass travel to the full-open and the full-closed position?**

→ **Yes**

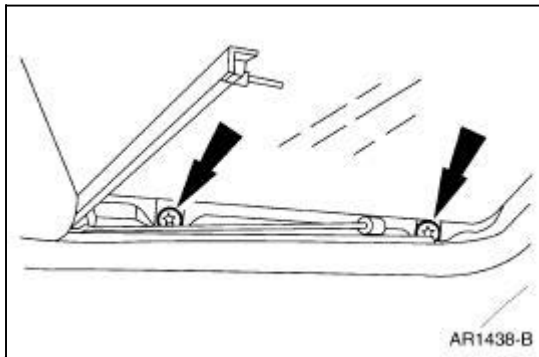
ADJUST the roof opening glass. REFER to Height Adjustment . If the roof opening glass closes unevenly, CHECK the roof opening panel timing. REFER to Timing Adjustment . TEST the system for normal operation.

→ **No**

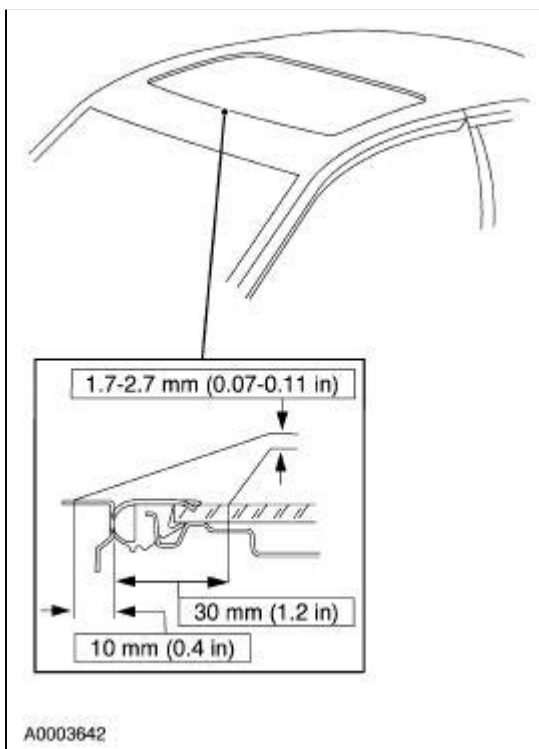
CHECK the roof opening glass seal. If necessary, INSTALL a new roof opening glass seal. REFER to Glass—Roof Opening Assembly . TEST the system for normal operation.

Height Adjustment

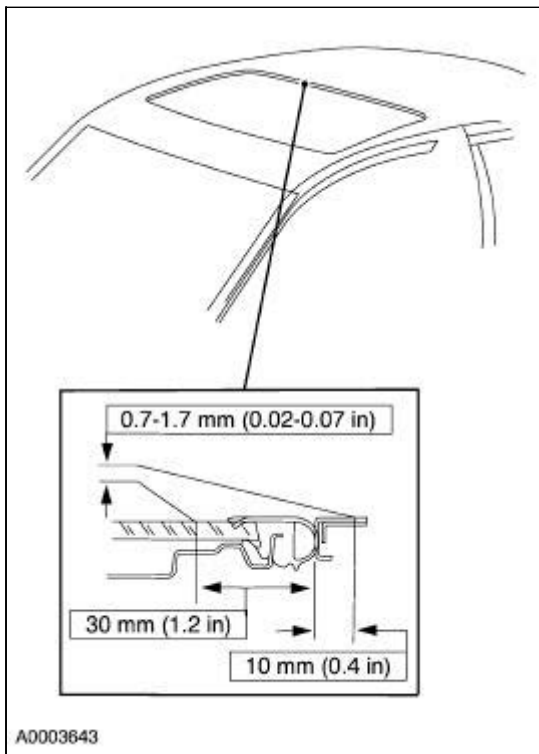
1. Operate the roof opening glass assembly to the closed position.
2. Swing the left sight shield and right sight shield rearward and loosen the screws on each side.



3. Adjust the front glass edge to between flush and 1.7 - 2.7 mm (0.07 - 0.11 in) low.

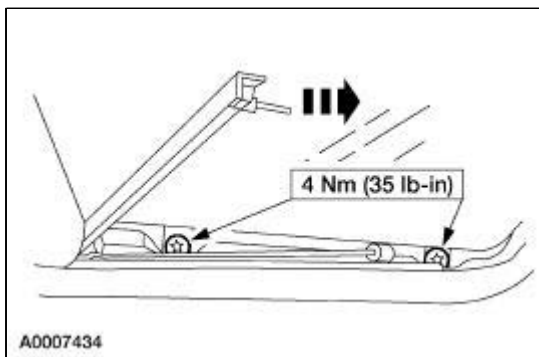


4. Adjust the rear glass edge to between flush and 0.7 - 1.7 mm (0.02 - 0.07 in) low.



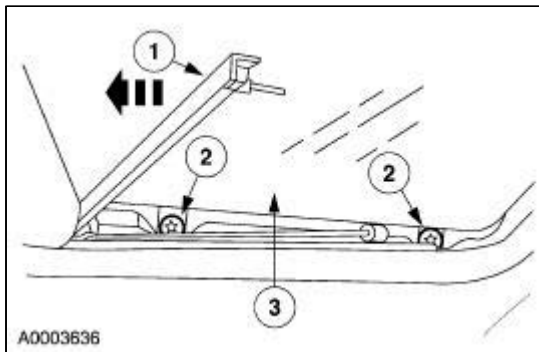
5. **NOTE:** Make sure to carefully align the sight shield to the snap retainer prior to positioning into place.

Tighten the four screws and swing the left and right sight shields forward and snap into place.

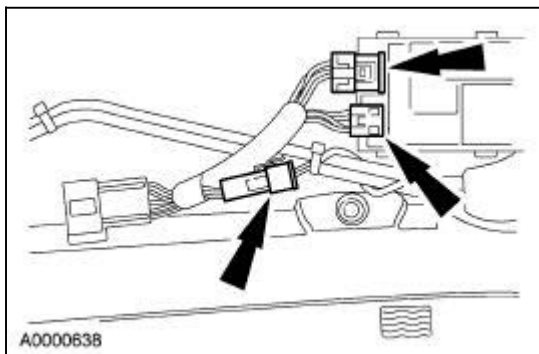


Timing Adjustment

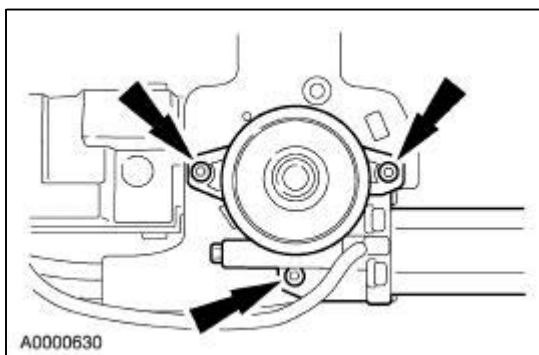
1. Remove the roof opening panel assembly. For additional information, refer to [Panel—Roof Opening Assembly](#) in this section.
2. Remove the roof opening glass assembly.
 1. Swing the left and right sight shields rearward.
 2. Remove the screws on each side.
 3. From the exterior of the vehicle, lift the roof opening glass assembly from the vehicle.



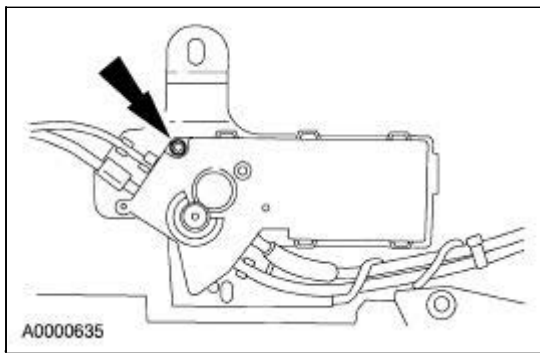
3. Disconnect the connectors.



4. Remove screws and the roof opening panel motor assembly.

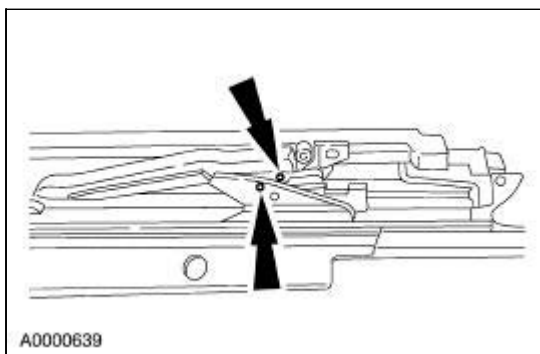


5. Remove the screw and the roof opening panel control module.

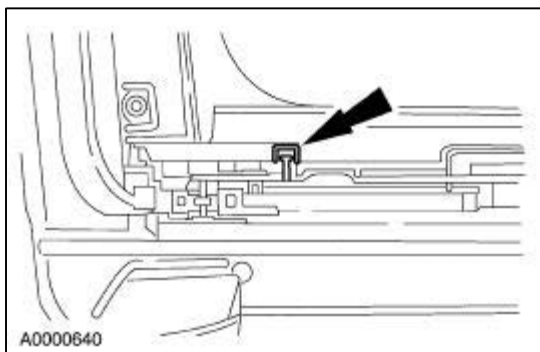


6. **NOTE:** It may be necessary to slightly separate the rail assembly to visually see the two alignment holes.

Align the holes in the mechanism on each side.



7. Make sure the flush locating pin is centered in the slot on each side.

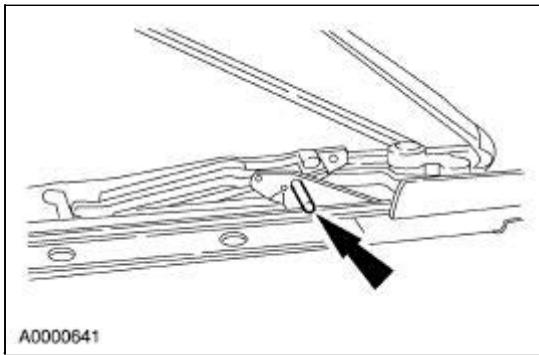


8. **NOTE:** The alignment pins must remain in place until the roof opening panel control module is installed.

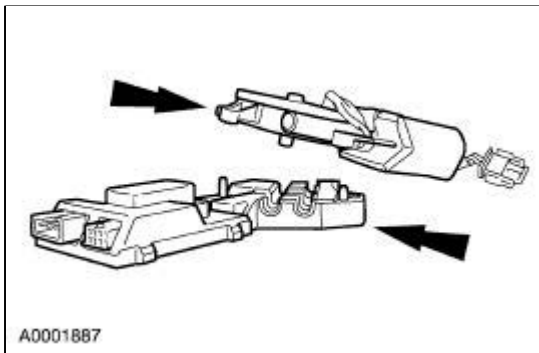
NOTE: A number 33 drill bit may be used as an alignment pin.

Install an alignment pin in the alignment hole in each side of the mechanism.

- The alignment pin should be approximately 2.83 mm (0.11 in) in diameter

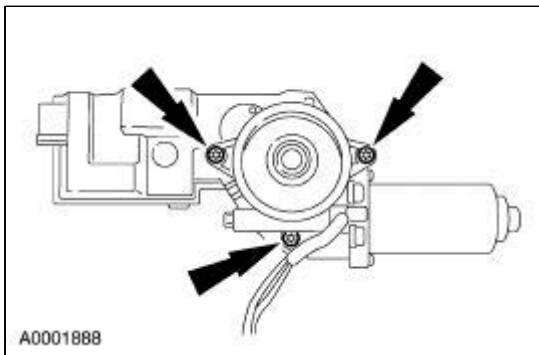


9. Position the roof opening panel motor assembly on the roof opening panel control module.

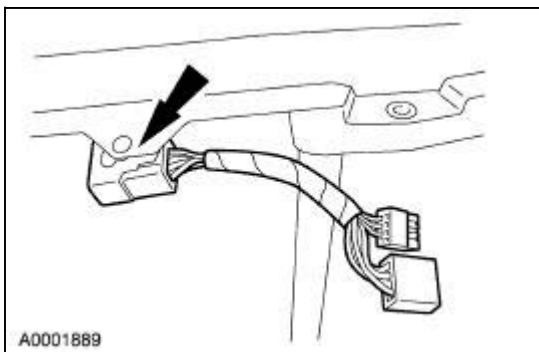


10.  **CAUTION: Do not snug or overtighten the roof opening panel mounting screws. Damage to the roof opening panel control module may result.**

Install the screws approximately two to three turns.

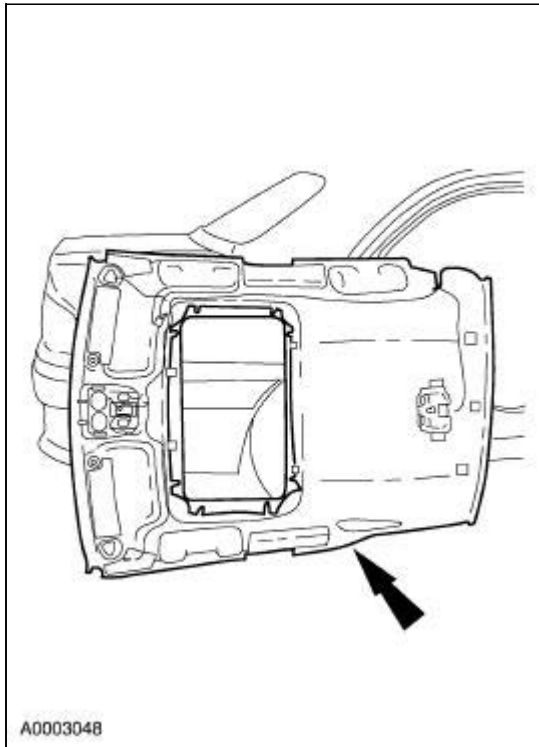


11. Remove the harness from the roof opening panel assembly.

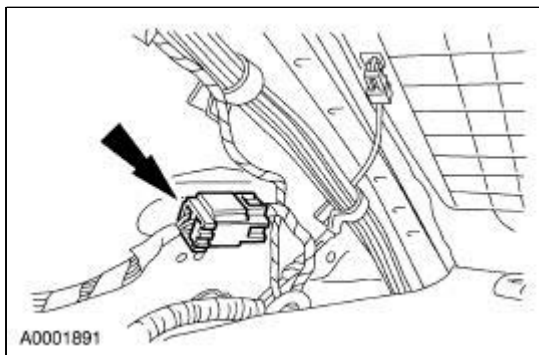


12. Position the headlining panel against the right rear quarter panel.

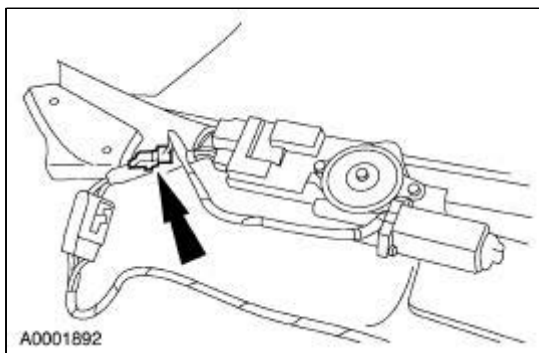
- The rear of the headliner should be towards the right rear door opening and the cloth side towards the vehicle.



13. Connect the headlining panel body harness connector at the right rear C-pillar.



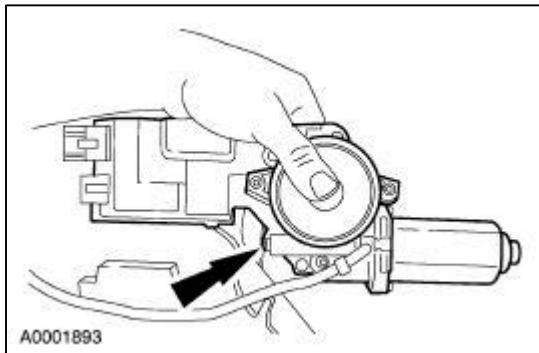
14. Connect the roof opening panel harness between the module motor assembly and the roof opening panel switch.



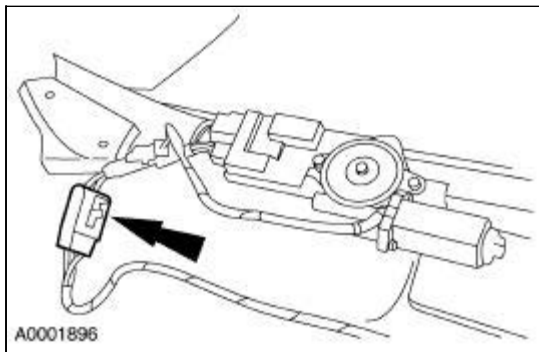
15. **NOTE:** Make sure the battery is fully charged.

Turn the ignition switch to RUN.

16. Firmly hold the roof opening panel control module and roof opening panel motor together.

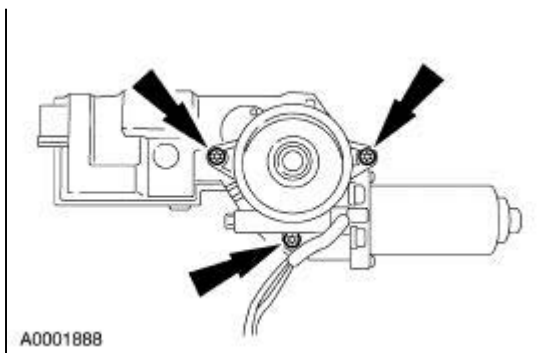


17. Operate the roof opening panel switch rearward (OPEN position) until the motor stops.
18. Operate the roof opening panel switch forward (CLOSE position) until the motor stops.
19. Disconnect the front body harness connector.

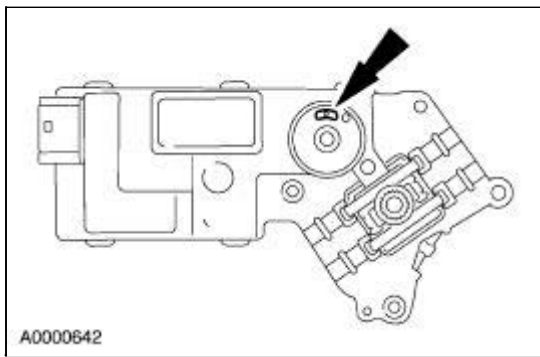


20. **NOTE:** Make sure the roof opening panel control module gear position is not altered.

Remove the screws.



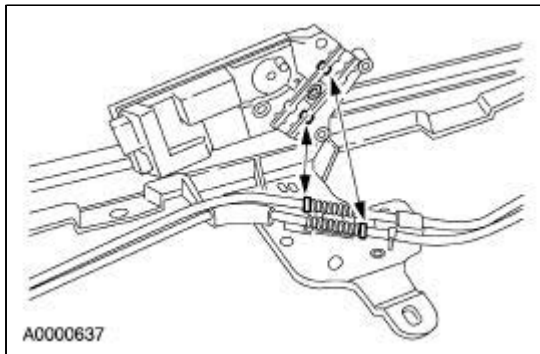
21. Make sure the alignment hole is visible in the view hole.



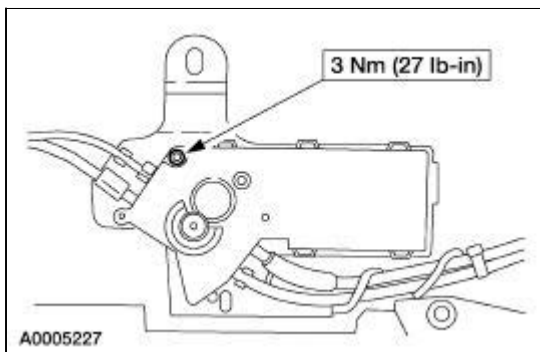
22. **NOTE:** Make sure the roof opening panel control module gear position is not altered.

Install the roof opening panel control module on the cable sleeves.

- Make sure the shoulder of each cable sleeve is correctly seated in the roof opening panel control module.

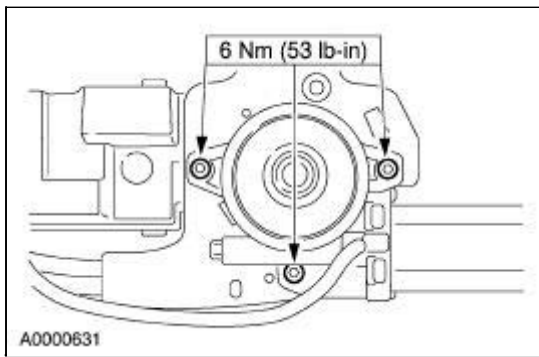


23. Make sure the roof opening panel control module is seated flush to the bracket and install the screw.

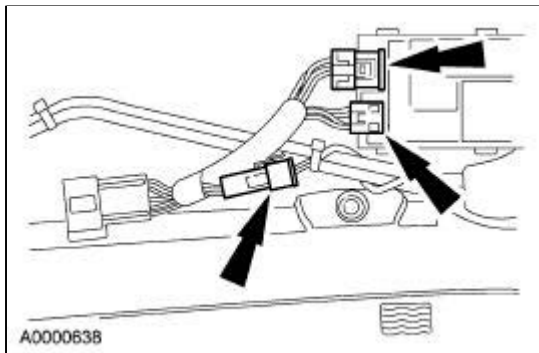


24. **NOTE:** Make sure the roof opening panel motor is correctly aligned and inserted into the control module. The roof opening panel motor should be sitting flush with the frame before installing the bolts.

Position the roof opening panel motor assembly and install the screws.

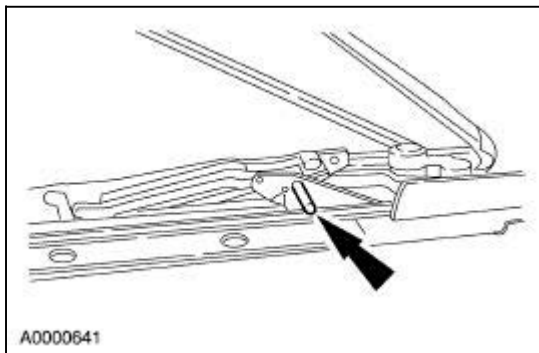


25. Connect the connectors.



26. Install the roof opening panel harness tie down and clip into place.

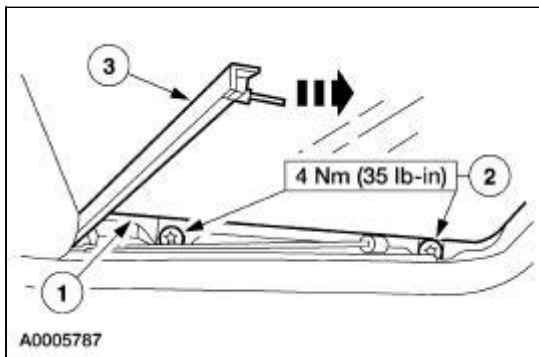
27. Remove the alignment pins from each side.



28. Install the roof opening glass assembly.

1. Install the roof opening glass assembly in place aligning screw holes.
2. Install the screws on each side.
3. **NOTE:** Make sure to carefully align the sight shield to the snap retainer prior to positioning into place.

Swing the left and right sight shields forward and snap into place.



29. Position the roof opening panel assembly near the headliner and connect the roof opening panel harness to the headliner harness.

30. **NOTE:** Make sure the battery is fully charged.

Operate the roof opening panel to the full open and full close position. Make sure both sides activate at the same time and the roof opening panel operates smoothly without jerking or binding. Make sure both sides reach flush at the same time.

31. Install the roof opening panel assembly. For additional information, refer to [Panel—Roof Opening Assembly](#) in this section.

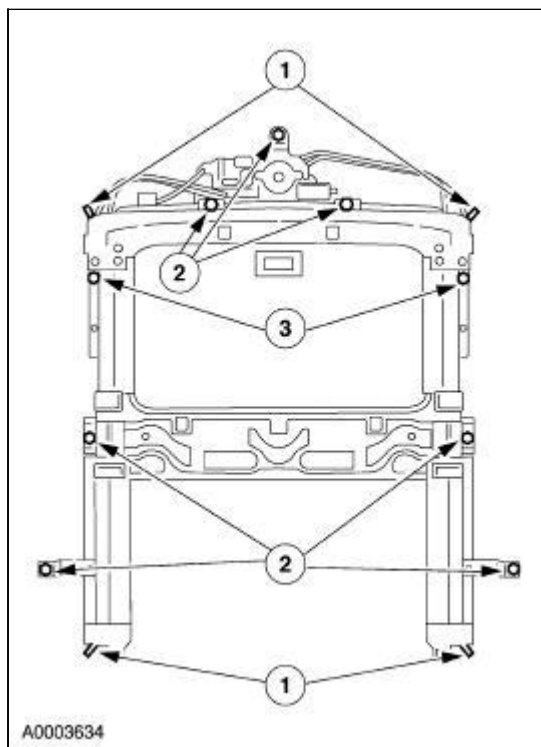
32. Adjust the roof opening glass height. For additional information, refer to [Height Adjustment](#) in this section.

Panel —Roof Opening Assembly

Removal

1. Remove the headliner. For additional information, refer to [Section 501-05](#).
2. Remove the roof opening panel assembly.
 1. Disconnect the drain tubes.
 2. Remove the bolts.
 3. **NOTE:** Support the roof opening panel assembly to prevent the unit from dropping.

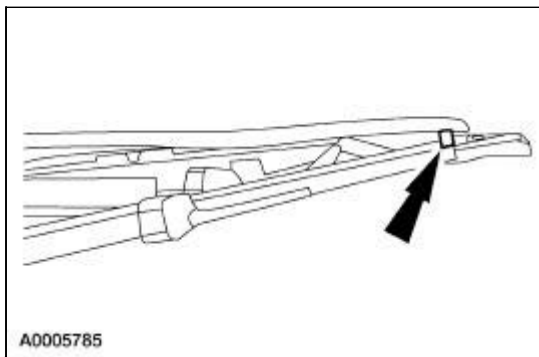
Remove the bolts.



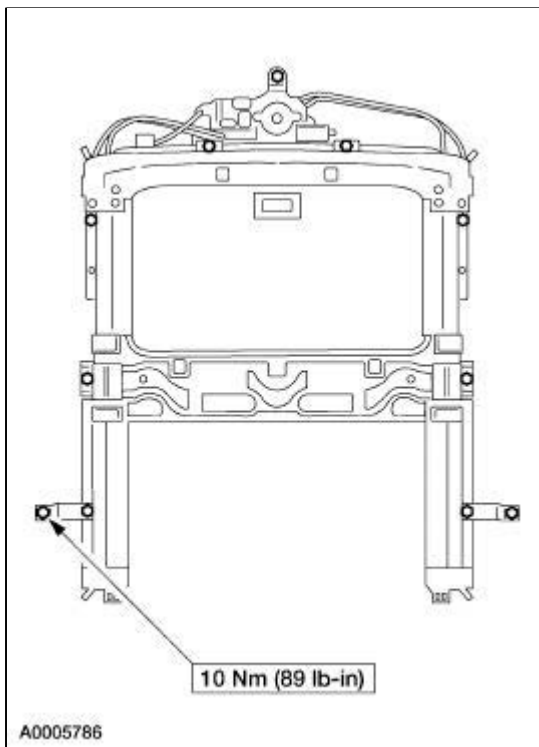
Installation

NOTE: The roof opening panel is available as an assembly or a track and rail assembly. The track and rail assembly must have the roof opening glass and the roof opening panel opening shield transferred from the old unit. The roof opening panel assembly can be installed without transferring parts from the old unit.

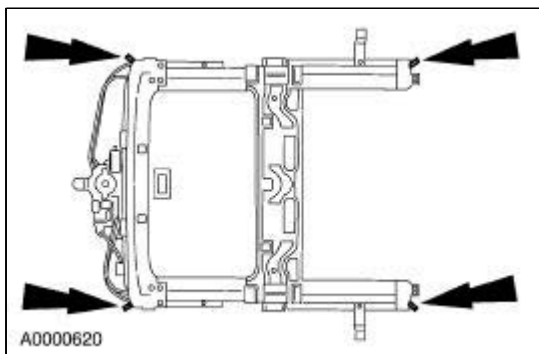
1. If necessary, transfer the roof opening glass assembly and the roof opening panel opening shield to the new roof opening panel assembly.
2. Install and support the roof opening panel assembly in the vehicle.
 - Make sure the alignment pins are correctly seated on each side.



3. Install the roof opening panel assembly bolts.



4. Connect the drain tubes.

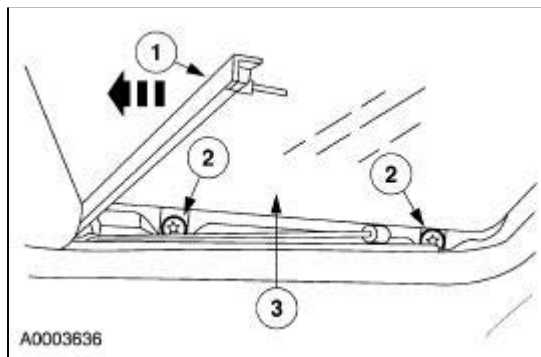


5. Install the headliner. For additional information, refer to [Section 501-05](#).
 6. Adjust the roof opening glass height. For additional information, refer to [Height Adjustment](#).
-

Glass —Roof Opening Assembly

Removal

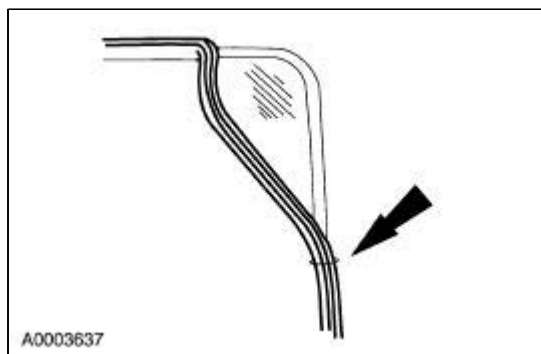
1. Operate the roof opening glass assembly to the closed position.
2. Remove the roof opening glass assembly.
 1. Swing the left and right sight shields rearward.
 2. Remove the four screws.
 3. From the exterior of the vehicle, lift the roof opening glass assembly from the vehicle.



3. Remove the roof opening glass seal.

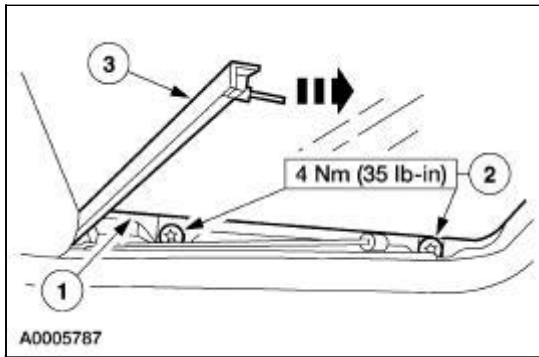
Installation

1. Install the roof opening glass seal.
 - Position the roof opening glass seal seam in the center of the passenger side of the roof opening glass.



2. Install the roof opening glass assembly.
 1. Install the roof opening glass assembly in place aligning screw holes.
 2. Install the four screws.
 3. **NOTE:** Make sure to carefully align the sight shield to the snap retainer prior to positioning into place.

Swing the left and right sight shields forward and snap into place.

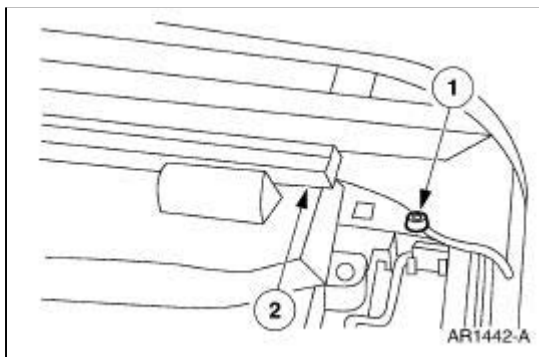


3. Adjust the roof opening glass height. For additional information, refer to [Height Adjustment](#).
-

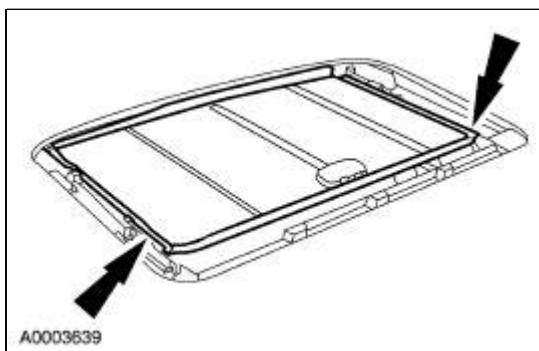
Opening Shield —Roof Opening Panel

Removal

1. Remove the roof opening glass assembly. For additional information, refer to [Glass—Roof Opening Assembly](#).
2. Remove the water trough.
 1. Remove the two screws.
 2. Remove the water trough.

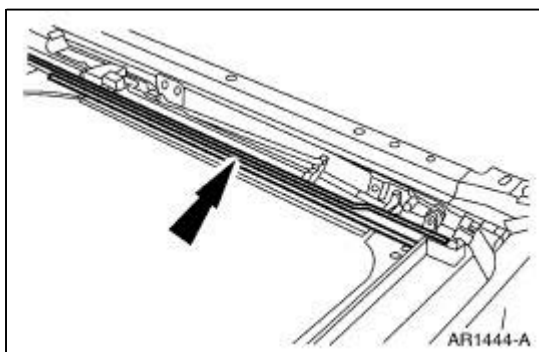


3. Pull the roof opening panel opening shield forward, lifting up slightly at the front openings until the front and rear tabs are disengaged from the track.

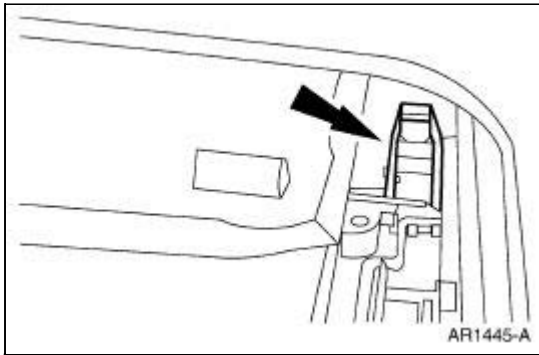


Installation

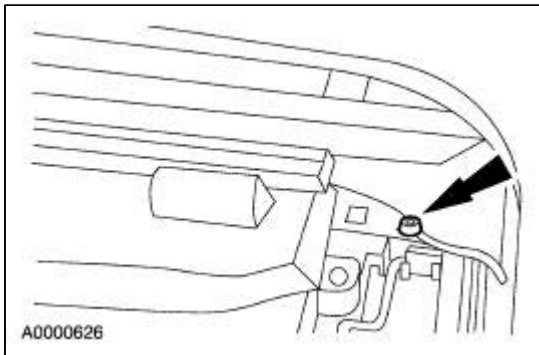
1. Insert the rear tabs into the track and slide the roof opening panel opening shield rearward until the front tabs insert into the track.



2. Install the water trough under the tab on each side.




3. Position the water trough and install the two screws.



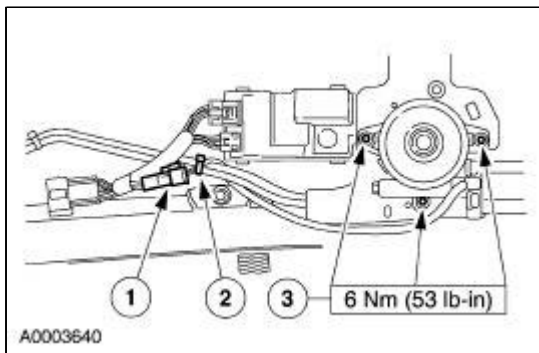
4. Install the roof opening glass assembly. For additional information, refer to [Glass—Roof Opening Assembly](#).
-

Motor —Roof Opening Panel Assembly

Removal and Installation

 **CAUTION:** Make sure the roof opening glass assembly is not moved during motor removal or installation. The roof opening panel assembly timing may be affected and cause the roof opening panel assembly to bind or be damaged.

1. Remove the headliner. For additional information, refer to [Section 501-05](#).
2. Remove the roof opening panel motor assembly.
 1. Disconnect the electrical connector.
 2. Remove the tie strap.
 3. Remove the bolts.



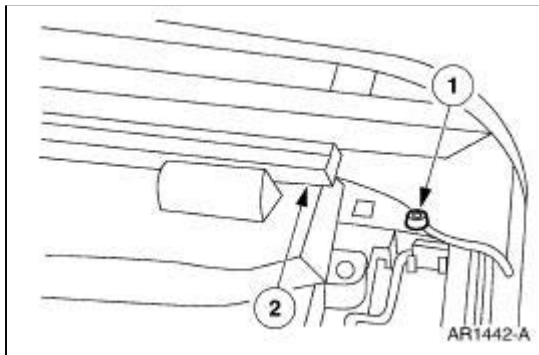
3. **NOTE:** If the roof opening glass assembly was moved while the roof opening panel motor was removed, the timing must be reset. Refer to [Timing Adjustment](#).

To install, reverse the removal procedure.

Trough Assembly

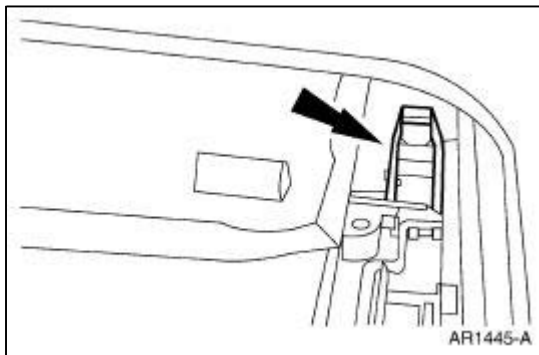
Removal

1. Remove the roof opening glass assembly. For additional information, refer to [Glass—Roof Opening Assembly](#).
2. Remove the water trough (5454022).
 1. Remove the two screws.
 2. Remove the water trough.

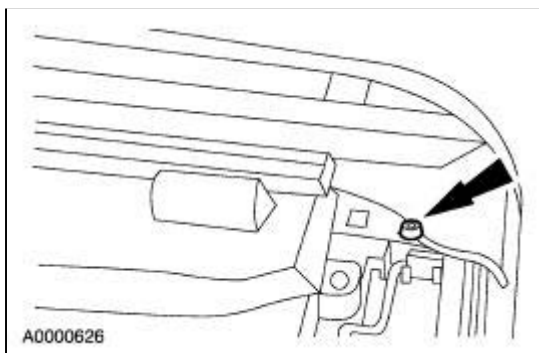


Installation

1. Install the water trough under the tab on each side.



2. Position the water trough and install the two screws.



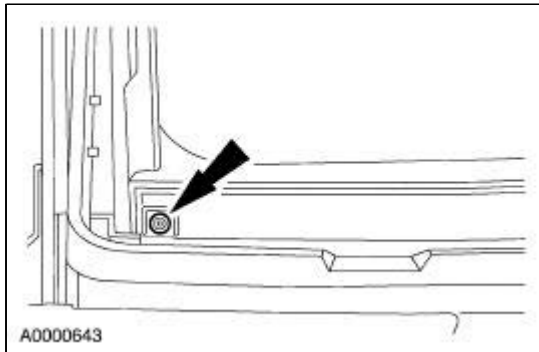
3. Install the roof opening glass assembly. For additional information, refer to [Glass—Roof](#)

Opening Assembly.

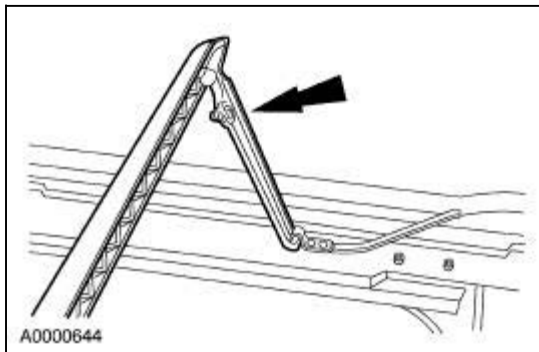
Air Deflector

Removal and Installation

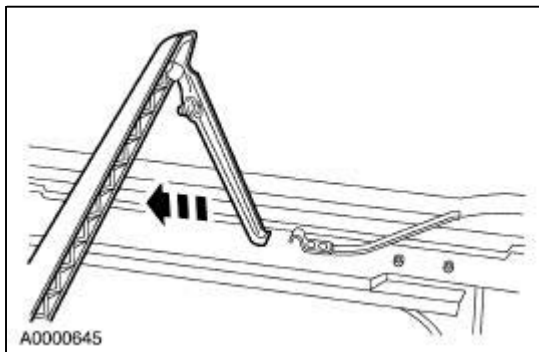
1. Move the roof opening glass assembly fully rearward.
2. Remove the two air deflector screws.



3. Move the air deflector to the complete vertical position.



4. Slide the air deflector rearward to unhook from the frame.

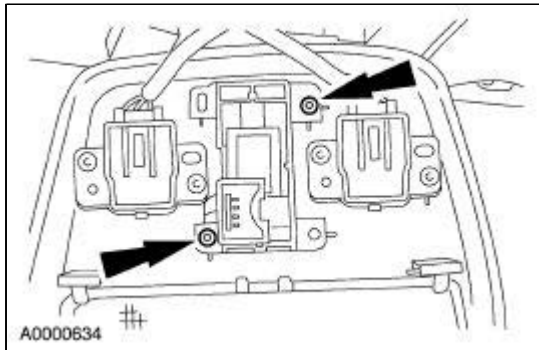


5. To install, reverse the removal procedure.

Switch —Roof Opening Panel

Removal and Installation

1. Position the dome/map lamp assembly aside.
2. Disconnect the electrical connector, remove the screws and the roof opening panel switch.



3. To install, reverse the removal procedure.
-

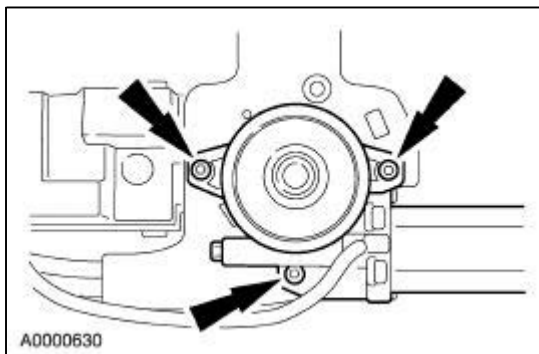
Module —Roof Opening Panel Control

Removal

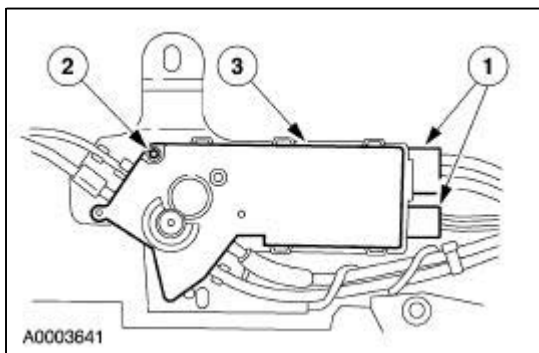
1. **NOTE:** Make sure the roof opening glass assembly is in the closed position.

Remove the roof opening panel assembly. For additional information, refer to [Panel—Roof Opening Assembly](#).

2. Remove the bolts and position the roof opening panel motor assembly aside.



3. Remove the roof opening panel control module.
 1. Disconnect the electrical connectors.
 2. Remove the screw.
 3. Remove the roof opening panel control module.



Installation

1. **NOTE:** Before a new roof opening panel control module can be installed, the roof opening panel and control module must be timed. The timing procedure will install the roof opening panel control module once the unit is timed.

Carry out the roof opening panel assembly timing. Refer to [Timing Adjustment](#).

Torque Specifications

Description	Nm	lb-ft	lb-in
Front bumper cover bracket bolts	7	—	62
Rear bumper cover nuts	7	—	62
Rear bumper cover bolts	7	—	62
Front bumper bolts (8mm)	25	18	—
Rear bumper bolts	23	17	—
Exhaust hanger bracket bolt	30	22	—
Front bumper bolts (6mm)	10	—	89

Bumpers

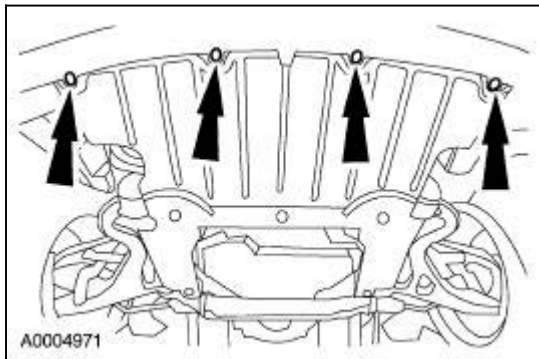
The bumper system consists of the following components:

- Front bumper cover (17D957)
 - Front bumper cover trim
 - Front bumper (17750)
 - Front bumper isolator (17E898)
 - Rear bumper cover (17K835)
 - Rear bumper cover trim
 - Rear bumper (17775)
 - Rear bumper isolator (17E899)
-

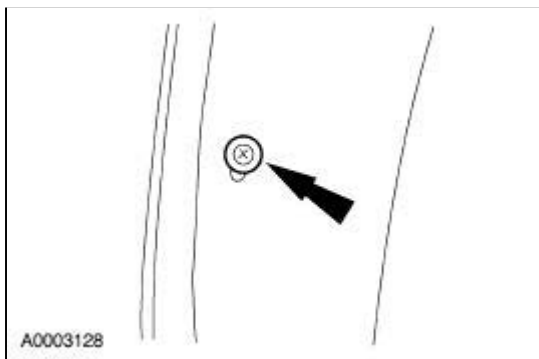
Bumper Cover —Front

Removal and Installation

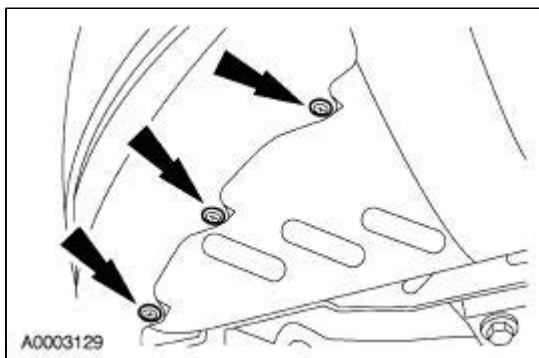
1. Remove the screws.



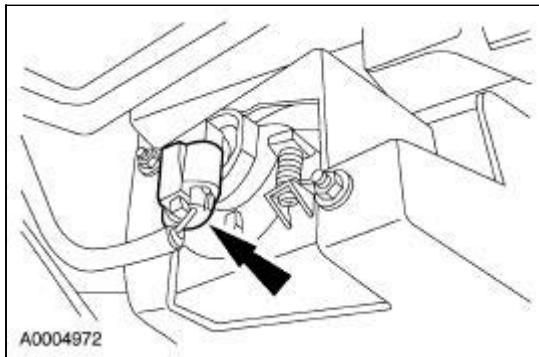
2. Remove the two screws from the inner fender splash shields.



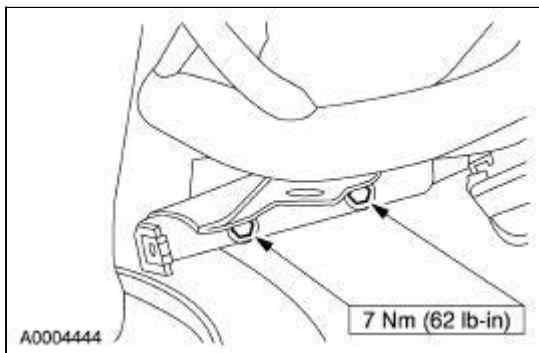
3. Remove the six screws from inner fender splash shields.



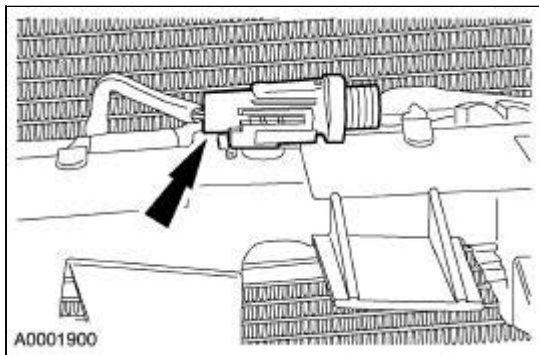
4. Disconnect the two fog lamp electrical connectors.



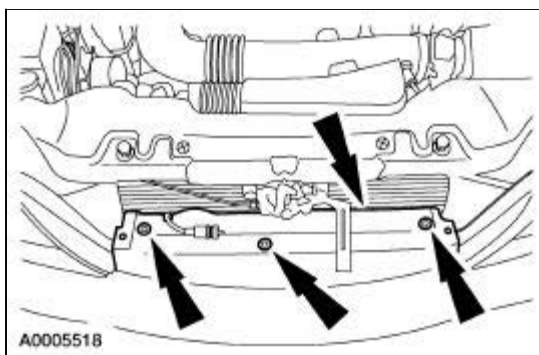
5. Disconnect the two side marker lamp electrical connectors.
6. Remove the four front bumper cover bracket bolts from the fenders.



7. Release the ambient air temperature sensor.

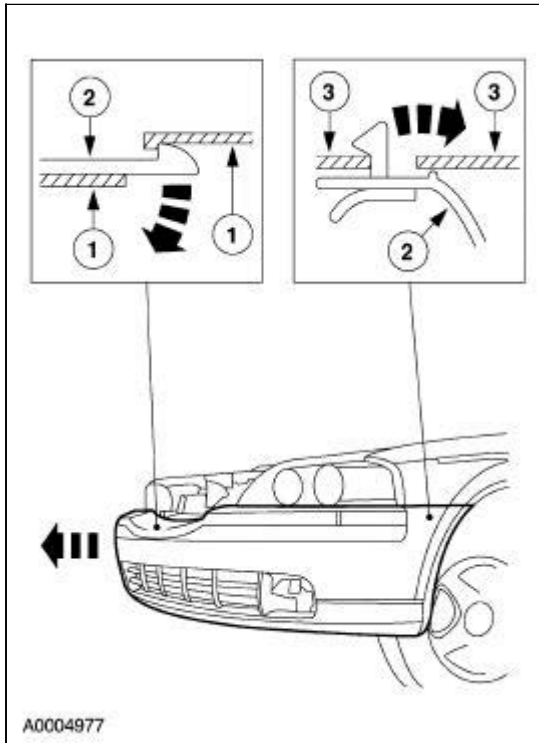


8. Remove the radiator grille opening cover at the top shelf of the bumper.



9. Remove the front bumper cover by pulling the center tabs downward and the outboard tabs on each side outward.

Item	Description
1	Grille opening panel reinforcement
2	Bumper cover
3	Fender



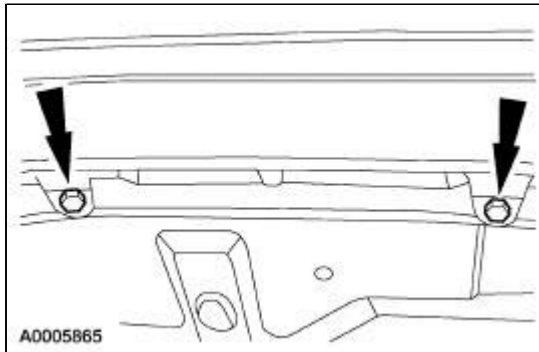
10. To install, reverse the removal procedure.

Bumper Cover —Rear

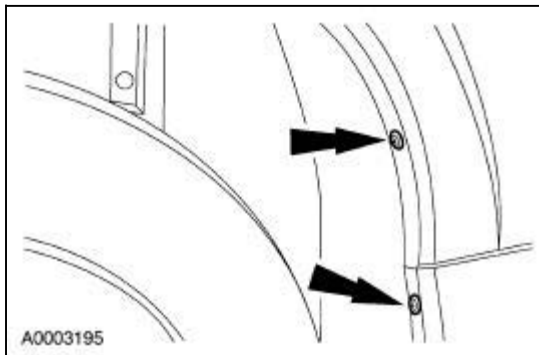
Removal and Installation

RH and LH Side

1. Remove the screws.

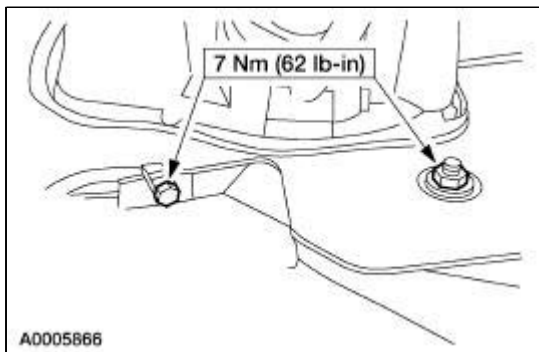


2. Remove the four inner fender screws.



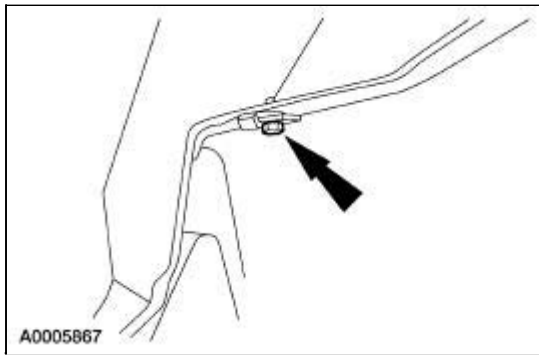
RH Side Only

3. Remove the rear bumper cover bolt and the nut located in the wheelwell area.



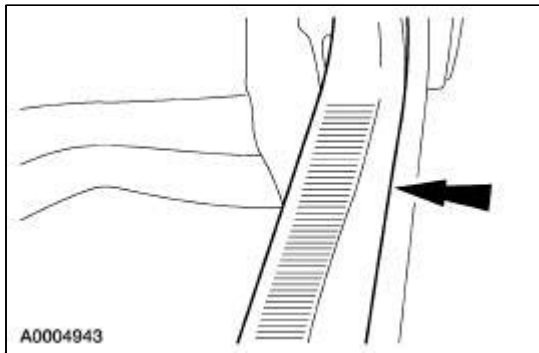
LH Side Only

4. Remove the rear bumper cover bolt.

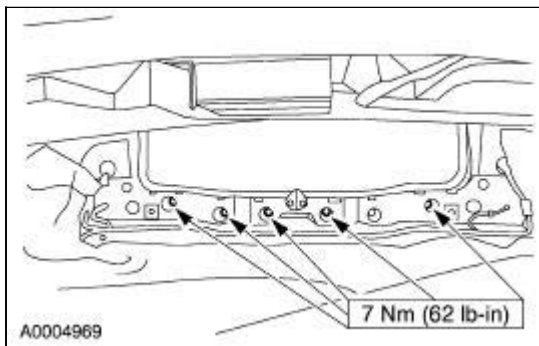


RH and LH Side

5. Remove the luggage compartment scuff plate.



6. Remove the luggage compartment back and side panel trim.
7. From the luggage compartment, remove the rear bumper cover nuts.

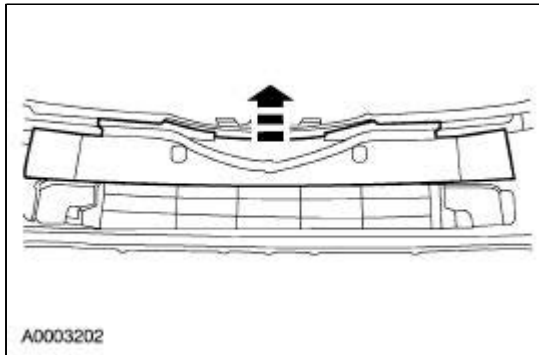


8. From the luggage compartment, remove the 10 rear bumper cover nuts (five each side).
 9. Remove the rear bumper cover.
 10. To install, reverse the removal procedure.
-

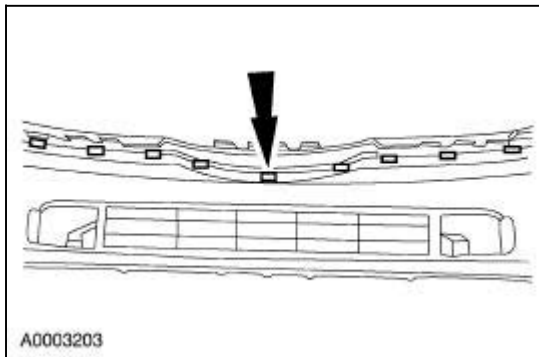
Bumper Cover —Trim, Front

Removal and Installation

1. Remove the front bumper cover. For additional information, refer to [Bumper Cover—Front](#).
2. Remove the retaining clips and the poly foam.



3. Remove the retaining clips and the trim.

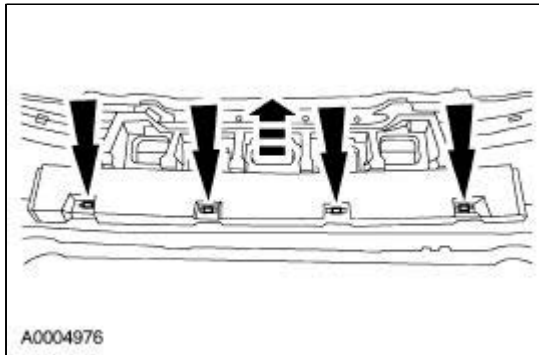


4. To install, reverse the removal procedure.
-

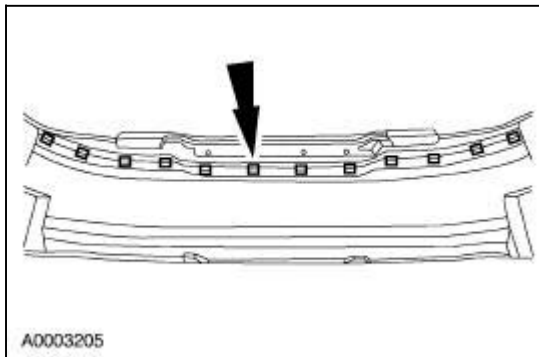
Bumper Cover —Trim, Rear

Removal and Installation

1. Remove the rear bumper cover. For additional information, refer to [Bumper Cover—Rear](#) .
2. Remove the retaining clips and the poly foam.



3. Remove the retaining clips and the trim.

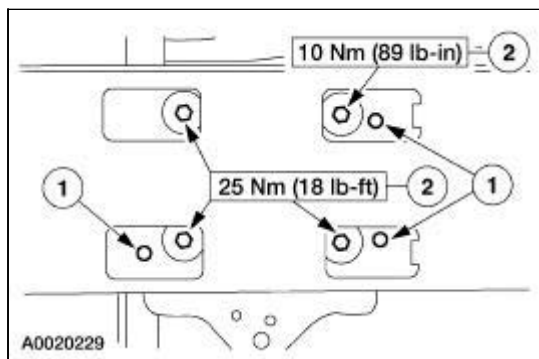


4. To install, reverse the removal procedure.
-

Bumper —Front

Removal

1. Remove the front bumper cover. For additional information, refer to [Bumper Cover—Front](#) in this section.
2. Disconnect the horn electrical connector.
3. Remove the front bumper.
 1. Drill out the six spot welds.
 2. Remove the eight bolts.



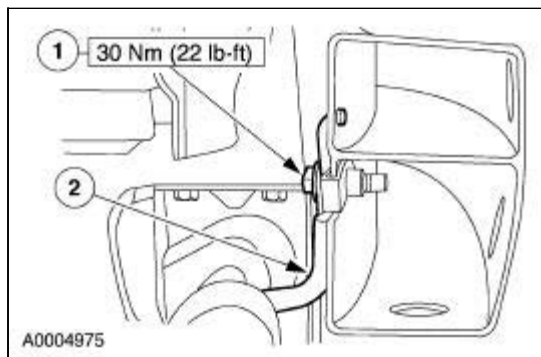
Installation

1. **NOTE:** Transfer the horns if required.
NOTE: Spot welding the bumper is not required.
To install, reverse the removal procedure.

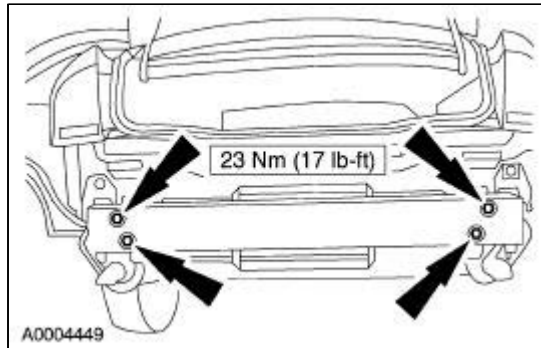
Bumper —Rear

Removal and Installation

1. Remove the rear bumper cover. For additional information, refer to [Bumper Cover—Rear](#) .
2. Remove the exhaust hanger bracket.
 1. Remove the bolt.
 2. Remove the bracket.



3. Remove the bolts and the rear bumper.



4. To install, reverse the removal procedure.


Part Replacement Chart — Safety Belt With Damaged Weld Nut Anchor Plate Threads


Part Number	Description	Location
N808687–S190	Nut M10 x 1.5 x 8.6 hex flanged extrusion	Fr. D-ring
N802068–S424	Nut M10 x 1.5 hex flange locking	Fr. o/b
W701917–S309	Screw M10 x 1.5 x 21.5 T50 Torx, pia w/54602B82	Ht. adj
W705643–S409	Screw M10 x 1.5 x 18 hex flange shoulder, pia w/5461202, 3 pia w/seat kit	Fr. bkl
W700883–S409	Screw M10 x 1.5 T50 Torx, pia w/all retractors	Retr.
W704703–S408	Screw M10 – 1.5 x 34.0 pan head tapping, pia w/54611B68, 54611B69	Rr D-ring
W700883–S409	Screw M10 x 1.5 T50 Torx	Rr o/b
N800937–S190	Nut-M10 x 1.75 hex flanged locking	Rr i/b

Torque Specifications

Description	Nm	lb-ft	lb-in
D-ring bolt	40	30	—
D-ring nut	40	30	—
Front safety belt anchor nut	40	30	—
Front safety belt buckle bolt	40	30	—
Front safety belt nut	40	30	—
Height adjuster bolts	40	30	—
Rear outboard safety belt nuts	40	30	—
Rear safety belt anchor bolts	40	30	—
Rear safety belt buckle bolt	48	35	—
Rear seat bolster nut	11	8	—
Retractor bolt	40	30	—
Child safety seat tether anchor bolts	20	15	—
Steering column opening reinforcement bolts	9	—	80
Instrument panel tunnel brace bolts	20	15	—
Child safety seat tether anchor LATCH bolt	10	—	89

Safety Belt System

 **WARNING:** All safety belt assemblies including retractors, buckles, front seat belt buckle support assemblies (slide bar), if equipped, shoulder belt height adjusters, if equipped, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. All belt assemblies should be installed new unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected. New safety belt assemblies should be installed if either damage or incorrect operation is noted.

 **WARNING:** Each seating position in the vehicle has a specific safety belt assembly which consists of one buckle and one tongue. The safety belt assembly is designed to be used as a pair and is not to be used across seating positions.

The active restraint system consists of:

- the front safety belt retractors with pretensioners secured to the body under the B-pillar lower trim panel.
- the rear LH and RH safety belt retractors secured to the body behind the quarter trim panels.
- the rear center safety belt retractor secured to the body under the package tray trim panel.
- the front inboard buckle end secured to the front seat assembly.
- the rear LH, RH, and center buckle ends secured to the rear floor pan under the rear seat cushion.
- the safety belt shoulder height adjuster, attached at the B-pillar under the trim panel.
- the child safety seat tether anchors attached to the package tray under the trim panel.
- the child safety seat LATCH system, attached to the floor pan under the second row seating.

A continuous-loop, single retractor active restraint system is used on both the front and rear seat safety belt assemblies.

Pretensioner System

The front safety belt and retractor assembly uses a pretensioner system which works in conjunction with the front air bag system mounted in the steering wheel and instrument panel. When the front air bag system is deployed, the pretensioner in the retractor deploys, causing the retractor spool to rotate. The rotating spool action removes excess webbing from the safety belt assembly, tightening the webbing around the occupant.

New driver and front passenger seat belt system (including belt and retractor assembly, buckles, and height adjusters) must be installed if the vehicle is involved in a collision that results in deployment of the front air bags and safety belt pretensioners.

For diagnostic information, refer to [Section 501-20B](#).

For pretensioner retractor disposal information, refer to [Section 501-20B](#).

Safety Belt, Lap/Shoulder

While the vehicle is in motion, the combination lap and shoulder belt adjusts to the occupant's movement. However, if the vehicle is braked hard, cornered hard or if the vehicle receives an impact of 8 km/h (5 mph) or more, the lap and shoulder belt locks and helps reduce the occupant's forward movement.

Safety Belt, Buckle End—Front

The inboard front safety belt buckle end and outboard anchor is secured to the front seat. This allows the front safety belt buckle end and outboard anchor to move with the front seat.

Safety Belt, Lap/Shoulder—Dual Locking Mode



WARNING: Rear-facing infant seats should never be placed in the front seats.

The dual locking mode retractor on the shoulder belt portion of the combination lap/shoulder safety belt for the front seat passenger and rear seat passengers operates in two ways:

1. In the vehicle-sensitive (emergency locking) mode, the shoulder belt retractor will allow the occupant freedom of movement, locking tight only on hard braking, hard cornering or impacts of approximately 8 km/h (5 mph) or more. The front and rear outboard safety belt retractors can also be made to lock by pulling/jerking on the belt.
2. In the automatic locking mode, the shoulder belt retractor will be automatically locked and remain locked when the combination lap/shoulder safety belt is buckled and does not allow the occupant freedom of movement. This mode provides tight lap/shoulder belt fit on the occupant and on a child safety seat or infant carrier installation restraint.

When the combination lap/shoulder belt is unbuckled and allowed to retract completely, the retractor will switch to the vehicle sensitive (emergency locking) mode.

The automatic locking mode must be used when installing a child safety seat.

Child Safety Seat Tether Anchors

Child safety seat tether anchors, located in the package tray, have been provided at all three rear seating positions. If a child safety seat was in use during a collision, inspect the tether anchor and all surrounding sheet metal for damage. Install a new tether anchor if necessary. Rework the sheet metal to its original condition and structural integrity. For additional information, refer to [Child Safety Seat Tether Anchor](#).

Attaching Safety Seats With Tether Straps

Some manufacturers make child safety seats that include a tether strap that goes over the back of the vehicle seat and attaches to an anchoring point. Other manufacturers offer the tether strap as an accessory. Contact the manufacturer of the child safety seat for information about ordering a tether strap.

Lower Anchors and Tethers for CHildren (LATCH)

The Lower Anchors and Tethers for CHildren (LATCH) system is a standardized and uniform attachment system for installing child safety seats in passenger vehicles. LATCH-equipped child safety seats have two lower attachments that connect to the vehicle portion of the LATCH system.

The vehicle portion of the system consists of two brackets, with two attachment points (6 mm wires) welded to each bracket. The attachment points protrude from the biteline between the seat cushion and seat backrest of the second row seating.

If a child safety seat was in use during a collision, inspect the vehicle portion of the system for damage. If any of the attachment points (6 mm wires) are damaged, install a new LATCH bracket.

Safety Belt Warning System

The safety belt warning indicator illuminates and a chime sounds to remind the occupants to fasten their safety belts.

The conditions of operation for the safety belt warning indicator and chime are as follows:

- If the driver safety belt is not buckled before the ignition switch is turned to RUN, then the safety belt warning indicator illuminates for one to two minutes and the warning chime sounds for four to eight seconds.
- If the driver safety belt is buckled while the warning indicator is illuminated and the reminder chime is sounding, then the safety belt warning indicator and reminder chime turn off.
- If the driver safety belt is buckled before the ignition switch is turned to RUN, then the safety belt warning indicator and reminder chime remain off.

Belt Minder

The Belt Minder feature is a supplemental warning to the safety belt warning function. This feature provides additional reminders to the driver that the driver's safety belt is unbuckled by intermittently sounding a chime and illuminating the safety belt warning lamp in the instrument cluster.

To activate or deactivate the Belt Minder feature, refer to [Section 413-09](#).

If...	Then...
The driver's safety belt is not buckled before the vehicle has reached at least 5 km/h (3 mph) and 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt Minder feature is activated — the safety belt warning light illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belt is buckled.
The driver's safety belt is buckled while the safety belt indicator light is illuminated and the safety belt warning chime is sounding...	The Belt Minder feature will not activate.
The driver's safety belt is buckled before the ignition switch is turned to the ON position...	The Belt Minder feature will not activate.

Safety Belt System

Inspection and Verification

1. Verify the customer's original concern by operating the active restraint system to duplicate the condition.
2. Inspect to determine if any of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Inspect the safety belt webbing for integrity. 	<ul style="list-style-type: none"> ● Open fuse. ● Bare, broken or disconnected wire. ● Connector not tightly engaged. ● Safety belt warning indicator lamp burned out or broken.

3. If the inspection reveals an obvious concern(s) that can be readily identified, repair the concern (s) as necessary.
4. If the concern remains after the inspection, determine the symptom. GO to [Symptom Chart](#).

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● The safety belt warning chime does not operate, the safety belt warning indicator lamp is OK 	<ul style="list-style-type: none"> ● Virtual image cluster (VIC). ● Circuitry. ● Driver seat module (DSM). 	<ul style="list-style-type: none"> ● REFER to Section 413-09.
<ul style="list-style-type: none"> ● The safety belt warning indicator lamp does not operate, the safety belt warning chime is OK 	<ul style="list-style-type: none"> ● Burned-out bulb. ● Circuitry. ● DSM. 	<ul style="list-style-type: none"> ● REFER to Section 413-01.
<ul style="list-style-type: none"> ● Neither the safety belt warning chime nor the safety belt warning indicator lamp operates 	<ul style="list-style-type: none"> ● Safety belt switch. ● DSM. ● Circuitry. 	<ul style="list-style-type: none"> ● REFER to Section 413-01.
<ul style="list-style-type: none"> ● Excessive pressure on the occupant during normal wear, the webbing cannot be extracted, excessive 	<ul style="list-style-type: none"> ● Front safety belt retractor and tongue. ● Rear safety 	<ul style="list-style-type: none"> ● CARRY OUT the Functional Test; REFER to Component Test in this section. INSTALL a

slack in webbing does not retract	belt retractor and tongue.	new safety belt retractor and tongue, if necessary.
<ul style="list-style-type: none"> ● Front safety belt and retractor does not function and a supplemental restraint system (SRS) fault code is present 	<ul style="list-style-type: none"> ● Pretensioner deployment. 	<ul style="list-style-type: none"> ● INSTALL a new driver and passenger safety belt system (including safety belt and retractor assembly, buckles, and height adjusters).


Component Test

Functional Test

1. **NOTE:** If the RH or the rear safety belts are to be tested, a passenger must be used.

Fasten the safety belts and proceed to a safe area.

2. Attain a speed of 8 km/h (5 mph).

3.  **WARNING: The driver and passenger must be prepared to brace themselves if the retractor does not lock.**


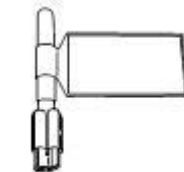
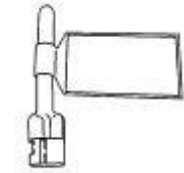
Test the safety belts.

1. Grasp the shoulder harness and prepare to lean forward.
 2. Make maximum brake application without a skid.
 3. **NOTE:** Do not jerk on the safety belt webbing when carrying out this test. Lean forward slightly when the brake application is made.
4. The safety belts should lock up with minimum webbing extension.
 5. If there is a lockup of both shoulder straps, the safety belt assemblies are functioning correctly. Should either or both retractors fail to lock up at the 8 km/h (5 mph) speed, repeat the test at a constant 24 km/h (15 mph) speed. (This test must be carried out with a RH front or rear passenger if the RH front or rear outboard safety belts are to be tested).
 6. **NOTE:** If either or both the shoulder belts do not lock up, the sheet metal in the retractor's mounting surface may need to be returned to its original shape and structural integrity.


If either or both shoulder belts do not lock up at the 24 km/h (15 mph) test, replace the suspect retractor with a new retractor.


Supplemental Restraint System (SRS) Deactivation and Reactivation

Special Tool(s)


 ST2502-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Deactivation


 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

 **WARNING:** The safety belt buckle pretensioner and safety belt retractor pretensioner are pyrotechnic devices. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.



WARNING: Vehicle sensor orientation is critical for proper system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Replace and properly position the sensor or any other damaged supplemental restraint system (SRS) components whether or not the air bag is deployed.



WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

NOTE: If a seat equipped with a seat mounted side air bag and/or a safety belt pretensioner (if equipped) system is being serviced, **the air bag system must be deactivated.**

NOTE: Restraint system diagnostic tools **MUST** be installed under the seats in the seat side air bag (if equipped) and safety belt pretensioner (if equipped) to floor connectors.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.



- WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

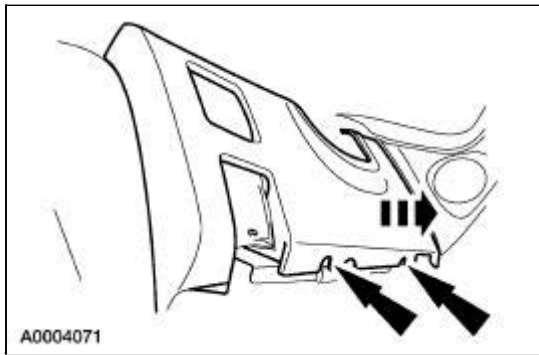
Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

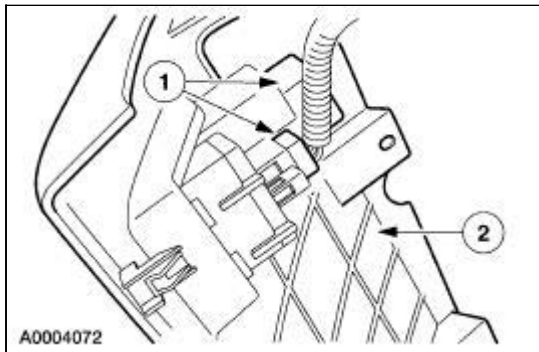
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).

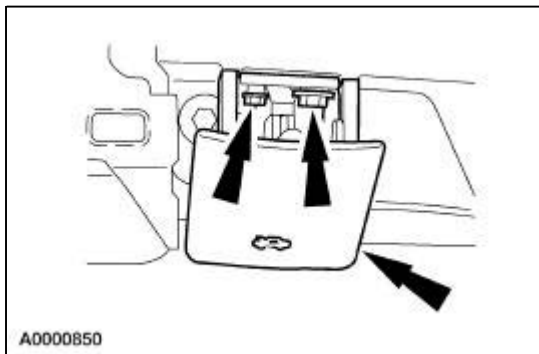
- Remove the two screws and pull out on the lower steering column opening finish panel enough to access the electrical connectors.



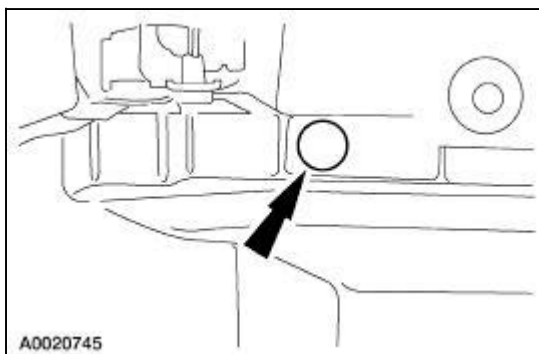
3. Remove the lower steering column opening finish panel.
 1. Disconnect the electrical connectors.
 2. Remove the lower steering column opening finish panel.



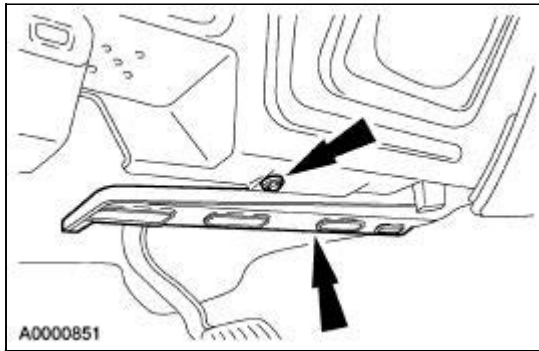
4. Remove the screws. Separate the hood latch release cable and handle assembly from the steering column opening reinforcement.



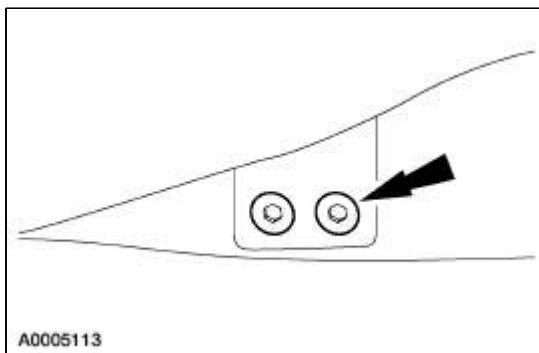
5. Remove the two pin-type retainers and the RH instrument panel insulator.
 - Disconnect the courtesy lamp.



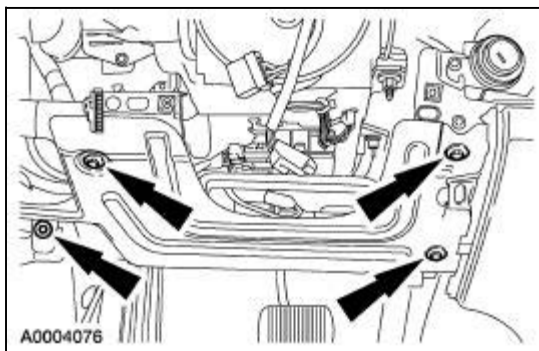
6. Remove the screw and the heater duct.



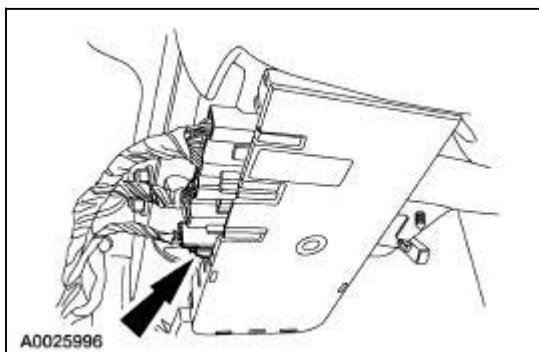
7. Loosen the two driver-side instrument panel tunnel brace bolts.
- Position the carpet aside to gain access to the bolts.



8. Remove the screws and the steering column opening reinforcement.

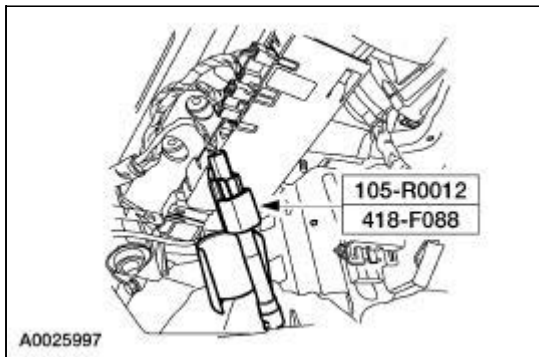


9. Disconnect the clockspring electrical connector at the base of the steering column.

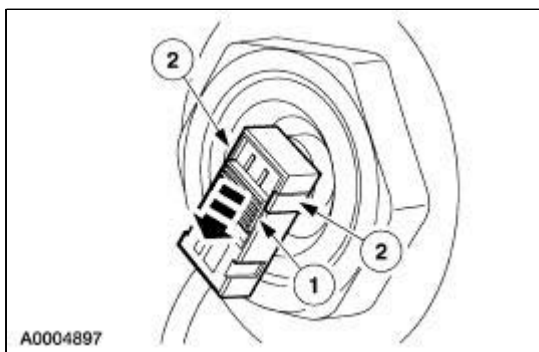


10. Attach the restraint system diagnostic tool to the vehicle harness side of the clockspring

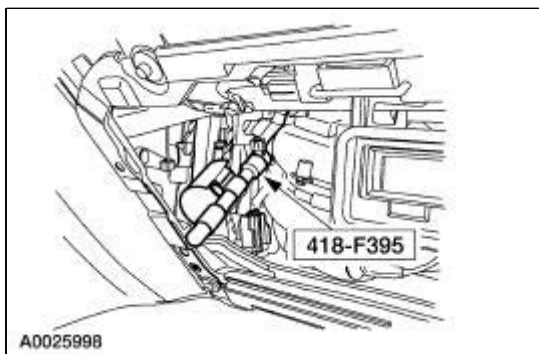
electrical connector.




11. Remove the glove compartment. For additional information, refer to [Section 501-12](#).
12. Disconnect the passenger air bag module electrical connector.
 1. Reaching into the glove box opening toward the center of the instrument panel, under the cross-car beam, slide and disengage the passenger air bag module electrical connector locking clip.
 2. Push in on the two release tabs and disconnect the passenger air bag module electrical connector.



13. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag electrical connector.



14. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
15. Move and tilt the front seats to their highest and most forward position.
16.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors,

instrument panel, console, door latches, strikers, seats and hood latches.

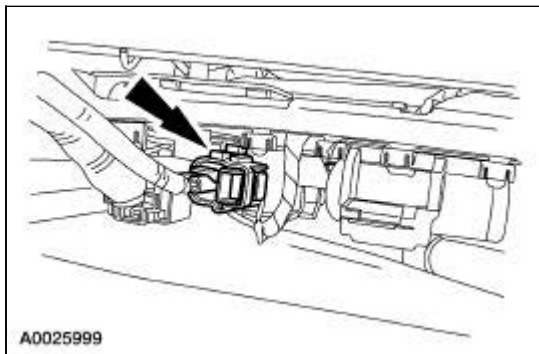
Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

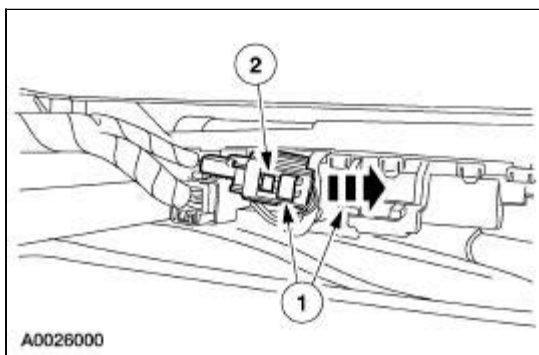
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).

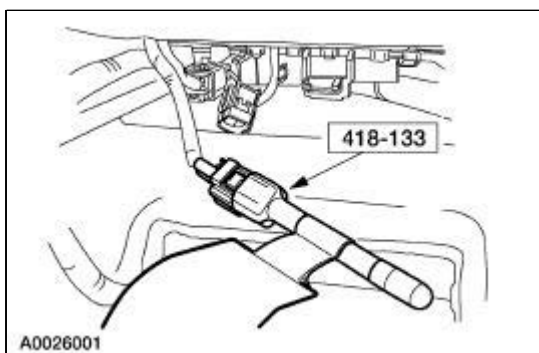
17. From under the passenger seat, release the tab on the connector bracket and remove the passenger seat side air bag electrical connector.



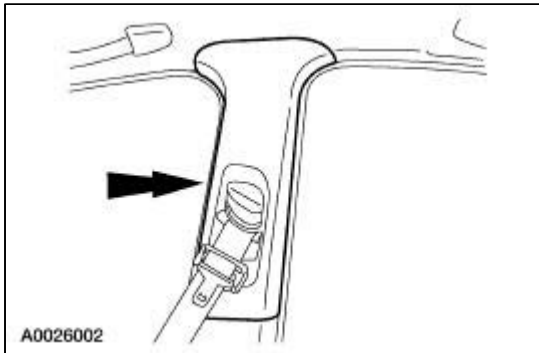
18. Disconnect the passenger seat side air bag electrical connector.
 1. Slide and disengage the passenger seat side air bag electrical connector locking clip.
 2. Push in to release the tab and disconnect the passenger seat side air bag electrical connector.



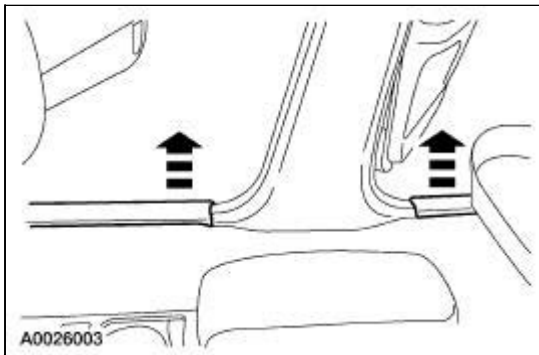
19. Attach the restraint system diagnostic tool to the passenger seat side air bag floor electrical connector.



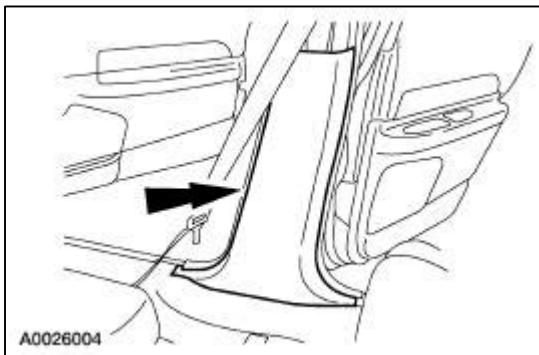
20. Remove the passenger side B-pillar weatherstripping.
21. Position the safety belt D-ring to its highest point.
22. Remove the passenger side B-pillar upper trim panel.



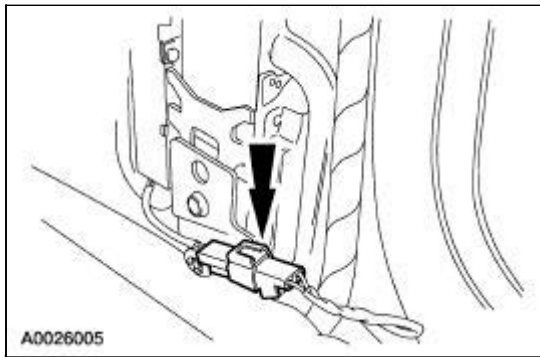
23. Remove the passenger side front and rear door scuff plates.



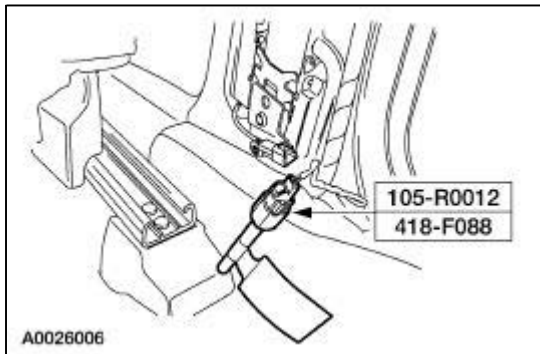
24. Remove the passenger side B-pillar lower trim panel.



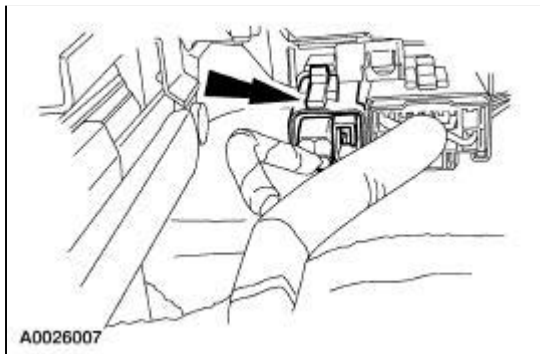
25. Disconnect the passenger side safety belt retractor pretensioner floor electrical connector.



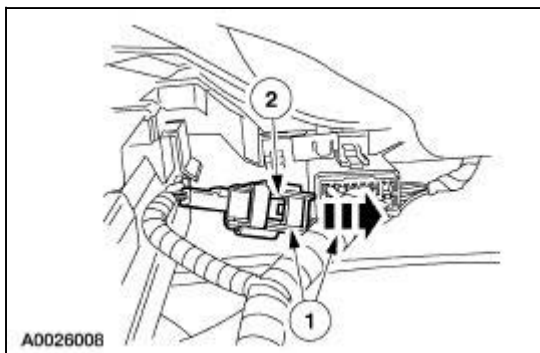
26. Attach the restraint system diagnostic tool to the passenger side safety belt retractor pretensioner floor electrical connector.



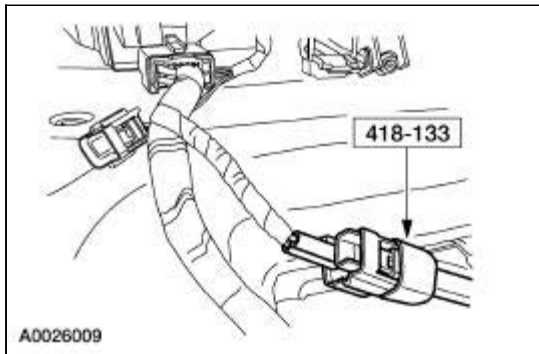
27. From under the driver seat, release the tab on the connector bracket and remove the driver seat side air bag electrical connector.



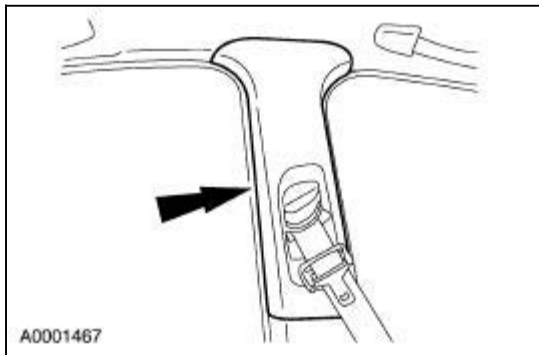
28. Disconnect the driver seat side air bag electrical connector.
1. Slide and disengage the driver seat side air bag electrical connector locking clip.
 2. Push down to release the tab and disconnect the driver seat side air bag electrical connector.



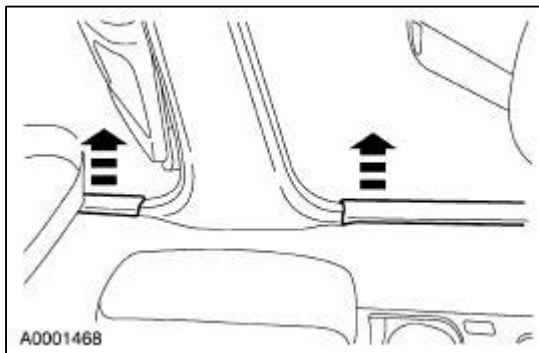
29. Attach the restraint system diagnostic tool to the driver seat side air bag floor electrical connector.



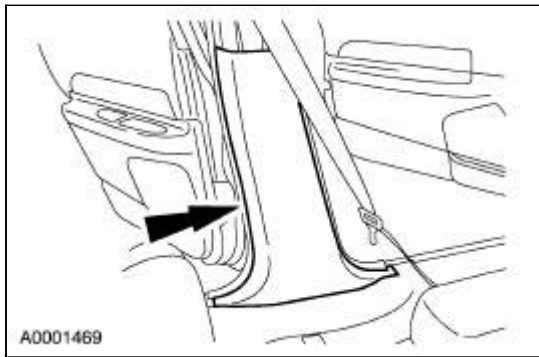
30. Remove the driver side B-pillar weatherstripping.
31. Position the safety belt D-ring to its highest point.
32. Remove the driver side B-pillar upper trim panel.



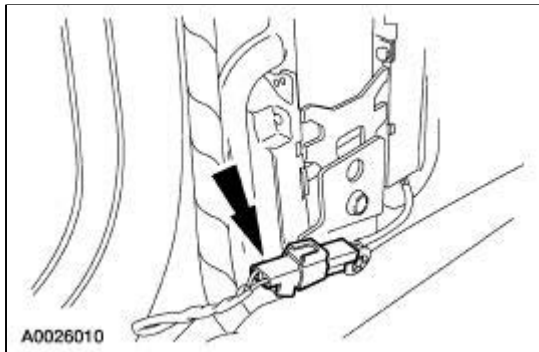
33. Remove the driver side front and rear door scuff plates.



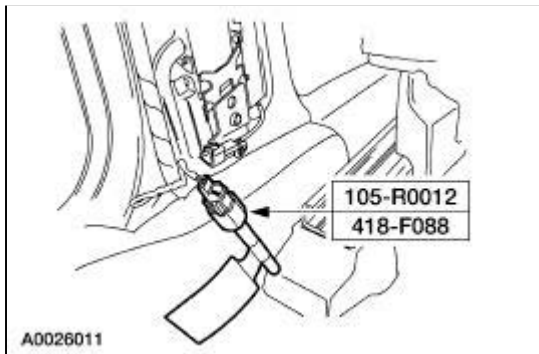
34. Remove the driver side B-pillar lower trim panel.



35. Disconnect the driver side safety belt retractor pretensioner electrical connector.



36. Attach the restraint system diagnostic tool to the driver side safety belt retractor pretensioner floor electrical connector.



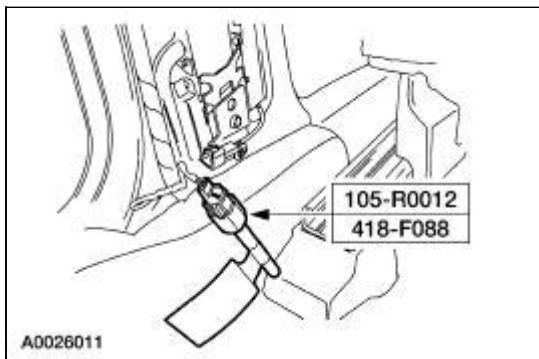
37. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
38. With the restraint system diagnostic tools installed at all deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).
39. Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).

Reactivation

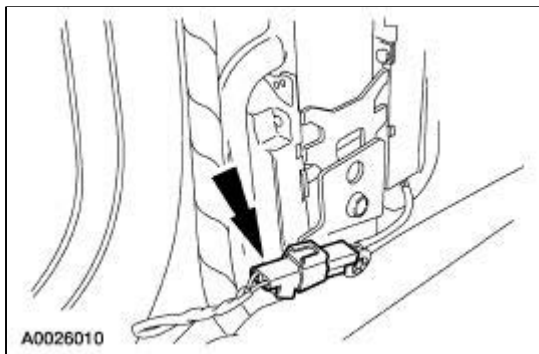


WARNING: To reduce the risk of serious personal injury, read and follow all warnings and notes at the beginning of the deactivation procedure.

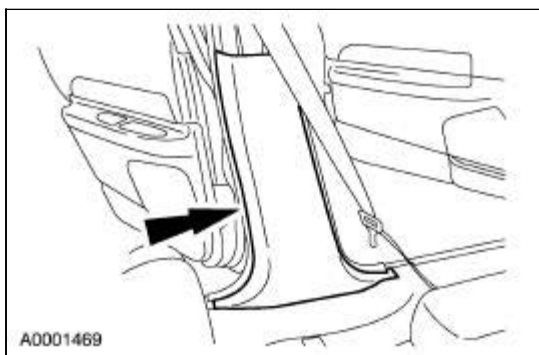
1. Remove the restraint system diagnostic tool from the driver side safety belt retractor pretensioner floor electrical connector.



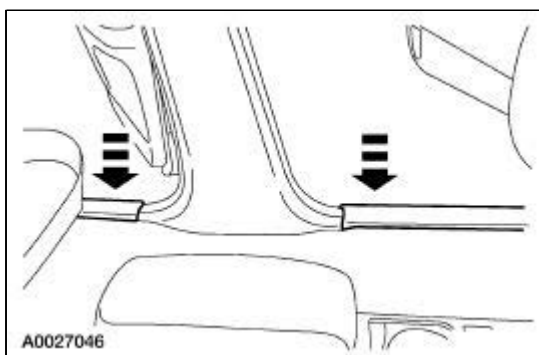
2. Connect the driver side safety belt retractor pretensioner electrical connector.



3. Install the driver side B-pillar lower trim panel.

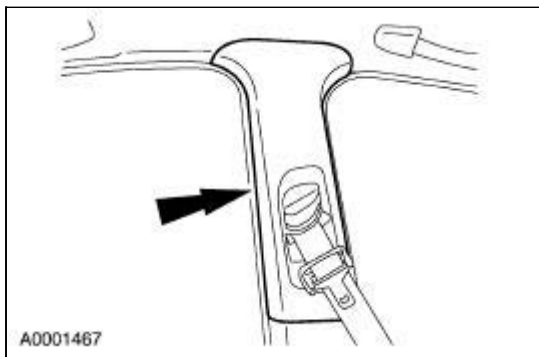


4. Install the driver side front and rear door scuff plates.

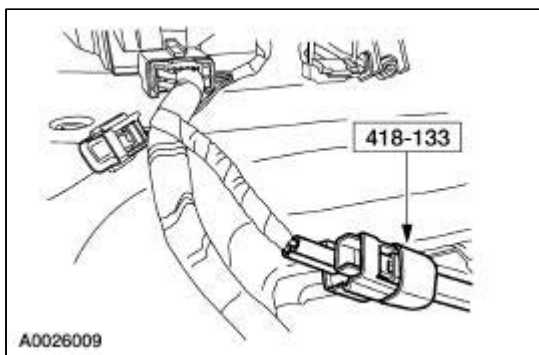


5. **NOTE:** Position the safety belt D-ring to its highest point.

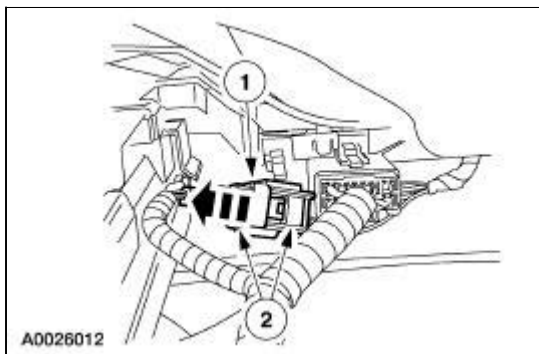
Install the driver side B-pillar upper trim panel.



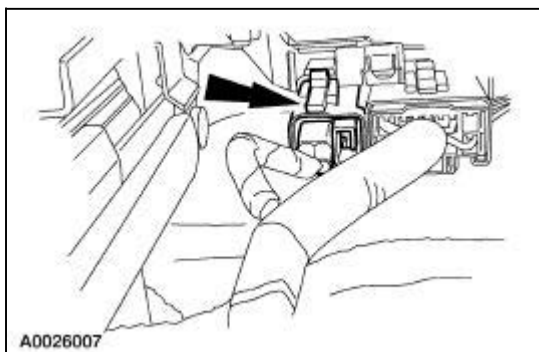
6. Install the driver side B-pillar weatherstripping.
7. Remove the restraint system diagnostic tool from the driver seat side air bag floor electrical connector.



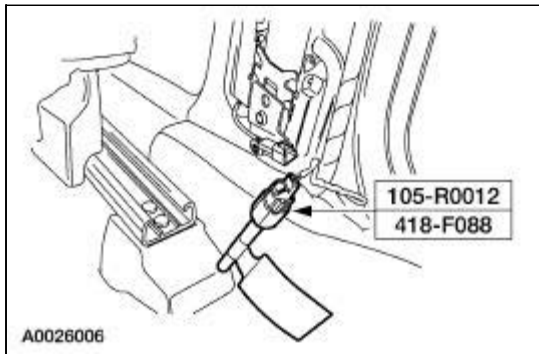
8. Connect the driver seat side air bag electrical connector.
 1. Connect the driver seat side air bag electrical connector.
 2. Slide and engage the driver seat side air bag electrical connector locking clip.



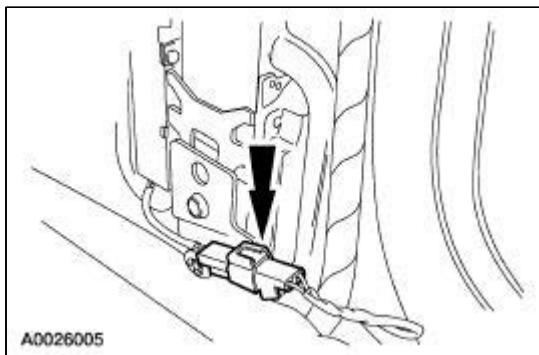
9. Install the driver seat side air bag electrical connector onto the connector bracket under the driver seat.



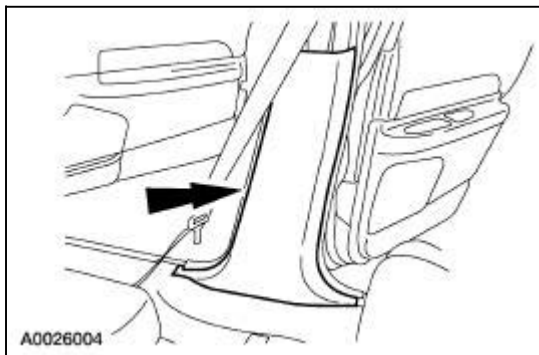
10. Remove the restraint system diagnostic tool from the passenger side safety belt retractor pretensioner electrical connector.



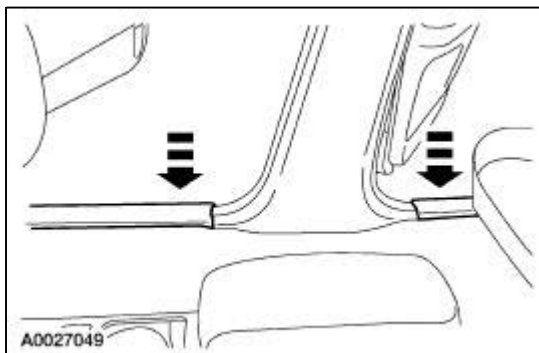
11. Connect the passenger side safety belt retractor pretensioner electrical connector.



12. Install the passenger side B-pillar lower trim panel.

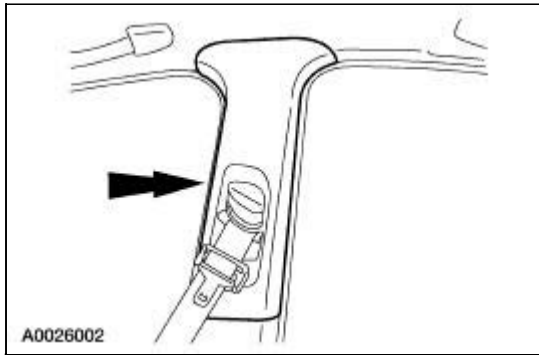


13. Install the passenger side front and rear door scuff plates.



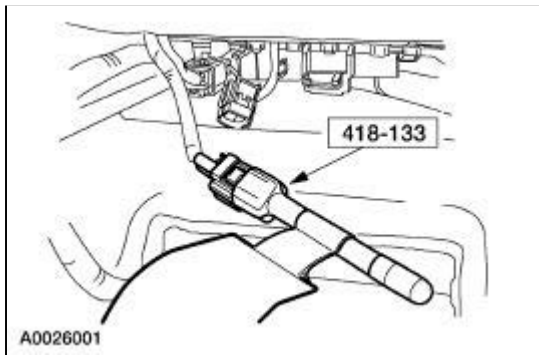
14. **NOTE:** Position the safety belt D-ring to its highest point.

Install the passenger side B-pillar upper trim panel.



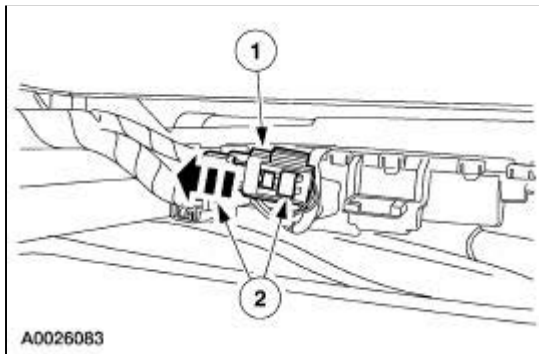
15. Install the passenger side B-pillar weatherstripping.

16. Remove the restraint system diagnostic tool from the passenger seat side air bag floor electrical connector.

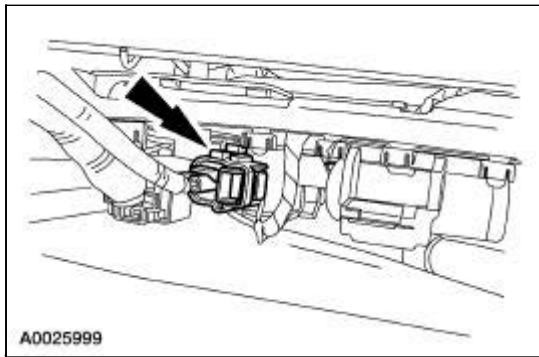


17. Connect the passenger seat side air bag electrical connector.

1. Connect the passenger seat side air bag electrical connector.
2. Slide and engage the passenger seat side air bag electrical connector locking clip.




18. Install the passenger seat side air bag electrical connector onto the connector bracket under the passenger seat.



19. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).

20. Position the front seats rearward.

21.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

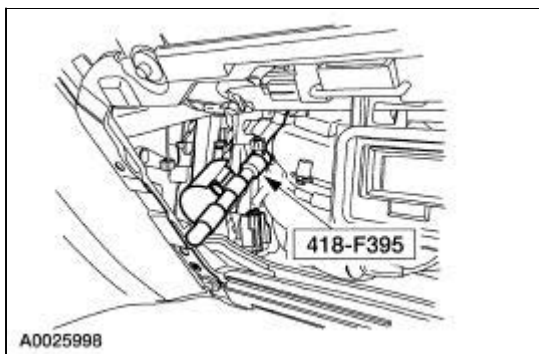
Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

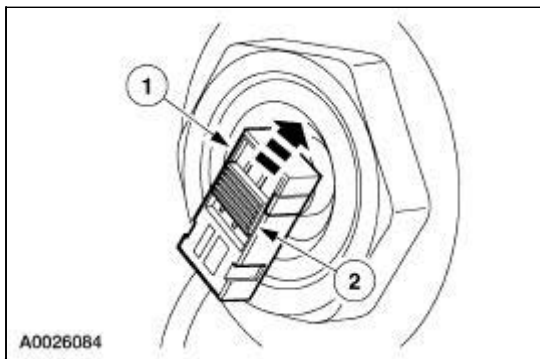
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).

22. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag electrical connector.

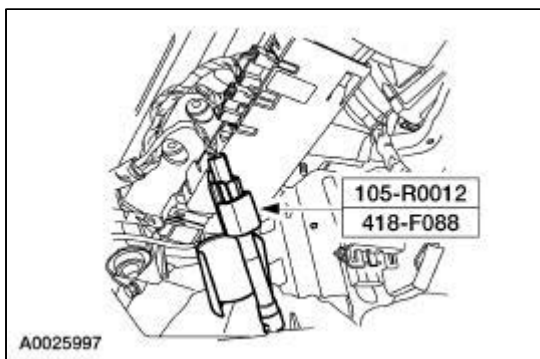


23. Connect the passenger air bag module electrical connector.
1. Reach into the glove box opening toward the center of the instrument panel, under the cross-car beam and connect the passenger air bag module electrical connector.
 2. Slide and engage the passenger air bag module electrical connector locking clip.

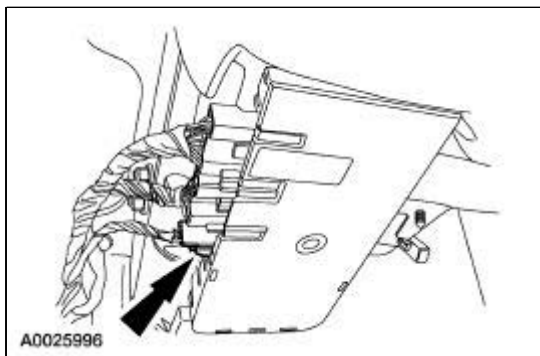


24. Install the glove compartment. For additional information, refer to [Section 501-12](#).

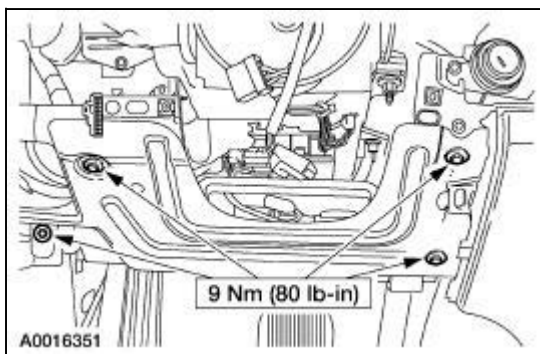
25. Remove the restraint system diagnostic tool from the vehicle harness side of the clockspring electrical connector.



26. Connect the clockspring electrical connector at the base of the steering column.

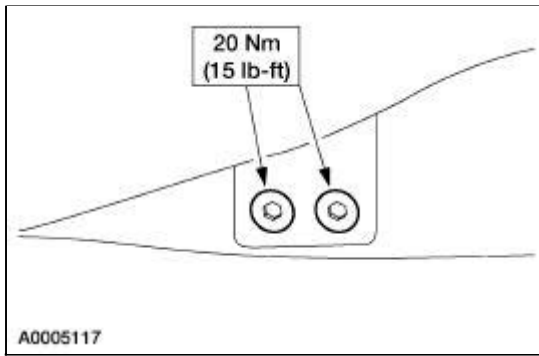


27. Position the steering column opening reinforcement and install the screws.

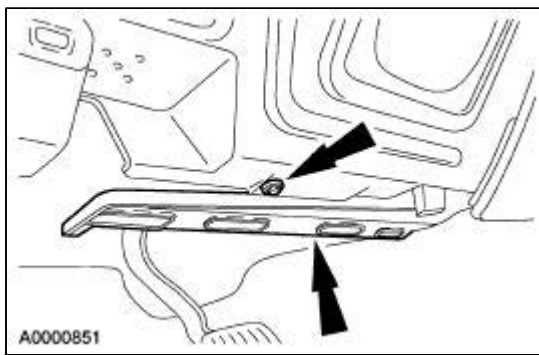


28. Tighten the two driver-side instrument panel tunnel brace bolts.

- Reposition the carpet.

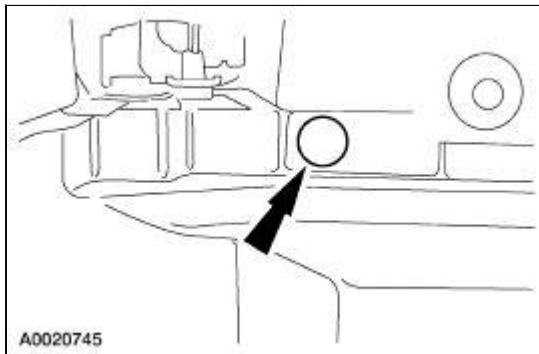


29. Position the heater duct and install the screw.

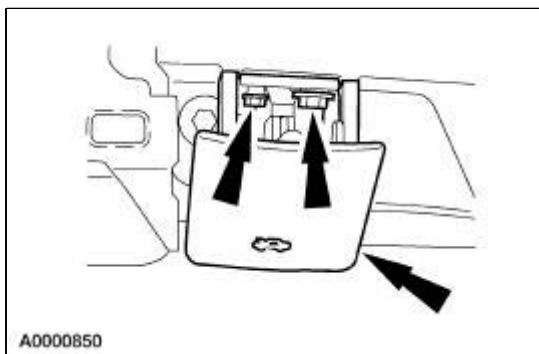


30. Install the RH instrument panel insulator and the two pin-type retainers.

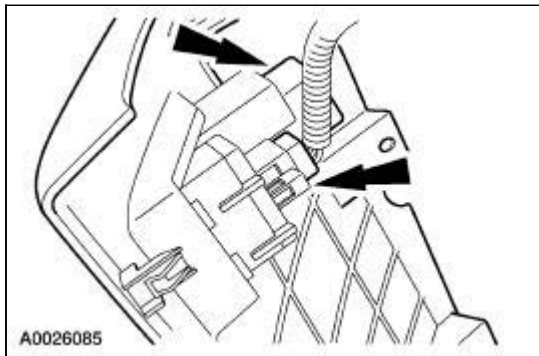
- Connect the courtesy lamp.



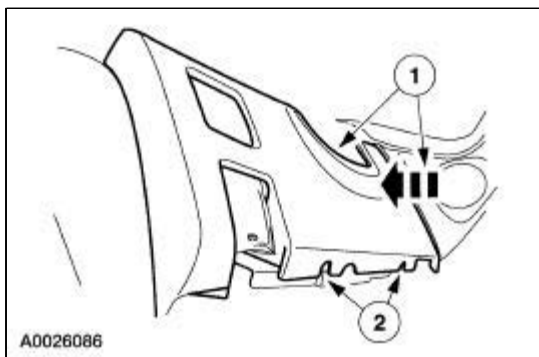
31. Position the hood latch release cable and handle assembly to the steering column opening reinforcement and install the screws.




32. Connect the electrical connectors to the switches in the lower steering column opening finish panel.



33. Install the lower steering column opening finish panel to the instrument panel.
1. Position the lower steering column opening finish panel to the instrument panel and push in, seating the retaining clips.
 2. Install the screws.



34. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).

35.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

36. Check the active restraint system for correct operation. For additional information, refer to [Safety Belt System](#) in the Diagnosis and testing portion of this section.
-

Safety Belt Cleaning

1.  **WARNING: Do not bleach or re-dye the webbing, as the webbing may weaken.**

Clean the safety belt webbing only with a mild soap solution recommended for cleaning upholstery or carpets. Follow the instructions provided with the soap.

Safety Belt Maintenance



WARNING: All safety belt assemblies include retractors, buckles, front seat belt buckle support assemblies (slide bar), if equipped, shoulder belt height adjuster, if equipped, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. All belt assemblies should be installed new unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected. New safety belt assemblies should be installed if either damage or incorrect operation is noted.

1. The safety belt assemblies should be periodically inspected to make sure that they have not become damaged and that they remain in correct operating condition, particularly if they have been subjected to severe stress.
 2. Before installing the new safety belt assembly; the safety belt retaining areas must be inspected for damage and distortion. If the retaining points are damaged and distorted, the sheet metal must be reworked back to its original shape and structural integrity.
 3. Install the new safety belt(s) using the appropriate instructions. Carry out the Functional Test Procedure. For additional information, refer to [Safety Belt System](#) in this section.
-

Replacement of the Weld Nut and Reinforcement


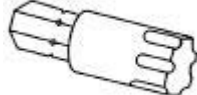
1. **NOTE:** If the safety belt anchor nuts or reinforcements are stripped or missing, a new nut/reinforcement plate must be installed.

Expose the suspect anchor point.

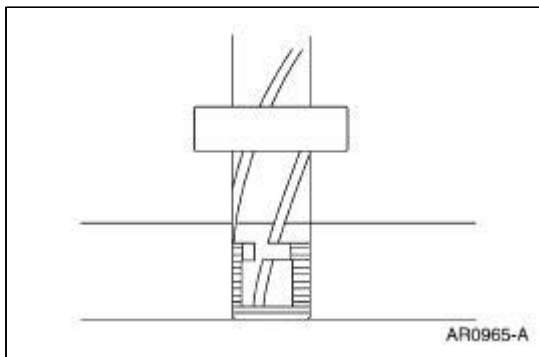
2. Drill out two 8 mm (5/16 inch) diameter access holes adjacent to the weld nut clearance hole.
 3. Thread a length of copper welding wire through the clearance hole and position to secure the weld nut and washer.
 4. Use MIG wire feed welder and plug weld a M10 weld nut and standard washer in place at the two 8 mm (5/16 inch) holes.
 5. Metal finish as necessary.
 6. Install the restraint system.
 7. Carry out the Functional Test. For additional information, refer to [Safety Belt System](#) in this section.
-

Safety Belt Shoulder Height Adjuster With Stripped Weld Nuts

Special Tool(s)

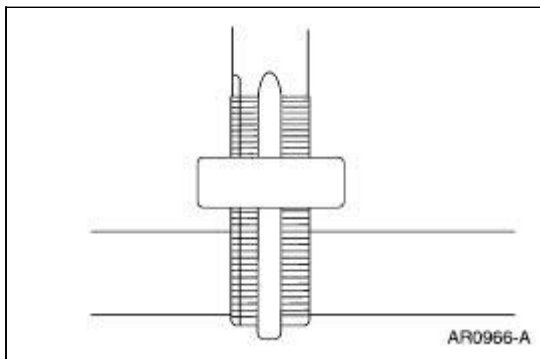
 <p>ST1657-A</p>	D-Ring Installation Kit 100-F012 (134-00018) or equivalent
 <p>ST1181-A</p>	Safety Belt Bolt Bit 501-010 (T77L-2100-A) or equivalent

1. Remove the shoulder safety belt height adjuster. For additional information, refer to [Height Adjuster—Front Shoulder Safety Belt](#) in this section.
2. Use the half-inch drill provided in the D-Ring Installation Kit to drill out the damaged threads in the upper pillar structure.

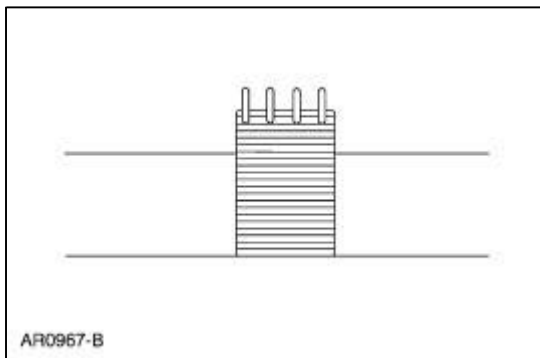


3. **NOTE:** After each rotation, back off the tap slightly to remove the new cuttings and be sure to blow out any chips before proceeding.

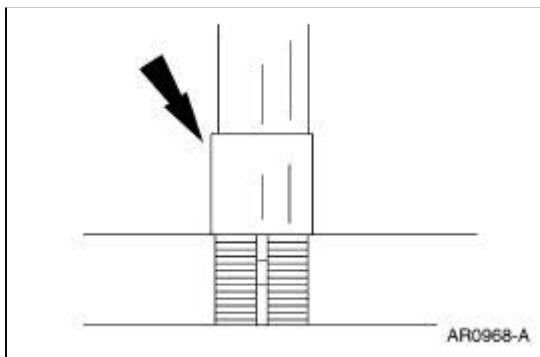
Apply a suitable lubricant to the M14x1.5 tap provided in the D-Ring Installation Kit and tap new threads.



4. Use a threaded insert (Part of #N807170-S190) provided in the D-Ring Installation Kit and screw it into the retapped hole until it is slightly below the surface.

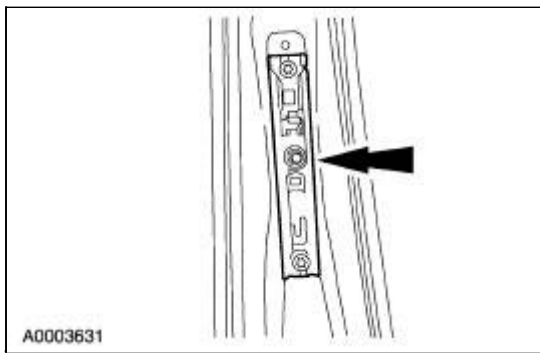


5. Use a hammer to lightly tap the installation tool provided in the D-Ring Installation Kit several times to seat the insert keys.

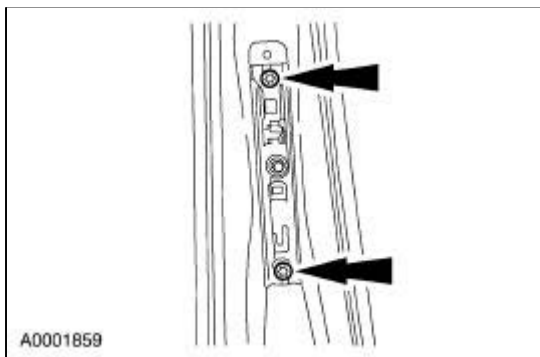


6. **NOTE:** If the shoulder safety belt height adjuster bolts are stripped, install a new height adjuster.

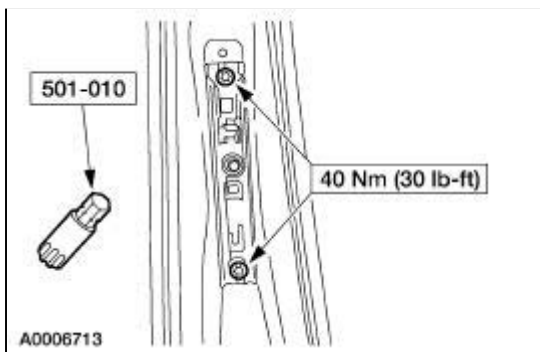
Insert the shoulder safety belt height adjuster in the opening of the upper B-pillar structure, making sure the shoulder belt height adjuster knob on the shoulder safety belt height adjuster is positioned above the D-ring attachment nut. (The tab is located at the top and is to be inserted in the hole provided in the B-pillar structure).



7. Hand tighten the height adjuster bolts until they are snug.

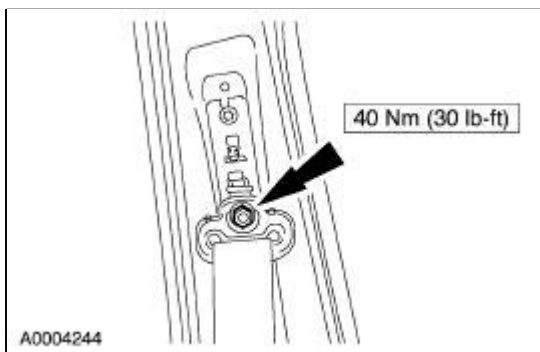


8. Using the special tool, tighten the height adjuster bolts.



9. **NOTE:** Make sure the D-ring rotates freely.

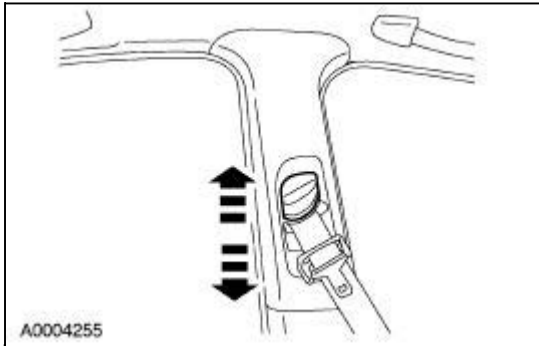
Install the safety belt D-ring and tighten the nut.



10. **NOTE:** Position the safety belt D-ring to its highest point before installing B-pillar trim.

Install the B-pillar trim.

11. Operate the front seat shoulder strap adjuster. Make sure it travels from top to bottom and locks correctly in each position.



12. Check the restraint system for correct operation.
-

Safety Belt Procedure After a Collision



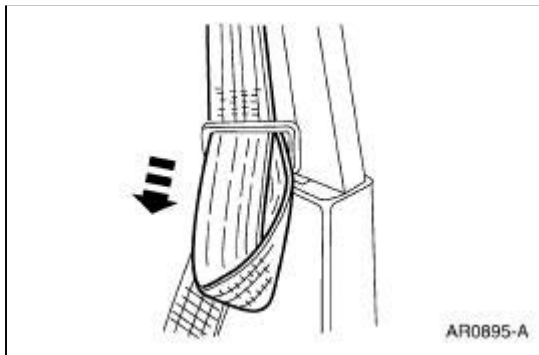
WARNING: All safety belt assemblies include retractors, buckles, front seat belt buckle support assemblies (slide bar), if equipped, shoulder belt height adjuster, if equipped, child safety seat tether bracket assemblies, if equipped, and attaching hardware should be inspected after any collision. All belt assemblies should be installed new unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected. New safety belt assemblies should be installed if either damage or incorrect operation is noted.

NOTE: The driver and front passenger seat belt system (including belt and retractor assembly, buckles, and height adjusters) must be replaced if the vehicle is involved in a collision that results in deployment of the front air bags and safety belt pretensioners.

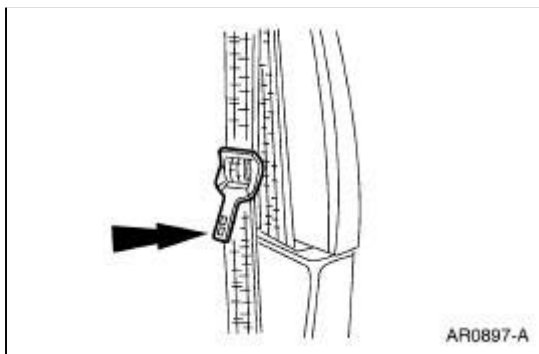
1. Before installing a new safety belt assembly, the safety belt attaching areas must be inspected for damage and distortion. If the attaching points are damaged and distorted, the sheet metal must be worked back to its original shape and structural integrity.
 2. Install the new safety belt(s). For additional information, refer to the procedure in this section. Carry out the Functional Test. For additional information, refer to [Safety Belt System](#) in this section.
-

Safety Belt Tongue Rotated on Belt

1. Grasp the belt tongue and pull the belt webbing down to form a loop through the slot in the tongue.

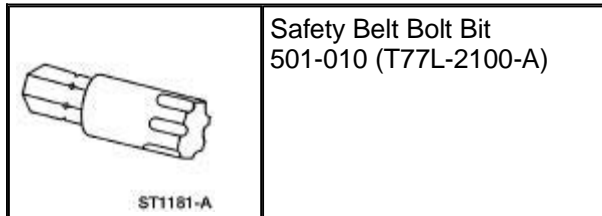


2. Rotate and fold the belt webbing over itself within the slot to remove the twist.
3. Pull the excess belt webbing back through the slot in the belt tongue.
4. Pull the excess belt webbing through the slot.
5. The safety belt tongue should face inward when completed.



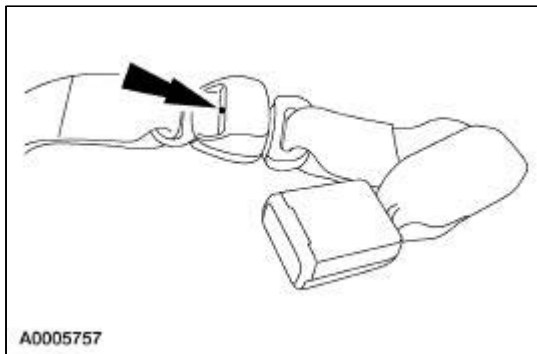
Retractor —Rear Center Safety Belt

Special Tool(s)

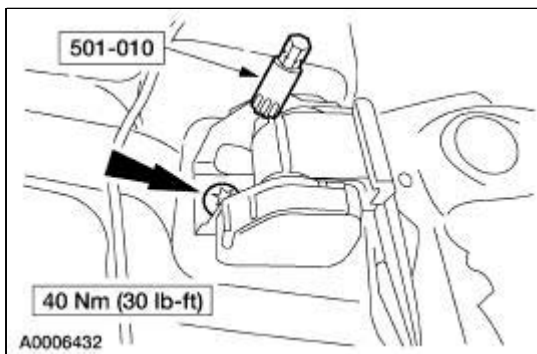


Removal

1. Using a suitable tool, release the mini-buckle.



2. Remove the retractor cover.
3. Using the special tool, remove the retractor.

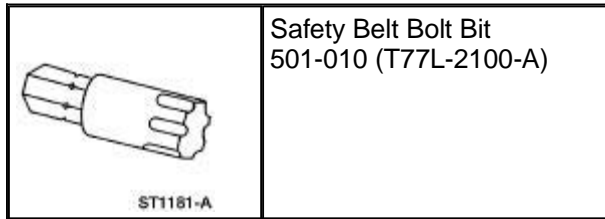


Installation

1. To install, reverse the removal procedure.
 - Check the restraint system for correct operation.

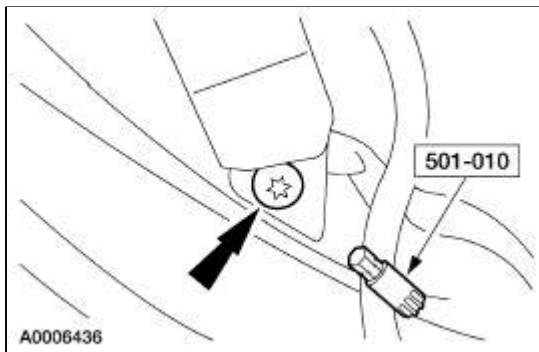
Retractor —Rear LH and RH Safety Belt

Special Tool(s)

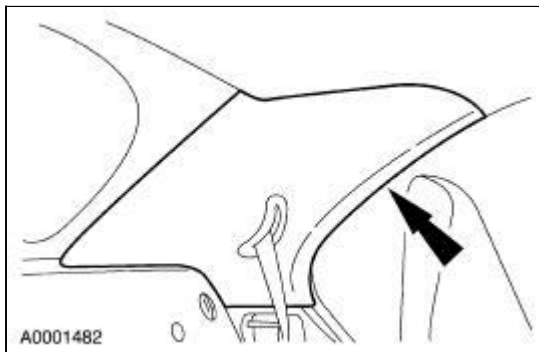


Removal

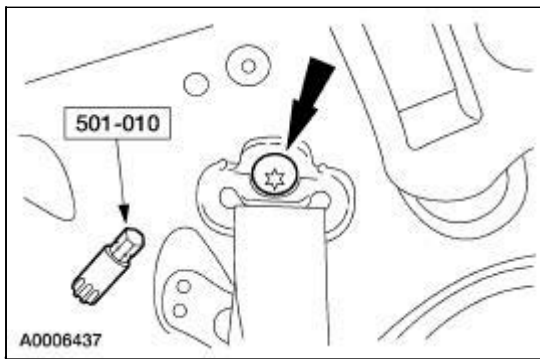
1. Remove the seat backrest rear side bolsters. For additional information, refer to [Section 501-10](#).
2. Using the special tool, remove the rear safety belt anchor bolt.



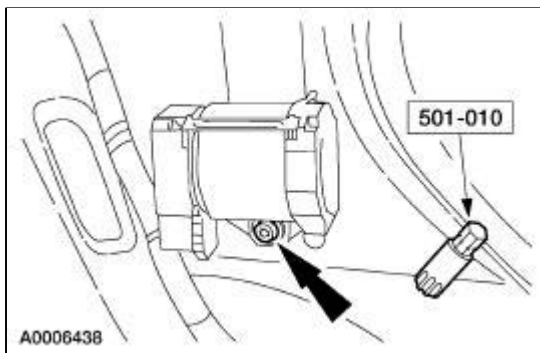
3. Remove the quarter trim panel.



4. Using the special tool, remove the D-ring bolt.

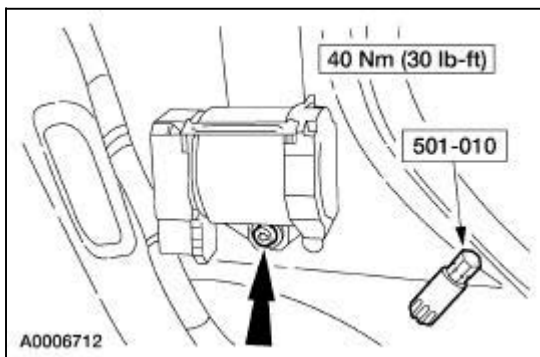


5. Using the special tool, remove the bolt and the retractor.

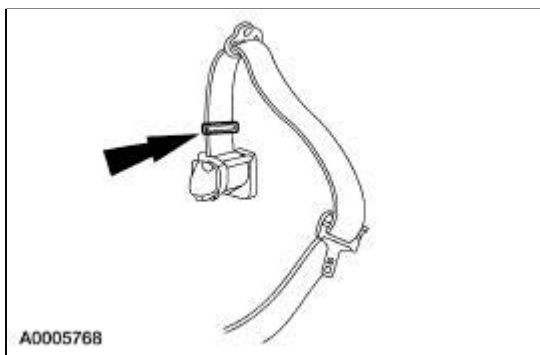


Installation

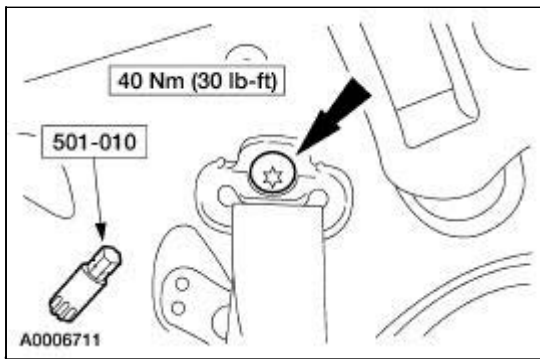
1. Using the special tool, install the retractor.



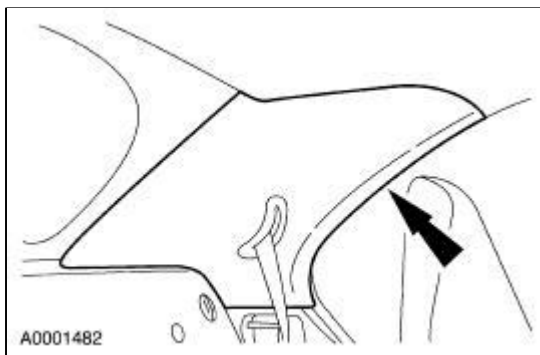
2. Remove the shipping clip from the safety belt webbing.



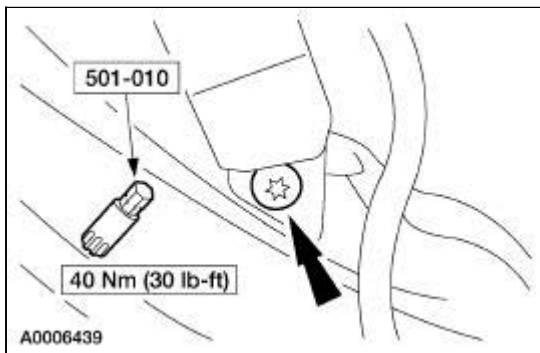
3. Using the special tool, install the D-ring bolt.



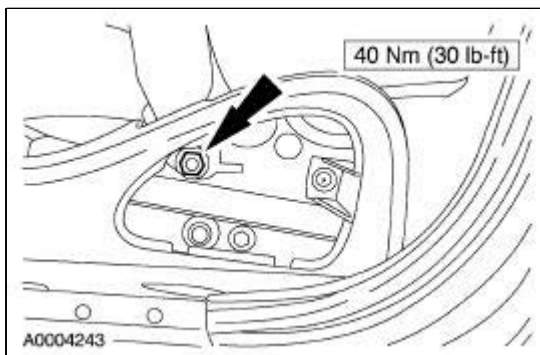
4. Install the rear quarter trim panel.



5. Using the special tool, install the rear safety belt anchor bolt.



6. Install the seat backrest rear side bolsters. For additional information, refer to [Section 501-10](#).

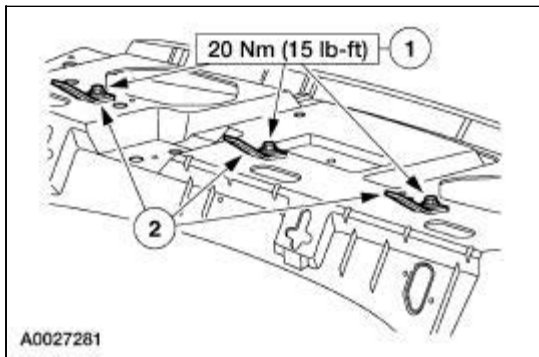



7. Check the restraint system for correct operation.
-

Child Safety Seat Tether Anchor

Removal and Installation

1. Remove the package tray trim panel. For additional information, refer to [Section 501-05](#).
2. Remove the child safety seat tether anchors.
 1. Remove the bolts.
 2. Remove the child safety seat tether anchors.



3.  **WARNING:** It is important that the bolt/anchor be securely tightened to specification. Otherwise, the child's safety seat may not be properly secured, and the child could be injured in case of a sudden stop or accident.

NOTE: Rework the sheet metal to its original condition and structural integrity.

NOTE: Make sure to tighten the bolts to specification.

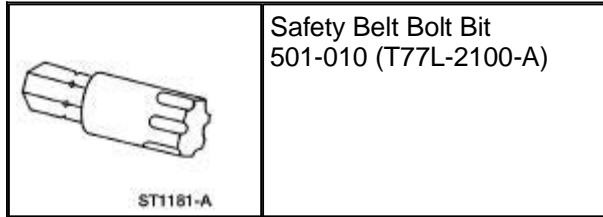
To install, reverse the removal procedure.

- See the removal procedure or Specifications for torque specifications.

4. Check the active restraint system for correct operation.

Height Adjuster —Front Shoulder Safety Belt

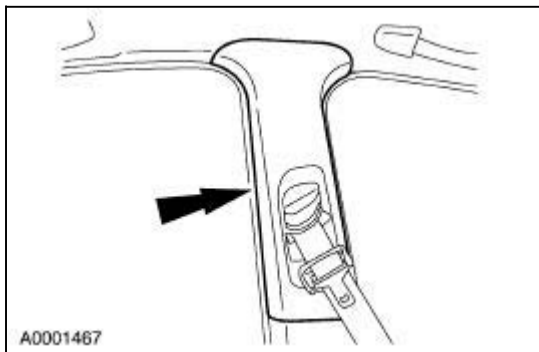
Special Tool(s)



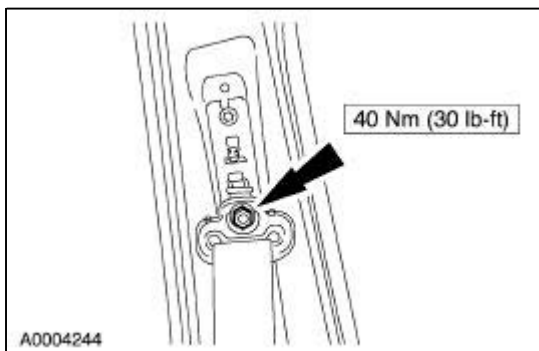
Removal and Installation

1. Pull back the weather-strip surrounding the upper B-pillar trim.
2. **NOTE:** Position the safety belt D-ring to its highest point.

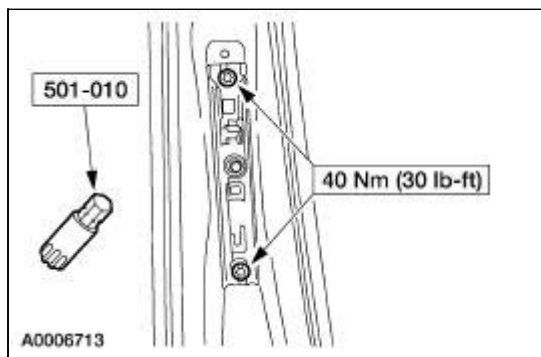
Remove the upper B-pillar trim.



3. Remove the D-ring nut.



4. Using the special tool, remove the height adjuster bolts.





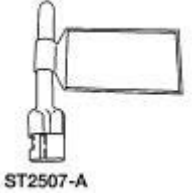
5. **NOTE:** Position the safety belt D-ring to its highest point.

To install, reverse the removal procedure.


- Check the restraint system for correct operation.
-

Safety Belt Buckle —Front

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal


 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface could contain deposits of sodium hydroxide, a product of the gas gernerant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so could result in air bag deployment which could result in personal injury.

All vehicles

1. Prepare the vehicle for seat removal.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.


The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the supplemental restraint system deactivation/reactivation procedure.**

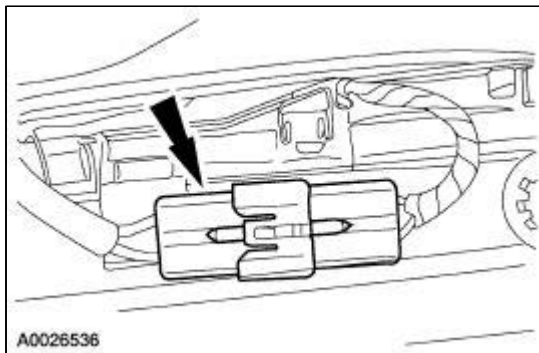
Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in the General Procedures portion of this section.

3.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the seat removal and installation procedure.**

Remove the seat on the side with the affected safety belt buckle. For additional information, refer to [Section 501-10](#).

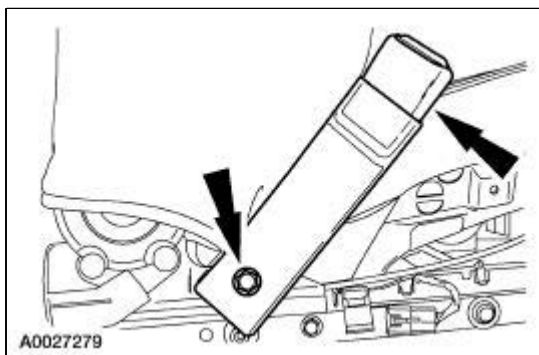
Driver seat only

2. Disconnect the safety belt buckle usage detection switch electrical connector.



All front safety belt buckles

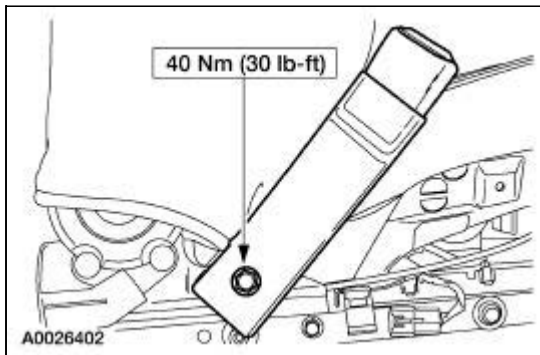
3. Remove the bolt and the safety belt buckle.



Installation

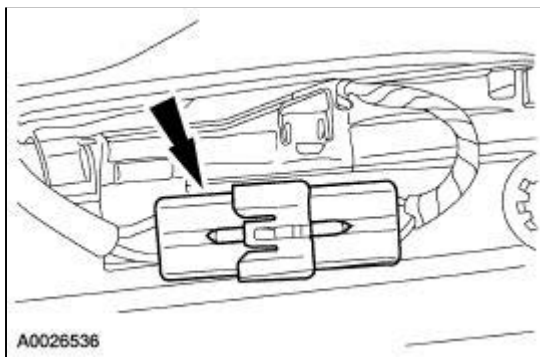
All front safety belt buckles

1. Position the safety belt buckle to the seat. Install the bolt.



Driver seat only

2. Connect the safety belt buckle usage detection switch electrical connector.



All vehicles

3. Restore the vehicle to operating condition.
 1. **⚠ WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the seat removal and installation procedure.**

Install the seat with the affected safety belt buckle. For additional information, refer to [Section 501-10](#).

2. **⚠ WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in the General Procedures portion of this section.

3. **⚠ WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

4. Check the active restraint system for correct operation. For additional information, refer to [Safety Belt System](#) in this section.

Child Safety Seat Tether Anchor —LATCH

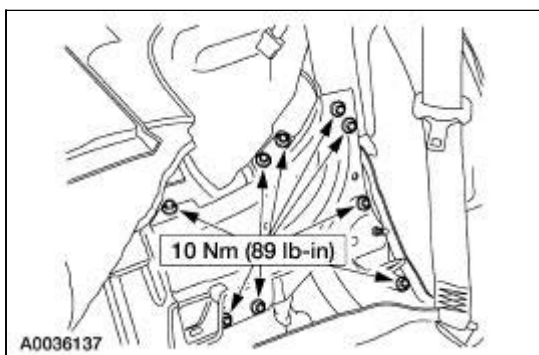
Removal and Installation

NOTE: The left-hand side is shown, the right-hand side is similar.

1. Remove the rear seat backrest side bolster. For additional information, refer to [Section 501-10](#).
2. Remove the rear seatback. For additional information, refer to [Section 501-10](#).
3. Remove the five pin-type retainers (three shown) and remove the finish panel.



4. Remove the bolts and the LATCH bracket.

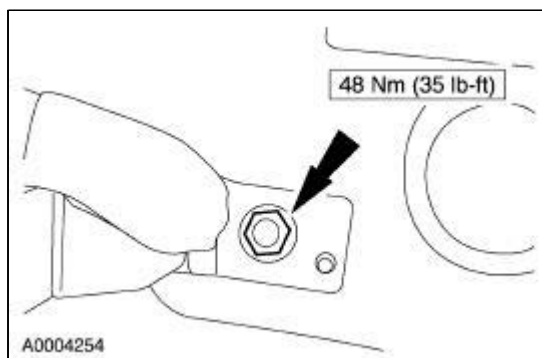


5. To install, reverse the removal procedure.
 - Make sure the wire harness is positioned correctly before installing the LATCH bracket.

Safety Belt Buckle —Rear

Removal and Installation


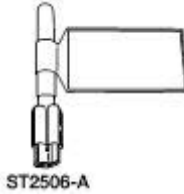
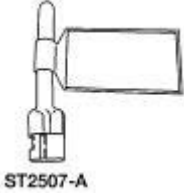

1. Remove the rear seat cushion. For additional information, refer to [Section 501-10](#).
2. Remove the nut and the rear safety belt buckle.



3. To install, reverse the removal procedure.
 - Check the restraint system for correct operation.
-


Safety Belt Retractor and Pretensioner


Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F395
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)
 ST1181-A	Safety Belt Bolt Bit 501-010 (T77L-2100-A)

Removal

 **WARNING:** The safety belt buckle pretensioner and safety belt retractor pretensioner are pyrotechnic devices. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner.


 **WARNING:** The safety belt buckle pretensioner and safety belt retractor pretensioner are pyrotechnic devices. Never probe an electrical connector pretensioner. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

 **WARNING:** After deployment, the air bag surface could contain deposits of sodium hydroxide, a product of the gas gernerant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so could result in air bag deployment which could result in personal injury.

NOTE: The driver side is shown, the passenger side is similar.

1. Prepare the vehicle for safety belt retractor and pretensioner removal.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

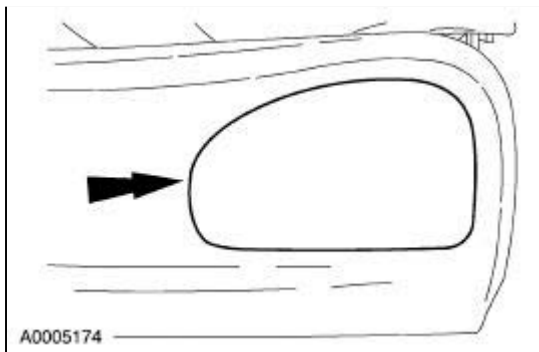
Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

2.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.

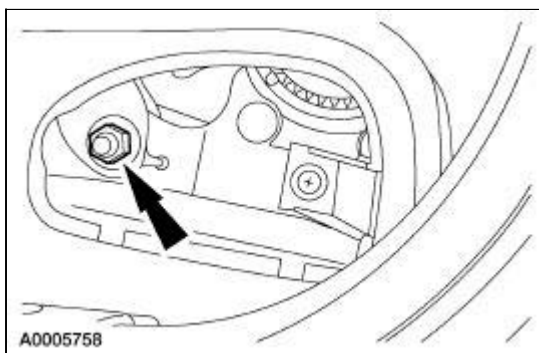
Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in the General Procedures portion of this section.

2.  **CAUTION:** Do not use a screwdriver to remove the safety belt cover.

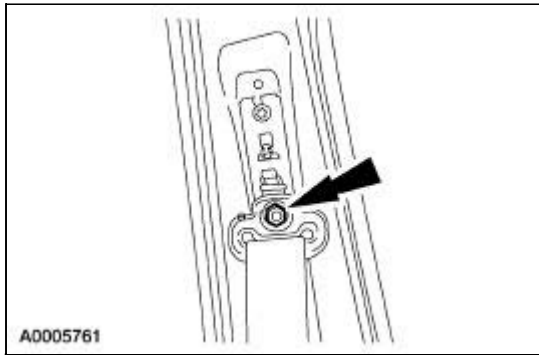
Remove the front safety belt anchor cover by placing fingers behind the cover and pushing outward.



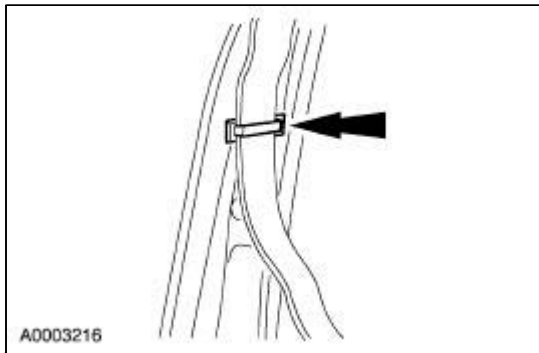
3. Remove the nut and the front safety belt anchor.



4. Remove the D-ring nut and route the safety belt out of the B-pillar trim panel.



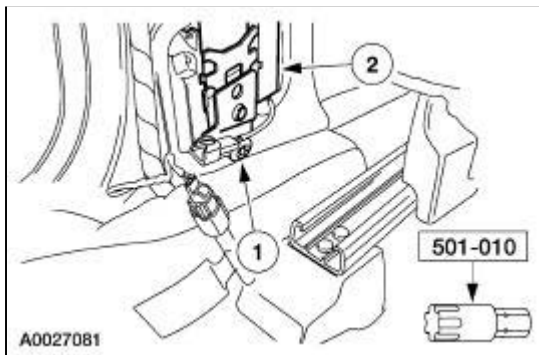
5. Remove the web guide.



6. **NOTE:** For pretensioner retractor disposal procedure, refer to [Section 501-20B](#).

Remove the safety belt retractor and pretensioner assembly.

1. Using the special tool, remove the bolt.
2. Remove the safety belt retractor and pretensioner.

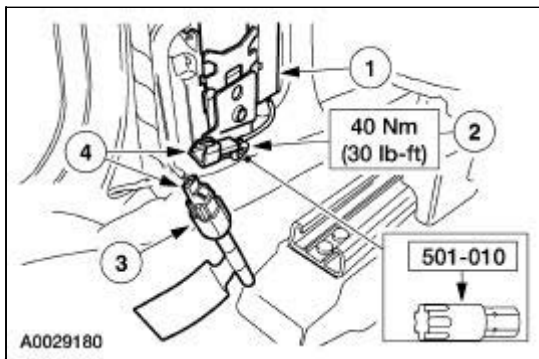


Installation




WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions and notes at the beginning of the removal procedure.

1. Install the safety belt retractor and pretensioner assembly.
 1. Position the safety belt retractor and pretensioner.
 2. Using the special tool, install the bolt.
 3. Remove the restraint system diagnostic tool from the driver side safety belt retractor pretensioner electrical connector.
 4. Connect the electrical connector.



2. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
3. With the restraint system diagnostic tools still installed at the remaining deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

4.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

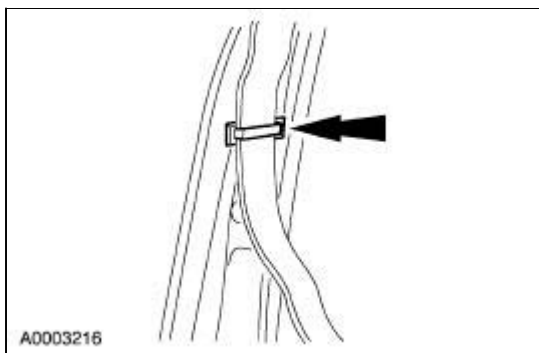
Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

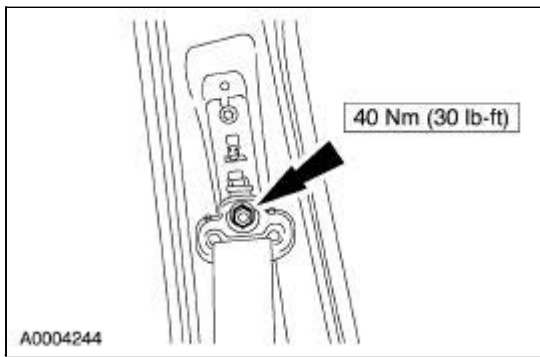
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).

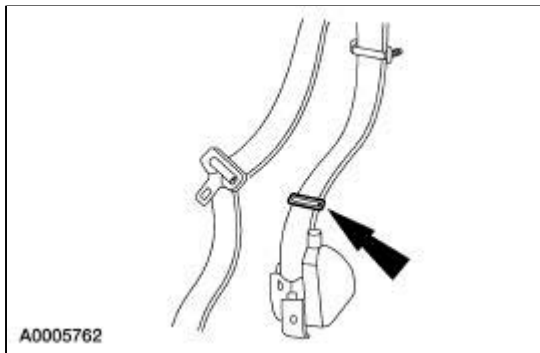
5. Install the web guide.



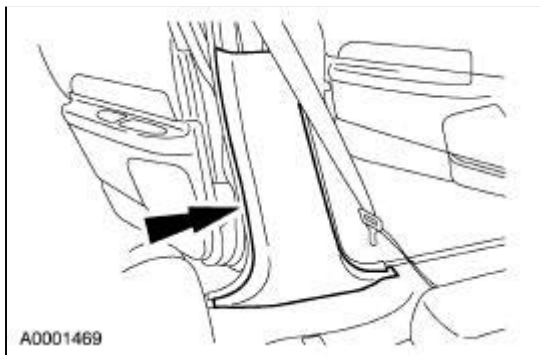
6. Install the D-ring and nut.



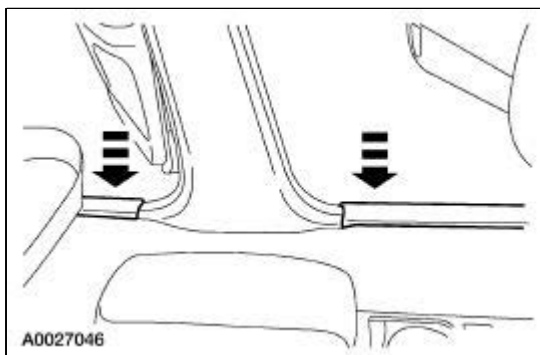
7. Remove the shipping clip from the safety belt webbing.



8. Install the B-pillar lower trim panel.

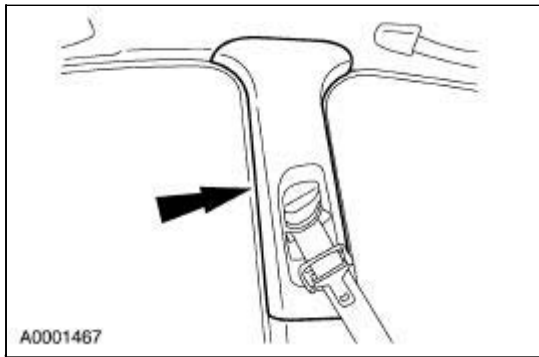


9. Install the driver side front and rear door scuff plates.

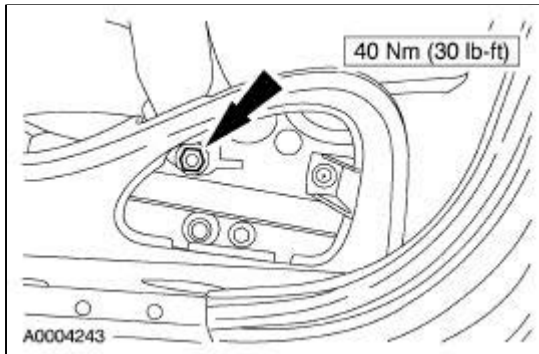


10. **NOTE:** Position the D-ring to its highest point.

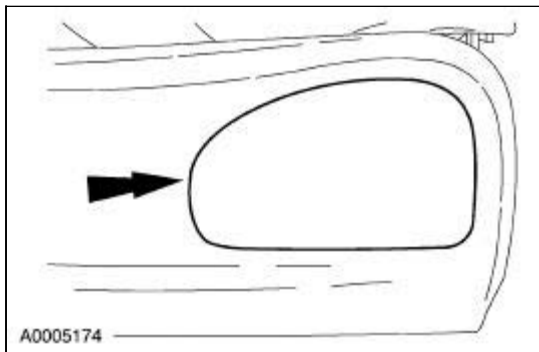
Route the safety belt through the B-pillar upper trim panel. Install the upper B-pillar trim panel.




11. Position the front safety belt anchor and install the nut.




12. Install the front safety belt anchor cover.



13. Restore the vehicle to operating condition.

1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in the General Procedures portion of this section.

2.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Section 501-20B](#).

3. Check the active restraint system for correct operation. For additional information, refer to [Safety Belt System](#).

Torque Specifications

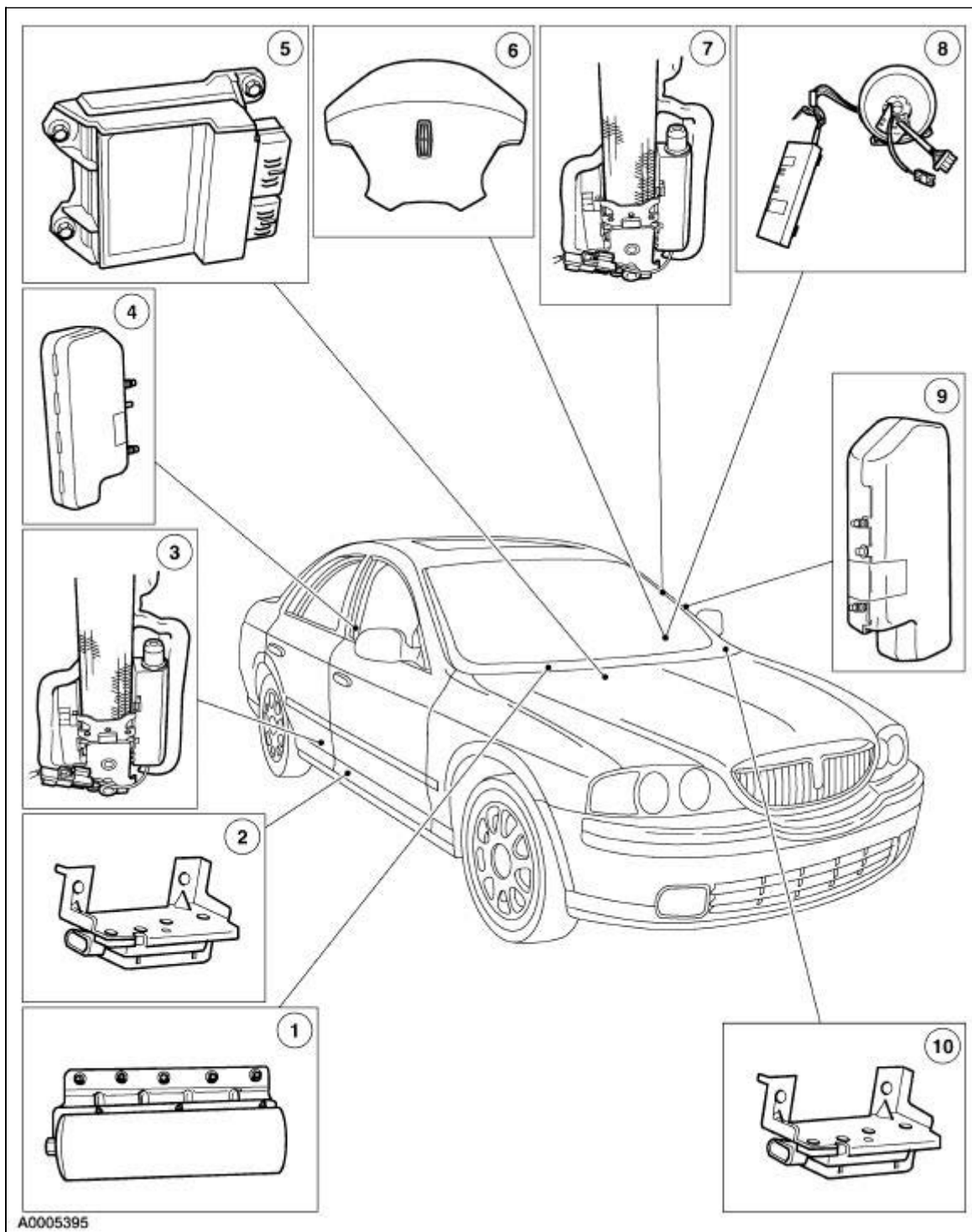
Description	Nm	lb-ft	lb-in
Passenger air bag module retaining nuts and bolts	9	—	80
Restraints control module (RCM) retaining bolts	12	9	—
Side impact sensor retaining bolts	12	9	—
Steering column retaining bolts	17	13	—
Driver air bag module retaining bolts	12	9	—
Side air bag module retaining bolts	9	—	80
Weld nut repair grounding screw (8 mm) (N802455-S190)	12	9	—
Grounding screw (6 mm) (N806327-S190)	12	9	—

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

The air bag supplemental restraint system (SRS) is designed to provide increased collision protection for front seat occupants in addition to that provided by the three-point safety belt system. Safety belt use is necessary to obtain the best occupant protection and to receive the full advantages of the SRS.

The air bag supplemental restraint system (SRS) components are shown in the following illustration.

Air Bag Supplemental Restraint System (SRS) Components



A0005395

Item	Part Number	Description
1	044A74	Passenger air bag module
2	14B345	Side impact sensor (RH)
3	611B08	Belt retractor pretensioner, passenger
4	611D10	Passenger side air bag module
5	14B321	Restraints control module (RCM)
6	043B13	Driver air bag module
7	611B09	Belt retractor pretensioner, driver
8	14A664	Clockspring

9	611D11	Driver side air bag module
10	14B345	Side impact sensor (LH)

Driver Air Bag Module

NOTE: References to the driver air bag module must not be confused with the seat-mounted air bag components of the supplemental restraint system (SRS).

The driver air bag module:

- is steering wheel mounted.
- will deploy upon receiving a signal from the RCM.
- has no subassemblies.

Clockspring

The clockspring:

- is mounted on the steering column, behind the steering wheel.
- provides a continuous electrical path from the driver air bag module to the restraints control module (RCM).

Driver Seat Side Air Bag Module

NOTE: References to side air bag modules refer to the seat-mounted and not to the steering wheel or instrument panel mounted air bag components of the supplemental restraint system (SRS).

The driver seat side air bag module:

- is installed as an assembly.
- is mounted in the driver seat back.

Passenger Seat Side Air Bag Module

NOTE: References to side air bag modules refer to the seat-mounted and not to the steering wheel or instrument panel mounted air bag components of the supplemental restraint system (SRS).

The passenger seat side air bag module:

- is installed as an assembly.
- is mounted in the passenger seat back.

Passenger Air Bag Module

NOTE: References to the passenger air bag module must not be confused with the seat-mounted air bag components of the supplemental restraint system (SRS).

The passenger air bag module:

- is installed as an assembly.
- is mounted in the passenger side of the instrument panel.

Safety Belt Pretensioners

As part of the supplemental restraint system (SRS), the safety belt retractors are equipped with pretensioners. The safety belt retractor pretensioners rotate the safety belt retractors to remove excess slack from the safety belt webbing. The pretensioners are activated by the restraints control module (RCM) when the module detects a crash event force exceeding a programmed limit.

Restraints Control Module (RCM)

The restraints control module (RCM) is mounted on the center tunnel under the instrument panel. The RCM performs the following functions:

- signals the inflators to deploy the air bags in the event of a deployable crash.
- activates the belt retractor pretensioners to remove slack from the safety belt webbing.
- monitors the air bag supplemental restraint system (SRS) for faults.
- illuminates the air bag indicator if a fault is detected.
- flashes the air bag indicator to indicate the lamp fault code (LFC) detected.
- communicates the current or historical diagnostic trouble codes (DTCs) through the data link connector (DLC).
- signals the instrument cluster to activate a chime if the air bag indicator is not available and another SRS fault exists.
- contains an internal safing sensor which is not serviced separately.

The RCM monitors the SRS for possible faults. If a fault is detected while the ignition switch is in the RUN position, the RCM will illuminate the air bag indicator located in the instrument cluster.

When the ignition is cycled (turned off and then on), the air bag indicator will remain lit for six seconds and then go out. If an SRS fault exists, the air bag indicator will then flash the two-digit LFC associated with that fault. The air bag indicator will flash the LFC five times, then remain illuminated for the rest of the key cycle. The RCM will also communicate the current and historical DTCs through the data link connector (DLC), using the New Generation Star (NGS) Tester. If the air bag indicator does not function, and the system detects a fault condition, the RCM will signal the instrument cluster to activate an audible chime. The chime is a series of five sets of five tone bursts. If the chime is heard, the SRS and the air bag indicator require repair.

LFCs are prioritized. If two or more faults occur at the same time, the fault having the highest priority will be displayed first. After that fault has been corrected, the next highest priority fault will be displayed.

The RCM includes a backup power supply. This feature provides sufficient backup power to deploy the air bags and belt retractor pretensioners in the event that the ignition circuit is damaged in a collision before the safing and air bag sensors determine that an air bag deployment is required. The backup

power supply will deplete its stored energy approximately one minute after the battery ground cable is disconnected.

Electrical System

The electrical system that supports the air bag supplemental restraint system (SRS):

- is powered from the battery through the ignition circuit.
- provides the electrical path from the restraints control module (RCM) to the SRS components.
- provides the electrical path from the RCM to the air bag indicator.
- provides the electrical path from the RCM to the data link connector (DLC).
- provides the electrical path from the RCM to the instrument cluster.

Sensors



WARNING: The restraints control module (RCM) orientation is critical for proper system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) has been involved in a collision in which the center tunnel area has been damaged, inspect the mounting and bracket for deformation. If damaged, the RCM must be replaced whether or not the air bags have deployed. In addition, make sure the area of the RCM mounting is restored to its original production configuration.


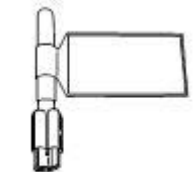
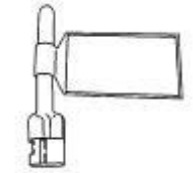


CAUTION: Sensors are repaired by replacement only. Do not attempt to determine whether a sensor is OK. Always replace the sensor even if it does not appear to be damaged.

For this vehicle the SRS employs four impact sensors. Two of the sensors are integral to the RCM and are not separately serviceable. In addition, there are two side impact sensors located at the base of the B-pillars. The RCM is mounted on the center tunnel under the instrument panel. Mounting orientation is critical for correct operation of all impact sensors.

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (2 Req'd) 418-F395 (014-R1079)
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Restraint System Diagnostic Tool Warning

 **WARNING:** This tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

Diagnosing Customer Concerns Without Hard Diagnostic Trouble Codes (DTCs)

If a lamp fault code (LFC) is reported by the customer but is not present when the vehicle comes in for repair, follow the Diagnostic Instructions procedure in this section to identify the intermittent diagnostic trouble code (DTC).

Once the DTC is known, read the Normal Operation section for the code involved.

- Follow the deactivation procedure in this section.
- Determine the location of components involved in creating that code.
- Carry out a thorough visual inspection of:
 - components.
 - connectors.
 - splices and wiring harnesses.

- pinched wires.
- worn insulation on conductors.
- opens, shorts or loosely mounted sensors.

Refer to Possible Causes, which lists the common concerns that relate to a particular code. Concerns are listed according to priority.

Diagnosing Customer Concerns with Hard Diagnostic Trouble Codes (DTCs)

Most air bag supplemental restraint system (SRS) diagnostic procedures will require the use of the deactivation and reactivation procedures in this section.

The deactivation and reactivation require the installation and removal of restraint system diagnostic tools. These procedures require removal of driver air bag module, and the disconnection of the passenger air bag module, driver side air bag module, passenger side air bag module, driver safety belt retractor pretensioner, and passenger safety belt retractor pretensioner. This reduces the risk of deployment of air bag modules and safety belt pretensioners while diagnostics are being carried out.

Restraint system diagnostic tools are required to carry out diagnosis and testing of the supplemental restraint system (SRS). It is not acceptable to short-circuit the air bag module connections with a jumper wire. If a jumper wire is used to short-circuit the air bag module connections, a lamp fault code (LFC) will be displayed.

Deactivation and Reactivation Procedures

There are two deactivation and reactivation procedures.

- One procedure requires removal of the front seats. This procedure will be used when diagnosing or repairing a seat side air bag concern. This procedure will also be used when diagnosing or repairing any in-seat or seat mounted component of a seat equipped with a seat side air bag.
- The other procedure does not require front seat removal during the diagnostic and repair process. This procedure will be used when diagnosing or repairing a concern that is not related to a seat equipped with a seat side air bag.

Deactivation Procedure — Seats Removed



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.


The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.


NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

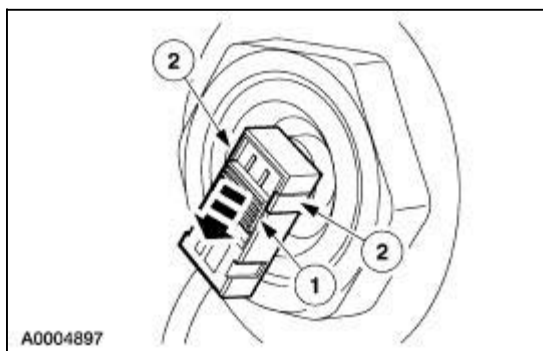
Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).

2. Wait at least one minute for the backup power supply in the restraints control module (RCM) to deplete its stored energy.
3.  **WARNING:** Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

Remove the driver air bag module from the vehicle. For additional information, refer to [Driver Air Bag Module](#) in this section.

4. Attach a restraint system diagnostic tool 418-F395 to the clockspring side of the driver air bag module electrical connector.
5. Remove the glove compartment. For additional information, refer to [Section 501-12](#).



6. Disconnect the passenger air bag electrical connector.
 1. Reaching over the cross-car beam, slide the passenger air bag module electrical connector lock downward.

2. Squeeze the electrical connector locking tabs and pull the electrical connector from the passenger air bag module.
7. Attach a restraint system diagnostic tool 418-F395 to the harness side of the passenger air bag module electrical connector.
8. Remove the affected front seat(s). For additional information, refer to [Section 501-10](#).
9. Disconnect (if necessary) and attach a restraint system diagnostic tool 418-133 to the passenger side air bag module electrical connector.
10. Access the passenger safety belt retractor pretensioner in the passenger side B-pillar.
11. Disconnect the passenger side safety belt retractor pretensioner electrical connector.
12. Attach a restraint system diagnostic tool 418-F088 to the passenger safety belt retractor pretensioner electrical connector.
13. Disconnect (if necessary) and attach a restraint system diagnostic tool 418-133 to the driver side air bag electrical connector.
14. Access the driver safety belt retractor pretensioner in the driver side B-pillar.
15. Disconnect the driver safety belt retractor pretensioner electrical connector.
16. Attach a restraint system diagnostic tool 418-F088 to the driver safety belt retractor pretensioner electrical connector.
17. Reconnect the battery ground cable. For additional information, refer to [Section 414-01](#).

Reactivation Procedure — Seats Removed



WARNING: The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.



WARNING: To reduce the risk of serious personal injury, read and follow all warnings and notes at the beginning of the deactivation procedure.

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Wait at least one minute for the backup power supply in the restraints control module (RCM) to deplete its stored energy.



3. **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

Remove the restraint system diagnostic tool from the driver side air bag module electrical connector.




4. **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and**


possible violation of vehicle safety standards.

Remove the restraint system diagnostic tool from the driver seat belt retractor pretensioner electrical connector.

5. Connect the driver seat belt retractor pretensioner electrical connector.
6. Install the driver side B-pillar trim panels.


7.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

Remove the restraint system diagnostic tool from the passenger side air bag electrical connector.

8.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**


Remove the restraint system diagnostic tool from the passenger seat belt buckle pretensioner electrical connector.

9. Connect the passenger seat belt retractor pretensioner electrical connector.
10. Install the passenger side B-pillar trim panels.
11. Install the affected front seat(s). For additional information, refer to [Section 501-10](#).
12. Connect the driver and passenger side air bag module electrical connectors.

13.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

Remove the restraint system diagnostic tool from the passenger air bag module electrical connector.

14. Reconnect the passenger air bag module electrical connector electrical connector.
15. Install the glove compartment. For additional information, refer to [Section 501-12](#).

16.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

Remove the restraint system diagnostic tool from the driver air bag module electrical connector.

17. Install the driver air bag module from the vehicle. For additional information, refer to [Driver Air Bag Module](#) in this section.
18. Reconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
19. Prove out the system.

Deactivation Procedure — Seats Not Removed



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.


The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.


NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).

2. Wait at least one minute for the backup power supply in the restraints control module (RCM) to deplete its stored energy.
3.  **WARNING:** Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

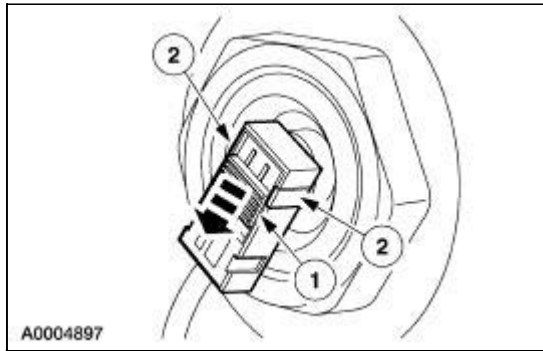



WARNING: Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

Remove the driver air bag module from the vehicle. For additional information, refer to [Driver Air Bag Module](#) in this section.

4. Attach a restraint system diagnostic tool 418-F395 to the clockspring side of the driver air bag module electrical connector.

5. Remove the glove compartment. For additional information, refer to [Section 501-12](#).



6. Disconnect the passenger air bag electrical connector.
 1. Reaching over the cross-car beam, slide the passenger air bag module electrical connector lock downward.
 2. Squeeze the electrical connector locking tabs and pull the electrical connector from the passenger air bag module.
7. Attach a restraint system diagnostic tool 418-F395 to the harness side of the passenger air bag module electrical connector.
8. Reconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
9. Move and tilt the front seats to their highest and most forward position.
10.  **WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.**

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).

11. Disconnect the passenger side air bag module electrical connector beneath the passenger seat.
12. Attach a restraint system diagnostic tool 418-133 to the passenger side air bag floor electrical connector.
13. Access the passenger safety belt retractor pretensioner in the passenger side B-pillar.
14. Disconnect the passenger side safety belt retractor pretensioner electrical connector.
15. Attach a restraint system diagnostic tool 418-F088 to the passenger safety belt retractor pretensioner electrical connector.
16. Disconnect the driver side air bag module electrical connector beneath the driver seat.
17. Attach a restraint system diagnostic tool 418-133 to the driver side air bag module electrical connector.

18. Access the driver safety belt retractor pretensioner in the driver side B-pillar.
19. Disconnect the driver safety belt retractor pretensioner electrical connector.
20. Attach a restraint system diagnostic tool 418-F088 to the driver safety belt retractor pretensioner electrical connector.
21. Reconnect the battery ground cable. For additional information, refer to [Section 414-01](#).

Reactivation Procedure — Seats Not Removed




WARNING: The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.




WARNING: To reduce the risk of serious personal injury, read and follow all warnings and notes at the beginning of the deactivation procedure.

1. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
2. Wait at least one minute for the backup power supply in the restraints control module (RCM) to deplete its stored energy.

3.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**


Remove the restraint system diagnostic tool from the driver side air bag module electrical connector.

4. Connect the driver side air bag module electrical connector.

5.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**


Remove the restraint system diagnostic tool from the driver seat belt retractor pretensioner electrical connector.

6. Connect the driver seat belt retractor pretensioner electrical connector.
7. Install the driver side B-pillar trim panels.

8.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**


Remove the restraint system diagnostic tool from the passenger side air bag module electrical connector.

9. Connect the passenger side air bag module electrical connector.

10.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

Remove the restraint system diagnostic tool from the passenger seat belt buckle pretensioner electrical connector.


11. Connect the passenger seat belt retractor pretensioner electrical connector.
12. Reconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
13. Move and tilt the front seats rearward.

14.  **WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.**

The side air bag sensors are located at or near the base of the B-pillar.


To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301). For additional information, refer to [Section 414-01](#).

15.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

Remove the restraint system diagnostic tool from the passenger air bag module electrical connector.

16. Reconnect the passenger air bag module electrical connector electrical connector.
17. Install the glove compartment. For additional information, refer to [Section 501-12](#).

18.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

Remove the restraint system diagnostic tool from the driver air bag module electrical connector.

19. Install the driver air bag module from the vehicle. For additional information, refer to [Driver Air Bag Module](#) in this section.
20. Reconnect the battery ground cable. For additional information, refer to [Section 414-01](#).
21. Prove out the system.

Prove Out Procedure

Turn the ignition switch from the OFF to the RUN position and visually monitor the air bag indicator with the air bag modules or restraint system diagnostic tools installed. The air bag indicator will light continuously for approximately six seconds and then turn off. If an air bag supplemental restraint system (SRS) fault is present, the air bag indicator will either:

- fail to light.
- remain lit continuously.
- flash.

The flashing might not occur until approximately 30 seconds after the ignition switch has been turned from the OFF to the RUN position. This is the time required for the restraints control module (RCM) to complete the testing of the SRS. If the air bag indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of five sets of five beeps. If this occurs, the air bag indicator will need to be repaired before diagnosis can continue.

Glossary

Restraint System Diagnostic Tools

Restraint system diagnostic tools are used to simulate air bag module connections to the system.

Disconnect the Component

Disconnect the component means disconnect the component vehicle harness connector. It does not mean remove the component. Do not reconnect a disconnected component unless instructed to do so.

Deactivate the System

Deactivate the system means to carry out the deactivation procedure. Refer to Deactivation Procedure in this section.

Prove Out the System

Prove out the system means to turn the ignition switch from the OFF to the RUN position and visually monitor the air bag indicator with the air bag modules installed. Refer to Prove Out Procedure in this section.

Reactivate the System

Reactivate the system means to carry out the reactivation procedure. Refer to Reactivation Procedure in this section.

Reconnect the System

Reconnect the system means to reconnect all system components. Refer to Air Bag Reconnect Checklist in this section.

Install a New Component

Install a new component means to remove the existing component and install a new authorized part obtained from Ford Customer Service Division.

Verify the System

Verify the system means to prove out the system with restraint system diagnostic tools for the air bag

modules in place of the components.


Air Bag Reconnect Checklist

The checklist below should be completed following diagnosis or repair of any air bag system concern:

1. All restraint system diagnostic tools removed?
 2. All in-seat electrical connectors connected?
 3. All air bag modules connected?
 4. Restraints control module (RCM) connected?
 5. All safety belt pretensioners connectors connected?
 6. All sensors (side impact) connected?
 7. Battery connected?
-

Diagnostic Instructions — Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Special Tool(s)

	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool
---	---

The symptom chart can be used to help locate the air bag supplemental restraint system (SRS) concerns if no diagnostic trouble codes (DTCs) are retrieved and the listed symptoms are observed. Whether or not the listed symptoms are observed, always carry out the following:

1. Retrieve all DTCs stored in the restraints control module (RCM) memory. For additional information, refer to Retrieve/Clear Continuous DTCs in this section.
2. Run the On-Demand Self Test to determine what DTCs are currently being sensed by the RCM. For additional information, refer to On-Demand Self Test in this section.
3. If the stored DTCs are different than the current DTCs, always repair the current DTCs first.
4. If memory displays different continuous DTCs than the On-Demand Self Test, perform in the following order:
 - On-Demand Self Test.
 - Memory (Retrieve/Clear Continuous DTCs).

A DTC can indicate several concerns. The DTCs are to assist in system diagnosis and are not to be considered definitive. Always refer to the pinpoint test corresponding to the DTC to determine where the concern lies and to repair the concern correctly.

The SRS diagnostics can be divided into three sections:

- diagnostic test modes.
- PID/data monitor and record.
- active command modes.

Diagnostic Test Modes

Two menu options are available under the diagnostic test modes:

- Retrieve/Clear Continuous DTCs.

- On-Demand Self Test.

Retrieve/Clear Continuous DTCs

During vehicle operation the restraints control module (RCM) will detect and store both intermittent and hard fault DTCs in nonvolatile memory. The DTC strategy employed by the RCM incorporates a time-out scheme for determining when a concern exists in the system. This requires a concern to exist for up to one minute in the system before the RCM will detect it. For the RCM to determine that a concern no longer exists, the concern must be absent for up to one minute. The actual detection time-outs vary with each DTC. The DTCs can be retrieved with the scan tool. Any DTCs stored in the RCM will be displayed on the scan tool along with a brief description of the DTC. If no DTCs are present, the scan tool will display a SYSTEM PASSED message. The scan tool can also be used to clear DTCs from the RCM memory, as long as the concern no longer exists. Once 254 key cycles have been recorded since the concern was last detected, the DTC will automatically be removed from memory.

To retrieve or clear DTCs, connect the scan tool to the data link connector (DLC). Follow the instructions for the scan tool being used. All continuous DTCs will be displayed on the screen. Before proceeding with the clearing operation, make note of the DTCs displayed, because once cleared, they cannot be retrieved. Hard DTCs will be redisplayed after clearing DTCs since they cannot be cleared from the RCM.

On-Demand Self Test

The On-Demand Self Test option is used to verify that no electrical concerns exist with the air bag supplemental restraint system (SRS). Upon entering the self test, the restraint control module (RCM) will make an electrical check of each electrical component in the system. If a concern is detected, a DTC is displayed on the scan tool with a brief description of the DTC. Concerns detected during the self test are not stored in memory, unless the same concern was also detected during normal vehicle operation. The self test should always be run after any repair to verify that the repair was successful.

To run the On-Demand Self Test, connect the scan tool to the data link connector (DLC). Follow the instructions for the scan tool being used. The RCM will run the On-Demand Self Test and display on-demand DTCs (reflecting hard system concerns) on the screen.

PID/Data Monitor and Record

The PID/Data Monitor and Record option allows the scan tool operator to read the state of several parameter IDs (PIDs) to aid in diagnosing the system. PIDs are real time measurements of parameters such as voltages, resistances, etc., calculated by the restraints control module (RCM) and sent to the scan tool for display. Many of the PIDs supported by the RCM are calculated periodically and therefore are not true real time readings.

To retrieve PIDs, connect the scan tool to the data link connector (DLC). Follow the instructions for the scan tool being used. PIDs are updated continuously on the display.

Active Commands

This command allows the technician to verify operation of the air bag indicator and chime. When the air bag output command is executed, the indicator and the chime are activated simultaneously for approximately four seconds. Both devices are deactivated automatically.

Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table

DTC^a	LFC^b	LFC Priority	Description	Action To Take
—	—	1	RCM Disconnected, Inoperative, or Lost/Low Ignition Feed	<u>Go To Pinpoint Test A.</u>
B1342	24	2	RCM is Faulted	INSTALL a new RCM.
B1231	19	3	RCM Crash Data Memory Full	INSTALL a new RCM and impact sensors.
B1921	21	4	RCM Bracket Ground Resistance High	<u>Go To Pinpoint Test B.</u>
C1414	29	5	Incorrect Vehicle Identification Code	<u>Go To Pinpoint Test C.</u>
B1887	15	6	Driver Air Bag Circuit Shorted to Ground	<u>Go To Pinpoint Test D.</u>
B1888	16	7	Passenger Air Bag Circuit Shorted to Ground	<u>Go To Pinpoint Test E.</u>
B1916	15	6	Driver Air Bag Circuit Shorted to Battery or Ignition	<u>Go To Pinpoint Test F.</u>
B1925	16	7	Passenger Air Bag Circuit Shorted to Battery or Ignition	<u>Go To Pinpoint Test G.</u>
B1932	32	8	Driver Air Bag Circuit Resistance High	<u>Go To Pinpoint Test H.</u>
B1933	33	9	Passenger Air Bag Circuit Resistance High	<u>Go To Pinpoint Test I.</u>
B1934	34	10	Driver Air Bag Circuit Resistance Low	<u>Go To Pinpoint Test J.</u>
B1935	35	11	Passenger Air Bag Circuit Resistance Low	<u>Go To Pinpoint Test K.</u>
B2444	48	16	Driver Side Crash Sensor is Faulted	<u>Go To Pinpoint Test L.</u>
B2440	43	19	Passenger Side Crash Sensor Mounting Fault	<u>Go To Pinpoint Test M.</u>
B2441	42	18	Driver Side Crash Sensor Mounting Fault	<u>Go To Pinpoint Test N.</u>
B2445	49	17	Passenger Side Crash Sensor is Faulted	<u>Go To Pinpoint Test O.</u>
U2017	44	20	Driver Side Crash Sensor Communication Fault	<u>Go To Pinpoint Test P.</u>
U2018	45	21	Passenger Side Crash Sensor Communication Fault	<u>Go To Pinpoint Test Q.</u>
B1993	36	22	Driver Side Air Bag Circuit Shorted to Ground	<u>Go To Pinpoint Test R.</u>
B1997	37	23	Passenger Side Air Bag Circuit Shorted to Ground	<u>Go To Pinpoint Test S.</u>
B1992	36	22	Driver Side Air Bag Circuit Shorted to Battery or Ignition	<u>Go To Pinpoint Test T.</u>
B1996	37	23	Passenger Side Air Bag Circuit Shorted to Battery or Ignition	<u>Go To Pinpoint Test U.</u>
B1994	36	22	Driver Side Air Bag Circuit High Resistance	<u>Go To Pinpoint Test V.</u>
B1998	37	23	Passenger Side Air Bag Circuit Resistance High	<u>Go To Pinpoint Test W.</u>
B1995	36	22	Driver Side Air Bag Circuit Resistance Low	<u>Go To Pinpoint Test X.</u>
B1999	37	23	Passenger Side Air Bag Circuit Resistance Low	<u>Go To Pinpoint Test Y.</u>

B1877	46	24	Driver Pretensioner Circuit Resistance High	Go To Pinpoint Test Z .
B1885	46	24	Driver Pretensioner Circuit Resistance Low	Go To Pinpoint Test Z .
B1881	47	25	Passenger Pretensioner Circuit Resistance High	Go To Pinpoint Test AA .
B1886	47	25	Passenger Pretensioner Circuit Resistance Low	Go To Pinpoint Test AA .
B1878	17	26	Driver Pretensioner Circuit Shorted to Battery or Ignition	Go To Pinpoint Test AB .
B1879	17	26	Driver Pretensioner Circuit Shorted to Ground	Go To Pinpoint Test AC .
B1882	18	27	Passenger Pretensioner Circuit Shorted to Battery or Ignition	Go To Pinpoint Test AD .
B1883	18	27	Passenger Pretensioner Circuit Shorted to Ground	Go To Pinpoint Test AE .
B1892	—	—	Air Bag Tone Warning Indicator Circuit Shorted to Ground or Open	Go To Pinpoint Test AF .
B1891	—	—	Air Bag Tone Warning Indicator Circuit Shorted to Battery or Ignition	Go To Pinpoint Test AG .
B1869	Tone ^c	—	Air Bag Indicator Inoperative	Go To Pinpoint Test AH .
B1870	Tone ^c	—	Air Bag Indicator Shorted to Battery	Go To Pinpoint Test AI .
—	—	—	No Communication with the Restraints Control Module (RCM)	Go To Pinpoint Test AJ .
—	5Hz	—	RCM in Plant Mode	Go To Pinpoint Test AK .

^a DTC: Diagnostic trouble code, retrieved using scan tool.

^b LFC: Lamp fault code, flashed on air bag indicator.

^c Tone will sound only if additional DTCs are present.

Inspection and Verification

1. Verify the customer concern by checking the air bag indicator in the instrument cluster. For additional information, refer to Prove Out Procedure in this section.
2. Visually inspect for obvious signs of mechanical and electrical damage using the following chart.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> ● Damaged restraints control module (RCM) bracket ● Loose component mounting 	<ul style="list-style-type: none"> ● Open fuse(s) ● Damaged wiring harness ● Loose or corroded connectors ● Circuitry open/shorted ● Damaged shorting bars

3. If the concern is not visually evident, use the scan tool to retrieve diagnostic trouble codes (DTCs) and carry out the on-demand self test.
4. If the on-demand self test is passed and no DTCs are retrieved, GO to [Symptom Chart .](#)

5. If DTCs are retrieved, refer to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
<ul style="list-style-type: none"> ● Air bag indicator is illuminated continuously 	<ul style="list-style-type: none"> ● Connector shorting bar. ● Circuitry. ● RCM disconnected. ● RCM. ● Instrument cluster. 	<ul style="list-style-type: none"> ● <u>Go To Pinpoint Test A.</u>
<ul style="list-style-type: none"> ● Air bag indicator flashing 	<ul style="list-style-type: none"> ● Air bag SRS system fault. 	<ul style="list-style-type: none"> ● REFER to DTC Priority Table.
<ul style="list-style-type: none"> ● Audible tone — DTCs retrieved 	<ul style="list-style-type: none"> ● Air bag SRS system fault. 	<ul style="list-style-type: none"> ● <u>Go To Pinpoint Test AF.</u> ● <u>Go To Pinpoint Test AG.</u>
<ul style="list-style-type: none"> ● No communication with the restraints control module (RCM) 	<ul style="list-style-type: none"> ● RCM. ● NGS Tester. ● Circuitry. ● Data link connector (DLC). 	<ul style="list-style-type: none"> ● <u>Go To Pinpoint Test AJ.</u>

Pinpoint Tests — Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Refer to Wiring Diagrams Section [501-20B](#) for schematic and connector information.

Special Tool(s)

<p>ST2502-A</p>	<p>Diagnostic Tool, Restraint System (2 Req'd) 418-F395 (014-R1079)</p>
<p>ST1590-A</p>	<p>Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)</p>
<p>ST2306-A</p>	<p>Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)</p>
<p>ST1137-A</p>	<p>FLUKE 73III Automotive Meter 105-R0057 or equivalent</p>
<p>ST2332-A</p>	<p>Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool</p>

Restraint System Diagnostic Tool Warning

WARNING: Restraint system diagnostic tools are for service only. Tools must be removed prior to operating the vehicle over the road. Failure to remove diagnostic tools could result in injury and possible violation of vehicle safety standards.

Pinpoint Test A: Air Bag Warning Indicator Is Illuminated Continuously — RCM Disconnected, Inoperative or Lost/Low Ignition Feed

Normal Operation

NOTE: Be sure to cycle the ignition switch and look for a 6 second indicator prove-out without LFCs.



During normal operation the air bag indicator will illuminate continuously for 6 seconds after the ignition switch is placed in the RUN position. The air bag indicator will also illuminate after five cycles of a lamp fault code (LFC) if a fault exists. The restraints control module (RCM) will communicate diagnostic trouble codes (DTCs) to the scan tool through the data link connector (DLC). If the scan tool displays NO COMMUNICATION when retrieving continuous DTCs, use Pinpoint Test AL to troubleshoot the system.

Possible Causes

An air bag indicator that is illuminated continuously can be caused by:


- a damaged shorting bar or other electrical connector component.
- the ignition circuit damaged.
- the RCM disconnected from the vehicle harness.
- a loss of RCM ground circuit.
- the RCM is faulted.
- air bag indicator circuit shorted to ground.

PINPOINT TEST A: AIR BAG WARNING INDICATOR IS ILLUMINATED CONTINUOUSLY — RCM DISCONNECTED, INOPERATIVE OR LOST/LOW IGNITION FEED

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CHECK FOR CONTINUOUS OR ON-DEMAND SELF TEST DTCs	
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 20px;"> <div style="border: 1px solid black; padding: 5px; width: 100px; text-align: center;">1</div>  <p style="text-align: center;">Retrieve/Clear Continuous DTCs</p> </div> <div> <div style="border: 1px solid black; padding: 5px; width: 100px; text-align: center;">2</div>  <p style="text-align: center;">On-Demand Self Test</p> </div> </div>	<div style="margin-bottom: 20px;"> <div style="border: 1px solid black; padding: 5px; width: 100px; text-align: center;">1</div> <p>Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> </div> <ul style="list-style-type: none"> ● Were any continuous or on-demand self test DTCs retrieved? <p>→ Yes If continuous DTCs were retrieved, GO to A3. If on-demand DTCs were retrieved, GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p>

→ **No**
GO to A2.

A2 CHECK THE RCM CONNECTION

 **WARNING:** If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



RCM C310a

1

Make sure RCM C310a is fully connected and the locking tab is engaged.

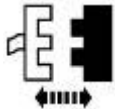
- Is RCM C310a fully connected and are the locking tabs engaged?

→ **Yes**
GO to A3.

→ **No**
CONNECT C310a and ENGAGE the locking tabs. GO to A7.

A3 CHECK THE RCM CONNECTOR

1

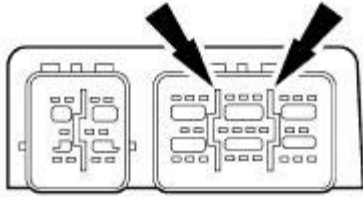


RCM C310a

2

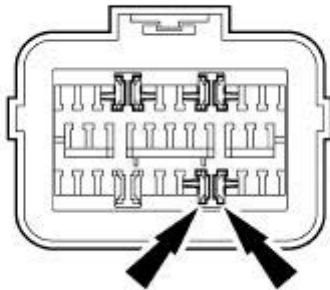
2

Inspect RCM C310a component side for worn, or damaged camming beam.



DR1540-A

3



DR1541-A

3 Inspect C310a harness side for worn, damaged or dislodged shorting bar at pins 20 and 21.

● Were any connector concerns found?

→ **Yes**
CORRECT connector concerns. GO to A7.

→ **No**
GO to A4.

A4 CHECK THE IGNITION CIRCUIT 20-JA10A (PK/OG) FOR AN OPEN



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

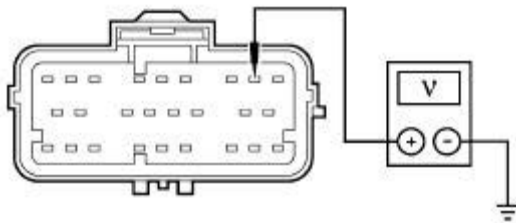
1



3



4



DR0994-A

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

4 Measure the voltage to ground at RCM C310a pin 2, circuit 20-JA10A (PK/OG), harness side.

- Is the voltage between 9 and 16 volts?

→ **Yes**
GO to A5.

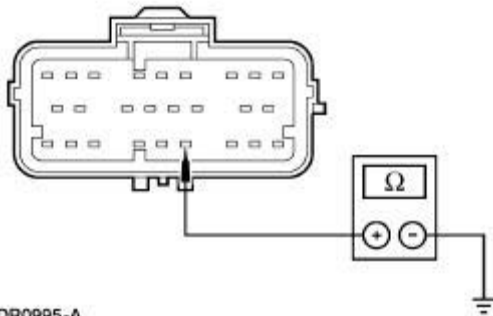
→ **No**
REPAIR the circuit. GO to A7.

A5 CHECK THE GROUND CIRCUIT 31-JA10A (BK/RD) FOR AN OPEN

1



2



DR0995-A

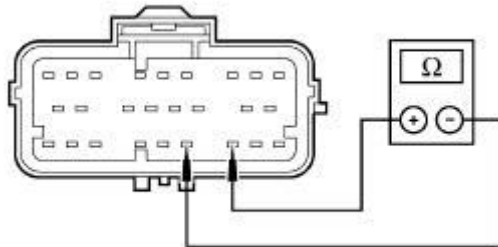
2 Measure the resistance between RCM C310a pin 21, circuit 31-JA10A (BK/RD), harness side and a sheet metal ground near the RCM.

- Is the resistance less than 10 ohms?

- **Yes**
GO to A6.
- **No**
REPAIR the circuit. GO to A7.

A6 CHECK CIRCUIT 31S-JA14 (BK/GN) FOR A SHORT TO GROUND

1



DR1217-A

- 1 Measure the resistance between RCM C310a pin 20, circuit 31S-JA14 (BK/GN), harness side and RCM C310a pin 21, circuit 31-JA10 (BK/RD), harness side.

- **Is the resistance less than 5 ohms?**

- **Yes**
REPAIR the circuit. GO to A7.
- **No**
INSTALL a new RCM. GO to A7.

A7 CHECK FOR ADDITIONAL DTCs

- 1 Refer to the continuous DTCs recorded during Step A1.

- **Were any continuous DTCs retrieved during Step A1?**

- **Yes**
Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.
- **No**
RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS). CLEAR all DTCs.

Pinpoint Test B: LFC 21/DTC B1921 — RCM Bracket Ground Resistance High

Normal Operation



WARNING: The tightening torque of the restraints control module (RCM) retaining bolts is

critical for proper air bag supplemental restraint system (SRS) operation. Refer to Restraints Control Module (RCM) in this section for correct torque values.



The restraints control module (RCM) monitors the resistance between the ground connections at its housing and the reference ground at pin 21. If the RCM detects a resistance greater than 100 ohms, it will store a diagnostic trouble code (DTC) B1921 in memory and flash a lamp fault code (LFC) 21 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

High resistance between the RCM housing ground and pin ground can be caused by:

- incorrect seating of the RCM retaining bolts.
- incorrect tightening torque of the RCM retaining bolts.
- high resistance on RCM logic ground circuit 31-JA10A (BK/RD).

PINPOINT TEST B: LFC 21/DTC B1921 — RCM BRACKET GROUND RESISTANCE HIGH

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1  Retrieve/Clear Continuous DTCs</p> <p>2  On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1921 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>B2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>B6</u>.</p>
B2 INSPECT THE RCM MOUNTING, MOUNTING BRACKET AND MOUNTING SURFACE	
	<p>1 Remove the RCM. Refer to <u>Restraints Control Module (RCM)</u> in this section.</p> <p>2 Visually inspect the RCM, mounting</p>

bracket and mounting surface for damage, corrosion or dirt.

3 Inspect the RCM mounting and make sure that the retaining bolts are fully seated and tightened correctly. Refer to Restraints Control Module (RCM) in this section for correct tightening torque.

- **Was a significant amount of corrosion or dirt found, the RCM mounting bracket attached to the mounting surface incorrectly or were the four RCM retaining bolts not fully seated and tightened correctly?**

→ **Yes**
MAKE SURE the RCM, mounting bracket and mounting surface are free of damage, corrosion or dirt, and the four retaining bolts are fully seated and correctly tightened. REATTACH the RCM and mounting bracket to the mounting surface. GO to B7.

→ **No**
GO to B3.

B3 CHECK THE RCM HARNESS CONNECTION

1 Check the RCM harness connection.

- **Are the RCM harness connectors connected to the RCM correctly with the red locking clips engaged?**

→ **Yes**
GO to B4.

→ **No**
ATTACH the RCM harness connectors correctly. GO to B7.

B4 CHECK THE VEHICLE CHASSIS GROUND

1 Measure the resistance between a known good chassis ground and the mounting surface of the RCM.

- **Is the resistance greater than 100 ohms?**

→ **Yes**
REPAIR the chassis grounding system. GO to B7.

→ **No**
GO to B5.

B5 CHECK THE GROUND CIRCUIT 31-JA10A (BK/RD) FOR AN OPEN

1

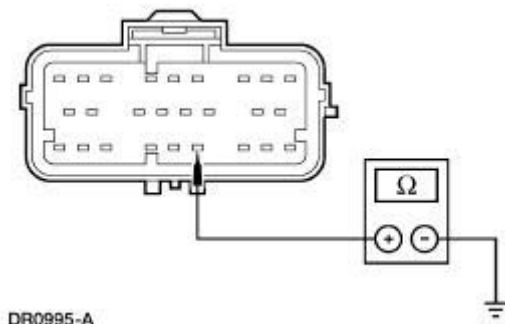


2



RCM C310a

3



3

Measure the resistance between RCM C310a pin 21, circuit 31-JA10A (BK/RD), harness side and a sheet metal ground near the RCM.

- Is the resistance greater than 100 ohms?

→ Yes

REPAIR the circuit. GO to B7.

→ No

INSTALL a new RCM. GO to B7.

B6 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS).

● **Was DTC B1921 retrieved during the on-demand self test?**

→ **Yes**
GO to B2.

→ **No**
CHECK for causes of intermittent high resistance on circuit 31-JA10A (BK/RD). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to B7.

B7 CHECK FOR ADDITIONAL DTCs

1 Refer to the continuous DTCs recorded during Step B1.

● **Were any continuous DTCs retrieved during Step B1?**

→ **Yes**
Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.

→ **No**
RECONNECT the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS). CLEAR all DTCs.

Pinpoint Test C: LFC 29/DTC C1414 — Incorrect Vehicle Identification Code

Normal Operation




The restraints control module (RCM) monitors the electrical condition at C310a pins 10, 13 and 14 to determine if it is installed on the correct vehicle. If the RCM detects an unexpected condition on any of these pins, it will store a diagnostic trouble code (DTC) C1414 in memory and flash a lamp fault code (LFC) 29 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

An incorrect vehicle ID code can be caused by:

- incorrect RCM.
- RCM incorrectly programmed.
- a wiring concern at RCM C310a pins 10, 13 and 14.

PINPOINT TEST C: LFC 29/DTC C1414 — INCORRECT VEHICLE IDENTIFICATION CODE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1  Retrieve/Clear Continuous DTCs</p> <p>2  On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <ul style="list-style-type: none"> ● Was DTC C1414 retrieved during the on-demand self test? <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>C2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>C6</u>.</p>
C2 CHECK THE VEHICLE IDENTIFICATION PIN NO. 1	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.</p> <p>The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. The</p>	

restraint system diagnostic tools must be removed prior to operating the vehicle over the road.

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



2



RCM C310a

3 Inspect C310a harness side. Make sure there is no wire attached to pin cavity 10.

• Does C310a cavity 10 contain a wire?

→ **Yes**
DETERMINE the cause of incorrect vehicle harness configuration. REPAIR as necessary. GO to C5.

→ **No**
GO to C3.

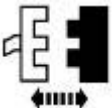
C3 CHECK THE VEHICLE IDENTIFICATION PIN NO. 2

NOTE: For this vehicle application, RCM C310a pin 13 should be ignition voltage.

1



2



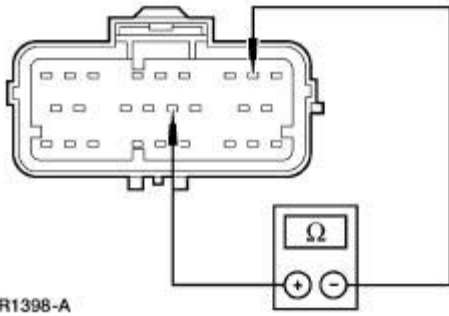
Battery Ground Cable

3



4

4 Measure the resistance between RCM C310a pin 13, circuit 20-JA10B (PK/OG) and pin 2, circuit 20-JA10A (PK/OG).



● Is the resistance less than 5 ohms?

→ **Yes**
GO to C4.

→ **No**
REPAIR the circuit. GO to C5.

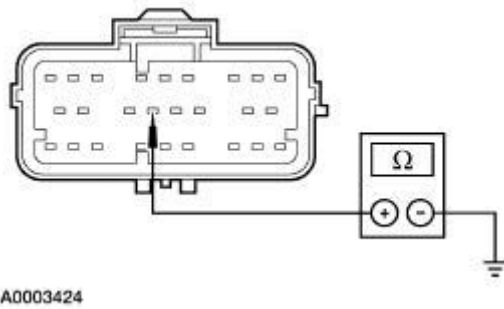
C4 CHECK THE VEHICLE IDENTIFICATION PIN NO. 3

NOTE: For this vehicle application, RCM C310a pin 14 should be grounded.

1



2



2 Measure the resistance to ground at RCM C310a pin 14, circuit 31-JA10B (BK/RD).

● Is the resistance less than 5 ohms?

→ **Yes**
GO to C5.

→ **No**
REPAIR the circuit. GO to C7.

C5 CHECK THE RCM PROGRAMMED VEHICLE ID

1



PID/Data Monitor and Record

2 Select PID VID No.1, VID No. 2 and VID No. 3.

- Was vehicle ID No. 1 open circuit, ID No. 2 ignition and No. 3 ground?

→ Yes
GO to C6.

→ No
INSTALL a new RCM. GO to C7.

C6 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#).

- Was DTC C1414 retrieved during the on-demand self test?

→ Yes
GO to C2.

→ No

	CHECK for causes of intermittent open circuits. ATTEMPT to recreate the failure by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concerns found. GO to <u>C7</u> .
C7 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step C1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step C1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. PROVE OUT the system. CLEAR all DTCs.</p>

Pinpoint Test D: LFC 15/DTC B1887 — Driver Air Bag Circuit Shorted to Ground

Normal Operation

The restraints control module (RCM) checks for driver air bag circuit shorts to ground by monitoring the voltage of circuits 30S-JA8 (RD/OG) and 31S-JA8 (BK/OG) at pins 3 and 4. If the RCM detects a short to ground on either of these pins, it will store a diagnostic trouble code (DTC) B1887 in memory and flash a lamp fault code (LFC) 15 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

A driver air bag circuit short to ground can be caused by:

- a short to ground on circuit 30S-JA8 (RD/OG).
- a short to ground on circuit 31S-JA8 (BK/OG).
- a short to ground on the clockspring (14A664).
- a short to ground on the driver air bag module.

PINPOINT TEST D: LFC 15/DTC B1887 — DRIVER AIR BAG CIRCUIT SHORTED TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK FOR A HARD OR INTERMITTENT DTC	
1	1 Retrieve and record any continuous DTCs for use later in this pinpoint test.



Retrieve/Clear Continuous DTCs

2



On-Demand Self Test

- Was DTC B1887 retrieved during the on-demand self test?

→ **Yes**

This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to D2.

→ **No**

This is an intermittent fault. The fault condition is not present at this time. GO to D2.

D2 CHECK THE DRIVER AIR BAG MODULE



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

3



On-Demand Self Test

● Was DTC B1887 retrieved?

→ Yes
GO to D3.

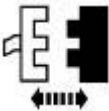
→ No
INSTALL a new driver air bag module.
GO to D6.

D3 CHECK THE DRIVER AIR BAG MODULE CIRCUIT

1

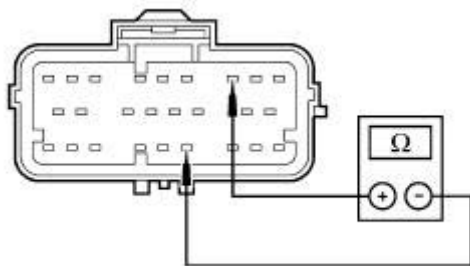


2



RCM C310a

3



DR0999-B

3 **NOTE:** Do not separate or remove the shorting bars from RCM C310a.

Measure the resistance between RCM C310a pin 3, circuit 30S-JA8 (RD/OG), harness side and RCM C310a pin 21, circuit 31-JA10A (BK/RD), harness side.

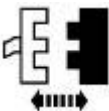
● Is the resistance less than 10,000 ohms?

→ Yes
GO to D4.

→ No
INSTALL a new RCM. GO to D6.

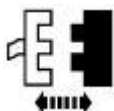
D4 CHECK THE DRIVER AIR BAG MODULE WIRING AND THE CLOCKSPrING

1



Driver Air Bag Module Restraint System Diagnostic Tool

2



Clockspring C218C

3 Inspect all crimps, terminals, wires and connectors in circuit 30S-JA8 (RD/OG) feeding the RCM pin 3, circuit 31S-JA8 (BK/OG) feeding pin 4, the clockspring assembly and the clockspring connector C218C. Check for pinched wires and damaged connector pin terminals.

• Was any damage found?

→ Yes REPAIR as necessary. GO to D6.

→ No GO to D5.

D5 CHECK FOR AN INTERMITTENT FAULT

WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS).

	<ul style="list-style-type: none"> ● Was DTC B1887 retrieved during the on-demand self test? <p>→ Yes CHECK for causes of intermittent fault at or near the driver air bag module connector. REPAIR any intermittent concerns found.</p> <p>If an intermittent concern was found and repaired, GO to <u>D6</u>.</p> <p>If an intermittent concern was not found, GO to <u>D3</u>.</p> <p>→ No CHECK for causes of intermittent short to ground on circuits 30S-JA8 (RD/OG) and 31S-JA8 (BK/OG), and the clockspring assembly. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to <u>D6</u>.</p>
D6 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step D1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step D1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test E: LFC 16/DTC B1888 — Passenger Air Bag Circuit Shorted to Ground

Normal Operation




The restraints control module (RCM) checks for passenger air bag circuit shorts to ground by monitoring the voltage of circuits 30S-JA11 (RD/WH) and 31S-JA11 (BK/WH) at pins 6 and 7. If the RCM detects a short to ground on either of these pins, it will store a diagnostic trouble code (DTC) B1888 in memory and flash a lamp fault code (LFC) 16 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

A passenger air bag circuit short to ground can be caused by:

- a short to ground on circuit 30S-JA11 (RD/WH).
- a short to ground on circuit 31S-JA11 (BK/WH).
- a short to ground on the passenger air bag module.

PINPOINT TEST E: LFC 16/DTC B1888 — PASSENGER AIR BAG CIRCUIT SHORTED TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1</p>  <p>Retrieve/Clear Continuous DTCs</p> <p>2</p>  <p>On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1888 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>E2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>E5</u>.</p>
E2 CHECK THE PASSENGER AIR BAG MODULE	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u> in this section.</p> <p>The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p>	

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● Was DTC B1888 retrieved?

→ **Yes**
GO to [E3](#).

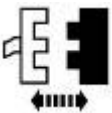
→ **No**
INSTALL a new passenger air bag module. GO to [E6](#).

E3 E3CHECK THE PASSENGER AIR BAG MODULE CIRCUIT

1

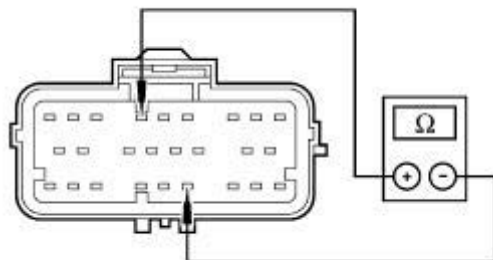


2



RCM C310a

3



DR1000-B

3

NOTE: Do not separate or remove the shorting bars from RCM C310a.

Measure the resistance between RCM C310a pin 6, circuit 30S-JA11 (RD/WH), harness side and RCM C310a pin 21, circuit 31-JA10A (BK/RD), harness side.

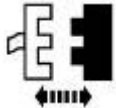
● Is the resistance less than 10,000 ohms?

→ **Yes**
GO to E4.

→ **No**
INSTALL a new RCM. GO to E6.

E4 CHECK THE PASSENGER AIR BAG MODULE WIRING

1



Passenger Air Bag Module Restraint System Diagnostic Tool

2

Inspect all crimps, terminals, wires and connectors in circuit 30S-JA11 (RD/WH) feeding the RCM pin 6, circuit 31S-JA11 (BK/WH) feeding pin 7. Check for pinched wires and damaged connector pin terminals.

● Was any damage found?

→ **Yes**
REPAIR as necessary. GO to E6.

→ **No**
GO to E6.

E5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

● **Was DTC B1888 retrieved during the on-demand self test?**

→ **Yes**

CHECK for causes of intermittent fault at or near the passenger air bag module connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to E6.

If an intermittent concern **was not** found, GO to E3.

→ **No**

CHECK for causes of intermittent short to ground on circuits 30S-JA11 (RD/WH) and 31S-JA11 (BK/WH). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to E6.

E6 CHECK FOR ADDITIONAL DTCs

1 Refer to the continuous DTCs recorded during Step E1.

● **Were any continuous DTCs retrieved during Step E1?**

→ **Yes**

Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.

→ **No**

RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS). CLEAR all DTCs.

Pinpoint Test F: LFC 15/DTC B1916 — Driver Air Bag Circuit Shorted to Battery or Ignition

Normal Operation



The restraints control module (RCM) checks for driver air bag circuit shorts to battery or ignition by monitoring the voltage of circuit 30S-JA8 (RD/OG) and 31S-JA8 (BK/OG) at pins 3 and 4. If the RCM detects a short to battery or ignition on either of these pins, it will store a diagnostic trouble code (DTC) B1916 in memory and flash a lamp fault code (LFC) 15 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

A driver air bag circuit short to battery or ignition can be caused by:

- a short to battery or ignition on circuit 30S-JA8 (RD/OG).
- a short to battery or ignition on circuit 31S-JA8 (BK/OG).
- a short to battery or ignition on the clockspring.
- a short to battery or ignition on the driver air bag module.

PINPOINT TEST F: LFC 15/DTC B1916 — DRIVER AIR BAG CIRCUIT SHORTED TO BATTERY OR IGNITION

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1 </p> <p>Retrieve/Clear Continuous DTCs</p> <p>2 </p> <p>On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1916 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>F2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>F5</u>.</p>
F2 CHECK THE DRIVER AIR BAG MODULE	



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● Was DTC B1916 retrieved?

→ **Yes**
GO to [F3](#).

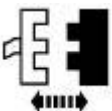
→ **No**
INSTALL a new driver air bag module.
GO to [F6](#).

F3 CHECK THE DRIVER AIR BAG MODULE CIRCUIT

1

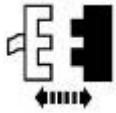


2



Driver Air Bag Module Restraint System Diagnostic Tool

3

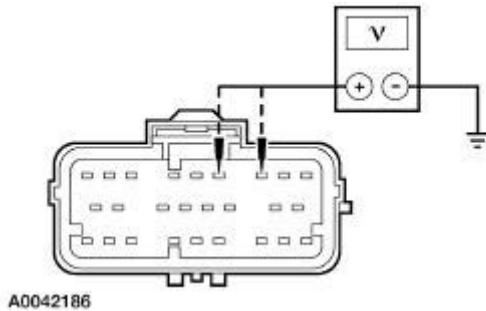


RCM C310a

4



5



A0042186

5 **NOTE:** Do not separate or remove the shorting bars from RCM C310a.

Measure the voltage between RCM C310a pin 3, circuit 30S-JA8 (RD/OG), harness side and ground; and between RCM C310a pin 4, circuit 31S-JA8 (BK/OG) harness side and ground.

• **Are the voltages less than 0.2 volt?**

→ **Yes**
REPAIR the affected circuit. GO to F4.

→ **No**
GO to F4.

F4 CHECK THE DRIVER AIR BAG MODULE WIRING AND THE CLOCKSPRING

1



Clockspring C218C

2 Inspect all crimps, terminals, wires and connectors in circuit 30S-JA8 (RD/OG) feeding the RCM pin 3, circuit 31S-JA8 (BK/OG) feeding pin 4, the clockspring assembly and the clockspring connector C218C. Check for pinched wires and damaged connector pin terminals.

• **Was any damage found?**

→ **Yes**
REPAIR as necessary. GO to F6.

→ **No**
INSTALL a new RCM. GO to F6.

F5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system

must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● Was DTC B1916 retrieved during the on-demand self test?

→ Yes

CHECK for causes of intermittent fault at or near the driver air bag module connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to [F6](#).

If an intermittent concern **was not** found, GO to [F3](#).

→ No

CHECK for causes of intermittent short to battery or ignition on circuits 30S-JA8 (RD/OG) and 31S-JA8 (BK/OG) and the clockspring. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to [F6](#).

F6 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step F1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step F1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test G: LFC 16/DTC B1925 — Passenger Air Bag Circuit Shorted to Battery or Ignition

Normal Operation


The restraints control module (RCM) checks for passenger air bag circuit shorts to battery or ignition by monitoring the voltage of circuits 30S-JA11 (RD/WH) and 31S-JA11 (BK/WH) at pins 6 and 7. If the RCM detects a short to battery or ignition on either of these pins, it will store a diagnostic trouble code (DTC) B1925 in memory and flash a lamp fault code (LFC) 16 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

A passenger air bag circuit short to battery or ignition can be caused by:

- a short to battery or ignition on circuit 30S-JA11 (RD/WH).
- a short to battery or ignition on circuit 31S-JA11 (BK/WH).
- a short to battery or ignition on the passenger air bag module.
- an RCM internal concern.

PINPOINT TEST G: LFC 16/DTC B1925 — PASSENGER AIR BAG CIRCUIT SHORTED TO BATTERY OR IGNITION

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1</p>  <p>Retrieve/Clear Continuous DTCs</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p>

2



On-Demand Self Test

- Was DTC B1925 retrieved during the on-demand self test?

→ Yes

This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to G2.

→ No

This is an intermittent fault. The fault condition is not present at this time. GO to G5.

G2 CHECK THE PASSENGER AIR BAG MODULE



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



2

Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

3



On-Demand Self Test

- Was DTC B1925 retrieved?

→ Yes

GO to G3.

→ No

INSTALL a new passenger air bag module. GO to G6.

G3 CHECK THE PASSENGER AIR BAG MODULE CIRCUIT

1

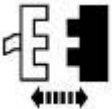


2



Passenger Air Bag Module Restraint System Diagnostic System

3

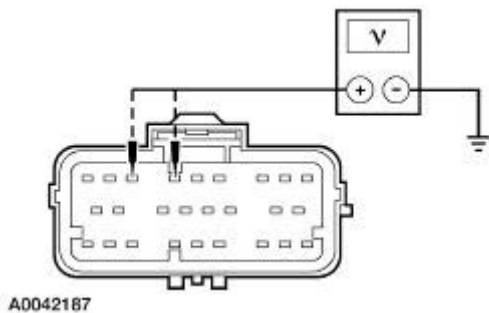


RCM C310a

4



5



A0042187

5 **NOTE:** Do not separate or remove the shorting bars from RCM C310a.

Measure the voltage between RCM C310a pin 6, circuit 30S-JA11 (RD/WH), harness side and ground; and between RCM C310a pin 7, circuit 31S-JA11 (BK/WH), harness side and ground.

- Are the voltages less than 0.2 volts

→ Yes

REPAIR the affected circuit. GO to G6.

→ No

GO to G4.

G4 CHECK THE PASSENGER AIR BAG MODULE WIRING

1



Passenger Air Bag Module Restraint System Diagnostic Tool

2 Inspect all crimps, terminals, wires, and connectors in circuit 30S-JA11 (RD/WH) feeding the RCM pin 6, circuit 31S-JA11 (BK/WH) feeding pin 7. Check for pinched wires and damaged connector pin terminals.

● Was any damage found?

→ Yes
REPAIR as necessary. GO to G6.

→ No
GO to G6.

G5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

	<ul style="list-style-type: none"> ● Was DTC B1925 retrieved during the on-demand self test? <p>→ Yes CHECK for causes of intermittent fault at or near the passenger air bag module connector. REPAIR any intermittent concerns found.</p> <p>If an intermittent concern was found and repaired, GO to <u>G6</u>.</p> <p>If an intermittent concern was not found, GO to <u>G3</u>.</p> <p>→ No CHECK for causes of intermittent short to battery or ignition on circuits 30S-JA11 (RD/WH) and 31S-JA11 (BK/WH). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to <u>G6</u>.</p>
G6 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step G1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step G1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test H: LFC 32/DTC B1932 — Driver Air Bag Circuit Resistance High

Normal Operation




The restraints control module (RCM) monitors the resistance of the driver air bag ignitor by measuring the resistance between pins 3 and 4. If the RCM detects high resistance between these pins, it will store a diagnostic trouble code (DTC) B1932 in memory and flash a lamp fault code (LFC) 32 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

Driver air bag high resistance can be caused by:

- a poor connection or corrosion in the driver air bag module circuits or the clockspring.
- high resistance in the clockspring.
- high resistance in the wiring harness.
- high resistance in the driver air bag module.
- RCM is faulted.

PINPOINT TEST H: LFC 32/DTC B1932 — DRIVER AIR BAG CIRCUIT RESISTANCE HIGH

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1</p>  <p>Retrieve/Clear Continuous DTCs</p> <p>2</p>  <p>On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1932 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>H2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>H5</u>.</p>
H2 CHECK THE DRIVER AIR BAG MODULE	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u> in this section.</p> <p>The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint</p>	

system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● Was DTC B1932 retrieved?

→ Yes

GO to [H3](#).

→ No

INSTALL a new driver air bag module.

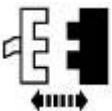
GO to [H6](#).

H3 CHECK THE DRIVER AIR BAG MODULE CIRCUIT

1

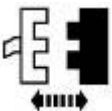


2



RCM C310a

3

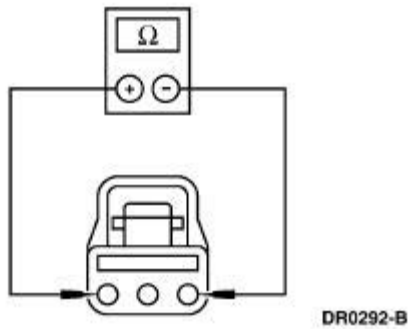


Driver Air Bag Module Restraint System Diagnostic Tool

4

4

NOTE: By disconnecting the RCM connector, circuit 30S-JA8 (RD/OG) and circuit 31S-JA8 (BK/OG) of the RCM connector are shorted together



with a shorting bar. Do not remove the shorting bar.

Measure the resistance between driver air bag C216, circuit 30S-JA8 (RD/OG), harness side and driver air bag C216, circuit 31S-JA8 (BK/OG), harness side.

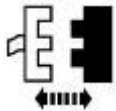
- Is the resistance greater than 1.0 ohm?

→ **Yes**
GO to H4.

→ **No**
INSTALL a new RCM. GO to H6.

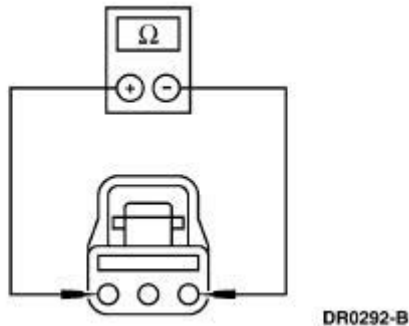
H4 CHECK THE CLOCKSPrING CIRCUIT

1



Clockspring C218C

2



2

NOTE: By disconnecting the clockspring connector, the connector pins are shorted together with a shorting bar. Do not remove the shorting bar.

Measure the resistance between clockspring C218C, circuit 30S-JA8 (RD/OG), harness side and clockspring C218C, circuit 31S-JA8 (BK/OG), harness side.

- Is the resistance greater than 1.0 ohm?

→ **Yes**
REPAIR the circuit(s) as necessary. GO to H6.

→ **No**
INSTALL a new clockspring. GO to H6.

H5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision,

resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● **Was DTC B1932 retrieved during the on-demand self test?**

→ **Yes**

CHECK for causes of intermittent fault at or near the driver air bag module connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to [H6](#).

If an intermittent concern **was not** found, GO to [H3](#).

→ **No**

CHECK for causes of intermittent short to battery or ignition on circuits 30S-JA8 (RD/OG) and 31S-JA8 (BK/OG) and the clockspring. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to [H6](#).

H6 CHECK FOR ADDITIONAL DTCs

1

Refer to the continuous DTCs recorded during Step H1.

	<ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step H1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS). CLEAR all DTCs.</p>
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Pinpoint Test I: LFC 33/DTC B1933 — Passenger Air Bag Circuit Resistance High

Normal Operation



The restraints control module (RCM) monitors the resistance of the passenger air bag ignitor by measuring the resistance between pins 6 and 7. If the RCM detects high resistance between these pins, it will store a diagnostic trouble code (DTC) B1933 in memory and flash a lamp fault code (LFC) 33 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

A passenger air bag high resistance can be caused by:

- a poor connection or corrosion in the passenger air bag module circuits.
- high resistance in the wiring harness.
- high resistance in the passenger air bag module.
- RCM is faulted.

PINPOINT TEST I: LFC 33/DTC B1933 — PASSENGER AIR BAG CIRCUIT RESISTANCE HIGH

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1 </p> <p>Retrieve/Clear Continuous DTCs</p> <p>2 </p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p>

On-Demand Self Test

- Was DTC B1933 retrieved during the on-demand self test?

→ **Yes**

This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to I2.

→ **No**

This is an intermittent fault. The fault condition is not present at this time. GO to I4.

I2 CHECK THE PASSENGER AIR BAG MODULE



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

- Was DTC B1933 retrieved?

→ **Yes**
GO to I3.

→ **No**
INSTALL a new passenger air bag module. GO to I5.

I3 CHECK THE PASSENGER AIR BAG MODULE CIRCUIT

1

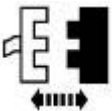


2



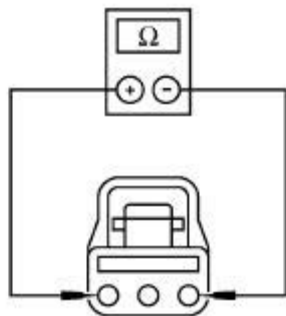
RCM C310a

3



Passenger Air Bag Module Restraint System Diagnostic Tool

4



DR0292-B

4 **NOTE:** By disconnecting the RCM connector, circuit 30S-JA11 (RD/WH) and circuit 31S-JA11 (BK/WH) of the RCM connector are shorted together with a shunting bar. Do not remove the shunting bar.

Measure the resistance between passenger air bag C256, circuit 30S-JA11 (RD/WH), harness side and passenger air bag C256, circuit 31S-JA11 (BK/WH) harness side.

- Is the resistance greater than 1.0 ohm?

→ **Yes**
REPAIR the circuit(s) as necessary. GO to I5.

→ **No**
INSTALL a new RCM. GO to I5.

I4 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when

equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● **Was DTC B1933 retrieved during the on-demand self test?**

→ **Yes**

CHECK for causes of intermittent fault at or near the passenger air bag module connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to 15.

If an intermittent concern **was not** found, GO to 13.

→ **No**

CHECK for causes of intermittent short to battery or ignition on circuits 30S-JA11 (RD/WH) and 31S-JA11 (BK/WH). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to 15.

15 CHECK FOR ADDITIONAL DTCs

1

Refer to the continuous DTCs recorded during Step 11.

● **Were any continuous DTCs retrieved during Step 11?**

	<p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) . CLEAR all DTCs.</p>
--	--

Pinpoint Test J: LFC 34/DTC B1934 — Driver Air Bag Circuit Resistance Low

Normal Operation


The restraints control module (RCM) monitors the resistance of the driver air bag ignitor by measuring the resistance between pins 3 and 4. If the RCM detects low resistance between these pins, it will store a diagnostic trouble code (DTC) B1934 in memory and flash a lamp fault code (LFC) 34 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

Driver air bag low resistance can be caused by:

- a short in the clockspring.
- a short in the wiring harness.
- a low resistance in the driver air bag module.
- worn or damaged electrical connector shorting bar.
- worn or damaged electrical connector camming beam.
- RCM is faulted.

PINPOINT TEST J: LFC 34/DTC B1934 — DRIVER AIR BAG CIRCUIT RESISTANCE LOW

CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 J1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1 </p> <p>Retrieve/Clear Continuous DTCs</p> <p>2</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p>



On-Demand Self Test

- Was DTC B1934 retrieved during the on-demand self test?

→ Yes

This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to J2.

→ No

This is an intermittent fault. The fault condition is not present at this time. GO to J5.

J2 CHECK THE DRIVER AIR BAG MODULE



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

● Was DTC B1934 retrieved?

→ **Yes**
GO to J3.

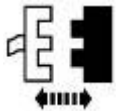
→ **No**
INSTALL a new driver air bag module.
GO to J6.

J3 CHECK THE DRIVER AIR BAG MODULE CIRCUIT

1

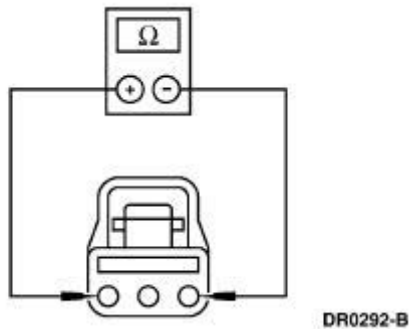


2



Driver Air Bag Module Restraint System Diagnostic Tool

3



3 Measure the resistance between driver air bag C216, circuit 30S-JA8 (RD/OG), harness side and driver air bag C216, circuit 31S-JA8 (BK/OG), harness side.

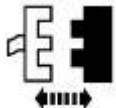
● Is the resistance greater than 10,000 ohms?

→ **Yes**
INSTALL a new RCM. GO to J6.

→ **No**
GO to J4.

J4 CHECK THE CLOCKSPRING

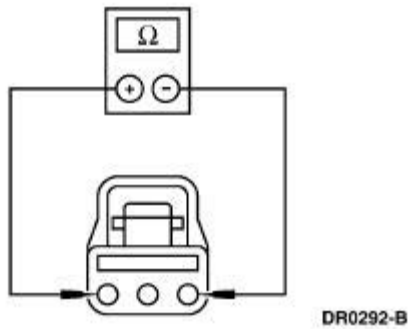
1



Clockspring C218C

2

2 Measure the resistance between clockspring C218C, circuit 30S-JA8 (RD/OG) and circuit 31S-JA8 (BK/OG), harness side.



- Is the resistance greater than 10,000 ohms?

- **Yes**
INSTALL a new clockspring. GO to J6.
- **No**
REPAIR the circuit(s) as necessary. GO to J6.

J5 CHECK FOR AN INTERMITTENT FAULT

⚠ WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



- 2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

<p>On-Demand Self Test</p>	<p>● Was DTC B1934 retrieved during the on-demand self test?</p> <p>→ Yes CHECK for causes of intermittent fault at or near the driver air bag module connector. REPAIR any intermittent concerns found.</p> <p>If an intermittent concern was found and repaired, GO to <u>J6</u>.</p> <p>If an intermittent concern was not found, GO to <u>J3</u>.</p> <p>→ No CHECK for causes of intermittent short to battery or ignition on circuits 30S-JA8 (RD/OG) and 31S-JA8 (BK/OG) and the clockspring. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to <u>J6</u>.</p>
<p>J6 CHECK FOR ADDITIONAL DTCs</p>	
	<p>1 Refer to the continuous DTCs recorded during Step J1.</p> <p>● Were any continuous DTCs retrieved during Step J1?</p> <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test K: LFC 35/DTC B1935 — Passenger Air Bag Circuit Resistance Low

Normal Operation




The restraints control module (RCM) monitors the resistance of the passenger air bag ignitor by measuring the resistance between pins 6 and 7. If the RCM detects low resistance between these pins, it will store a diagnostic trouble code (DTC) B1935 in memory and flash a lamp fault code (LFC) 35 (or higher priority code if one exists) on the air bag indicator.

Possible Causes

Passenger air bag low resistance can be caused by:

- a short in the wiring harness.
- a low resistance in the passenger air bag module.
- an RCM internal concern.
- a worn or damaged electrical connector shorting bar.
- a worn or damaged electrical connector camming beam.

PINPOINT TEST K: LFC 35/DTC B1935 — PASSENGER AIR BAG CIRCUIT RESISTANCE LOW

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1</p>  <p>Retrieve/Clear Continuous DTCs</p> <p>2</p>  <p>On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1935 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>K2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>K4</u>.</p>
K2 CHECK THE PASSENGER AIR BAG MODULE	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u> in this section.</p> <p>The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint</p>	

system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● Was DTC B1935 retrieved?

→ **Yes**
GO to [K3](#).

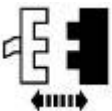
→ **No**
INSTALL a new passenger air bag module. GO to [K5](#).

K3 CHECK THE PASSENGER AIR BAG MODULE CIRCUIT

1



2

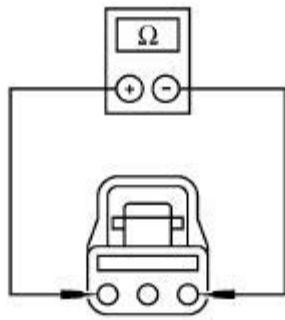


Passenger Air Bag Module Restraint System Diagnostic Tool

3

3

Measure the resistance between passenger air bag C256, circuit 30S-JA11 (RD/WH), harness side and passenger air bag C256, circuit 31S-JA11 (BK/WH), harness side.



DR0292-B

- Is the resistance greater than 10,000 ohms?

→ **Yes**

INSTALL a new RCM. GO to K5.

→ **No**

REPAIR the circuit(s) as necessary. GO to K5.

K4 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



2

Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

<p>On-Demand Self Test</p>	<ul style="list-style-type: none"> ● Was DTC B1935 retrieved during the on-demand self test? <p>→ Yes CHECK for causes of intermittent fault at or near the passenger air bag module connector. REPAIR any intermittent concerns found.</p> <p>If an intermittent concern was found and repaired, GO to <u>K5</u>.</p> <p>If an intermittent concern was not found, GO to <u>K3</u>.</p> <p>→ No CHECK for causes of intermittent short to battery or ignition on circuits 30S-JA11 (RD/WH) and 31S-JA11 (BK/WH). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to <u>K5</u>.</p>
<p>K5 CHECK FOR ADDITIONAL DTCs</p>	
	<p>1 Refer to the continuous DTCs recorded during Step K1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step K1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test L: LTC 48/DTC B2444 — Driver Seat Side Impact Sensor Is Faulted

Normal Operation

The driver seat side impact sensor monitors the severity of a crash event. If the crash is severe enough, the sensor will signal the restraints control module (RCM) to deploy the driver seat side air bag.

The RCM monitors the two-wire current loop to the driver seat side impact sensor for a signal that is out of the expected range. If the RCM detects an out-of-range signal from the driver seat side impact



sensor, indicating a fault, it will store diagnostic trouble code (DTC) B2444 and flash a lamp fault code (LFC) 48 (or a higher priority code if one exists) on the air bag indicator.

Possible Causes

A driver seat side impact sensor fault can be caused by:

- Faulted driver seat side impact sensor.

PINPOINT TEST L: LFC 48/DTC B2444 — DRIVER SEAT SIDE IMPACT SENSOR IS FAULTED

CONDITIONS	DETAILS/RESULTS/ACTIONS
L1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1</p>  <p>Retrieve/Clear Continuous DTCs</p> <p>2</p>  <p>On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B2444 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. INSTALL a new driver seat side impact sensor. GO to <u>L2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. INSTALL a new driver seat side impact sensor. GO to <u>L2</u>.</p>
L2 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step L1.</p> <p>● Were any continuous DTCs retrieved during Step L1?</p> <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No CLEAR all DTCs.</p>

Pinpoint Test M: LFC 43/DTC B2440 — Passenger Seat Side Impact Sensor Mounting Fault

Normal Operation

The passenger seat side impact sensor monitors the severity of a crash event. If the crash is severe enough, the sensor will signal the restraints control module (RCM) to deploy the passenger seat side air bag.



The RCM monitors the two-wire current loop to the passenger seat side impact sensor for a signal that is out of the expected range. If the RCM detects an out-of-range signal from the passenger seat side impact sensor, indicating a sensor mounting fault, it will store diagnostic trouble code (DTC) B2440 and flash a lamp fault code (LFC) 43 (or a higher priority code if one exists) on the air bag indicator.

Possible Causes

A passenger seat side impact sensor mounting fault can be caused by:

- a passenger seat side impact sensor internal fault.
- a passenger seat side impact sensor mounting fault.
- RCM is faulted.

PINPOINT TEST M: LFC 43/DTC B2440 — PASSENGER SEAT SIDE IMPACT SENSOR MOUNTING FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
M1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1 </p> <p>Retrieve/Clear Continuous DTCs</p> <p>2 </p> <p>On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B2440 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>M2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>M5</u>.</p>
M2 CHECK THE MOUNTING OF THE PASSENGER SEAT SIDE IMPACT SENSOR	



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- 1 Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.
 - 2 Remove the passenger seat side impact sensor. Refer to [Side Impact Sensor](#) in the Removal and Installation portion of this section.
 - 3 Visually inspect the passenger seat side impact sensor, mounting bracket and mounting surface for damage, corrosion or dirt.
 - 4 Inspect the passenger seat side impact sensor mounting and make sure that the retaining bolts are fully seated and tightened correctly. Refer to [Side Impact Sensor](#) in the Removal and Installation portion of this section for correct tightening torque.
- **Was a significant amount of corrosion or dirt found, the passenger seat side impact sensor mounting bracket attached to the mounting surface in correctly, or the two passenger seat side impact sensor retaining bolts not fully seated and tightened correctly?**
- **Yes**
MAKE SURE the passenger seat side impact sensor, mounting bracket and mounting surface are free of damage, corrosion or dirt and the two retaining bolts are fully seated and correctly tightened. REATTACH the passenger seat side impact sensor and mounting bracket to the mounting surface. GO to [M6](#).
- **No**
GO to [M3](#).

M3 CHECK THE PASSENGER SEAT SIDE IMPACT SENSOR HARNESS CONNECTION

- 1 Check the passenger seat side impact sensor harness connection.
- **Is the passenger seat side impact sensor harness connector connected to the passenger seat side impact sensor correctly?**
- **Yes**
GO to [M4](#).

→ **No**
ATTACH the passenger seat side impact sensor harness connector correctly. GO to M6.

M4 CHECK THE VEHICLE CHASSIS GROUND

1 Measure the resistance between a known good chassis ground and the mounting surface of the passenger seat side impact sensor.

- **Is the resistance greater than 100 ohms?**

→ **Yes**
REPAIR the chassis grounding system. GO to M6.

→ **No**
INSTALL a new RCM. GO to M6.

M5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

2



On-Demand Self-test

1 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

3 Refer to the continuous DTCs recorded during Step M1.

- **Was DTC B2440 retrieved during the on-demand self test?**

→ **Yes**
GO to M2.

→ **No**

	CHECK for causes of an intermittent mounting fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to <u>M6</u> .
M6 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step M1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step M1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. PROVE OUT the system. CLEAR all DTCs.</p>

Pinpoint Test N: LFC 42/DTC B2441 — Driver Seat Side Impact Sensor Mounting Fault

Normal Operation

The driver seat side impact sensor monitors the severity of a crash event. If the crash is severe enough, the sensor will signal the restraints control module (RCM) to deploy the driver seat side air bag.


The RCM monitors the two-wire current loop to the driver seat side impact sensor for a signal that is out of the expected range. If the RCM detects an out-of-range signal from the driver seat side impact sensor, indicating a sensor mounting fault, it will store diagnostic trouble code (DTC) B2441 and flash a lamp fault code (LFC) 42 (or a higher priority code if one exists) on the air bag indicator.

Possible Causes

A driver seat side impact sensor mounting fault can be caused by:

- a driver seat side impact sensor internal fault.
- a driver seat side impact sensor mounting fault.
- RCM is faulted.

PINPOINT TEST N: LFC 42/DTC B2441 — DRIVER SEAT SIDE IMPACT SENSOR MOUNTING FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
N1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1</p>  <p>Retrieve/Clear Continuous DTCs</p> <p>2</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p>



On-Demand Self Test

- Was DTC B2441 retrieved during the on-demand self test?

→ Yes

This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to [N2](#).

→ No

This is an intermittent fault. The fault condition is not present at this time. GO to [N5](#).

N2 CHECK THE MOUNTING OF THE DRIVER SIDE CRASH SENSOR



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- 1 Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.
- 2 Remove the driver seat side impact sensor. Refer to [Side Impact Sensor](#) in the Removal and Installation portion of this section.
- 3 Visually inspect the driver seat side impact sensor, mounting bracket and mounting surface for damage, corrosion or dirt.
- 4 Inspect the driver seat side impact sensor mounting and make sure that the retaining bolts are fully seated and tightened correctly. Refer to [Side Impact Sensor](#) in this section for correct tightening torque.

- Was a significant amount of corrosion or dirt found, the driver seat side impact sensor mounting bracket attached to the mounting surface incorrectly, or the two driver seat side impact sensor retaining bolts not fully seated and tightened correctly?

→ Yes

MAKE SURE the driver seat side impact sensor, mounting bracket and mounting surface are free of damage, corrosion or dirt and the two retaining bolts are fully seated and correctly tightened. REATTACH the driver seat side impact sensor and mounting bracket to the mounting surface. GO to [N6](#).

→ **No**
GO to [N3](#).

N3 CHECK THE DRIVER SEAT SIDE CRASH SENSOR HARNESS CONNECTION

1 Check the driver seat side impact sensor harness connection.

- **Is the driver seat side impact sensor harness connector connected to the driver seat side impact sensor correctly?**

→ **Yes**
GO to [N4](#).

→ **No**
ATTACH the driver seat side impact sensor harness connector correctly.
GO to [N6](#).

N4 CHECK THE VEHICLE CHASSIS GROUND

1 Measure the resistance between a known good chassis ground and the mounting surface of the driver seat side impact sensor.

- **Is the resistance greater than 100 ohms?**

→ **Yes**
REPAIR the chassis grounding system. GO to [N6](#).

→ **No**
INSTALL a new RCM. GO to [N6](#).

N5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.


NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1 Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing

<p>2</p>  <p>On-Demand Self Test</p>	<p>portion of this section.</p> <ul style="list-style-type: none"> ● Was DTC B2441 retrieved during the on-demand self test? <p>→ Yes GO to <u>N2</u>.</p> <p>→ No CHECK for causes of an intermittent mounting fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to <u>N6</u>.</p>
<p>N6 CHECK FOR ADDITIONAL DTCs</p>	
	<p>1 Refer to the continuous DTCs recorded during Step N1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step N1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. PROVE OUT the system. CLEAR all DTCs.</p>

Pinpoint Test O: LFC 49/DTC B2445 — Passenger Seat Side Impact Sensor Is Faulted

Normal Operation

The passenger seat side impact sensor monitors the severity of a crash event. If the crash is severe enough, the sensor will signal the restraints control module (RCM) to deploy the passenger seat side air bag.



The RCM monitors the two-wire current loop to the passenger seat side impact sensor for a signal that is out of the expected range. If the RCM detects an out-of-range signal from the passenger seat side impact sensor, indicating a fault, it will store diagnostic trouble code (DTC) B2445 and flash a lamp fault code (LFC) 49 (or a higher priority code if one exists) on the air bag indicator.

Possible Causes

A passenger seat side impact sensor fault can be caused by:

- damaged passenger seat side impact sensor.

PINPOINT TEST O: LFC 49/DTC B2445 — PASSENGER SEAT SIDE IMPACT SENSOR IS FAULTED

CONDITIONS	DETAILS/RESULTS/ACTIONS
O1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1 </p> <p>Retrieve/Clear Continuous DTCs</p> <p>2 </p> <p>On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B2445 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. INSTALL a new passenger seat side impact sensor. GO to <u>O2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. INSTALL a new passenger seat side impact sensor. GO to <u>O2</u>.</p>
O2 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step O1.</p> <p>● Were any continuous DTCs retrieved during Step O1?</p> <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No CLEAR all DTCs.</p>

Pinpoint Test P: LFC 44/DTC U2017 — Driver Side Impact Sensor Communication Fault

Normal Operation

The driver seat side impact sensor monitors the severity of a crash event. If the crash is severe enough, the sensor will signal the restraints control module (RCM) to deploy the driver seat side air bag.




The RCM monitors the two-wire current loop to the driver seat side impact sensor for a signal that is out of the expected range. If the RCM detects an out-of-range signal from the driver seat side impact sensor, indicating a sensor communication fault, it will store diagnostic trouble code (DTC) U2017 and flash a lamp fault code (LFC) 44 (or a higher priority code if one exists) on the air bag indicator.

Possible Causes

A driver seat side impact sensor communication fault can be caused by:

- damaged wiring on circuit 7-JA39 (YE).
- damaged wiring on circuit 9-JA39 (BN).
- damaged driver seat side impact sensor.

PINPOINT TEST P: LFC 44/DTC U2017 — DRIVER SEAT SIDE IMPACT SENSOR COMMUNICATION FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
P1 CHECK FOR CONTINUOUS OR ON-DEMAND SELF TEST DTCs	
<p>1 </p> <p>Retrieve/Clear Continuous DTCs</p> <p>2 </p> <p>On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC U2017 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>P2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>P9</u>.</p>
P2 CHECK THE DRIVER SIDE CRASH SENSOR HARNESS CONNECTOR	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.</p> <p>The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p>	

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

2 Check the driver seat side impact sensor electrical connector for a correct connection.

- Is the driver seat side impact sensor connected correctly?

→ **Yes**
GO to P3.

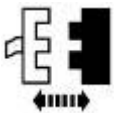
→ **No**
CONNECT the driver seat side impact sensor connector correctly. GO to P10.

P3 CHECK THE CIRCUIT 7-JA39 (YE) FOR AN OPEN

1

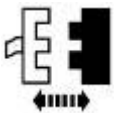


2



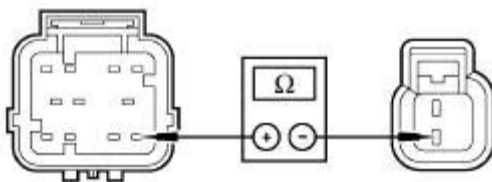
RCM C310

3



Driver Side Crash Sensor C305

4



DR1002-A

4 Measure the resistance between RCM C310b pin 8, circuit 7-JA39 (YE), harness side and driver seat side impact sensor C305, circuit 7-JA39 (YE), harness side.

- Is the resistance greater than

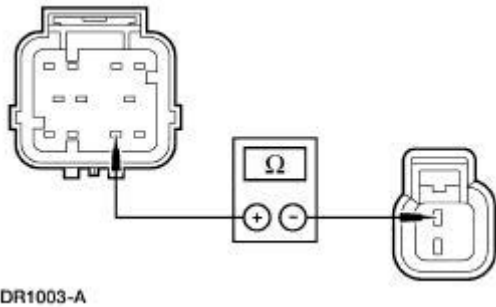
10,000 ohms?

→ **Yes**
REPAIR the circuit. GO to P10.

→ **No**
GO to P4.

P4 CHECK CIRCUIT 9-JA39 (BN) FOR AN OPEN

1



1

Measure the resistance between RCM C310b pin 9, circuit 9-JA39 (BN), harness side and driver seat side impact sensor C305, circuit 9-JA39 (BN), harness side.

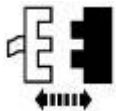
● **Is the resistance greater than 10,000 ohms?**

→ **Yes**
REPAIR the circuit. GO to P10.

→ **No**
GO to P5.

P5 CHECK CIRCUIT 7-JA39 (YE) FOR A SHORT TO GROUND

1

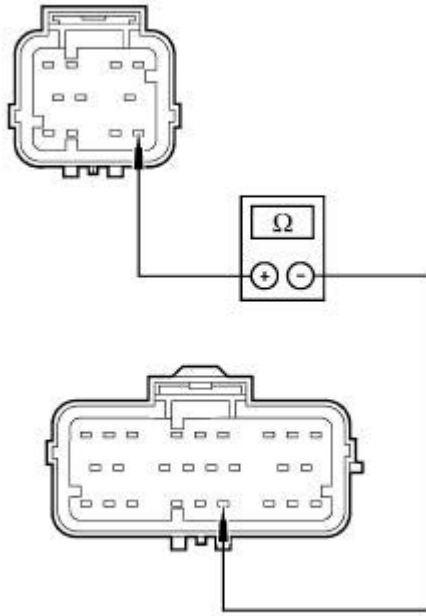


RCM C310a

2

2

Measure the resistance between RCM C310b pin 8, circuit 7-JA39 (YE), harness side and RCM C310a pin 21, circuit 31-JA10A (BK/RD), harness side.



DR1010-A

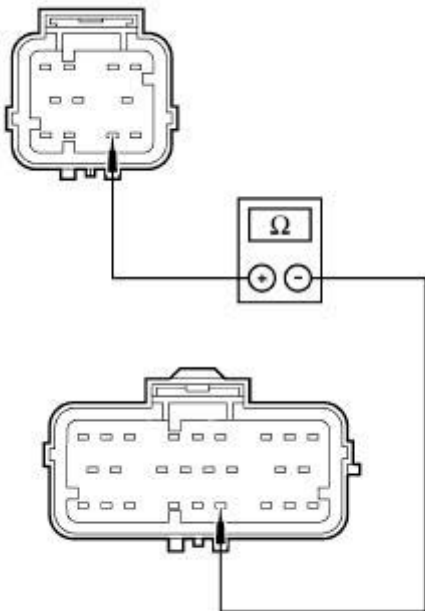
- Is the resistance less than 10,000 ohms?

→ **Yes**
REPAIR the circuit. GO to P10.

→ **No**
GO to P6.

P6 CHECK CIRCUIT 9-JA39 (BN) FOR A SHORT TO GROUND

1



DR1020-A

1

Measure the resistance between RCM C310b pin 9, circuit 9-JA39 (BN), harness side and RCM C310a pin 21, circuit 31-JA10A (BK/RD), harness side.

- Is the resistance less than 10,000 ohms?

→ **Yes**
REPAIR the circuit. GO to P10.

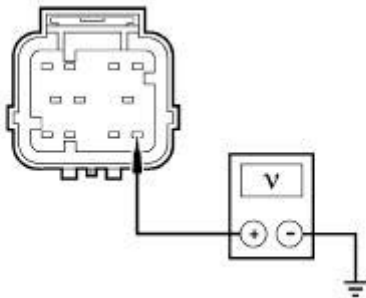
→ **No**
GO to P7.

P7 CHECK CIRCUIT 7-JA39 (YE) FOR A SHORT TO BATTERY OR IGNITION

1



2



A0042307

2 Measure the voltage between RCM C310b pin 8, circuit 7-JA39 (YE), harness side and ground.

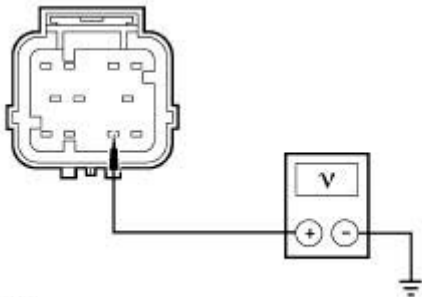
- Is the voltage less than 0.2 volt?

→ **Yes**
GO to P8.

→ **No**
REPAIR the circuit. GO to P10.

P8 CHECK CIRCUIT 9-JA39 (BN) FOR A SHORT TO BATTERY OR IGNITION

1



A0030433


1 Measure the voltage between RCM C310b pin 9, circuit 9-JA39 (BN), harness side and ground.

- Is the voltage less than 0.2 volt?

→ **Yes**
INSTALL a new driver seat side impact sensor. GO to P10.

→ **No**
REPAIR the circuit. GO to P10.

P9 CHECK FOR AN INTERMITTENT FAULT

 **WARNING:** If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

2



On-Demand Self Test

1 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

- Was DTC U2017 retrieved during the on-demand self test?

→ **Yes**
GO to P2.

→ **No**
CHECK for causes of a communication fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to P10.

P10 CHECK FOR ADDITIONAL DTCs

1 Refer to the continuous DTCs recorded during Step P1.

- Were any continuous DTCs retrieved during Step P1?

	<p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) . CLEAR all DTCs.</p>
--	--

Pinpoint Test Q: LFC 45/DTC U2018 — Passenger Seat Side Impact Sensor Communication Fault

Normal Operation

The passenger seat side impact sensor monitors the severity of a crash event. If the crash is severe enough, the sensor will signal the restraints control module (RCM) to deploy the passenger seat side air bag.


The RCM monitors the two-wire current loop to the passenger seat side impact sensor for a signal that is out of the expected range. If the RCM detects an out-of-range signal from the passenger seat side impact sensor, indicating a sensor communication fault, it will store diagnostic trouble code (DTC) U2018 and flash a lamp fault code (LFC) 45 (or a higher priority code if one exists) on the air bag indicator.

Possible Causes

A passenger seat side impact sensor communication fault can be caused by:

- damaged wiring on circuit 7-JA40 (YE/VT).
- damaged wiring on circuit 9-JA40 (BN/WH).
- damaged passenger seat side impact sensor.

PINPOINT TEST Q: LFC LFC 45/DTC U2018 — PASSENGER SIDE IMPACT SENSOR COMMUNICATION FAULT

CONDITIONS	DETAILS/RESULTS/ACTIONS
Q1 CHECK FOR CONTINUOUS OR ON-DEMAND SELF TEST DTCs	
<p>1 </p> <p>Retrieve/Clear Continuous DTCs</p> <p>2</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p>



On-Demand Self Test

- **Was DTC U2018 retrieved during the on-demand self test?**

→ **Yes**

This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to Q2.

→ **No**

This is an intermittent fault. The fault condition is not present at this time. GO to Q9.

Q2 CHECK THE PASSENGER SIDE IMPACT SENSOR HARNESS CONNECTOR



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

2 Check the passenger seat side impact sensor electrical connector for a correct connection.

- **Is the passenger seat side impact sensor connected correctly?**

→ **Yes**

GO to Q3.

→ **No**
CONNECT the passenger seat side impact sensor connector correctly. GO to Q6.

Q3 CHECK CIRCUIT 7-JA40 (YE/VT) FOR AN OPEN

1



2



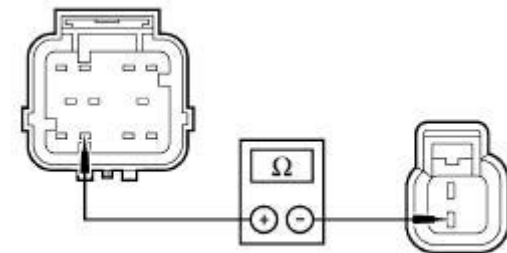
RCM C310

3



Passenger Side Crash Sensor C304

4



DR1004-A

4 Measure the resistance between RCM C310b pin 10, circuit 7-JA40 (YE/VT), harness side and passenger seat side impact sensor C304, circuit 7-JA40 (YE/VT), harness side.

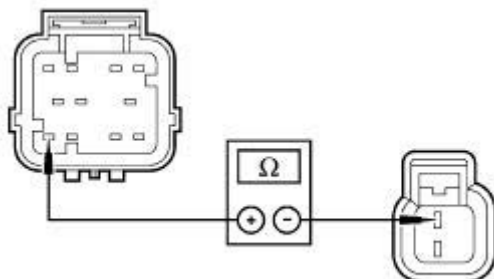
- Is the resistance greater than 10,000 ohms?

→ **Yes**
REPAIR the circuit. GO to Q10.

→ **No**
GO to Q4.

Q4 CHECK CIRCUIT 9-JA40 (BN/WH) FOR AN OPEN

1



DR1005-A

1 Measure the resistance between RCM C310b pin 11, circuit 9-JA40 (BN/WH), harness side and passenger seat side impact sensor C304, circuit 9-JA40 (BN/WH), harness side.

● Is the resistance greater than 10,000 ohms?

→ **Yes**
REPAIR the circuit. GO to Q10.

→ **No**
GO to Q5.

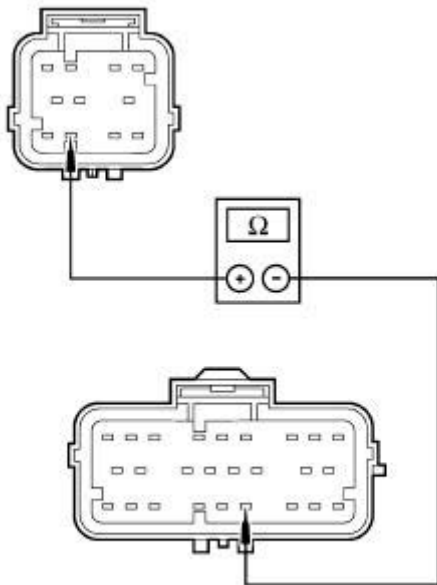
Q5 CHECK CIRCUIT 7-JA40 (YE/VT) FOR A SHORT TO GROUND

1



RCM C310a

2



DR1023-A

2 Measure the resistance between RCM C310b pin 10, circuit 7-JA40 (YE/VT), harness side and RCM C310a pin 21, circuit 31-JA10A (BK/RD), harness side.

● Is the resistance less than 10,000 ohms?

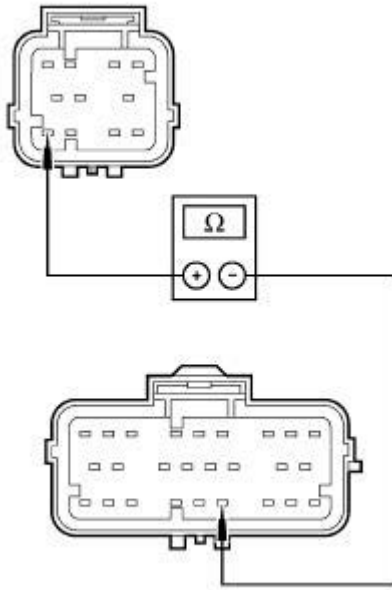
→ **Yes**
REPAIR the circuit. GO to Q10.

→ **No**
GO to Q6.

Q6 CHECK CIRCUIT 9-JA40 (BN/WH) FOR A SHORT TO GROUND

1

1 Measure the resistance between RCM C310b pin 11, circuit 9-JA40 (BN/WH), harness side and RCM C310a pin 21, circuit 31-JA10A (BK/RD), harness side.



DR1057-A

- Is the resistance less than 10,000 ohms?

→ **Yes**
REPAIR the circuit. GO to Q10.

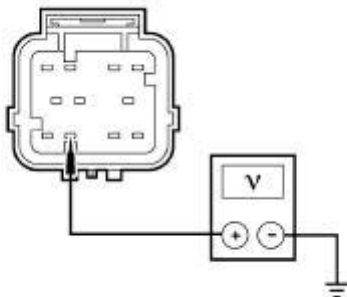
→ **No**
GO to Q7.

Q7 CHECK CIRCUIT 7-JA40 (YE/VT) FOR A SHORT TO BATTERY OR IGNITION

1



2



A0042310

- 2 Measure the voltage between RCM C310b pin 10, circuit 7-JA40 (YE/VT), harness side and ground.

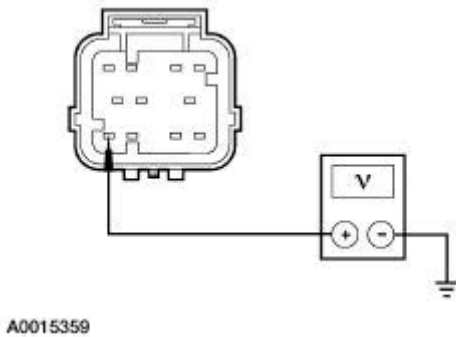
- Is the voltage less than 0.2 volt?

→ **Yes**
GO to Q8.

→ **No**
REPAIR the circuit. GO to Q10.

Q8 CHECK CIRCUIT 9-JA40 (BN/WH) FOR A SHORT TO BATTERY OR IGNITION

1



1 Measure the voltage between the RCM C310b pin 11, circuit 9-JA40 (BN/WH), harness side and ground.

● **Is the voltage less than 0.2 volt?**

→ **Yes**
INSTALL a new passenger seat side impact sensor. GO to Q10.

→ **No**
REPAIR the circuit. GO to Q10.

Q9 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

2



On-Demand Self Test

1 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

	<ul style="list-style-type: none"> ● Was DTC U2018 retrieved during the on-demand self test? <p>→ Yes GO to <u>Q2</u>.</p> <p>→ No CHECK for causes of a communication fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to <u>Q10</u>.</p>
Q10 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step Q1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step Q1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test R: LFC 36/DTC B1993 — Driver Seat Side Air Bag Circuit Shorted to Ground

Normal Operation




The restraints control module (RCM) monitors the resistance to ground at RCM C310b pins 2 and 3. If the resistance is less than 10,000 ohms at either pin, the RCM will interpret that as a ground short, store diagnostic trouble code (DTC) B1993 and flash lamp fault code (LFC) 36.

Possible Causes

A driver seat side air bag circuit short to ground can be caused by:

- grounded wiring on circuit 30S-JA37 (RD/GN).
- damaged wiring on circuit 31S-JA37 (BK/GN).
- ground short in the driver seat side air bag module.
- RCM is faulted.

PINPOINT TEST R: LFC 36/DTC B1993 — DRIVER SIDE AIR BAG CIRCUIT SHORTED TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
R1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1  Retrieve/Clear Continuous DTCs</p> <p>2  On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1993 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>R2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>R5</u>.</p>
R2 CHECK THE DRIVER SIDE AIR BAG MODULE	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u> in this section.</p> <p>The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p> <p>NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.</p> <p>NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.</p> <p>NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.</p>	
<p>1</p>	



3



On-Demand Self Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

● **Was DTC B1993 retrieved?**

→ **Yes**
GO to R3.

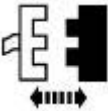
→ **No**
INSTALL a new driver seat side air bag module. GO to R6.

R3 CHECK THE DRIVER SIDE AIR BAG MODULE CIRCUITS

1

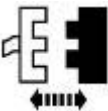


2



RCM C310b

3

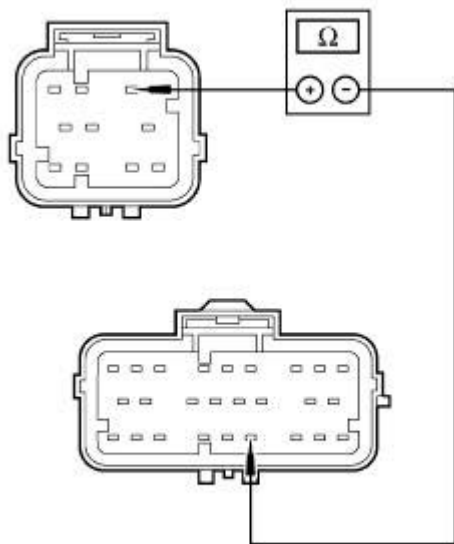


RCM C310a

4

4 **NOTE:** Do not separate or remove shorting bars from RCM C310b.

Measure the resistance between RCM C310b pin 2, circuit 30S-JA37 (RD/GN), harness side and RCM C310a pin 21, circuit 31-JA10A (BK/RD), harness side.



DR1011-A

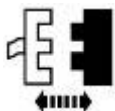
- Is the resistance less than 10,000 ohms?

→ **Yes**
REPAIR the circuit(s) as necessary. GO to R6.

→ **No**
GO to R4.

R4 CHECK THE WIRING TO DRIVER SIDE AIR BAG MODULE

1



Driver Side Air Bag Module Restraint System Diagnostic Tool

2

Inspect all crimps, terminals, wires and connectors in circuit 30S-JA37 (RD/GN) between the driver seat side air bag module connector C367 and RCM C310b pin 2 and circuit 31S-JA37 (BK/GN) between the driver seat side air bag module connector C367 and RCM C310b pin 3. Check for pinched wires and damaged connector pin terminals.

- Was any damage found?

→ **Yes**
REPAIR as necessary. GO to R6.

→ **No**
INSTALL a new RCM. GO to R6.

R5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

- Was DTC B1993 retrieved during the on-demand self test?

→ **Yes**

CHECK for causes of intermittent fault at or near the driver air bag module connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to [R6](#).

If an intermittent concern **was not** found, GO to [R3](#).

→ **No**

CHECK for causes of intermittent short to battery or ignition on circuits 30S-JA8 (RD/OG) and 31S-JA8 (BK/OG) and the clockspring. ATTEMPT to recreate the

	hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to <u>R6</u> .
R6 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step R1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step R1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test S: LFC 37/DTC B1997 — Passenger Seat Side Air Bag Circuit Shorted to Ground

Normal Operation


The restraints control module (RCM) monitors the resistance to ground at RCM C310b pins 5 and 6. If the resistance is less than 10,000 ohms at either pin, the RCM will interpret that as a ground short, store diagnostic trouble code (DTC) B1997 and flash lamp fault code (LFC) 37.

Possible Causes

A passenger seat side air bag circuit short to ground can be caused by:

- grounded wiring on circuit 30S-JA38 (RD/BK).
- damaged wiring on circuit 31S-JA38 (BK/RD).
- ground short in the passenger seat side air bag module.
- RCM is faulted.

PINPOINT TEST S: LFC 37/DTC B1997 — PASSENGER SEAT SIDE AIR BAG CIRCUIT SHORTED TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
S1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1</p> 	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p>

Retrieve/Clear Continuous DTCs

2



On-Demand Self Test

● Was DTC B1997 retrieved during the on-demand self test?

→ Yes

This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to S2.

→ No

This is an intermittent fault. The fault condition is not present at this time. GO to S5.

S2 CHECK THE PASSENGER SEAT SIDE AIR BAG MODULE



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.



On-Demand Self Test

● Was DTC B1997 retrieved?

→ **Yes**

GO to S3.

→ **No**

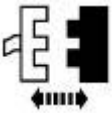
INSTALL a new passenger seat side air bag module. GO to S6.

S3 CHECK THE PASSENGER SEAT SIDE AIR BAG MODULE CIRCUITS

1

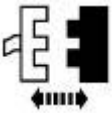


2



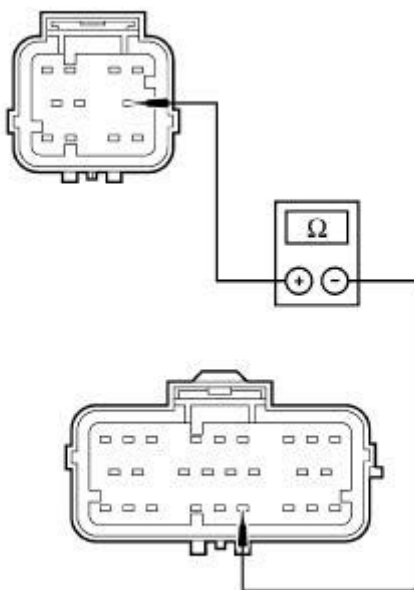
RCM C310b

3



RCM C310a

4



4

Measure the resistance between RCM C310b pin 5, circuit 30S-JA38 (RD/BK), harness side and RCM C310a pin 21, circuit 31-JA10A (BK/RD), harness side.

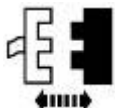
● Is the resistance less than 10,000 ohms?

→ **Yes**
REPAIR the circuit(s) as necessary. GO to S6.

→ **No**
GO to S4.

S4 CHECK THE WIRING TO THE PASSENGER SEAT SIDE AIR BAG MODULE

1



Passenger Seat Side Air Bag Module Restraint System Diagnostic Tool

2 Inspect all crimps, terminals, wires and connectors in circuit 30S-JA38 (RD/BK) between the passenger seat side air bag module connector C314 and RCM C310b pin 5 and circuit 31S-JA38 (BK/RD) between the passenger seat side air bag module connector C314 and RCM C310b pin 6. Check for pinched wires and damaged connector pin terminals.

● Was any damage found?

→ **Yes**
REPAIR as necessary. GO to S6.

→ **No**
INSTALL a new RCM. GO to S6.

S5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

● **Was DTC B1997 retrieved during the on-demand self test?**

→ **Yes**

CHECK for causes of intermittent fault at or near the passenger seat air bag module connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to S6.

If an intermittent concern **was not** found, GO to S3.

→ **No**

CHECK for causes of intermittent short to ground on circuits 30S-JA38 (RD/BK) and 31S-JA38 (BK/RD). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to S6.

S6 CHECK FOR ADDITIONAL DTCs

1 Refer to the continuous DTCs recorded during Step S1.

● **Were any continuous DTCs retrieved during Step S1?**

→ **Yes**

Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.

→ **No**

RECONNECT the system. REACTIVATE the system. PROVE OUT the system.

REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS). CLEAR all DTCs.

Pinpoint Test T: LFC 36/DTC B1992 — Driver Seat Side Air Bag Circuit Shorted to Battery or Ignition

Normal Operation



The restraints control module (RCM) monitors the driver seat side air bag circuits at RCM C310b pins 2 and 3 for a short to battery or ignition. If battery or ignition voltage is detected, the RCM will store diagnostic trouble code (DTC) B1992 and flash lamp fault code (LFC) 36.

Possible Causes

A driver seat side air bag circuit short to battery or ignition can be caused by:


- battery or ignition voltage on circuit 30S-JA38 (RD/BK).
- battery or ignition voltage on circuit 31S-JA38 (BK/RD).
- battery or ignition voltage short in the driver seat side air bag module.
- RCM is faulted.

PINPOINT TEST T: LFC 36/DTC B1992 — DRIVER SEAT SIDE AIR BAG CIRCUIT SHORTED TO BATTERY OR IGNITION

CONDITIONS	DETAILS/RESULTS/ACTIONS
T1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1  Retrieve/Clear Continuous DTCs</p> <p>2  On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1992 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>T2</u>.</p> <p>→ No This is an intermittent fault. The fault</p>

condition is not present at this time. GO to T5.

T2 CHECK THE DRIVER SEAT SIDE AIR BAG MODULE

 **WARNING:** If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

● Was DTC B1992 retrieved?

→ **Yes**
GO to T3.

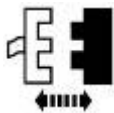
→ **No**
INSTALL a new driver seat side air bag module. GO to T6.

T3 CHECK THE DRIVER SEAT SIDE AIR BAG MODULE CIRCUITS

1

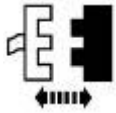


2



Driver Seat Side Air Bag Module Restraint System Diagnostic Tool

3

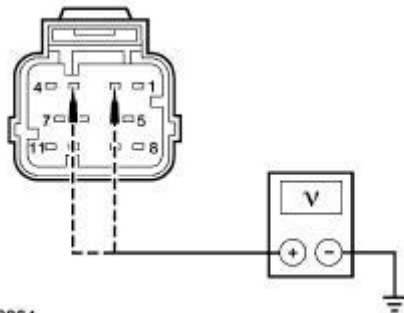


RCM C310b

4



5



5

NOTE: Do not separate or remove shorting bars from RCM C310b.

Measure the voltage between RCM C310b pin 2, circuit 30S-JA37 (RD/GN), harness side and ground; and between RCM C310b pin 3, circuit 31S-JA37 (BK/GN) harness side and ground.

● Are the voltages less than 0.2 volt?

→ **Yes**
GO to T4.

→ **No**
REPAIR the circuit(s) as necessary. GO to T6.

T4 CHECK THE WIRING TO THE DRIVER SEAT SIDE AIR BAG MODULE

1

Inspect all crimps, terminals, wires and connectors in circuit 30S-JA37 (RD/GN) between the driver seat side air bag module connector C367 and RCM C310b pin 2 and circuit 31S-JA37 (BK/GN) between the driver seat side air bag module connector C367 and RCM C310b pin 3. Check for pinched wires and damaged connector pin terminals.

● Was any damage found?

→ **Yes**
REPAIR as necessary. GO to T6.

→ **No**
INSTALL a new RCM. GO to T6.

T5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● **Was DTC B1992 retrieved during the on-demand self test?**

→ **Yes**

CHECK for causes of intermittent fault at or near the driver seat air bag module connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to [T6](#).

If an intermittent concern **was not** found, GO to [T3](#).

→ **No**

CHECK for causes of intermittent short to battery or ignition on circuits 30S-JA37 (RD/GN) and 31S-JA37 (BK/GN). ATTEMPT to recreate the hard fault by

	flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found.GO to <u>T6</u> .
T6 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step V1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step V1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test U: LFC 37/DTC B1996 — Passenger Seat Side Air Bag Circuit Shorted to Battery or Ignition

Normal Operation

The restraints control module (RCM) monitors the passenger seat side air bag circuits at RCM C310b pins 5 and 6 for a short to battery or ignition. If battery or ignition voltage is detected, the RCM will store diagnostic trouble code (DTC) B1996 and flash lamp fault code (LFC) 37.

Possible Causes:

A passenger seat side air bag circuit short to battery or ignition can be caused by:

- battery or ignition voltage on circuit 30S-JA38 (RD/BK).
- battery or ignition voltage on circuit 31S-JA38 (BK/RD).
- battery or ignition voltage short in the passenger seat side air bag module.
- RCM is faulted.

PINPOINT TEST U: LFC 37/DTC B1996 — PASSENGER SEAT SIDE AIR BAG CIRCUIT SHORTED TO BATTERY OR IGNITION

CONDITIONS	DETAILS/RESULTS/ACTIONS
U1 CHECK FOR A HARD OR INTERMITTENT DTC	
1	1 Retrieve and record any continuous DTCs for use later in this pinpoint test.



Retrieve/Clear Continuous DTCs

2



On-Demand Self Test

- **Was DTC B1996 retrieved during the on-demand self test?**

→ **Yes**

This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to U2.

→ **No**

This is an intermittent fault. The fault condition is not present at this time. GO to U5.

U2 CHECK THE PASSENGER SIDE AIR BAG MODULE



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



- 2 Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

3



On-Demand Self Test

● Was DTC B1996 retrieved?

→ Yes
GO to U3.

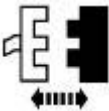
→ No
INSTALL a new passenger seat side air bag module. GO to U6.

U3 CHECK THE PASSENGER SEAT SIDE AIR BAG MODULE CIRCUITS

1

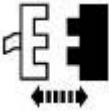


2



Passenger Seat Side Air Bag Module Restraint System Diagnostic Tool

3

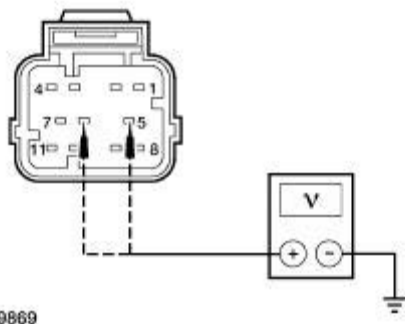


RCM C310b

4



5



5 Measure the voltage between RCM C310b pin 5, circuit 30S-JA38 (RD/BK), harness side and ground; between RCM C310b pin 6, circuit 31S-JA38 (BK/RD), harness side and ground.

● Are the voltages less than 0.2 volt?

→ Yes
GO to U4.

→ **No**
REPAIR the circuit(s) as necessary. GO to U6.

U4 CHECK THE WIRING TO THE PASSENGER SEAT SIDE AIR BAG MODULE

1 Inspect all crimps, terminals, wires and connectors in circuit 30S-JA38 (RD/BK) between the passenger air bag module connector C337 and RCM C310b pin 5 and circuit 31S-JA38 (BK/RD) between the passenger air bag module connector C337 and RCM C310b pin 6. Check for pinched wires and damaged connector pin terminals.

● **Was any damage found?**

→ **Yes**
REPAIR as necessary. GO to U6.

→ **No**
INSTALL a new RCM. GO to U6.

U5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.



On-Demand Self Test

- **Was DTC B1996 retrieved during the on-demand self test?**

→ **Yes**

CHECK for causes of intermittent fault at or near the passenger seat air bag module connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to U6.

If an intermittent concern **was not** found, GO to U3.

→ **No**

CHECK for causes of intermittent short to battery or ignition on circuits 30S-JA38 (RD/BK) and 31S-JA38 (BK/RD). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to U6.

U6 CHECK FOR ADDITIONAL DTCs

1 Refer to the continuous DTCs recorded during Step U1.

- **Were any continuous DTCs retrieved during Step U1?**

→ **Yes**

Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.

→ **No**

RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS). CLEAR all DTCs.

Pinpoint Test V: LFC 36/DTC B1994 — Driver Seat Side Air Bag Circuit Resistance High

Normal Operation




The restraints control module (RCM) monitors the resistance of the driver seat side air bag circuit loop and the air bag module igniter at RCM C301b pins 2 and 3. If the resistance is greater than 3.6 ohms, the RCM will store diagnostic trouble code (DTC) B1994 and flash lamp fault code (LFC) 36.

Possible Causes

A high resistance on the driver seat side air bag circuit can be caused by:

- damaged wiring on circuit 30S-JA37 (RD/GN).
- damaged wiring on circuit 31S-JA37 (BK/GN).
- damaged driver seat side air bag module.
- RCM is faulted.

PINPOINT TEST V: LFC 36/DTC B1994 — DRIVER SEAT SIDE AIR BAG CIRCUIT RESISTANCE HIGH

CONDITIONS	DETAILS/RESULTS/ACTIONS
V1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1  Retrieve/Clear Continuous DTCs</p> <p>2  On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1994 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>V2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>V5</u>.</p>
V2 CHECK THE DRIVER SEAT SIDE AIR BAG MODULE	
<p>1 </p>	<p>2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.</p>

3



On-Demand Self Test

● Was DTC B1994 retrieved?

→ Yes

GO to V3.

→ No

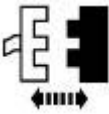
INSTALL a new driver seat side air bag module. GO to V6.

V3 CHECK THE DRIVER SEAT SIDE AIR BAG MODULE CIRCUITS

1



2



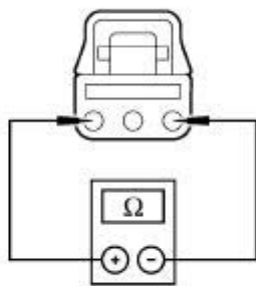
RCM C310b

3



Driver Side Air Bag Module Restraint System Diagnostic Tool

4



DR1050-A

4

NOTE: By disconnecting RCM C310b, circuit 30S-JA37 (RD/GN) and circuit 31S-JA37 (BK/GN) of the RCM connector are shorted together with a shorting bar. Do not remove the shorting bar.

Measure the resistance between driver seat side air bag C367, circuit 30S-JA37 (RD/GN), harness side and driver seat side air bag C367, circuit 31S-JA37 (BK/GN), harness side.

● Is the resistance greater than 1.0 ohm?

→ Yes

REPAIR the circuit(s) as necessary. GO to V6.

→ No

GO to V4.

V4 CHECK THE WIRING TO THE DRIVER SEAT SIDE AIR BAG MODULE


1 Inspect all crimps, terminals, wires and connectors in circuit 30S-JA37 (RD/GN) between the driver seat side air bag module connector C367 and RCM C310b pin 2 and circuit 31S-JA37 (BK/GN) between the driver seat side air bag module connector C367 and RCM C310b pin 3. Check for pinched wires and damaged connector pin terminals.

● Was any damage found?

→ Yes
REPAIR as necessary. GO to V6.

→ No
INSTALL a new RCM. GO to V6.

V5 CHECK FOR AN INTERMITTENT FAULT

 **WARNING:** If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● Was DTC B1994 retrieved during the on-demand self test?

	<p>→ Yes CHECK for causes of intermittent fault at or near the driver seat air bag module connector. REPAIR any intermittent concerns found.</p> <p>If an intermittent concern was found and repaired, GO to <u>V6</u>.</p> <p>If an intermittent concern was not found, GO to <u>V3</u>.</p> <p>→ No CHECK for causes of intermittent high resistance on circuits 30S-JA37 (RD/GN) and 31S-JA37 (BK/GN). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to <u>V6</u>.</p>
<p>V6 CHECK FOR ADDITIONAL DTCs</p>	
	<p>1 Refer to the continuous DTCs recorded during Step V1.</p> <p>● Were any continuous DTCs retrieved during Step V1?</p> <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test W LFC 37/DTC B1998 — Passenger Seat Side Air Bag Circuit Resistance High

Normal Operation

The restraints control module (RCM) monitors the resistance of the passenger seat side air bag circuit loop and the air bag module igniter at RCM C301b pins 5 and 6. If the resistance is greater than 3.6 ohms, the RCM will store diagnostic trouble code (DTC) B1998 and flash lamp fault code (LFC) 37.




Possible Causes

A high resistance on the passenger seat side air bag circuit can be caused by:

- damaged wiring on circuit 30S-JA38 (RD/BK).
- damaged wiring on circuit 31S-JA38 (BK/RD).
- damaged passenger seat side air bag module.

- RCM is faulted.

PINPOINT TEST W: LFC 37/DTC B1998 — PASSENGER SIDE AIR BAG CIRCUIT RESISTANCE HIGH

CONDITIONS	DETAILS/RESULTS/ACTIONS
W1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1 </p> <p>Retrieve/Clear Continuous DTCs</p> <p>2 </p> <p>On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1998 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>W2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>W6</u>.</p>
W2 CHECK THE PASSENGER SIDE AIR BAG MODULE	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u> in this section.</p> <p>The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p> <p>NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.</p> <p>NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.</p>	

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● Was DTC B1998 retrieved?

→ Yes
GO to [W3](#).

→ No
INSTALL a new passenger seat side air bag module. GO to [W5](#).

W3 CHECK THE PASSENGER SIDE AIR BAG MODULE CIRCUIT

1

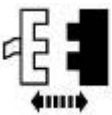


2



RCM C310b

3

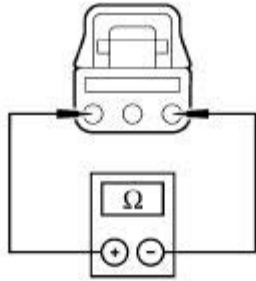


Passenger Seat Side Air Bag Module Restraint System Diagnostic Tool

4

4 **NOTE:** By disconnecting RCM C310b, circuit 30S-JA38 (RD/BK) and circuit 31S-JA38 (BK/RD) of the RCM connector are shorted together with a shorting bar. Do not remove the shorting bar.

Measure the resistance between passenger seat side air bag C337, circuit 30S-JA38 (RD/BK), harness side and passenger seat side air bag



DR1050-A

C337, circuit 31S-JA38 (BK/RD), harness side.

- Is the resistance greater than 1.0 ohm?

→ **Yes**
REPAIR the circuit(s) as necessary. GO to W6.

→ **No**
GO to W4.

W4 CHECK THE WIRING TO THE PASSENGER SIDE AIR BAG MODULE

- 1 Inspect all crimps, terminals, wires and connectors in circuits 30S-JA38 (RD/BK) and 31S-JA38 (BK/RD) between passenger seat side air bag module connector C337 and RCM C310b pins 5 and 6. Check for pinched wires and damaged connector pin terminals.

- Was any damage found?

→ **Yes**
REPAIR as necessary. GO to W6.

→ **No**
INSTALL a new RCM. GO to W6.

W5 CHECK FOR AN INTERMITTENT FAULT

⚠ WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools

must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

● **Was DTC B1998 retrieved during the on-demand self test?**

→ **Yes**

CHECK for causes of intermittent fault at or near the passenger seat air bag module connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to W6.

If an intermittent concern **was not** found, GO to W3.

→ **No**

CHECK for causes of intermittent high resistance on circuit 30S-JA38 (RD/BK) and circuit 31S-JA38 (BK/RD).

ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to W6.

W6 CHECK FOR ADDITIONAL DTCs

1 Refer to the continuous DTCs recorded during Step W1.

● **Were any continuous DTCs retrieved during Step W1?**

→ **Yes**

Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.

→ **No**
 RECONNECT the system.
 REACTIVATE the system. PROVE OUT
 the system. REFER to [Air Bag and
 Safety Belt Pretensioner Supplemental
 Restraint System \(SRS\)](#). CLEAR all
 DTCs.

Pinpoint Test X: LFC 36/DTC B1995 — Driver Seat Side Air Bag Circuit Resistance Low

Normal Operation



The restraints control module (RCM) monitors the resistance of the driver seat side air bag circuit loop and the air bag module igniter at RCM C310b pin 2 and 3. If the resistance is less than 0.7 ohms, the RCM will store diagnostic trouble code (DTC) B1995 and flash lamp fault code (LFC) 36.

Possible Causes

A low resistance on the driver seat side air bag circuit can be caused by:

- damaged wiring on circuit 30S-JA37 (RD/GN).
- damaged wiring on circuit 31S-JA37 (BK/GN).
- damaged driver seat side air bag module.
- RCM is faulted.
- damaged electrical connector shorting bar.
- damaged electrical connector camming beam.


PINPOINT TEST X: LFC 36/DTC B1995 — DRIVER SEAT SIDE AIR BAG CIRCUIT RESISTANCE LOW

CONDITIONS	DETAILS/RESULTS/ACTIONS
X1 CHECK FOR A HARD OR INTERMITTENT DTC	
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 20px;"> <div style="border: 1px solid black; padding: 5px; width: 100px; text-align: center;">1</div>  <p>Retrieve/Clear Continuous DTCs</p> </div> <div> <div style="border: 1px solid black; padding: 5px; width: 100px; text-align: center;">2</div>  <p>On-Demand Self-Test</p> </div> </div>	<div style="margin-bottom: 20px;"> <div style="border: 1px solid black; padding: 5px; width: 100px; text-align: center;">1</div> <p>Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> </div> <ul style="list-style-type: none"> ● Was DTC B1995 retrieved during the on-demand self test? <p>→ Yes This is a hard fault. The fault condition is</p>

still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to X2.

→ **No**
This is an intermittent fault. The fault condition is not present at this time. GO to X4.

X2 CHECK THE DRIVER SIDE AIR BAG MODULE

 **WARNING:** If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

● Was DTC B1995 retrieved?

→ **Yes**
GO to X3.

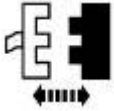
→ **No**
INSTALL a new driver seat side air bag module. GO to X5.

X3 CHECK THE DRIVER SIDE AIR BAG MODULE CIRCUIT TO THE SEAT HARNESS

1

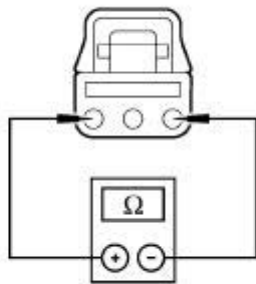


2



Driver Seat Side Air Bag Module Restraint System Diagnostic Tool

3



DR1050-A

3

Measure the resistance between driver seat side air bag C367, circuit 30S-JA37 (RD/GN), harness side and driver seat side air bag C367, circuit 31S-JA37 (BK/GN), harness side.

- Is the resistance greater than 10,000 ohms?

→ Yes

INSTALL a new RCM. GO to X5.

→ No

REPAIR the circuit(s) as necessary. GO to X5.

X4 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

- 2 Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● **Was DTC B1995 retrieved during the on-demand self test?**

→ **Yes**

CHECK for causes of intermittent fault at or near the driver seat air bag module connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to [X5](#).

If an intermittent concern **was not** found, GO to [X3](#).

→ **No**

CHECK for causes of intermittent high resistance on circuits 30S-JA37 (RD/GN) and 31S-JA37 (BK/GN). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to [X5](#).

X5 CHECK FOR ADDITIONAL DTCs

- 1 Refer to the continuous DTCs recorded during Step X1.

● **Was the continuous DTC retrieved during Step X1?**

→ **Yes**

Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.

→ **No**

RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to [Air Bag and](#)

Pinpoint Test Y: LFC 37/DTC B1999 — Passenger Seat Side Air Bag Circuit Resistance Low

Normal Operation



The restraints control module (RCM) monitors the resistance of the passenger seat side air bag circuit loop and the air bag module igniter at RCM C310b pins 5 and 6. If the resistance is less than 0.7 ohms, the RCM will store diagnostic trouble code (DTC) B1999 and flash lamp fault code (LFC) 37.

Possible Causes

A low resistance on the passenger seat side air bag circuit can be caused by:


- damaged wiring on circuit 30S-JA38 (RD/BK).
- damaged wiring on circuit 31S-JA38 (BK/RD).
- damaged passenger seat side air bag module.
- RCM is faulted.
- damaged electrical connector shorting bar.
- damaged electrical connector camming beam.

PINPOINT TEST Y: LFC 37/DTC B1999 — PASSENGER SIDE AIR BAG CIRCUIT RESISTANCE LOW

CONDITIONS	DETAILS/RESULTS/ACTIONS
Y1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1  Retrieve/Clear Continuous DTCs</p> <p>2  On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1999 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>Y2</u>.</p>

→ **No**
This is an intermittent fault. The fault condition is not present at this time. GO to Y4.

Y2 CHECK THE PASSENGER SIDE AIR BAG MODULE

 **WARNING:** If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

● **Was DTC B1999 Retrieved?**

→ **Yes**
GO to Y3.

→ **No**
INSTALL a new passenger seat side air bag module. GO to Y5.

Y3 CHECK THE PASSENGER SIDE AIR BAG MODULE CIRCUIT

1

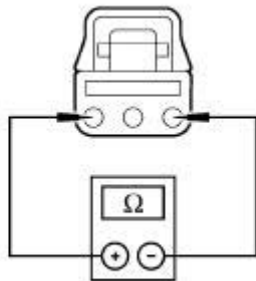


2



Passenger Side Air Bag Module Restraint System Diagnostic Tool

3



DR1050-A

3

Measure the resistance between passenger seat side air bag C337, circuit 30S-JA38 (RD/BK), harness side and circuit 31S-JA38 (BK/RD), harness side.

- Is the resistance greater than 10,000 ohms?

→ Yes

INSTALL a new RCM. GO to Y5.

→ No

REPAIR the circuit(s) as necessary. GO to Y5.

Y4 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



2

Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner

3



On-Demand Self Test

Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

- **Was DTC B1999 retrieved during the on-demand self test?**

→ **Yes**

CHECK for causes of intermittent fault at or near the passenger seat air bag module connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to Y5.

If an intermittent concern **was not** found, GO to Y3.

→ **No**

CHECK for causes of intermittent high resistance on circuits 30S-JA38 (RD/BK) and 31S-JA38 (BK/RD). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the key frequently. REPAIR any intermittent concern found. GO to Y5.

Y5 CHECK FOR ADDITIONAL DTCs

1 Refer to the continuous DTCs recorded during Step Y1.

- **Were any continuous DTCs retrieved during Step Y1?**

→ **Yes**

Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.

→ **No**

RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS). CLEAR all DTCs.

Normal Operation



The restraints control module (RCM) monitors the resistance of the circuit to the driver safety belt retractor pretensioner. When the RCM detects a resistance that is out of the expected range (high or low) it will set lamp fault code (LFC) 46 and diagnostic test code (DTC) B1885 or B1877.

Possible Causes

An out of range resistance on the driver safety belt retractor pretensioner circuit can be caused by:

- out of range resistance on circuit 30S-JA33 (RD/BU).
- out of range resistance on circuit 31S-JA33 (BK/BU).
- out of range resistance on the driver safety belt retractor pretensioner.
- RCM is faulted.

PINPOINT TEST Z: LFC 46/DTC B1885/B1877 — DRIVER SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT RESISTANCE HIGH OR LOW

CONDITIONS	DETAILS/RESULTS/ACTIONS
Z1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1 </p> <p>Retrieve/Clear Continuous DTCs</p> <p>2 </p> <p>On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1877 or B1885 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>Z2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>Z4</u>.</p>
Z2 CHECK THE DRIVER SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT	
1	



PID/Data Monitor and Record

2 Select PID D_PRTNR.

● Is the resistance greater than 3.2 or less than 1.7 ohms?

→ Yes
GO to Z3.

→ No
INSTALL a new RCM. GO to Z5.

Z3 CHECK THE DRIVER SAFETY BELT RETRACTOR PRETENSIONER



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



2 Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

3



PID/Data Monitor and Record

3 Select PID D_PRTNR.


● Is the resistance greater than 3.2 or less than 1.7 ohms?

→ Yes
REPAIR the resistance concern on circuit 30S-JA33 (RD/BU) or 31S-JA33

(BK/BU). GO to Z5.

→ **No**
INSTALL a new driver safety belt retractor pretensioner. GO to Z5.

Z4 CHECK FOR AN INTERMITTENT FAULT

 **WARNING:** If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



2

Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

3



On-Demand Self Test

- Was DTC B1877 or B1885 retrieved during the on-demand self test?

→ **Yes**

CHECK for causes of intermittent fault at or near the driver safety belt retractor pretensioner connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to Z5.

If an intermittent concern **was not** found, GO to Z2.

→ **No**

CHECK for causes of intermittent high resistance on circuits 30S-JA33 (RD/BU) and circuit 31S-JA33 (BK/BU). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to Z5.

Z5 CHECK FOR ADDITIONAL DTCs

	<p>1 Refer to the continuous DTCs recorded during Step Z1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step Z1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>
--	---

Pinpoint Test AA: LFC 47/DTC B1881/B1886 — Passenger Safety Belt Retractor Pretensioner Circuit Resistance High or Low

Normal Operation


The restraints control module (RCM) monitors the resistance of the circuit to the passenger safety belt retractor pretensioner. When the RCM detects a resistance that is out of the expected range (high or low) it will set lamp fault code (LFC) 47 and diagnostic test code (DTC) B1881 or B1886.

Possible Causes

An out of range resistance on the passenger safety belt retractor pretensioner circuit can be caused by:

- out of range resistance on circuit 30S-JA34 (RD/BK).
- out of range resistance on circuit 31S-JA34 (BK/RD).
- out of range resistance on the passenger safety belt retractor pretensioner.
- RCM is faulted.

PINPOINT TEST AA: LFC 47/DTC B1881/B1886 — PASSENGER SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT RESISTANCE HIGH OR LOW

CONDITIONS	DETAILS/RESULTS/ACTIONS
AA1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1</p>  <p>Retrieve/Clear Continuous DTCs</p> <p>2</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p>



On-Demand Self Test

- Was DTC B1881 or B1886 retrieved during the on-demand self test?

→ **Yes**

This is a hard fault. This fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to [AA2](#).

→ **No**

This is an intermittent fault. The fault condition is not present at this time. GO to [AA4](#).

AA2 CHECK THE PASSENGER PRETENSIONER CIRCUIT

1



PID/Data Monitor and Record

2 Select PID P_PRTNR.

- Is the resistance greater than 3.2 or less than 1.7 ohms?

→ **Yes**

GO to [AA3](#).

→ **No**

INSTALL a new RCM. GO to [AA5](#).

AA3 CHECK THE PASSENGER PRETENSIONER



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



PID/Data Monitor and Record

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

3 Select PID P_PRTNR

● Is the resistance greater than 3.2 or less than 1.7 ohms?

→ Yes

REPAIR the resistance concern on circuit 30S-JA34 (RD/BK) or 31S-JA34 (BK/RD). GO to AA5.

→ No

INSTALL a new passenger pretensioner. GO to AA5.

AA4 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

On-Demand Self Test	<ul style="list-style-type: none"> ● Was DTC B1881 or B1886 retrieved during the on-demand self test? <p>→ Yes CHECK for causes of intermittent fault at or near the passenger safety belt retractor pretensioner electrical connector. REPAIR any intermittent concerns found.</p> <p>If an intermittent concern was found and repaired, GO to <u>AA5</u>.</p> <p>If an intermittent concern was not found, GO to <u>AA2</u>.</p> <p>→ No CHECK for causes of intermittent high resistance on circuits 30S-JA34 (RD/BK) and circuit 31S-JA34 (BK/RD). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to <u>AA5</u>.</p>
AA5 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step AA1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step AA1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test AB: LFC 17/DTC B1878 — Driver Safety Belt Retractor Pretensioner Circuit Shorted to Battery or Ignition

Normal Operation




The restraints control module (RCM) monitors the circuit to the driver safety belt retractor pretensioner. When the RCM detects a circuit short to battery or ignition it will set lamp fault code (LFC) 17 and diagnostic test code (DTC) B1878.

Possible Causes

A short to battery or ignition on the driver safety belt retractor pretensioner circuit can be caused by:

- a short to battery or ignition on circuit 30S-JA33 (RD/BU).
- a short to battery or ignition on circuit 31S-JA33 (BK/BU).
- a short to battery or ignition on the driver safety belt retractor pretensioner.
- RCM is faulted.

PINPOINT TEST AB: LFC 17/DTC B1878 — DRIVER SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT SHORTED TO BATTERY OR IGNITION

CONDITIONS	DETAILS/RESULTS/ACTIONS
AB1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1  Retrieve/Clear Continuous DTCs</p> <p>2  On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1878 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to AB2.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to AB4.</p>
AB2 CHECK THE DRIVER PRETENSIONER	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.</p> <p>The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p> <p>NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.</p> <p>NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.</p> <p>NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.</p>	
1	



3



On-Demand Self Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

• Was DTC B1878 retrieved?

→ Yes
GO to AB3.

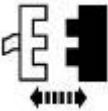
→ No
INSTALL a new driver belt pretensioner.
GO to AB5.

AB3 CHECK THE DRIVER PRETENSIONER CIRCUITS

1

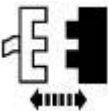


2



Driver Safety Belt Pretensioner Restraint System Diagnostic Tool

3



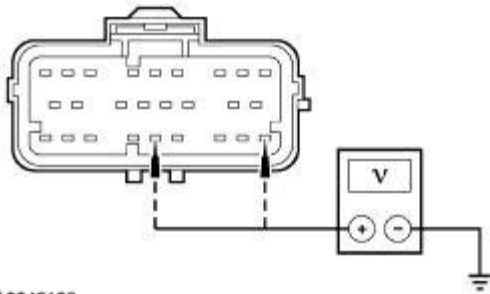
RCM C310a

4



5

5 Measure the voltage between the RCM C310a pin 18, circuits 30S-JA33 (RD/BU), harness side and ground; and between the RCM C310a pin 22, circuit 31S-JA33 (BK/BU), harness side and ground.



A0042188

- Are the voltages less than 0.2 volt?

→ **Yes**
INSTALL a new RCM. GO to [AB5](#).

→ **No**
REPAIR the affected circuit. GO to [AB5](#).

AB4 CHECK FOR AN INTERMITTENT FAULT

⚠ WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

	<ul style="list-style-type: none"> ● Was DTC B1878 retrieved during the on-demand self test? <p>→ Yes CHECK for causes of intermittent fault at or near the driver safety belt retractor pretensioner electrical connector. REPAIR any intermittent concerns found.</p> <p>If an intermittent concern was found and repaired, GO to <u>AB5</u>.</p> <p>If an intermittent concern was not found, GO to <u>AB3</u>.</p> <p>→ No CHECK for causes of intermittent high resistance on circuits 30S-JA33 (RD/BK) and circuit 31S-JA33 (BK/RD). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to <u>AB5</u>.</p>
AB5 CHECK FOR ADDITIONAL DTCs	
	<p>1 Refer to the continuous DTCs recorded during Step AB1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step AB1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test AC: LFC 17/DTC B1879 — Driver Safety Belt Retractor Pretensioner Circuit Shorted to Ground

Normal Operation




The restraints control module (RCM) monitors the circuit to the driver safety belt retractor pretensioner. When the RCM detects a circuit short to ground it will set lamp fault code (LFC) 17 and diagnostic test code (DTC) B1879.

Possible Causes

A short to ground on the driver safety belt retractor pretensioner circuit can be caused by:

- a short to ground on circuit 30S-JA33 (RD/BU).
- a short to ground on circuit 31S-JA33 (BK/BU).
- a short to ground on the driver safety belt retractor pretensioner.
- RCM is faulted.

PINPOINT TEST AC: LFC 17/DTC B1879 — DRIVER PRETENSIONER CIRCUIT SHORTED TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
AC1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1</p>  <p>Retrieve/Clear Continuous DTCs</p> <p>2</p>  <p>On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1879 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>AC2</u>.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to <u>AC4</u>.</p>
AC2 CHECK THE DRIVER PRETENSIONER	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u> in this section.</p> <p>The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the</p>	

road.

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

● Was DTC B1879 retrieved?

→ **Yes**
GO to [AC3](#).

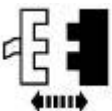
→ **No**
INSTALL a new driver belt pretensioner.
GO to [AC5](#).

AC3 CHECK THE DRIVER PRETENSOR CIRCUITS

1

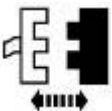


2



Driver Safety Belt Pretensioner Restraint System Diagnostic Tool

3

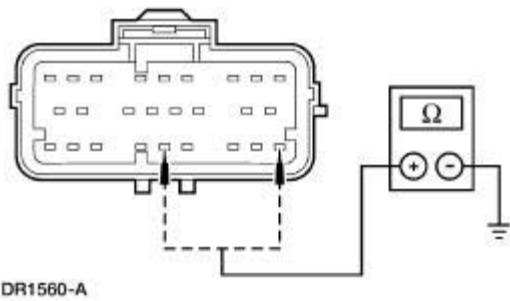


RCM C310a

4

4

Measure the resistance to ground at RCM C310a pin 18, circuit 30S-JA33 (RD/BU) and pin 22, circuit 31S-JA33 (BK/BU).



DR1560-A

- Is the resistance less than 10,000 ohms at either pin?

→ **Yes**
REPAIR the short to ground. GO to AC5.

→ **No**
INSTALL a new RCM. GO to AC5.

AC4 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



2

Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

<p>On-Demand Self Test</p>	<p>● Was DTC B1879 retrieved during the on-demand self test?</p> <p>→ Yes CHECK for causes of intermittent fault at or near the driver safety belt retractor pretensioner electrical connector. REPAIR any intermittent concerns found.</p> <p>If an intermittent concern was found and repaired, GO to <u>AC5</u>.</p> <p>If an intermittent concern was not found, GO to <u>AC3</u>.</p> <p>→ No CHECK for causes of intermittent short to ground on circuit 30S-JA33 (RD/BU) and circuit 31S-JA33 (BK/BU). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to <u>AC5</u>.</p>
<p>AC5 CHECK FOR ADDITIONAL DTCs</p>	
	<p>1 Refer to the continuous DTCs recorded during Step AC1.</p> <p>● Were any continuous DTCs retrieved during Step AC1?</p> <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test AD: LFC 18/DTC B1882 — Passenger Safety Belt Retractor Pretensioner Circuit Shorted to Battery or Ignition

Normal Operation




The restraints control module (RCM) monitors the circuit to the passenger safety belt retractor pretensioner. When the RCM detects a circuit short to battery or ignition it will set lamp fault code (LFC) 18 and diagnostic test code (DTC) 1882.

Possible Causes

A short to battery or ignition on the passenger safety belt retractor pretensioner circuit can be caused by:

- a short to battery or ignition on circuit 30S-JA34 (RD/BK).
- a short to battery or ignition on circuit 31S-JA34 (BK/RD).
- a short to battery or ignition on the passenger safety belt retractor pretensioner.
- RCM is faulted.

PINPOINT TEST AD: LFC 18/DTC B1882 — PASSENGER SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT SHORTED TO BATTERY OR IGNITION



CONDITIONS	DETAILS/RESULTS/ACTIONS
AD1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1  Retrieve/Clear Continuous DTCs</p> <p>2  On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1882 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to AD2.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to AD4.</p>
AD2 CHECK THE PASSENGER PRETENSIONER	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.</p> <p>The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.</p>	

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**


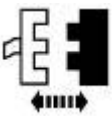
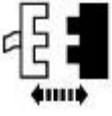
NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

<p>1</p>  <p>3</p>  <p>On-Demand Self Test</p>	<p>2</p> <p>Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.</p> <p>● Was DTC B1882 retrieved?</p> <p>→ Yes GO to AD3.</p> <p>→ No INSTALL a new passenger belt pretensioner. GO to AD5.</p>
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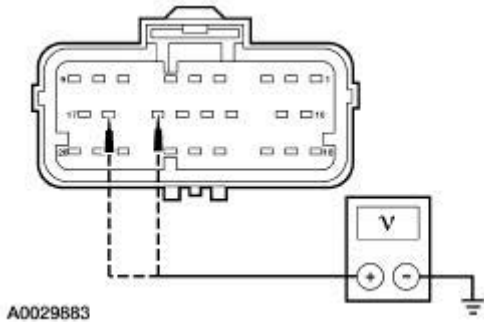
AD3 CHECK THE PASSENGER PRETENSIONER CIRCUITS

<p>1</p>  <p>2</p>  <p>Passenger Safety Belt Pretensioner Restraint System Diagnostic Tool</p> <p>3</p>  <p>RCM C310a</p>	
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4



5



5

Measure the voltage between the RCM C310a pin 15, circuit 30S-JA34 (RD/BK), harness side and ground; and between the RCM C310a pin 16, and 31S-JA34 (BK/RD), harness side and ground.

● **Is the voltage less than 0.2 volt?**

→ **Yes**
INSTALL a new RCM. GO to [AD5](#).

→ **No**
REPAIR the short to battery. GO to [AD5](#).

AD4 CHECK FOR AN INTERMITTENT FAULT

1

Refer to the continuous DTCs recorded during Step AD1.

● **Was the continuous DTC retrieved during Step AD1 an intermittent fault?**

→ **Yes**
CHECK for causes of intermittent fault at or near the passenger safety belt retractor pretensioner electrical connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to [AD5](#).

If an intermittent concern **was not** found, GO to [AD3](#).

→ **No**
CHECK for causes of intermittent short to battery or ignition on circuit 30S-JA34 (RD/BK) and circuit 31S-JA34 (BK/RD). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to [AD5](#).

AD5 CHECK FOR ADDITIONAL DTCs

	<p>1 Refer to the continuous DTCs recorded during Step AD1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step AD1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>
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Pinpoint Test AE: LFC 18/DTC B1883 — Passenger Safety Belt Retractor Pretensioner Circuit Shorted to Ground

Normal Operation


The restraints control module (RCM) monitors the circuit to the passenger safety belt retractor pretensioner. When the RCM detects a circuit short to ground it will set lamp fault code (LFC) 18 and diagnostic test code (DTC) B1883.

Possible Causes

A short to ground on the passenger safety belt retractor pretensioner circuit can be caused by:

- a short to ground on circuit 30S-JA34 (RD/BK).
- a short to ground on circuit 31S-JA34 (BK/RD).
- a short to ground on the passenger safety belt retractor pretensioner.
- RCM is faulted.

PINPOINT TEST AE: LFC 18/DTC B1883 — PASSENGER SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT SHORTED TO GROUND

CONDITIONS	DETAILS/RESULTS/ACTIONS
AE1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1</p>  <p>Retrieve/Clear Continuous DTCs</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p>

2



On-Demand Self Test

- Was DTC B1883 retrieved during the on-demand self test?

→ Yes

This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to [AE2](#).

→ No

This is an intermittent fault. The fault condition is not present at this time. GO to [AE4](#).

AE2 CHECK THE PASSENGER PRETENSIONER



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

3



On-Demand Self Test

● Was DTC B1883 retrieved?

→ **Yes**
GO to [AE3](#).

→ **No**
INSTALL a new passenger belt pretensioner. GO to [AE5](#).

AE3 CHECK THE PASSENGER PRETENSIONER CIRCUITS

1



2



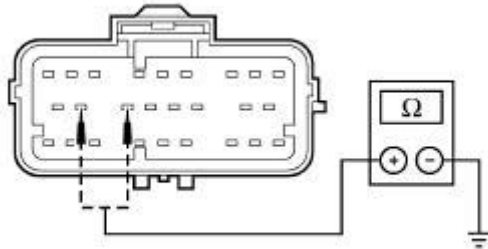
Passenger Safety Belt Pretensioner Restraint System Diagnostic Tool

3



RCM C310a

4



DR1562-A

4 Measure the resistance to ground at RCM C310a pin 15, circuit 30S-JA34 (RD/BK) and pin 16, circuit 31S-JA34 (BK/RD).

● Is the resistance less than 10,000 ohms at either pin?

→ **Yes**
REPAIR the short to ground. GO to [AE5](#).

→ **No**
INSTALL a new RCM. GO to [AE5](#).

AE4 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1 Refer to the continuous DTCs recorded during Step AE1.

● **Was DTC B1883 retrieved during the on-demand self test?**

→ **Yes**

CHECK for causes of intermittent fault at or near the passenger safety belt retractor pretensioner connector. REPAIR any intermittent concerns found.

If an intermittent concern **was** found and repaired, GO to [AE5](#).

If an intermittent concern **was not** found, GO to [AE3](#).

→ **No**

CHECK for causes of intermittent short to ground on circuit 30S-JA34 (RD/BK) and circuit 31S-JA34 (BK/RD).

ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to [AE5](#).

AE5 CHECK FOR ADDITIONAL DTCs

1 Refer to the continuous DTCs recorded during Step AE1.

● **Were any continuous DTCs retrieved during Step AE1?**

→ **Yes**

Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.

→ **No**
 RECONNECT the system.
 REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS). CLEAR all DTCs.

Pinpoint Test AF: B1892 — Air Bag Tone Warning Indicator Circuit Shorted to Ground or Open

Normal Operation



The restraints control module (RCM) monitors its connection to the instrument cluster at C310a at pin 26. This connection is used to signal a chime if the air bag indicator is inoperative and another SRS fault exists. If the RCM detects a short to ground or open on the connection to the instrument cluster, it will store a diagnostic trouble code (DTC) B1892 in memory.

Possible Causes

An air bag tone warning indicator circuit short to ground or open can be caused by:


- a short to ground or open on circuit 8-JA13 (WH/BK).
- a damaged or inoperative instrument cluster.
- RCM is faulted.

PINPOINT TEST AF: DTC B1892 — AIR BAG TONE WARNING INDICATOR CIRCUIT SHORTED TO GROUND OR OPEN

CONDITIONS	DETAILS/RESULTS/ACTIONS
AF1 CHECK FOR A HARD OR INTERMITTENT DTC	
<p>1  Retrieve/Clear Continuous DTCs</p> <p>2  On-Demand Self Test</p>	<p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> <p>● Was DTC B1892 retrieved during the on-demand self test?</p> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to <u>AF2</u>.</p>

→ **No**
This is an intermittent fault. The fault condition is not present at this time. GO to AF5.

AF2 CHECK THE AIR BAG TONE WARNING INDICATOR CIRCUIT

 **WARNING:** If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

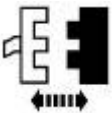
NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1

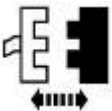


3



RCM C310a

4

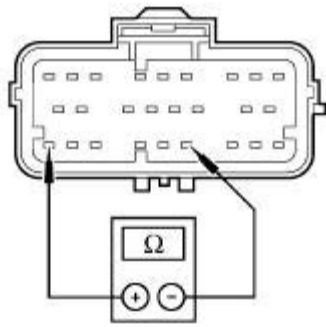


Instrument Cluster C220B

5

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

5 Measure the resistance between RCM C310a pin 26, circuit 8-JA13 (WH/BK), harness side and RCM C310a pin 21, circuit 31-JA10A (BK/RD), harness side.



DR1013-A

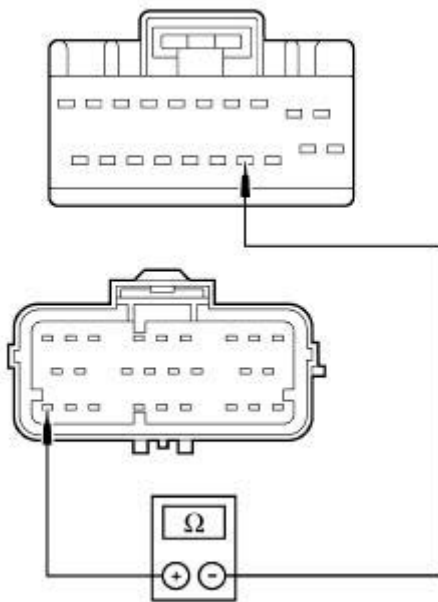
- Is the resistance less than 10,000 ohms?

→ **Yes**
REPAIR the circuit. GO to AF6.

→ **No**
GO to AF3.

AF3 CHECK THE AIR BAG TONE WARNING INDICATOR MODULE CIRCUIT

1



A0003425

1

Measure the resistance between RCM C310a pin 26, circuit 8-JA13 (WH/BK), harness side and instrument cluster C220B pin 14, circuit 8-JA13 (WH/BK), harness side.

- Is the resistance greater than 100 ohms?

→ **Yes**
REPAIR the circuit. GO to AF6.

→ **No**
GO to AF4.

AF4 CHECK THE AIR BAG TONE WARNING INDICATOR

1

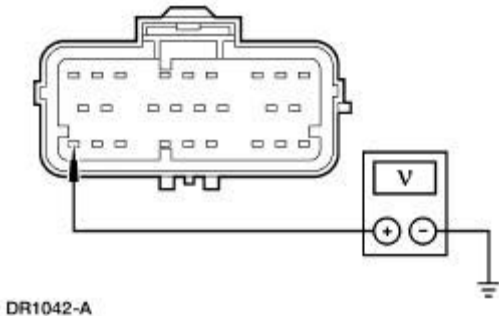


Instrument Cluster C220B

2



3



3

Measure the voltage between RCM C310a pin 26, circuit 8-JA13 (WH/BK), harness side and ground.

● Is the voltage less than 1.0 volt?

→ **Yes**
REPAIR the instrument cluster. GO to AF6.

→ **No**
INSTALL a new RCM. GO to AF6.

AF5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

● **Was DTC B1892 retrieved during the on-demand self test?**

→ **Yes**
GO to AF2.

→ **No**
CHECK for causes of intermittent short to ground or open on circuit 8-JA13 (WH/BK). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to AF6.

AF6 CHECK FOR ADDITIONAL DTCs

1 Refer to the continuous DTCs recorded during Step AF1.

● **Were any continuous DTCs retrieved during Step AF1?**

→ **Yes**
Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.

→ **No**
RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS). CLEAR all DTCs.

Pinpoint Test AG DTC B1891 — Air Bag Tone Warning Indicator Circuit Shorted to Battery or Ignition

Normal Operation




The restraints control module (RCM) monitors its connection to the instrument cluster at pin 26. This connection is used to signal a chime if the air bag indicator is inoperative and another SRS fault exists. If the RCM detects a short to battery or ignition on the connection to the instrument cluster, it will store a diagnostic trouble code (DTC) B1891 in memory.

Possible Causes

An air bag tone warning indicator circuit short to battery or ignition can be caused by:

- a short to battery or ignition on circuit 8-JA13 (WH/BK).
- a damaged or inoperative instrument cluster.
- RCM is faulted.

PINPOINT TEST AG: DTC B1891 — AIR BAG TONE WARNING INDICATOR CIRCUIT SHORTED TO BATTERY OR IGNITION

CONDITIONS	DETAILS/RESULTS/ACTIONS
AG1 CHECK FOR A HARD OR INTERMITTENT DTC	
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 20px;"> <div style="border: 1px solid black; padding: 2px; width: 20px; text-align: center; margin-bottom: 5px;">1</div>  <p>Retrieve/Clear Continuous DTCs</p> </div> <div> <div style="border: 1px solid black; padding: 2px; width: 20px; text-align: center; margin-bottom: 5px;">2</div>  <p>On-Demand Self Test</p> </div> </div>	<div style="margin-bottom: 20px;"> <div style="border: 1px solid black; padding: 2px; width: 20px; text-align: center; margin-bottom: 5px;">1</div> <p>Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> </div> <ul style="list-style-type: none"> ● Was DTC B1891 retrieved during the on-demand self test? <div style="margin-top: 10px;"> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to AG2.</p> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to AG4.</p> </div>
AG2 CHECK THE AIR BAG TONE WARNING INDICATOR CIRCUIT	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.</p> <p>The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision,</p>	

resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

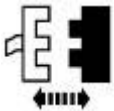
NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1

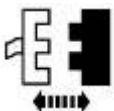


3



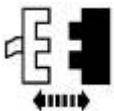
Battery Ground Cable

4



RCM C310a

5



Instrument Cluster C220B

6



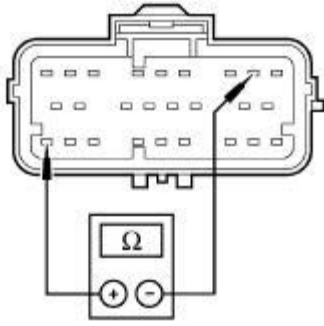
7

2

Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

7

Measure the resistance between RCM C310a pin 26, circuit 8-JA13 (WH/BK), harness side and RCM C310a pin 2, circuit 20-JA10A, harness side.



DR1015-A

- Is the resistance less than 10,000 ohms?

→ **Yes**
REPAIR the circuit. GO to AG5.

→ **No**
GO to AG3.

AG3 CHECK THE AIR BAG TONE WARNING INDICATOR

1



2



Battery Ground Cable

3

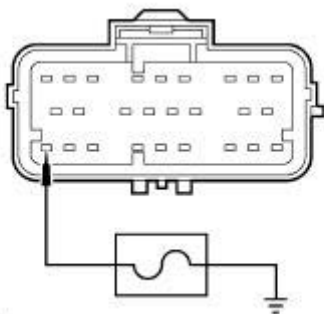


Instrument Cluster C220B

4



5




DR1043-A

5 Jumper RCM C310a pin 26, circuit 8-JA13 (WH/BK), harness side to ground.

- Does the instrument cluster

	<p style="text-align: center;">generate a tone?</p> <p>→ Yes INSTALL a new RCM. GO to AG5.</p> <p>→ No REPAIR the instrument cluster. GO to AG5.</p>
--	---

AG4 CHECK FOR AN INTERMITTENT FAULT

 **WARNING:** If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.


The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

<p>1</p> 	<p>2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.</p> <ul style="list-style-type: none"> ● Was DTC B1891 retrieved during the on-demand self test? <p>→ Yes GO to AG2.</p> <p>→ No CHECK for causes of intermittent short to ground or open on circuit 8-JA13 (WH/BK). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to AG5.</p>
---	--

AG5 CHECK FOR ADDITIONAL DTCs

	<p>1 Refer to the continuous DTCs recorded</p>
--	---

	<p>during Step AG1.</p> <ul style="list-style-type: none"> ● Were any continuous DTCs retrieved during Step AG1? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>
--	---

Pinpoint Test AH: DTC B1869 — Air Bag Indicator Inoperative

Normal Operation

The air bag indicator is designed to illuminate for 6 (+/-2) seconds when the ignition switch is turned to the RUN position. This initial 6 seconds of illumination is considered normal operation and is called prove out of the air bag indicator. The air bag indicator is then used to warn the driver that there is a fault in the air bag supplemental restraint system (SRS).

The restraints control module (RCM) monitors the air bag indicator for open and short to ground conditions. If the RCM detects an open or short to ground condition on the air bag indicator circuit, it will store a diagnostic trouble code (DTC) B1869 in memory.

If the RCM detects an air bag indicator failure in addition to another SRS failure, the RCM will send a signal to the air bag tone warning indicator to produce five sets of five tone bursts.

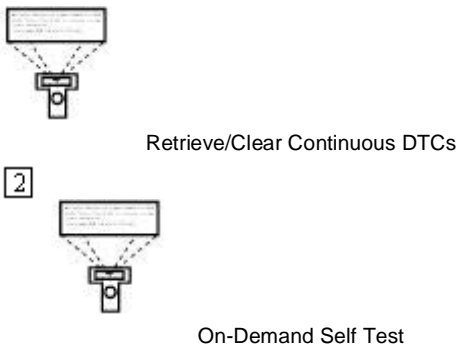
Possible Causes

An air bag indicator inoperative condition can be caused by:

- damaged wiring on circuit 31S-JA14.
- a damaged or burned out air bag indicator.
- an instrument cluster malfunction.
- RCM is faulted.

PINPOINT TEST AH: DTC B1869 — AIR BAG INDICATOR INOPERATIVE

CONDITIONS	DETAILS/RESULTS/ACTIONS
AH1 CHECK FOR A HARD OR INTERMITTENT DTC	
1	1 Retrieve and record any continuous



DTCs for use later in this pinpoint test.

- Was DTC B1869 retrieved during the on-demand self test?

→ **Yes**

This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to [AH2](#).

→ **No**

This is an intermittent fault. The fault condition is not present at this time. GO to [AH5](#).

AH2 CHECK THE RCM



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



2

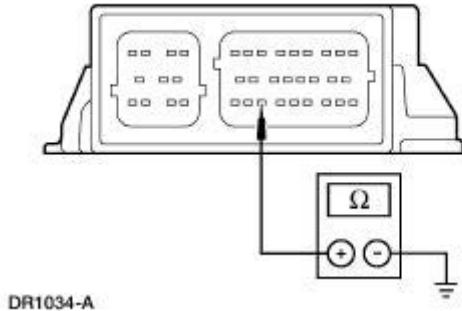
Deactivate the system. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

3



RCM C310a

4



4

Measure the resistance between the RCM C310a, pin 20, component side, and a known good chassis ground.

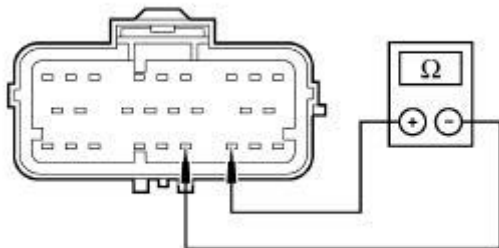
● Is the resistance less than 100 ohms?

→ Yes
INSTALL a new RCM. GO to AH6.

→ No
GO to AH3.

AH3 CHECK CIRCUIT 31S-JA14 FOR A SHORT TO GROUND

1



DR1217-A

1

Measure the resistance between RCM C310a pin 20, circuit 31S-JA14, harness side and RCM C310a pin 21, circuit 31-JA10 (BK/RD), harness side.

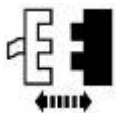
● Is the resistance less than 100 ohms?

→ Yes
REPAIR the circuit. GO to AH6.

→ No
GO to AH4.

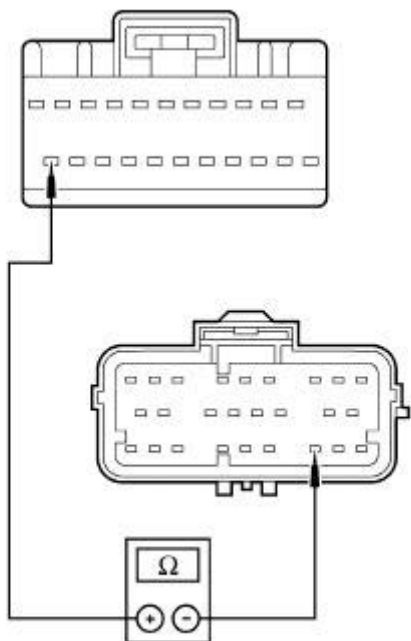
AH4 CHECK CIRCUIT 31S-JA14 (BK/GN) FOR AN OPEN

1



Instrument Cluster C220A

2



A0003426

2

Measure the resistance between RCM C310a pin 20, circuit 31S-JA14, harness side and instrument cluster C220A pin 22, circuit 31S-JA14, harness side.

- Is the resistance greater than 10 ohms?

→ **Yes**
REPAIR the circuit. GO to [AH6](#).

→ **No**
REPAIR the instrument cluster. REFER to [Section 413-01](#). GO to [AH6](#).

AH5 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



3



On-Demand Self-Test

2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

● **Was DTC B1869 retrieved during the on-demand self test?**

→ **Yes**
GO to AH2 .

→ **No**
CHECK for causes of intermittent short to ground or open on circuit 31S-JA14. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to AH6 .

AH6 CHECK FOR ADDITIONAL DTCs

1 Refer to the continuous DTCs recorded during Step AH1.

● **Were any continuous DTCs retrieved during Step AH1?**

→ **Yes**
Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.

→ **No**
RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) . CLEAR all DTCs.

Pinpoint Test AI: DTC B1870 — Air Bag Indicator Shorted to Battery

Normal Operation

The air bag indicator is designed to illuminate for 6 seconds when the ignition switch is turned to the

RUN position. This is considered normal operation and is called SRS prove out . The air bag indicator is used to warn the driver that there is a fault in the (SRS).

The restraints control module (RCM) monitors the air bag indicator for short to battery conditions. If the RCM detects a short to battery condition on the air bag indicator circuit, it will store a diagnostic trouble code (DTC) B1870 in memory.




If the RCM detects an air bag indicator failure in addition to another SRS failure, the RCM will send a signal to the air bag tone warning indicator to produce five sets of five tone bursts.

Possible Causes

An air bag indicator short to battery condition can be caused by:

- damaged wiring on circuit 31S-JA14.
- an instrument cluster concern.
- RCM is faulted.

PINPOINT TEST AI: DTC B1870 — AIR BAG INDICATOR SHORTED TO BATTERY

CONDITIONS	DETAILS/RESULTS/ACTIONS
AI1 CHECK FOR A HARD OR INTERMITTENT DTC	
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 20px;"> <div style="border: 1px solid black; width: 60px; height: 20px; margin-bottom: 5px;"></div>  <p>Retrieve/Clear Continuous DTCs</p> </div> <div> <div style="border: 1px solid black; width: 60px; height: 20px; margin-bottom: 5px;"></div>  <p>On-Demand Self Test</p> </div> </div>	<div style="margin-bottom: 20px;"> <p>1 Retrieve and record any continuous DTCs for use later in this pinpoint test.</p> </div> <div style="margin-bottom: 20px;"> <ul style="list-style-type: none"> ● Was DTC B1870 retrieved during the on-demand self test? </div> <div style="margin-bottom: 20px;"> <p>→ Yes This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to AI2.</p> </div> <div> <p>→ No This is an intermittent fault. The fault condition is not present at this time. GO to AI3.</p> </div>
AI2 CHECK THE AIR BAG INDICATOR CIRCUIT	
<p> WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.</p>	

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1



2

Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

3



RCM C310a

4



● Is the air bag indicator illuminated?

→ **Yes**
INSTALL a new RCM. GO to AI4.

→ **No**
CHECK the air bag indicator. REFER to Section 413-01. If the air bag indicator is OK, REPAIR the circuit. GO to AI4.

AI3 CHECK FOR AN INTERMITTENT FAULT



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.


NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The**

restraint system diagnostic tools must be removed prior to operating the vehicle over the road.

NOTE: After diagnosing or repairing an SRS, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: After diagnosing or repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

<p>1</p> 	<p>2</p> <p>Deactivate the system. Refer to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u> in the Diagnosis and Testing portion of this section.</p> <ul style="list-style-type: none">● Was DTC B1870 retrieved during the on-demand self test? <p>→ Yes GO to <u>A12</u>.</p> <p>→ No CHECK for causes of intermittent short to battery on circuit 31S-JA14. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. REPAIR any intermittent concerns found. GO to <u>A14</u>.</p>
<p>A14 CHECK FOR ADDITIONAL DTCs</p>	
	<p>1</p> <p>Refer to the continuous DTCs recorded during Step A11.</p> <ul style="list-style-type: none">● Were any continuous DTCs retrieved during Step A11? <p>→ Yes Do not clear any DTCs until all DTCs have been resolved. GO to the Restraints Control Module (RCM) Diagnostic Trouble Code (DTC) Priority Table in this section for pinpoint test direction.</p> <p>→ No RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>. CLEAR all DTCs.</p>

Pinpoint Test AJ: No Communication with the Restraints Control Module (RCM)

Normal Operation


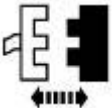
The RCM communicates with the scan tool using ISO 9141 communication mode through the data link connector (DLC).

Possible Causes

A no communication condition can be caused by:

- damage to circuit 4-EE1 (GY).
- DLC connection open.
- scan tool inoperative.
- RCM is faulted.

PINPOINT TEST AJ: NO COMMUNICATION WITH THE RESTRAINTS CONTROL MODULE (RCM)

CONDITIONS	DETAILS/RESULTS/ACTIONS
AJ1 CHECK THE RCM CONNECTOR C310a AND CONNECTOR PIN 5 FOR DAMAGE	
<p>NOTE: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.</p> <p>NOTE: Restraint system diagnostic tools MUST be installed under the seats in the side airbag and safety belt retractor pretensioner electrical connectors.</p> <p>NOTE: Diagnostics or repairs are not to be performed on a side airbag system or safety belt retractor pretensioner with the seat in the vehicle. Prior to attempting to diagnose/repair the side airbag system or safety belt retractor pretensioner the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the side airbag and the safety belt retractor pretensioner electrical connectors. The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.</p> <p>NOTE: Diagnostics may be performed on seat systems other than the side airbag or the safety belt retractor pretensioner such as (lumbar, climate controlled, heated, power seat track) with the seat installed in the vehicle as long as the SRS system is deactivated and the restraint system diagnostic tools are installed under the seats in the side airbag and safety belt retractor pretensioner electrical connectors.</p> <p>NOTE: After diagnosing/repairing a seat system, the restraint system diagnostic tools must be removed before operating the vehicle over the road.</p>	
<p>1</p>  <p>3</p>  <p>RCM C310a</p>	<p>2 Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.</p> <p>4 Inspect RCM C310a and RCM C310a pin 5 for damage.</p> <ul style="list-style-type: none"> ● Are RCM C310a and RCM C310a pin 5 OK?

→ **Yes**
GO to AJ2.

→ **No**
REPAIR RCM C310a or RCM C310a pin 5 as necessary. RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS).

AJ2 CHECK THE DLC CONNECTOR C251 AND CONNECTOR PIN 7 FOR DAMAGE

1 Inspect DLC C251 and DLC C251 pin 7 for damage.

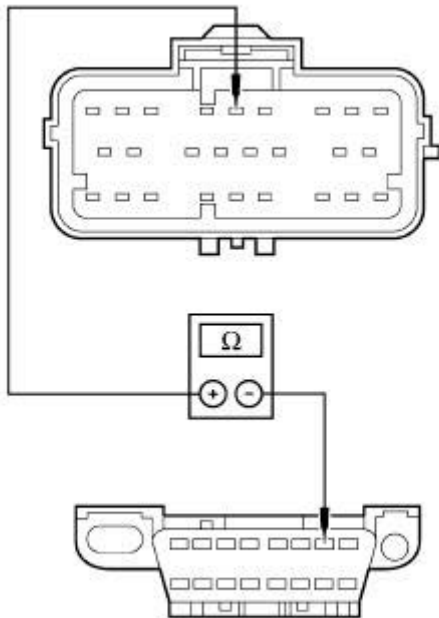
- **Are DLC C251 and DLC C251 pin 7 OK?**

→ **Yes**
GO to AJ3.

→ **No**
REPAIR DLC C251 or DLC C251 pin 7 as necessary. RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS).

AJ3 CHECK CIRCUIT 4-EE1 (GY) FOR AN OPEN

1



DR1019-A

1 Measure the resistance between RCM C310a pin 5, circuit 4-EE1 (GY), harness side and DLC C251 pin 7, circuit 4-EE1 (GY), harness side.

- **Is the resistance less than 5 ohms?**

	<p>→ Yes INSTALL a new RCM. RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>.</p> <p>→ No REPAIR the circuit. RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to <u>Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)</u>.</p>
--	---

Pinpoint Test AK: LFC 5 Hz — RCM in Plant Mode

Normal Operation

A new restraints control module (RCM) is programmed to flash a special code. The code is 5 Hz and is used during vehicle assembly. The code indicates that both (driver and passenger) side air bags are not installed correctly. The code will normally occur when both (and only both) of the following conditions are met:

- a new RCM is installed.
- both side air bags are not correctly installed.

Possible Causes

A 5 Hz LFC can be caused by:

- both front seats not installed.
- both side air bags not correctly installed.
- RCM is faulted.

PINPOINT TEST AK: PINPOINT TEST AG: LFC 5 HZ — RCM IN PLANT MODE

CONDITIONS	DETAILS/RESULTS/ACTIONS
AK1 CHECK THE LAMP FAULT CODE (LFC)	<p>1 Observe the flashing air bag indicator.</p> <p>● Is the air bag indicator flashing rapidly with no pauses?</p> <p>→ Yes GO to <u>AK2</u>.</p> <p>→ No REFER to the Restraints Control Module (RCM) Diagnostic Trouble</p>

Code (DTC) Priority Table for the indicated LFC.

AK2 CHECK FRONT SEAT INSTALLATION

- 1 Check that both front seats are installed.
 - **Are both front seats correctly installed?**
- **Yes**
GO to AK3.
- **No**
INSTALL the front seats. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS).

AK3 CHECK SIDE AIR BAG INSTALLATION

- 1 Check that both side air bags are correctly installed and connected.
 - **Are both side air bags correctly installed and connected?**
- **Yes**
GO to AK4.
- **No**
Correctly INSTALL and CONNECT both side air bags. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS).

AK4 CHECK BOTH SIDE AIR BAG LOOP RESISTANCES



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

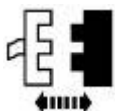
NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1

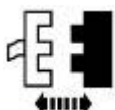


3



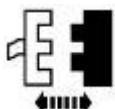
Battery Ground Cable

4



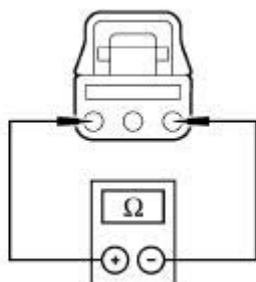
Driver and Passenger Side Air Bag Module Restraint System Diagnostic Tools

5



RCM C310b

6



DR1050-A

2

Deactivate the system. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in the Diagnosis and Testing portion of this section.

6

NOTE: By disconnecting RCM C310b each driver and passenger seat side air bag loop circuit will be shorted through a shorting bar. Do not remove the shorting bar.

Measure the resistances through C367 circuits 30S-JA37 (RD/GN) and 31S-JA37 (BK/GN) and through C337 circuits 30S-JA38 (RD/BK) and 31S-JA38 (BK/RD).

● **Is the resistance more than 1.0 ohm for both measurements?**

→ **Yes**


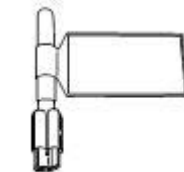
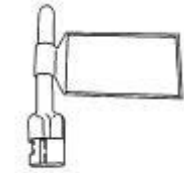
REPAIR the circuits. RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS).

→ **No**


INSTALL a new RCM. RECONNECT the system. REACTIVATE the system. PROVE OUT the system. REFER to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS).


Supplemental Restraint System (SRS) Deactivation and Reactivation

Special Tool(s)


 ST2502-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F395 (014-R1079)
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Deactivation


 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

 **WARNING:** The safety belt buckle pretensioner and safety belt retractor pretensioner are pyrotechnic devices. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.



WARNING: Vehicle sensor orientation is critical for proper system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Replace and properly position the sensor or any other damaged supplemental restraint system (SRS) components whether or not the air bag is deployed.



WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.

NOTE: If a seat equipped with a seat mounted side air bag and/or a safety belt pretensioner (if equipped) system is being serviced, **the air bag system must be deactivated.**

NOTE: Restraint system diagnostic tools **MUST** be installed under the seats in the seat side air bag (if equipped) and safety belt pretensioner (if equipped) to floor connectors.

NOTE: Diagnostics or repairs are not to be performed on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.



- WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

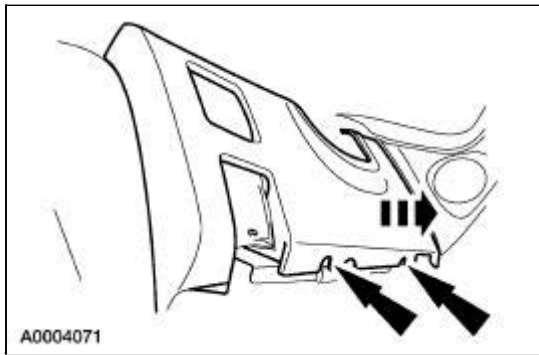
Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

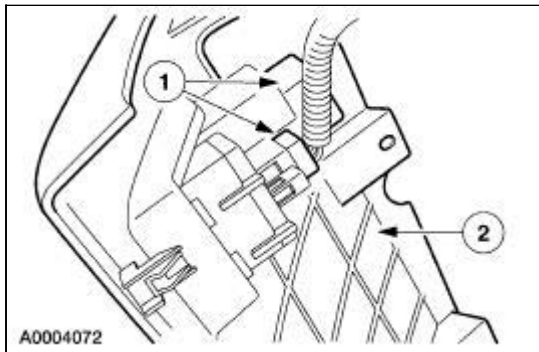
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).

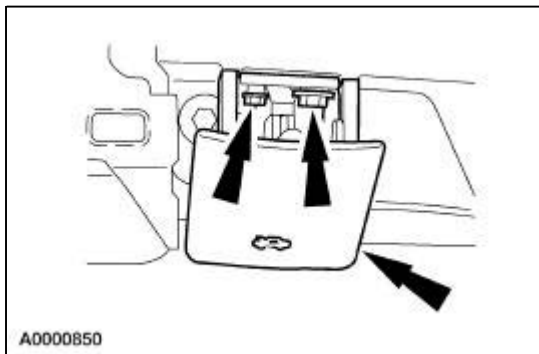
- Remove the two screws and pull out on the lower steering column opening finish panel enough to access the electrical connectors.



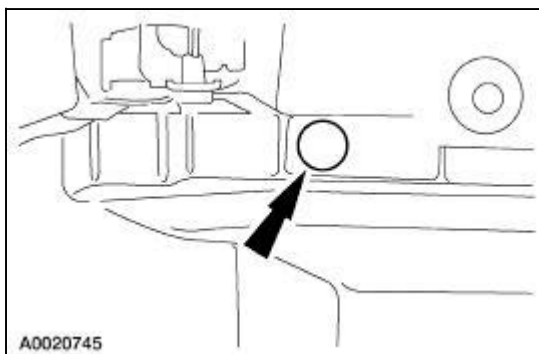
3. Remove the lower steering column opening finish panel.
 1. Disconnect the electrical connectors.
 2. Remove the lower steering column opening finish panel.



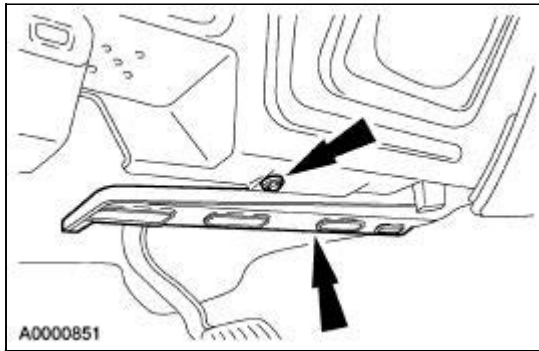
4. Remove the screws. Separate the hood latch release cable and handle assembly from the steering column opening reinforcement.



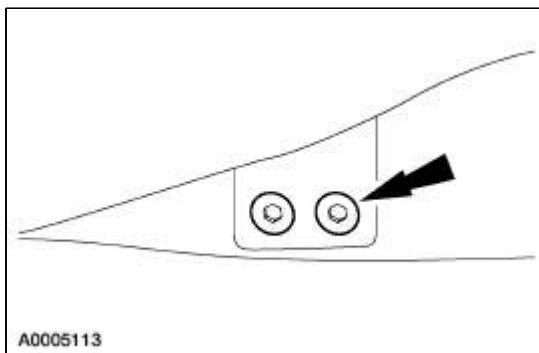
5. Remove the two pin-type retainers and the RH instrument panel insulator.
 - Disconnect the courtesy lamp.



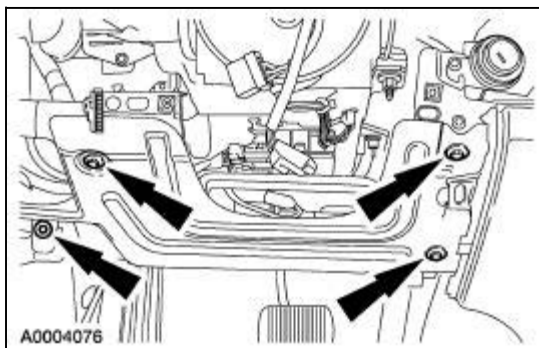
6. Remove the screw and the heater duct.



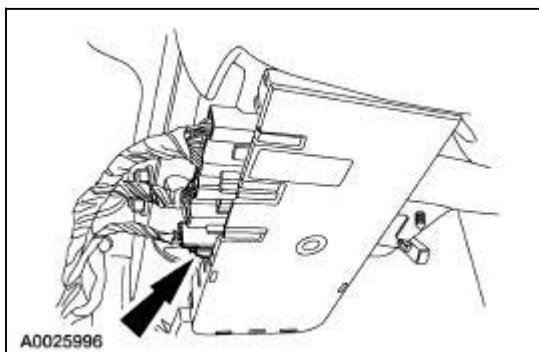
7. Loosen the two driver-side instrument panel tunnel brace bolts.
- Position the carpet aside to gain access to the bolts.



8. Remove the screws and the steering column opening reinforcement.

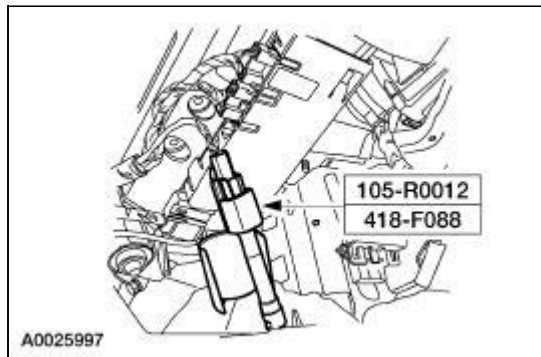


9. Disconnect the clockspring electrical connector at the base of the steering column.

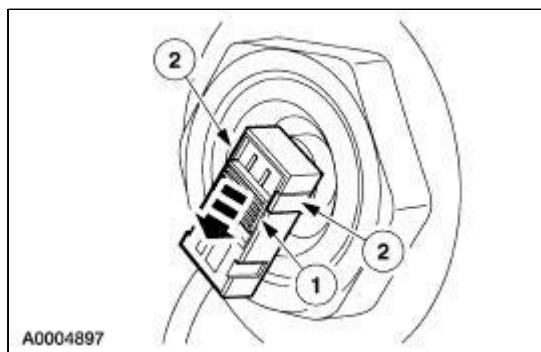


10. Attach the restraint system diagnostic tool to the vehicle harness side of the clockspring

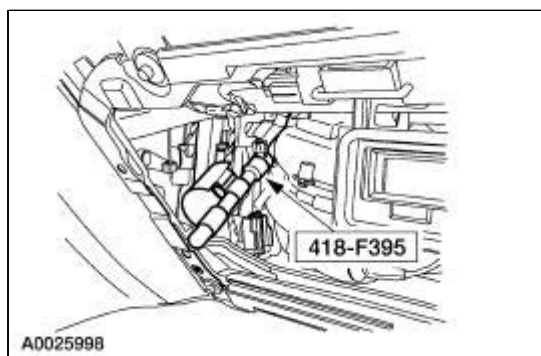
electrical connector.




11. Remove the glove compartment. For additional information, refer to [Section 501-12](#).
12. Disconnect the passenger air bag module electrical connector.
 1. Reaching into the glove box opening toward the center of the instrument panel, under the cross-car beam, slide and disengage the passenger air bag module electrical connector locking clip.
 2. Push in on the two release tabs and disconnect the passenger air bag module electrical connector.



13. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag electrical connector.



14. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
15. Move and tilt the front seats to their highest and most forward position.
16.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors,

instrument panel, console, door latches, strikers, seats and hood latches.

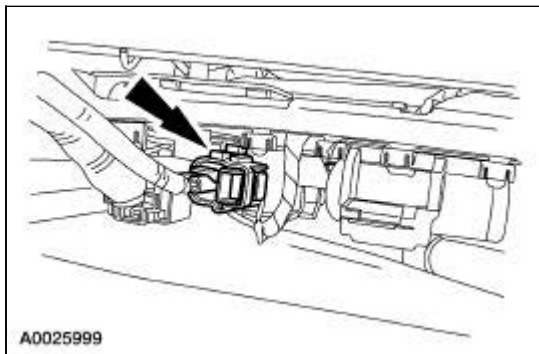
Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

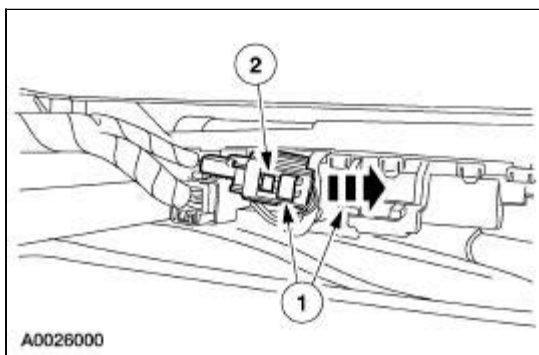
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).

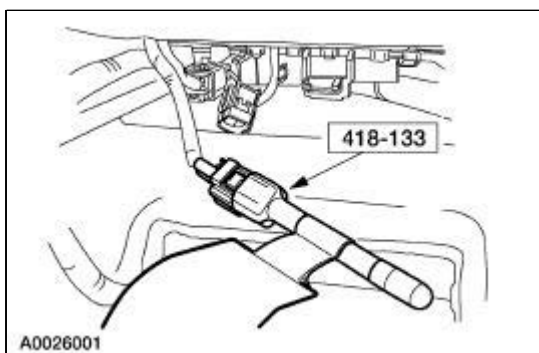
17. From under the passenger seat, release the tab on the connector bracket and remove the passenger seat side air bag electrical connector.



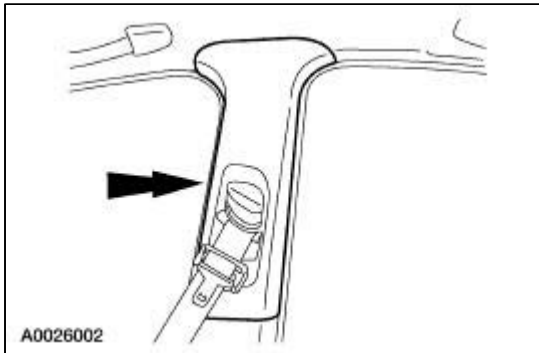
18. Disconnect the passenger seat side air bag electrical connector.
 1. Slide and disengage the passenger seat side air bag electrical connector locking clip.
 2. Push in to release the tab and disconnect the passenger seat side air bag electrical connector.



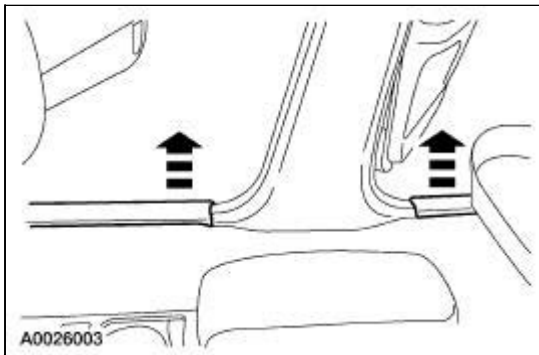
19. Attach the restraint system diagnostic tool to the passenger seat side air bag floor electrical connector.



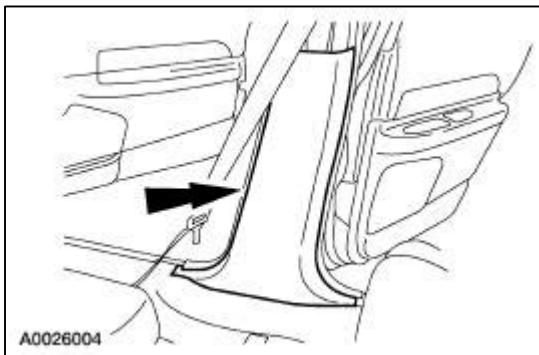
20. Remove the passenger side B-pillar weatherstripping.
21. Position the safety belt D-ring to its highest point.
22. Remove the passenger side B-pillar upper trim panel.



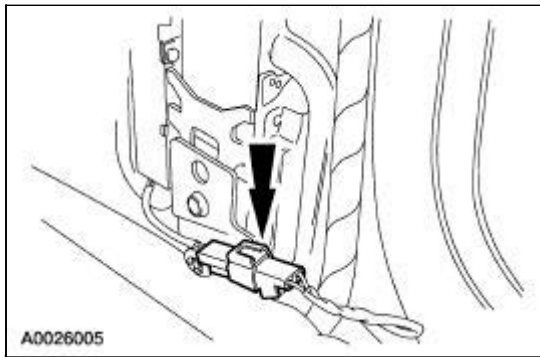
23. Remove the passenger side front and rear door scuff plates.



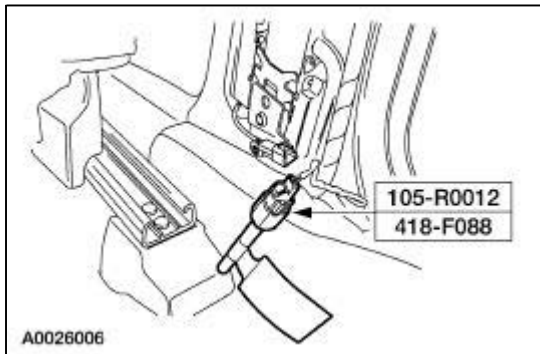
24. Remove the passenger side B-pillar lower trim panel.



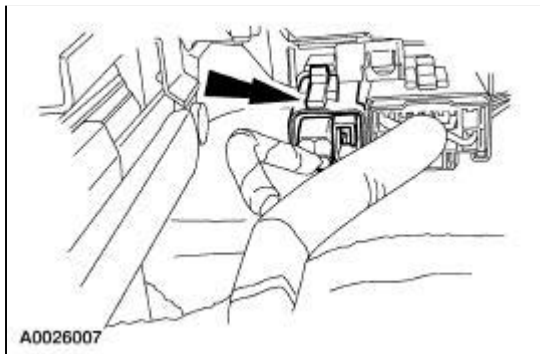
25. Disconnect the passenger side safety belt retractor pretensioner floor electrical connector.



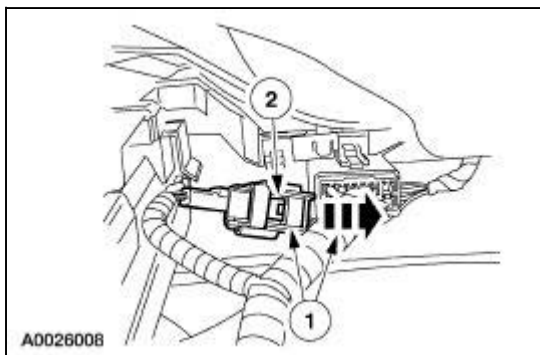
26. Attach the restraint system diagnostic tool to the passenger side safety belt retractor pretensioner floor electrical connector.



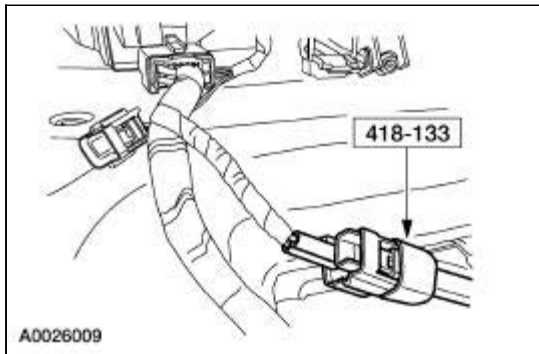
27. From under the driver seat, release the tab on the connector bracket and remove the driver seat side air bag electrical connector.



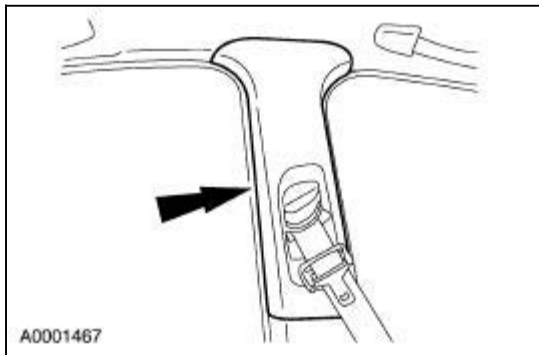
28. Disconnect the driver seat side air bag electrical connector.
1. Slide and disengage the driver seat side air bag electrical connector locking clip.
 2. Push down to release the tab and disconnect the driver seat side air bag electrical connector.



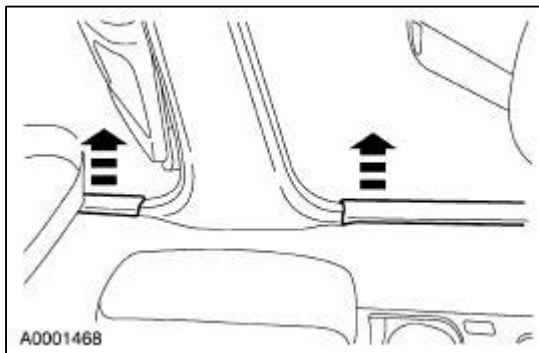
29. Attach the restraint system diagnostic tool to the driver seat side air bag floor electrical connector.



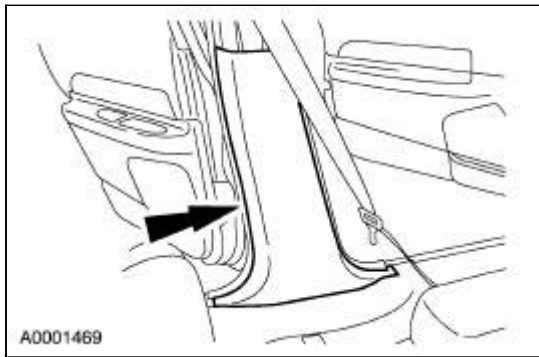
30. Remove the driver side B-pillar weatherstripping.
31. Position the safety belt D-ring to its highest point.
32. Remove the driver side B-pillar upper trim panel.



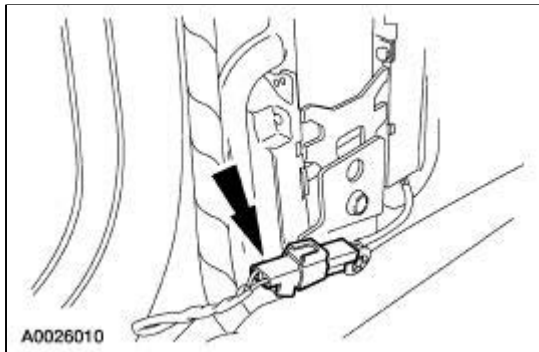
33. Remove the driver side front and rear door scuff plates.



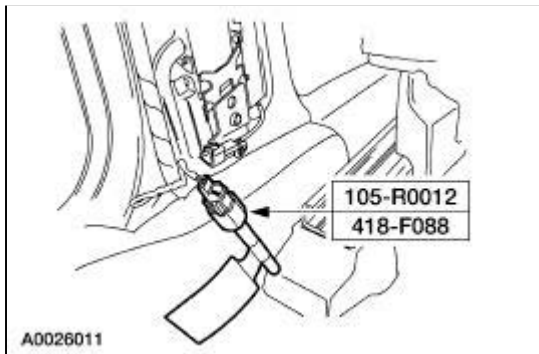
34. Remove the driver side B-pillar lower trim panel.



35. Disconnect the driver side safety belt retractor pretensioner electrical connector.



36. Attach the restraint system diagnostic tool to the driver side safety belt retractor pretensioner floor electrical connector.



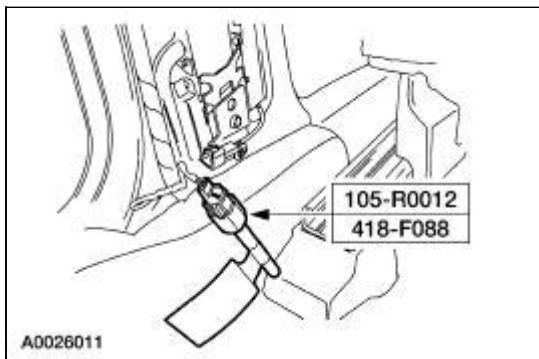
37. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
38. With the restraint system diagnostic tools installed at all deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.
39. Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).

Reactivation

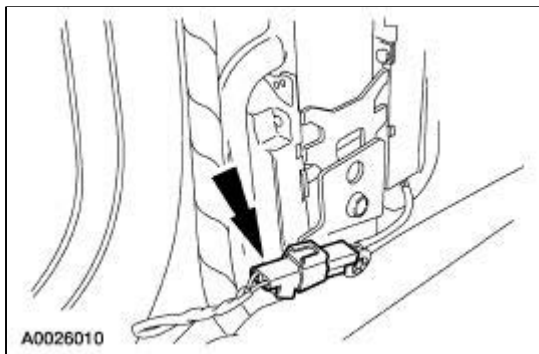


WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, and notes at the beginning of the deactivation procedure.

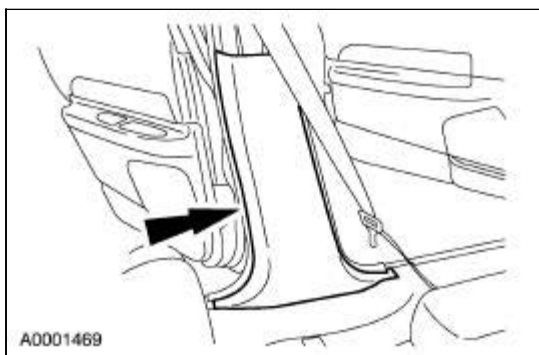
1. Remove the restraint system diagnostic tool from the driver side safety belt retractor pretensioner floor electrical connector.



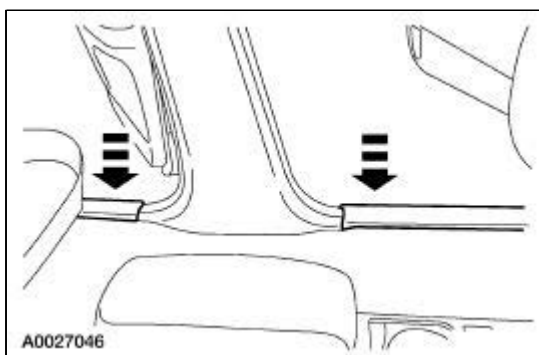
2. Connect the driver side safety belt retractor pretensioner electrical connector.



3. Install the driver side B-pillar lower trim panel.

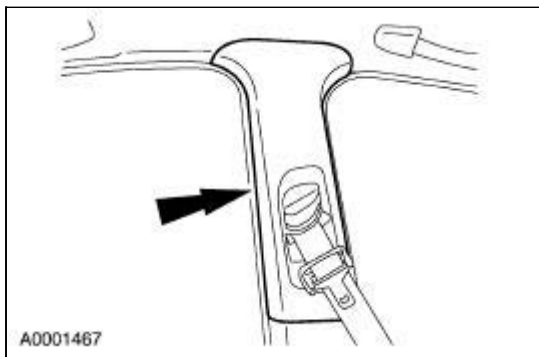


4. Install the driver side front and rear door scuff plates.

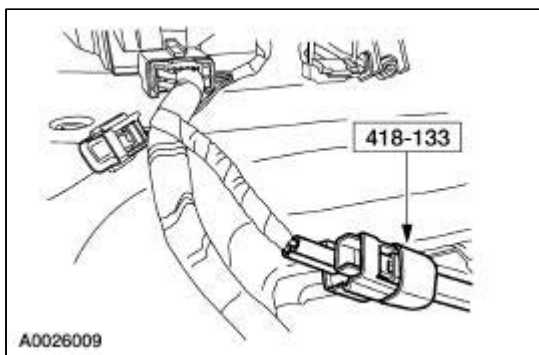


5. **NOTE:** Position the safety belt D-ring to its highest point.

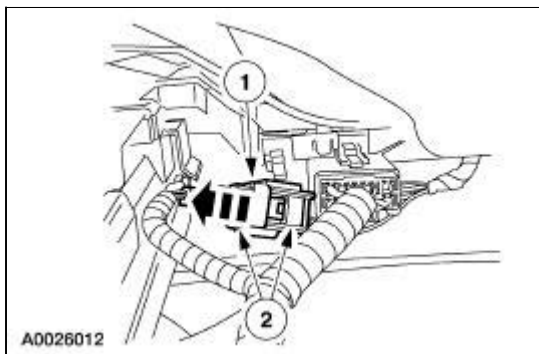
Install the driver side B-pillar upper trim panel.



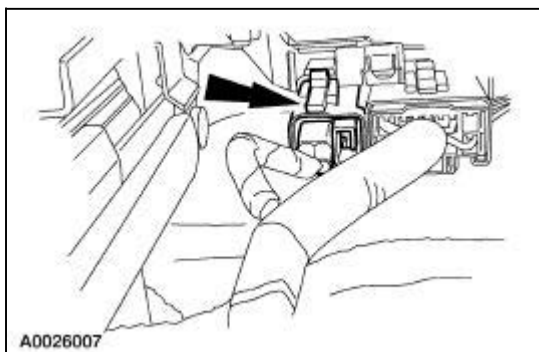
6. Install the driver side B-pillar weatherstripping.
7. Remove the restraint system diagnostic tool from the driver seat side air bag floor electrical connector.



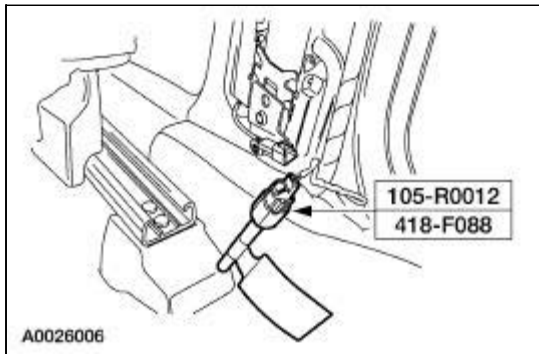
8. Connect the driver seat side air bag electrical connector.
 1. Connect the driver seat side air bag electrical connector.
 2. Slide and engage the driver seat side air bag electrical connector locking clip.



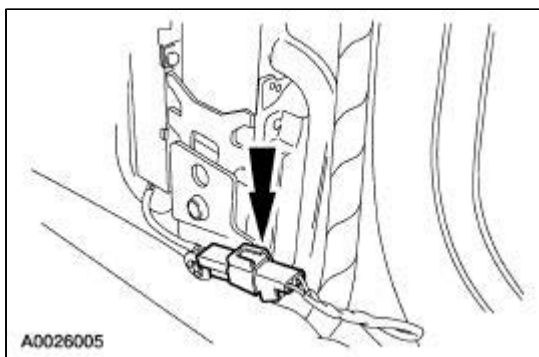
9. Install the driver seat side air bag electrical connector onto the connector bracket under the driver seat.



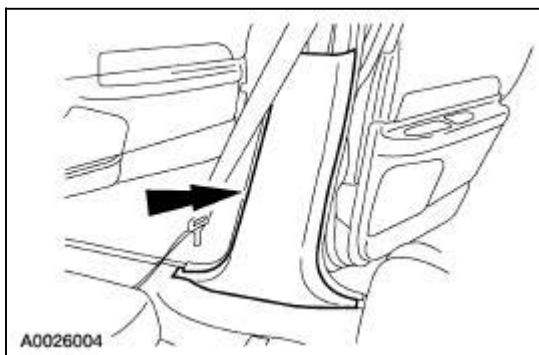
10. Remove the restraint system diagnostic tool from the passenger side safety belt retractor pretensioner electrical connector.



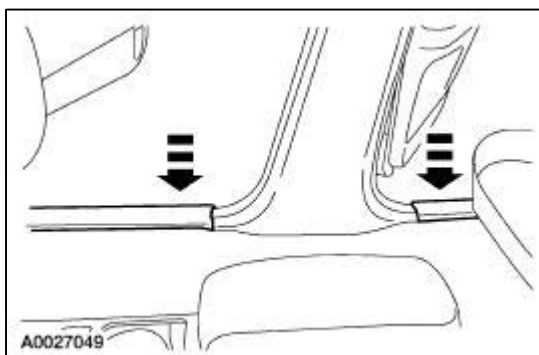
11. Connect the passenger side safety belt retractor pretensioner electrical connector.



12. Install the passenger side B-pillar lower trim panel.

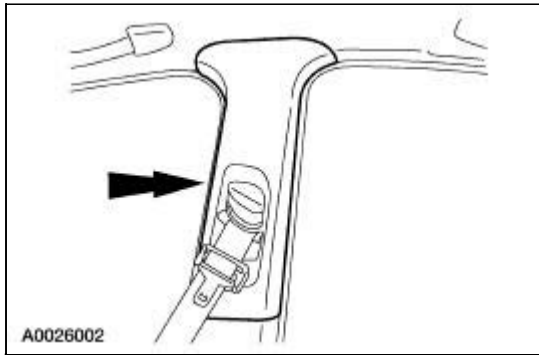


13. Install the passenger side front and rear door scuff plates.



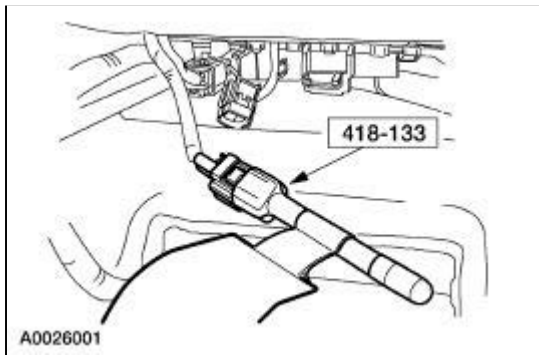
14. **NOTE:** Position the safety belt D-ring to its highest point.

Install the passenger side B-pillar upper trim panel.



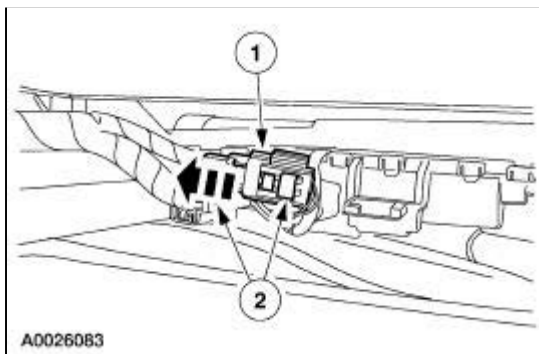
15. Install the passenger side B-pillar weatherstripping.

16. Remove the restraint system diagnostic tool from the passenger seat side air bag floor electrical connector.

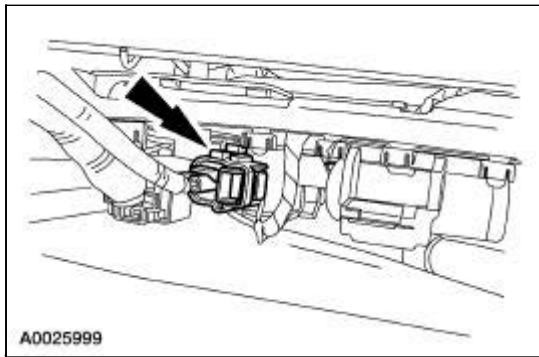


17. Connect the passenger seat side air bag electrical connector.

1. Connect the passenger seat side air bag electrical connector.
2. Slide and engage the passenger seat side air bag electrical connector locking clip.




18. Install the passenger seat side air bag electrical connector onto the connector bracket under the passenger seat.



19. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).

20. Position the front seats rearward.

21.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

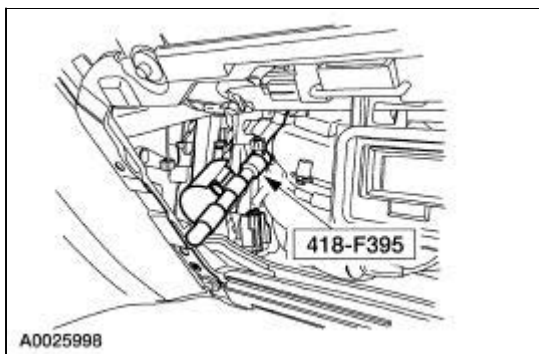
Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

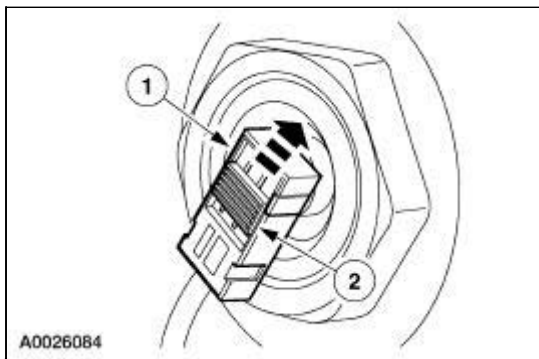
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).

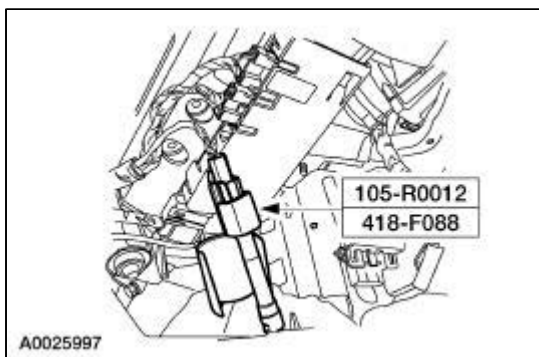
22. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag electrical connector.



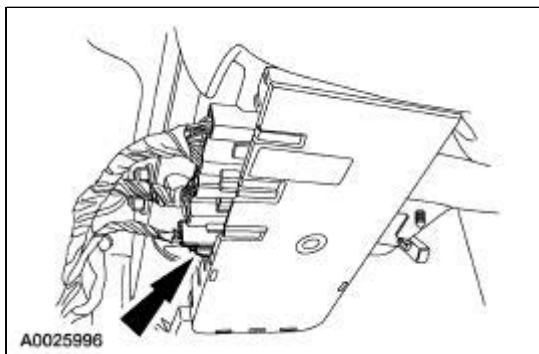
23. Connect the passenger air bag module electrical connector.
1. Reach into the glove box opening toward the center of the instrument panel, under the cross-car beam and connect the passenger air bag module electrical connector.
 2. Slide and engage the passenger air bag module electrical connector locking clip.



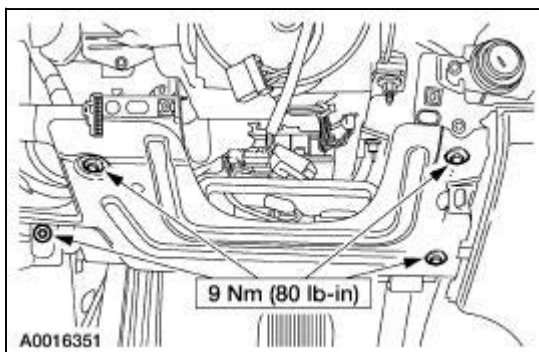
24. Install the glove compartment. For additional information, refer to [Section 501-12](#).
25. Remove the restraint system diagnostic tool from the vehicle harness side of the clockspring electrical connector.



26. Connect the clockspring electrical connector at the base of the steering column.



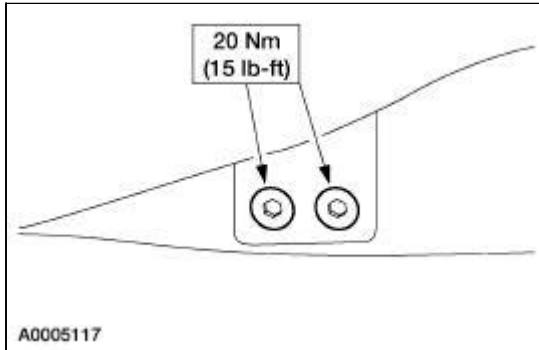
27. Position the steering column opening reinforcement and install the screws.



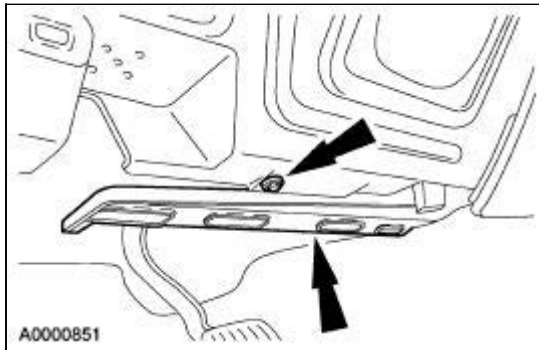
28.  **CAUTION: Be sure the steering column opening reinforcement is in place before tightening the driver-side instrument panel tunnel brace bolts.**

Tighten the two driver-side instrument panel tunnel brace bolts.

- Reposition the carpet.

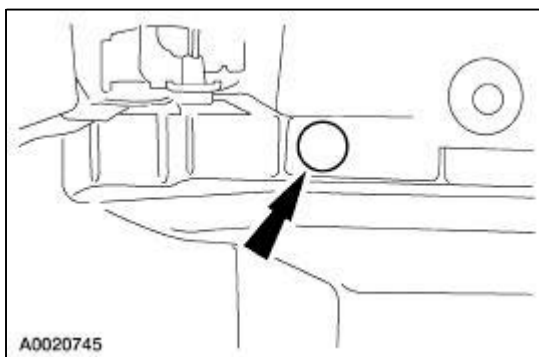


29. Position the heater duct and install the screw.

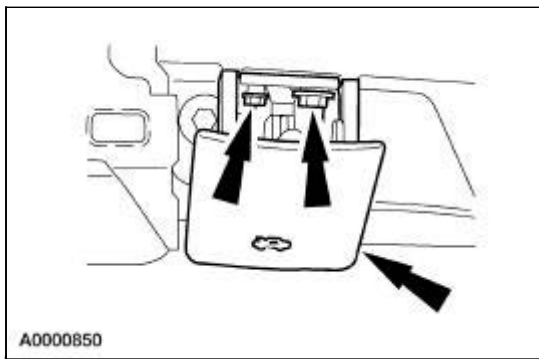


30. Install the RH instrument panel insulator and the two pin-type retainers.

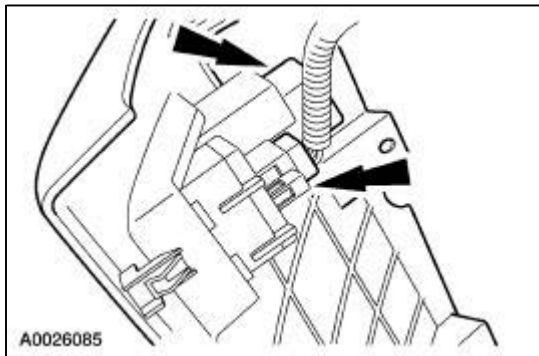
- Connect the courtesy lamp.



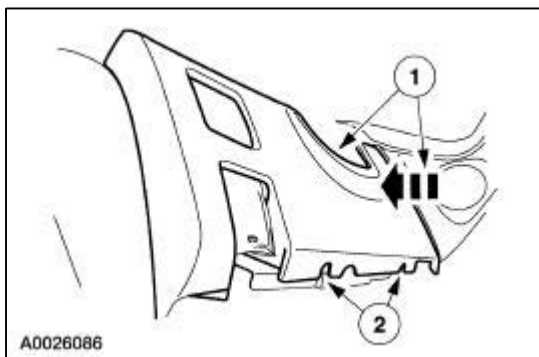
31. Position the hood latch release cable and handle assembly to the steering column opening reinforcement and install the screws.




32. Connect the electrical connectors to the switches in the lower steering column opening finish panel.



33. Install the lower steering column opening finish panel to the instrument panel.
1. Position the lower steering column opening finish panel to the instrument panel and push in, seating the retaining clips.
 2. Install the screws.



34. Connect the battery ground cable. For additional information, refer to [Section 414-01](#) .

35.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

36. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#) .

Inspection and Repair After a Supplemental Restraint System (SRS) Deployment



WARNING: If the supplemental restraint system (SRS) is being serviced, the system must be deactivated and restraint system diagnostic tools must be installed. For additional information, refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The air bag restraint system diagnostic tools must be removed and the air bag modules reconnected when the system is reactivated to avoid non-deployment in a collision, resulting in possible personal injury.

NOTE: Diagnostics or repairs are not to be carried out on a seat equipped with a seat side air bag with the seat in the vehicle. Prior to attempting to diagnose or repair a seat concern when equipped with a seat side air bag, the seat must be removed from the vehicle and the restraint system diagnostic tools must be installed in the seat side air bag electrical connectors. **The restraint system diagnostic tools must be removed prior to operating the vehicle over the road.**

NOTE: After diagnosing or repairing an SRS, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**


NOTE: After diagnosing or repairing a seat system, **the restraint system diagnostic tools must be removed before operating the vehicle over the road.**

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. When any deployable device (driver air bag, passenger air bag, seat side air bag, safety belt pretensioner, etc.) or combination of devices are deployed and/or the RCM has the DTC B1231 (Crash Data Memory Full) in memory, the repair of the vehicle's supplemental restraint system (SRS) is to include the removal of all deployed devices and the installation of new deployable devices, the removal and installation of new impact sensors, and the removal and installation of a new RCM.
2. When any damage to the impact sensor mounting points or mounting hardware has occurred, repair or install new mounting points and mounting hardware as needed.
3. When the driver air bag module has deployed a new clockspring must be installed.
4. Inspect the entire vehicle for damage, including the following components:
 - steering column.
 - instrument panel knee bolsters and mounting points.
 - instrument panel braces and brackets.
 - instrument panel and mounting points.
 - seats and seat mounting points.
 - safety belts, safety belt buckles, and safety belt retractors. For additional information, refer to Section 501-20A.
 - supplemental restraint system (SRS) wiring, wiring harnesses, and connectors.
5. After carrying out the review and inspection of the entire vehicle for damage, repair or install


new components as needed.

Air Bag Disposal —Deployed


1.  **WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.**

Dispose of the deployed air bag modules and safety belt pretensioners in the same manner as any other part to be scrapped.

Air Bag Disposal —Undeployed Inoperative

 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

 **WARNING:** Carry a live air bag module with the air bag and trim cover or deployment door pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

NOTE: All inoperative air bag modules and safety belt pretensioners have been placed on the Mandatory Return List. All discolored or damaged air bag modules must be treated the same as any inoperative live air bag being returned.

1. Remove the inoperative component from the vehicle. For additional information, refer to the appropriate air bag procedure in this section.

AIR BAG MODULE VERIFICATION


VEHICLE SERIAL NO.

This 17 digit number can be found (1) on your vehicle registration (2) on the dash panel at left side close to lower edge of windshield.

ATTENTION INSTALLER

Please complete and mail this postcard with your New Air Bag Module Serial Number (see sample below) and the Vehicle Identification Number (VIN) of the vehicle in which you are installing this module.

LOOK FOR YOUR REPLACEMENT AIR BAG MODULE SERIAL NUMBER (SN) AT THE LOCATION SHOWN IN THIS SAMPLE AND ENTER IT IN THE SPACE PROVIDED BELOW



SAMPLE

REPLACEMENT AIR BAG MODULE SERIAL NO.


A0005406


2. **NOTE:** When installing a new air bag module, a prepaid return postcard is provided with the replacement air bag module. The serial number for the new part and the vehicle identification number (VIN) must be recorded and sent to Ford Motor Company.


If installing a new air bag module, record the necessary information and return the inoperative air bag module to Ford Motor Company.


Air Bag Disposal —Driver, Undeployed, Scrapped Vehicle

Remote Deployment

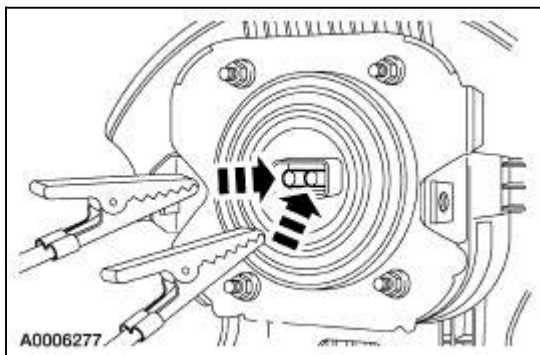
 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module or safety belt retractor/pretensioner assembly. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Carry a live air bag module with the air bag and trim cover or deployment door pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

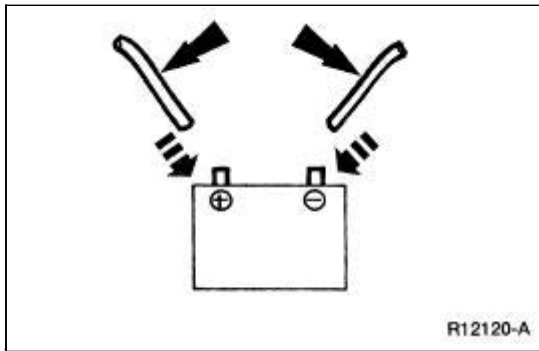
 **WARNING:** Remote deployment is to be performed outdoors with all personnel at least 6.1 meters (20 feet) away to ensure personal safety. Due to the loud report which occurs when the air bag is deployed, hearing protection is required.

 **WARNING:** Do not place the driver or passenger air bag module with the trim cover or deployment door facing down, as the forces of the deploying air bag can cause it to ricochet and cause personal injury.

1. Remove the driver air bag from the vehicle. For additional information, refer to [Driver Air Bag Module](#) in this section.
2. Obtain two wires (20 gauge minimum) at least 6.1 meters (20 feet) long and attach one end of each wire to the connector pins on the air bag module.




3. Place the air bag module on a flat surface in an open outdoor area with the trim cover facing upward.
4. Remain at least 6.1 meters (20 feet) away from the air bag module.
5. Deploy the air bag module by touching the other ends of the two wires to the terminals of a 12-volt battery.





6. To allow for cooling, wait at least ten minutes before approaching the deployed air bag.
 7. Dispose of the deployed air bag module in the same manner as any other part to be scrapped.
-


Air Bag Disposal —Passenger, Undeployed, Scrapped Vehicle

Remote Deployment

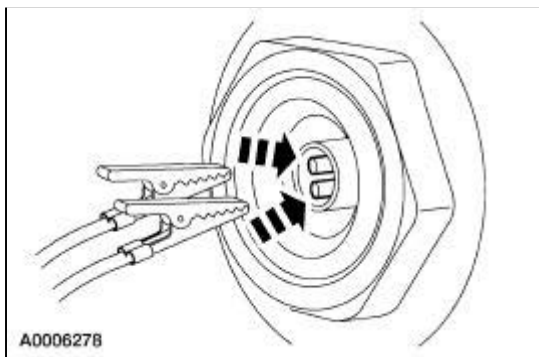
 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module or safety belt retractor/pretensioner assembly. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Carry a live air bag module with the air bag and trim cover or deployment door pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

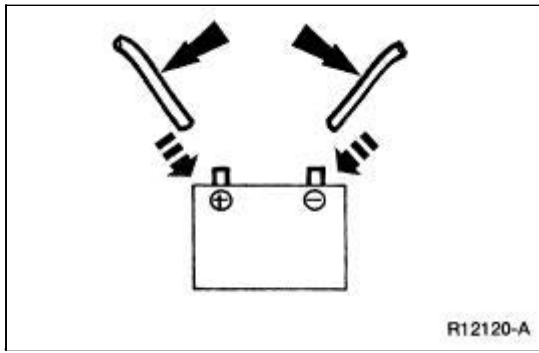
 **WARNING:** Remote deployment is to be performed outdoors with all personnel at least 6.1 meters (20 feet) away to ensure personal safety. Due to the loud report which occurs when the air bag is deployed, hearing protection is required.

 **WARNING:** Do not place the driver or passenger air bag module with the trim cover or deployment door facing down, as the forces of the deploying air bag can cause it to ricochet and cause personal injury.

1. Remove the passenger air bag from the vehicle. For additional information, refer to [Passenger Air Bag Module](#) in this section.
2. Obtain two wires (20 gauge minimum) at least 6.1 meters (20 feet) long and attach one end of each wire to the connector pins on the air bag module.




3. Place the air bag module on a flat surface in an open outdoor area with the deflector can facing downward.
4. Remain at least 6.1 meters (20 feet) away from the air bag module.
5. Deploy the air bag module by touching the other ends of the two wires to the terminals of a 12-volt battery.





6. To allow for cooling, wait at least ten minutes before approaching the deployed air bag.
 7. Dispose of the deployed air bag module in the same manner as any other part to be scrapped.
-


Air Bag Disposal —Side, Undeployed, Scrapped Vehicle

Remote Deployment

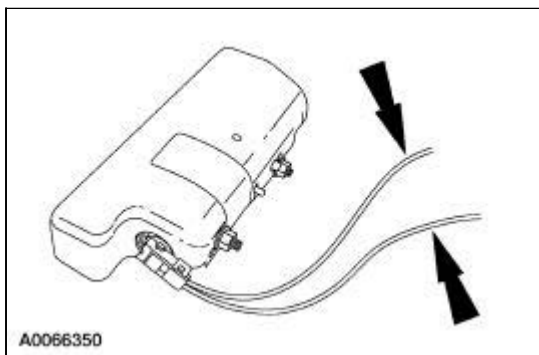
 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module or safety belt retractor/pretensioner assembly. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Carry a live air bag module with the air bag and trim cover or deployment door pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

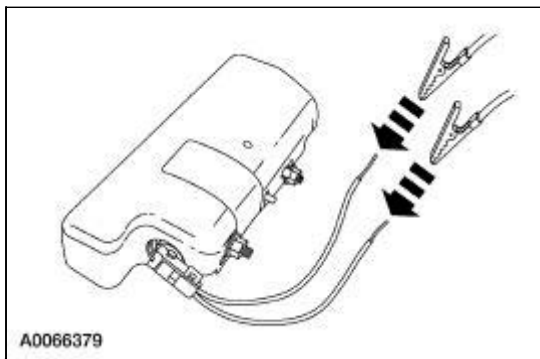
 **WARNING:** Remote deployment is to be carried out outdoors with all personnel at least 6.1 meters (20 feet) away to ensure personal safety. Due to the loud report which occurs when the air bag is deployed, hearing protection is required.

 **WARNING:** Do not place the side air bag module with the tear seam facing down or the attaching studs facing upward, as the forces of the deploying air bag can cause it to ricochet and cause personal injury.

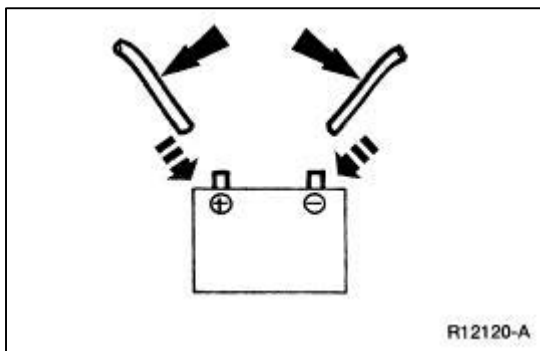
1. Remove the side air bag from the vehicle. For additional information, refer to [Side Air Bag Module](#) in this section.
2. Cut and strip the wires and connect the connector to the air bag module.



3. Obtain two wires (20 gauge minimum) at least 6.1 meters (20 feet) long and attach one end of each wire to the connector pins on the air bag module.




4. Place the air bag module on a flat surface in an open outdoor area with the tear seam facing upward and the attaching studs facing downward.
5. Remain at least 6.1 meters (20 feet) away from the air bag module.
6. Deploy the side air bag module by touching the other ends of the two wires to the terminals of a 12-volt battery.



7. To allow for cooling, wait at least ten minutes before approaching the deployed air bag.
 8. Dispose of the deployed side air bag module in the same manner as any other part to be scrapped.
-

Safety Belt Pretensioner Disposal —Deployed

1.  **WARNING:** The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

Dispose of the deployed safety belt pretensioner in the same manner as any other part to be scrapped.

Safety Belt Pretensioner Disposal —Undeployed, Inoperative



WARNING: The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.




WARNING: Carry a live safety belt retractor pretensioner or safety belt buckle pretensioner so as to keep fingers and clothing away from moveable parts. This will reduce the risk of injury in the event of an accidental deployment.


NOTE: All inoperative safety belt buckle pretensioners and safety belt retractor pretensioners have been placed on the Mandatory Return List. All damaged safety belt buckle pretensioners and safety belt retractor pretensioners must be treated the same as any inoperative live safety belt buckle pretensioner or safety belt retractor pretensioner being returned.


1. Remove the inoperative safety belt buckle pretensioner or safety belt retractor pretensioner from the vehicle. For additional information, refer to [Section 501-20A](#).
 2. Package and return the inoperative safety belt buckle pretensioner or safety belt retractor pretensioner to Ford Motor Company.
-


Safety Belt Pretensioner Disposal —Undeployed, Scrapped Vehicle

Remote Deployment

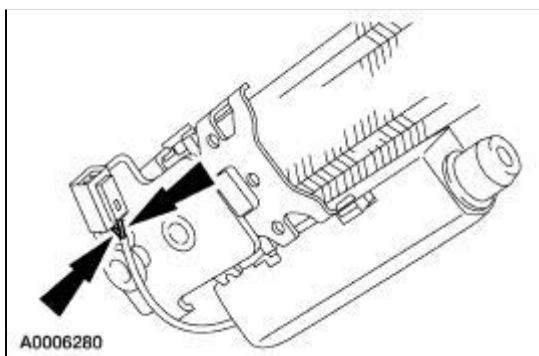
 **WARNING:** The safety belt pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

 **WARNING:** Carry a live safety belt retractor/pretensioner assembly so as to keep fingers and clothing away from moveable parts. This will reduce the risk of injury in the event of an accidental deployment.

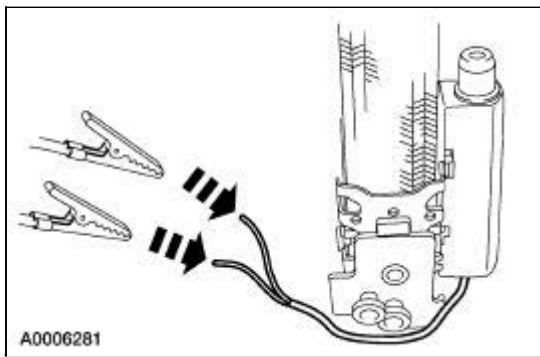
 **WARNING:** Remote deployment is to be carried out outdoors with all personnel at least 6.1 meters (20 feet) away to ensure personal safety. Due to the loud report which occurs when the safety belt pretensioner is deployed, hearing protection is required.

 **WARNING:** Do not position the safety belt retractor/pretensioner assembly so that moveable parts contact the support surface, as the forces of the deploying pretensioner can cause it to ricochet and cause personal injury.

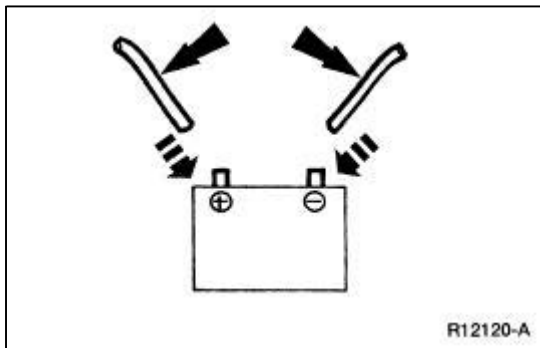
1. Remove the safety belt retractor/pretensioner assembly from the vehicle. For additional information, refer to [Section 501-20A](#).
2. Cut off the electrical connector and strip 25 mm (1 inch) of insulation off the wires.



3. Obtain two wires (20 gauge minimum) at least 6.1 meters (20 feet) long and attach one end of each wire to the safety belt pretensioner wires.



4. Position the safety belt retractor/pretensioner assembly on a flat surface in an open outdoor area so that moveable parts do not contact the support surface.
5. Remain at least 6.1 meters (20 feet) away from the safety belt retractor/pretensioner assembly.
6. Deploy the safety belt pretensioner by touching the other ends of the two wires to the terminals of a 12-volt battery.



7. To allow for cooling, wait at least ten minutes before approaching the deployed safety belt pretensioner retractor/pretensioner assembly.
 8. Dispose of the deployed safety belt retractor/pretensioner assembly in the same manner as any other part to be scrapped.
-

Wiring Repair

1. Inspect the supplemental restraint system (SRS) wiring and the wiring harness for any damage that may have occurred as a result of the accident. Inspect and repair or install new, as required, any damaged:
 - wires.
 - insulation.
 - terminal.
 - connectors.
 - splices.

 2. Splice damaged wires using the specified butt-splice connector or equivalent.
 - For splices required in adjacent wiring, stagger the splices 51 mm (2 inches) apart from each other.
 - Use waterproof butt-splice type connectors.
 - Use the correct size heat shrink nylon tube to prevent water, salt, condensation, and heat from affecting the wiring repair. Make sure the tube extends 25 mm (1 inch) each side of the repair.
 - Use a splice connector that is lined with a sealer that melts when heated with a heat gun and flows from the tubing, sealing and splice.
 - Use the correct gauge connector for the wire being repaired.
 - Use connectors that are transparent to allow inspection of the finished splice.
-

Weld Nut Repair — "J" Nut, Restraints Control Module (RCM) and Side Impact Sensor



WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side impact sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

NOTE: There are two procedures to repair a vehicle having missing restraints control module or side impact sensor attaching weld nut(s). Read both this procedure and [Weld Nut Repair—Missing Weld Nut, Restraints Control Module \(RCM\) and Side Impact Sensor](#) before proceeding with the repair.

NOTE: If two or more weld nuts are missing, do not install the "J" nuts as outlined in this procedure. Weld nuts must be installed as outlined in [Weld Nut Repair—Missing Weld Nut, Restraints Control Module \(RCM\) and Side Impact Sensor](#).

NOTE: The following procedure applies to vehicles that have a rectangular hole in the sheet metal that is in close proximity to the missing weld nut.

1. Obtain a "J" nut (part number N623332-S301) or any of the following optional "J" nuts (part numbers: N623342-S101, N800854-S100, N800925-S100).
2. Obtain a 6 mm (0.24 in) grounding screw (part number N806327-S190) or equivalent.
3. Install the "J" nut through the rectangular hole in the sheet metal.
4. **NOTE:** Be sure the threaded portion of the "J" nut is aligned with the clearance hole in the sheet metal.

Install the crash sensor.

5. Tighten the attaching screws to specification. For additional information, refer to Torque Specifications in this section.
-

Weld Nut Repair —Missing Weld Nut, Restraints Control Module (RCM) and Side Impact Sensor



WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side impact sensors are located at or near the base of the B-pillar.

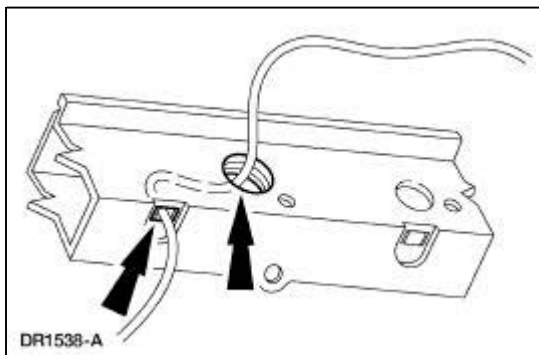
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

NOTE: There are two procedures to repair a vehicle having missing restraints control module or side impact sensor attaching weld nut(s). Read both this procedure and [Weld Nut Repair—"J" Nut, Restraints Control Module \(RCM\) and Side Impact Sensor](#) before proceeding with the repair.

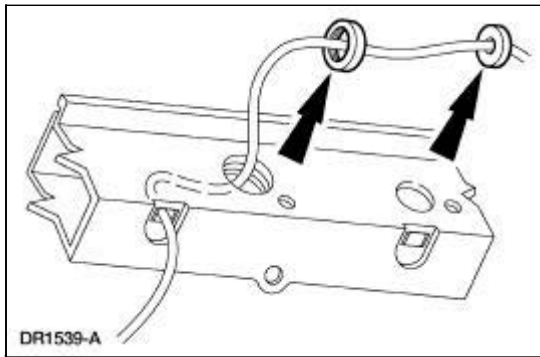
NOTE: Use only this procedure if two or more weld nuts are missing, do not install the "J" nuts as outlined in [Weld Nut Repair — "J" Nut, Restraints Control Module \(RCM\) and Side Crash Sensor](#).

NOTE: Radiator support repair shown, others are similar.

1. Obtain a 6 mm (0.24 in) weld nut (part number N806285-S190).
2. Obtain a 6 mm (0.24 in) grounding screw (part number N806327-S190).
3. Route a sufficient length of copper welding wire through the weld nut clearance hole and back out an adjacent access hole.



4. Feed the copper welding wire through the weld nut, then through a standard flatwasher.



5. Secure the flatwasher so that it cannot be pulled off the end of the copper welding wire.
 6. Pull the copper welding wire back through the clearance hole, allowing the weld nut and flatwasher to follow the copper welding wire through.
 7. Position the weld nut to the weld nut clearance hole, firmly pulling on the copper welding wire allowing the secured flatwasher to hold the weld nut in position.
 8. Holding the weld nut securely in place and using a MIG welder, weld in four places around the edge of the weld nut.
 9. Metal finish as required.
 10. Verify the nut is securely in place.
 11. Install the crash sensor.
 12. Tighten the attaching screws to specification. For additional information, refer to Torque Specifications in this section.
-

Weld Nut Repair —Stripped Weld Nut, Restraints Control Module (RCM) and Side Impact Sensor



WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.


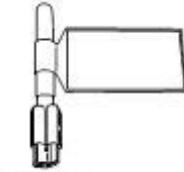
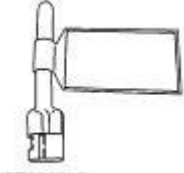
The side impact sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).


1. Obtain an 8 mm (0.32 in) grounding screw (part number N802455-S190).
 2. Drill out the internal threads of the stripped-out weld nut to 7.37 mm (0.29 in) using a letter "L" size drill bit.
 3. Position the crash sensor to the vehicle.
 4. Install the 8 mm (0.32 in) grounding screw into the drilled-out weld nut.
 5. Install the remaining attaching screws.
 6. Tighten the attaching screws to specification. For additional information, refer to Torque Specifications in this section.
-

Side Impact Sensor

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F395 (014-R1079)
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)


Removal

 **WARNING:** Vehicle sensor orientation is critical for proper system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Replace and properly position the sensor or any other damaged supplemental restraint system (SRS) components whether or not the air bag is deployed.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and perform the diagnostic procedure again.

NOTE: The left side is shown, the right side is similar.

1. Prepare the vehicle for side impact sensor removal.

1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.


Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power

supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

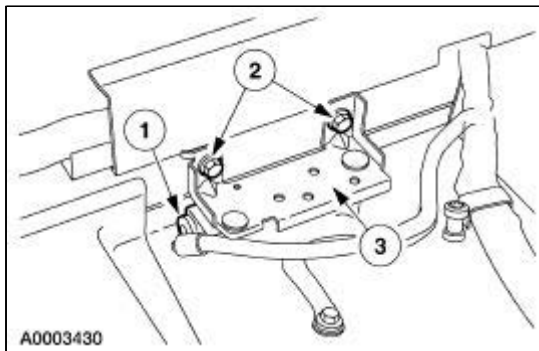
2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.**

Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in the General Procedures portion of this section.


3.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.**


Remove the seat on the side with the affected side impact sensor. For additional information, refer to [Section 501-10](#).

2. Position the carpet away from the B-pillar.
3. Remove the side impact sensor.
 1. Disconnect the side impact sensor electrical connector.
 2. Remove the bolts.
 3. Remove the side impact sensor with bracket.



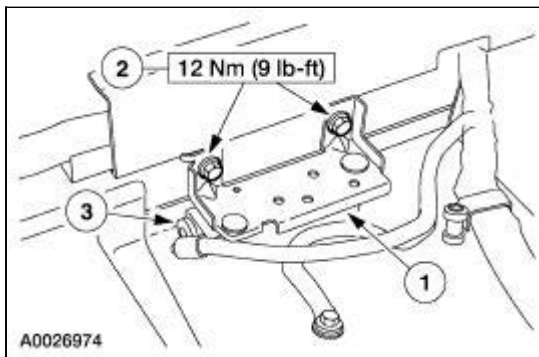
Installation

 **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions and notes at the beginning of the removal procedure.**

1.  **WARNING: The tightening torque of the air bag side impact sensor retaining bolts is critical for proper system operation.**

Install the side impact sensor.


1. Position the side impact sensor with bracket.
2. Install the bolts.
3. Connect the side impact sensor.




2. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
3. With the restraint system diagnostic tools installed at all deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#), in the Diagnosis and Testing portion of this section.
4. Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).
5. Reposition the carpet back at the B-pillar.
6. Restore the vehicle to operating condition.

1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.**

Install the seat on the side with the affected side impact sensor. For additional information, refer to [Section 501-10](#).

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in the General Procedures portion of this section.



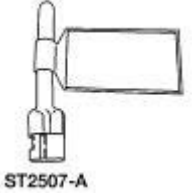
3.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the [Diagnosis and Testing](#) portion of this section.


4. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).
-


Restraints Control Module (RCM)

Special Tool(s)

 ST2502-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F395 (014-R1079)
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal

 **WARNING:** The restraints control module (RCM) orientation is critical for proper air bag supplemental restraint system (SRS) operation. If a vehicle equipped with an SRS system has been involved in a collision in which the center tunnel area has been damaged, inspect the mounting and bracket for deformation. If damaged, the RCM must be replaced whether or not the air bags have deployed. In addition, make sure the area of the RCM mounting is restored to its original condition.


 **WARNING:** Vehicle sensor orientation is critical for proper system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. Replace and properly position the sensor or any other damaged supplemental restraint system (SRS) components whether or not the air bag is deployed.

 **CAUTION:** Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage can result.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and perform the diagnostic procedure again.

All vehicles

1. Prepare the vehicle for restraints control module (RCM) removal.

1.  **WARNING:** To avoid accidental deployment and possible personal injury, the


backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

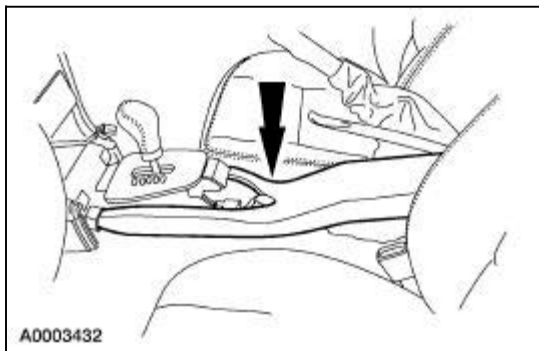
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

2.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.

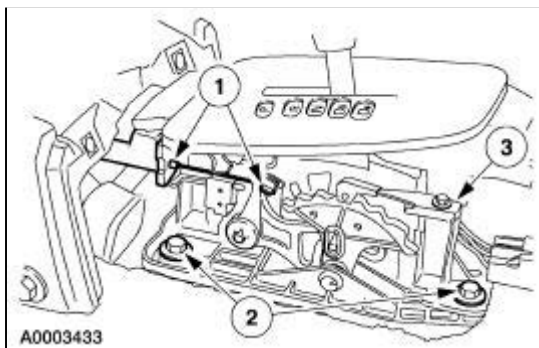
Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

2. Remove the center console. For more information, refer to [Section 501-12](#).
3. Remove the rear vent duct.



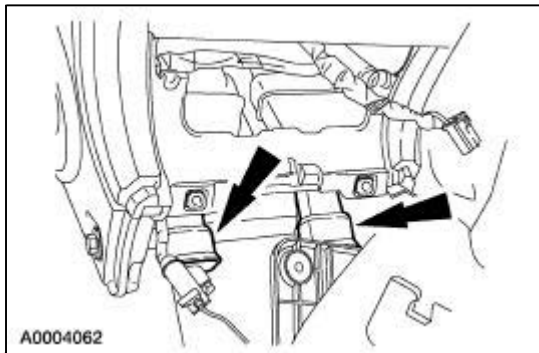
Vehicles with automatic transmission

4. Position the shifter out of the way.
 1. Disconnect and separate the shifter interlock cable and casing from the shifter.
 2. Remove the shifter retaining bolts (two shown).
 3. Position the shifter out of the way.



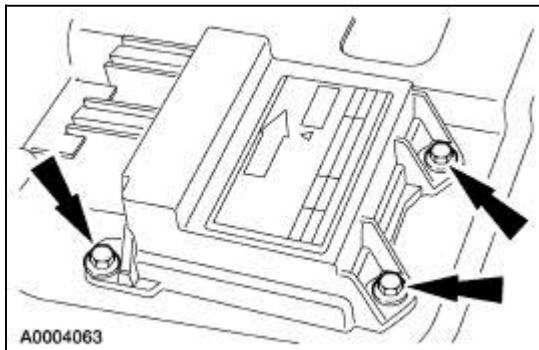
All vehicles

5. Remove the extension duct.

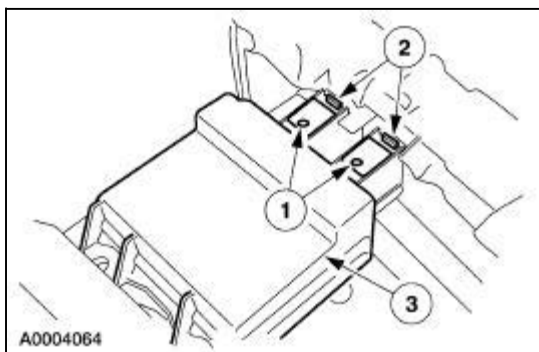


6. **NOTE:** The instrument panel has been removed for clarity.


Remove the bolts.



7. Remove the RCM.
 1. Slide and disengage the RCM electrical connector locking clips.
 2. Depressing the locking tab, disconnect the RCM electrical connectors.
 3. Remove the RCM.



Installation

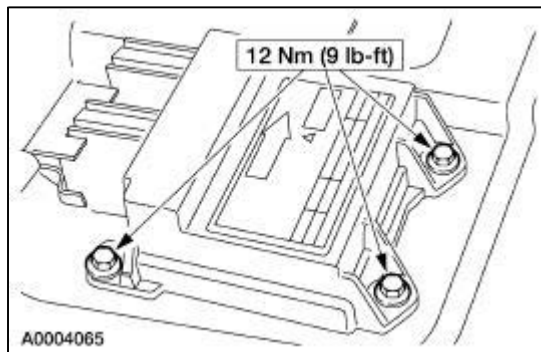
 **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions and notes at the beginning of the removal procedure.

All vehicles

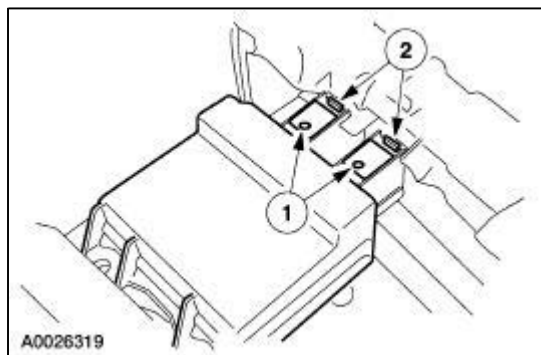
1.  **WARNING:** The tightening torque of the air bag restraints control module (RCM)

retaining bolts is critical for correct system operation.

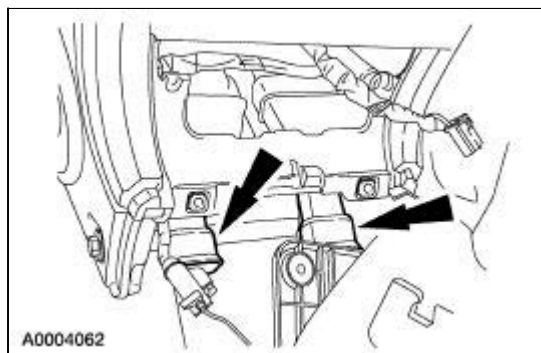
Position the RCM. Install the bolts.



2. Connect the RCM electrical connector.
 1. Connect the RCM electrical connectors.
 2. Slide and engage the RCM electrical connector locking clips.



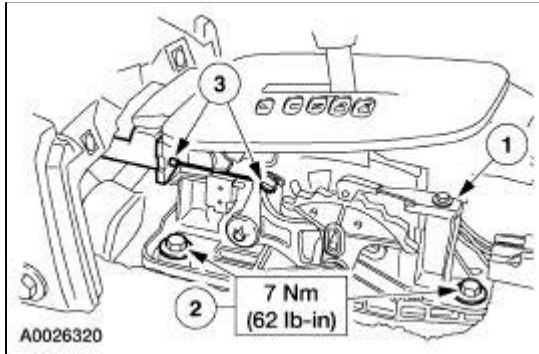
3. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
4. With the restraint system diagnostic tools installed at all deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#), in the Diagnosis and Testing portion of this section.
5. Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).
6. Install the extension duct.



Vehicles with automatic transmission

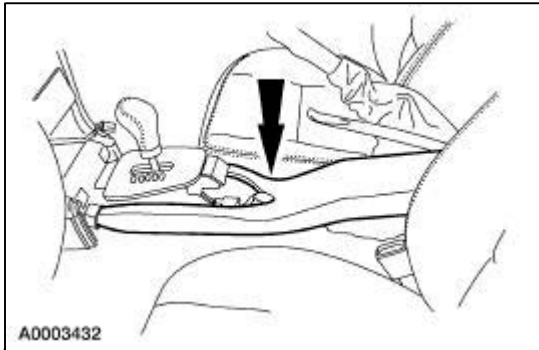
7. Install the shifter.


1. Position the shifter.
2. Install the shifter bolts (two shown).
3. Connect the shifter interlock cable and casing to the shifter.




All vehicles

8. Install the rear vent duct.



9. Install the center console. For additional information, refer to [Section 501-12](#).
10. Restore the vehicle to operating condition.
 1.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.



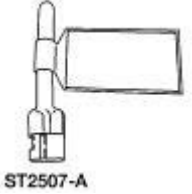
Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

2.  **WARNING:** The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.


With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.


Driver Air Bag Module

Special Tool(s)


 ST2502-A	Diagnostic Tool, Restraint System (2 Req'd) 418-F395 (014-R1079)
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)


Removal

 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.


 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

 **WARNING:** Air bag modules with discolored or damaged trim covers must be replaced, not repainted.

NOTE: A repair is made by installing a new part only. If the new part does not correct the condition,

install the original part and perform the diagnostic procedure again.

1. Prepare the vehicle for driver air bag module removal.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

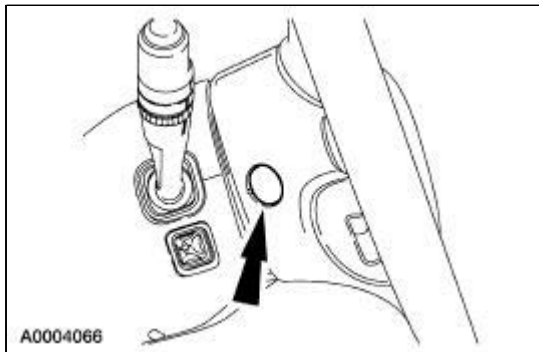
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

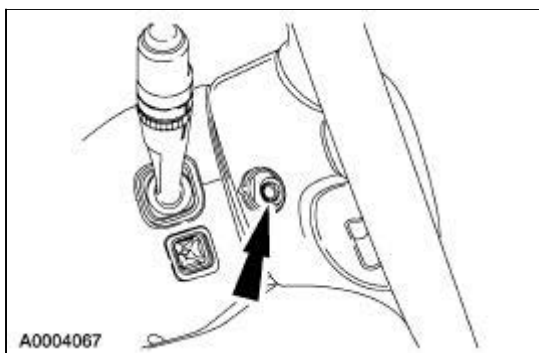
2.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.

Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

2. Remove the two steering wheel plugs.

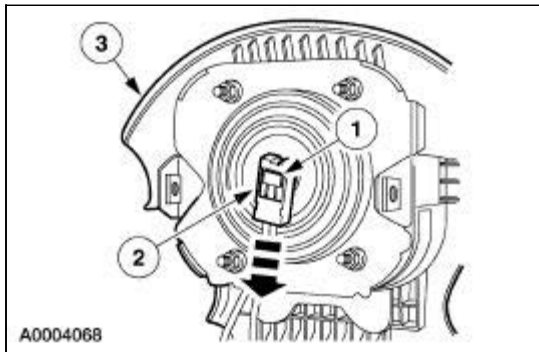


3. Remove the two driver air bag module retaining bolts.

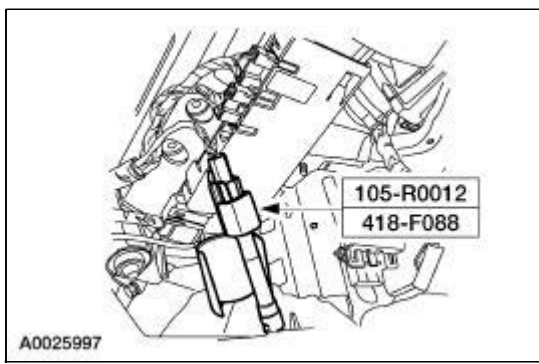


4. Disconnect and remove the driver air bag module.
 1. Slide and disengage the driver air bag electrical connector locking clip.

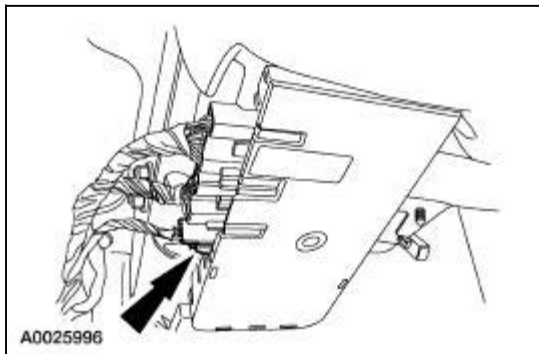
2. Depress the locking tabs and disconnect the driver air bag module electrical connector.
3. Remove the driver air bag module.



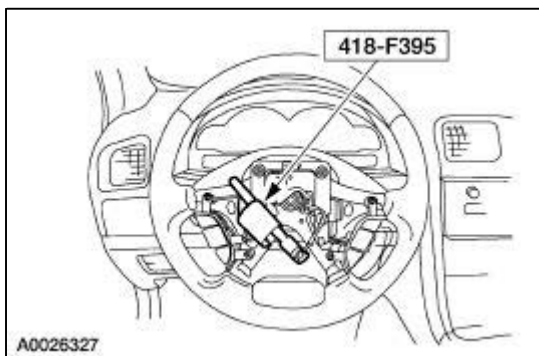
5. Remove the restraint system diagnostic tool from the vehicle harness side of the clockspring electrical connector at the base of the steering column.



6. Connect the clockspring electrical connector at the base of the steering column.




7. Attach the restraint system diagnostic tool to the clockspring electrical connector at the top of the steering column.

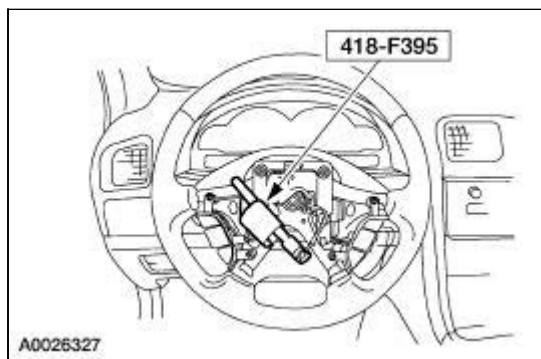


8. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
9. With the restraint system diagnostic tools installed at all deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.
10. Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).

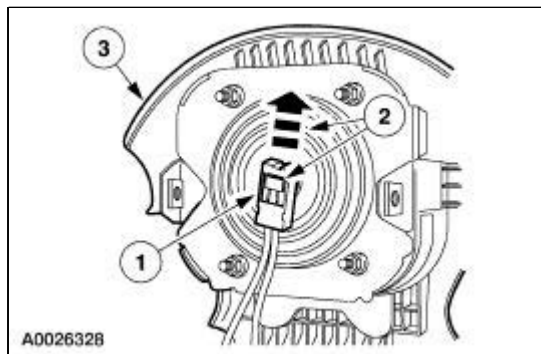
Installation

 **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions and notes at the beginning of the removal procedure.**

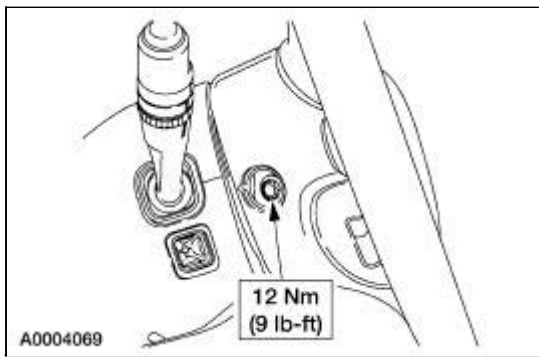
1. Remove the restraint system diagnostic tool from the clockspring electrical connector at the top of the steering column.



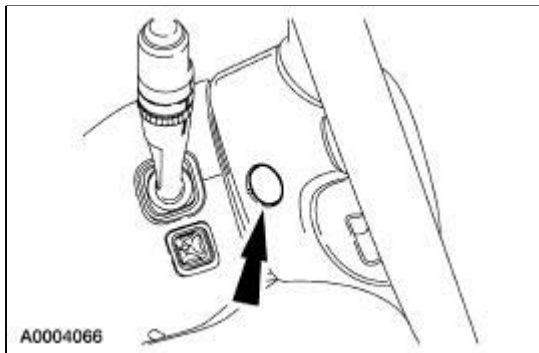
2. Connect and position the driver air bag module to the steering wheel.
 1. Connect the driver air bag module electrical connector.
 2. Slide and engage the driver air bag module electrical connector locking clip.
 3. Position the driver air bag module to the steering wheel.




3. Install the two driver air bag module bolts.



4. Install the two steering wheel back cover plugs.



5. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
6. With the restraint system diagnostic tools still installed at the remaining deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.


7.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.


The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).

8. Restore the vehicle to operating condition.
 1.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.


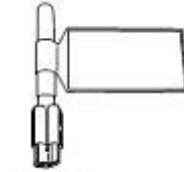
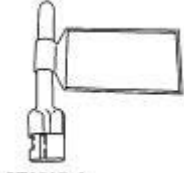
2.  **WARNING:** The restraint system diagnostic tool is for restraint system

service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.


With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.


Passenger Air Bag Module


Special Tool(s)


 ST2502-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F395 (014-R1079)
 ST2506-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal

 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Do not set a live air bag module with the trim cover in the face down position. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.


 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

 **WARNING:** If the air bag module is discolored or damaged it must be replaced, not repaired.

NOTE: A repair is made by installing a new part only. If the new part does not correct the condition,

install the original part and perform the diagnostic procedure again.

1. Prepare the vehicle for passenger air bag module removal.


1.  **WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.**

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side impact sensors are located at or near the base of the B-pillar.

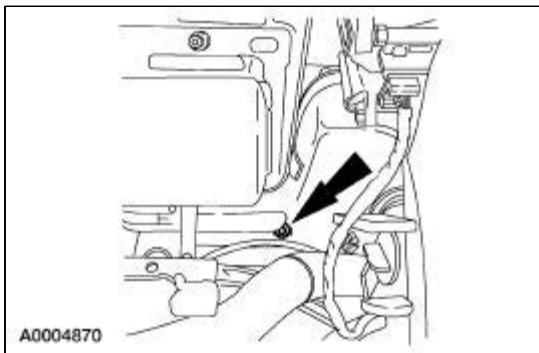
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

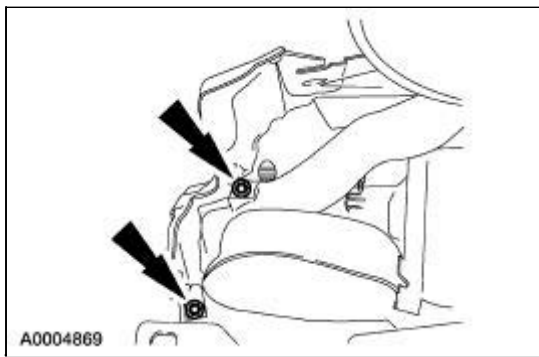
2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.**

Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in the General Procedures portion of this section.

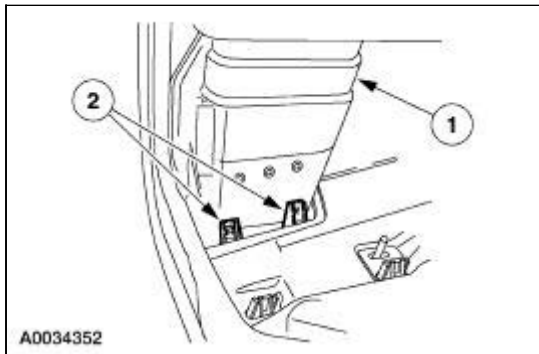
2. Remove the instrument panel. For additional information, refer to [Section 501-12](#).
3. Position the instrument panel face down on the bench.
 - Cover the work area with something clean and nonabrasive to protect the instrument panel.
4. Remove the screw for the passenger side A/C duct near the center of the instrument panel.



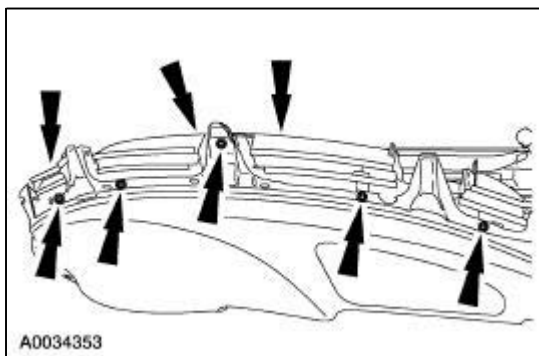
5. Remove the screws from the passenger side A/C and demister duct.



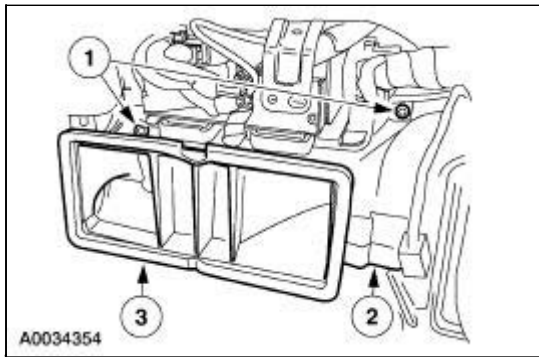
6. Remove the passenger side air conditioning register.
 1. Separate the A/C duct from the register.
 2. Push in on the retaining clips and remove the passenger side air conditioning register.



7. Remove the eight screws. Separate the driver side demister duct and remove the defrost nozzle.



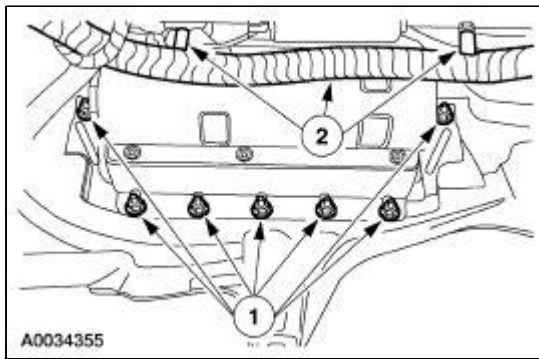
8. Remove the plenum chamber. For additional information, refer to [Section 412-01](#).
9. Remove the center A/C duct.
 1. Remove the screws.
 2. Pull out on the center A/C duct, separating the passenger A/C duct.
 3. Remove the center A/C duct.



10. **NOTE:** If installing a new passenger air bag module, install new retaining nuts and bolts.

Remove the passenger air bag module nuts.

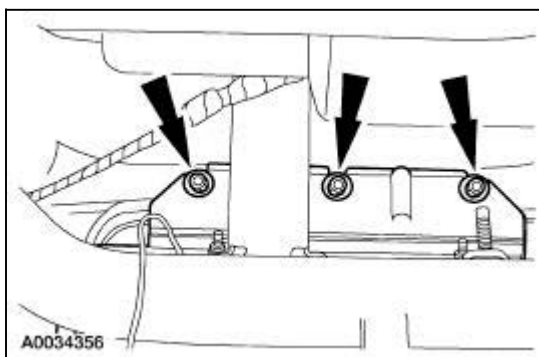
1. Remove the passenger air bag module nuts.
2. Release the three retainers and position the wire harness out of the way.



11. **NOTE:** If installing a new passenger air bag module, install new retaining nuts and bolts.

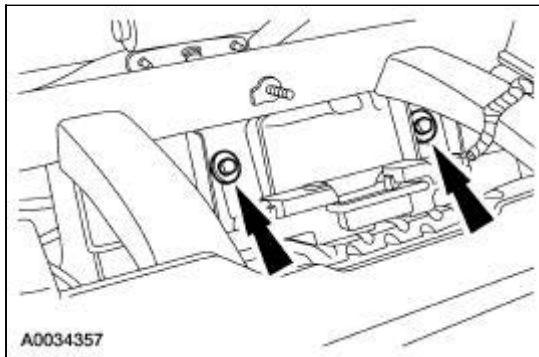
Remove the passenger air bag module nuts.

- Position the passenger side A/C duct out of the way to access the passenger air bag nuts.



12. **NOTE:** If installing a new passenger air bag module, install new retaining nuts and bolts.

Remove the passenger air bag module bolts.



13. Remove the passenger air bag module through the back of the instrument panel.

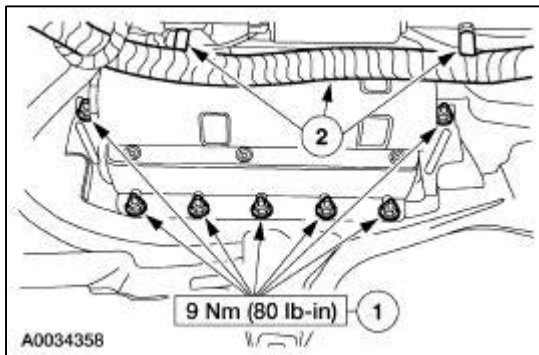
Installation

⚠ WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions and notes at the beginning of the removal procedure.

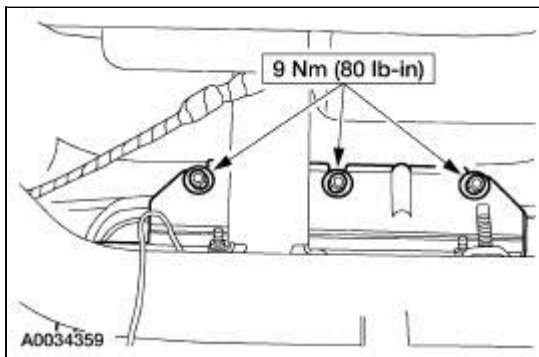
1. Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).
2. **NOTE:** If installing a new passenger air bag module, install new retaining nuts and bolts.

Position the passenger air bag module to the instrument panel. Start all nuts and bolts by hand. Do not tighten at this time.

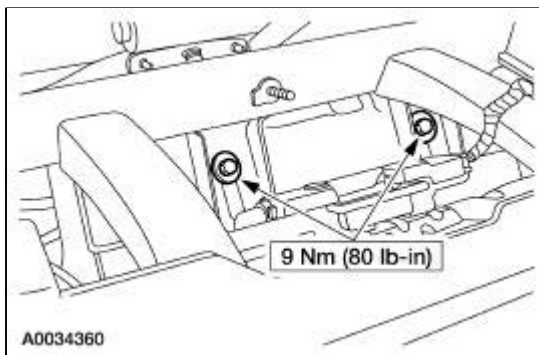
3. Tighten the passenger air bag module nuts.
 1. Tighten the passenger air bag module nuts to specification.
 2. Route the wire harness. Install the retainers.



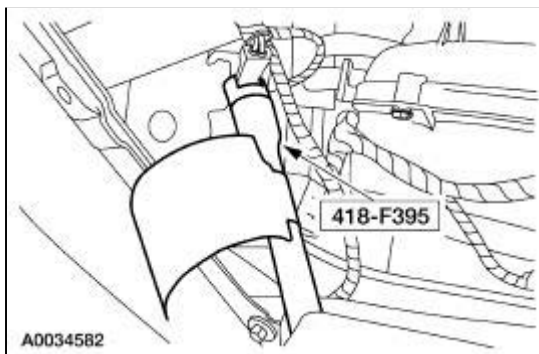
4. Tighten the passenger air bag module nuts to specification.
 - Position the glove box and passenger side A/C duct out of the way to access the passenger air bag nuts.



5. Tighten the passenger air bag module bolts.



6. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag module electrical connector.

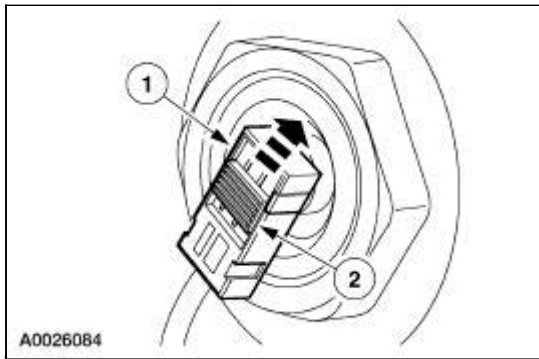


7. **NOTE:** The passenger air bag module is shown with instrument panel removed for clarity.

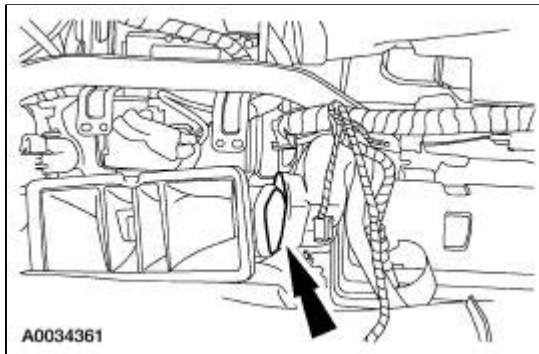
This is a blind operation due to the passenger air bag module electrical connector mounting location.

Connect the passenger air bag module electrical connector (this is a blind operation).

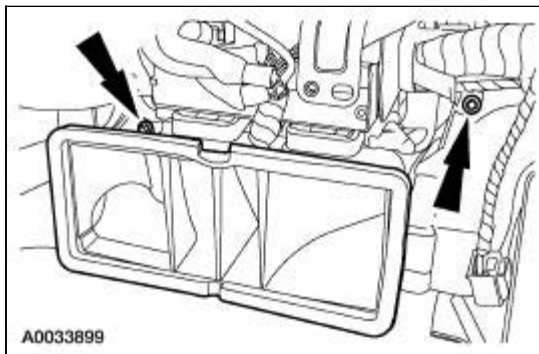
1. Connect the passenger air bag module electrical connector.
2. Slide and engage the driver air bag module electrical connector locking clip.



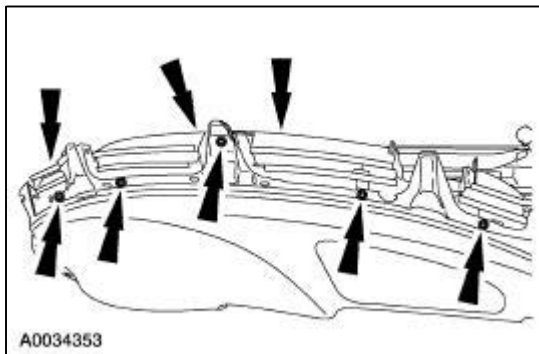
8. Position the center A/C duct into the passenger A/C duct.



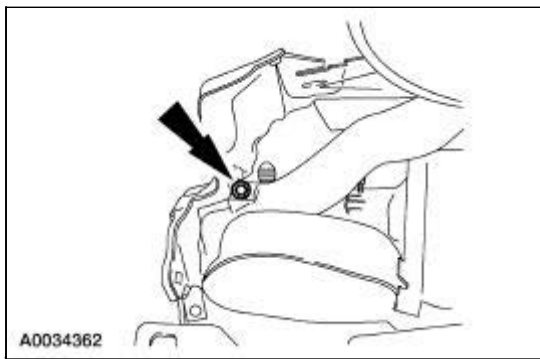
9. Position the center A/C duct to the instrument panel. Install the screws.



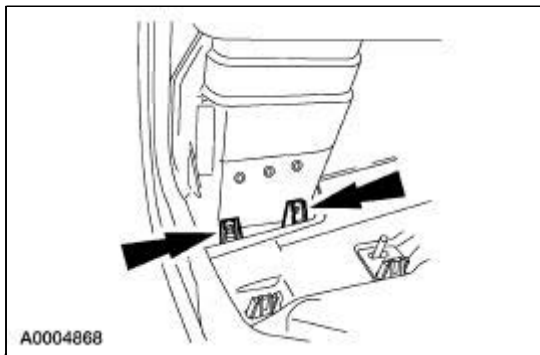
10. Install the plenum chamber. For additional information, refer to [Section 412-01](#).
11. Position the defrost nozzle to the instrument panel while installing the driver side demister duct. Install the eight screws.



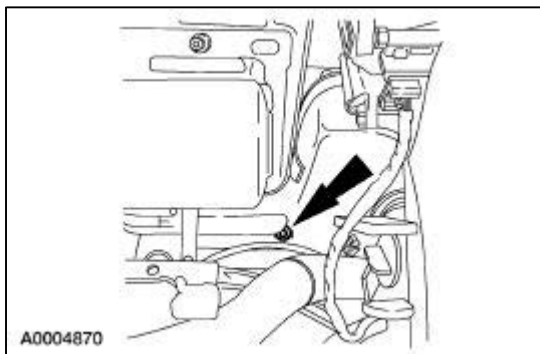
12. Position the passenger side demister duct to the instrument panel. Install the screw.



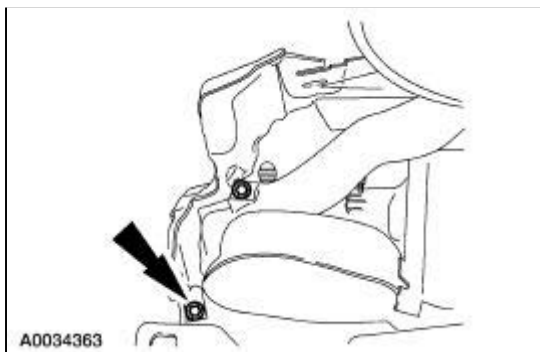
13. Install the passenger side air conditioning register into the instrument panel and engage the retaining clips.
 - Attach the passenger side air conditioning duct to the register.



14. Position the A/C duct and install the screw near the center of the instrument panel.




15. Install the screw for the A/C duct near the passenger register.



16. Install the instrument panel. Do not install the driver air bag module at this time. For additional information, refer to [Section 501-12](#).

17. Install the glove compartment. For additional information, refer to [Section 501-12](#).
18. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
19. With the restraint system diagnostic tools still installed at the remaining deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.

20.  **WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.**

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side impact sensors are located at or near the base of the B-pillar.


To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).


21.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the driver air bag module procedure.**

Install the driver air bag module. For additional information, refer to [Driver Air Bag Module](#) in this section.

22. Restore the vehicle to operating condition.

1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.**



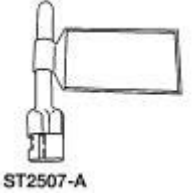
Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in the General Procedures portion of this section.

2.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**


With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in the Diagnosis and Testing portion of this section.


Side Air Bag Module

Special Tool(s)


 ST2502-A	Diagnostic Tool, Restraint System (1 Req'd) 418-F395 (014-R1079)
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)

Removal

 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Carry a live side air bag module with the air bag and tear seam pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Do not set a live side air bag module down on the cover tear seam. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.

 **WARNING:** Side air bag modules with damaged covers must be replaced.


NOTE: If a side air bag deployment took place the seat back pad, trim cover, and side air bag module must be replaced. The seat back frame should be replaced if necessary.

NOTE: When replacing the side air bag after deployment, refer to [Section 501-10](#) for additional information concerning the installation of a new side air bag.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and perform the diagnostic procedure again.

NOTE: The passenger seat is shown, the driver seat is similar.

1. Prepare the vehicle for side air bag module removal.


1.  **WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.**

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.**

Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

3.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.**

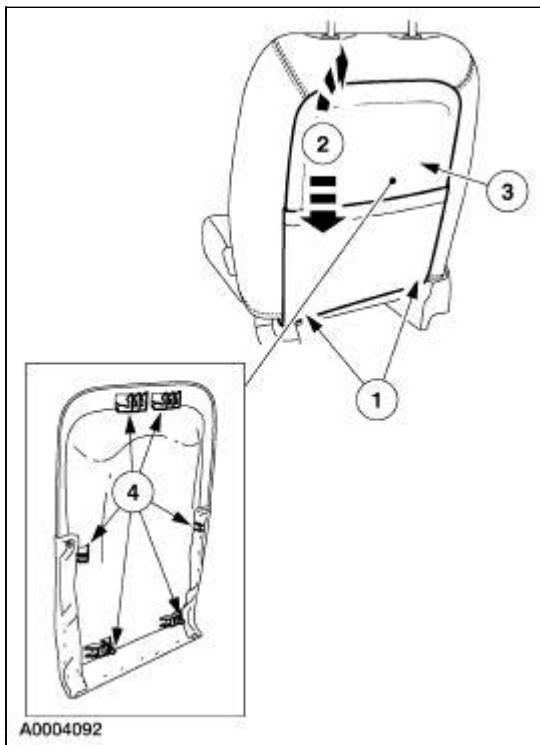
Remove the seat on the side with the affected side air bag module. For additional information, refer to [Section 501-10](#).

2.  **WARNING: Front seat back trim covers installed on seats equipped with side air bags cannot be repaired, they are to be replaced (cleaning is permissible).**

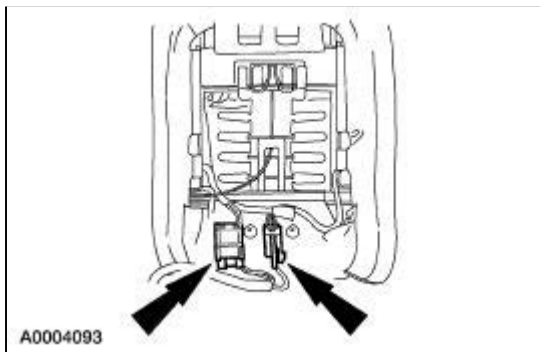
 **CAUTION: When removing the seat back trim panel, be careful not to damage the J-hooks. If the seat back trim panel J-hooks are damaged, install a new seat back trim panel.**

Remove the seat back trim panel.

1. Pull and release the pin-type retainers at the bottom of the seat back trim panel.
2. While pushing in at the top of the seat back trim panel, slide it down to disengage the J-hooks.
3. Pull out evenly at the top of the seat back trim panel and remove it.
4. Inspect the seat back trim panel J-hooks and pin-type retainers for damage.



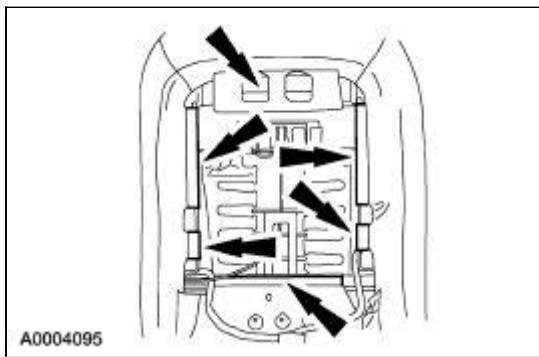
3. Disconnect the electrical connectors.



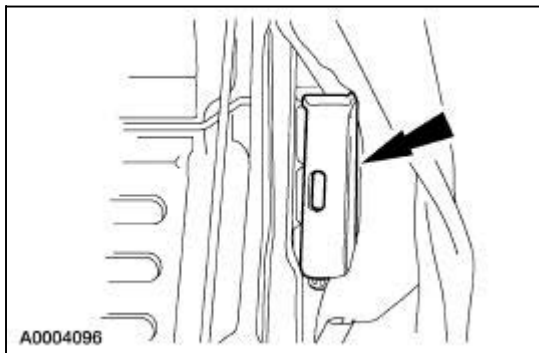
4. Separate the pin-type retainers from the seat back frame as indicated.



5. Detach the seat back trim cover J-clips.



6. Reposition the seat back trim cover and pad and remove the side air bag module retaining nut cover.

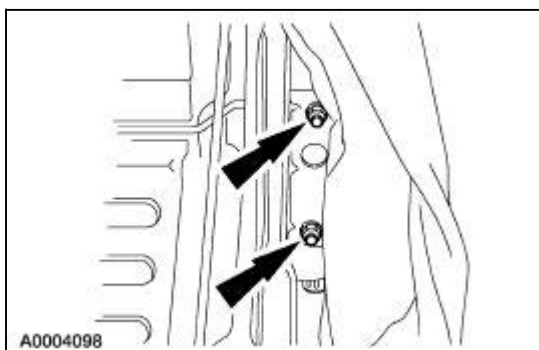


7. Push the wire harness and grommet through the seat back frame.



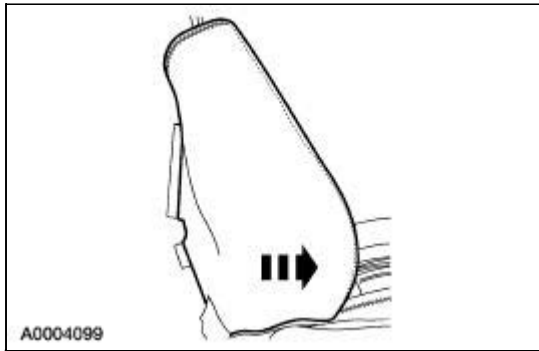
8. **NOTE:** If installing a new side air bag module, use new retaining nuts. If the same side air bag module is to be reused then reuse the side air bag module nuts.

Remove the side air bag module retaining nuts.

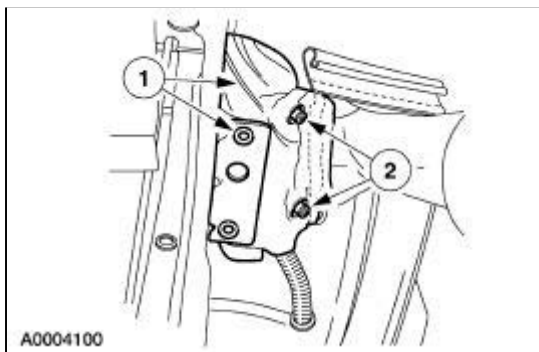


9. With one hand on the side air bag module, position the seat back trim cover and pad forward

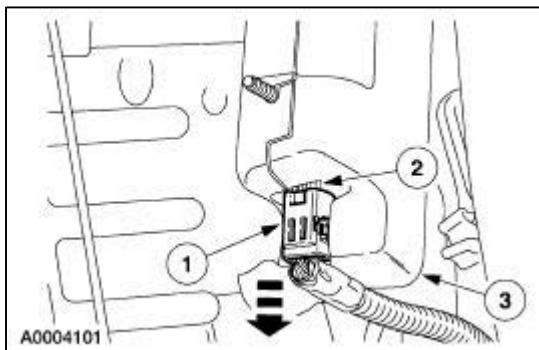
enough to access the side air bag module.



10. Remove the side air bag module from the deployment chute.
 1. Separate the side air bag module and deployment chute from the seat back mounting bracket.
 2. Pull the side air bag module mounting studs back through the deployment chute openings and remove the side air bag module from the deployment chute.



11. Remove the side air bag module.
 1. Slide the side air bag electrical connector locking clip to disengage it.
 2. Release the two connector tabs (one shown) by pushing in on them and disconnect the side air bag module.
 3. Remove the side air bag module.

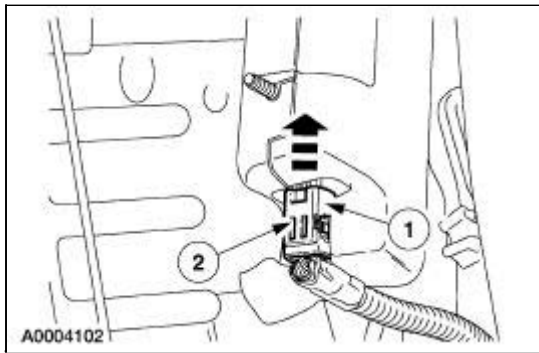


Installation

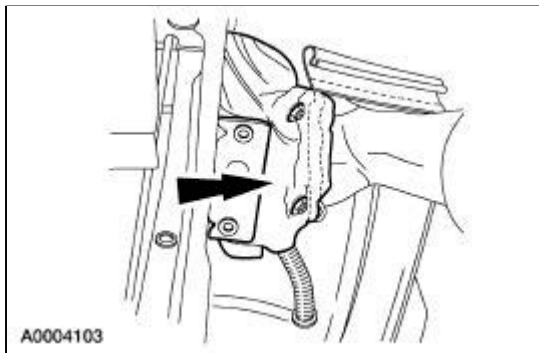



WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions and notes at the beginning of the removal procedure.


1. Connect the side air bag module electrical connector.
 1. Install the connector to the side air bag module.
 2. Slide the side air bag module electrical connector locking clip to secure the connector to the side air bag module.





2. Make sure the electrical connector is securely fastened to the side air bag module.




3.  **WARNING:** Inspect the mounting surfaces of the side air bag module for any foreign objects before installing the side air bag module. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

 **WARNING:** Inspect the side air bag deployment chute and the side air bag cavity in the seat back pad for any foreign objects. If any foreign objects are found remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

 **WARNING:** Before installing the side air bag module into the deployment chute, check it for damage and foreign objects. If the air bag module is damaged, replace it. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.

 **WARNING:** If the air bag cover has separated or the air bag material has been exposed, install a new side air bag module. Do not attempt to repair the air bag module. Failure to do so may result in personal injury, in the event of an air bag deployment.


 **WARNING:** Check the side air bag deployment chute for damage. The deployment chute must not be repaired. If there is any damage to the deployment chute, the seat back trim cover and deployment chute must be installed new as a unit.

 **WARNING:** If the air bag deployment chute is not properly positioned, the side air bag may not deploy properly.

NOTE: The alignment pin will only allow the side air bag module to be installed to the seat back mounting bracket one way.

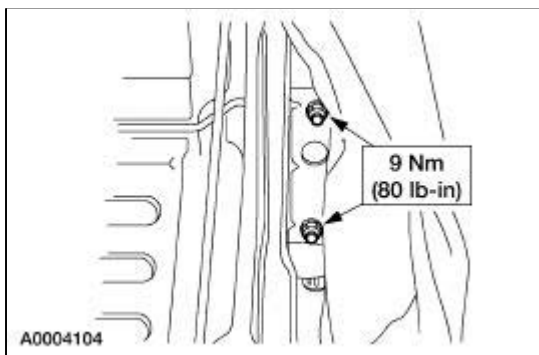
Position the side air bag module into the deployment chute.

- Position the side air bag module into the deployment chute with the alignment pin offset to the top and the electrical connector to the bottom of the seat back. This will position the alignment pin correctly when the side air bag module and deployment chute are mounted to the seat back frame mounting bracket.
- The side air bag module mounting studs must come through the deployment chute stud openings.

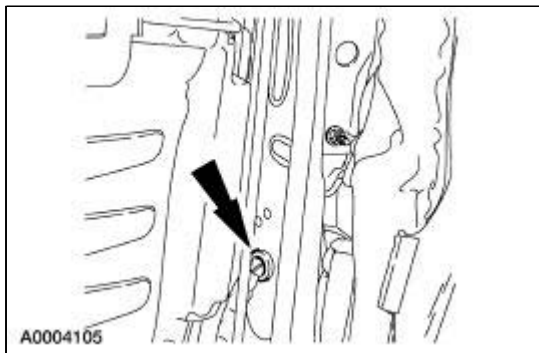
4.  **WARNING: Inspect the mounting surfaces of the deployment chute and the seat back frame mounting bracket for any foreign objects, before installing the side air bag module/deployment chute assembly. If any foreign objects are found, remove them. Failure to do so may result in personal injury, in the event of an air bag deployment.**

Install the side air bag module onto the front seat back frame mounting bracket. Install the nuts.

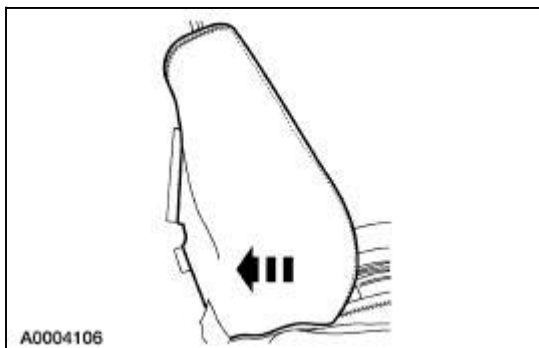
- The deployment chute should not have any wrinkles or folds where it contacts the seat back frame mounting bracket.



5. Pull the wire harness back through the hole in the seat back frame and seat the grommet.

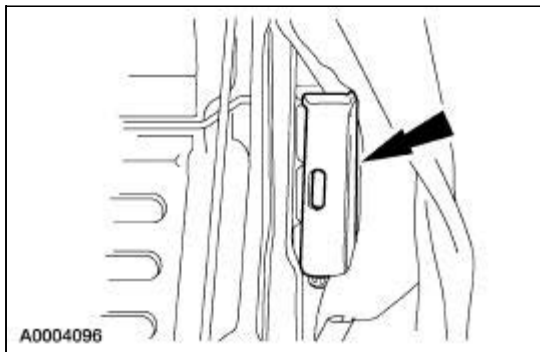


6. Reposition the seat back pad and trim cover to the seat back frame.

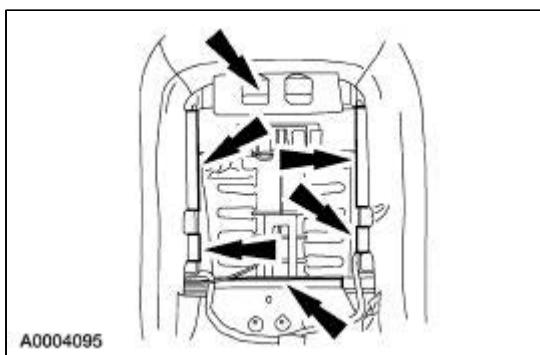


7. Attach the side air bag retaining nuts cover.

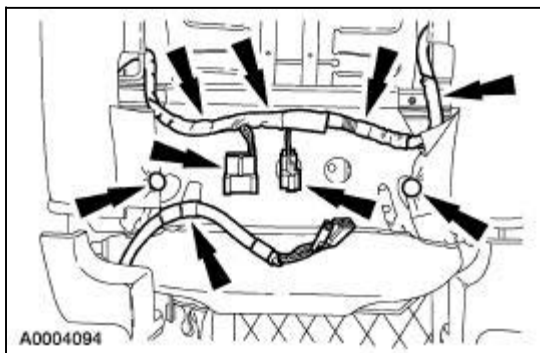
- Check that all three attaching clips on the side air bag nuts cover are correctly installed around the side air bag mounting bracket.



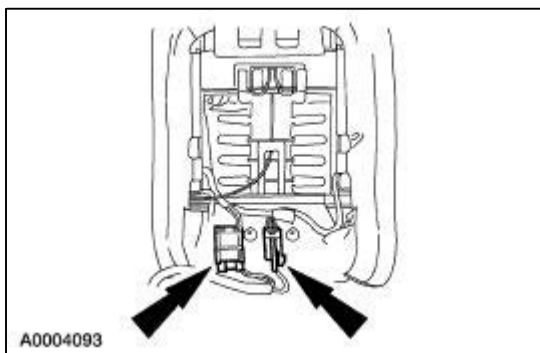
8. Fasten the seat back trim cover J-clips.



9. Install the pin-type retainers indicated.



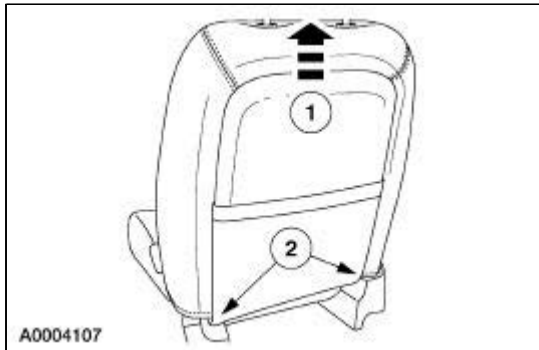
10. Connect the electrical connectors.



11.  **CAUTION: Inspect the seat back trim panel J-hooks for damage. If damaged, install a new seat back trim panel.**

Install the seat back trim panel.


1. Angle the top of the seat back trim panel inward and up to engage the upper J-hooks to the seat back frame.
2. While holding the seat back trim panel up, align the pin-type retainers at the bottom of the seat back trim panel and install them into the seat back frame.




12. Restore the vehicle to operating condition.

1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the seat removal and installation procedure.**

Install the seat on the side with the affected side air bag. For additional information, refer to [Section 501-10](#).

2.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.



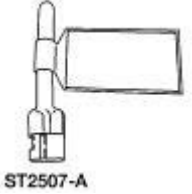
3.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.


4. Check the active restraint system for correct operation. For additional information, refer to [Section 501-20A](#).
-


Clockspring

Special Tool(s)


 ST2502-A	Diagnostic Tool, Restraint System (2 Req'd) 418-F395 (014-R1079)
 ST2506-A	Diagnostic Tool, Restraint System (3 Req'd) 418-F088 (105-R0012)
 ST2507-A	Diagnostic Tool, Restraint System (2 Req'd) 418-133 (40-009)


Removal

 **WARNING:** Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** Do not set a live air bag module down with the trim cover face down. This will reduce the risk of injury in the event of an accidental deployment.

 **WARNING:** After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards.

 **WARNING:** Never probe the connectors on the air bag module. Doing so can result in air bag deployment, which can result in personal injury.


 **WARNING:** Air bag modules with discolored or damaged trim covers must be replaced, not repainted.

NOTE: A repair is made by installing a new part only. If the new part does not correct the condition,

install the original part and perform the diagnostic procedure again.

All vehicles

1. Prepare the vehicle for clockspring removal.


1.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any front or side air bag supplemental restraint system (SRS) components and before servicing, replacing, adjusting or striking components near the front or side air bag sensors, such as doors, instrument panel, console, door latches, strikers, seats and hood latches.

Please refer to the appropriate vehicle shop manual to determine location of the front air bag sensors.

The side air bag sensors are located at or near the base of the B-pillar.

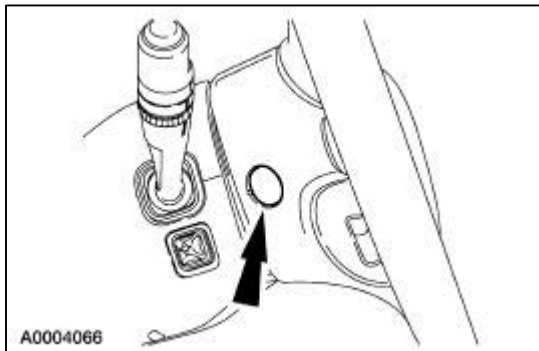
To deplete the backup power supply energy, disconnect the battery ground cable and wait at least one minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Disconnect the battery ground cable (14301) and wait at least one minute. For additional information, refer to [Section 414-01](#).

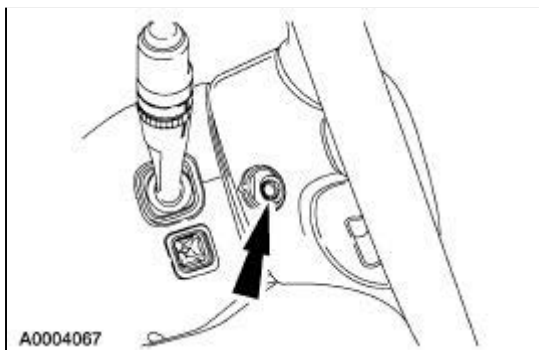
2.  **WARNING:** To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.

Deactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

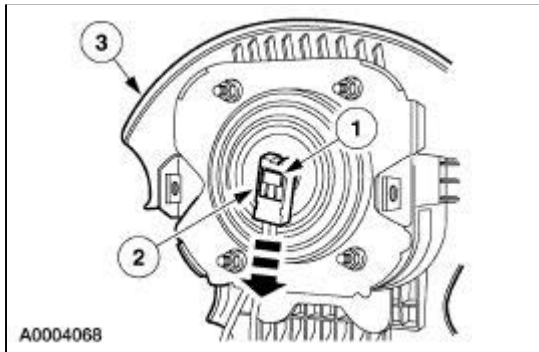
2. Remove the two steering wheel back cover plugs.



3. Remove the two driver air bag module bolts.



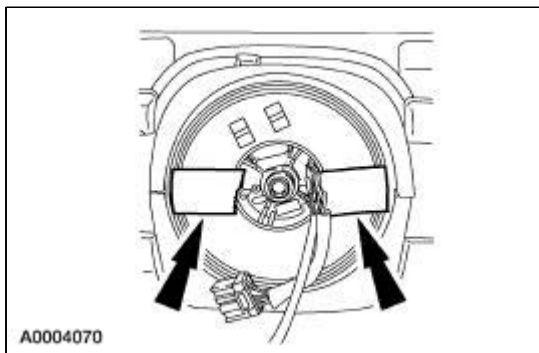
4. Remove the driver air bag module.
 1. Slide and disengage the driver air bag module electrical connector locking clip.
 2. Depressing the locking tabs, disconnect the driver air bag module electrical connector.
 3. Remove the driver air bag module.



5. **NOTE:** Make sure the wheels are in the straight-ahead position.

Remove the steering wheel. For additional information, refer to [Section 211-04](#).

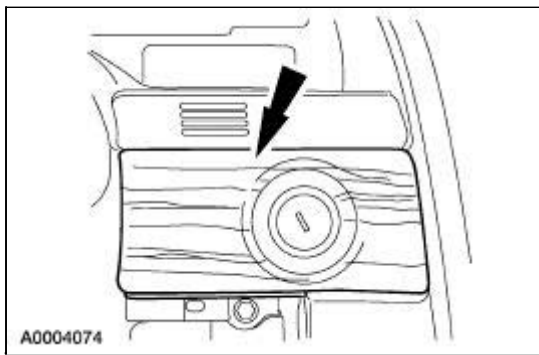
6. Apply two strips of masking tape across the clockspring to prevent accidental rotation when the clockspring is removed.



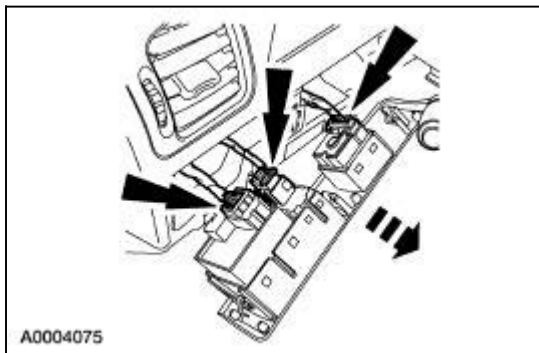
7. Remove the two screws and the lower steering column shroud.



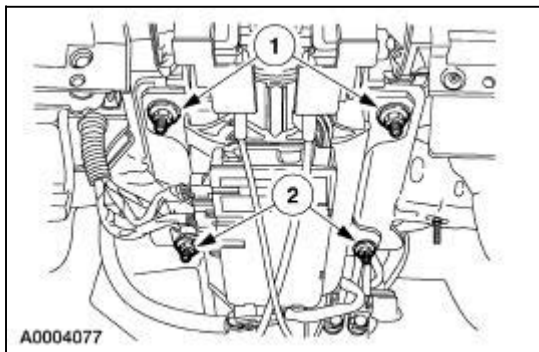
8. Pull out and remove the ignition switch finish panel.



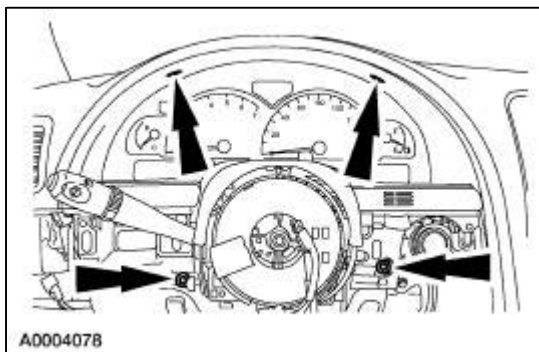
9. Remove the headlight switch finish panel by pulling out on it enough to disconnect the electrical connectors and remove it.



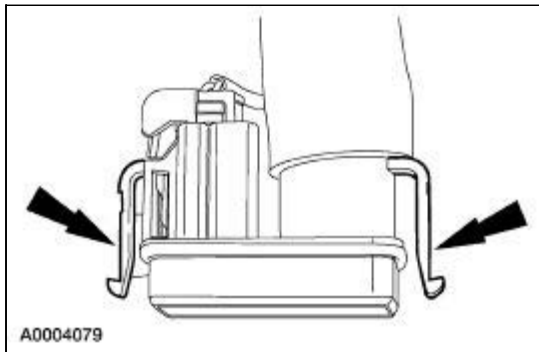
10. Lower the steering column.
 1. Remove the two steering column retaining nuts.
 2. Loosen the two steering column retaining nuts enough to pivot the steering column and remove the instrument cluster finish panel.



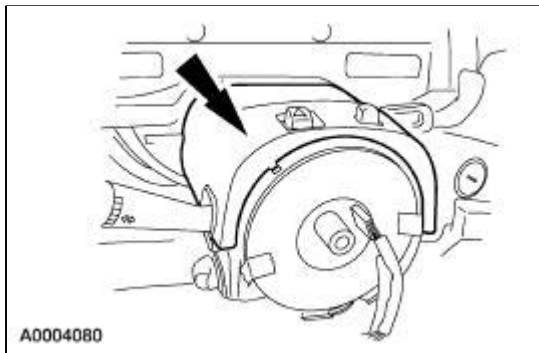
11. Remove the screws and the instrument cluster finish panel enough to access the automatic temperature control sensor assembly.



12. Separate the automatic temperature control sensor assembly from the instrument cluster finish panel by pushing in and releasing the tabs.

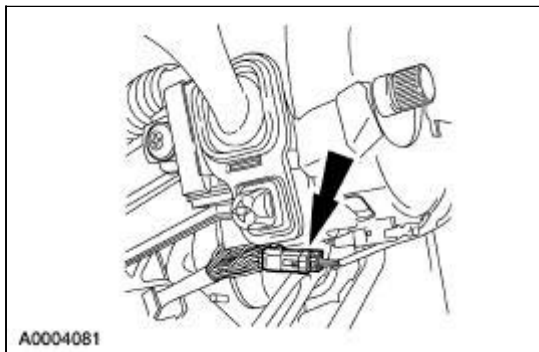


13. Remove the instrument cluster finish panel.
14. Remove the upper steering column shroud.



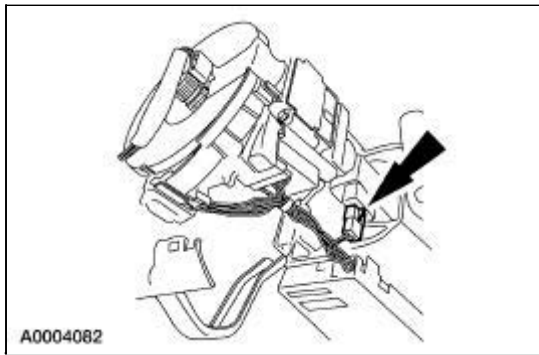
Vehicles with hands free microphone

15. Disconnect the microphone electrical connector.

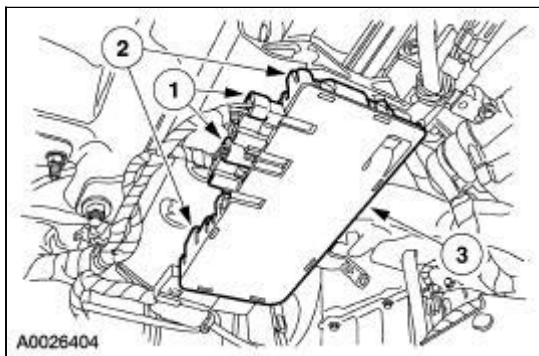


All vehicles

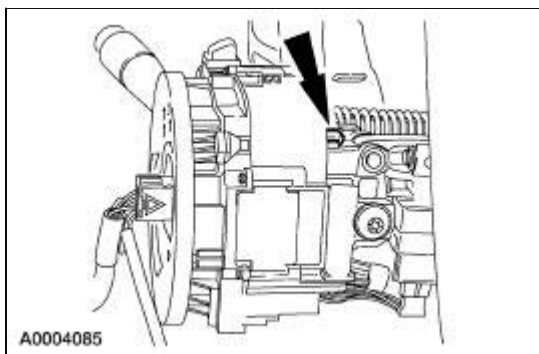
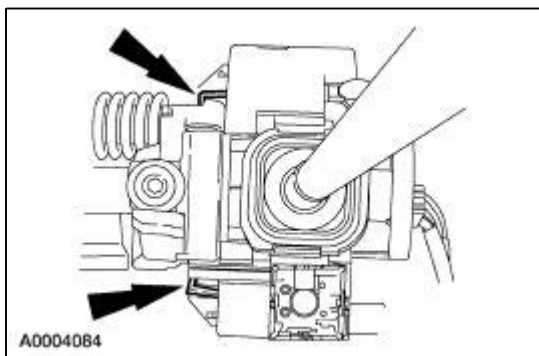
16. Disconnect the steering column position sensor electrical connector.



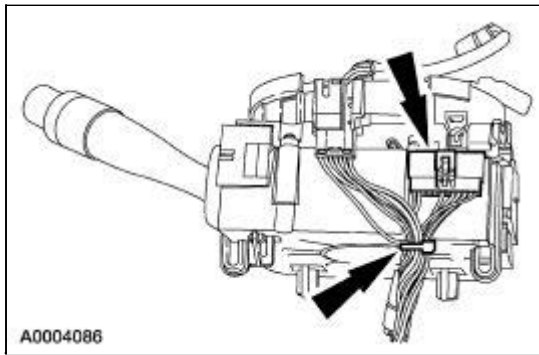
17. Separate the clockspring electrical connector assembly from the steering column.
1. Disconnect the remaining clockspring electrical connectors.
 2. Release the four clockspring connector assembly retaining clips (two shown).
 3. Separate the clockspring electrical connector assembly from the steering column.



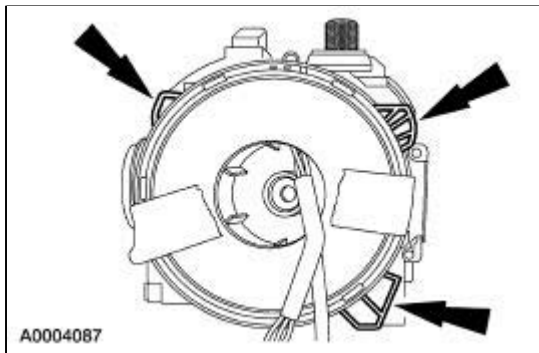
18. Releasing the three clips, remove the clockspring with the multi-function switch.



19. Cut the tie strap. Disconnect the electrical connector.



20. Releasing the tabs, separate the clockspring from the multi-function switch.



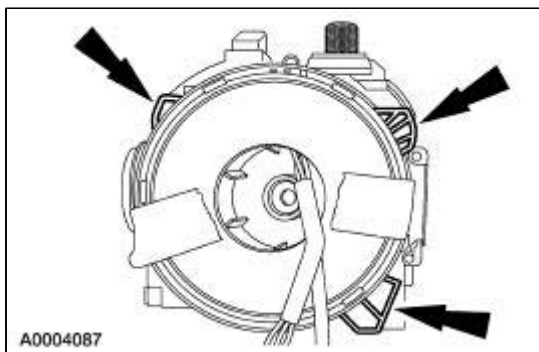
Installation



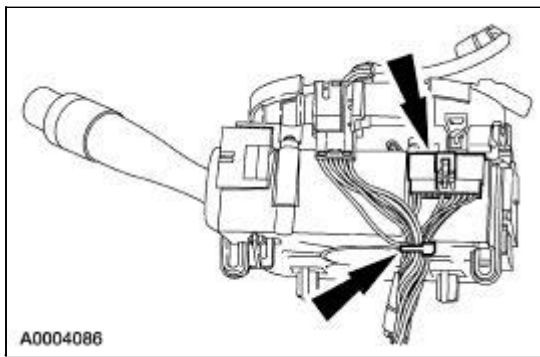
WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions and notes at the beginning of the removal procedure.

All vehicles

1. Align the clockspring to the multi-function switch and attach the two, engaging the retaining tabs.



2. Connect the electrical connector. Install a new tie strap to secure the wire harness.

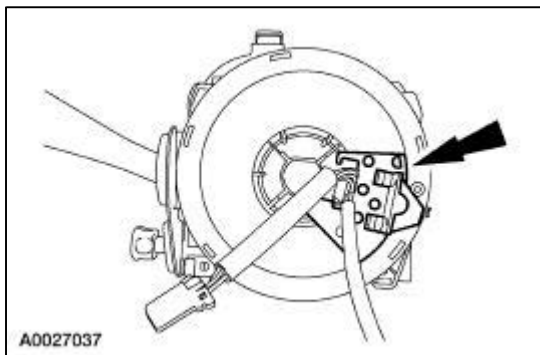


Vehicles receiving a new clockspring


3. **NOTE:** A new clockspring is supplied in a centralized position and held there with a key.

Remove the key from the clockspring, holding the rotor in its centralized position.

- Do not allow the clockspring rotor to turn from this position.




Vehicles needing clockspring recentering

4.  **WARNING:** Incorrect centralization may result in premature component failure. If in doubt when centralizing the clockspring, repeat the centralizing procedure. Failure to follow this instruction may result in personal injury.

 **CAUTION:** Make sure the road wheels are in the straight ahead position.

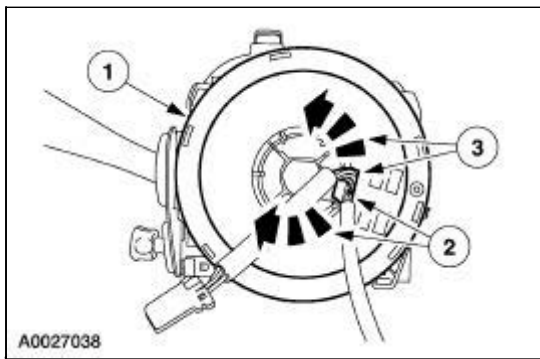
NOTE: If a clockspring has rotated out of center, follow through with this step.

Centralize the clockspring.

1. Hold the clockspring outer housing stationary.
2.  **CAUTION:** Overturning will destroy the clockspring. The internal ribbon wire acts as the stop and can be broken from its internal connection.

While turning the rotor clockwise, carefully feel for the ribbon wire to run out of length, and a slight resistance is felt. Stop turning at this point.

3. Turn the rotor counterclockwise 2-1/2 turns. This is the center point of the clockspring.
 - Do not allow the rotor to turn from this position.



Vehicle repairs reusing the same clockspring

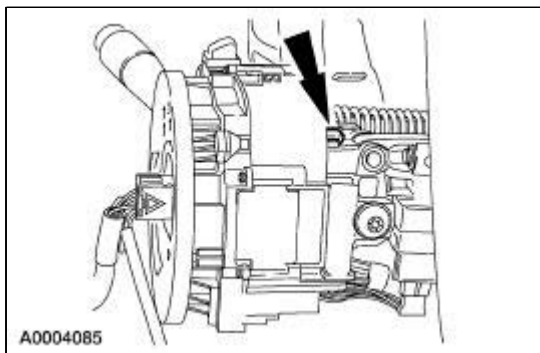
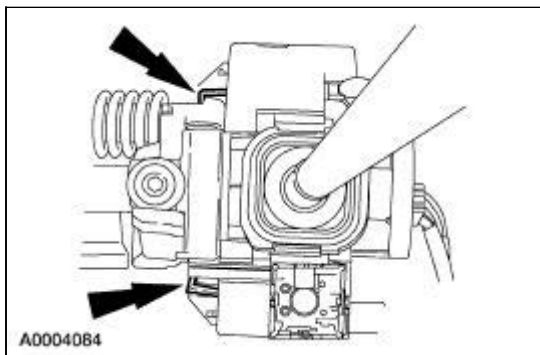
5. **NOTE:** When the tape is removed, do not allow the clockspring to turn.

Remove the tape applied during clockspring removal.

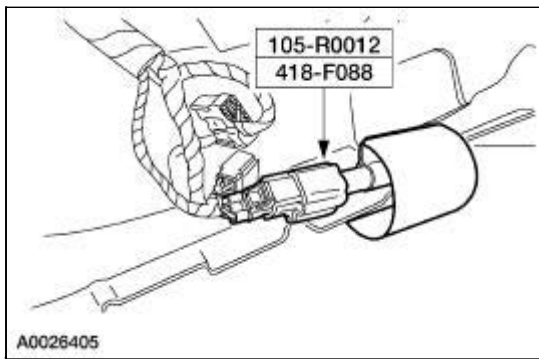
All vehicles

6. **NOTE:** Slight turning of the clockspring rotor is allowable for alignment purposes to the steering column.

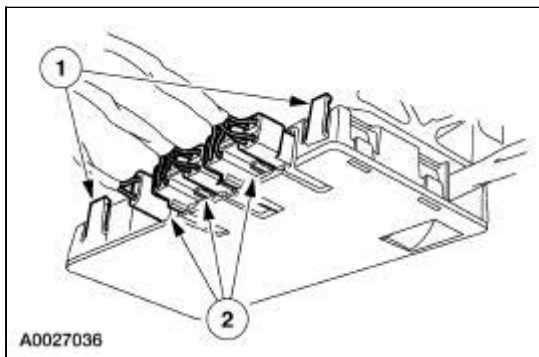
With the flats of the clockspring aligned to the flats of the steering column, slide the clockspring onto the steering column engaging the retaining tabs.



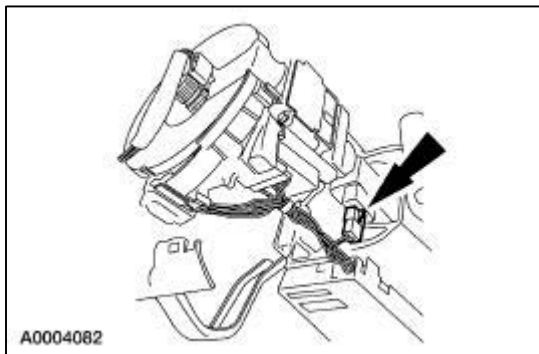
7. Remove the restraint system diagnostic tool from the vehicle harness side of the clockspring electrical connector.



8. Install and connect the clockspring electrical connector assembly.
 1. Align the clockspring electrical connector assembly to the steering column and engage the four retaining tabs (two shown).
 2. Connect the clockspring electrical connector assembly electrical connectors.

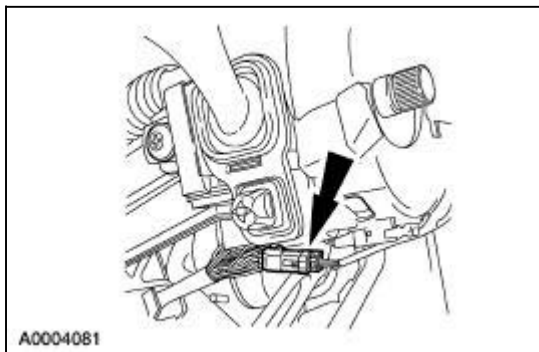


9. Connect the steering column position sensor electrical connector.



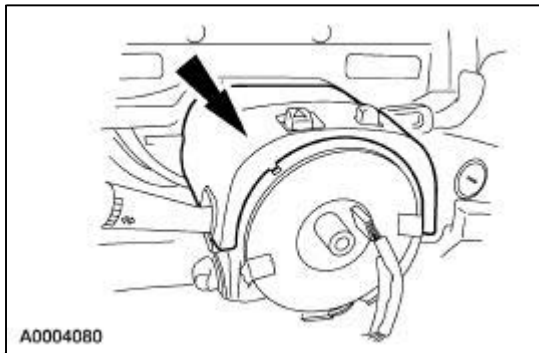
Vehicles with hands free microphone

10. Connect the microphone electrical connector.

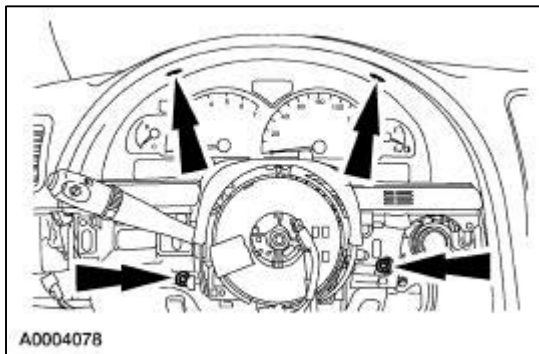


All vehicles

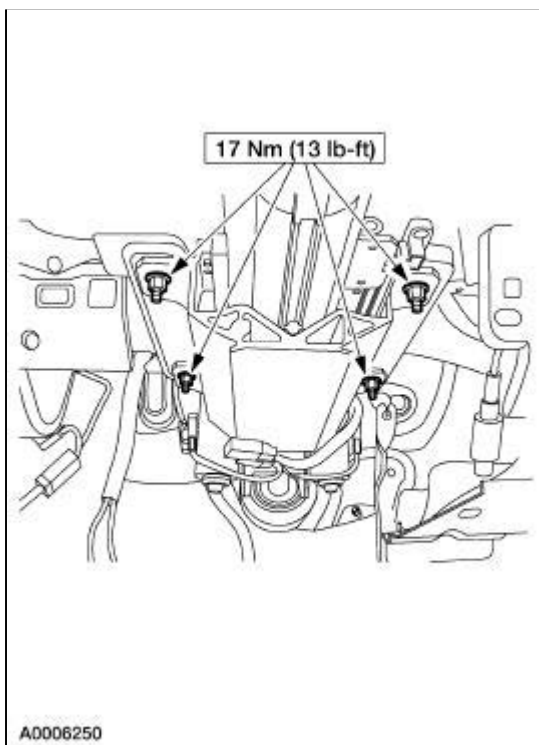
11. Position the upper steering column shroud.



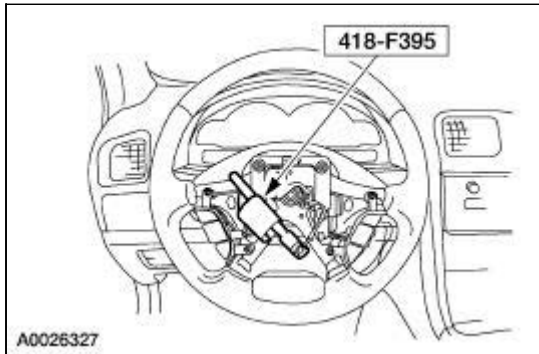
12. Align the instrument cluster finish panel to the instrument panel and install the four screws.
 - Install the automatic temperature sensor to the instrument cluster finish panel (not shown).



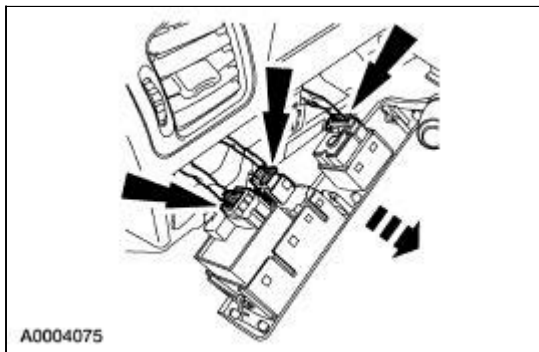
13. Install the nuts.



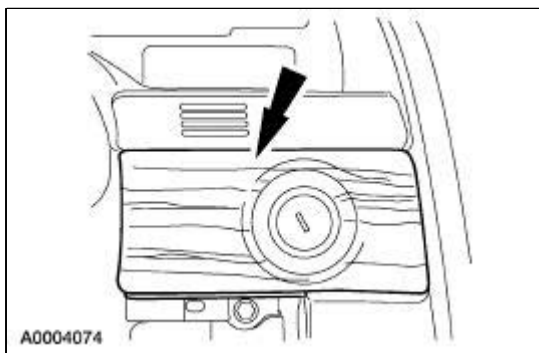
14. Install the steering wheel. Do not install the driver air bag module at this time. For additional information, refer to [Section 211-04](#).
15. Attach the restraint system diagnostic tool to the clockspring electrical connector at the top of the steering column.



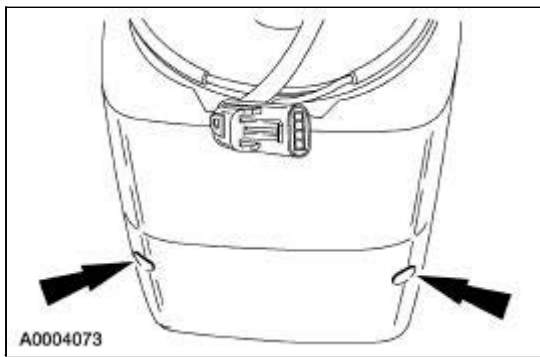
16. Connect the battery ground cable. For additional information, refer to [Section 414-01](#).
17. With the restraint system diagnostic tools installed at all deployable devices, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.
18. Disconnect the battery ground cable and wait at least one minute. For additional information, refer to [Section 414-01](#).
19. Connect the electrical connectors. Aligning the retaining clips, install the headlight switch panel.



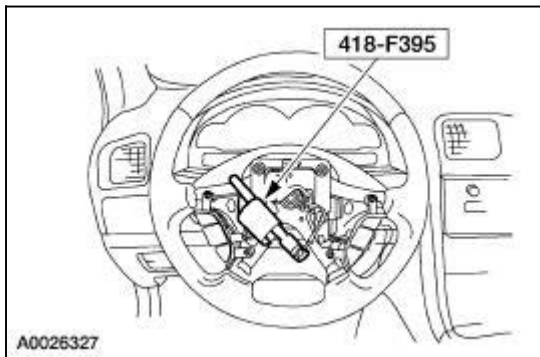
20. Align the ignition switch finish panel and push in, seating the retaining clips.



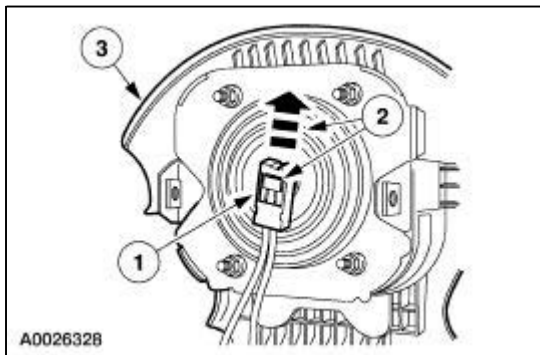
21. Position the lower steering column shroud. Install the screws.



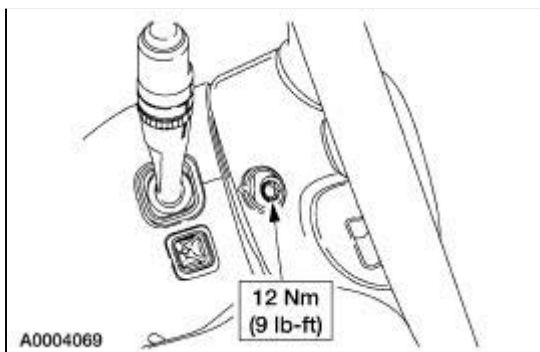
22. Remove the restraint system diagnostic tool from the clockspring electrical connector at the top of the steering column.



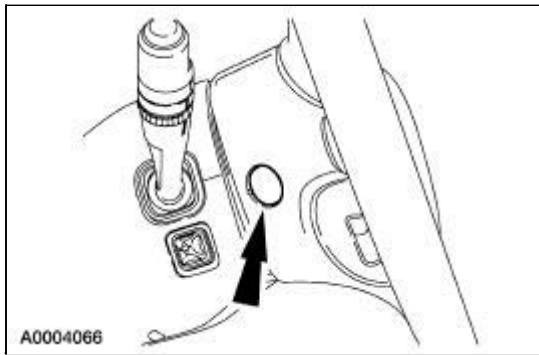
23. Connect and position the driver air bag module to the steering wheel.
1. Connect the driver air bag module electrical connector.
 2. Slide and engage the driver air bag module electrical connector locking clip.
 3. Position the driver air bag module to the steering wheel.




24. Install the two driver air bag module bolts.




25. Install the two steering wheel back cover plugs.



26. Restore the vehicle to operating condition.

1.  **WARNING: To reduce the risk of serious personal injury, read and follow all warnings, cautions, notes, and instructions in the supplemental restraint system (SRS) deactivation/reactivation procedure.**

Reactivate the supplemental restraint system (SRS). For additional information, refer to [Supplemental Restraint System \(SRS\) Deactivation and Reactivation](#) in this section.

2.  **WARNING: The restraint system diagnostic tool is for restraint system service only. Remove from the vehicle prior to road use. Failure to remove could result in injury and possible violation of vehicle safety standards.**

With all the restraint system diagnostic tools removed, prove out the supplemental restraint system (SRS). For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) in this section.

General Specifications

Item	Specification
Fluid/Lubricant Specification	
Premium Life Long Grease XG-1-K	ESA-M1C75-B

Torque Specifications

Description	Nm	lb-ft	lb-in
A/C and power steering bracket bolts	10	—	89
Balance nuts	24	18	—
Center bearing bracket bolts	40	30	—
Control arm cam nuts	175	129	—
Driveshaft yoke adjuster	90	66	—
Engine crossmember bolts	103	76	—
Engine mount nuts	63	46	—
Flex coupling bolts	85	63	—
Flex coupling nuts	85	63	—
Front brake capiler bolts	35	26	—
Front I-brace bolts (front)	55	41	—
Front I-brace bolts (rear)	30	22	—
Front I-brace bracket shoulder bolt	30	22	—
Front strut mount bolts	175	129	—
Power steering gear bolts	103	76	—
Radiator support crossmember bolts	103	76	—
Rear anti-lock brake sensor bolts	9	—	80
Rear brake hose bolts	47	35	—
Rear shock mount bolts	133	98	—
Rear subframe bolts	103	76	—
Stabilizer bar bolts	55	41	—
Stabilizer bar link nuts	55	41	—
Tie rod end nuts	80	59	—
Upper ball joint nuts	90	66	—
Water control valve bracket nuts	9	—	80

Body Misalignment Check



CAUTION: Do not attempt to correct any serious misalignment with one pulling/pushing operation. Damage to the structure could occur.

NOTE: All body alignment measurements should be made without trim and from metal to metal.

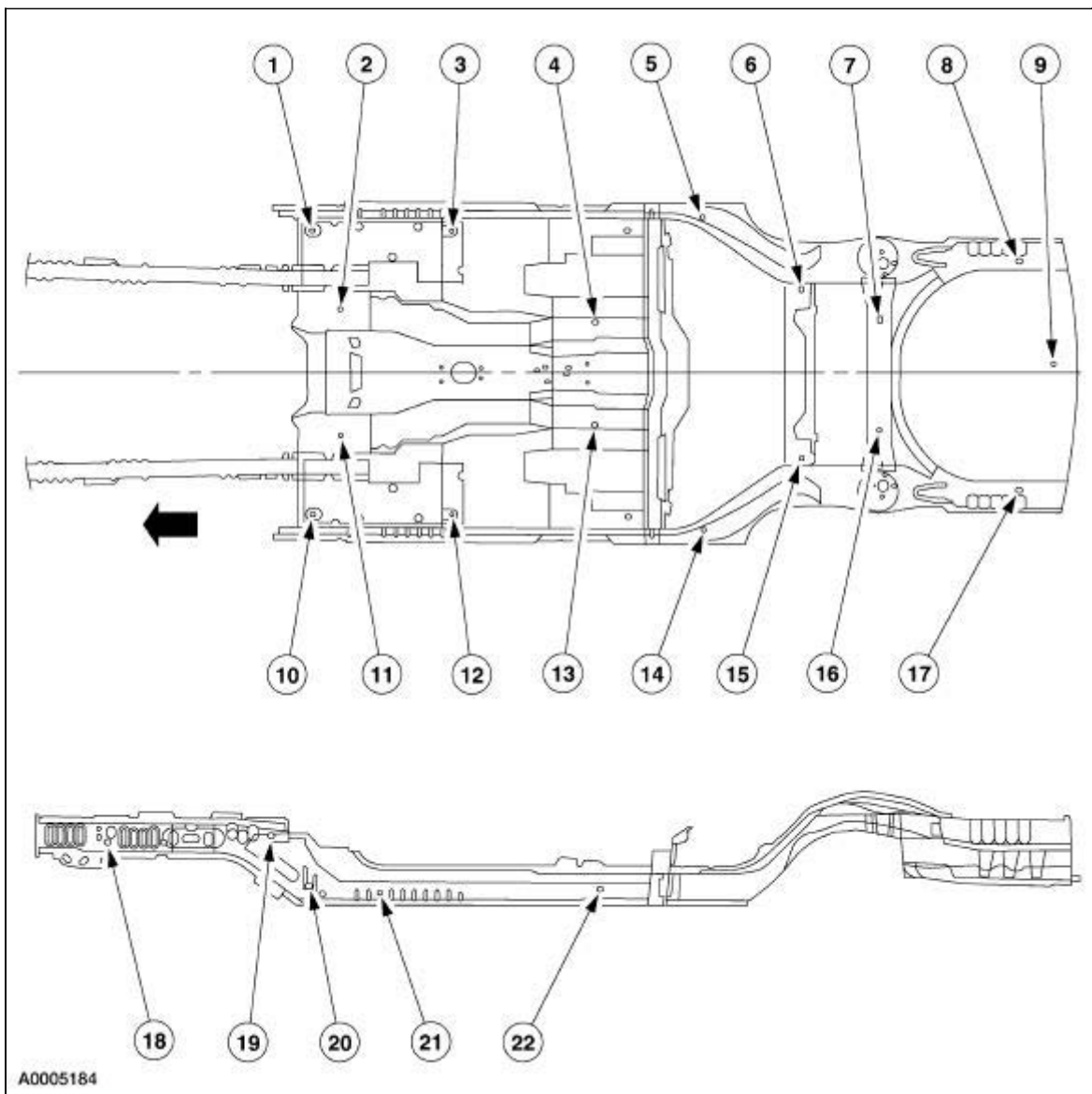
1. To check the body alignment, take two opposite diagonal measurements between the front, center or rear pillars. Take the measurements between reference points, such as crease lines or weld joints which are diagonally opposite each other on the two pillars being measured.
-

Underbody Misalignment Check

1. The dimensions of the underbody must be restored to provide the correct front and rear wheel alignment geometry.
2. All the dimensions are measured between the centers of the existing holes in the underbody unless otherwise specified.
3. Inspect all underbody structural members for cracks, twists or bends. Check all welded connections for cracks. Inspect the support brackets for looseness. Carry out any necessary repairs or install new components as necessary.
4. The X axis is referenced from the front of the vehicle. The Y axis is referenced from the center line of the vehicle.

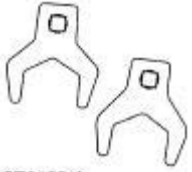
Underbody Dimensions

Dimension	X axis mm(in)	Y axis mm(in)
1	2,044.59 mm (80.49 in)	614 mm (24.17 in)
2	2,164 mm (85.19 in)	273 mm (10.74 in)
3	2,643 mm (104.05 in)	614 mm (24.17 in)
4	3,258 mm (128.26 in)	224 mm (8.81 in)
5	3,275 mm (146.65 in)	675 mm (26.57 in)
6	4,150 mm (163.38 in)	365 mm (14.37 in)
7	4,490 mm (176.77 in)	240 mm (9.44 in)
8	5,100 mm (200.78 in)	500 mm (19.68)
9	5,250 mm (206.69 in)	50 mm (1.96)
10	2,044.59 mm (80.49 in)	614 mm (24.17 in)
11	2,164 mm (85.19 in)	273 mm (10.74 in)
12	2,643 mm (104.05 in)	614 mm (24.17 in)
13	3,258 mm (128.26 in)	224 mm (8.81 in)
14	3,725 mm (146.65 in)	675 mm (26.57 in)
15	4,150 mm (163.38 in)	365 mm (14.37 in)
16	4,490 mm (176.77 in)	240 mm (9.44 in)
17	5,100 mm (200.78 in)	500 mm (19.68 in)
18	1,118 mm (44.01 in)	—
19	1,825 mm (71.85 in)	—
20	1,990 mm (78.34 in)	—
21	2,300 mm (90.55 in)	—
22	3,258 mm (128.26 in)	—



Subframe —Rear

Special Tool(s)

 ST2455-A	Torque Wrench, Driveshaft Coupler 205-474
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Removal

NOTE: If a new rear subframe is to be installed, the differential and halfshafts must be removed prior to removal of the rear subframe. For all other procedures, the differential, halfshafts and rear subframe are to be removed as an assembly.


All

1. Drain the fuel tank. For additional information, refer to [Section 310-00](#).
2. Remove the rear wheel and tire assemblies. For additional information, refer to [Section 204-04](#).

Installing a new rear subframe only

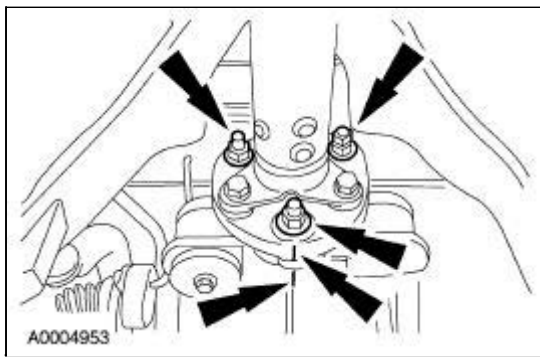
3. Remove the differential and halfshafts. Refer to [Section 205-02](#).

Removing rear subframe assembly (differential and halfshafts attached)

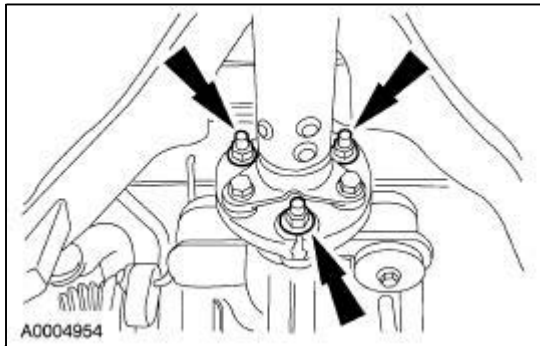
4. Remove the muffler and rear heat shield. For additional information, refer to [Section 309-00](#).
5.  **CAUTION: The differential companion flange bolts, nuts and washers must be removed as matched pairs and installed in the original location. The system balance add-on nuts must be installed in the original location.**

NOTE: Make sure to disconnect the flexible coupling only from the differential companion flange.

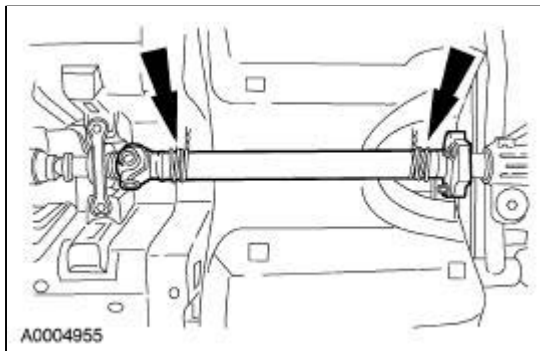
Using different color paint markers, place index matchmarks on the differential companion flange, driveshaft flexible coupling and the differential companion flange bolts, nuts, washers and system balance add-on nuts so the driveshaft and differential may be realigned during installation.



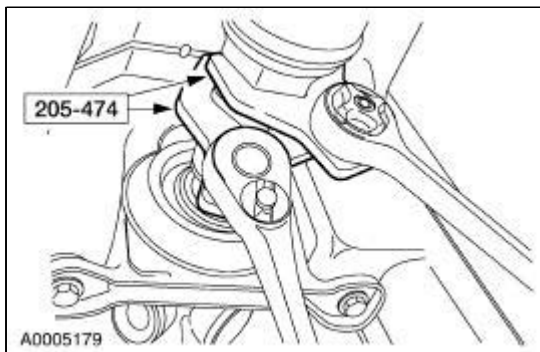
6. Remove the flex coupling bolts, nuts and washers.
 - If equipped, remove the balance nuts prior to the removal of the flex coupling nuts.



7. Support the driveshaft at the center and rear.



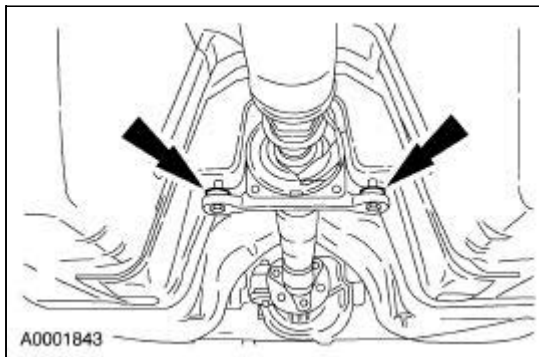
8. Using the special tools, loosen the driveshaft yoke adjuster nut.



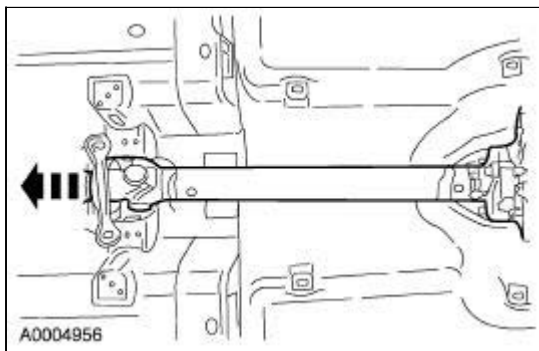
9. **NOTE:** There are shims between the center bearing mounting bracket and the body.

NOTE: The shims must be installed in the original location.

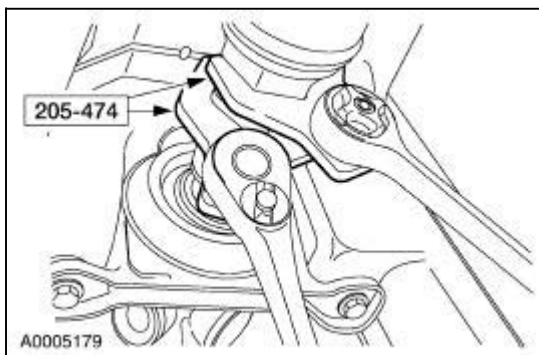
Remove the center bearing bracket bolts and the shims.



10. Slide the rear driveshaft to the full forward position.

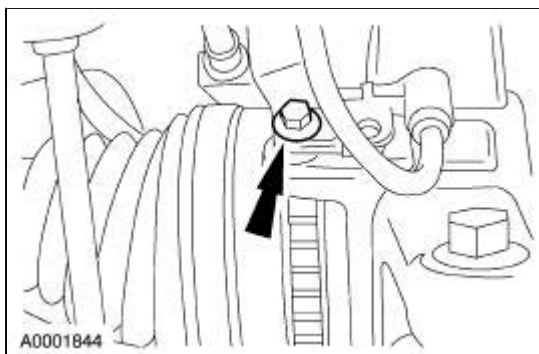


11. Using the special tools, tighten the driveshaft yoke adjuster nut.

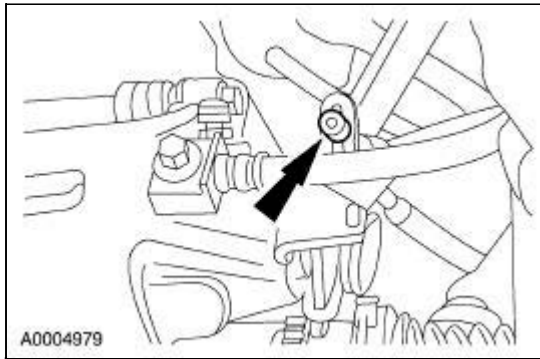


All

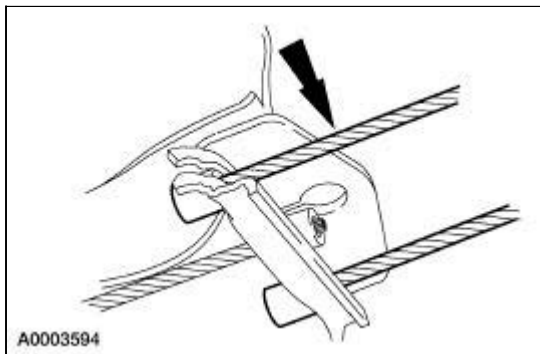
12. Remove the two bolts and position the rear anti-lock brake sensors aside.



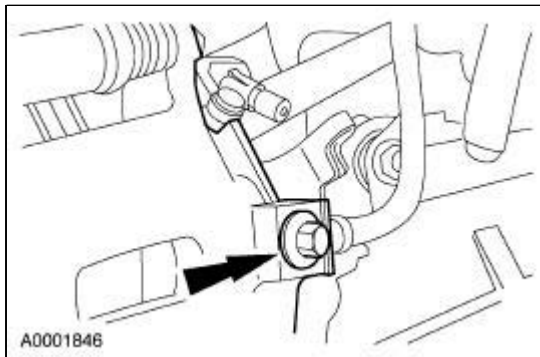
13. Disconnect the two rear parking brake cables.



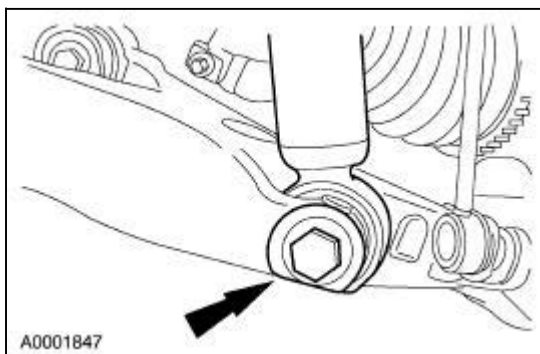
14. Disconnect the two parking brake cables from the junction bracket located to the rear of the fuel tank.



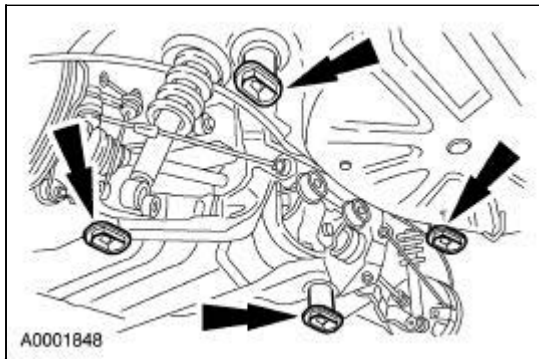
15. Remove the two bolts and position the rear brake hoses aside.




16. Remove and discard the two lower rear shock mount bolts.

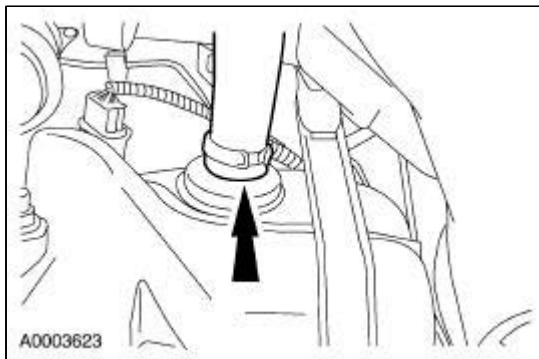


17. Paint or mark the position of the subframe to the body for assembly reference.

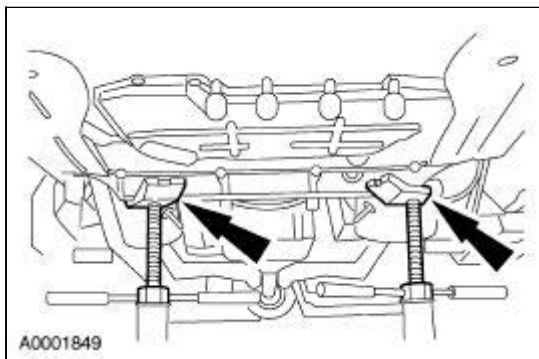


18.  **CAUTION:** Make sure to remove any residual fuel from the fuel filler hose prior to removal to avoid potential spillage.

Loosen the clamp and remove the fuel filler hose from the fuel tank.

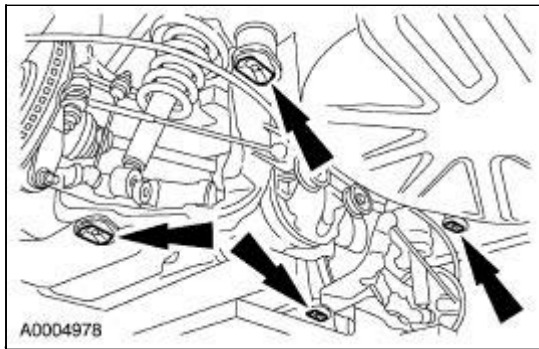


19. Support the vehicle with jack stands at the engine crossmember.



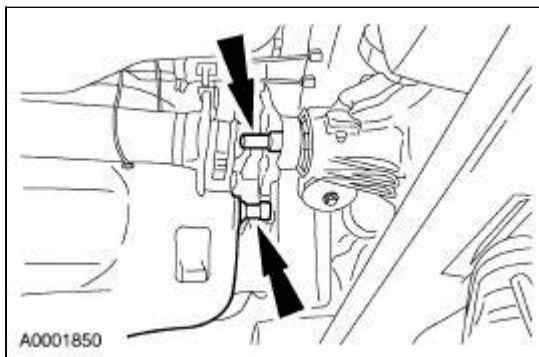
20.  **WARNING:** Make sure the rear subframe is secured to the lift table. Failure to follow these instructions may result in personal injury.

Position the lift table under the rear subframe and remove the rear subframe bolts.



21. **NOTE:** Make sure to clear the fuel filler tube and the differential pinion stem during the subframe removal.

Lower the rear subframe.

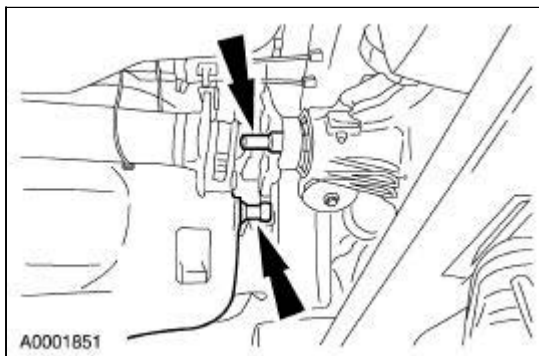


Installation

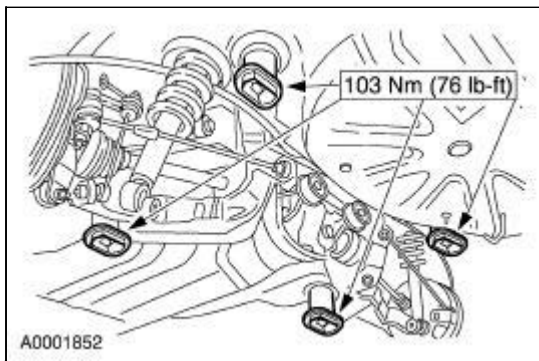
All

1. **NOTE:** Make sure the subframe clears the fuel filler tube and that the differential pinion stem aligns with the driveshaft.

Raise the subframe into contact with the body and hand-start the rear subframe bolts.



2. Align the location marks.
3. Tighten the rear subframe bolts.

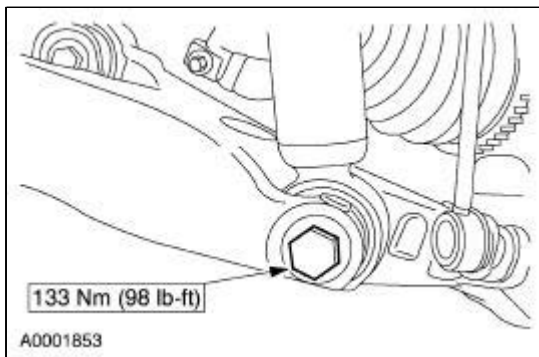


Installing a new rear subframe only

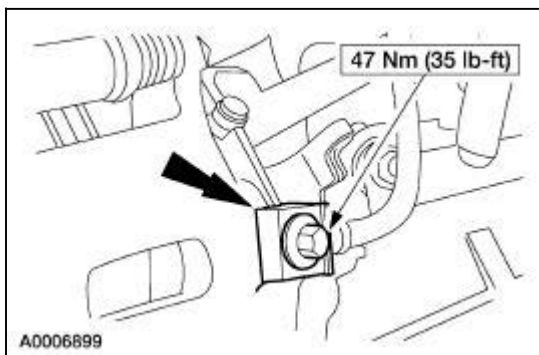
4. Install the differential and halfshafts. Refer to [Section 205-02](#).

All

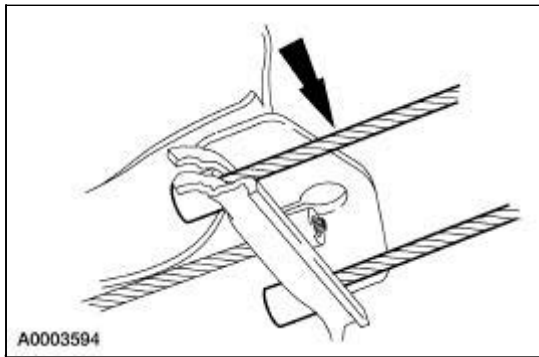
5. Install the two new lower rear shock mount bolts.



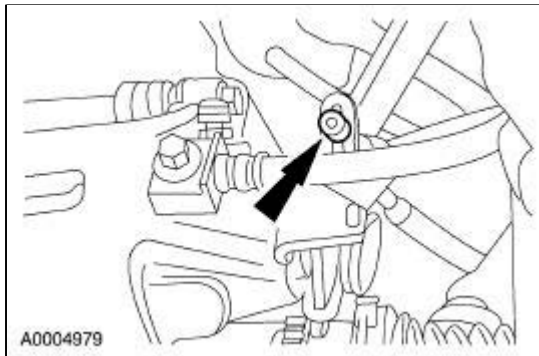
6. Position the two rear brake hoses and install the bolts.



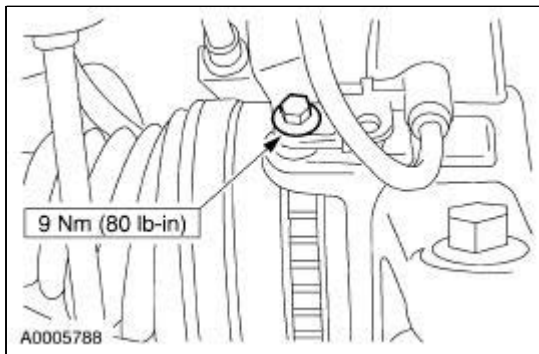
7. Connect the two parking brake cables to the junction bracket located to the rear of the fuel tank.



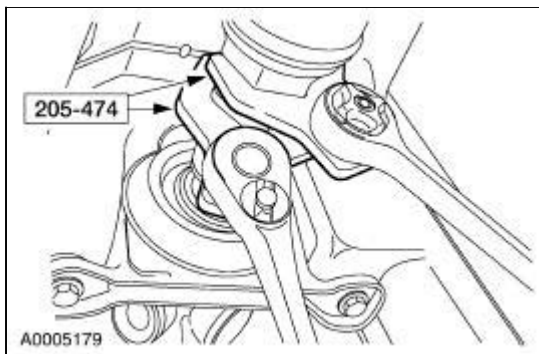
8. Connect the two rear parking brake cables.



9. Position the two rear anti-lock brake sensors and install the bolts.



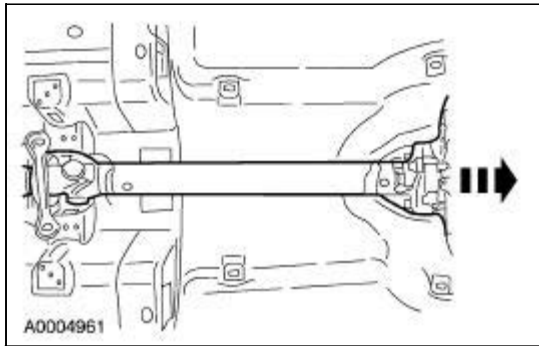
10. Using the special tools, loosen the driveshaft yoke adjuster nut.



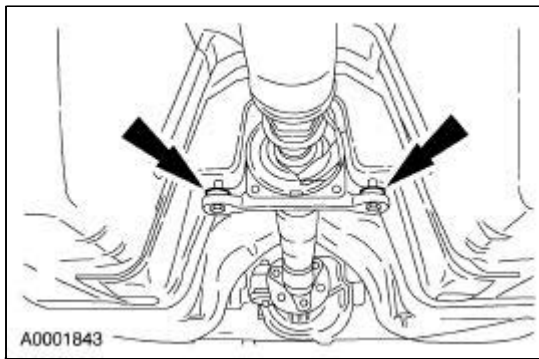
11. **NOTE:** Install one gram (0.04 ounce) of Premium Long Life Grease, XG-1-K or equivalent meeting Ford specification ESA-M1C75-B, in the alignment bushing prior to installation.

Slide the driveshaft rearward until the flexible coupling engages with the differential companion

flange.



12. **NOTE:** Make sure to install the shims between the center bearing bracket and the floor pan. Install the shims in their original position and loosely install the center bearing bracket bolts.

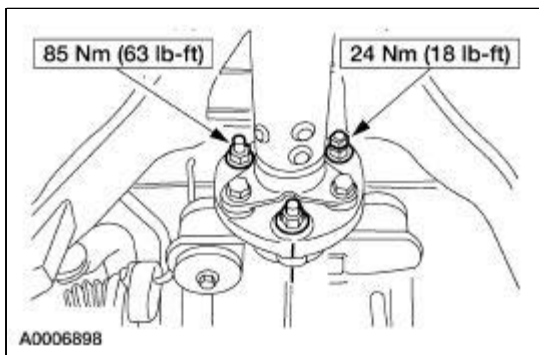


13. **NOTE:** Align the driveshaft index matchmarks.

NOTE: Make sure to match the bolts, washers, attaching nuts and balance nuts (if equipped) to their original locations.

Install the flex coupling bolts, attaching nuts and washers.

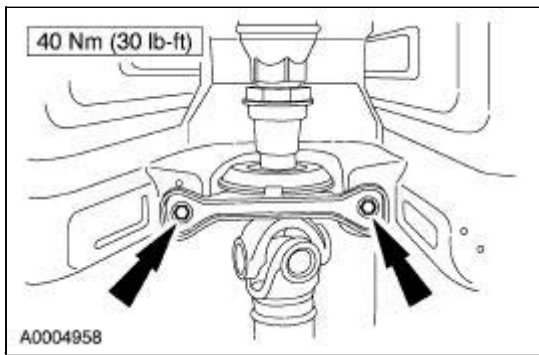
- If equipped, install the balance nut(s).



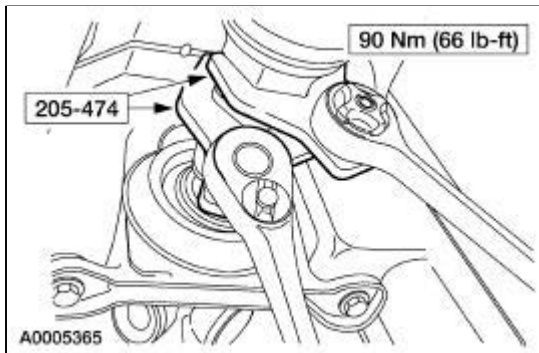
14. **NOTE:** Tighten the bolts using hand tools only.

NOTE: Avoid twisting the center bearing bracket when tightening.

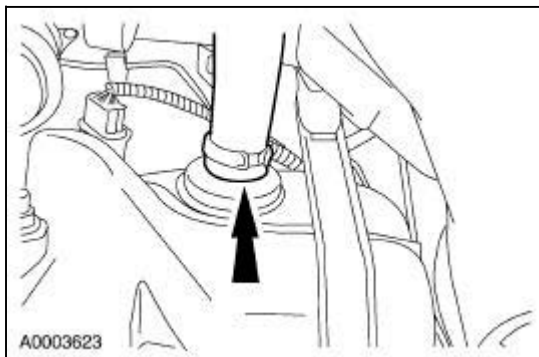
Tighten the center bearing bracket bolts evenly.



- Using the special tools, tighten the driveshaft yoke adjuster nut.



- Install the rear heat shield and muffler exhaust system. For additional information, refer to [Section 309-00](#).
- Install the fuel filler hose and tighten the clamp.



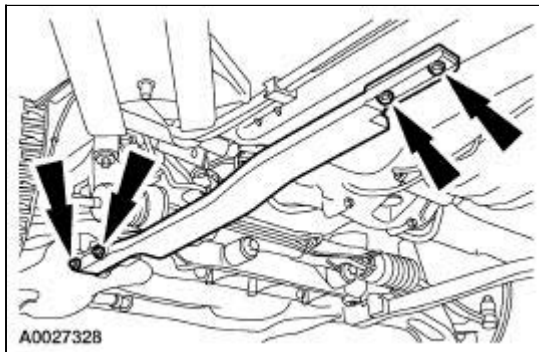
- Install the rear wheel and tire assemblies. For additional information, refer to [Section 204-04](#).
 - Bleed the brake system. For additional information, refer to [Section 206-00](#).
 - Refill the fuel tank.
 - Check and adjust rear alignment. For additional information, refer to [Section 204-00](#).
 - Test drive the vehicle. If any vibration is present, refer to [Section 100-04](#).
-

Crossmember —Front

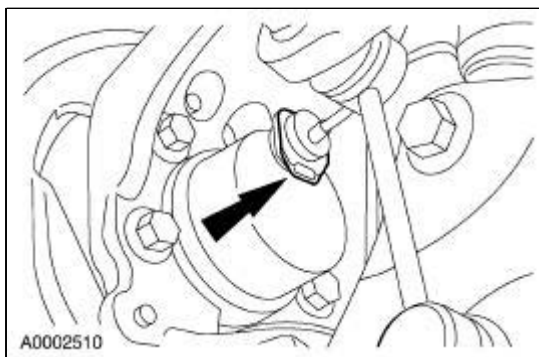
Removal

All vehicles

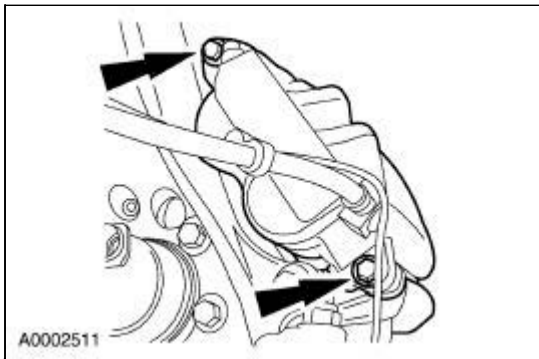
1. Remove the upper radiator sight shield.
2. Support the radiator to the upper radiator support.
3. Install the three-bar engine support.
4. Remove the front wheel and tire assemblies. For additional information, refer to [Section 204-04](#).
5. Remove the eight bolts and the two front I-braces.
 - Discard the bolts.



6. Remove the two clips and position the front anti-lock brake sensors aside.

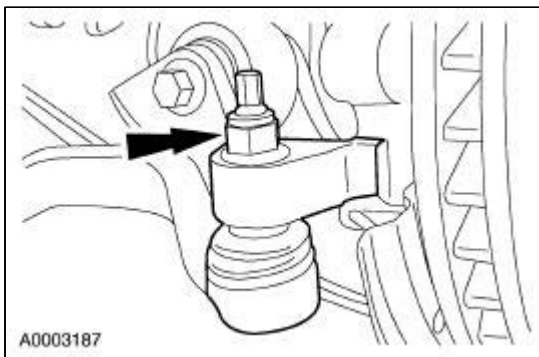


7. Remove the four bolts, support and position the front brake calipers aside.



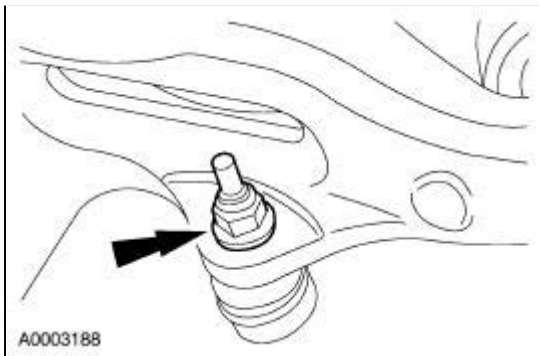
8.  **CAUTION: Hold the external hex of the tie rods when removing the nuts.**

Remove and discard the two nuts and separate the tie rod ends from the front spindles.



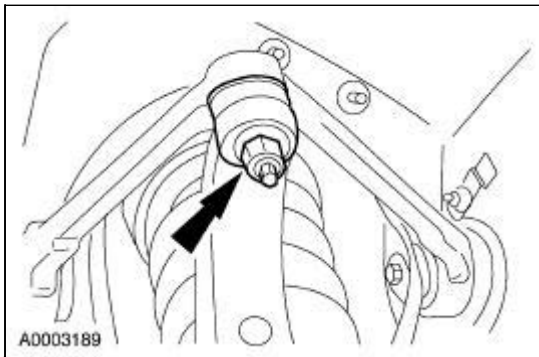
9.  **CAUTION: Hold the external hex of the stabilizer bar links when removing the nuts.**

Remove and discard the two nuts and separate the stabilizer bar links from the lower control arm and position aside.

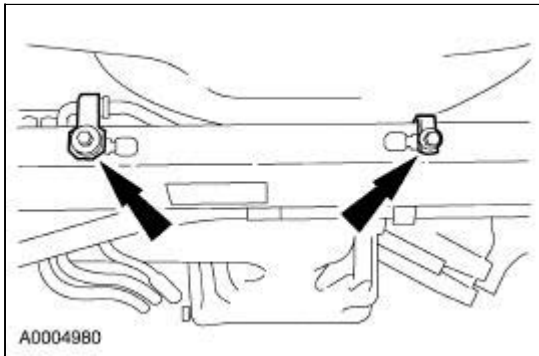


10.  **CAUTION: Hold the external hex of the ball joints when removing the nuts.**

Remove and discard the nuts and separate the upper ball joint from the spindle.

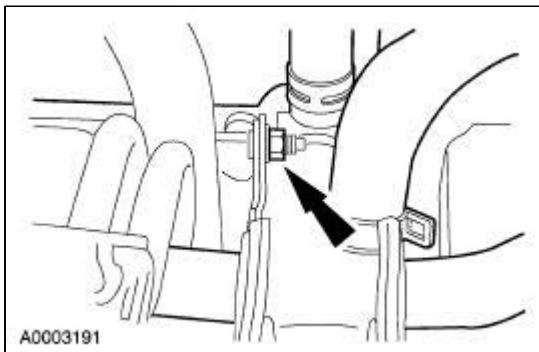


11. Remove the underbody splash shields.
12. Remove the A/C and power steering line bracket bolts.



13. **NOTE:** The nut is most easily accessed from above the front of the radiator support crossmember.

Loosen the nut two turns, remove the bolt and position the water control valve aside.

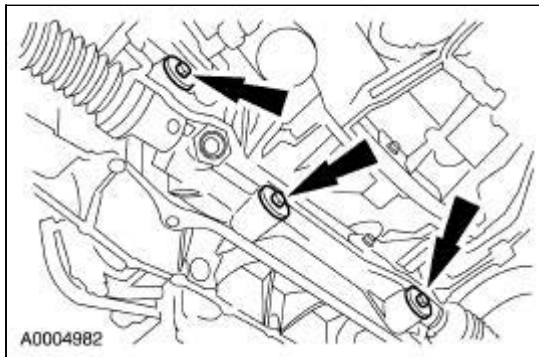


3.9L only

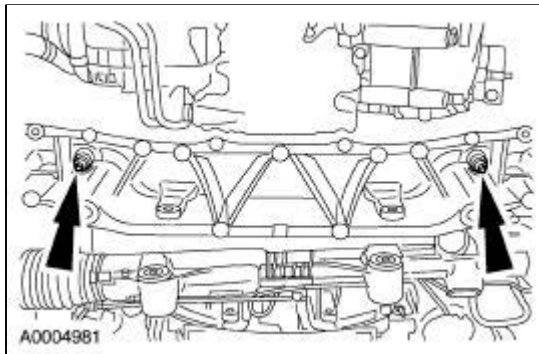
14. Remove the block heater harness retainer.

All vehicles

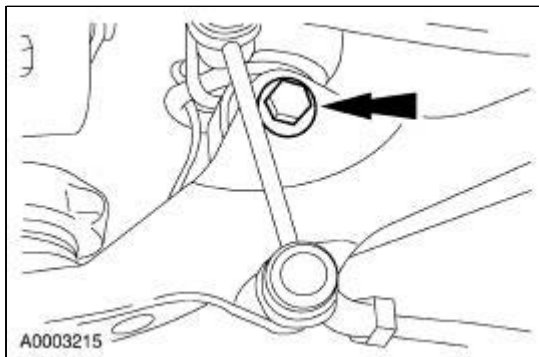
15. Remove the bolts, position and support the power steering gear aside.
 - Discard the nuts.



16. Remove the engine mount nuts.



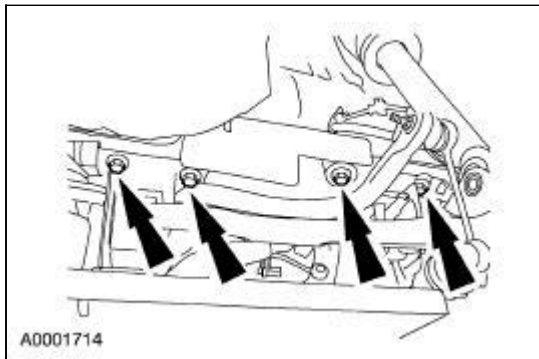
17. Remove and discard the lower front strut mount bolts.



18.  **WARNING:** Make sure the front crossmembers are secured to the lift table. Failure to follow these instructions may result in personal injury.

NOTE: Mark the right and left crossmember locations to the body.

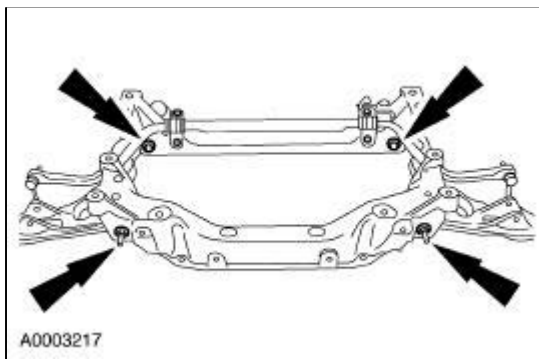
Position the lifting table under the two crossmembers and remove the four engine crossmember bolts and the four radiator support crossmember bolts.



19. Lower the radiator support and engine crossmembers as an assembly.

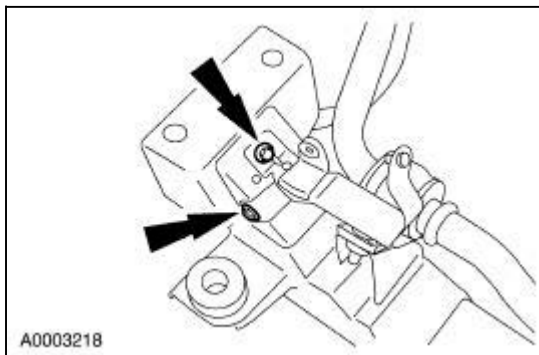
20. **NOTE:** Discard the control arm nuts and bolts.

Remove the control arm nuts and bolts.

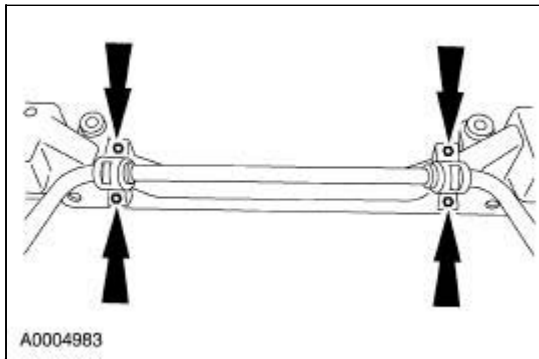


Radiator support crossmember removal

21. Remove the bolts and the water control valve bracket.



22. Remove and discard the bolts and position the stabilizer bar aside.

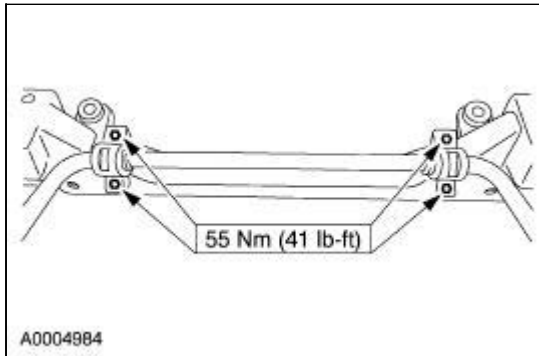


Installation

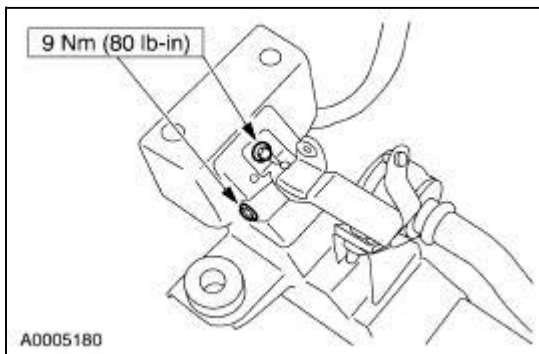
Radiator support crossmember

1. **NOTE:** The front I-brace shoulder bolt will have 1.5mm (0.059in) of clearance between the front I-brace bracket and the bolt. This is normal and the bolt should not be tightened any further.

Position the stabilizer bar and install the new bolts.

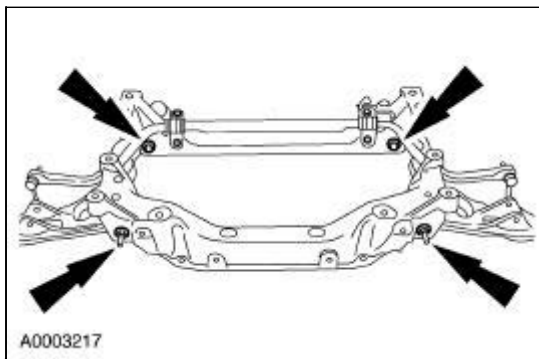


2. Position the water control valve bracket and install the bolts.



All vehicles

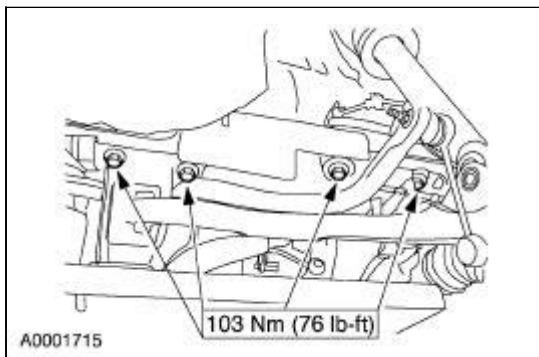
3. Loosely install the new control arm cam bolts and nuts.



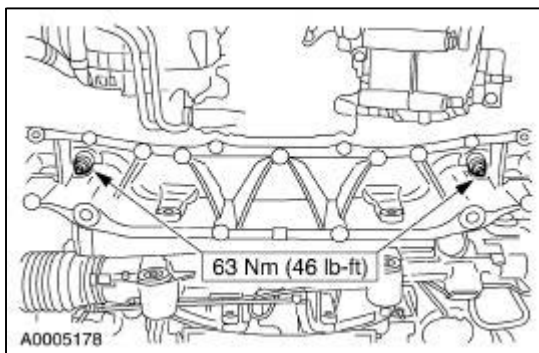
4. Position the radiator support and engine crossmembers as an assembly.
5. **NOTE:** Align the crossmember markings.

NOTE: Make sure the weight of the engine is not contacting the crossmember and make sure the crossmember assembly is in contact with the body before tightening the bolts.

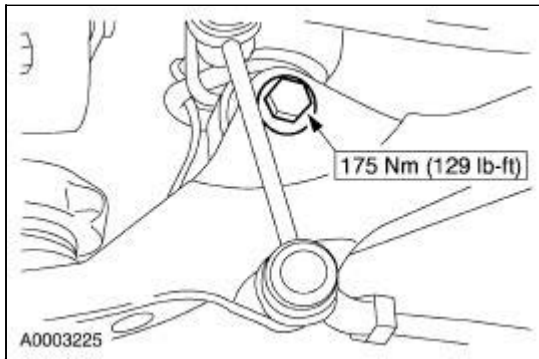
Install the four engine crossmember bolts and the four radiator support crossmember bolts.



6. Install the engine mount nuts.

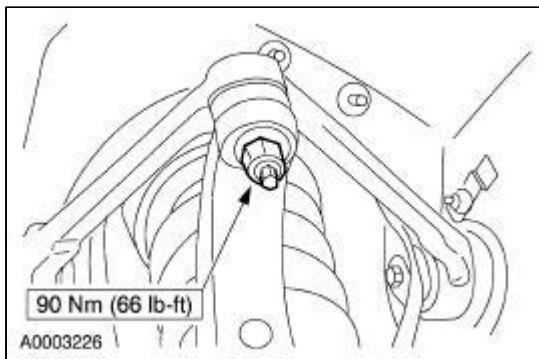



7. Install the new lower front strut mount bolts.



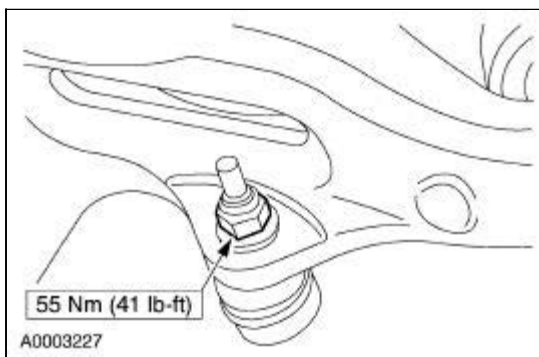
8.  **CAUTION: Hold the external hex of the ball joints when installing the nuts.**

Position the upper ball joints into the spindles and install the new nuts.

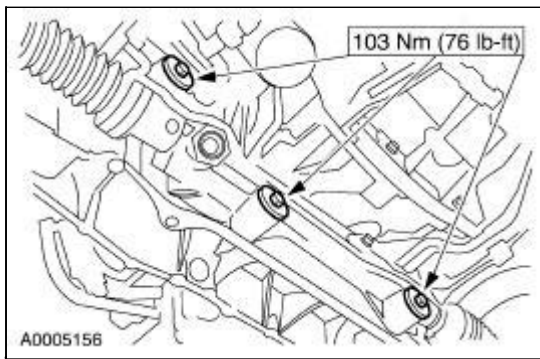


9.  **CAUTION: Hold the external hex of the stabilizer bar links when installing the nuts.**

Position the two stabilizer bar links into the lower control arm and install the new nuts.

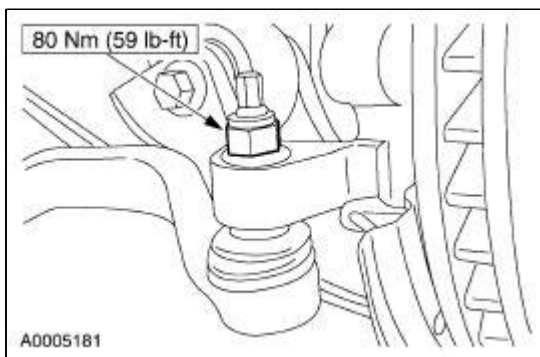


10. Position the power steering gear and install the bolts.

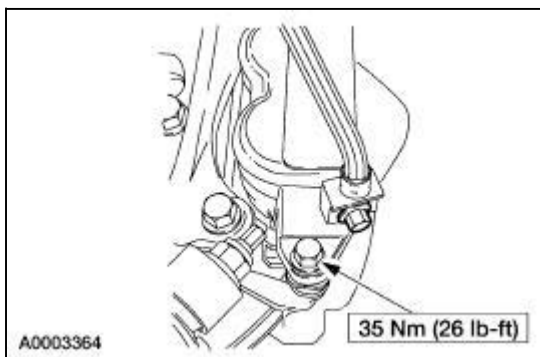


11.  **CAUTION: Hold the external hex of the tie rods when installing the nuts.**

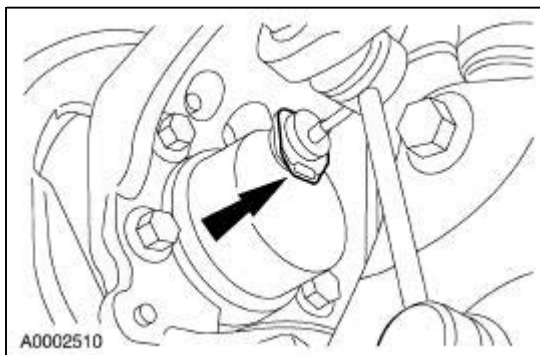
Position the two tie rod ends into the spindles and install the new nuts.



12. Position the two front brake calipers and install the bolts.



13. Position the two front anti-lock brake sensors and install the clips.

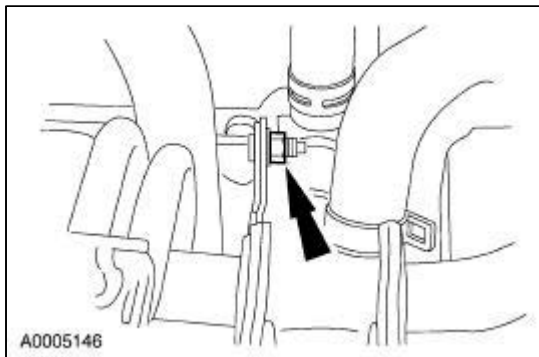


3.9L only

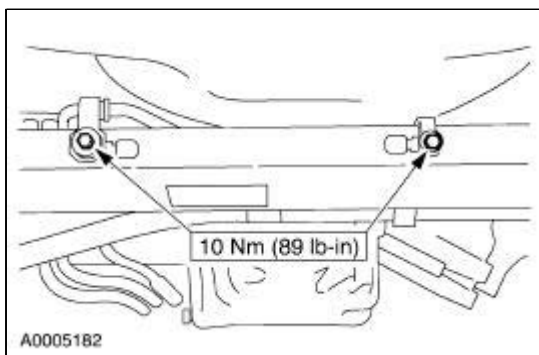
14. Install the block heater harness.

All vehicles

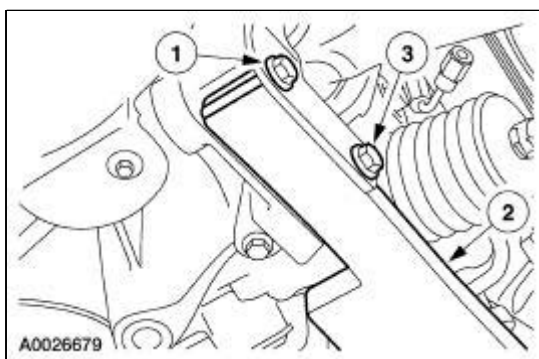
15. Position the water control valve and tighten the nut.



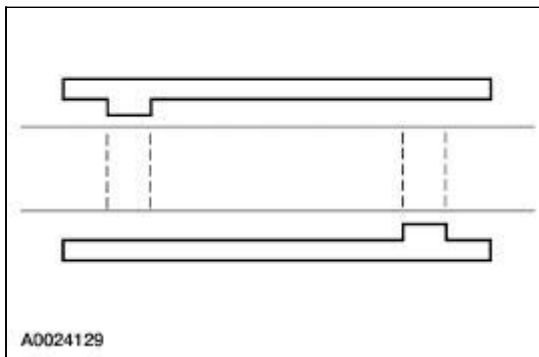
16. Position the A/C and power steering brackets and install the bolts.



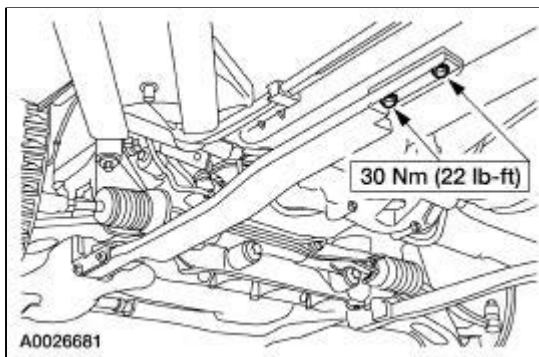
17. Position the two front I-braces and loosely install the four bolts.
 1. Loosely install the front bolts.
 2. Position the I-braces.
 3. Loosely install the rear bolts.



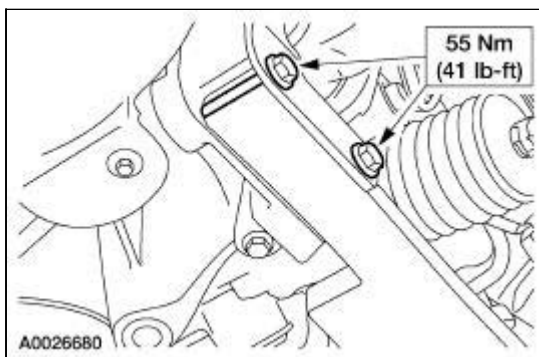
18. Make sure that the four front I-brace insulators are correctly positioned.



19. Install the four front I-brace bolts.



20. Tighten the four front I-brace bolts.

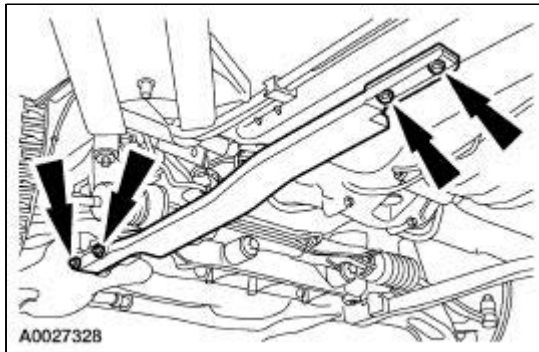


21. Install the underbody splash shields.
 22. Install the front wheel and tire assemblies. For additional information, refer to [Section 204-04](#).
 23. Remove the three-bar engine support.
 24. Remove the support from the radiator.
 25. Install the upper radiator sight shield.
 26. Align the front suspension. For additional information, refer to [Section 204-00](#).
-

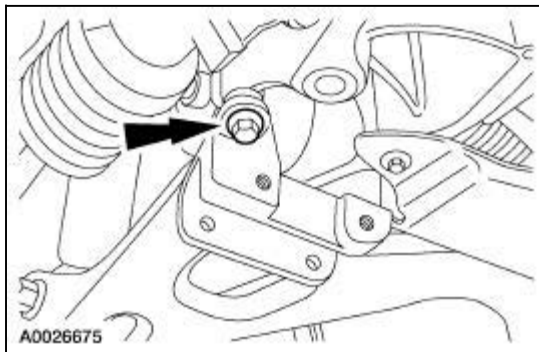
Crossmember —Front I-Brace Bracket

Removal

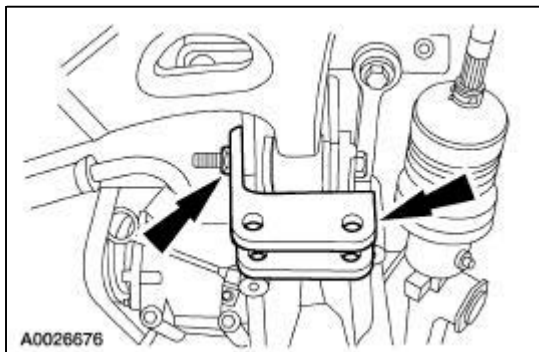
1. Raise and support the vehicle. For additional information, refer to [Section 100-02](#).
2. Remove the four bolts and the front I-brace. Discard the bolts.



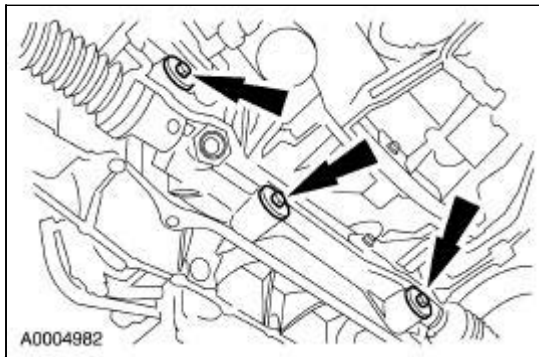
3. Remove and discard the front I-brace bracket shoulder bolt.



4. Remove the rear lower control arm nut and the front I-brace bracket. Discard the nut.



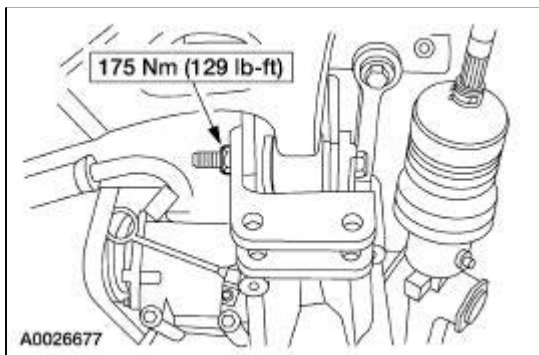
5. Remove the bolts and position the power steering gear aside.
 - Discard the nuts.



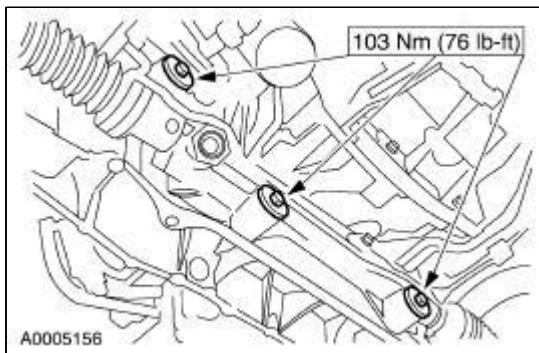
6. Remove and discard the rear lower control arm bolt.

Installation

1. Position the front I-brace bracket and install the rear lower control arm cam bolt and nut.

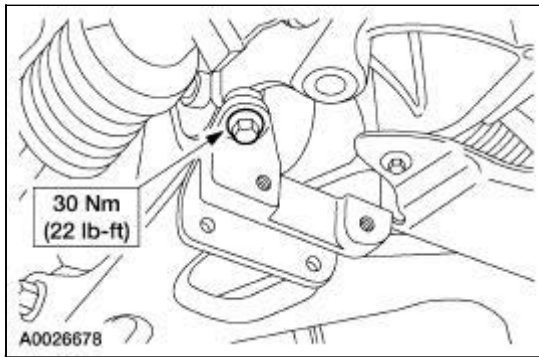


2. Position the power steering gear and install the bolts.

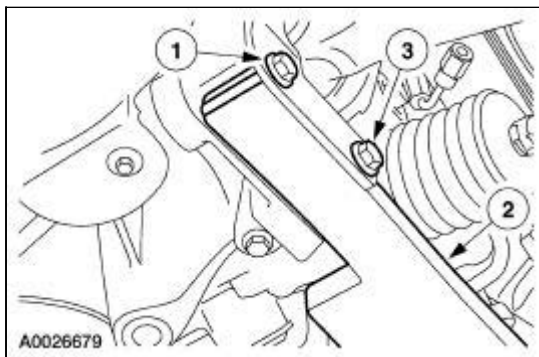


3. **NOTE:** The front I-brace shoulder bolt will have 1.5mm (0.059in) if clearance between the front I-brace bracket and the bolt. This is normal and the bolt should not be tightened any further.

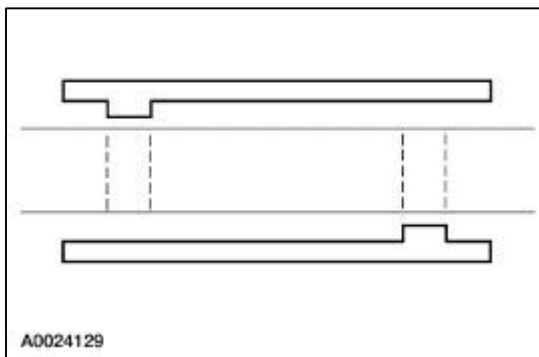
Install the front I-brace bracket shoulder bolt.



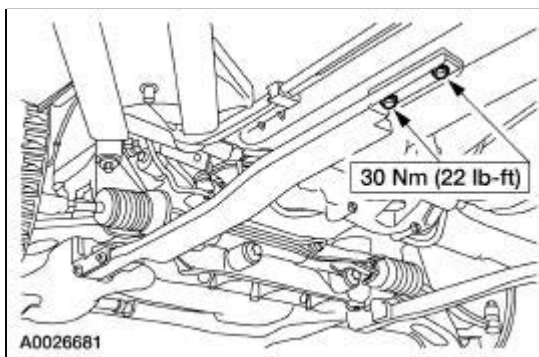
4. Position the front I-brace and loosely install the bolts.
 1. Loosely install the front bolt.
 2. Position the front I-brace.
 3. Loosely install the rear bolt.



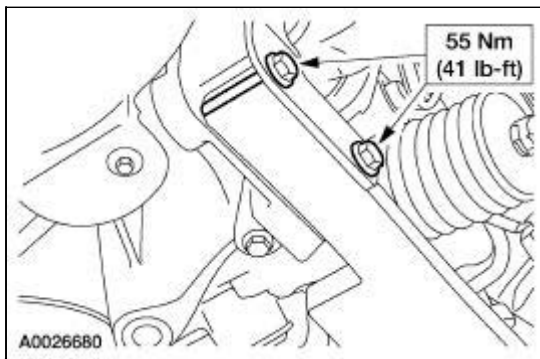
5. Make sure that the front I-brace insulators are correctly positioned.



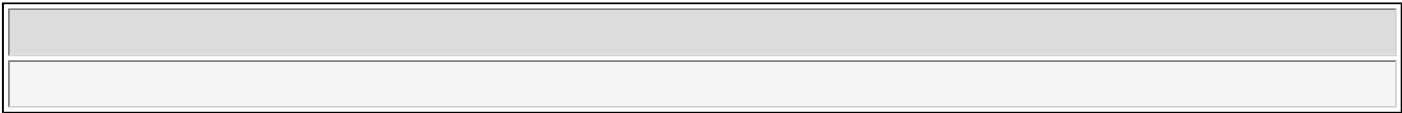
6. Install the front I-brace bolts.



7. Tighten the front I-brace bolts.



8. Align the front suspension. For additional information, refer to [Section 204-00](#).
-



GENERAL INFORMATION

INTRODUCTION

In the past, when cars were simpler, diagrams were simpler. All components were connected by wires, and diagrams seldom exceeded 4 pages in length. Today, some wiring diagrams require more than 16 pages. It would be impractical to expect a service technician to trace a wire from page 1 across every page to page 16.

Components shown with a dashed line instead of a solid line indicate not all circuits are shown in this particular diagram (circuits shown in system diagrams are typically applicable to that system only). The remaining circuits connected to that component will be shown in the appropriate system that they apply to.

Today, the wiring diagram necessary to support a given repair procedure is included within that article or a link is provided to the appropriate SYSTEM WIRING DIAGRAM article. For example, the wiring diagram for a Ford EEC-IV system may be included in ENGINE PERFORMANCE and WIRING DIAGRAMS articles for Ford Motor Co. The wiring diagram for a cruise control system may be included in ACCESSORIES & EQUIPMENT section for the specific vehicle manufacturer, and the wiring diagram for an anti-lock brake system may be included in BRAKES and WIRING DIAGRAMS for the specific manufacturer.

WIRING DIAGRAMS contains all wiring diagrams not included in STARTING & CHARGING SYSTEMS and ACCESSORIES & EQUIPMENT. This includes: Data Link Connectors, Ground Distribution, Power Distribution, Engine Performance, Electric Cooling Fans, Anti-Lock Brakes, Electronic Suspension and Electronic Steering wiring diagrams. The Data Link Connectors wiring diagrams show the circuits by which the various on-board computers exchange information, and the diagnostic connectors used for diagnosis and their location. The Ground Distribution wiring diagrams show all vehicle ground points, their location, and the components common to those ground points. The Power Distribution wiring diagrams show the power feed circuits and the components common to those power feeds.

Wiring diagrams used to support the information in ACCESSORIES & EQUIPMENT are drawn in a "top-down" format. The diagrams are drawn with the power source at the top of the diagram and the ground point at the bottom of the diagram. Component locations are identified on the wiring diagrams. Any wires that do not connect directly to a component are identified on the diagram to indicate where they go.

WIRING DIAGRAM COLOR ABBREVIATIONS

COLOR ABBREVIATIONS

Color

Normal

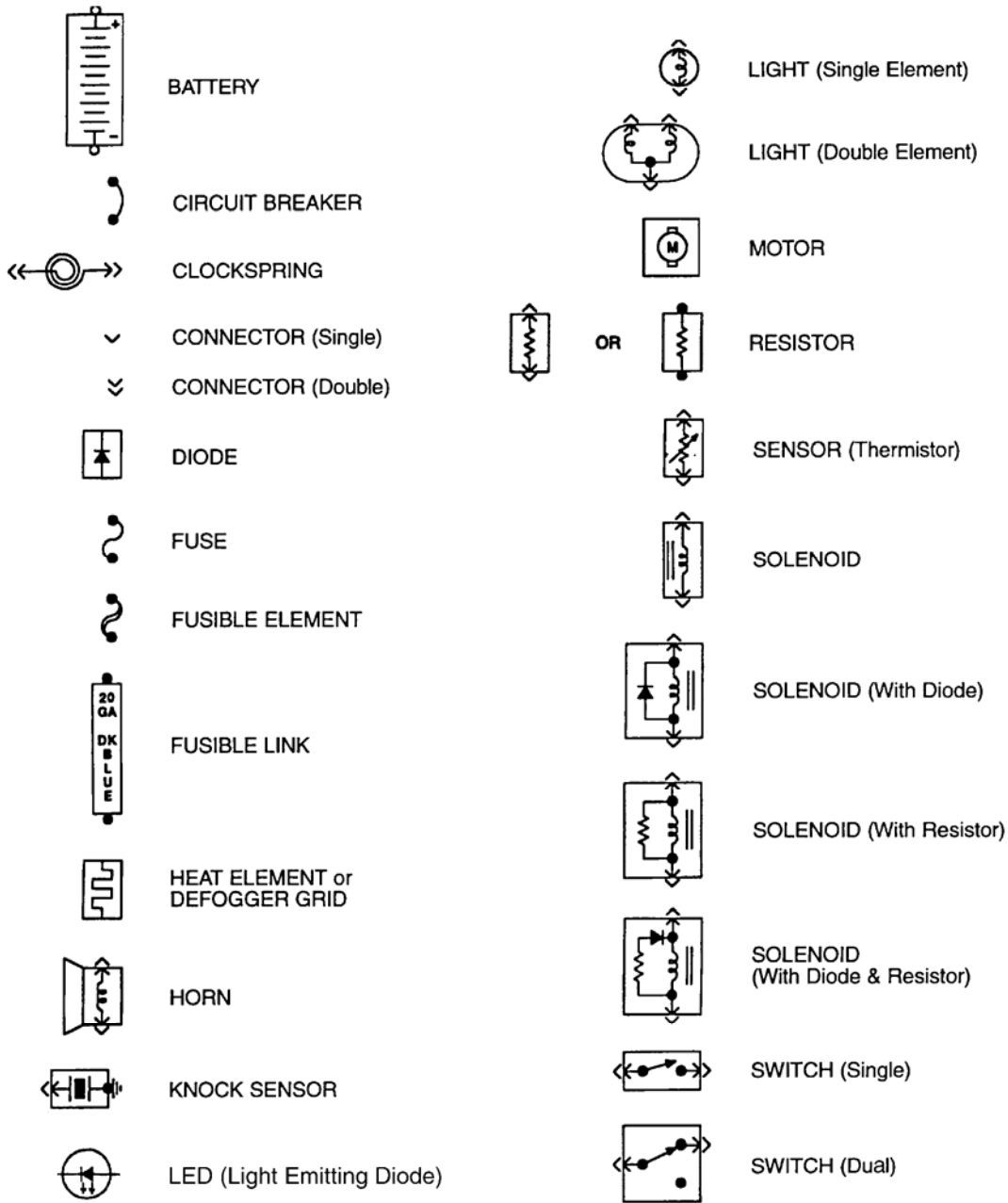
Optional

--	--	--

Black	BLK	BK
Blue	BLU	BU
Brown	BRN	BN
Clear	CLR	CR
Dark Blue	DK BLU	DK BU
Dark Green	DK GRN	DK GN
Green	GRN	GN
Gray	GRY	GY
Light Blue	LT BLU	LT BU
Light Green	LT GRN	LT GN
Orange	ORG	OG
Pink	PNK	PK
Purple	PPL	PL
Red	RED	RD
Tan	TAN	TN
Violet	VIO	VI
White	WHT	WT
Yellow	YEL	YL

WIRING DIAGRAM SYMBOLS

NOTE: Standard wiring symbols are used on all wiring diagrams. The list below will help clarify any symbols that are not easily understood at a glance. Most components are labeled "Motor", "Switch" or "Relay" in addition to being drawn with the standard symbol.



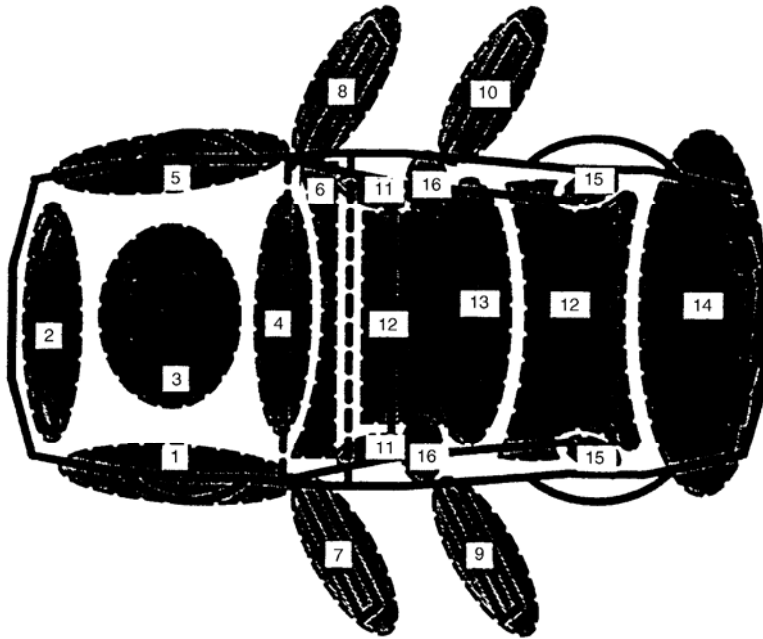
G50E03637

Fig. 1: Identifying Standard Wiring Diagram Symbols

WIRING DIAGRAM GROUND NUMBER LOCATIONS

NOTE: The following illustration depicts standardized ground numbers and locations to be used in conjunction with wiring diagrams applying to 2001 and prior model years only. See [Fig. 2](#). Wiring diagrams applying to newer model years depict manufacturer-specified ground numbers and locations. Do not utilize the illustration with 2002 and newer

model year wiring diagrams.



- | | | |
|---|---|--|
| <p>1) Left Fender
 G100 Front Of Fender
 G102 On Shock Tower
 G104 Rear Of Fender</p> <p>2) Front of Vehicle
 G106 Behind Left Headlight
 G107 Behind Right Headlight
 G108 Left Radiator Support
 G109 Right Radiator Support</p> <p>3) Engine
 G110 Left Front Of Engine
 G111 Left Front Behind Battery
 G112 Left Side Of Engine
 G114 Left Rear Of Engine
 G115 Rear Of Engine
 G117 Right Rear Of Engine
 G119 Right Front Of Engine
 G120 Right Side Of Engine
 G125 Front Of Engine
 G127 Left Underside Of Hood
 G128 Right Underside Of Hood
 G129 Top Center Of Transaxle</p> <p>4) Safety Wall
 G116 Left Side Of Safety Wall
 G121 Center Of Safety Wall
 G123 Right Side Of Safety Wall</p> <p>5) Right Fender
 G101 Front Of Fender
 G103 On Shock Tower
 G105 Rear Of Fender</p> | <p>6) Instrument Panel
 G200 Left Kick Panel
 G201 Right Side Of I/P
 G202 Left Side Of I/P
 G203 Right Kick Panel
 G204 Left Rear Of Steering Support
 G205 Right Rear Of Steering Support
 G206 Center Of I/P
 G207 Top Of Steering Column</p> <p>7) Left Front Door
 G500 Left Front Door</p> <p>8) Right Front Door
 G600 Right Front Door</p> <p>9) Left Rear Door
 G700 Left Rear Door</p> <p>10) Right Rear Door
 G800 Right Rear Door</p> <p>11) "A" Pillars
 G900 Left "A" Pillar
 G901 Right "A" Pillar</p> <p>12) Passenger Compartment
 G300 Below Left Front Seat
 G301 Below Right Front Seat
 G302 Below Center Console
 G303 Below Right Rear Seat
 G304 Below Left Rear Seat
 G306 Below Center Of Rear Seat
 G307 Below Right Rear Window
 G309 Left Front Door Sill
 G310 Behind Right Rear Seat
 G311 Center Of Rear Shelf
 G312 Behind Left Rear Seat</p> | <p>13) Roof
 G902 Left Front Of Roof
 G903 Right Front Of Roof
 G906 Left Rear Of Roof
 G907 Right Rear Of Roof
 G908 Center Front Of Roof
 G909 Center Rear Of Roof</p> <p>14) Rear Of Vehicle
 G400 Left Front Side Of Trunk
 G401 Right Front Side Of Trunk
 G402 Left Rear Wheelwell
 G403 Right Rear Wheelwell
 G404 Left Rear Side Of Trunk
 G405 Right Rear Side Of Trunk
 G406 Center Rear Of Trunk Lid
 G407 Center Rear Of Trunk
 G408 Center Front Of Trunk
 G409 Rear Of Cargo Bed</p> <p>15) "C" Pillars
 G904 Left "C" Pillar
 G905 Right "C" Pillar</p> <p>16) "B" Pillars
 G305 Right "B" Pillar
 G308 Left "B" Pillar</p> |
|---|---|--|

G00027307

Fig. 2: Ground Numbers & Locations (2001 & Prior Model Years)

WIRING DIAGRAM COMPONENT LOCATIONS

When trying to locate a component in a wiring diagram and you don't know the specific system where it is located, use this handy component locator to find the system wiring diagram in which the component is located. Then, go to that system and locate the component within the wiring diagram.

For example, if you don't know the specific system in which the ignition switch is located, look up ignition switch in the wiring diagram component location tables and go to the appropriate wiring diagram(s) which contain either full or partial views of the ignition switch. The full view of the ignition switch is located in Power Distribution.

The first listing for the component will be the full or most complete view of the component. Additional listings will be partial views of the component. Not all components are used on all models.

All components will have a partial view in Ground Distribution and Power Distribution. Data Link Connectors show connecting circuits between modules. Alternate names for components may be listed in wiring diagram component locations tables.

WIRING DIAGRAM COMPONENT LOCATIONS

Component	Wiring Diagram
ABS Electronic Control Unit	Anti-Lock Brakes; Data Link Connectors
ABS Hydraulic Unit	Anti-Lock Brakes
Acceleration Sensor	Anti-Lock Brakes
Accessory Delay Relay	Power Windows
A/C Compressor Clutch Relay	Engine Performance
A/C Sensor	Engine Performance
A/C Pressure Switch	Engine Performance
Adaptive Lamp Control Module	Exterior Lights
Air Bag(s)	Air Bag Restraint System
Air Bag Module	Air Bag Restraint System
Air Bag Sensor(s)	Air Bag Restraint System
Air Injection Pump Relay	Engine Performance
Air Temperature Sensor	Overhead Console
Alternator (Generator)	Generators & Regulators
Anti-Theft Control Module	Anti-Theft System; Starters
Autolamp Control Relay	Headlight Systems; Daytime Running Lights
Automatic Shutdown (ASD) Relay	Engine Performance; Generators & Regulators
Autostick Switch	Engine Performance
Auxiliary Battery Relay	Generators & Regulators
Back-Up Lights	Back-Up Lights; Exterior Lights
Barometric (BARO) Pressure Sensor	Engine Performance
Battery	Power Distribution
Battery Temperature Sensor	Engine Performance
Body Control Module	Body Control Computer; Anti-Theft System; Daytime Running Lights; Engine Performance; Headlight Systems; Warning Systems
Boost Control Solenoid	Engine Performance
Boost Sensor	Engine Performance
Brake Fluid Level Switch	Analog Instrument Panels
Brake On/Off (BOO) Switch	Cruise Control Systems; Engine Performance; Shift Interlock Systems
Buzzer Module	Warning Systems

Camshaft Position (CMP) Sensor	Engine Performance
Central Control Module	Anti-Theft System
Clockspring	Air Bag Restraint System; Cruise Control Systems; Steering Column Switches
Clutch Pedal Position Switch	Starters
Clutch Start Switch	Starters
Combination Meter	Analog Instrument Panels
Constant Control Relay Module (CCRM)	Engine Performance; Electric Cooling Fans
Convenience Center	Power Distribution; Illumination/Interior Lights
Convertible Top Motor	Power Convertible Top
Convertible Top Switch	Power Convertible Top
Crankshaft Position (CKP) Sensor	Engine Performance
Cruise Control Module	Cruise Control Systems
Cruise Control Switch	Cruise Control Systems
Condenser Fan Relay(s)	Electric Cooling Fans
Data Link Connector (DLC)	Engine Performance
Daytime Running Lights Module	Daytime Running Lights; Exterior Lights
Defogger Relay	Rear Window Defogger
Diagnostic Energy Reserve Module (DERM)	Air Bag Restraint System
Discriminating Sensor (Air Bag)	Air Bag Restraint System
Distributor	Engine Performance
Door Lock Actuators	Power Door Locks; Remote Keyless Entry
Door Lock Relay(s)	Power Door Locks
Electrochromic Mirror	Power Mirrors
Electronic Level Control (ELC) Height Sensor	Electronic Suspension
Electronic Level Control (ELC) Module	Electronic Suspension
Engine Coolant Temperature (ECT) Sending Unit	Analog Instrument Panels
Engine Coolant Temperature (ECT) Sensor	Engine Performance
Engine Control Module	Engine Performance; Generators & Regulators; Starters
ETACS ECU	Warning Systems; Power Windows; Remote Keyless Entry
Evaporative (EVAP) Emissions Canister	Engine Performance
EVAP Canister Purge Solenoid	Engine Performance
EVAP Canister Vent Solenoid	Engine Performance
Exhaust Gas Recirculation (EGR) Valve	Engine Performance
Fuel Tank Vacuum Sensor	Engine Performance
Fog Lights	Headlight Systems; Daytime Running Lights
Fog Light Relay	Headlight Systems; Daytime Running Lights
Fuel Door Release Solenoid	Power Fuel Door Release
Fuel Gauge Sending Unit	Analog Instrument Panels
Fuel Injectors	Engine Performance
Fuel Pump	Engine Performance
Fuel Pump Relay	Engine Performance; Power Distribution

Fuse/Relay Block	Power Distribution
Fusible Links	Power Distribution; Generators & Regulators; Starters
Generator	Generators & Regulators; Engine Performance; Power Distribution
Generic Electronic Module (GEM)	Body Control Modules; Electronic Suspension
Glow Plug Relay	Engine Performance
Glow Plugs	Engine Performance
Grounds	Ground Distribution
Headlight Door Module	Headlight Doors
Headlight Relay	Headlight Systems; Daytime Running Lights
Headlights	Headlight Systems; Daytime Running Lights
Heated Oxygen Sensor(s) (HO2S)	Engine Performance
Heated Windshield Control Module	Heated Windshields
Height Sensor	Electronic Suspension
Horns	Steering Column Switches
Horn Relay	Steering Column Switches
Idle Air Control (IAC) Motor/Valve	Engine Performance
Ignition Coil(s)	Engine Performance
Ignition Key Lock Cylinder	Anti-Theft System
Ignition Module	Engine Performance
Ignition Switch	Power Distribution; Engine Performance; Generators & Regulators; Starters
Illuminated Entry Module	Illumination/Interior Lights
Illumination Lights	Illumination/Interior Lights
Impact Sensor	Air Bag Restraint System
Inertia Fuel Shutoff Switch	Engine Performance
Inhibit Relay	Starters
Instrument Cluster	Analog Instrument Panels
Intake Air Temperature (IAT) Sensor	Engine Performance
Interior Lights	Illumination/Interior Lights
Interlock Switch	Starters
Junction Block	Power Distribution
Keyless Entry Receiver	Remote Keyless Entry
Key Reminder Switch	Starters
Knock Sensor	Engine Performance
Lamp Control Module	Exterior Lights
License Plate Lamp	Exterior Lights
Lighting Control Module	Lighting Control Modules; Anti-Theft System; Daytime Running Lights; Headlight Systems
Lower Relay	Power Convertible Top
Malfunction Indicator Light (MIL)	Engine Performance; Instrument Panels
Manifold Absolute Pressure (MAP) Sensor	Engine Performance
Mass Airflow (MAF) Sensor	Engine Performance

Mega Fuse	Generators & Regulators
Memory Seat/Mirror Module	Memory Systems
Mirror Defogger	Rear Window Defogger
Moon Roof Motor	Power Moon Roof
Moon Roof Relay	Power Moon Roof
Multi-Function Control Module	Warning Systems
Neutral Safety Switch	Starters
Oil Level Switch	Engine Performance
Oil Pressure Switch/Sending Unit	Analog Instrument Panels; Engine Performance
Overhead Console	Overhead Console
Oxygen Sensor(s) (O2S)	Engine Performance
Parking Brake Switch	Analog Instrument Panels
Park Lights	Exterior Lights
Park/Neutral Position Switch	Starters; Engine Performance; Anti-Theft System; Body Control Module
Perimeter Lighting Control Relay	Exterior Lights
Power Amplifier	Power Antennas
Power Antenna Module	Power Antennas
Power Antenna Motor	Power Antennas
Power Distribution Center	Power Distribution; Generators & Regulators; Starters
Power Door Lock Motors	Power Door Locks
Power Mirror Motors	Power Mirrors; Memory Systems
Power Sliding Door Controller	Power Sliding Side Door
Power Seat Motors	Power Seats; Memory Systems
Power Steering Pressure Switch	Engine Performance
Power Top Motor	Power Convertible Top
Power Top Relay(s)	Power Convertible Top
Powertrain Control Module	Engine Performance; Analog Instrument Panels; Cruise Control Systems; Data Link Connectors; Generators & Regulators; Starters
Power Window Motors	Power Windows
Power Window Relay(s)	Power Windows
Radiator Fan Motor(s)	Electric Cooling Fans
Radiator Fan Relay(s)	Engine Performance; Electric Cooling Fans;
Rainsense Module	Wiper/Washer Systems
Raise Relay	Power Convertible Top
Remote Anti-Theft Personality (RAP) Module	Anti-Theft System; Starters; Warning Systems
Seat Belt Pretensioners	Air Bag Restraint System
Seat Belt Retractor Solenoid	Passive Restraints
Seat Belt Switch	Air Bag Restraint System; Passive Restraints
Shift Interlock Solenoid	Shift Interlock Systems
Shift Lock Actuator	Shift Interlock Systems
Side Marker Lights	Exterior Lights

SIR Coil Assembly (Clockspring)	Air Bag Restraint System
Slip Ring (Clockspring)	Air Bag Restraint System; Steering Column Switches
SRS Control Module	Air Bag Restraint System
Starter Motor	Starters
Starter Interrupt Relay	Starters
Starter Solenoid	Starters
Starter Relay	Starters
Steering Wheel Position Sensor	Anti-Lock Brakes
Stoplights	Exterior Lights
Stoplight Switch	Engine Performance; Cruise Control Systems; Anti-Lock Brakes
Sun Roof ECU	Power Sun Roof
Sun Roof Motor	Power Sun Roof
Sun Roof Position Sensor	Power Sun Roof
Taillights	Exterior Lights
Throttle Position (TP) Sensor	Engine Performance
Torque Converter Clutch Solenoid/Switch	Engine Performance
Traction Control Switch	Anti-Lock Brakes
Trailer Tow Connector	Exterior Lights
Trailer Tow Relay	Exterior Lights
Transmission/Transaxle	Engine Performance
Transmission Control Module (TCM)	Engine Performance; Starters
Transmission Range Sensor	Starters; Back-Up Lights; Engine Performance
Transmission Range Switch	Back-Up Lights; Engine Performance; Anti-Theft System
Turn Signal Flasher	Exterior Lights
Turn Signal Lights	Exterior Lights
Twilight Sentinel Switch	Headlight Systems; Daytime Running Lights
Vapor Canister Leak Detection Pump	Engine Performance
Vehicle Control Module (VCM)	Engine Performance
Vehicle Dynamic Module	Electronic Suspension
Vehicle Speed Control Servo	Cruise Control Systems
Vehicle Speed Sensor	Data Link Connectors; Analog Instrument Panels; Cruise Control Systems; Electronic Suspension
Voltage Regulator	Generators & Regulators
Water-In-Fuel Sensor	Engine Performance; Analog Instrument Panels
Wheel Speed Sensors	Anti-Lock Brakes
Window Timer Module	Power Convertible Top
Windshield Intermittent Wiper Relay	Wiper/Washer Systems
Windshield Washer Motor	Wiper/Washer Systems
Wiper Motor	Wiper/Washer Systems

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

AIR CONDITIONING

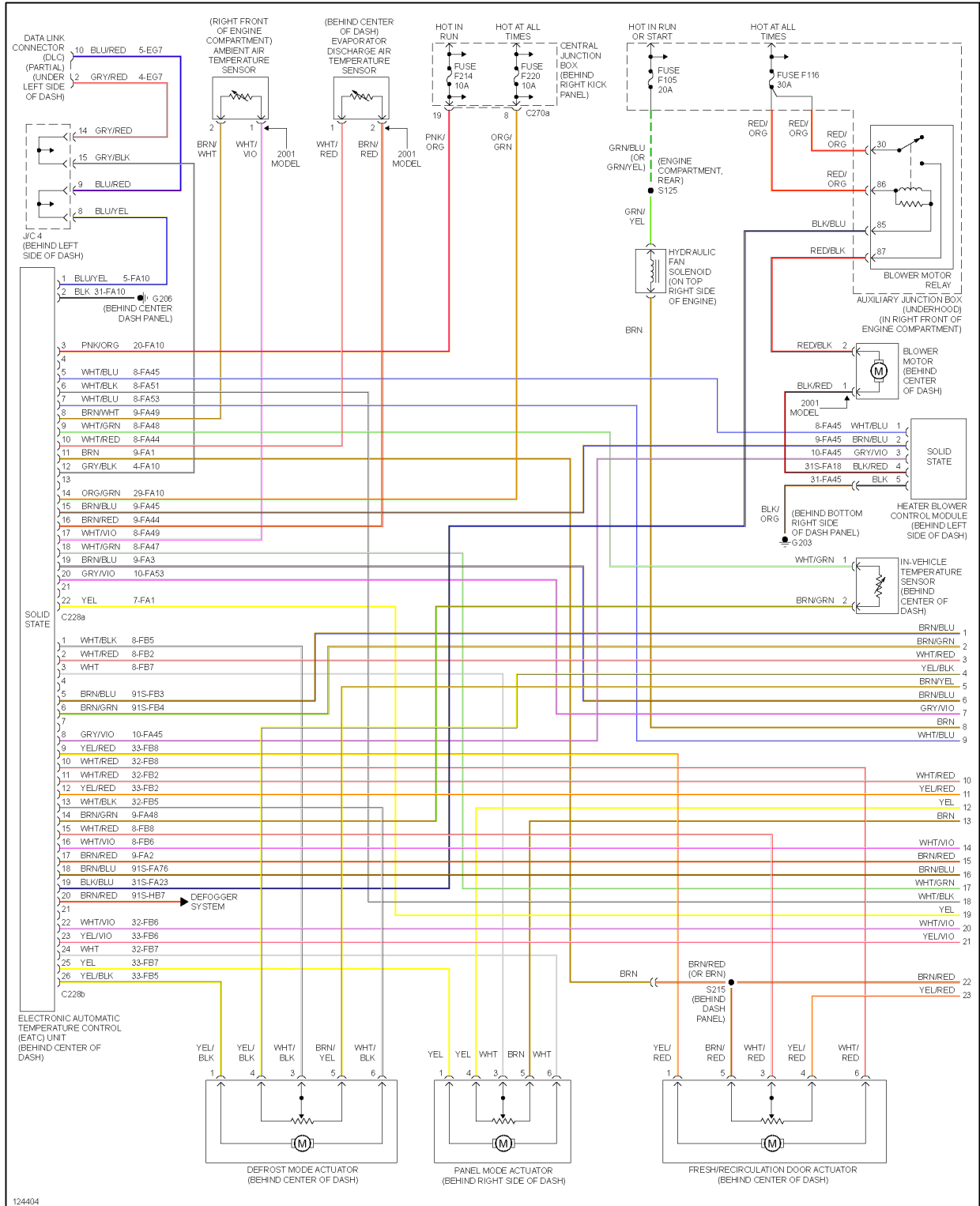


Fig. 1: Automatic A/C Circuit (1 of 2)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

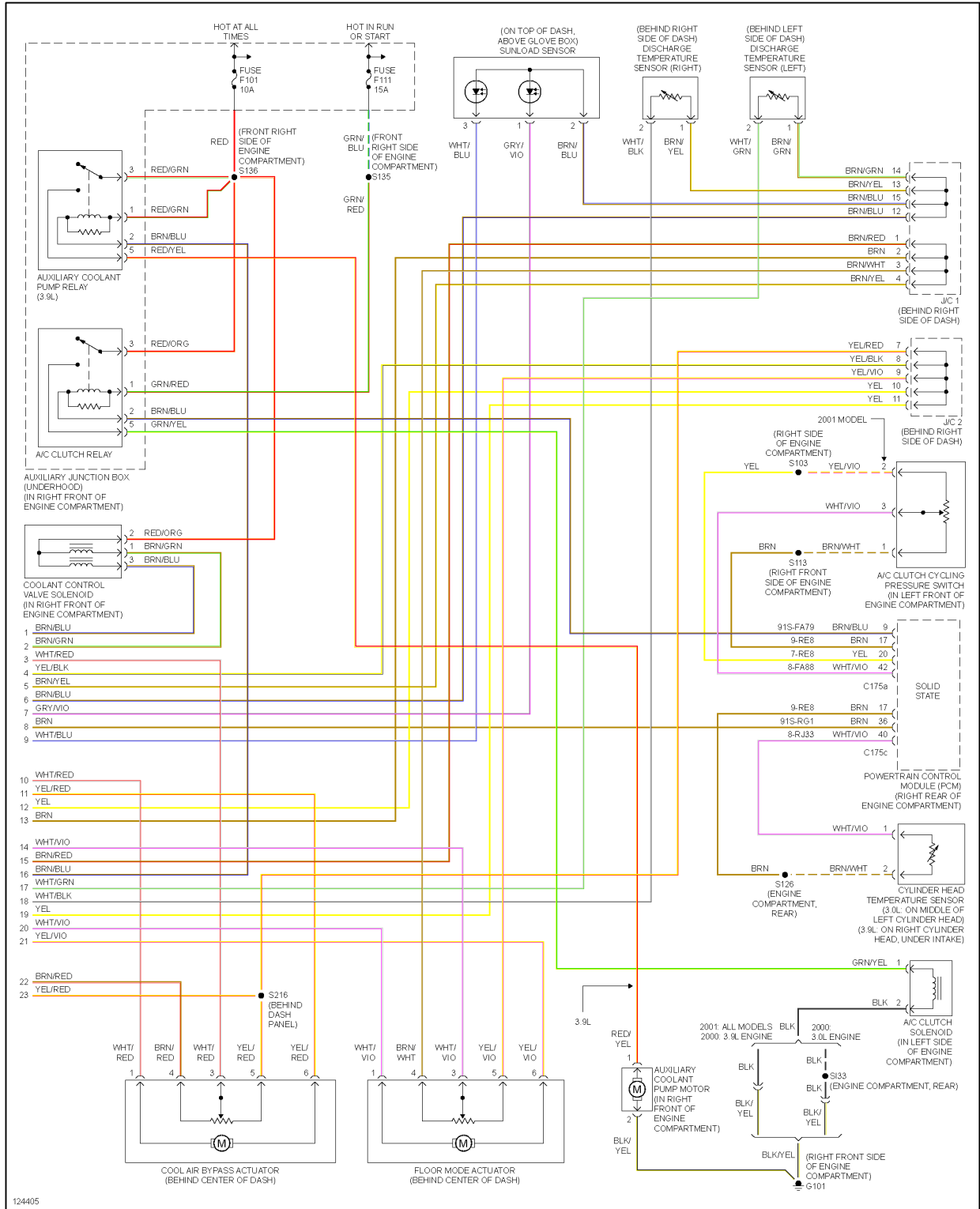


Fig. 2: Automatic A/C Circuit (2 of 2)

ANTI-LOCK BRAKES

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

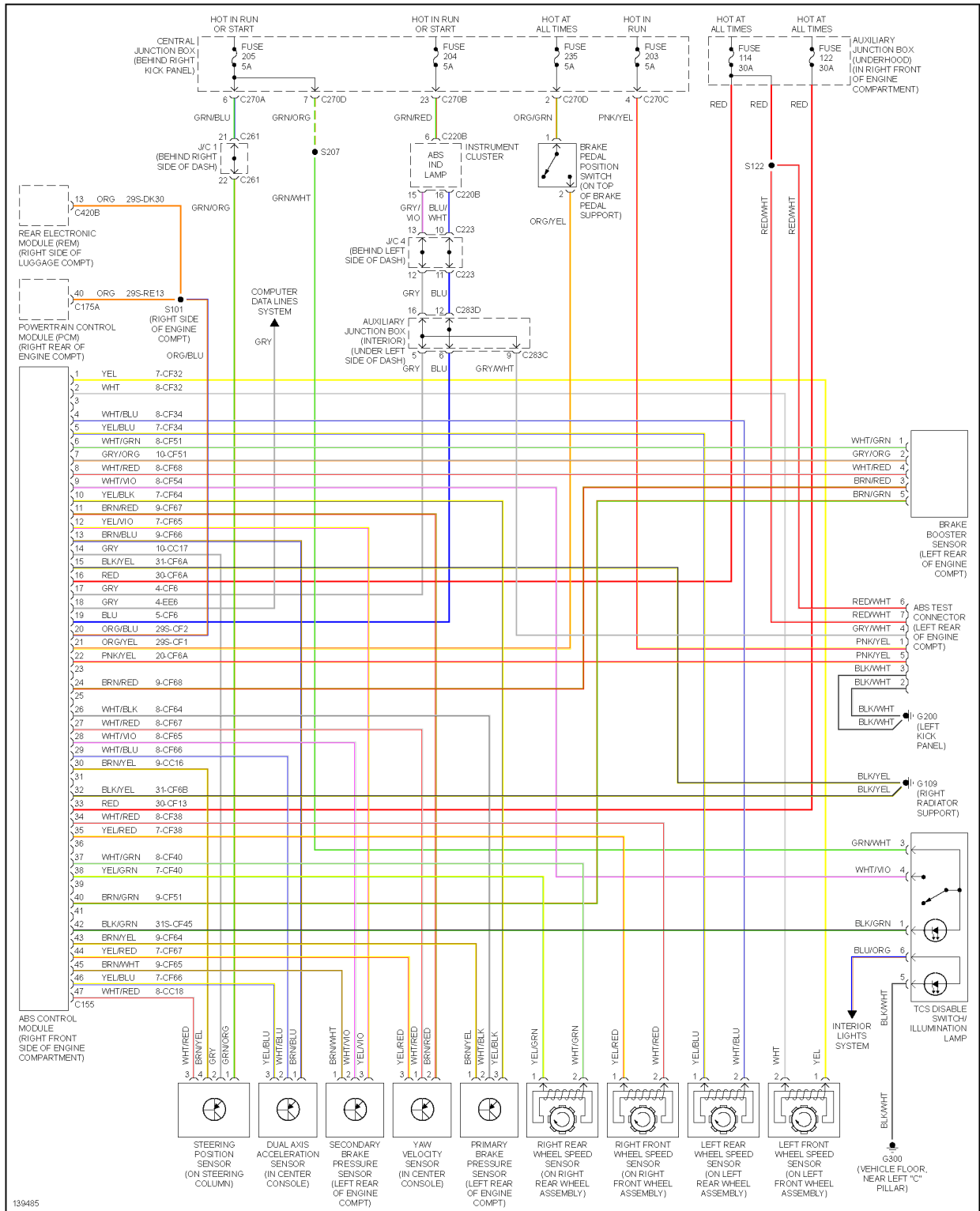


Fig. 3: Anti-lock Brakes Circuit, W/ Traction Control & Stability Assist

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

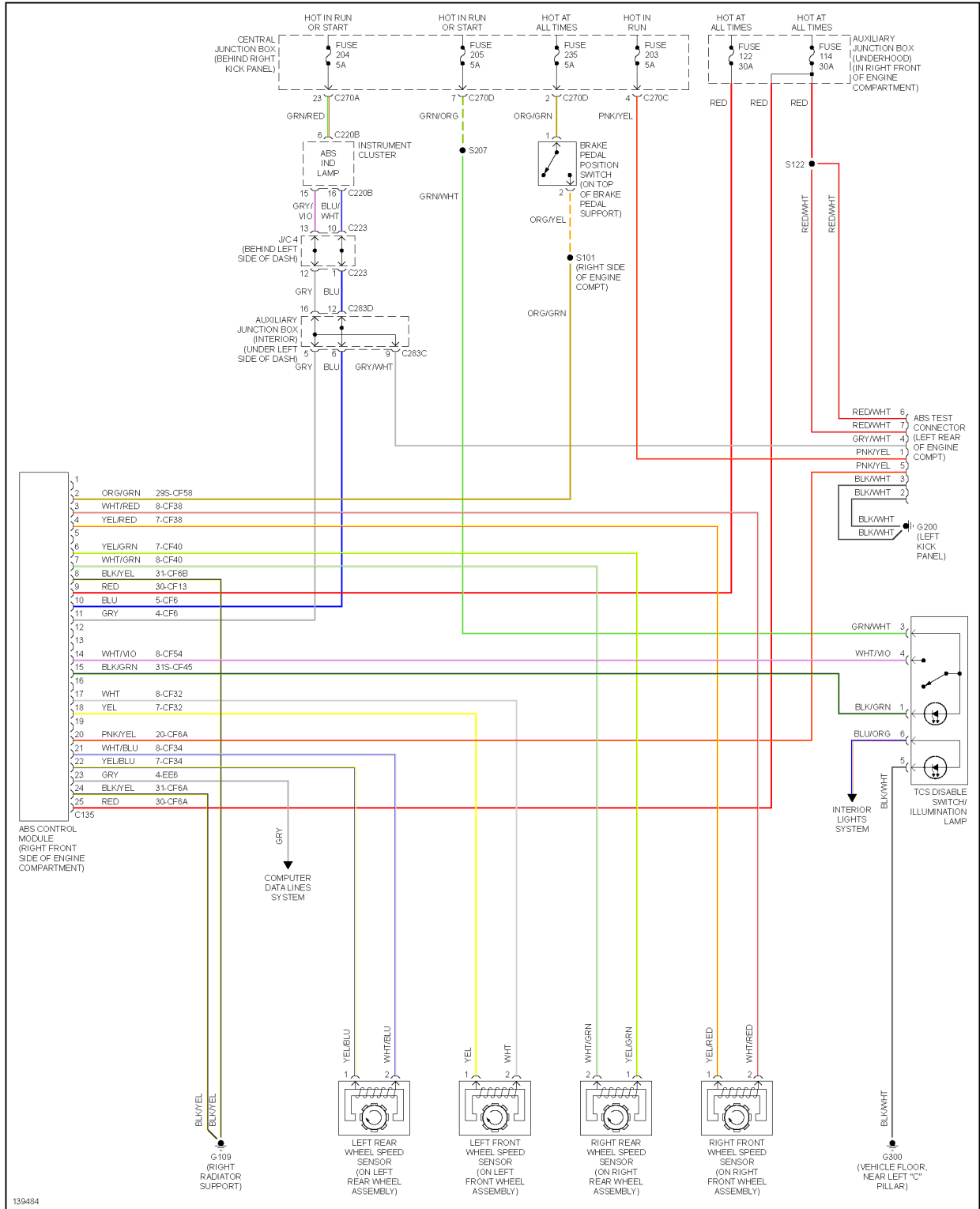


Fig. 4: Anti-lock Brakes Circuit, W/ Traction Control

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

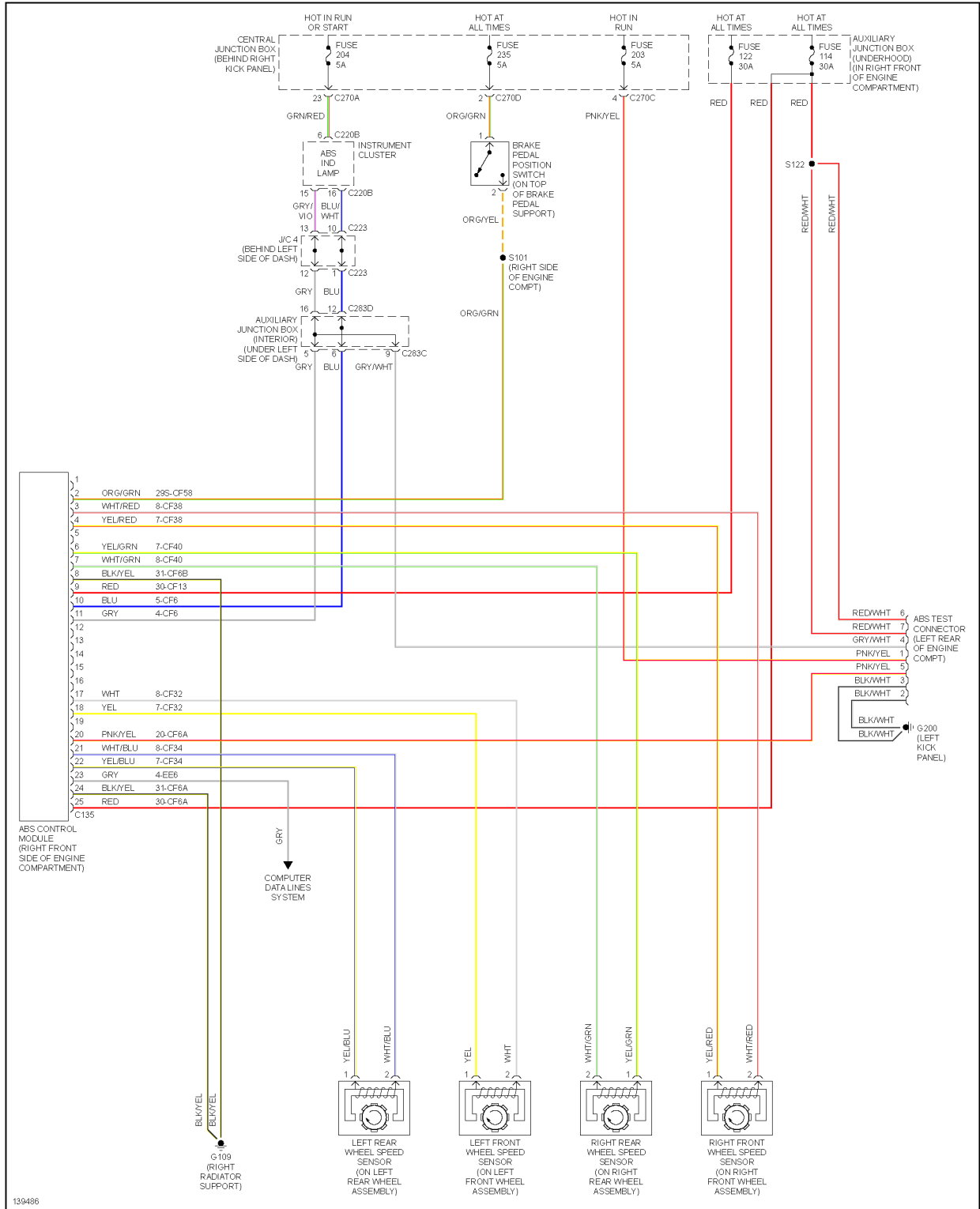


Fig. 5: Anti-lock Brakes Circuit, W/O Traction Control

ANTI-THEFT

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

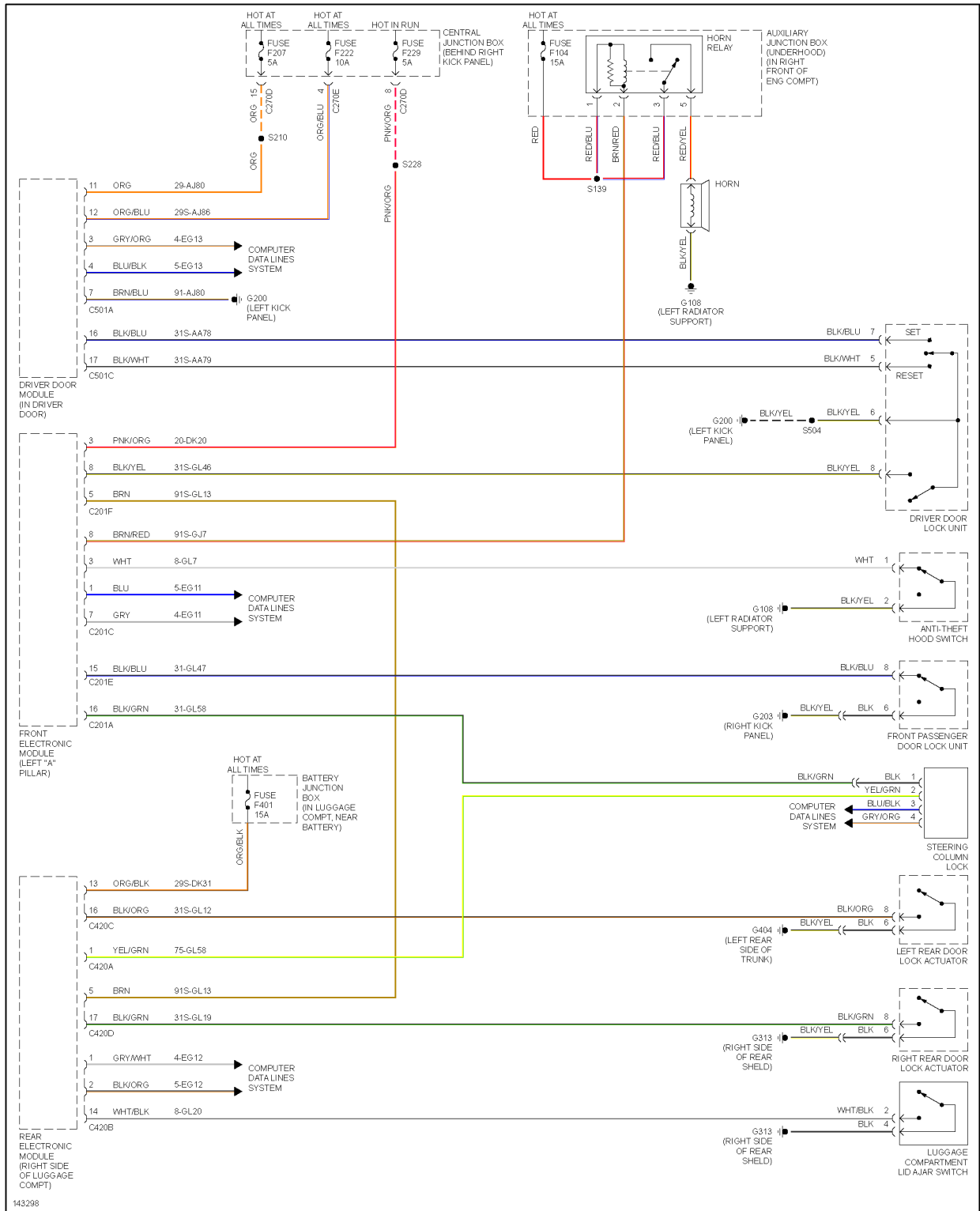


Fig. 6: Forced Entry Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

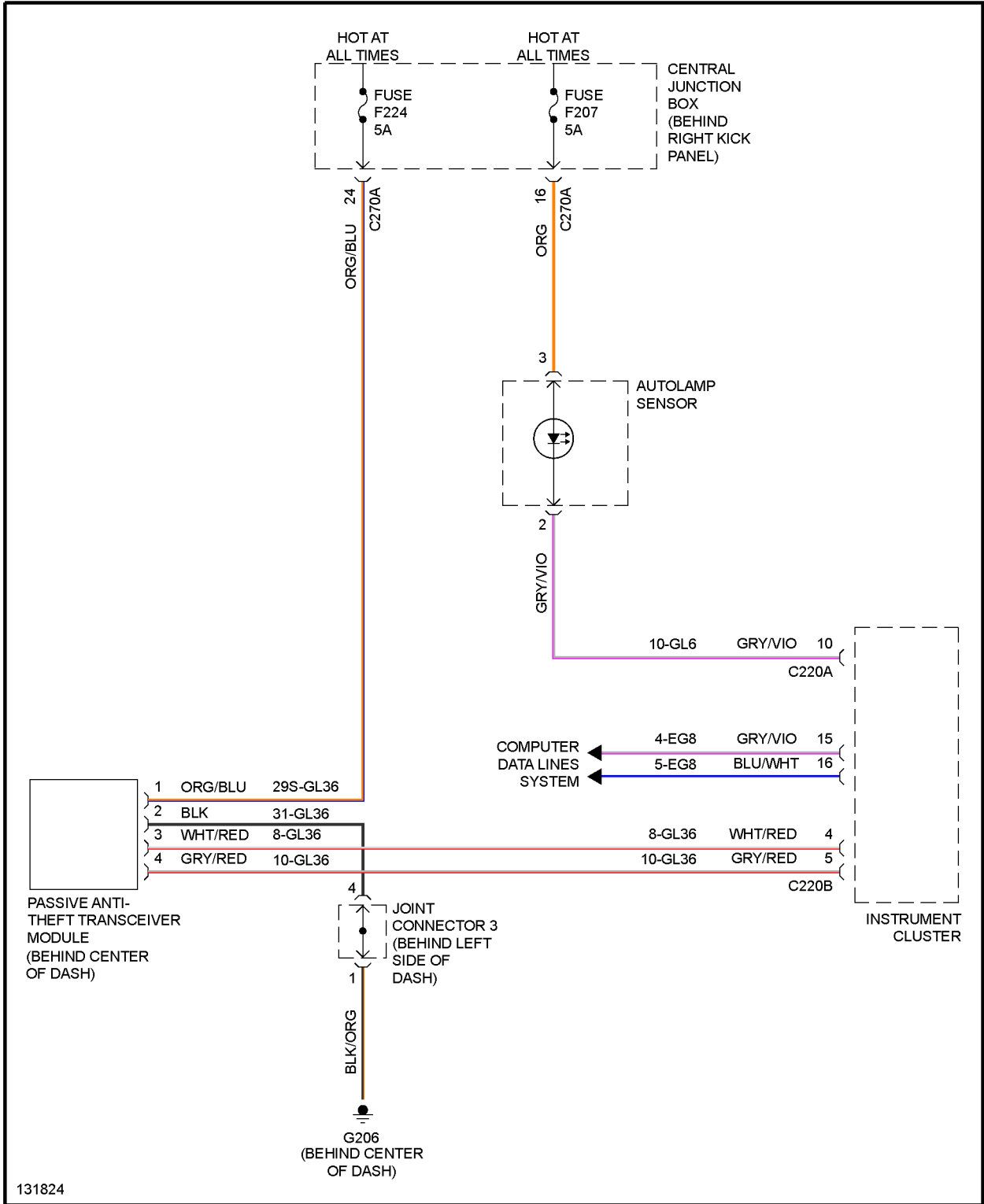


Fig. 7: Passive Anti-theft Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

BODY CONTROL MODULES

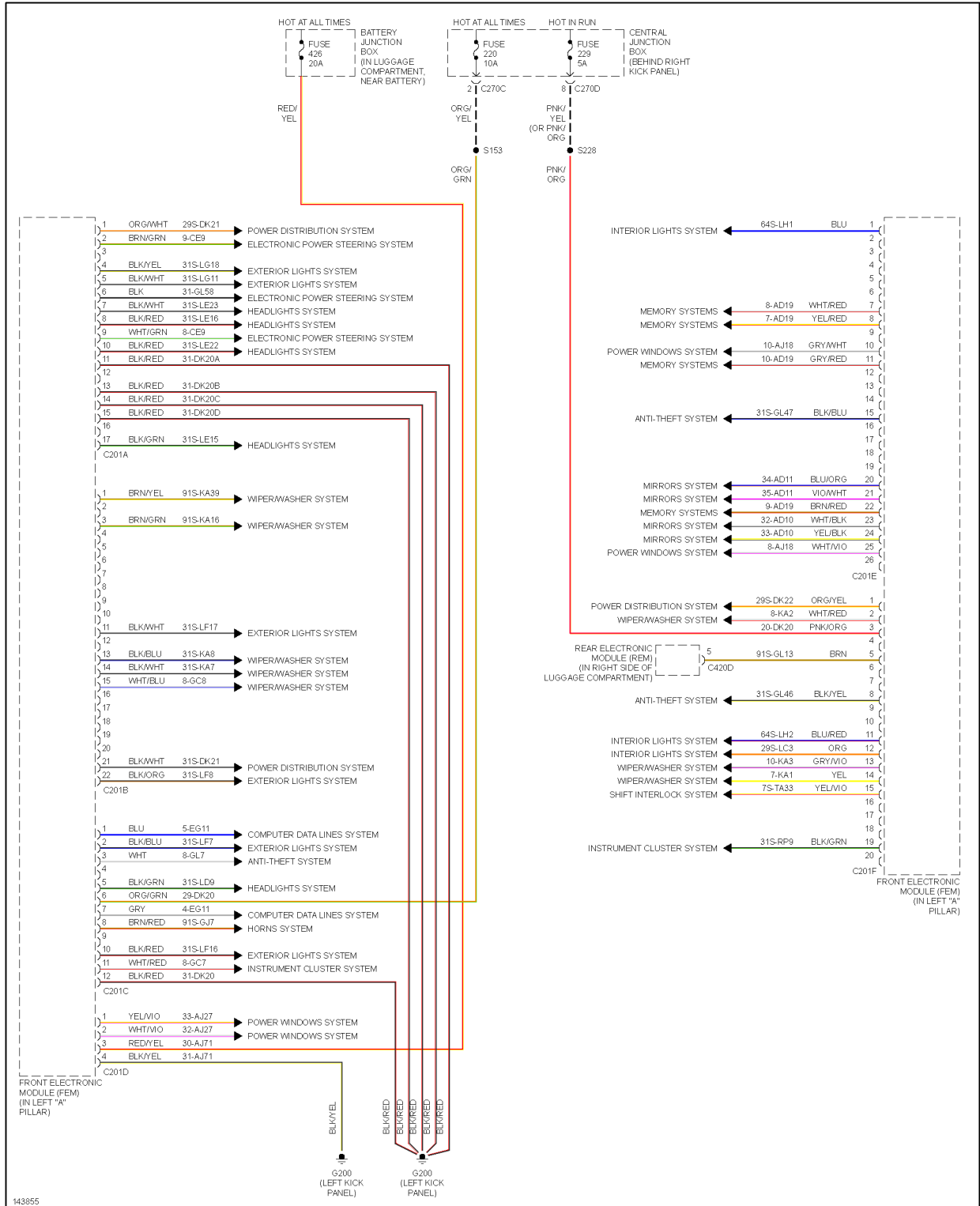


Fig. 8: Body Control Modules Circuit (1 of 2)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

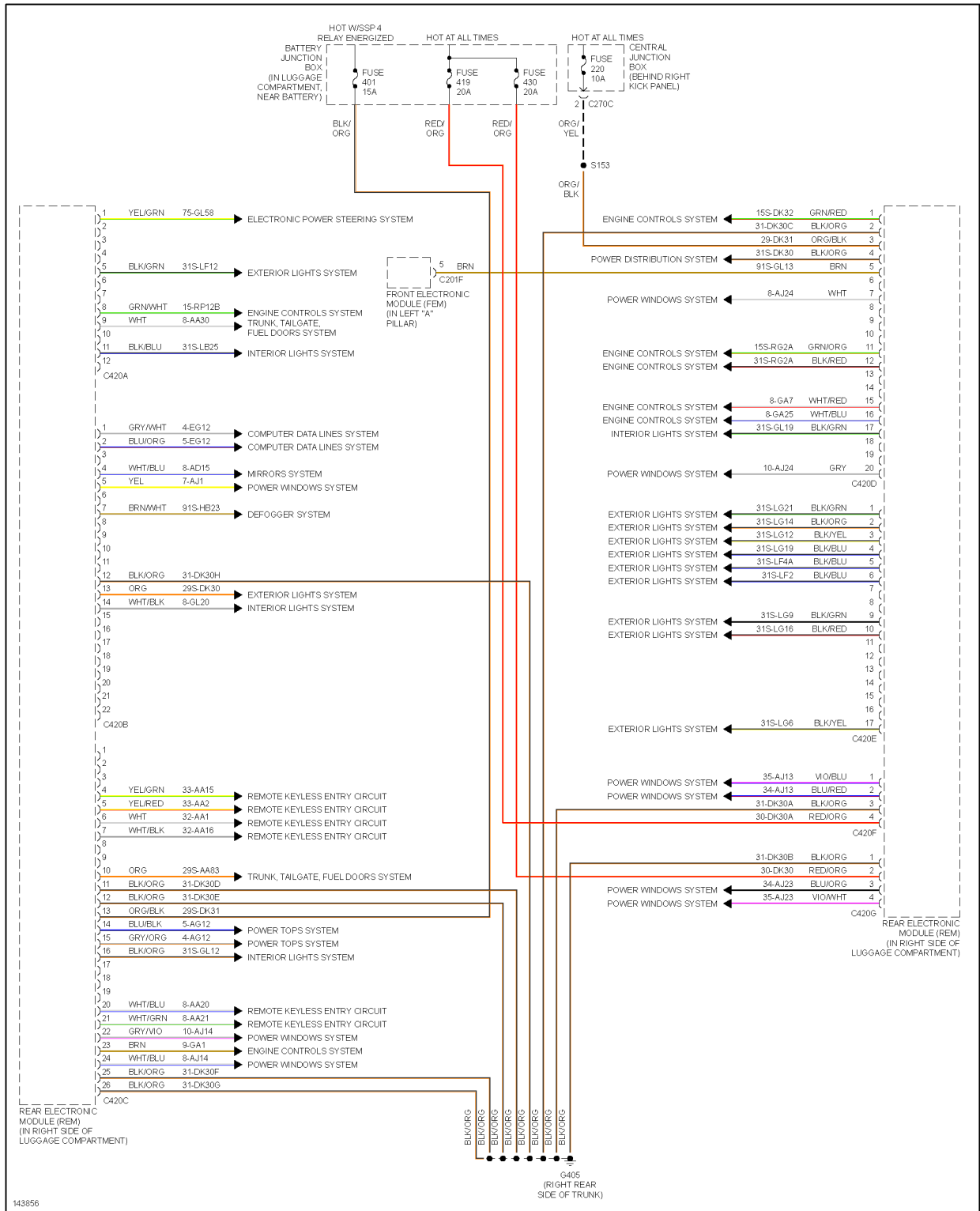


Fig. 9: Body Control Modules Circuit (2 of 2)

COMPUTER DATA LINES

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

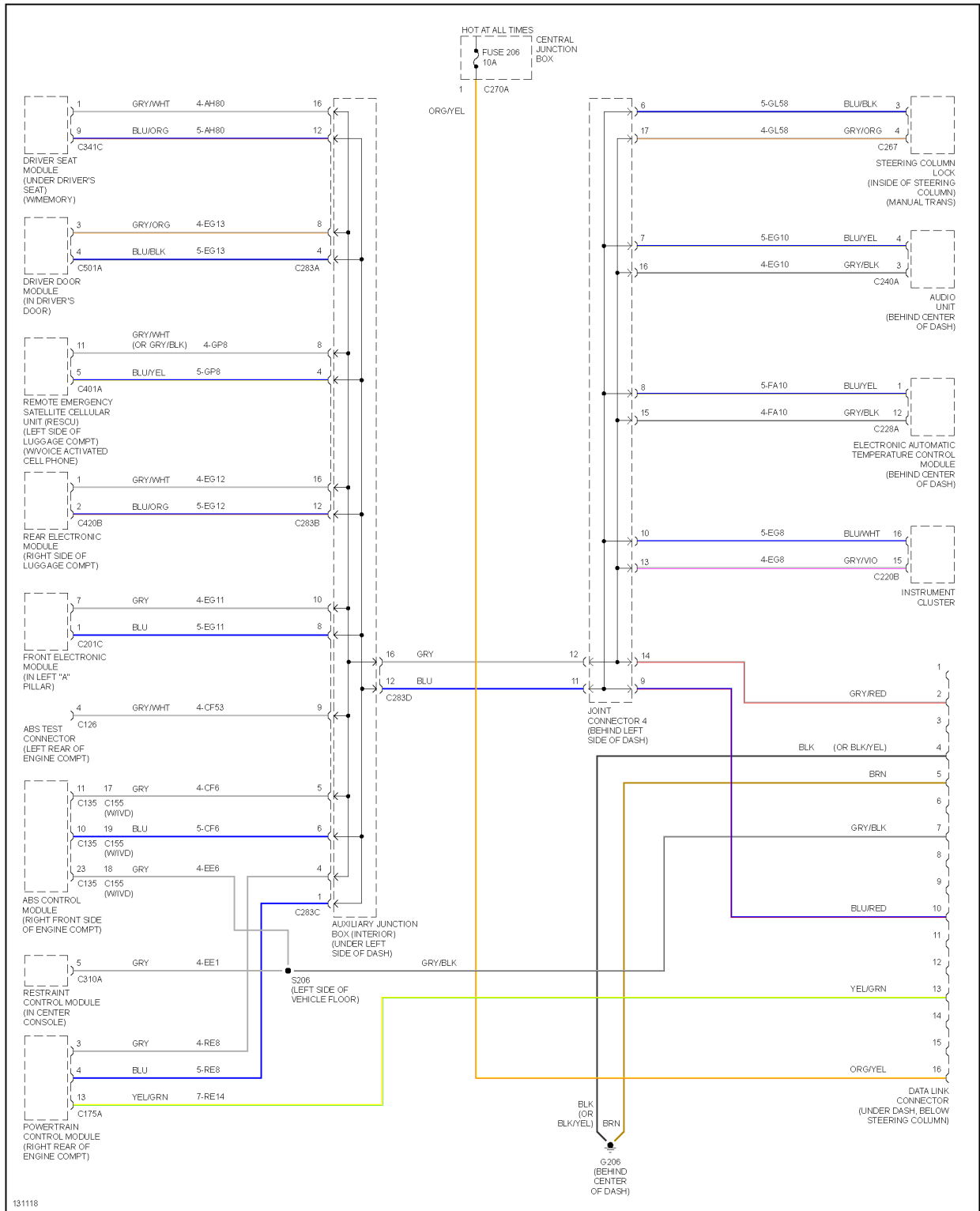
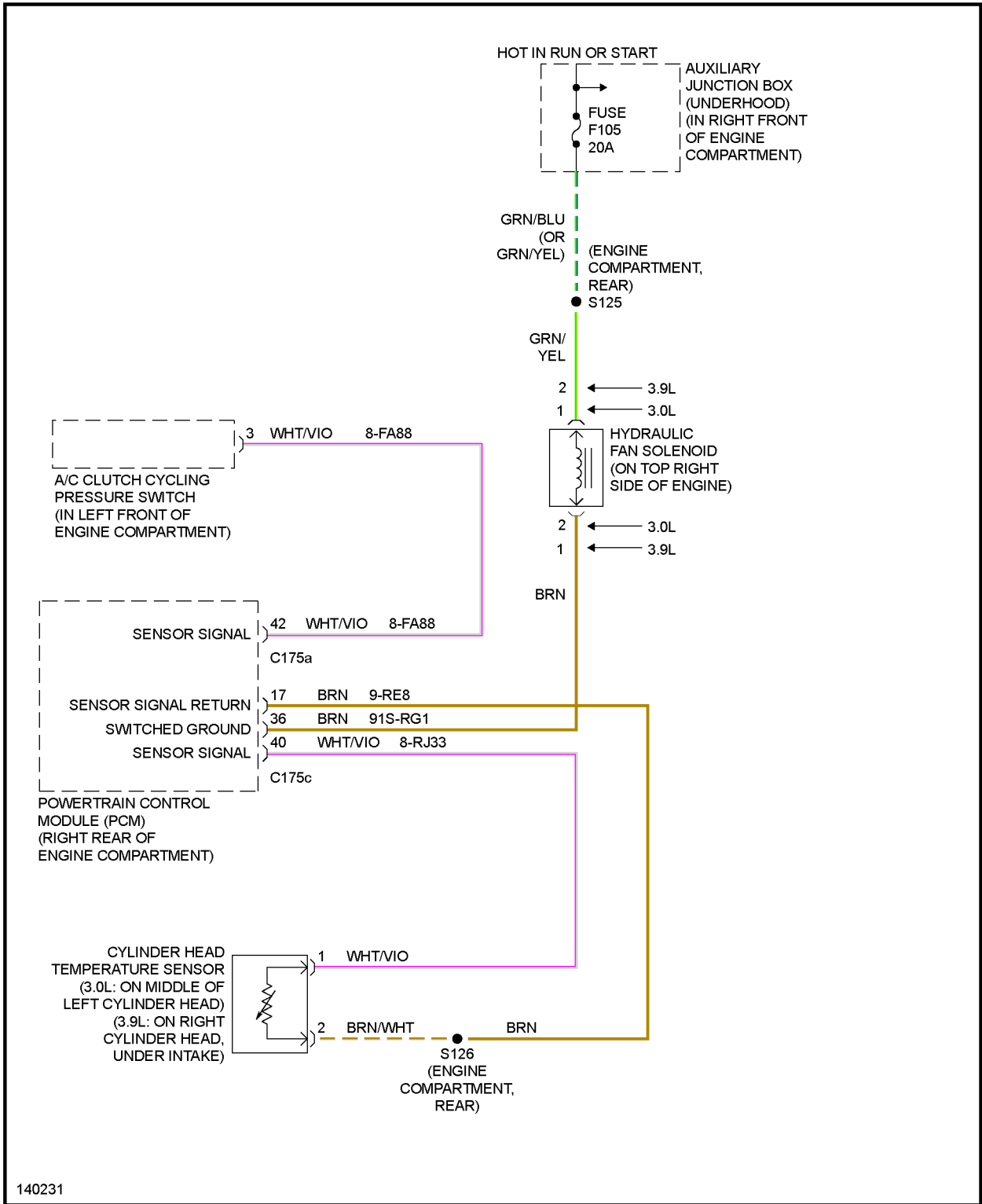


Fig. 10: Computer Data Lines Circuit

COOLING FAN

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS



140231

Fig. 11: Cooling Fan Circuit

CRUISE CONTROL

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

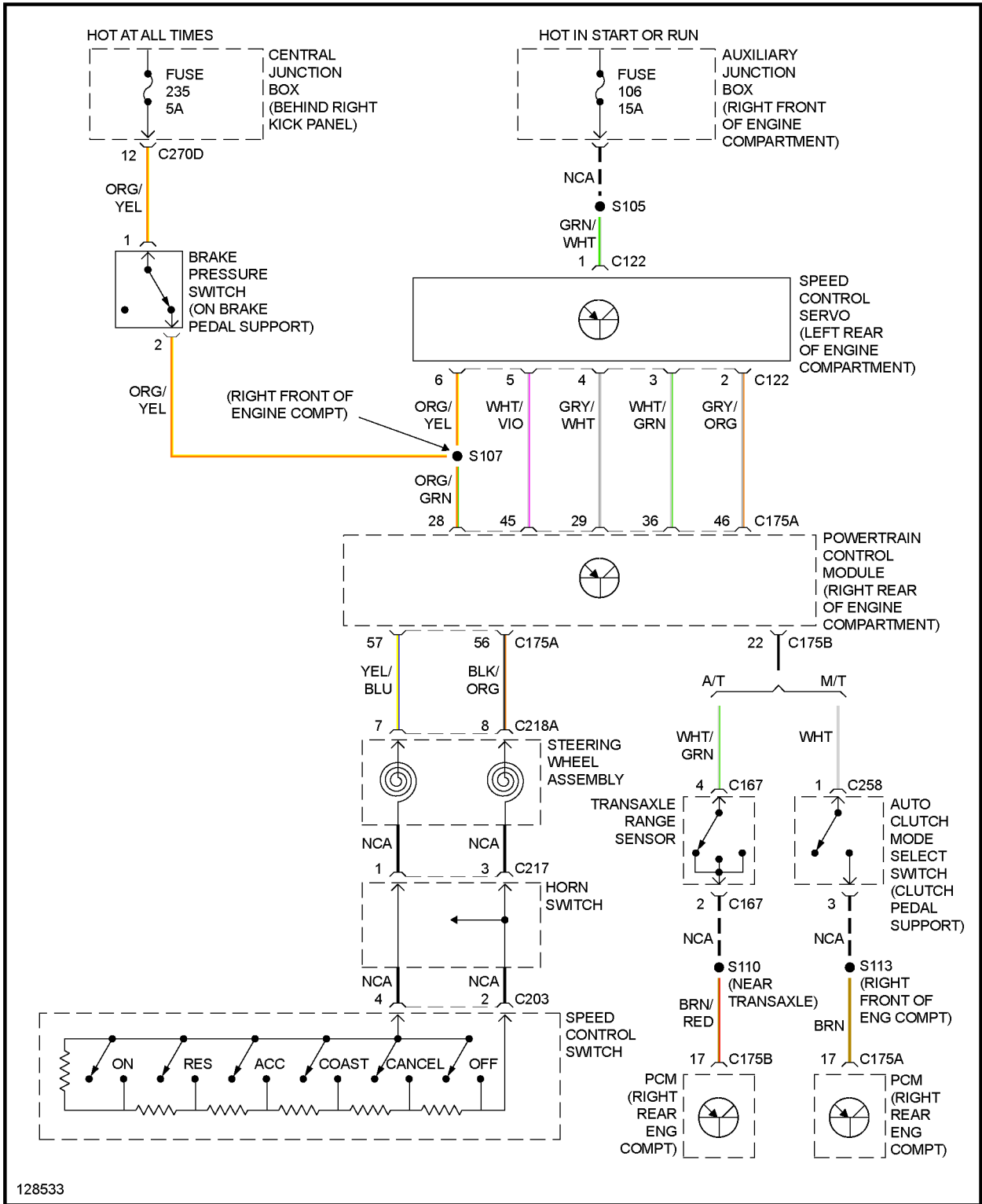


Fig. 12: Cruise Control Circuit

DEFOGGERS

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

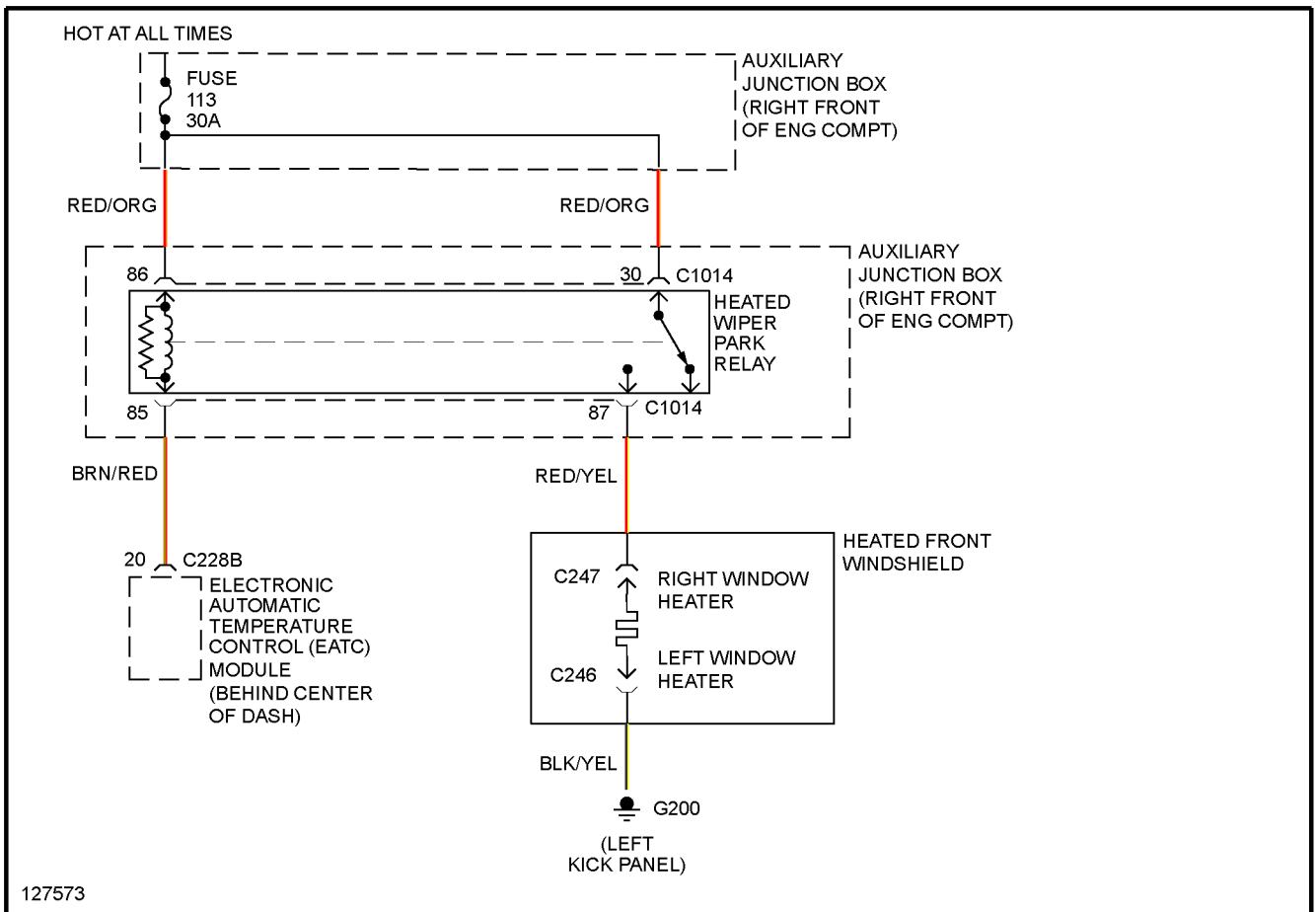


Fig. 13: Front Defogger Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

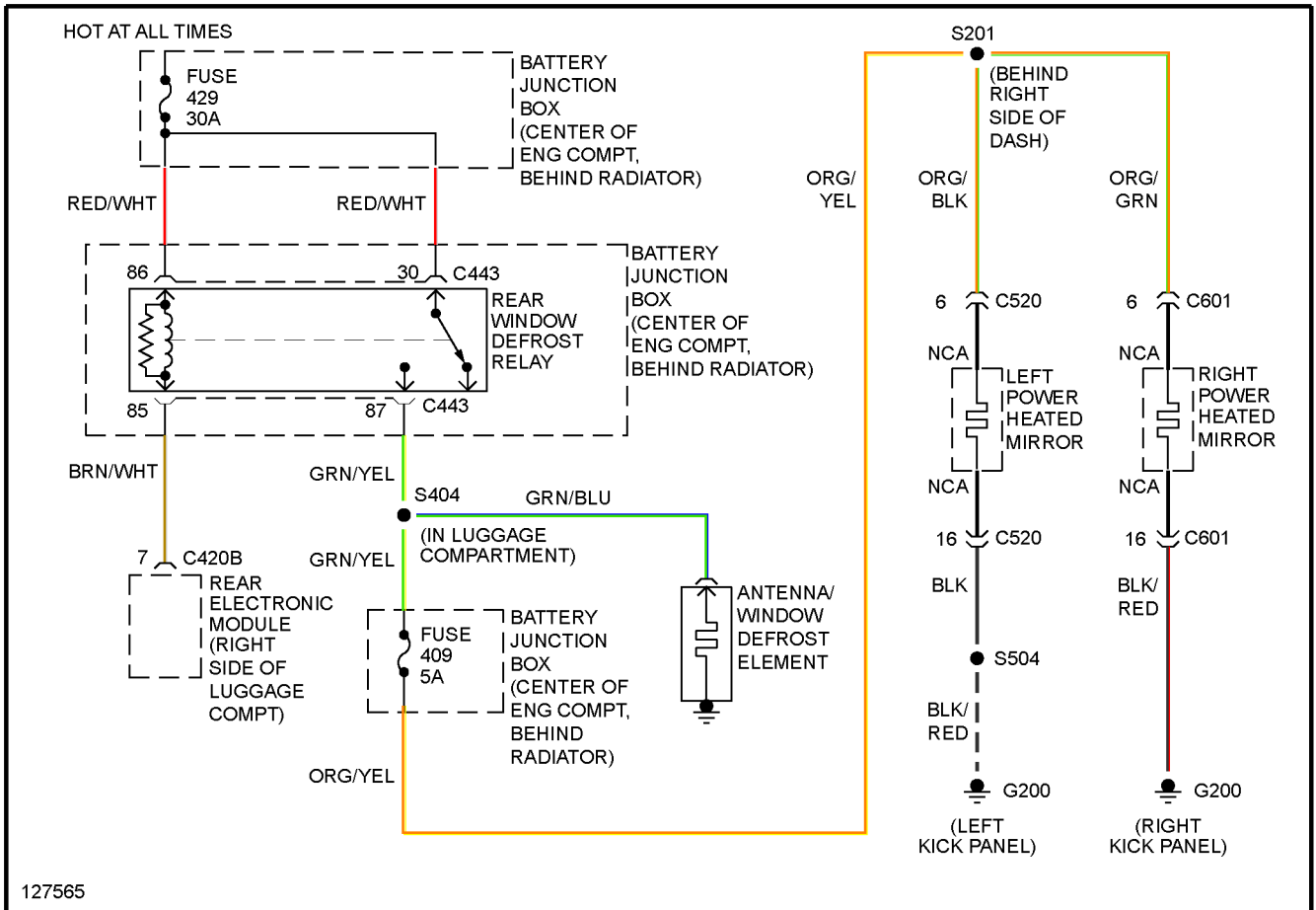


Fig. 14: Rear Defogger & Heated Mirrors Circuit

ELECTRONIC POWER STEERING

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

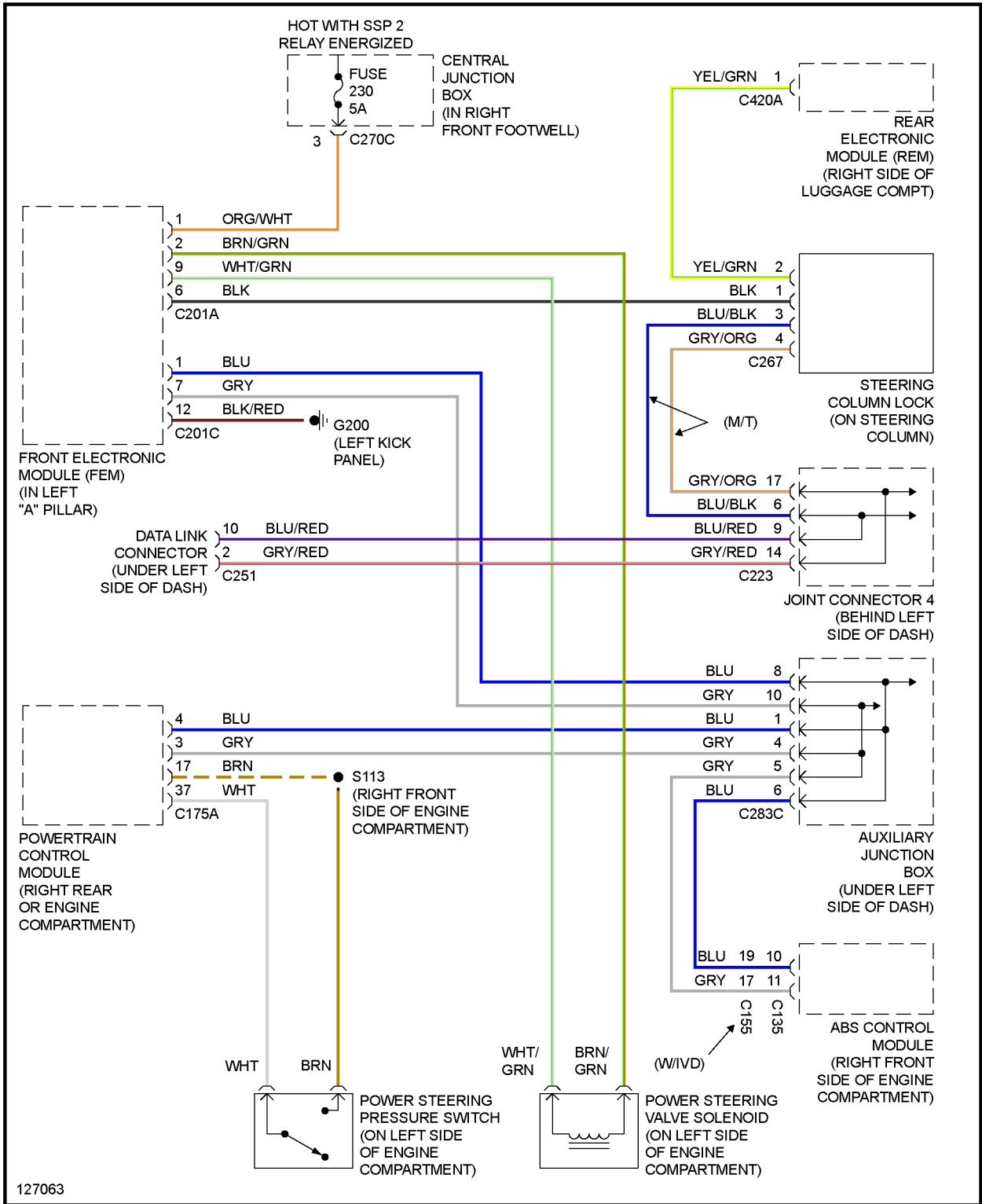


Fig. 15: Electronic Power Steering Circuit

ENGINE PERFORMANCE

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

3.0L

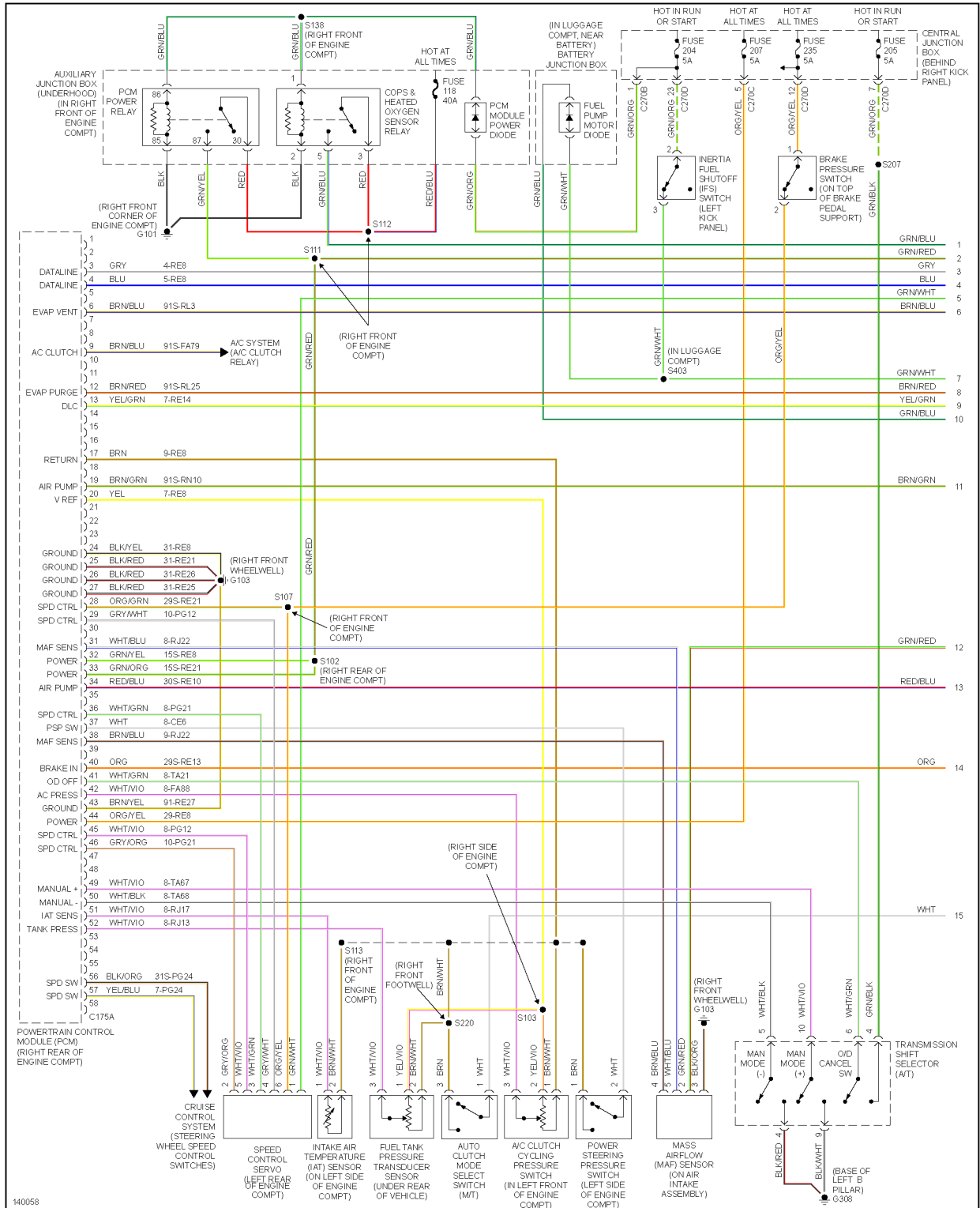


Fig. 16: 3.0L, Engine Performance Circuit (1 of 4)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

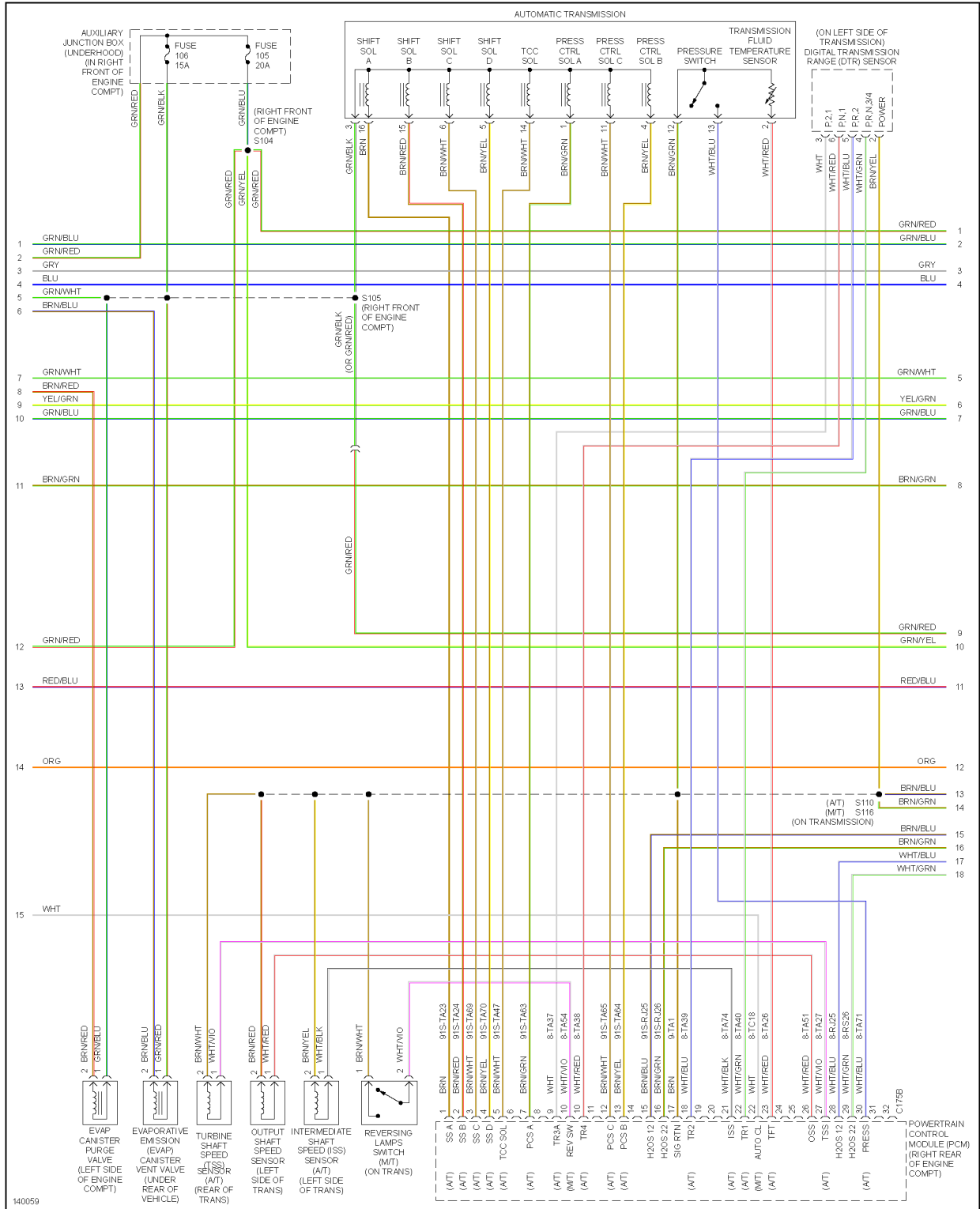


Fig. 17: 3.0L, Engine Performance Circuit (2 of 4)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

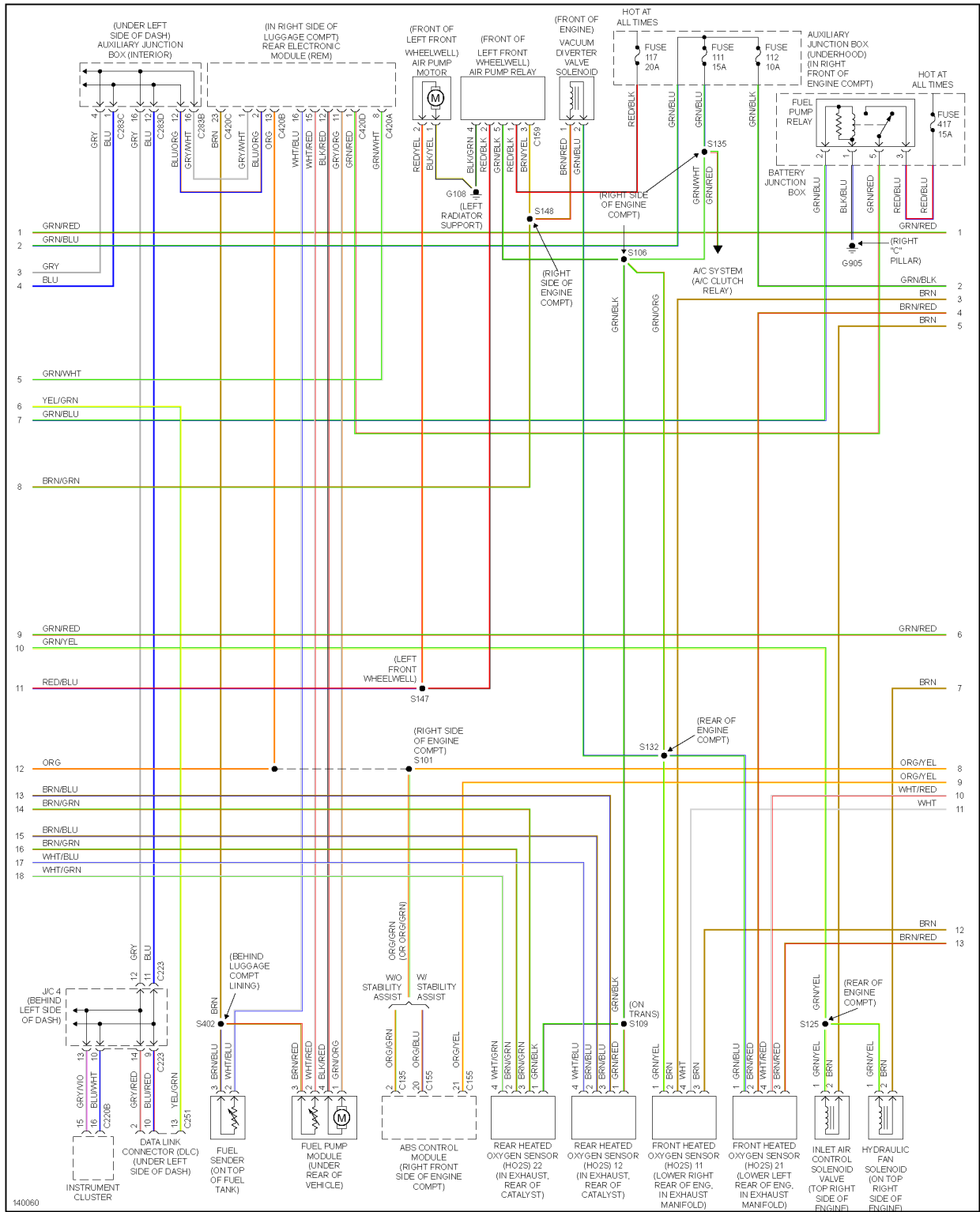


Fig. 18: 3.0L, Engine Performance Circuit (3 of 4)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

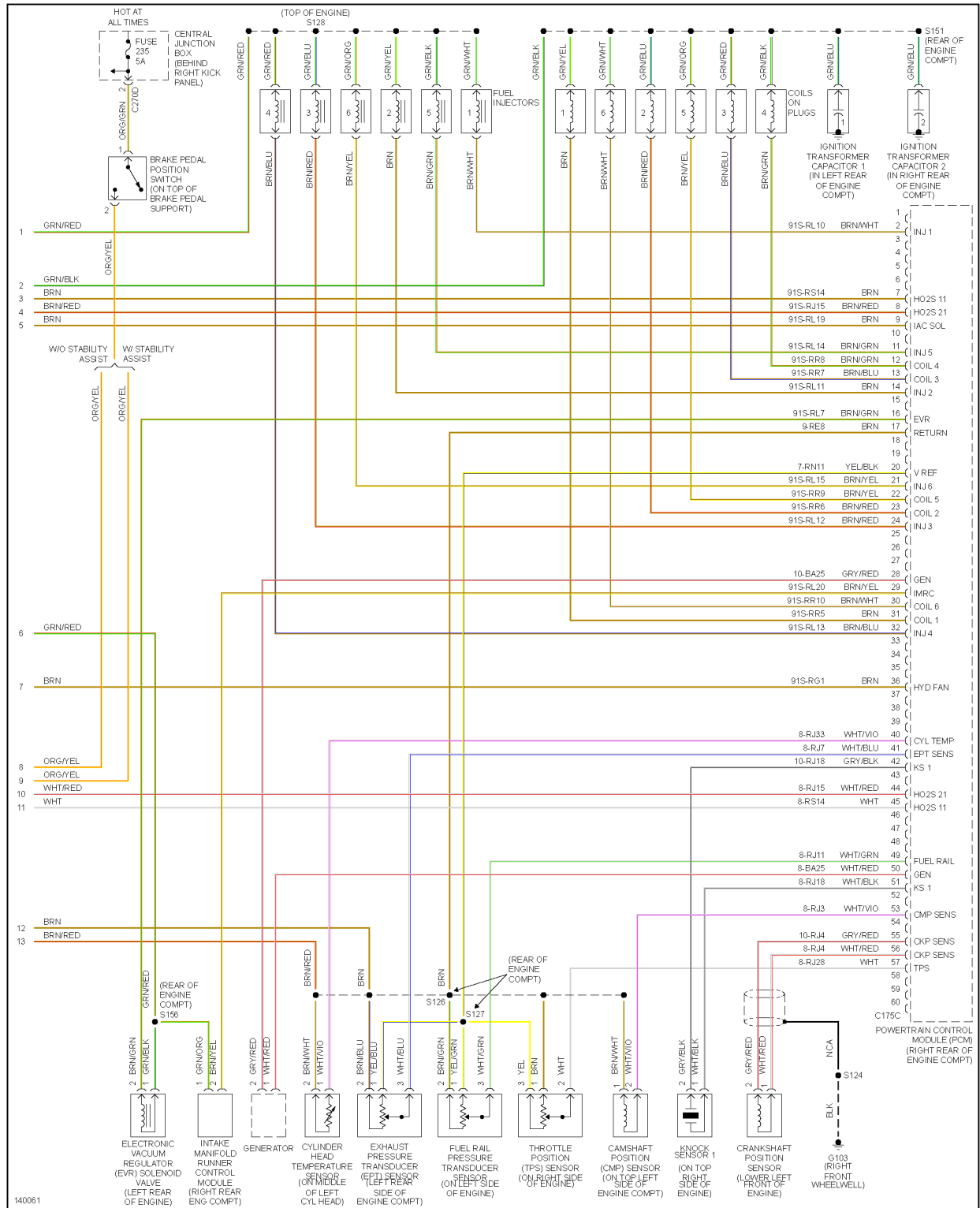


Fig. 19: 3.0L, Engine Performance Circuit (4 of 4)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

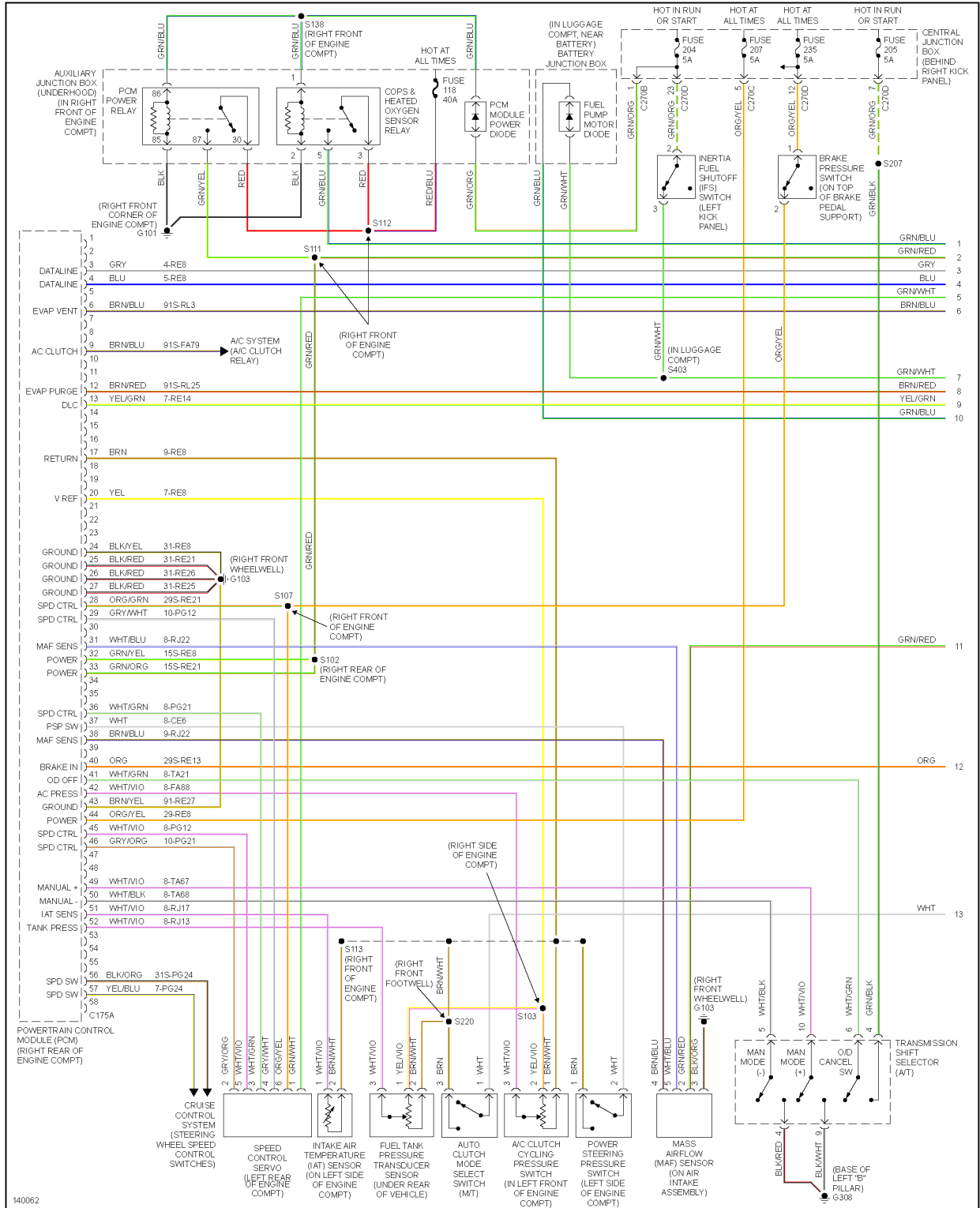


Fig. 20: 3.9L, Engine Performance Circuit (1 of 4)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

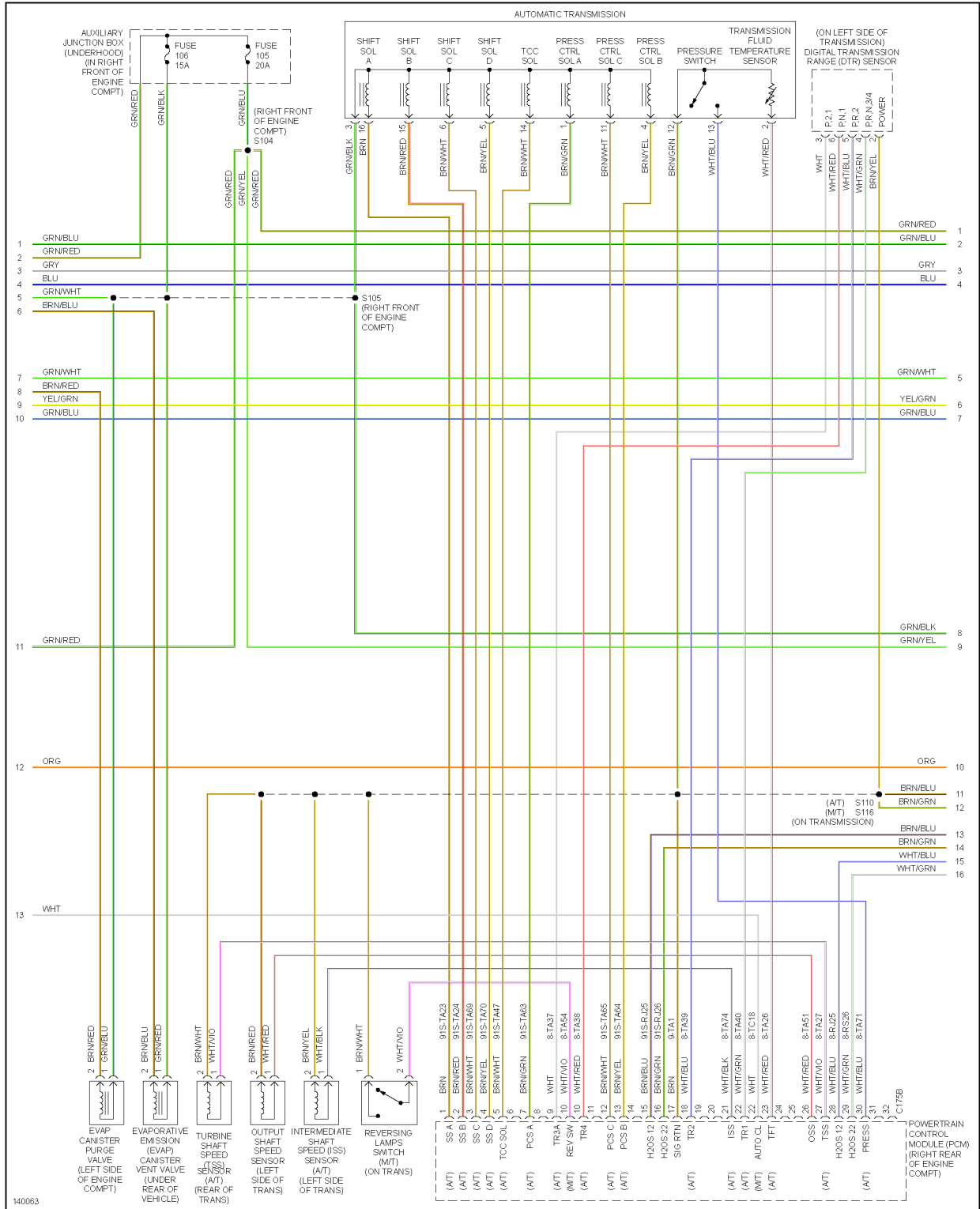


Fig. 21: 3.9L, Engine Performance Circuit (2 of 4)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

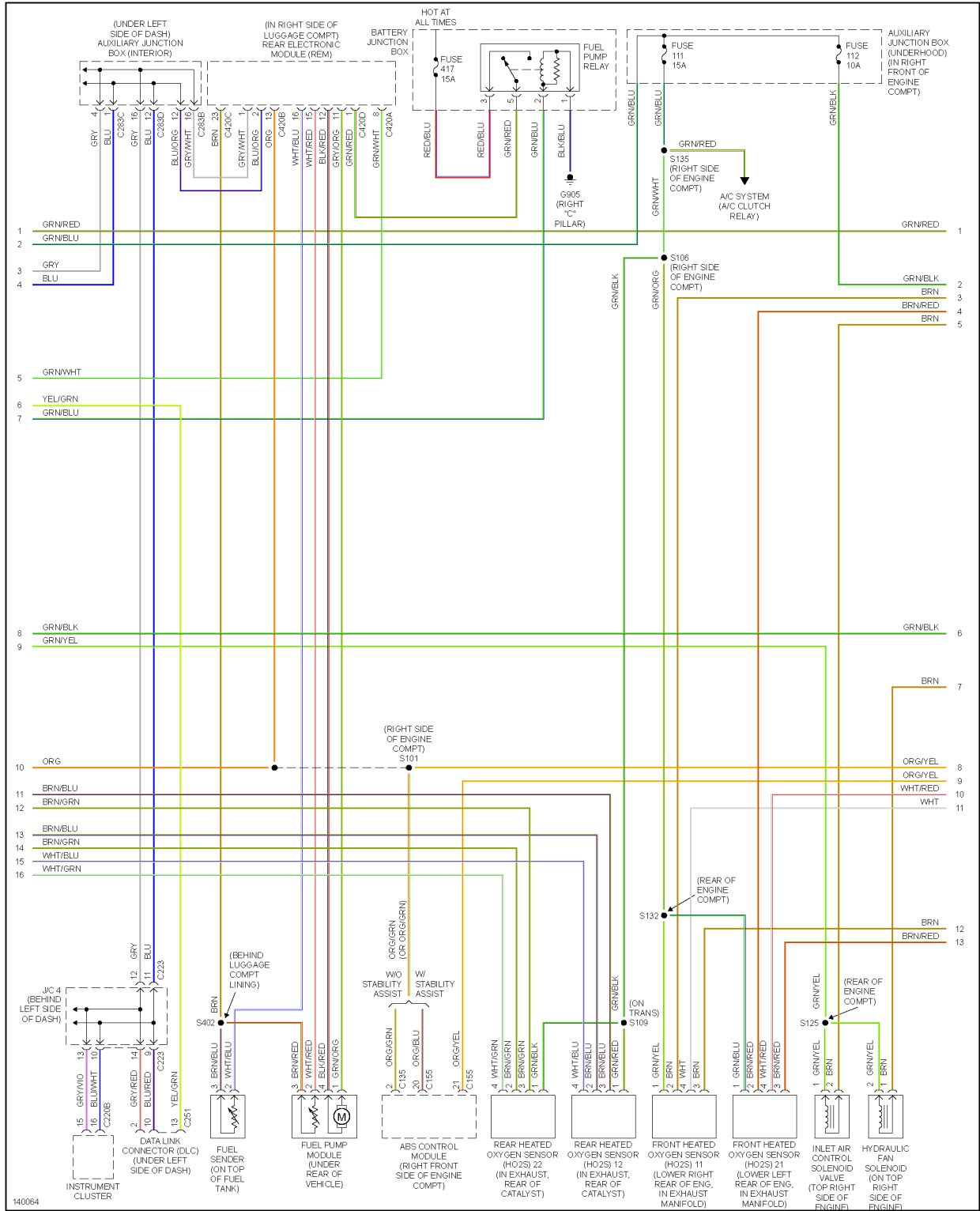


Fig. 22: 3.9L, Engine Performance Circuit (3 of 4)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

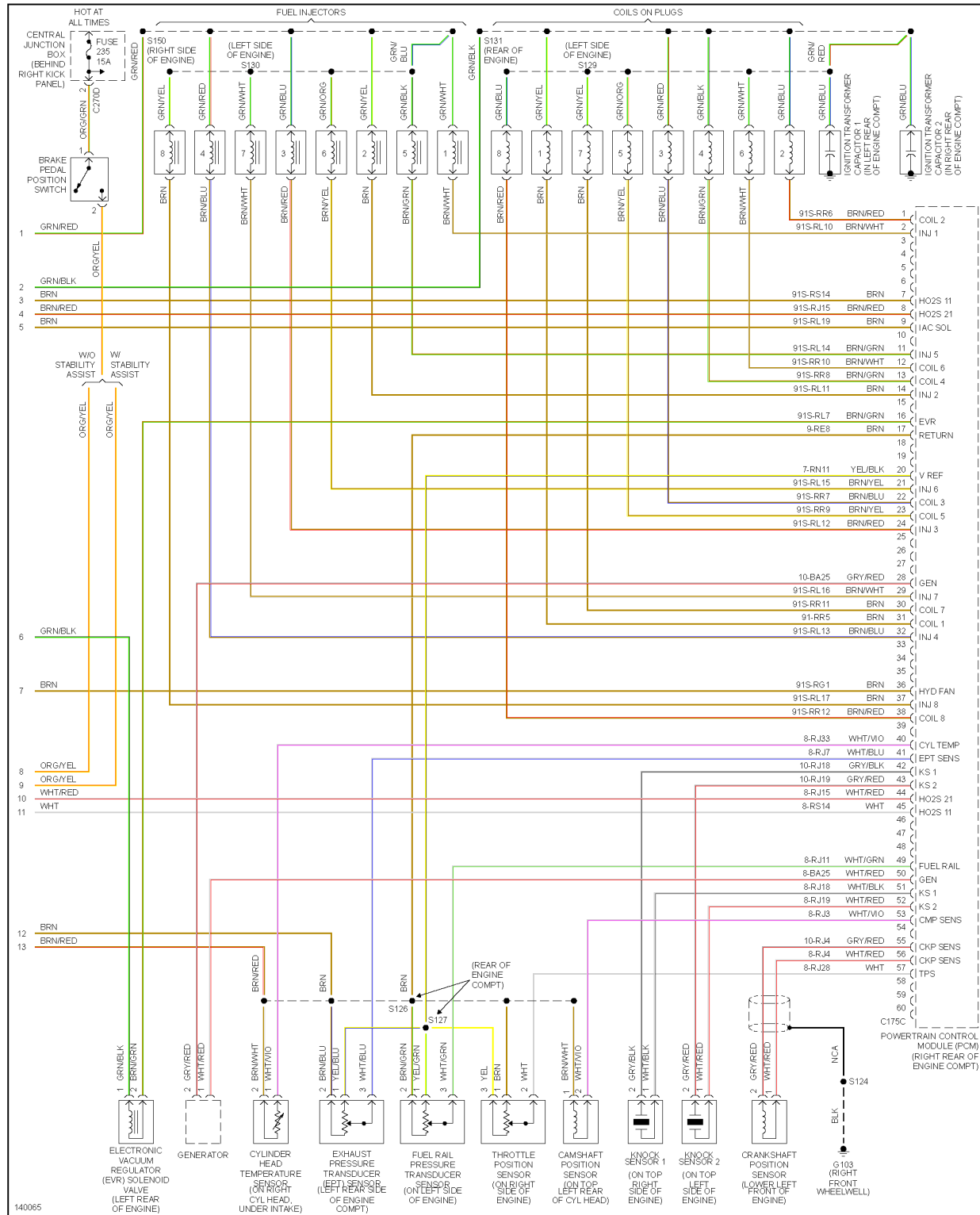


Fig. 23: 3.9L, Engine Performance Circuit (4 of 4)

EXTERIOR LIGHTS

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

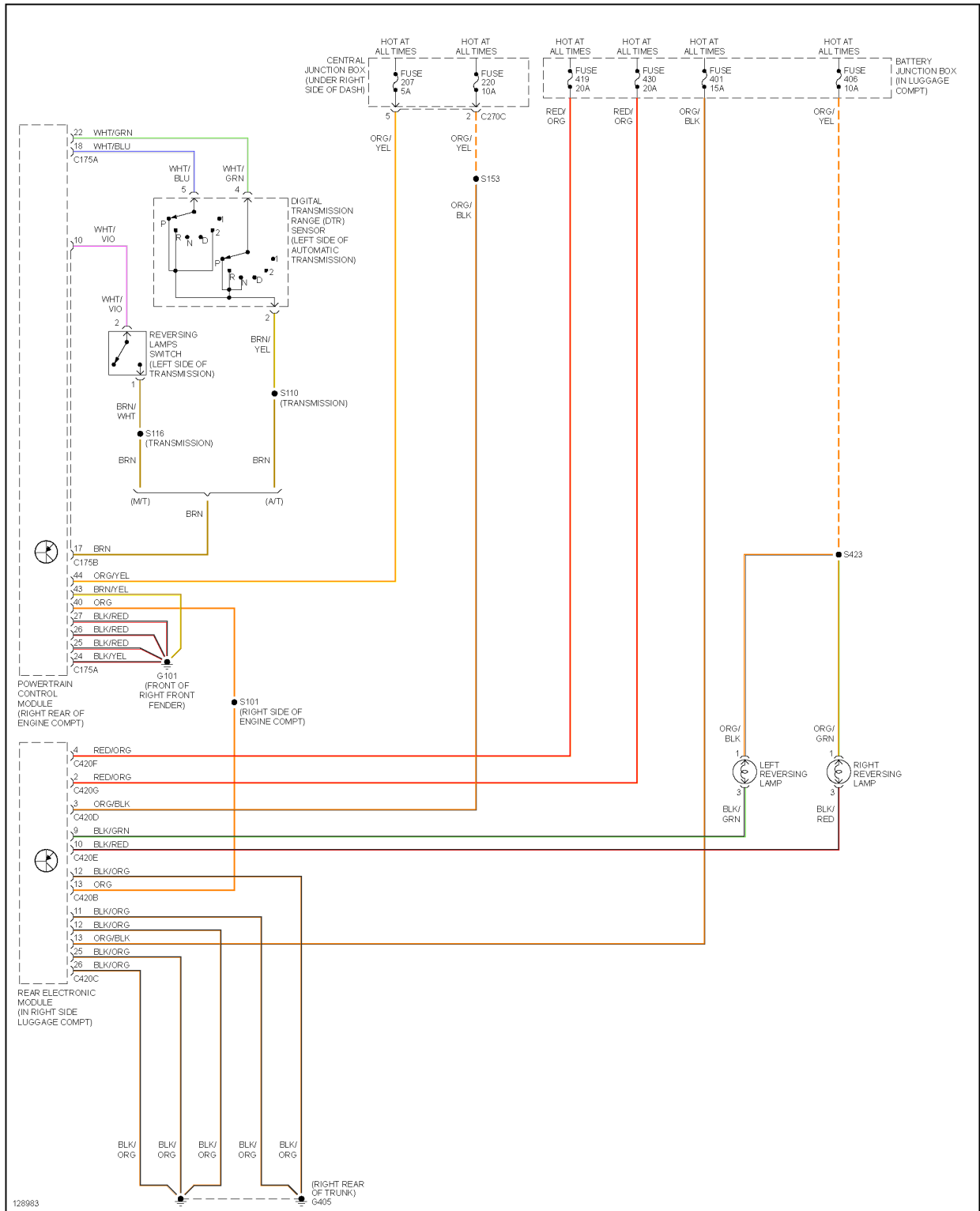


Fig. 24: Backup Lamps Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

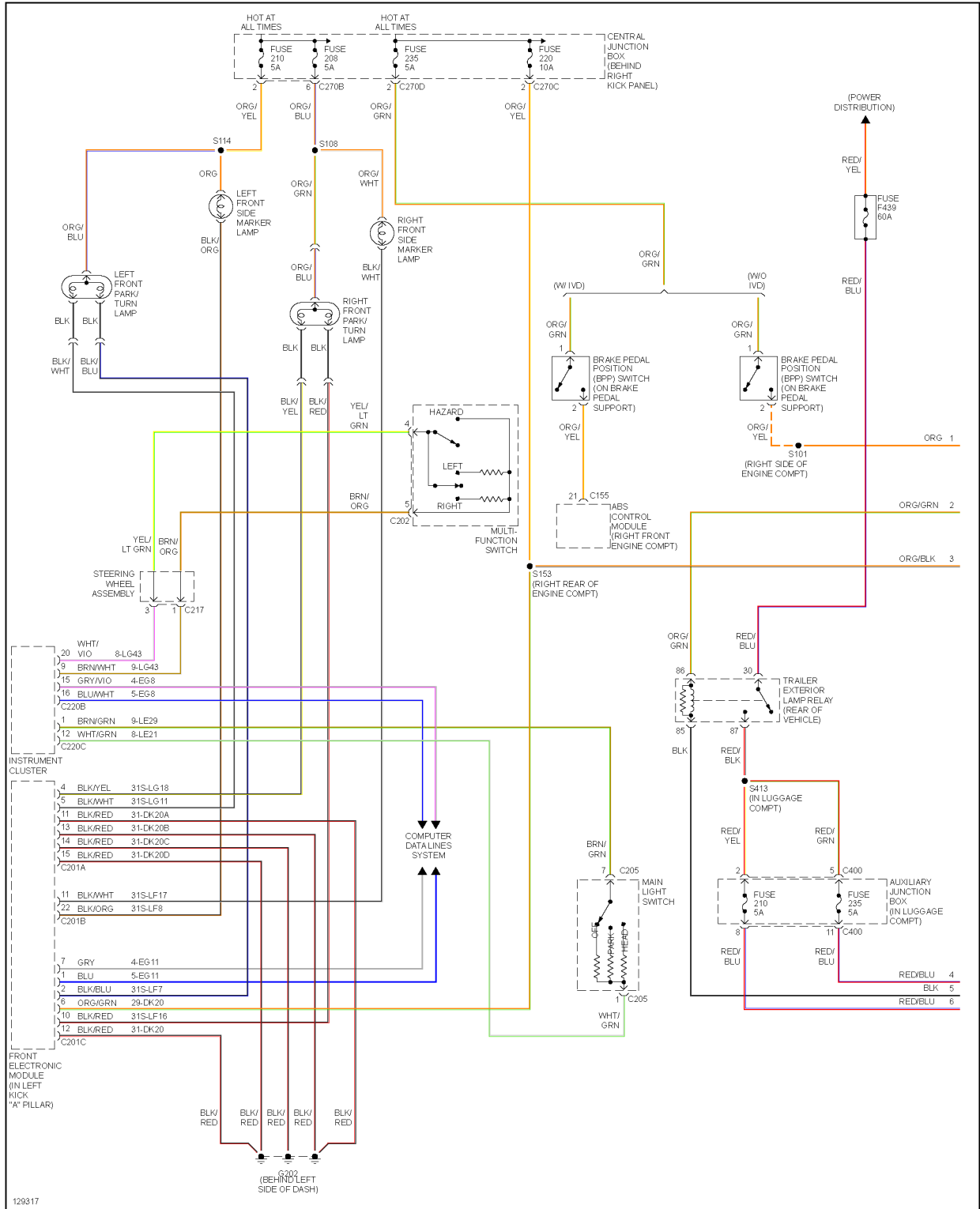


Fig. 25: Exterior Lamps Circuit (1 of 2)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

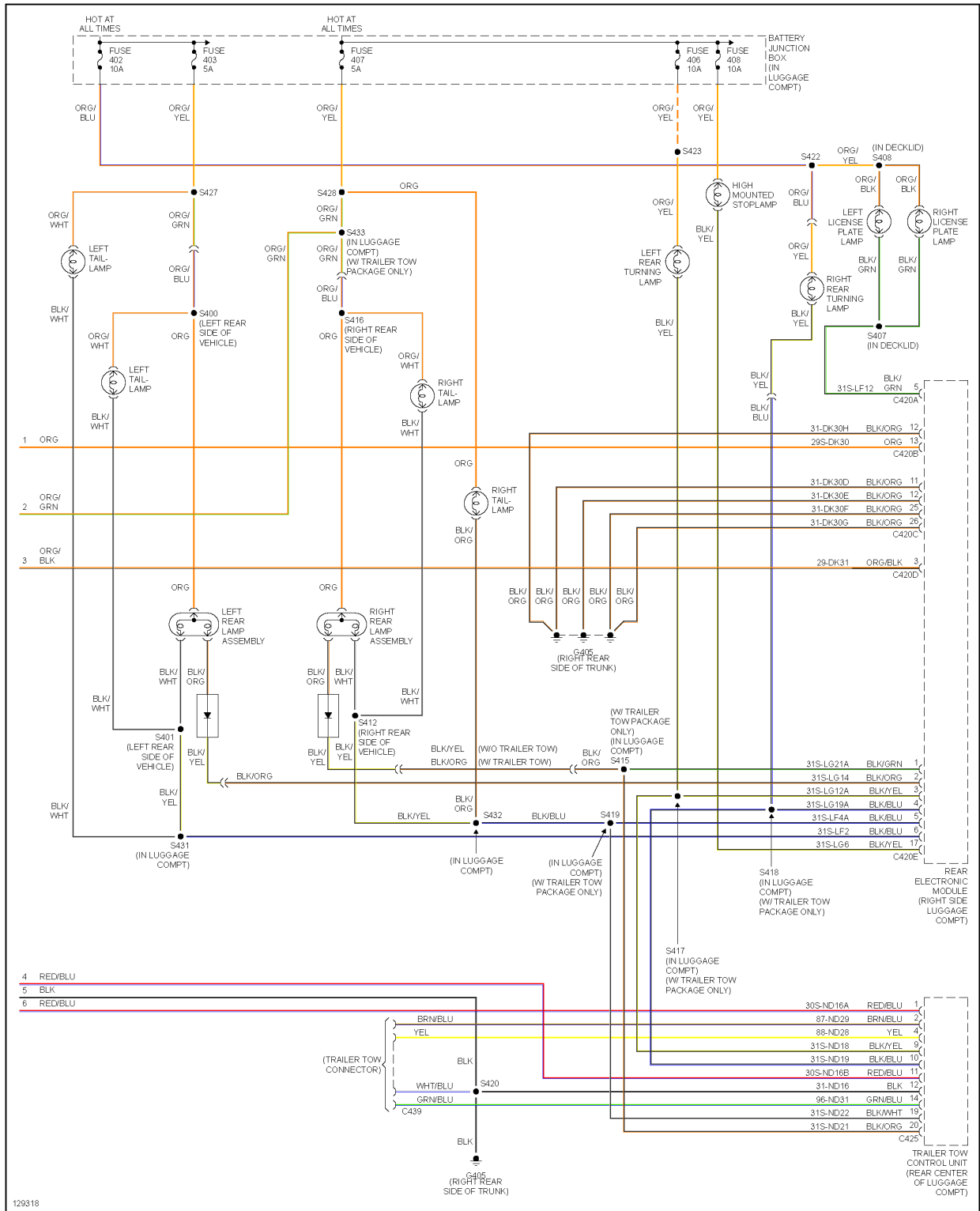


Fig. 26: Exterior Lamps Circuit (2 of 2)

GROUND DISTRIBUTION

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

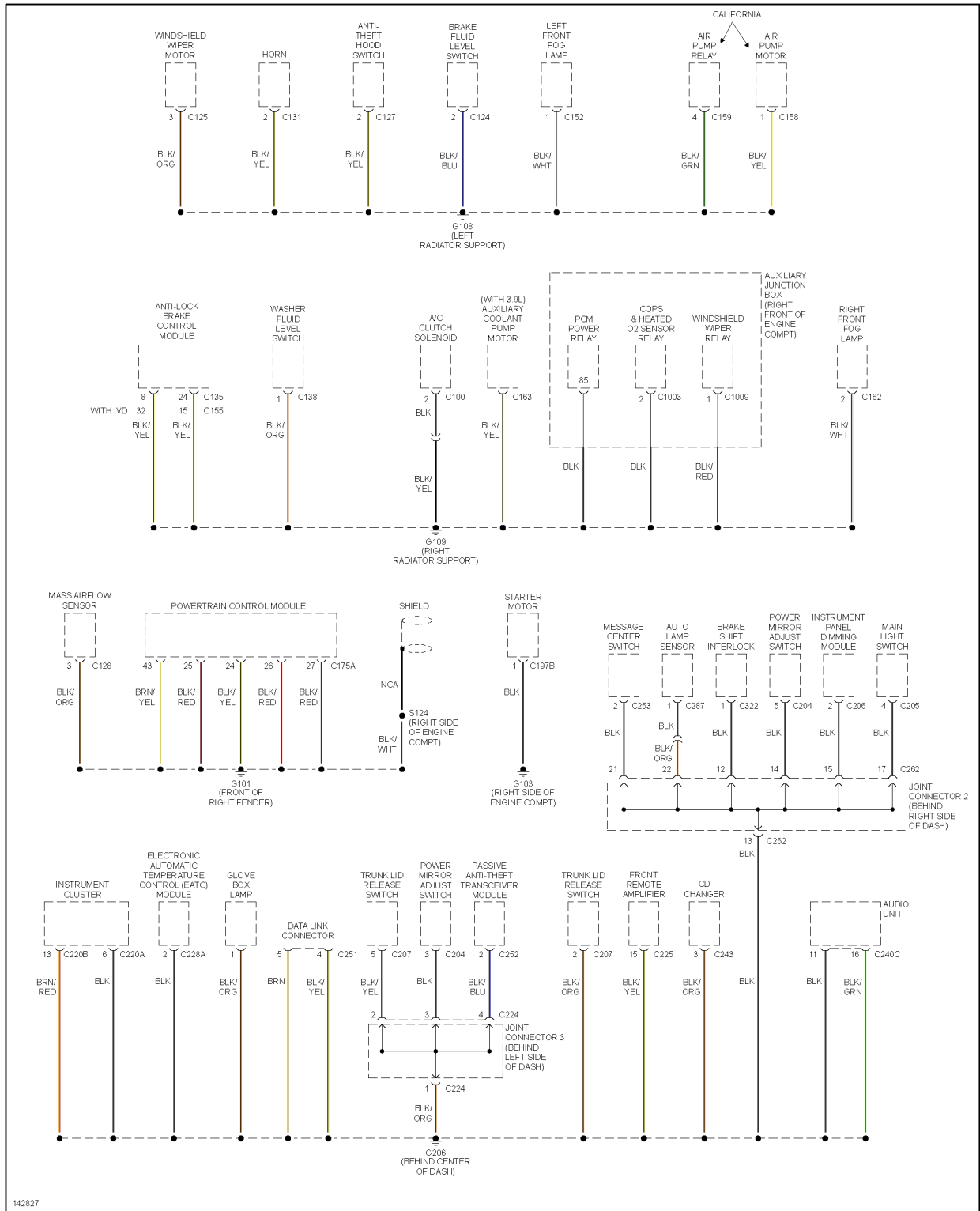


Fig. 27: Ground Distribution Circuit (1 of 3)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

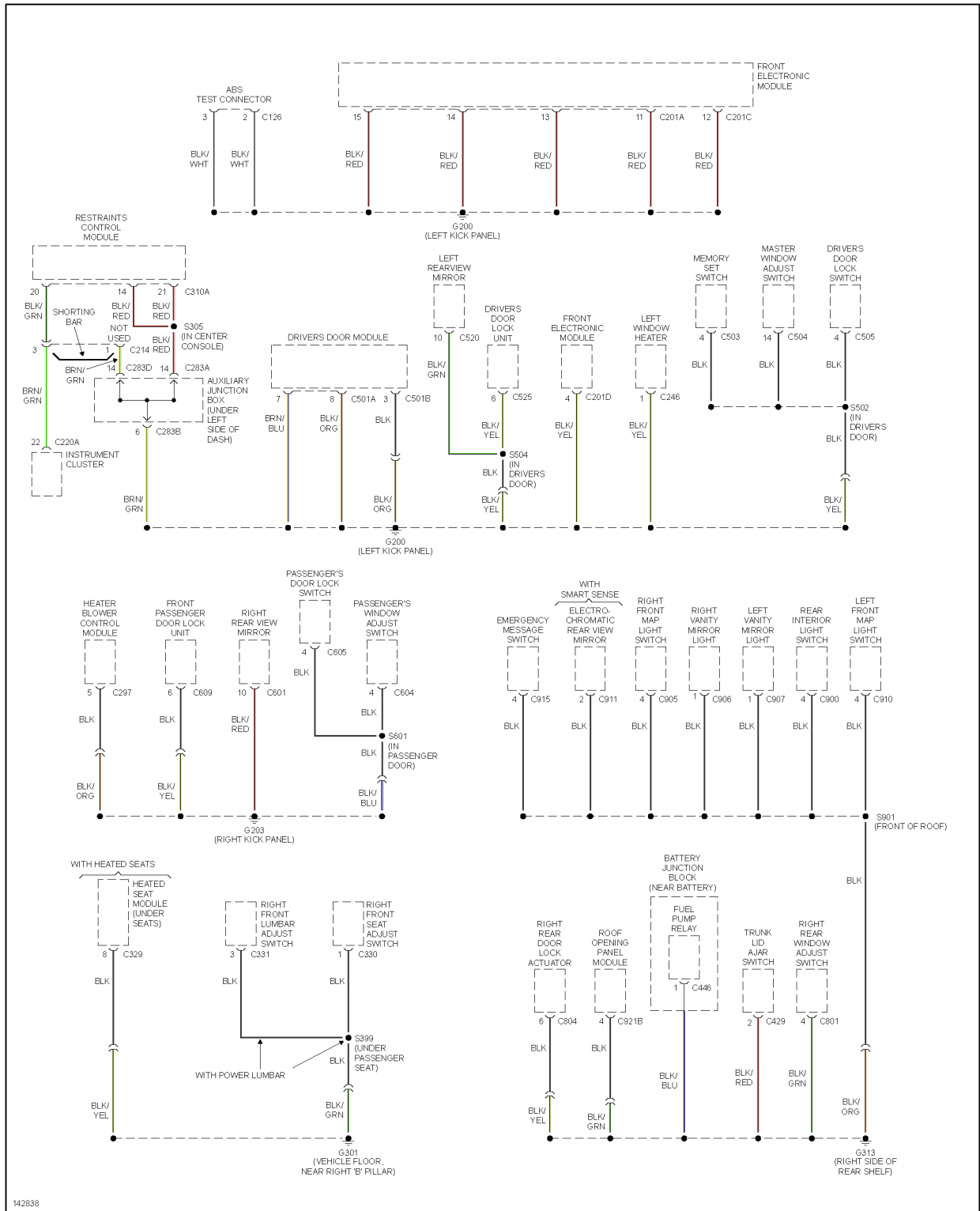


Fig. 28: Ground Distribution Circuit (2 of 3)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

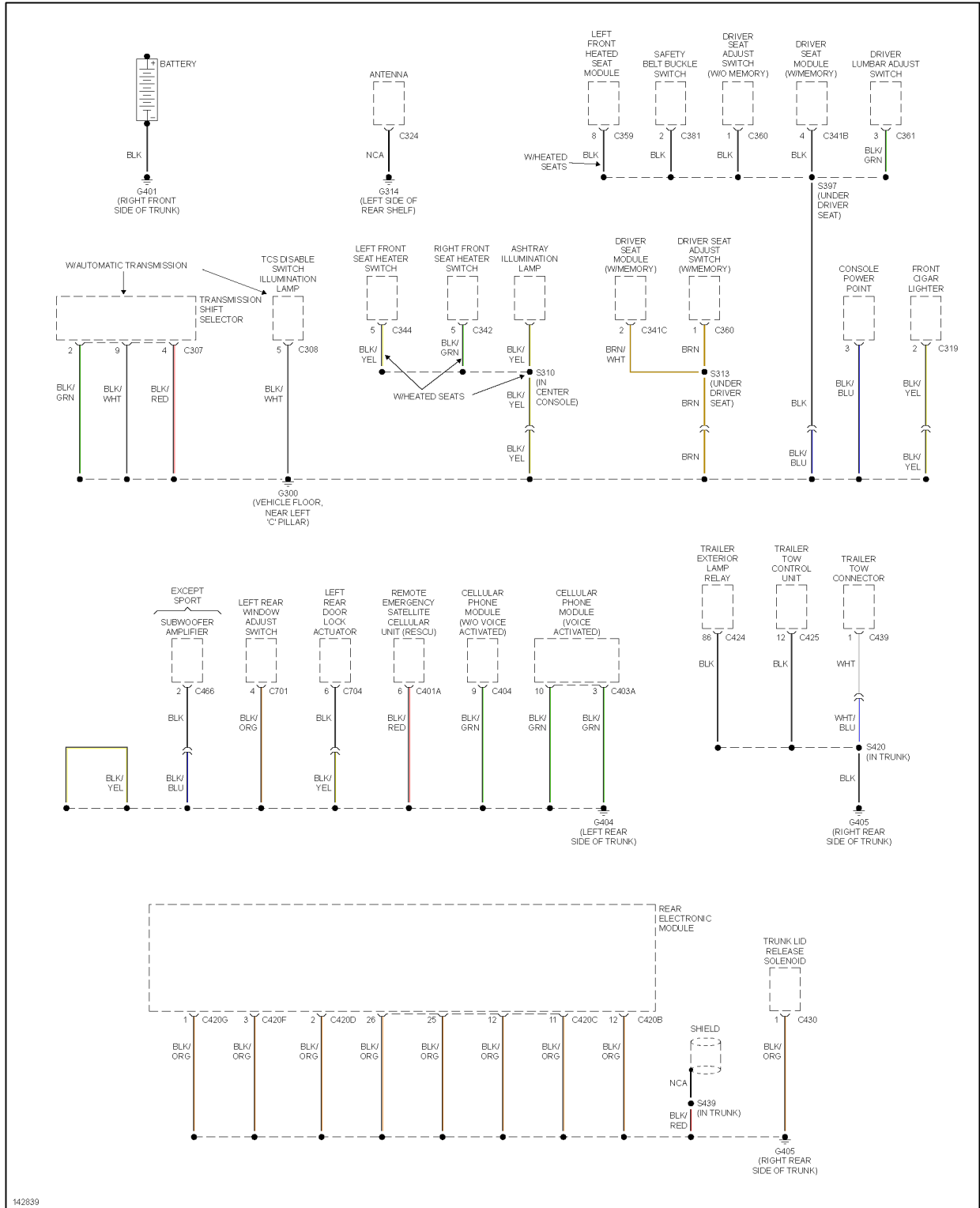


Fig. 29: Ground Distribution Circuit (3 of 3)

HEADLIGHTS

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

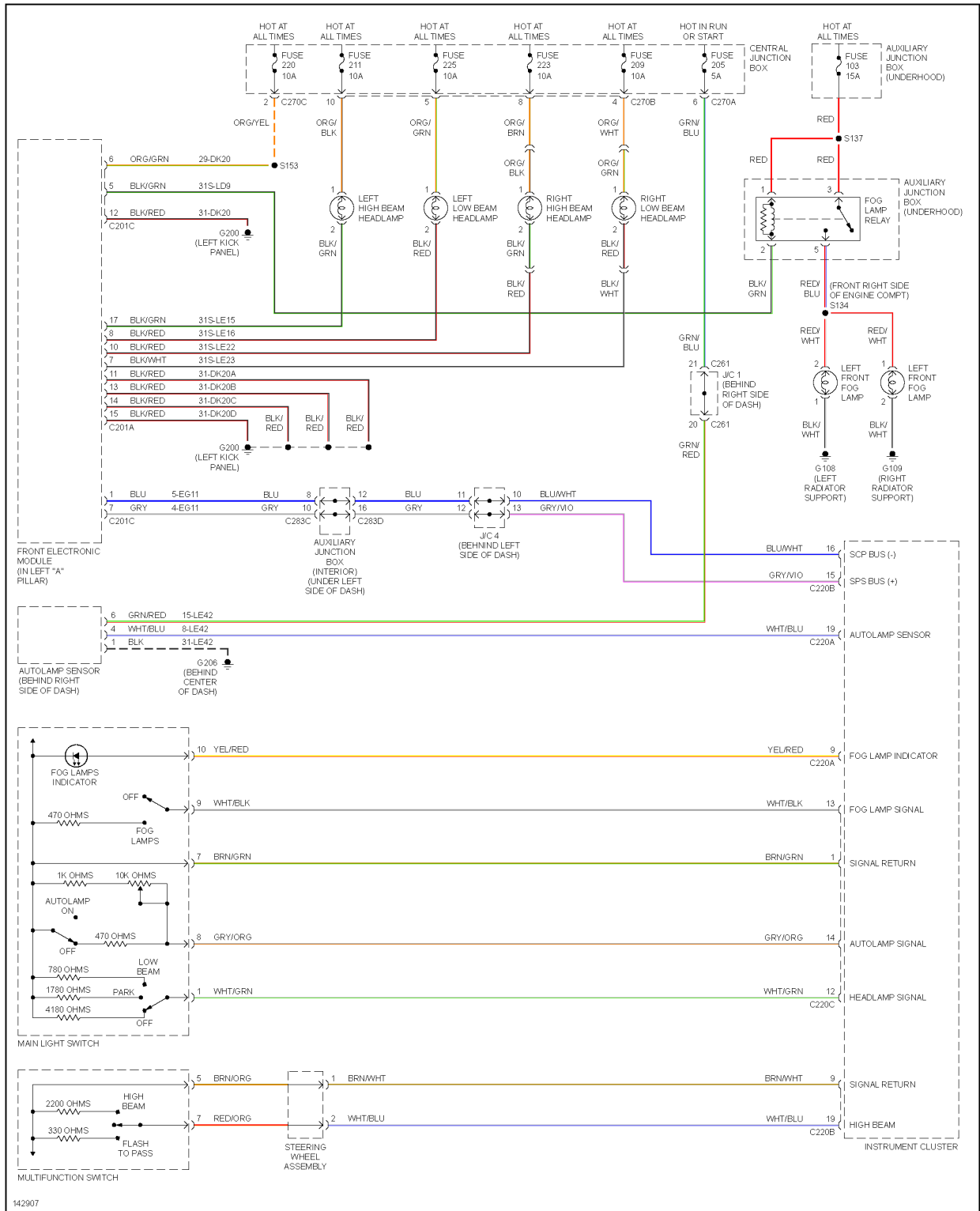


Fig. 30: Headlights Circuit

HORN

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

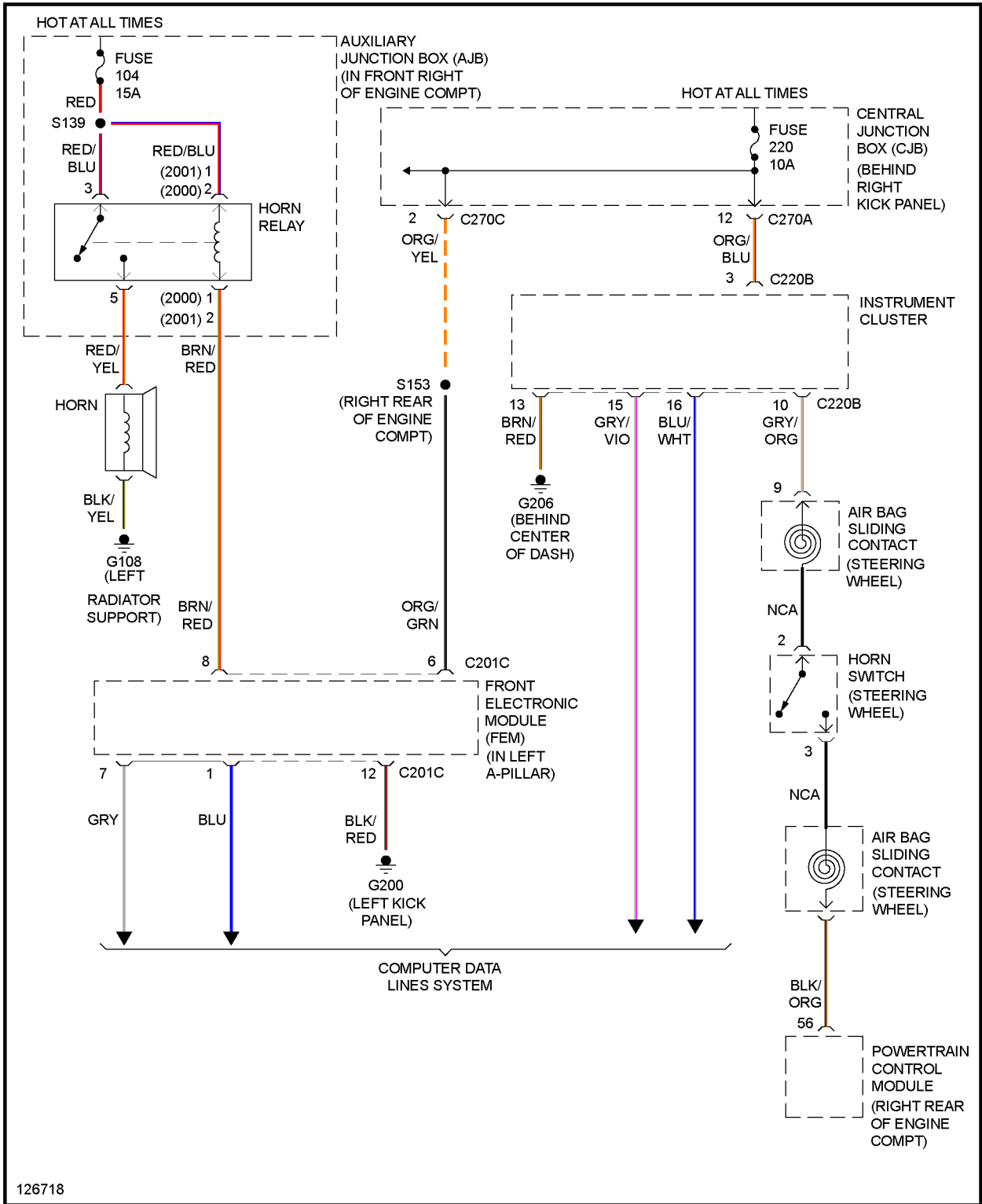


Fig. 31: Horn Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

INSTRUMENT CLUSTER

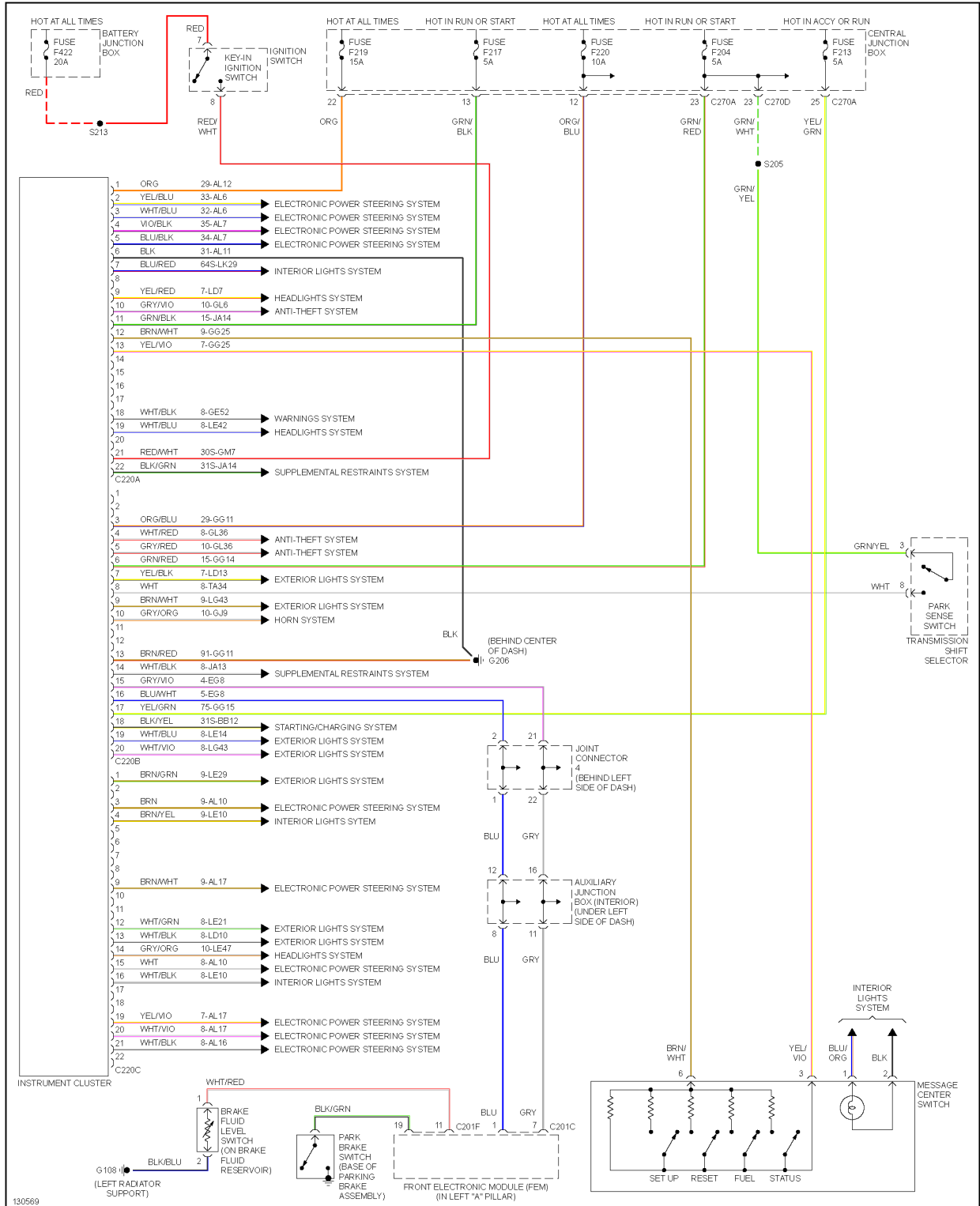


Fig. 32: Instrument Cluster Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

INTERIOR LIGHTS

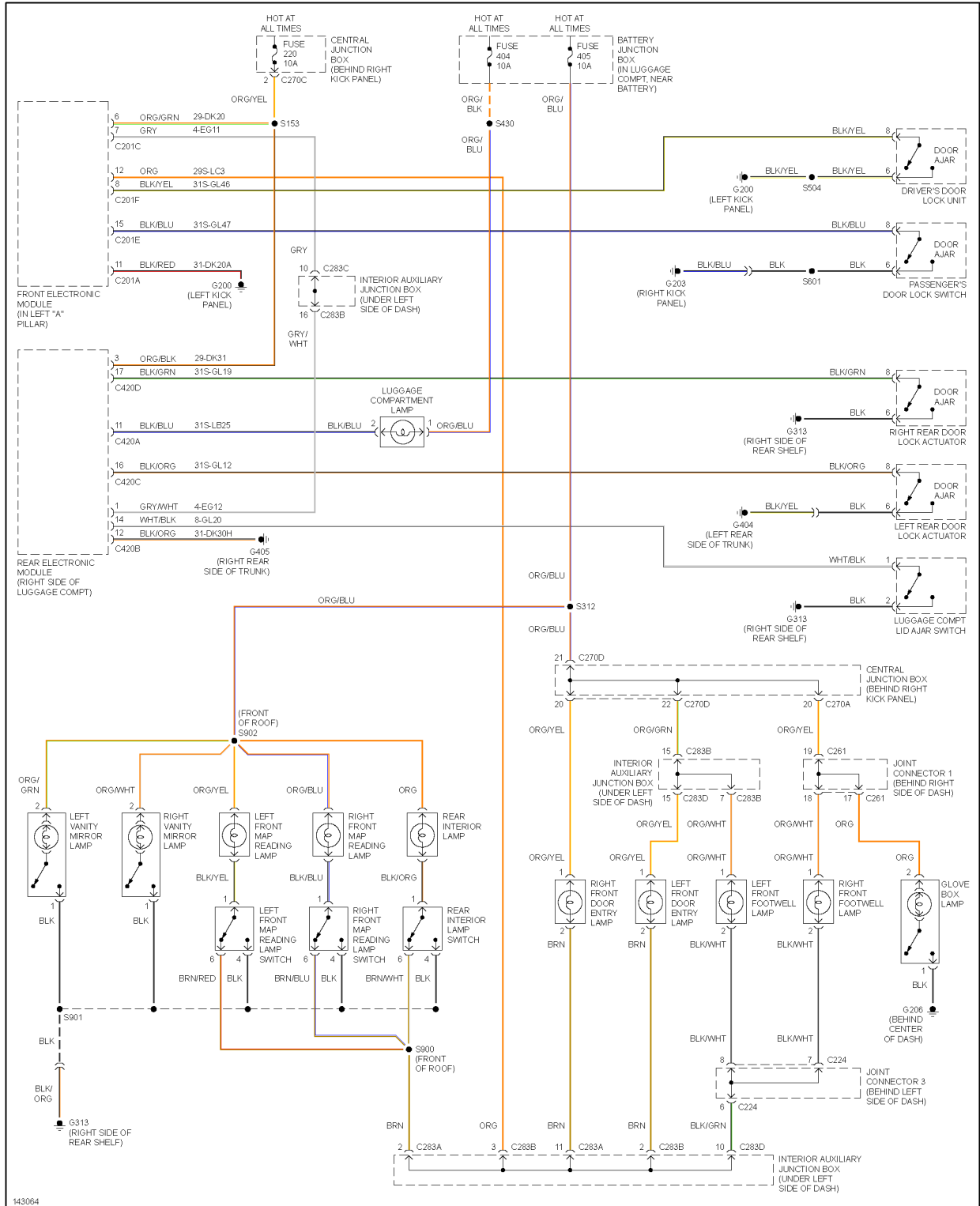


Fig. 33: Courtesy Lamps Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

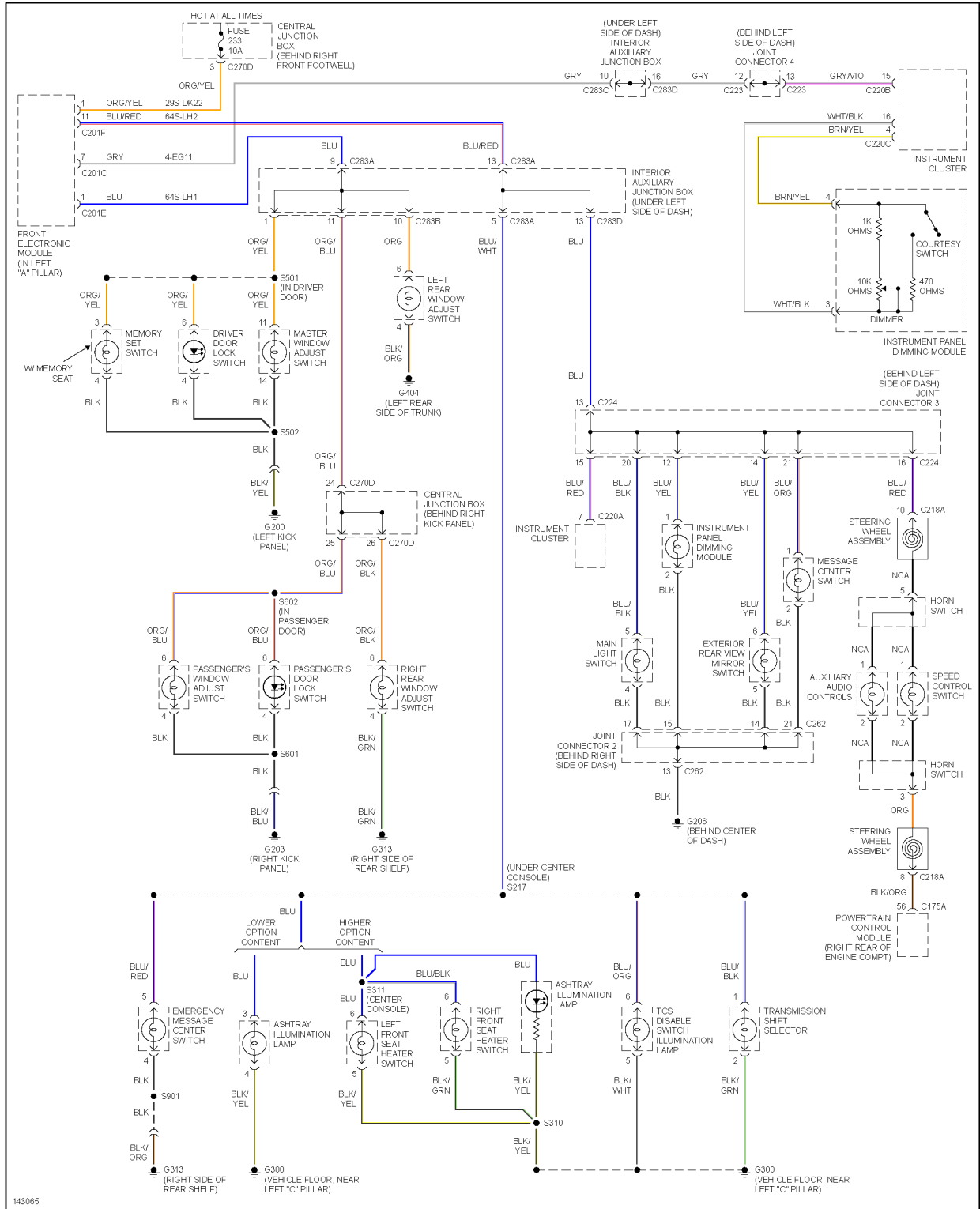


Fig. 34: Instrument Illumination Circuit

MEMORY SYSTEMS

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

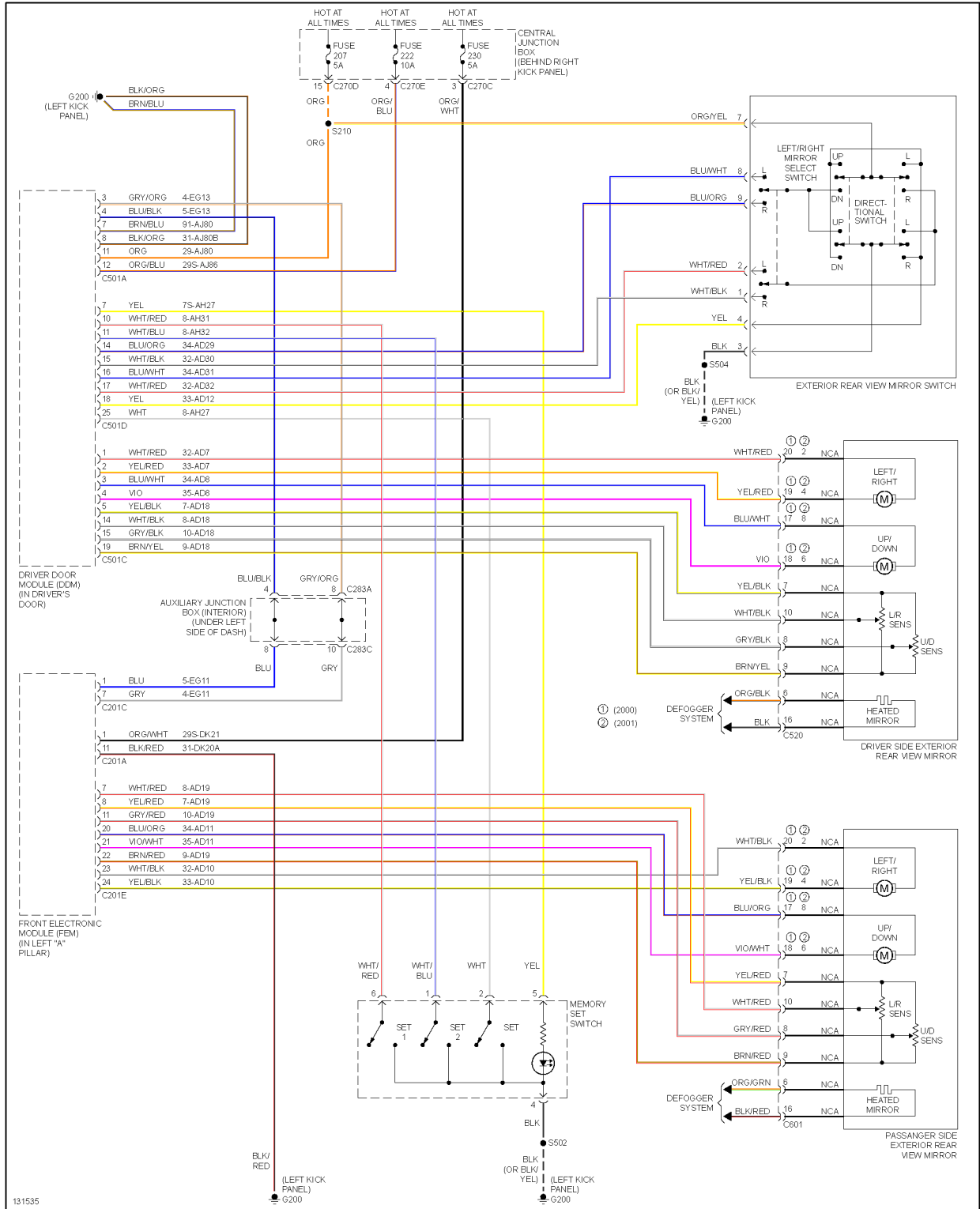


Fig. 35: Memory Mirrors Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

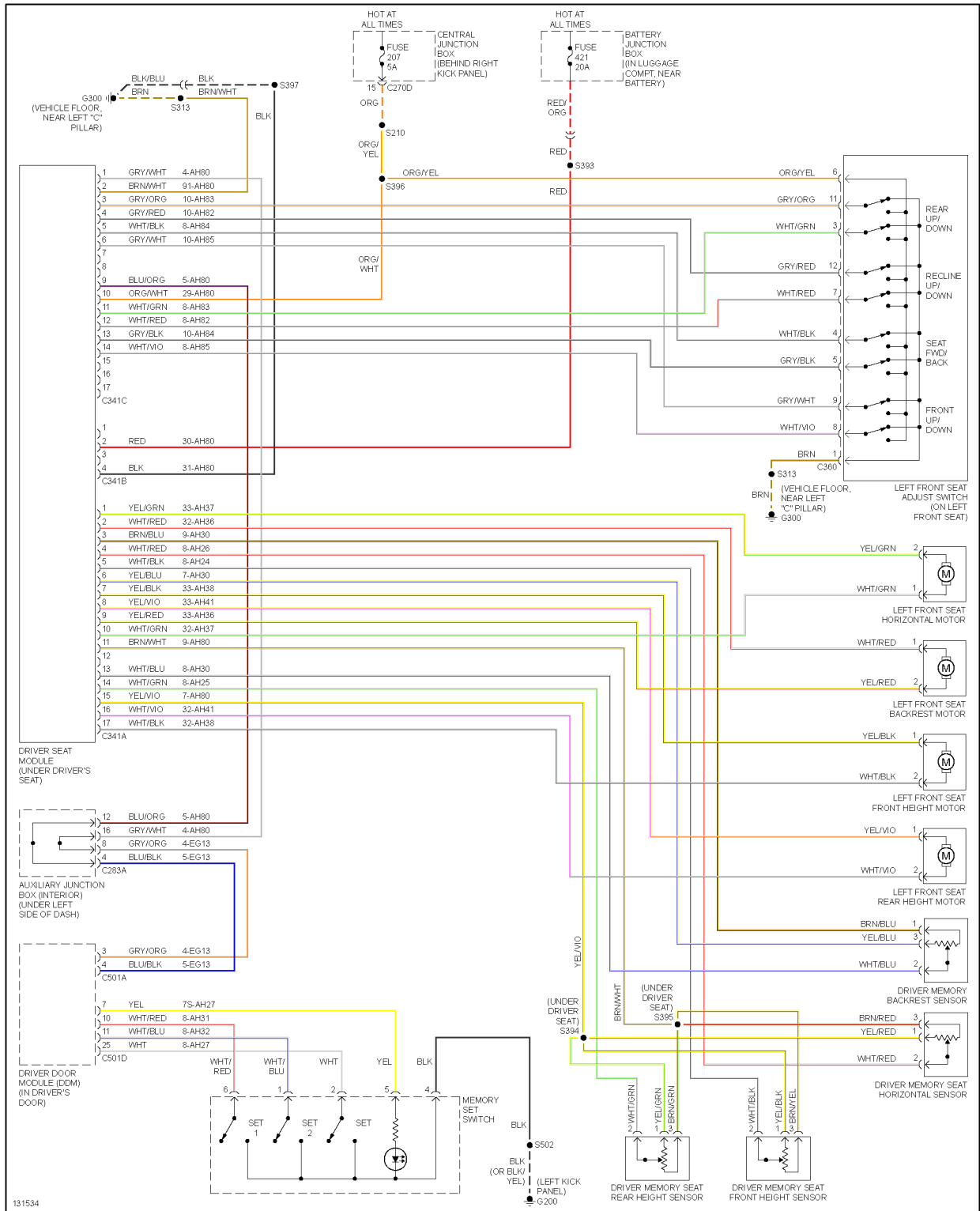


Fig. 36: Memory Seat Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

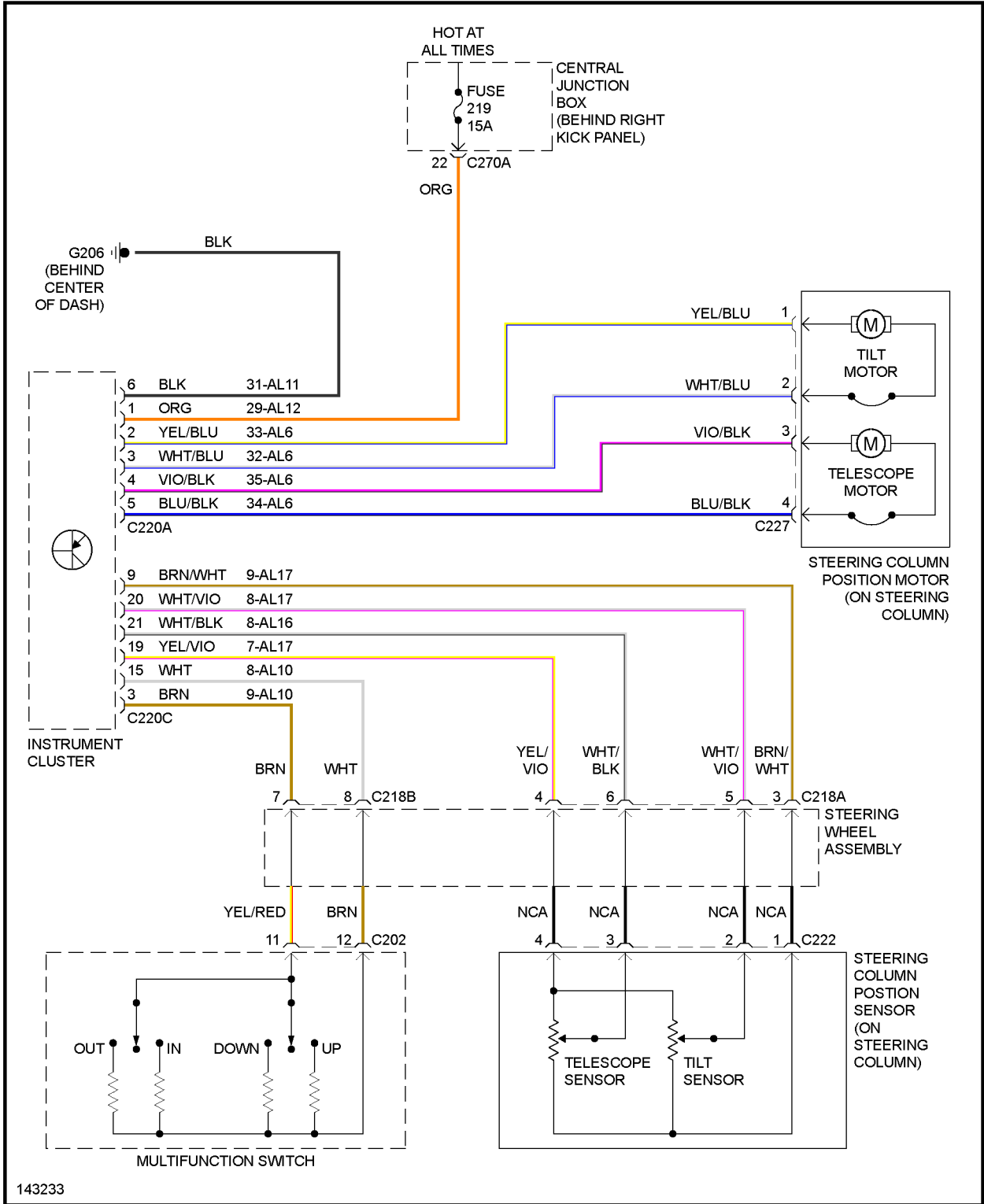


Fig. 37: Steering Column Memory Circuit

NAVIGATION

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

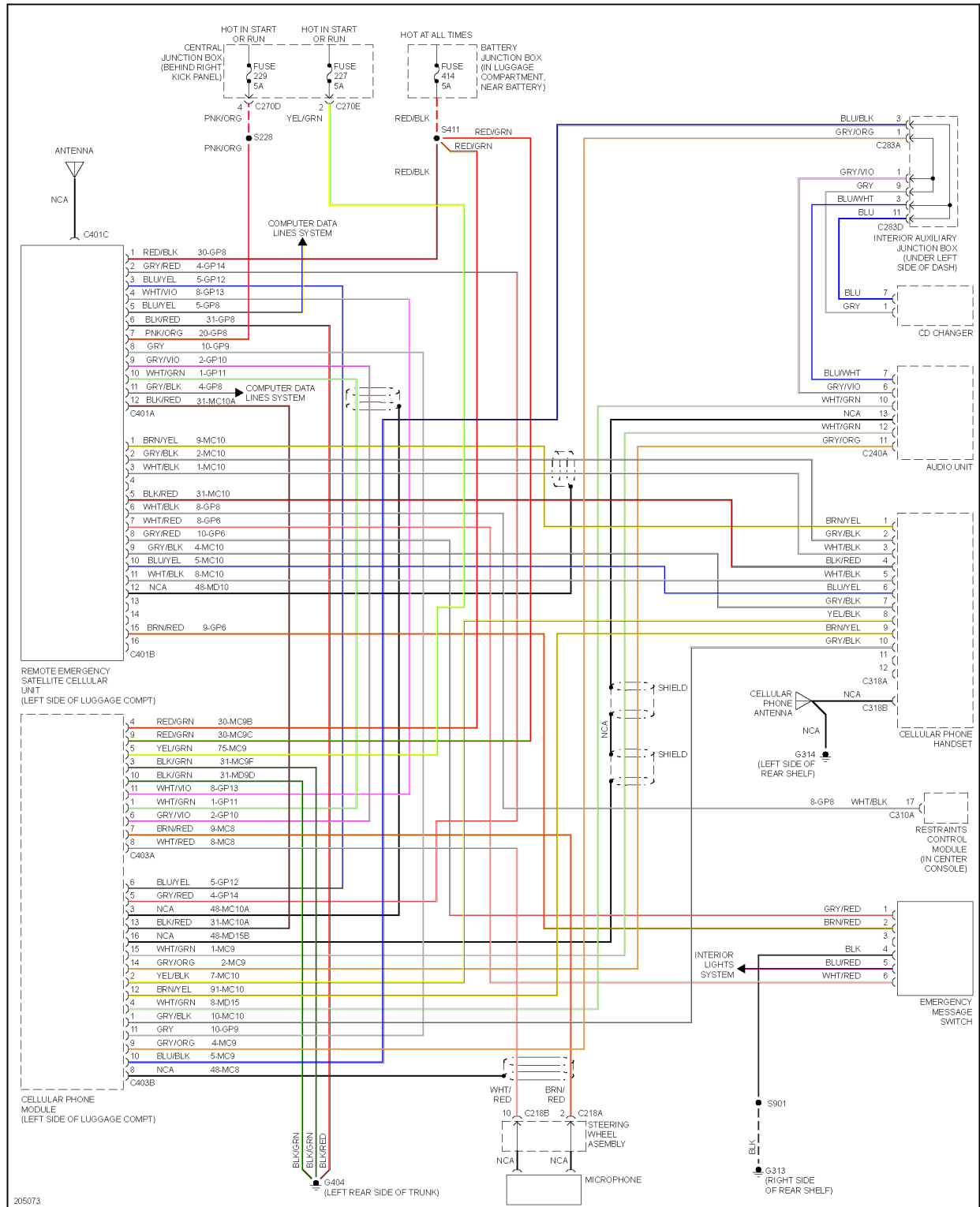


Fig. 38: Vehicle Emergency Messaging Circuit

POWER DISTRIBUTION

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

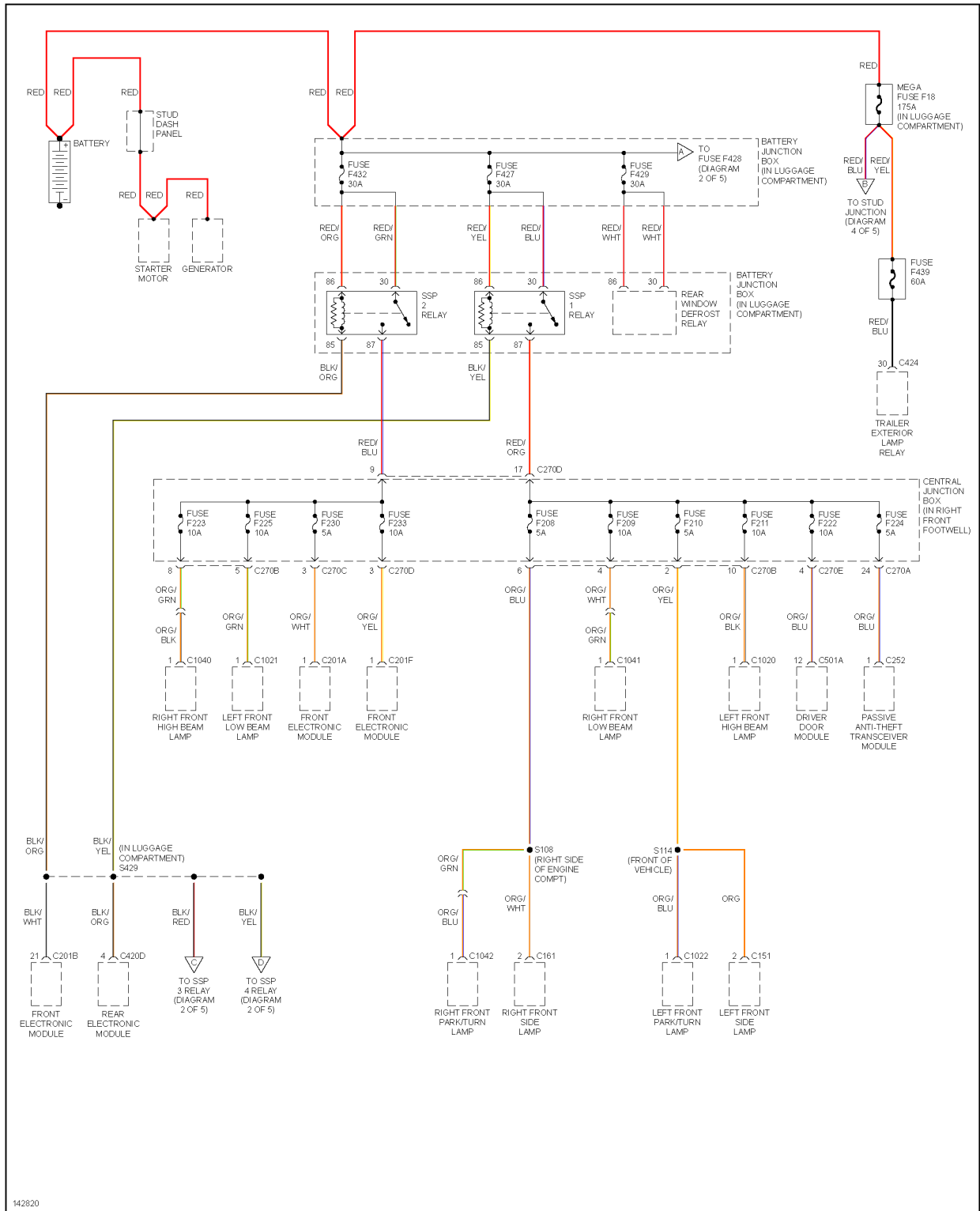


Fig. 39: Power Distribution Circuit (1 of 5)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

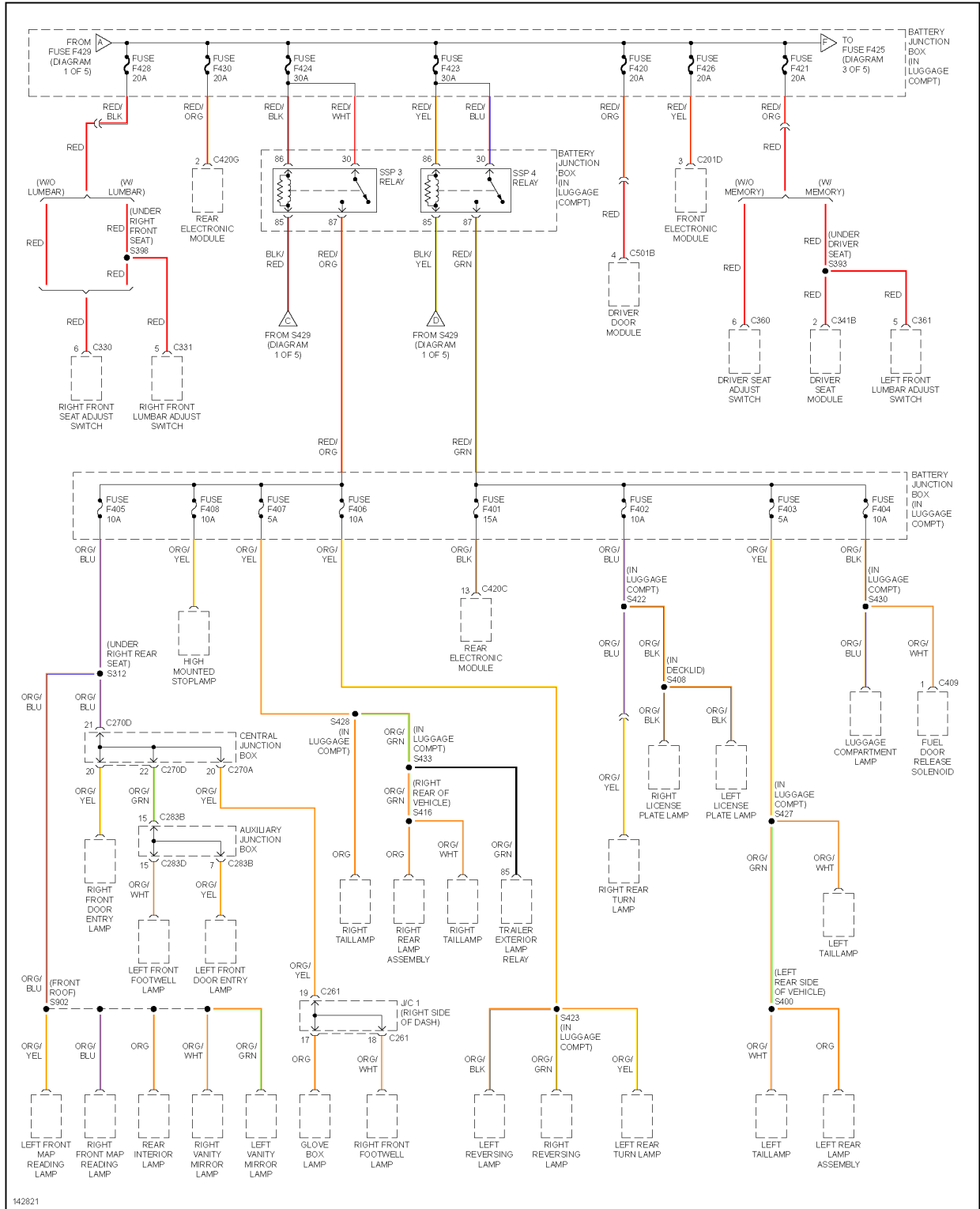


Fig. 40: Power Distribution Circuit (2 of 5)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

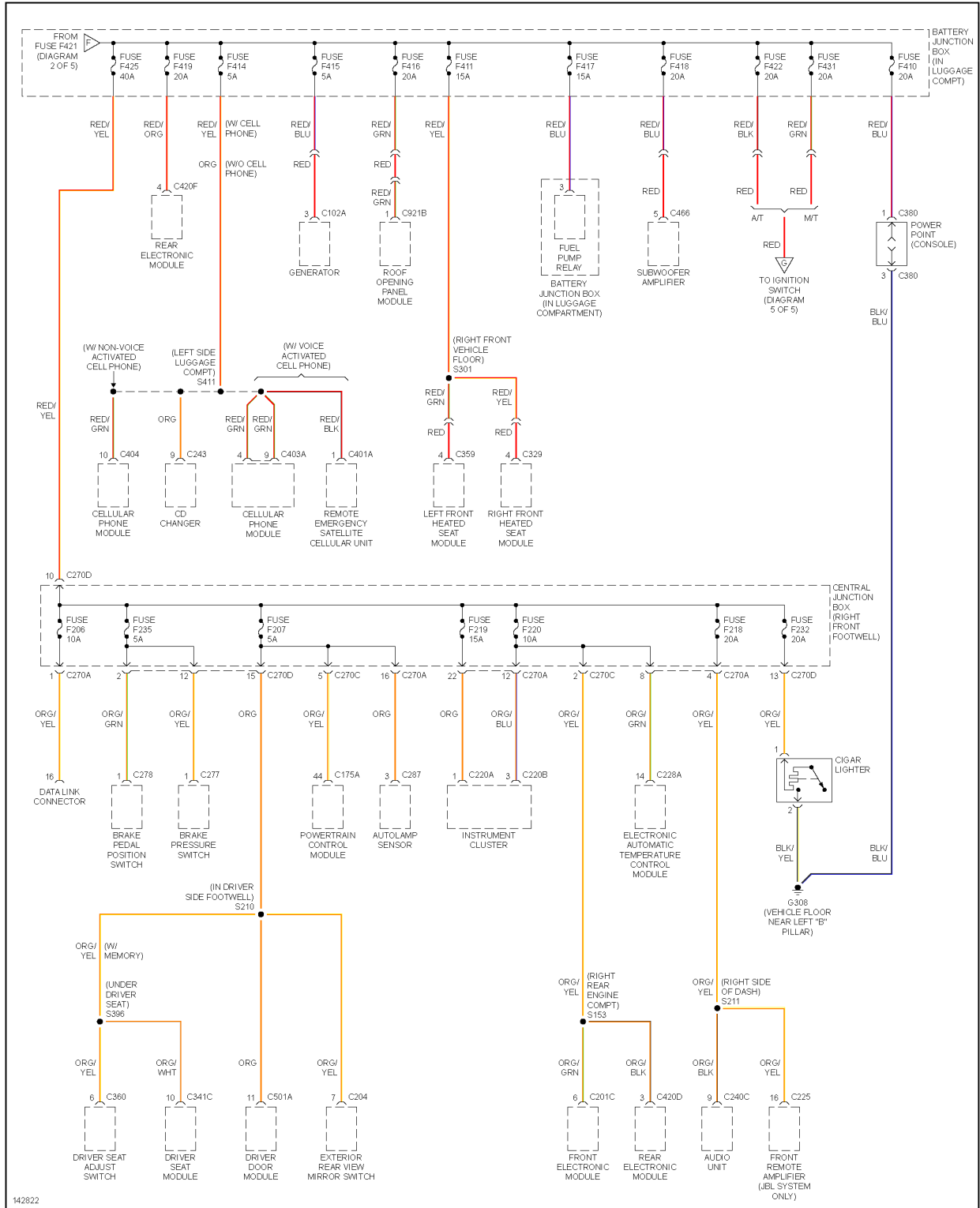


Fig. 41: Power Distribution Circuit (3 of 5)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

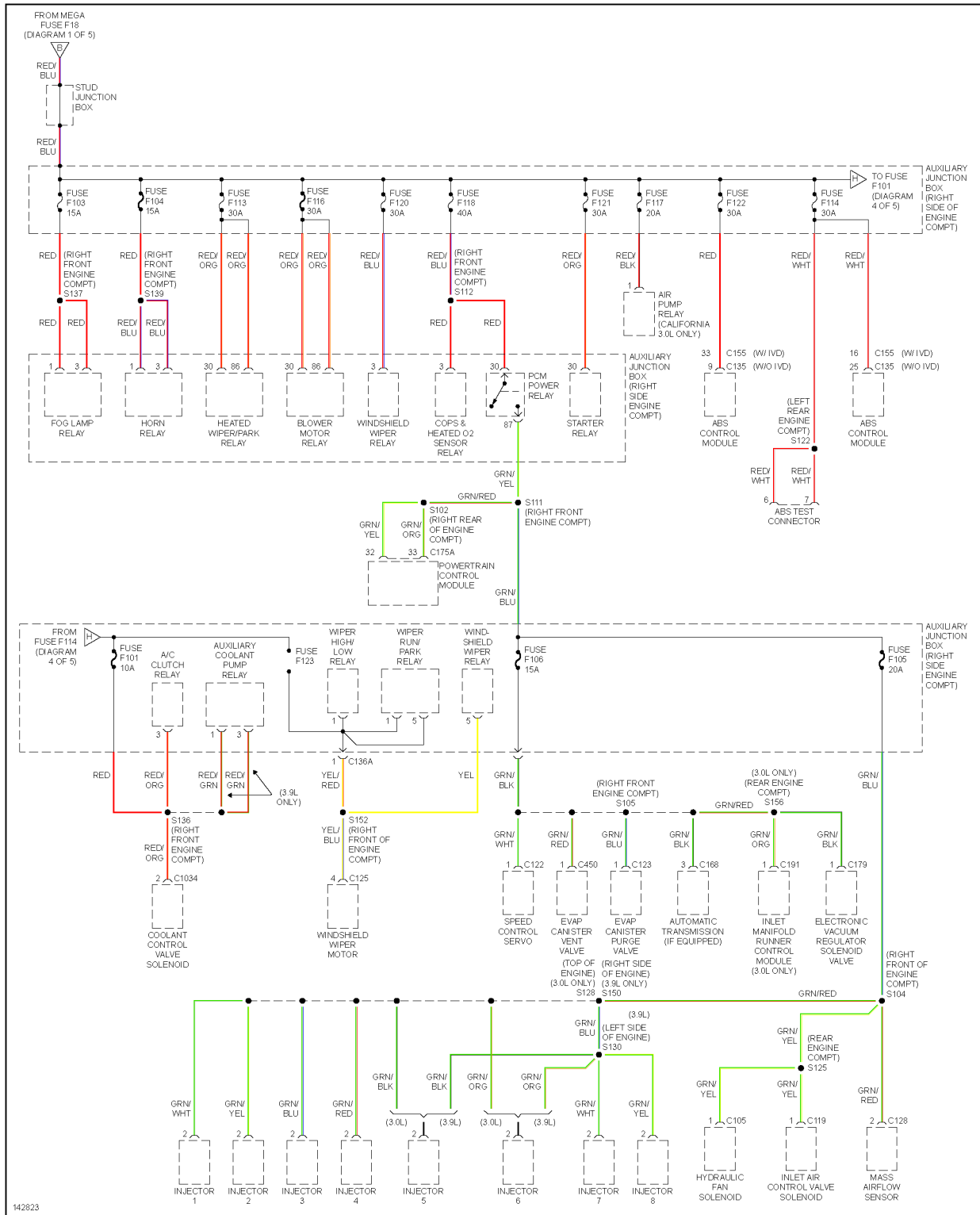


Fig. 42: Power Distribution Circuit (4 of 5)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

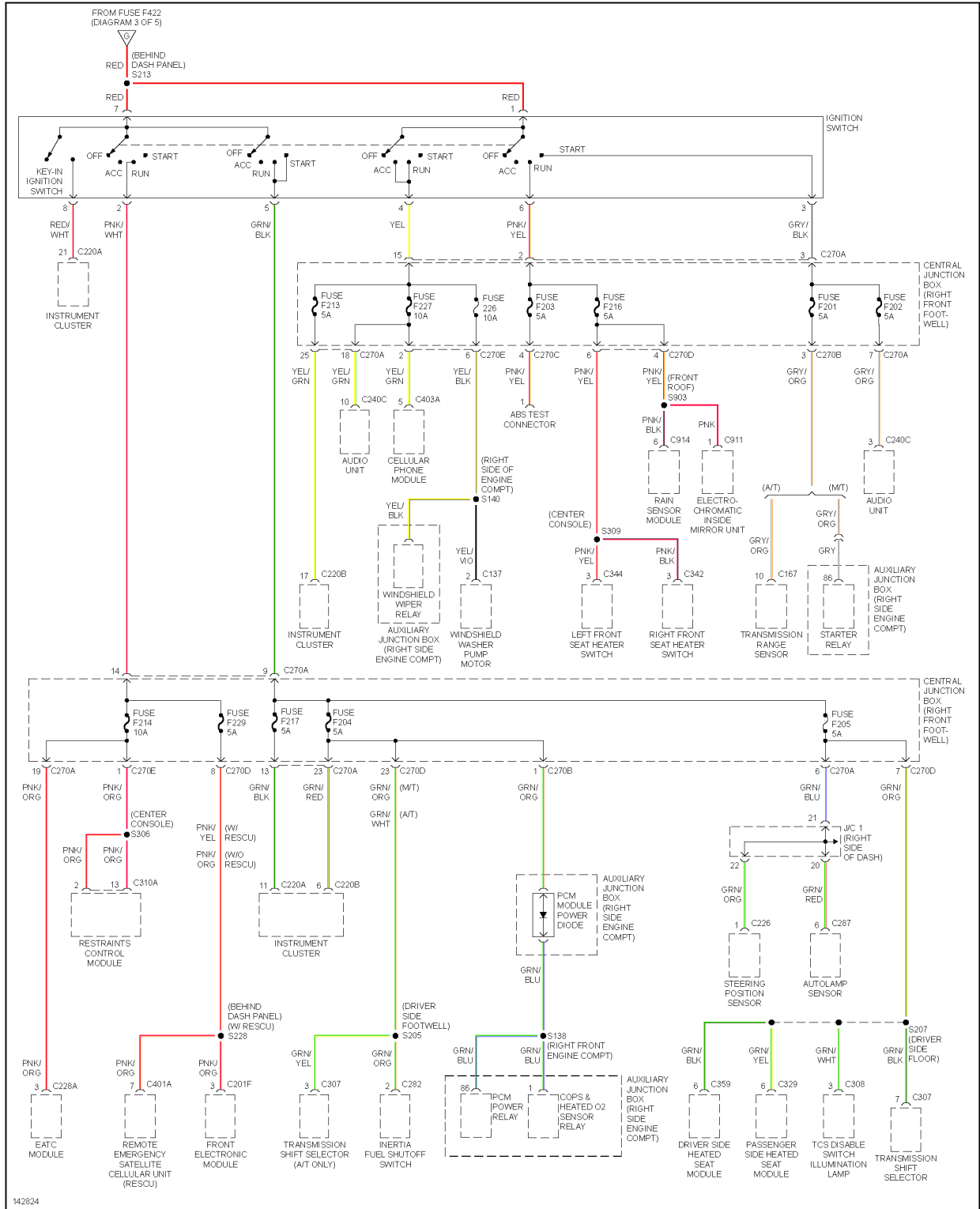
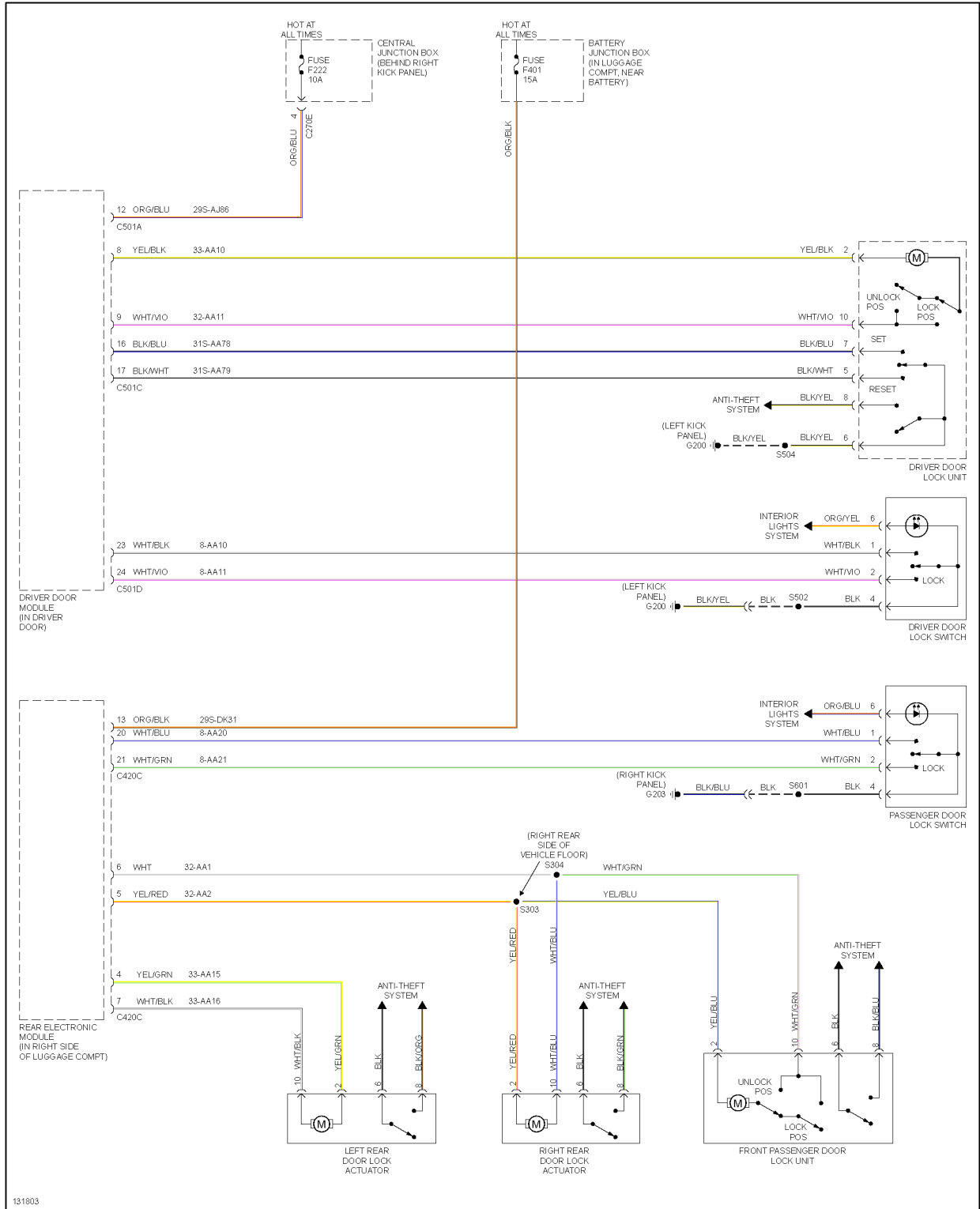


Fig. 43: Power Distribution Circuit (5 of 5)

POWER DOOR LOCKS

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS



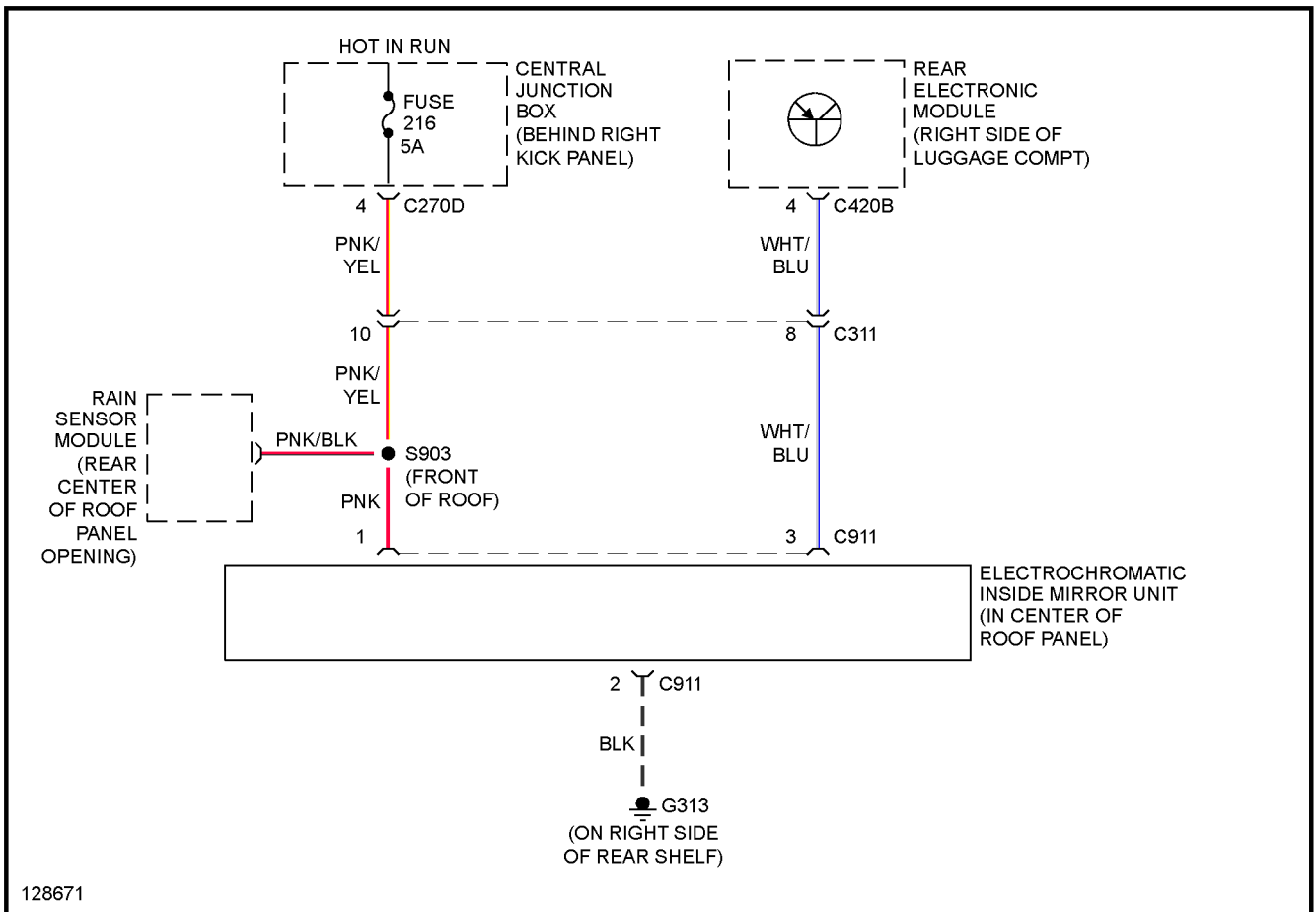
131803

Fig. 44: Power Door Locks Circuit

POWER MIRRORS

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS



128671

Fig. 45: Electrochromic Mirror Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

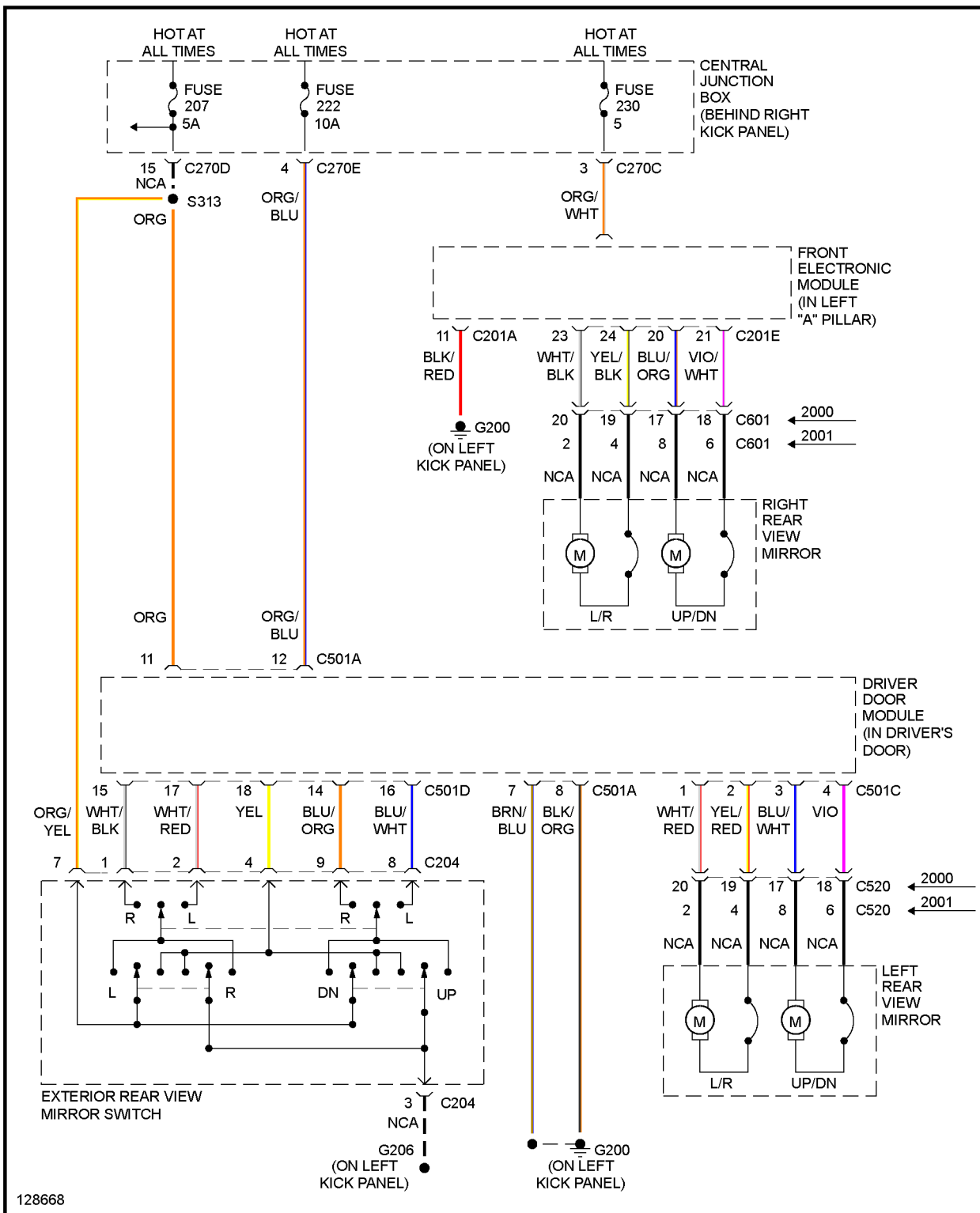


Fig. 46: Power Mirror Circuit

POWER SEATS

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

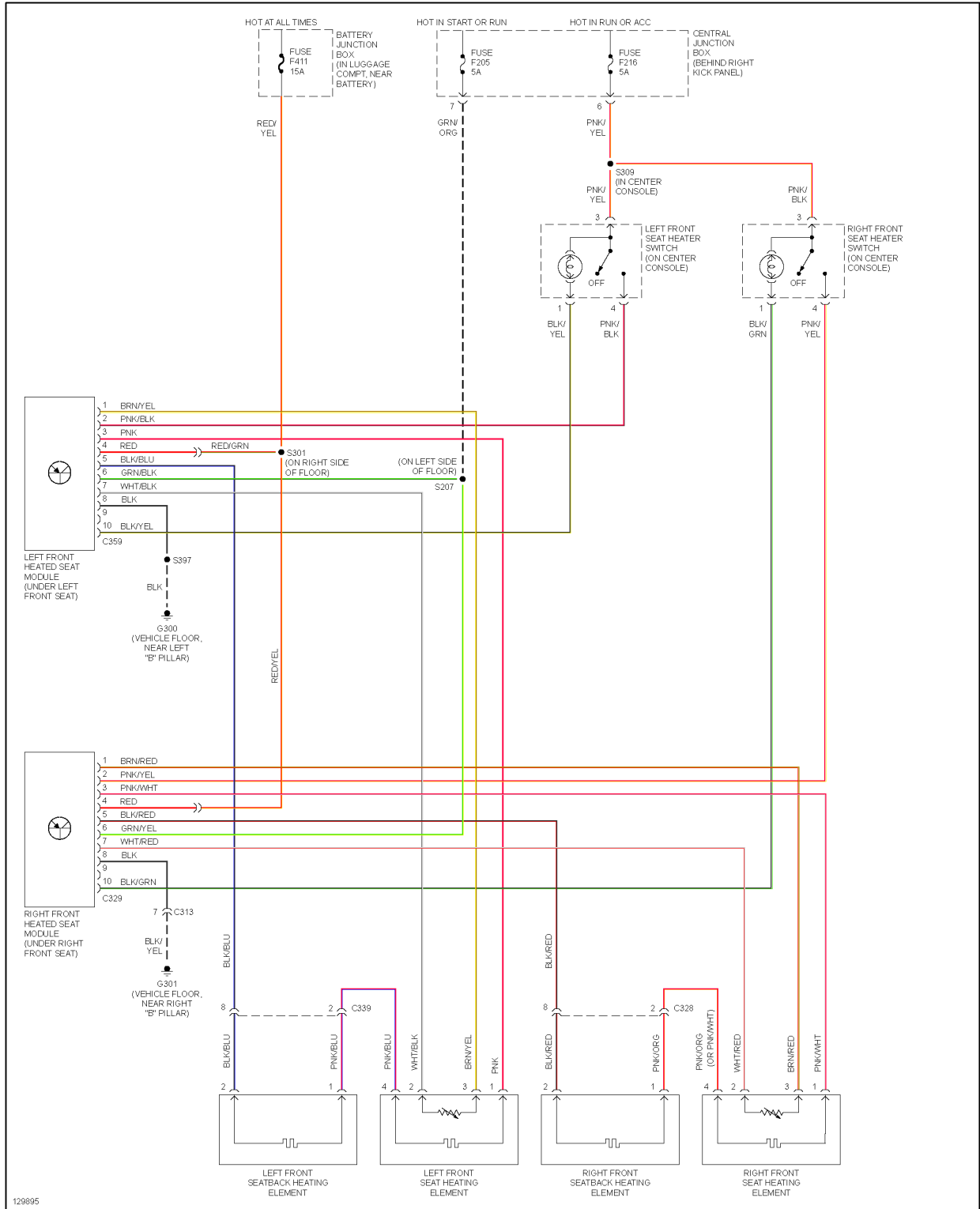


Fig. 47: Heated Seats Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

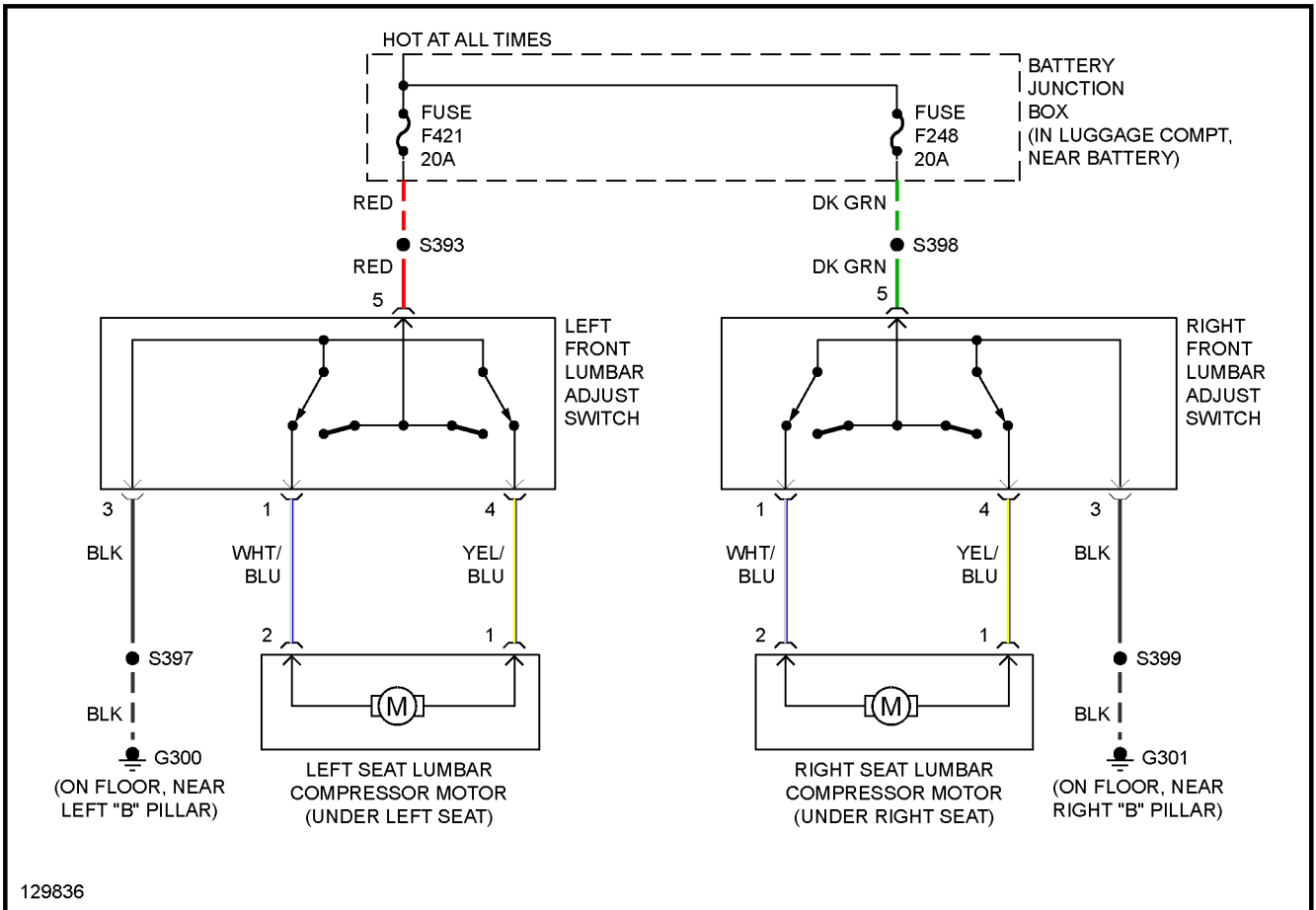


Fig. 48: Power Lumbar Seat Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

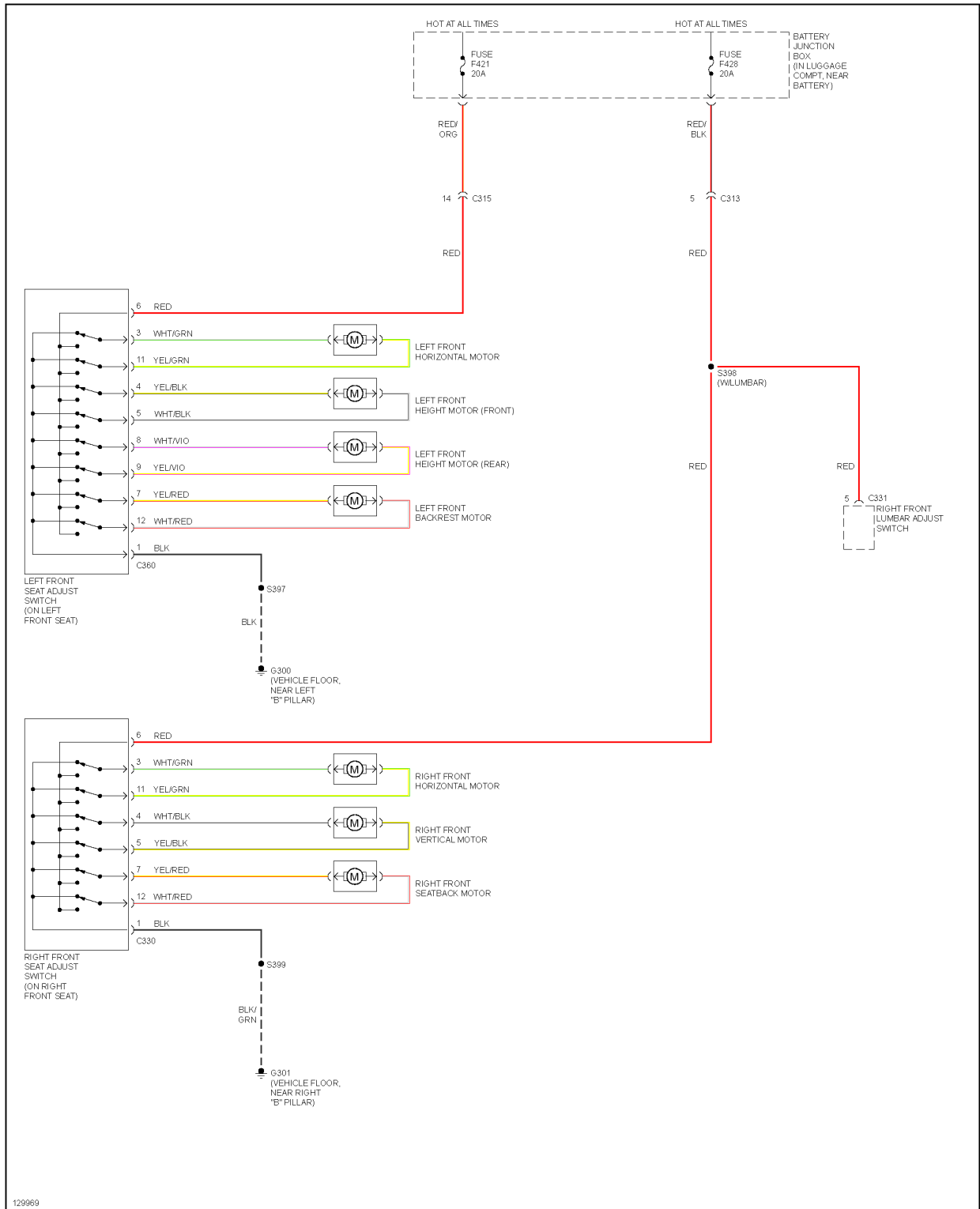


Fig. 49: Power Seats Circuit

POWER TOP/SUNROOF

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

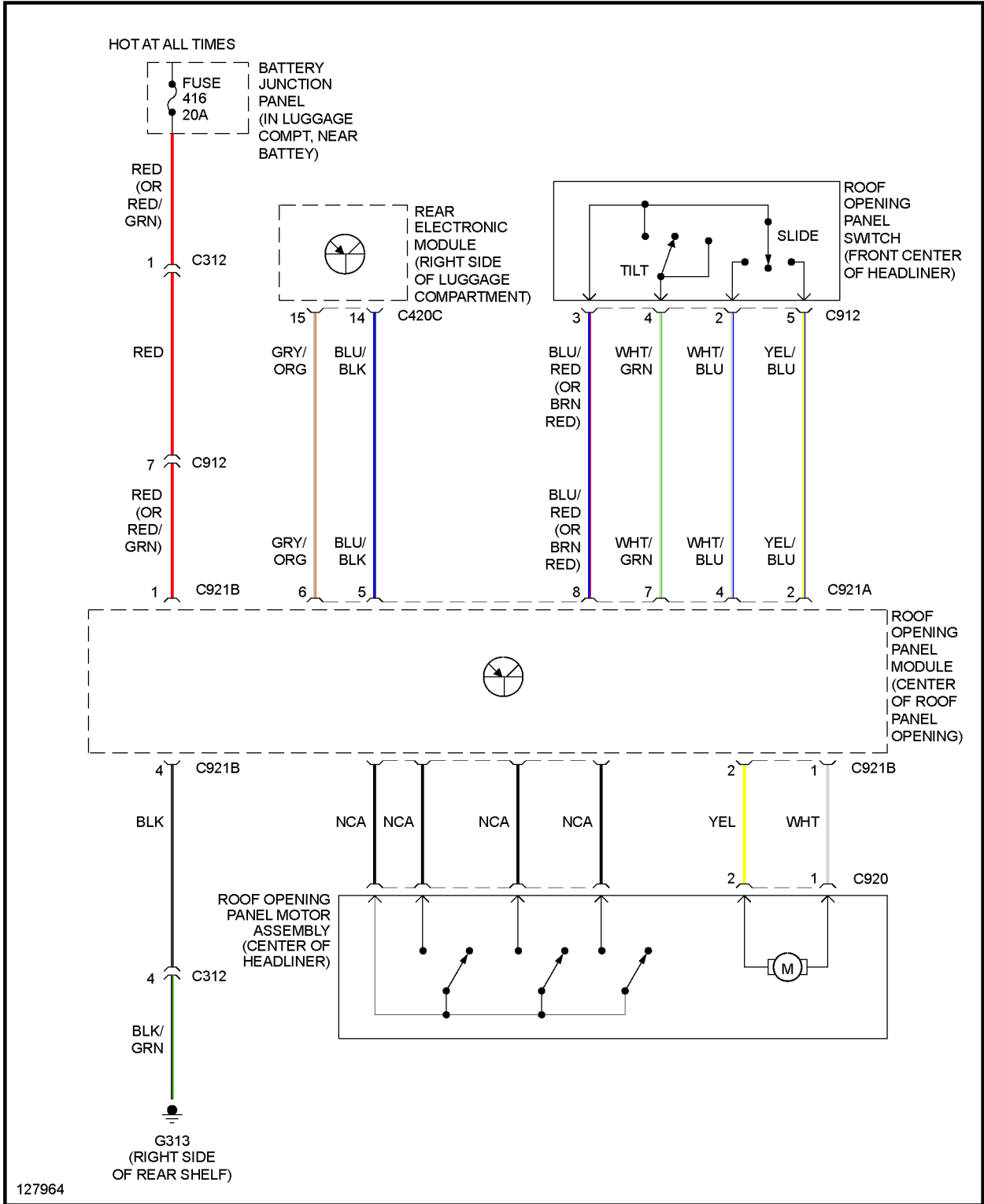


Fig. 50: Power Top/Sunroof Circuit

POWER WINDOWS

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

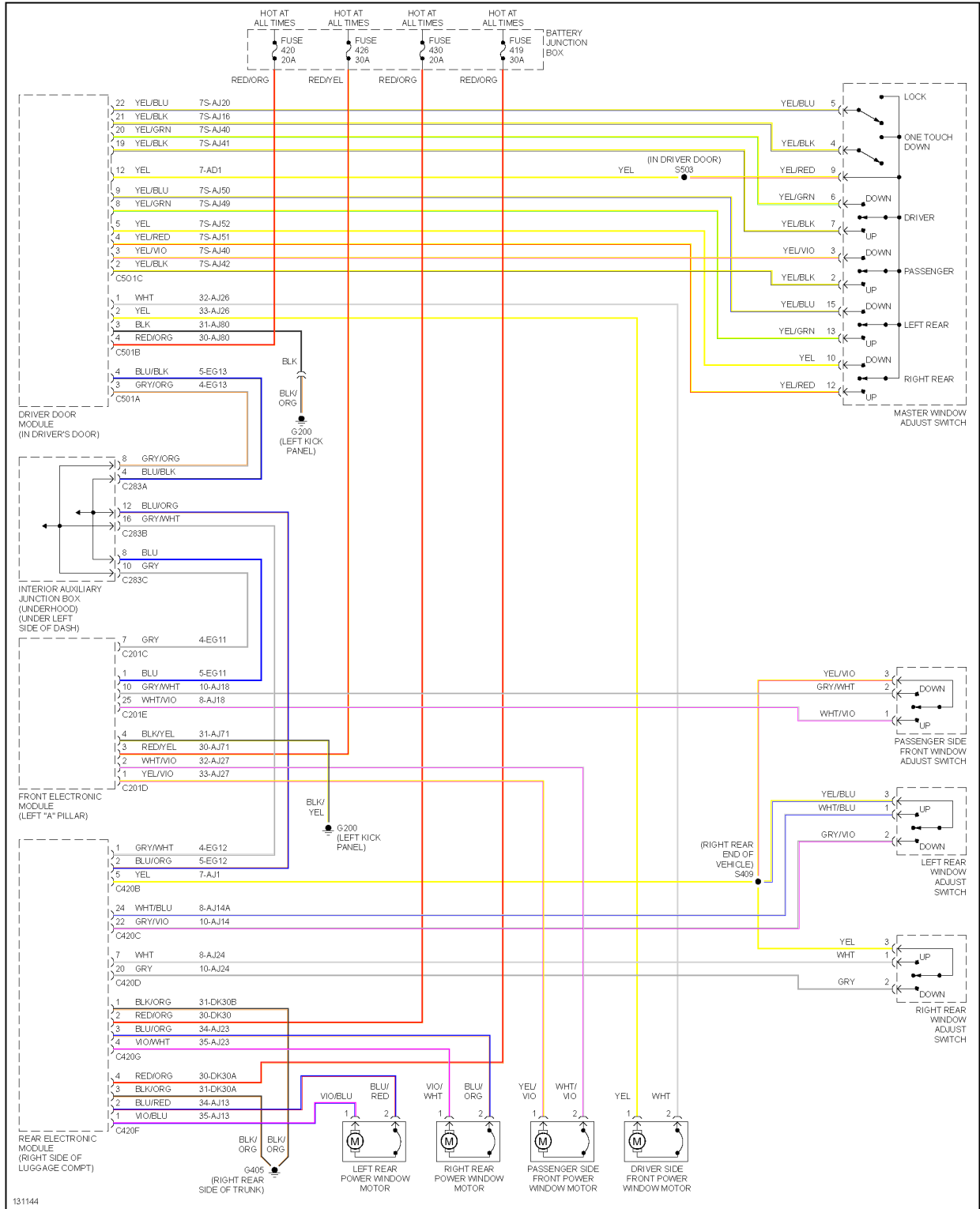


Fig. 51: Power Windows Circuit

RADIO

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

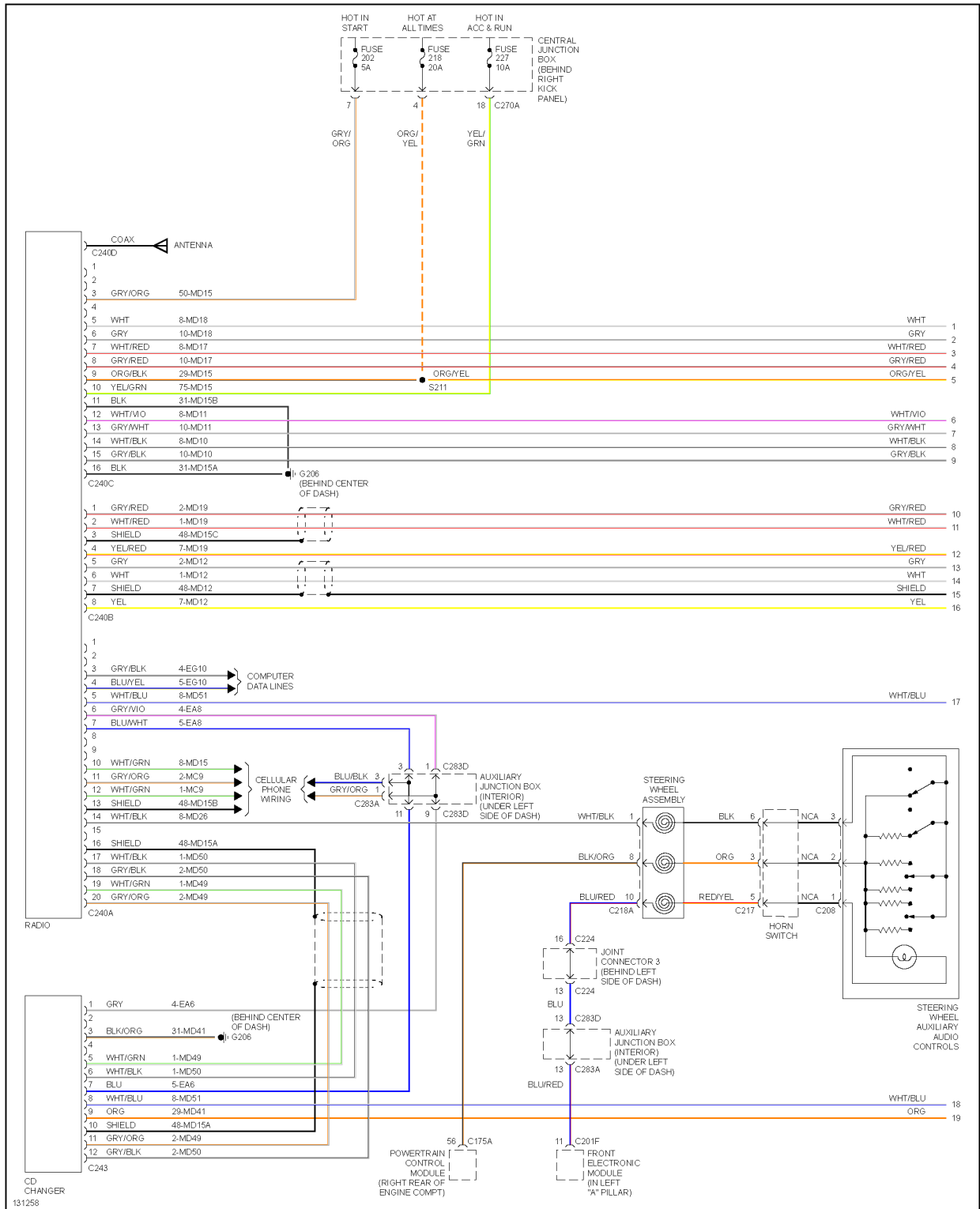


Fig. 52: Radio Circuit (1 of 2)

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

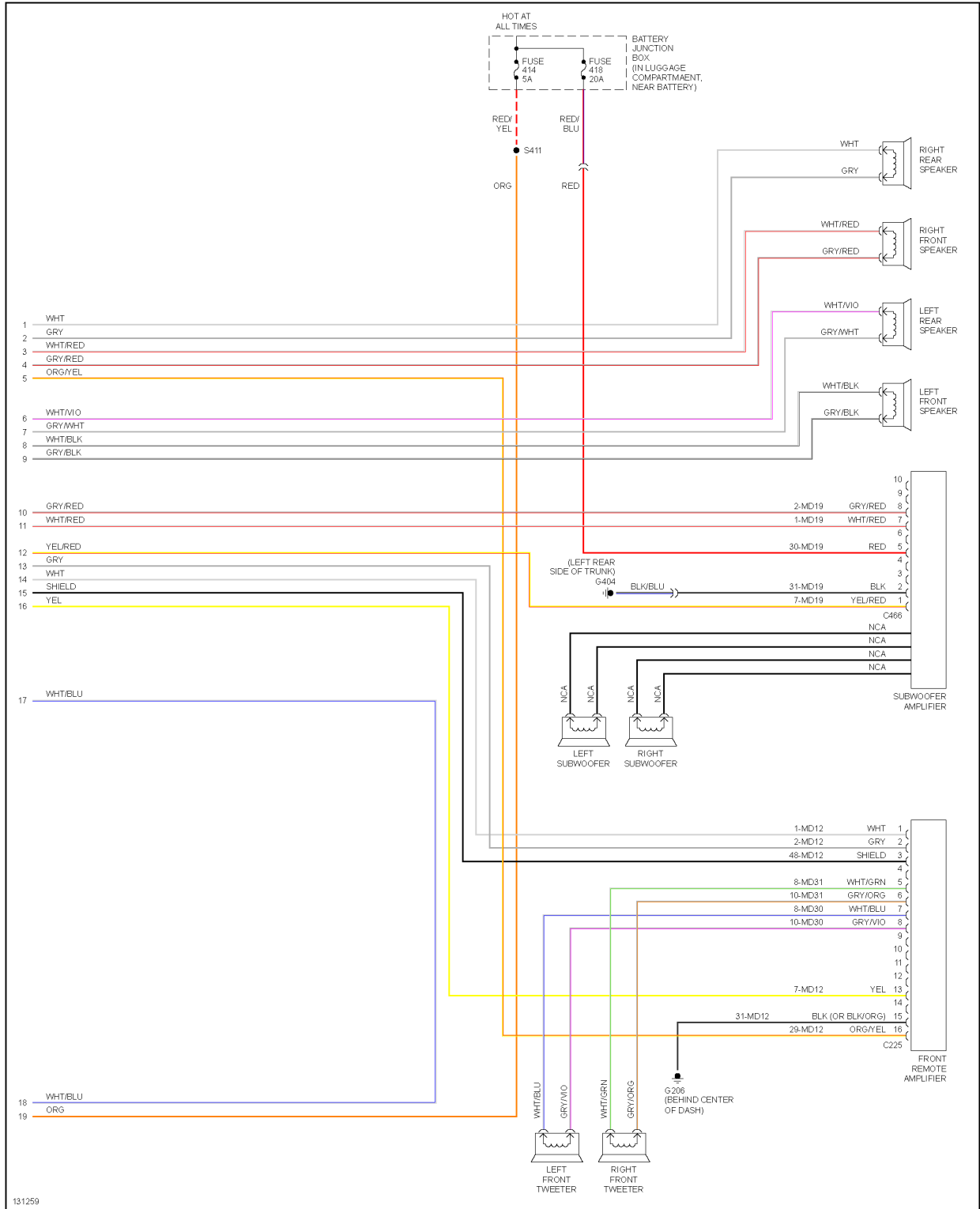
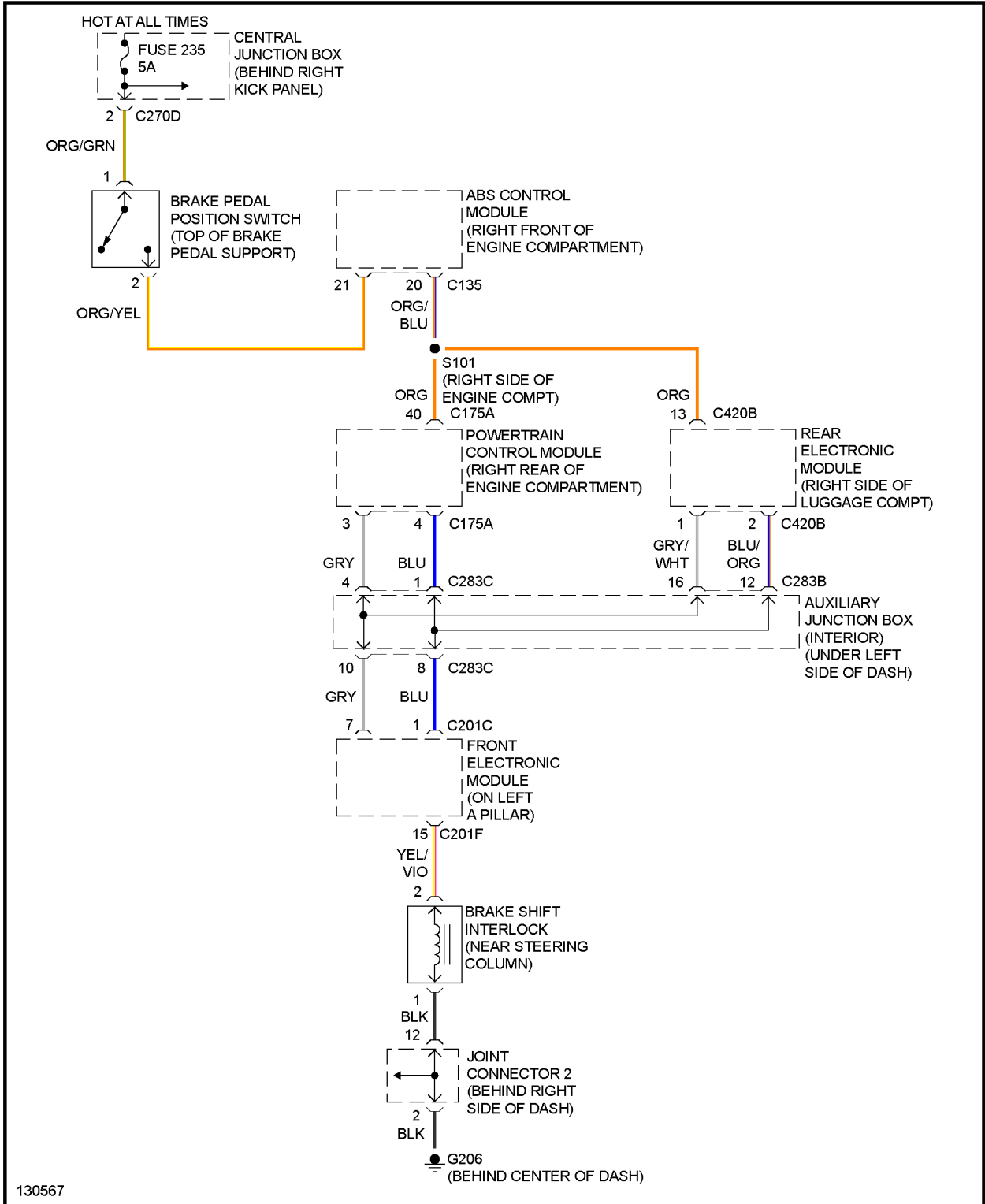


Fig. 53: Radio Circuit (2 of 2)

SHIFT INTERLOCK



130567

Fig. 54: Shift Interlock Circuit, W/ IVD

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

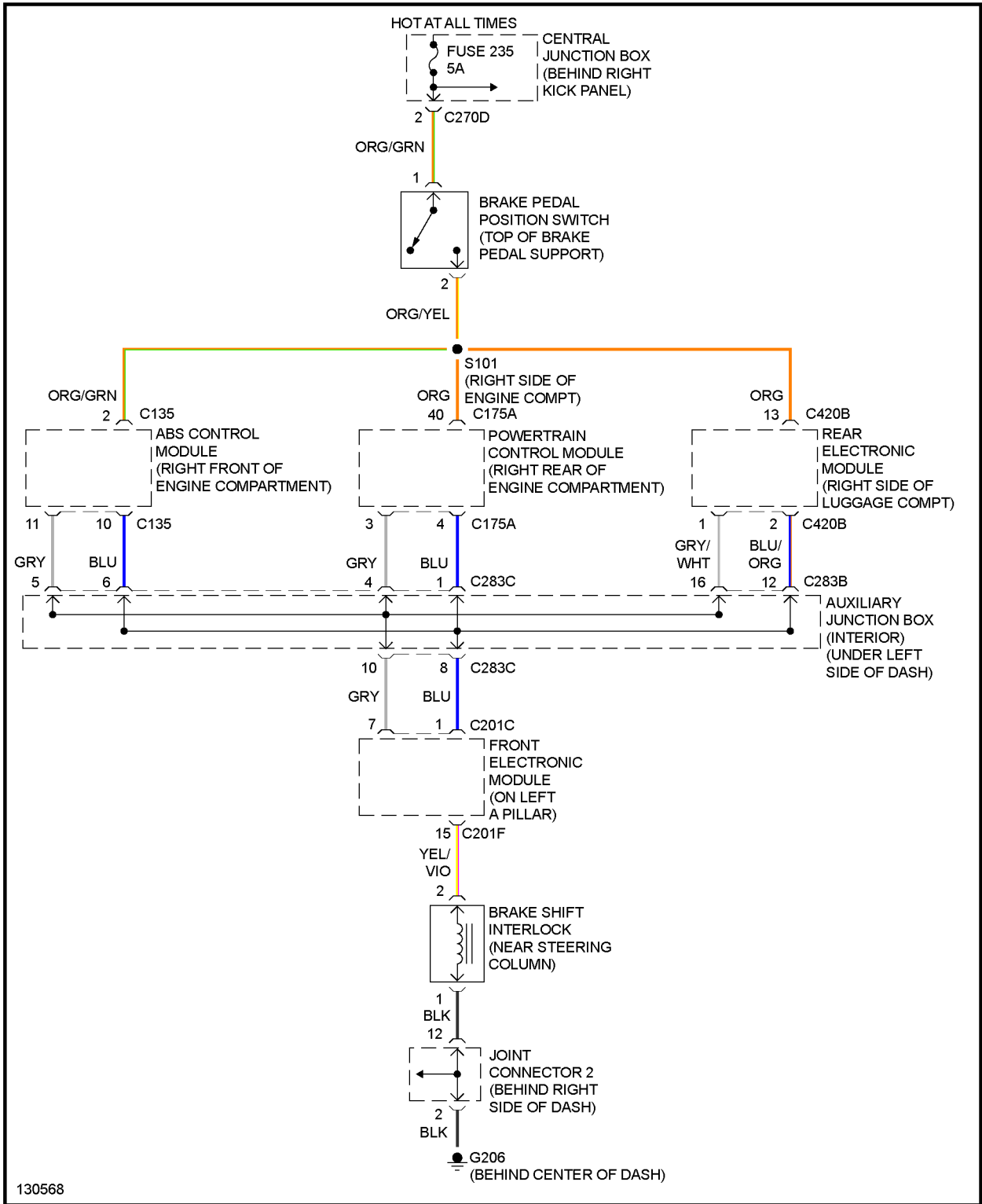


Fig. 55: Shift Interlock Circuit, W/O IVD

STARTING/CHARGING

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

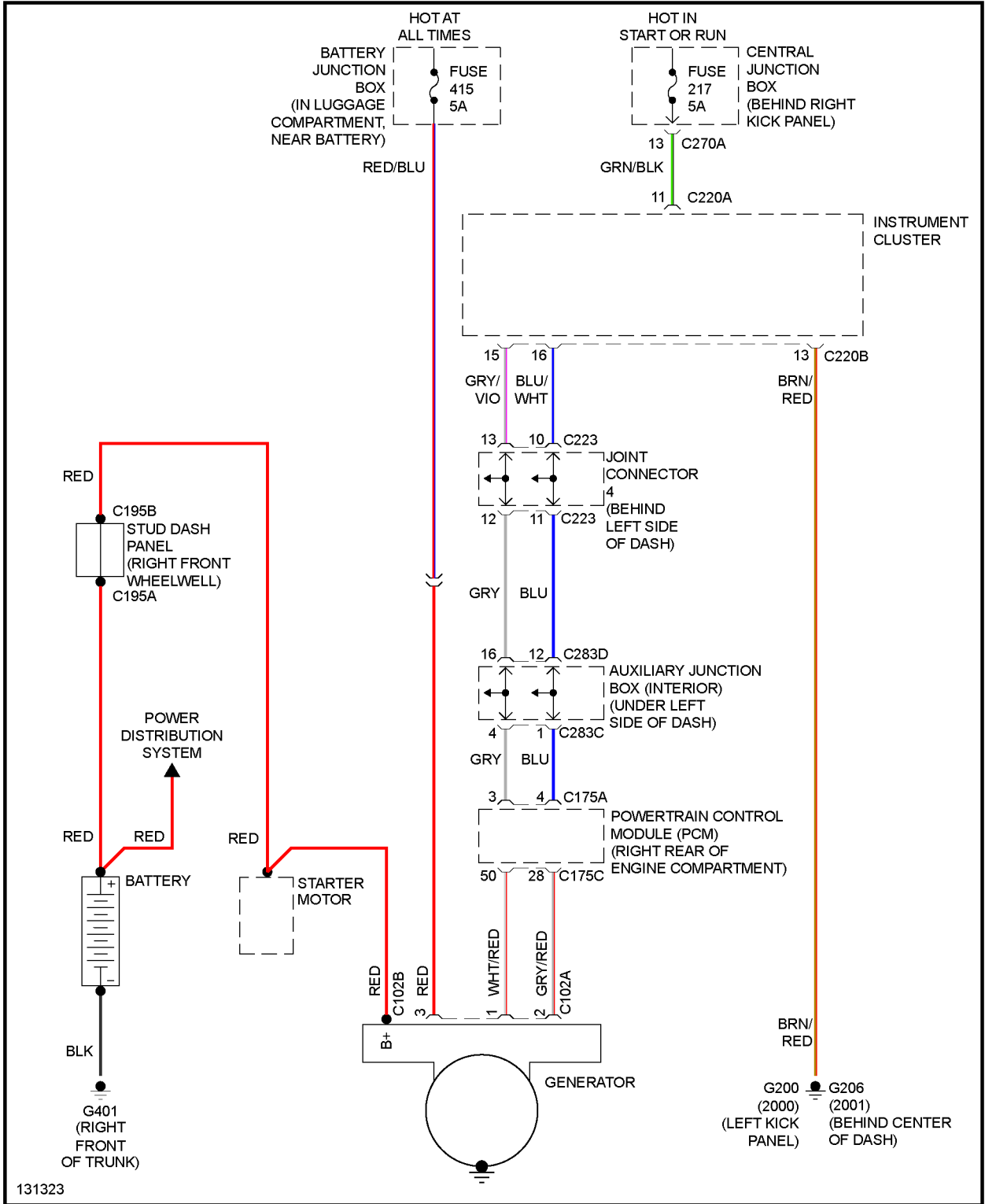


Fig. 56: Charging Circuit

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

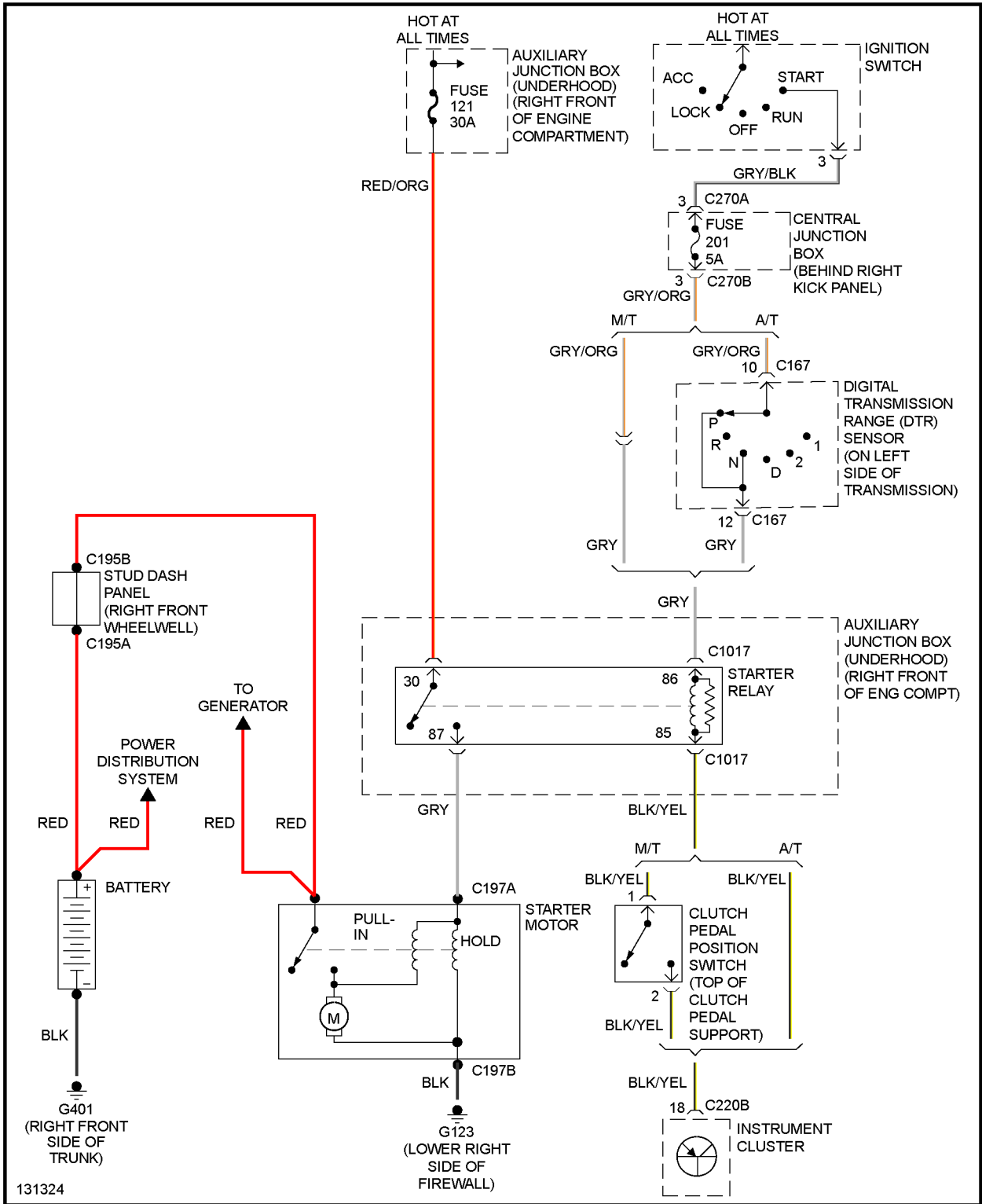


Fig. 57: Starting Circuit

SUPPLEMENTAL RESTRAINTS

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

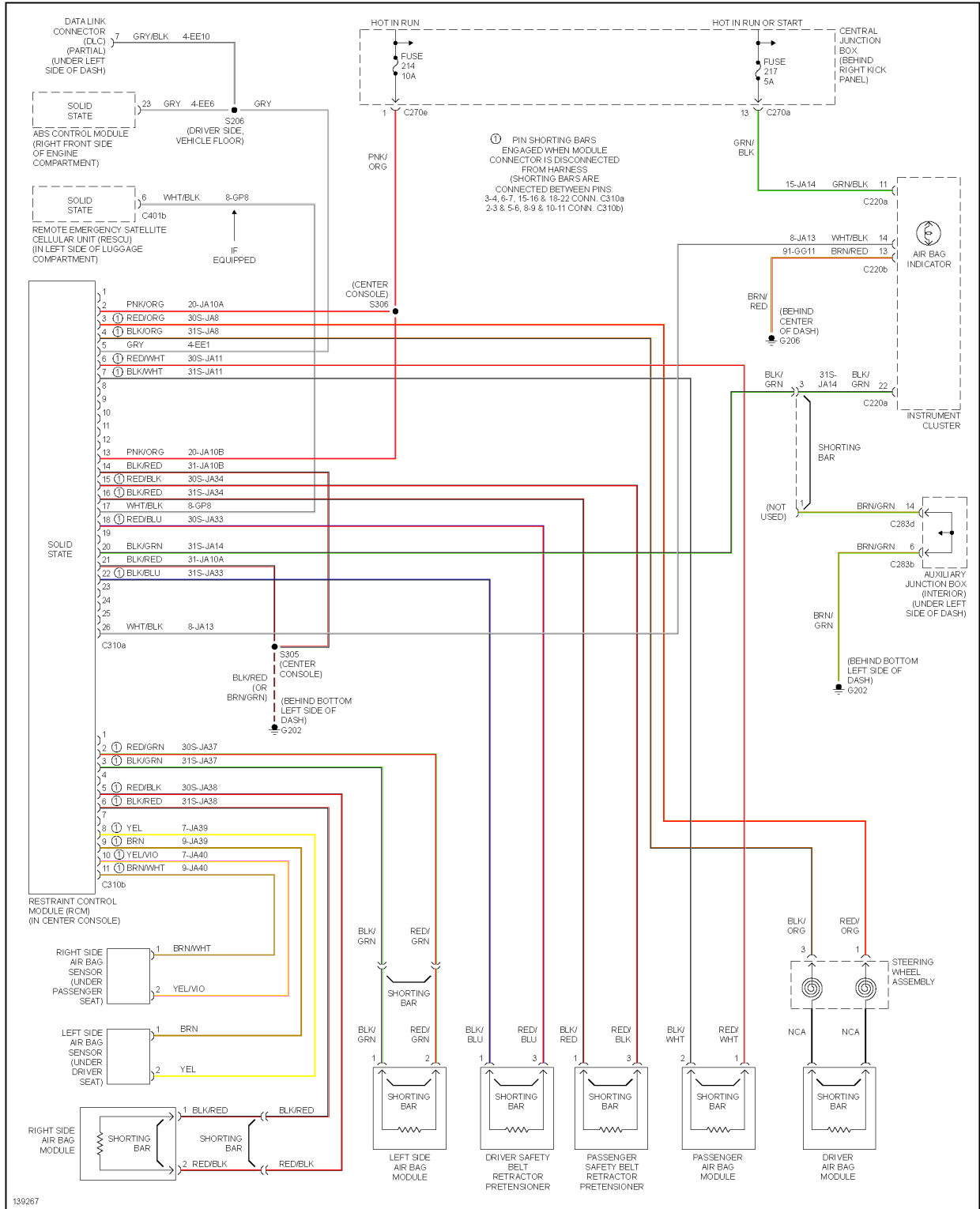


Fig. 58: Supplemental Restraints Circuit

TRANSMISSION

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

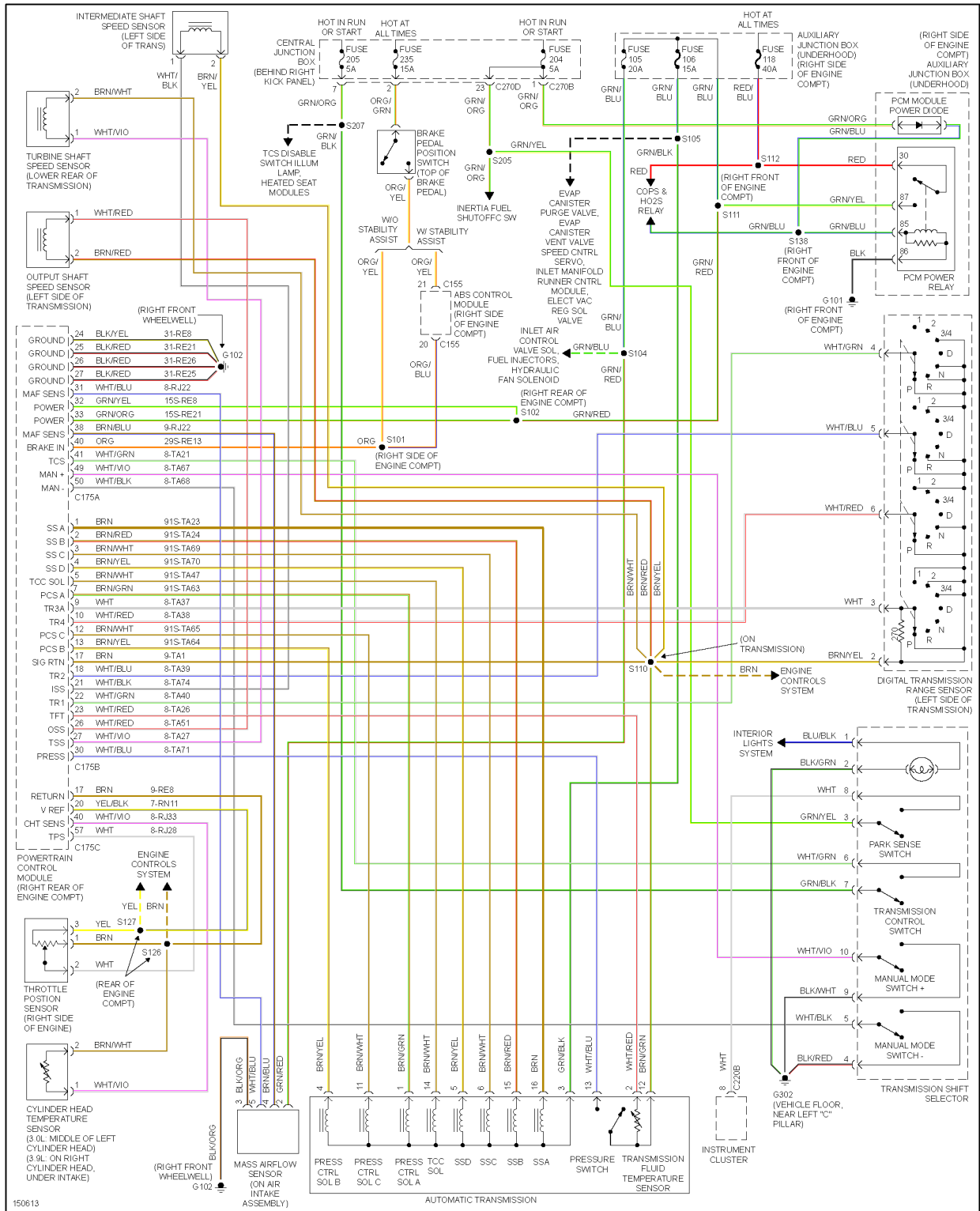


Fig. 59: A/T Circuit

TRUNK, TAILGATE, FUEL DOOR

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS

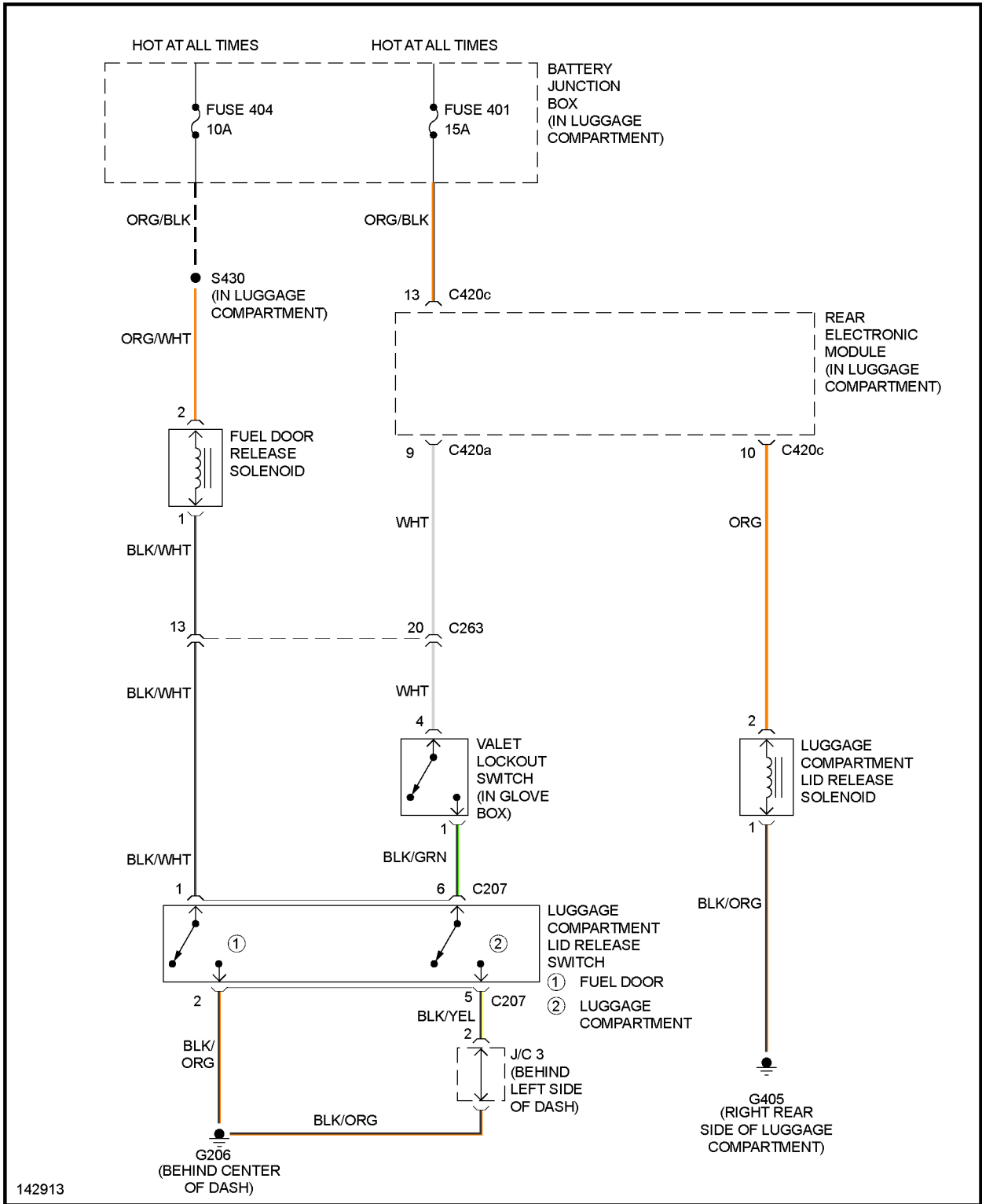
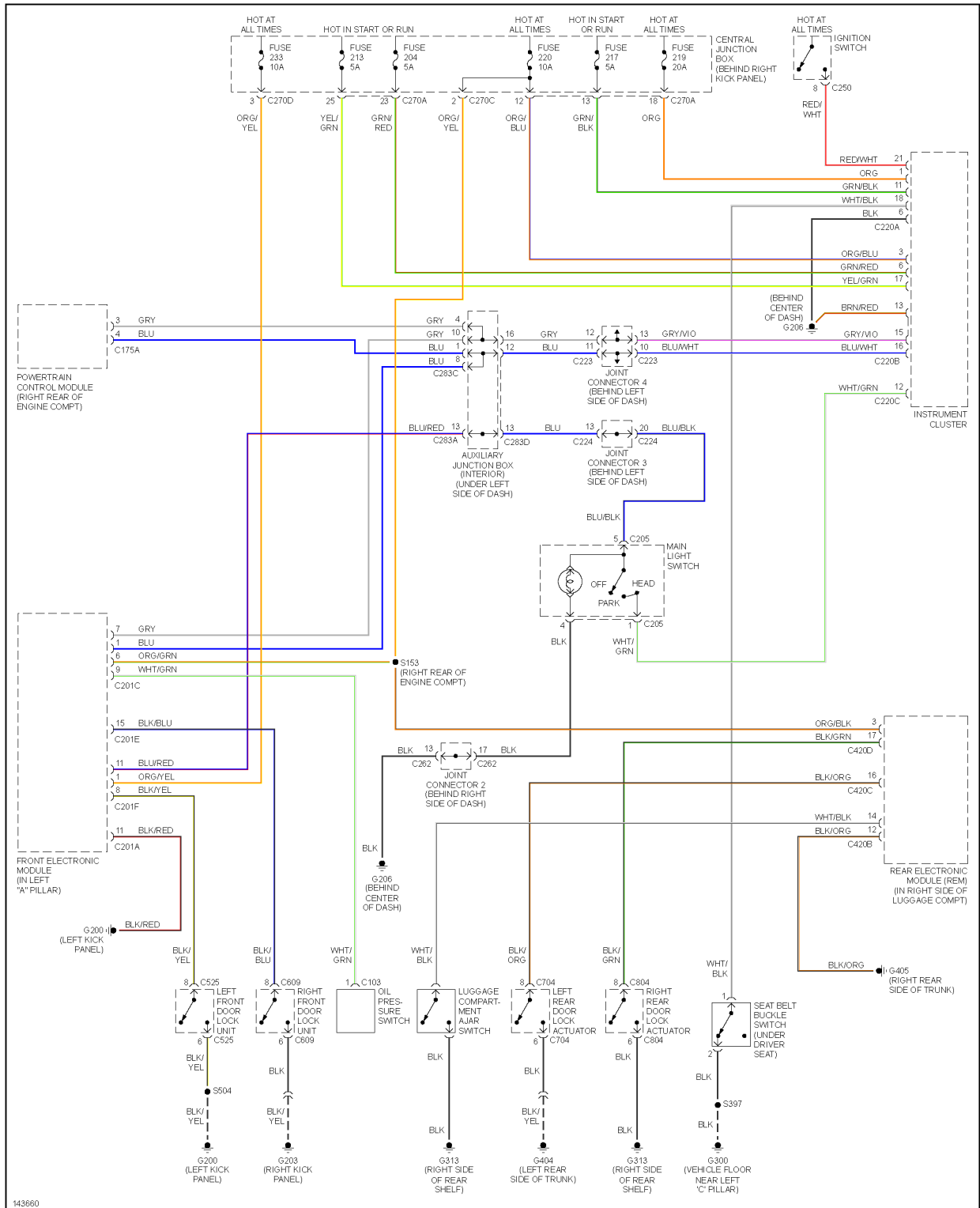


Fig. 60: Trunk, Tailgate, Fuel Door Circuit

WARNING SYSTEMS

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2001 SYSTEM WIRING DIAGRAMS Lincoln - LS



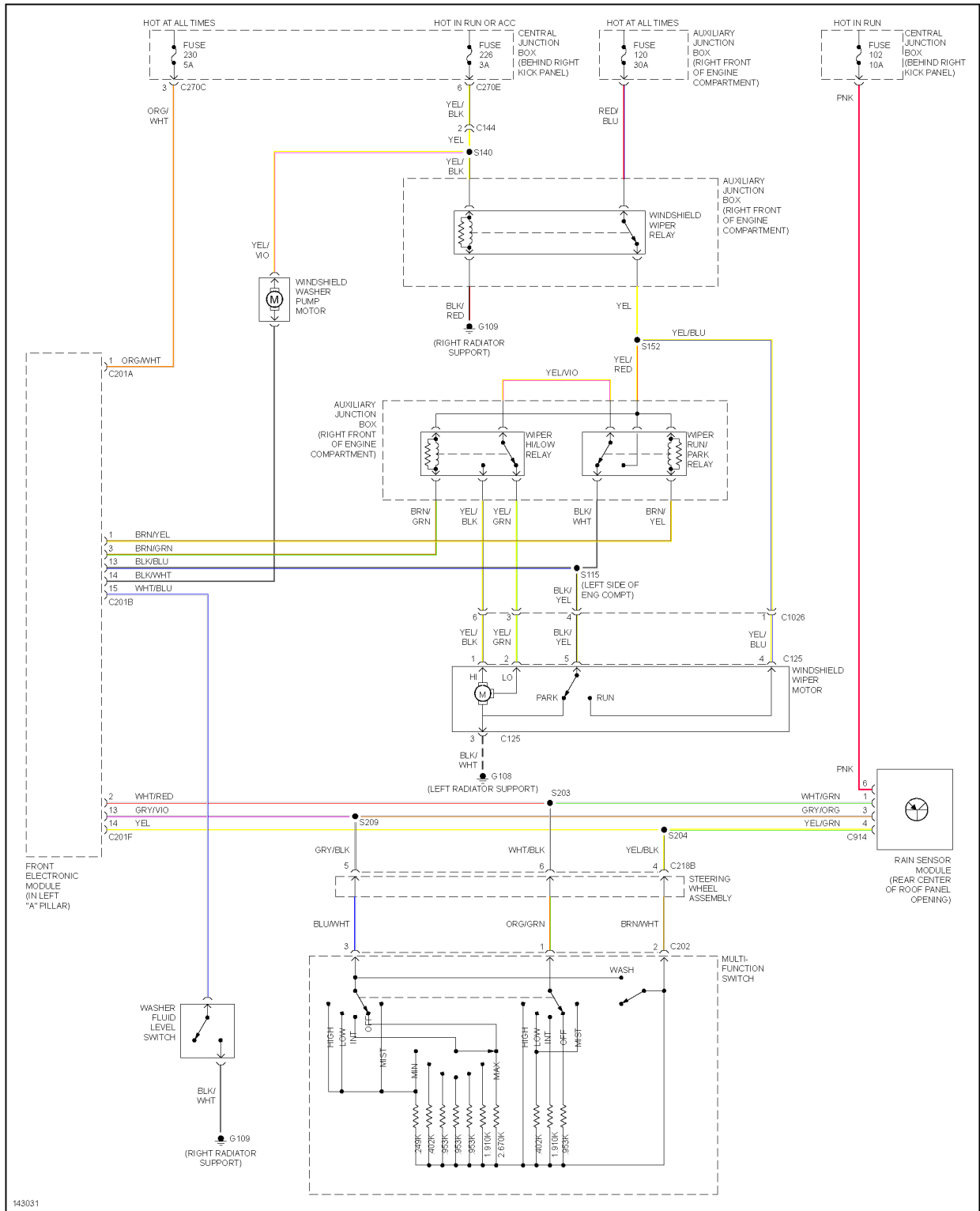
143660

Fig. 61: Warning Systems Circuit

WIPER/WASHER

2001 Lincoln LS

2001 SYSTEM WIRING DIAGRAMS Lincoln - LS



143031

Fig. 62: Wiper/Washer Circuit

2001 Lincoln LS

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2001 FORD MOTOR CO.**LS****BUZZERS, RELAYS & TIMERS****BUZZERS, RELAYS & TIMERS**

Component	Location
A/C Clutch Relay	In underhood auxiliary junction box.
Air Pump Relay	Front of left front wheelwell.
Auxiliary Coolant Pump Relay	In underhood auxiliary junction box.
Blower Motor Relay	In underhood auxiliary junction box.
Compressor Relay	In front center of engine compartment, above right cooling fan.
COPS & Heated Oxygen Sensor (HO2S) Relay	In underhood auxiliary junction box.
Foglight Relay	In underhood auxiliary junction box.
Fuel Pump Relay	In battery junction box.
Heated Wiper Park Relay	In underhood auxiliary junction box.
Horn Relay	In underhood auxiliary junction box.
PCM Power Relay	In underhood auxiliary junction box.
Rear Window Defrost Relay	In battery junction box.
SSP 1 Relay	In battery junction box.
SSP 2 Relay	In battery junction box.
SSP 3 Relay	In battery junction box.
SSP 4 Relay	In battery junction box.
Starter Relay	In underhood auxiliary junction box.
Trailer Exterior Light Relay	Rear end of vehicle.
Windshield Wiper Relay	In underhood auxiliary junction box.
Wiper High/Low Relay	In underhood auxiliary junction box.
Wiper Run/Park Relay	In underhood auxiliary junction box.

CIRCUIT PROTECTION DEVICES**CIRCUIT PROTECTION DEVICES**

Component	Location
Auxiliary Junction Box (Interior)	Under left side of dash. See Fig. 10 .
Auxiliary Junction Box (Underhood)	In right front of engine compartment. See Fig. 7 .
Battery Junction Box	In luggage compartment, near battery. See Fig. 11 .
Central Junction Box	Behind right kick panel.
Mega Fuse	In luggage compartment, near battery junction box. See Fig. 11 .

CONTROL UNITS**CONTROL UNITS**

2001 Lincoln LS

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Component	Location
ABS Control Module	Right front side of engine compartment. See Fig. 8 .
Audio Unit	Behind center of dash.
Cellular Phone Module	In left side of luggage compartment.
Driver Door Lock Unit	In driver's door.
Driver Door Module (DDM)	In driver's door.
Driver Heated Seat Module	Under driver's seat.
Driver Seat Module	Under driver's seat.
Electrochromatic Inside Mirror Unit	In center of roof panel.
Electronic Automatic Temperature Control (ETAC) Unit	Behind center of dash.
Front Electronic Module (FEM)	In left "A" pillar.
Fuel Pump Module	Under rear of vehicle.
Heater Blower Control Module	Behind left side of dash. See Fig. 10 .
Instrument Panel Dimming Module	Behind left side of dash.
Intake Manifold Runner Control (IMRC) Module (3.0L)	Right rear of engine compartment. See Fig. 1 .
Intake Manifold Runner Control (IMRC) Module (3.9L)	Right rear of engine compartment.
Passenger Door Lock Unit	In passenger's door.
Passenger Heated Seat Module	Under passenger's seat.
Passive Anti-Theft Transceiver Module	Behind center of dash.
Powertrain Control Module (PCM)	Right rear of engine compartment.
Rain Sensor Module	In rear center of roof panel opening.
Rear Electronic Module (REM)	In right side of luggage compartment. See Fig. 11 .
Remote Emergency Satellite Cellular Unit (RESCU)	In left side of luggage compartment.
Restraint Control Module (RCM)	In center console.
Roof Opening Panel Module	In center of roof panel opening.
Trailer Tow Control Unit	Rear center of luggage compartment.

MOTORS**MOTORS**

Component	Location
Air Pump Motor	Front of left front wheelwell.
Auxiliary Coolant Pump Motor	In right front of engine compartment. See Fig. 6 .
Blower Motor	Behind center of dash.
Speed Control Servo	In left rear of engine compartment.
Steering Column Position Motor	On steering column.
Washer Pump Motor	On windshield washer fluid reservoir.
Windshield Wiper Motor	On center of firewall. See Fig. 5 .

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SENDING UNITS & SENSORS**SENDING UNITS & SENSORS**

Component	Location
Ambient Air Temperature Sensor	Right front of engine compartment.
Autolamp Sensor	Behind right side of dash.
Brake Booster Sensor	In left rear of engine compartment. See Fig. 5 .
Camshaft Position (CMP) Sensor (3.0L)	On top left side of engine compartment. See Fig. 1 .
Camshaft Position (CMP) Sensor (3.9L)	On top left rear of cylinder head. See Fig. 2 .
Crankshaft Position (CKP) Sensor (3.0L)	Lower left front of engine. See Fig. 1 .
Crankshaft Position (CKP) Sensor (3.9L)	Lower left front of engine.
Cylinder Head Temperature Sensor (3.0L)	On middle of left cylinder head. See Fig. 1 .
Cylinder Head Temperature Sensor (3.9L)	On right cylinder head, under intake. See Fig. 2 .
Digital Transmission Range (DTR) Sensor	On left side of transmission. See Fig. 9 .
Discharge Temperature Sensor (Left)	Behind left side of dash.
Discharge Temperature Sensor (Right)	Behind right side of dash.
Driver Memory Backrest Sensor	In driver's seat.
Driver Memory Seat Front Height Sensor	Under driver's seat.
Driver Memory Seat Horizontal Sensor	Under driver's seat.
Driver Memory Seat Rear Height Sensor	Under driver's seat.
Dual Axis Acceleration Sensor	In center console.
Evaporator Discharge Air Temperature Sensor	Behind center of dash.
Exhaust Pressure Transducer (EPT) Sensor (3.0L)	Left rear side of engine compartment. See Fig. 1 .
Exhaust Pressure Transducer (EPT) Sensor (3.9L)	Left rear side of engine compartment. See Fig. 4 .
Fuel Pump/Fuel Gauge Sender	On top of fuel tank.
Fuel Rail Pressure Transducer Sensor (3.0L)	On left side of engine.
Fuel Rail Pressure Transducer Sensor (3.9L)	On left side of engine. See Fig. 4 .
Fuel Tank Pressure Transducer Sensor	Under rear of vehicle.
Heated Oxygen Sensor (HO2S) No. 11 (Front)	Lower right rear of engine in exhaust manifold.
Heated Oxygen Sensor (HO2S) No. 12 (Rear)	In exhaust, rear of catalyst.
Heated Oxygen Sensor (HO2S) No. 21 (Front)	Lower left rear of engine in exhaust manifold.
Heated Oxygen Sensor (HO2S) No. 22 (Rear)	In exhaust, rear of catalyst.
Intake Air Temperature (IAT) Sensor	On left side of engine compartment.
Intermediate Shaft Speed (ISS) Sensor	On left side of transmission. See Fig. 9 .
In-Vehicle Temperature Sensor	Behind center of dash.
Knock Sensor 1 (3.0L)	On top right side of engine. See Fig. 1 .
Knock Sensor 1 (3.9L)	On top right side of engine. See Fig. 2 .
Knock Sensor 2 (3.9L)	On top left side of engine. See Fig. 2 .
Mass Airflow (MAF) Sensor	On air intake assembly.
Output Shaft Speed (OSS) Sensor	On left side of transmission. See Fig. 9 .
Primary Brake Pressure Sensor	In left rear of engine compartment. See Fig. 5 .
Secondary Brake Pressure Sensor	In left rear of engine compartment. See Fig. 5 .
Side Air Bag Sensor (Left)	Under driver's seat.
Side Air Bag Sensor (Right)	Under passenger's seat.

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Steering Column Position Sensor	On steering column.
Steering Position Sensor	On steering column.
Sun Load Sensor	On top of dash, above glove box.
Throttle Position (TPS) Sensor (3.0L)	On right side of engine. See Fig. 1 .
Throttle Position (TPS) Sensor (3.9L)	On right side of engine. See Fig. 3 .
Turbine Shaft Speed (TSS) Sensor	On lower rear of transmission. See Fig. 9 .
Wheel Speed Sensor (Left Front)	On left front wheel assembly, on spindle assembly.
Wheel Speed Sensor (Left Rear)	On left rear wheel assembly, on brake knuckle.
Wheel Speed Sensor (Right Front)	On right front wheel assembly, on spindle assembly.
Wheel Speed Sensor (Right Rear)	On right rear wheel assembly, on brake knuckle.
Yaw Velocity Sensor	In center console.

SOLENOIDS & SOLENOID VALVES**SOLENOIDS & SOLENOID VALVES**

Component	Location
A/C Clutch Field Coil (3.0L)	In left side of engine compartment. See Fig. 1 .
A/C Clutch Field Coil (3.9L)	In left side of engine compartment.
Brake Shift Interlock	Behind left side of dash, near steering column.
Coolant Control Valve Solenoid	In right front of engine compartment. See Fig. 6 .
Electronic Vacuum Regulator (EVR) Solenoid Valve (3.0L)	On left rear of engine. See Fig. 1 .
Electronic Vacuum Regulator (EVR) Solenoid Valve (3.9L)	On left rear of engine. See Fig. 4 .
EVAP Canister Purge Valve	In left side of engine compartment. See Fig. 5 .
Evaporative Emission (EVAP) Canister Vent Valve	Under rear of vehicle.
Fuel Door Release Solenoid	On right side of luggage compartment. See Fig. 11 .
Hydraulic Fan Solenoid (3.0L)	On top right side of engine. See Fig. 1 .
Hydraulic Fan Solenoid (3.9L)	On top right side of engine. See Fig. 3 .
Inlet Air Control Valve Solenoid (3.0L)	On top right side of engine. See Fig. 1 .
Inlet Air Control Valve Solenoid (3.9L)	On top right side of engine. See Fig. 3 .
Luggage Compartment Lid Release Solenoid	In luggage compartment deck lid.
Power Steering Valve Solenoid	On left side of engine compartment. See Fig. 5 .
Shift Lock Actuator	In top of steering column.
Vacuum Diverter Valve Solenoid (3.0L)	On front of engine. See Fig. 1 .
Vacuum Diverter Valve Solenoid (3.9L)	On front of engine.

SWITCHES**SWITCHES**

Component	Location

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A/C Clutch Cycling Pressure Switch	In left front of engine compartment.
Anti-Theft Hood Switch	In top left front of engine compartment.
Brake Fluid Level Switch	In left rear of engine compartment, on brake fluid reservoir. See Fig. 5 .
Brake Pedal Position Switch	On top of brake pedal support.
Brake Pressure Switch	On top of brake pedal support.
Clutch Pedal Position Switch	On top of clutch pedal support.
Emergency Message Switch	In center of roof panel.
Inertia Fuel Shut-Off (IFS) Switch	Inside left kick panel. See Fig. 10 .
Luggage Compartment Lid Ajar Switch	In deck lid.
Luggage Compartment Lid Release Switch	On left side of dash panel.
Oil Pressure Switch (3.0L)	On lower left side of engine. See Fig. 1 .
Oil Pressure Switch (3.9L)	On lower left side of engine.
Park Brake Switch	At base of parking brake assembly, in center console.
Power Steering Pressure Switch	In left side of engine compartment. See Fig. 5 .
Safety Belt Buckle Switch	In seat belt buckle.
Valet Lockout Switch	In glove box.
Washer Fluid Level Switch	In windshield washer fluid reservoir.

MISCELLANEOUS**MISCELLANEOUS**

Component	Location
ABS Test Connector	In left rear of engine compartment. See Fig. 5 .
Battery	In right side of luggage compartment.
Data Link Connector (DLC)	Under left side of dash.
Fuel Pump Motor Diode	In luggage compartment under floor lining.
Ignition Transformer Capacitor 1 (3.0L)	In left rear of engine compartment. See Fig. 1 .
Ignition Transformer Capacitor 1 (3.9L)	In left rear of engine compartment. See Fig. 4 .
Ignition Transformer Capacitor 2 (3.0L)	In right rear of engine compartment. See Fig. 1 .
Ignition Transformer Capacitor 2 (3.9L)	In right rear of engine compartment. See Fig. 3 .
Joint Connector 1	Behind right side of dash.
Joint Connector 2	Behind right side of dash.
Joint Connector 3	Behind left side of dash.
Joint Connector 4	Behind left side of dash.
PCM Module Power Diode	In right front side of engine compartment.
Remote Amplifier	Behind front center of dash.
Subwoofer Amplifier	In front of luggage compartment.

CONNECTORS**CONNECTORS**

Component	Location
C110 (8 Pin)	At left front of vehicle.

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C133 (8 Pin)	At right front of vehicle.
C134 (6 Pin)	At right front of engine compartment. See Fig. 6 .
C139 (A/T) (6 Pin)	At upper rear of engine. See Fig. 9 .
C139 (M/T) (6 Pin)	At upper rear of engine.
C140 (3.0L) (Black, 12 Pin)	At right rear of engine compartment. See Fig. 1 .
C140 (Black, 12 Pin) (3.9L)	At right rear of engine compartment. See Fig. 3 .
C144 (20 Pin)	At right front footwell.
C145 (Gray, 4 Pin)	At right front footwell.
C146 (2 Pin)	At right front wheelwell.
C192 (12 Pin) (3.0L)	At rear of engine. See Fig. 1 .
C192 (3.9L) (12 Pin)	At rear of engine.
C210 (12 Pin)	Under left side of dash, at footwell. See Fig. 10 .
C211 (20 Pin)	Under left side of dash, at footwell. See Fig. 10 .
C212 (20 Pin)	Under left side of dash, at footwell. See Fig. 10 .
C213 (16 Pin)	Under left side of dash, at footwell. See Fig. 10 .
C214 (3 Pin)	Under left side of dash, at footwell. See Fig. 10 .
C215 (3 Pin)	Under left side of dash, at footwell. See Fig. 10 .
C219 (7 Pin)	Behind right side of dash.
C248 (4 Pin)	On steering column.
C260 (16 Pin)	Behind center of dash. See Fig. 10 .
C263 (20 Pin)	Under right side of dash, at footwell.
C264 (16 Pin)	Under right side of dash, at footwell.
C265 (3 Pin)	Under right side of dash, at footwell.
C274 (1 Pin)	Under left side of dash, at footwell. See Fig. 10 .
C275 (2 Pin)	Behind center of dash. See Fig. 10 .
C300 (12 Pin)	Under center console.
C311 (10 Pin)	At right "C" pillar.
C312 (8 Pin)	At right "C" pillar.
C313 (8 Pin)	Under right front seat.
C314 (2 Pin)	Under right front seat.
C315 (14 Pin)	Under left front seat.
C316 (2 Pin)	Under left front seat.
C327 (3 Pin)	Under right front seat.
C328 (10 Pin)	Under right front seat.
C339 (10 Pin)	Under left front seat.
C340 (3 Pin)	Under left front seat.
C406 (6 Pin)	At right side of luggage compartment.
C408 (6 Pin)	At left rear of luggage compartment.
C410 (14 Pin)	At left side of luggage compartment.
C411 (6 Pin)	At right rear of luggage compartment.
C421 (17 Pin)	At right side of luggage compartment.
C422 (8 Pin)	At right side of luggage compartment.
C431 (8 Pin)	Beneath right rear of vehicle.
C432 (6 Pin)	Beneath right rear of vehicle.
C465 (10 Pin)	

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	At front of luggage compartment.
C510 (14 Pin)	In left front door.
C511 (16 Pin)	In left front door.
C610 (14 Pin)	In right front door.
C611 (10 Pin)	In right front door.
C710 (14 Pin)	In left rear door.
C810 (14 Pin)	In right rear door.
C913 (8 Pin)	At right side of roof panel.
C1019 (3.0L) (Gray, 2 Pin)	At left front of vehicle.
C1019 (3.9L) (Gray, 2 Pin)	At left front of vehicle. See Fig. 4 .
C1026 (6 Pin)	At left rear of engine compartment. See Fig. 5 .

GROUND S**GROUND S**

Component	Location
G100	On left side of engine compartment.
G101	On right front of engine compartment. See Fig. 6 .
G102	On right front of engine compartment.
G103	On right side of engine compartment.
G201	Behind center of dash.
G202	Behind lower left side of dash. See Fig. 10 .
G203	Behind lower left side of dash. See Fig. 10 .
G204	Behind lower right side of dash.
G300	At right "C" pillar.
G301	Below right front seat.
G302	Below left front seat.
G324	At top left side of speaker shelf.
G400	At left rear of luggage compartment.
G401	At right rear of luggage compartment.
G402	At right side of luggage compartment.
G403	At right side of luggage compartment. See Fig. 11 .

SPLICES**SPLICES**

Component	Location
S101	At right side of engine compartment.
S102	At right rear of engine compartment.
S103	At right side of engine compartment.
S104	At right front of engine compartment.
S105	At right front of engine compartment.
S106	At right front of engine compartment.
S107	At right front of engine compartment.

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S108	At right front of engine compartment.
S109	At transmission.
S110	At transmission.
S111	At right front of engine compartment.
S112	At right front of engine compartment.
S113	At right front of engine compartment.
S114	At front of vehicle.
S115	At left side of engine compartment.
S116	At transmission.
S122	At left rear of engine compartment.
S124	At right side of engine compartment.
S125	At rear of engine compartment.
S126	At rear of engine compartment.
S127	At rear of engine compartment.
S128	At top of engine.
S129	At left side of engine.
S130	At left side of engine.
S131	At rear of engine compartment.
S132	At rear of engine compartment.
S134	At right front of engine compartment.
S135	At right front of engine compartment.
S136	At right front of engine compartment.
S137	At right front of engine compartment.
S138	At right front of engine compartment.
S139	At right front of engine compartment.
S140	At right front of engine compartment.
S147	At front left wheelwell.
S148	At right side of engine compartment.
S150	At right side of engine.
S151	At rear of engine compartment.
S152	At right front of engine compartment.
S153	At right rear of engine compartment.
S156	At rear of engine compartment.
S201	Behind right side of dash.
S203	Behind left side of dash.
S204	Behind left side of dash.
S205	In left front footwell.
S206	At left side of vehicle floor.
S207	At left side of vehicle floor.
S209	In left front footwell.
S210	In left front footwell.
S211	Behind right side of dash.
S213	Behind dash.
S215	Behind dash.
S216	

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	Behind dash.
S217	Under center console.
S220	At right front footwell.
S228	Behind dash.
S301	On right side of vehicle floor.
S303	At right rear of vehicle floor.
S304	At right rear of vehicle floor.
S305	At center console.
S306	At center console.
S309	At center console.
S310	At center console.
S311	At center console.
S312	Under right rear seat.
S313	Under left front seat.
S393	Under left front seat.
S394	Under left front seat.
S395	Under left front seat.
S396	Under left front seat.
S397	Under left front seat.
S398	Under right front seat.
S399	Under right front seat.
S400	At left rear of vehicle.
S401	At left rear of vehicle.
S402	Behind luggage compartment lining.
S403	In luggage compartment.
S404	In luggage compartment.
S407	In trunk lid.
S408	In trunk lid.
S409	At right rear of vehicle.
S411	At left side of luggage compartment.
S412	At right rear of vehicle.
S413	In luggage compartment.
S415	In luggage compartment.
S416	At right rear of vehicle.
S417	In luggage compartment.
S418	In luggage compartment.
S419	In luggage compartment.
S420	In luggage compartment.
S422	In luggage compartment.
S423	In luggage compartment.
S427	In luggage compartment.
S428	In luggage compartment.
S429	In luggage compartment.
S430	In luggage compartment.
S431	

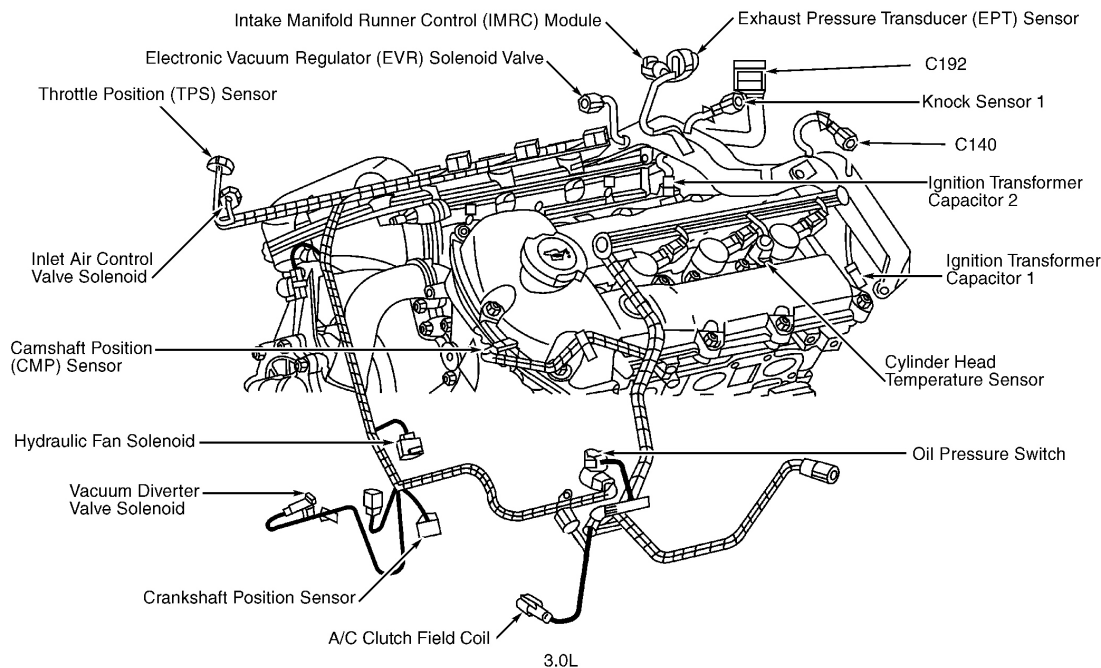
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	In luggage compartment.
S432	In luggage compartment.
S433	In luggage compartment.
S434	In luggage compartment.
S435	In luggage compartment.
S436	In luggage compartment.
S437	Behind dash.
S438	Behind dash.
S439	In luggage compartment.
S501	In left front door.
S502	In left front door.
S503	In left front door.
S504	In left front door.
S601	In right front door.
S602	In right front door.
S900	At front of roof.
S901	At front of roof.
S902	At front of roof.
S903	At front of roof.

COMPONENT LOCATION GRAPHICS

NOTE: Figures may show multiple component locations. Refer to appropriate table for proper figure references.



G00074712

Fig. 1: Left Side Of Engine (3.0L)

Courtesy of FORD MOTOR CO.

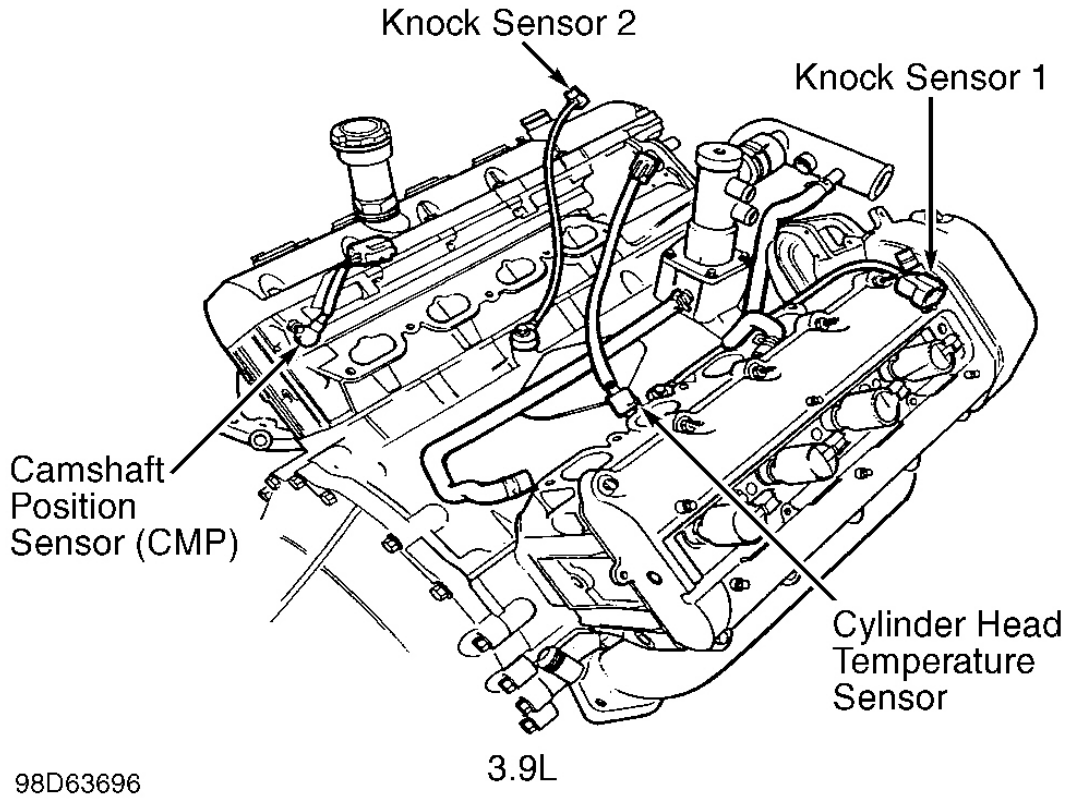
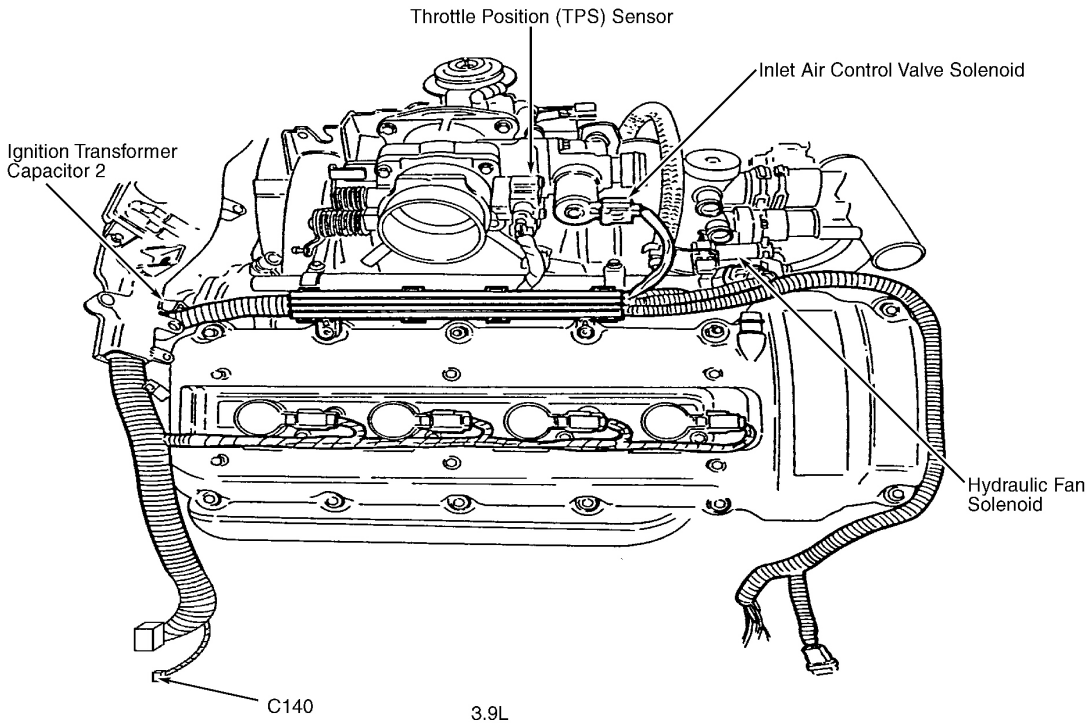


Fig. 2: Top Of Engine (3.9L)
Courtesy of FORD MOTOR CO.

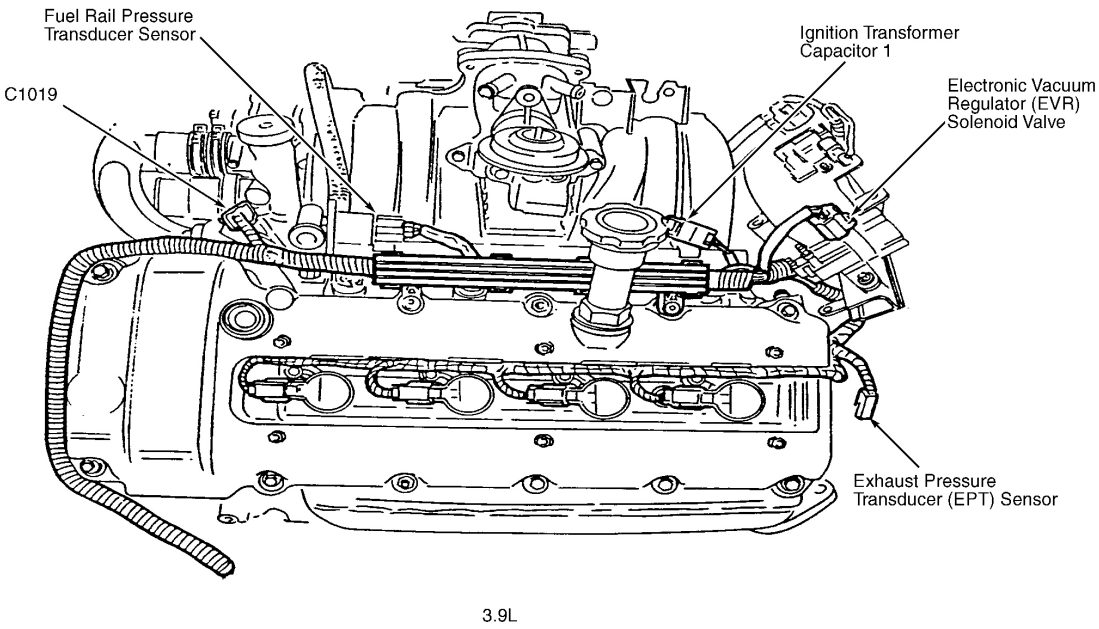
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Fig. 3: Right Side Of Engine (3.9L)
Courtesy of FORD MOTOR CO.

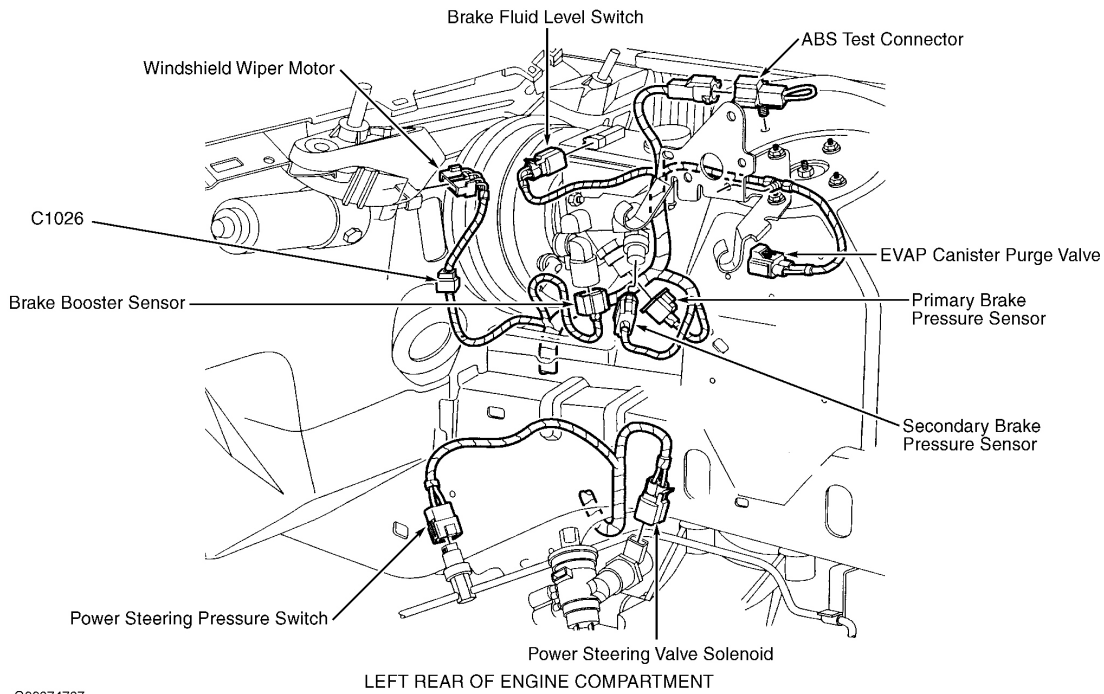


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Fig. 4: Left Side Of Engine (3.9L)
Courtesy of FORD MOTOR CO.

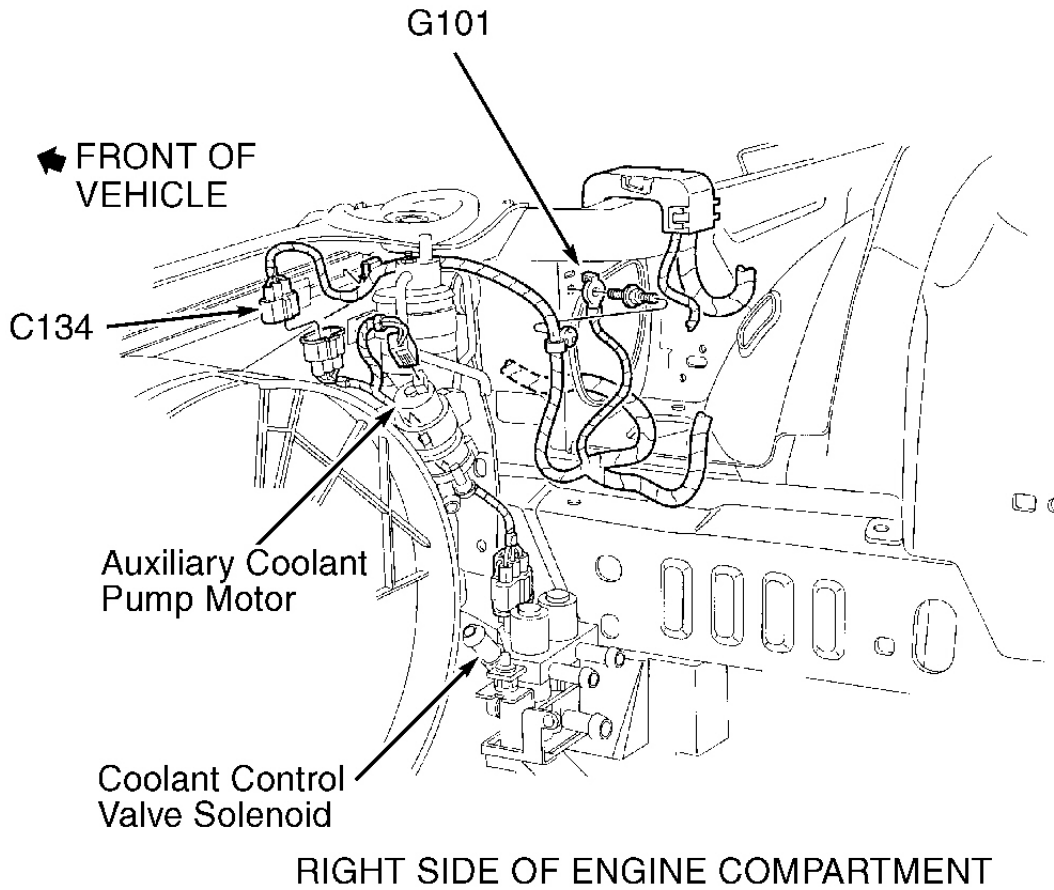
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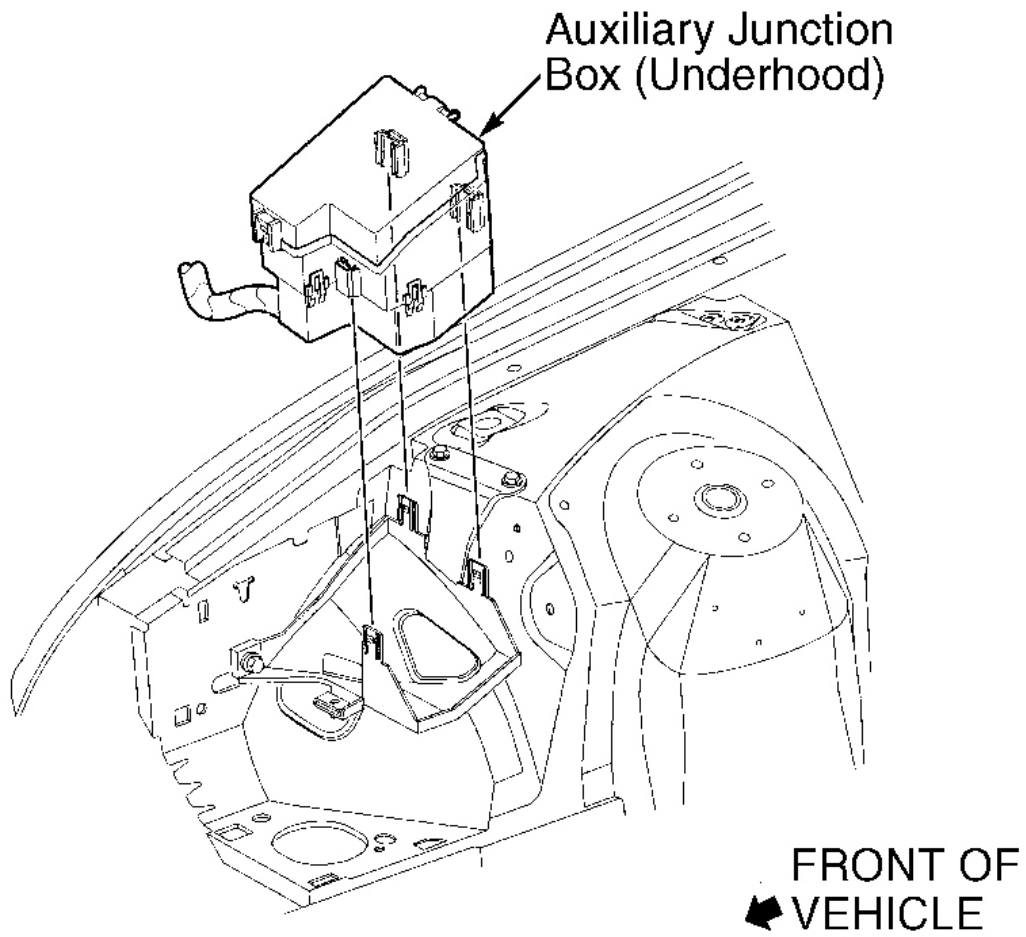
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Fig. 5: Left Rear Of Engine Compartment
Courtesy of FORD MOTOR CO.



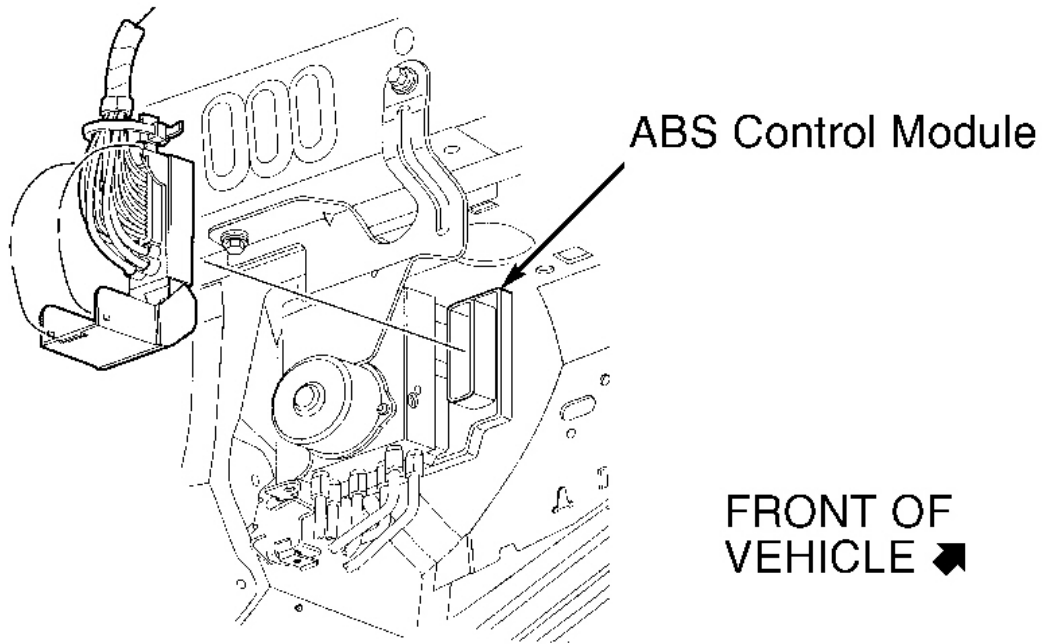
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Fig. 6: Right Side Of Engine Compartment
Courtesy of FORD MOTOR CO.



98E63838

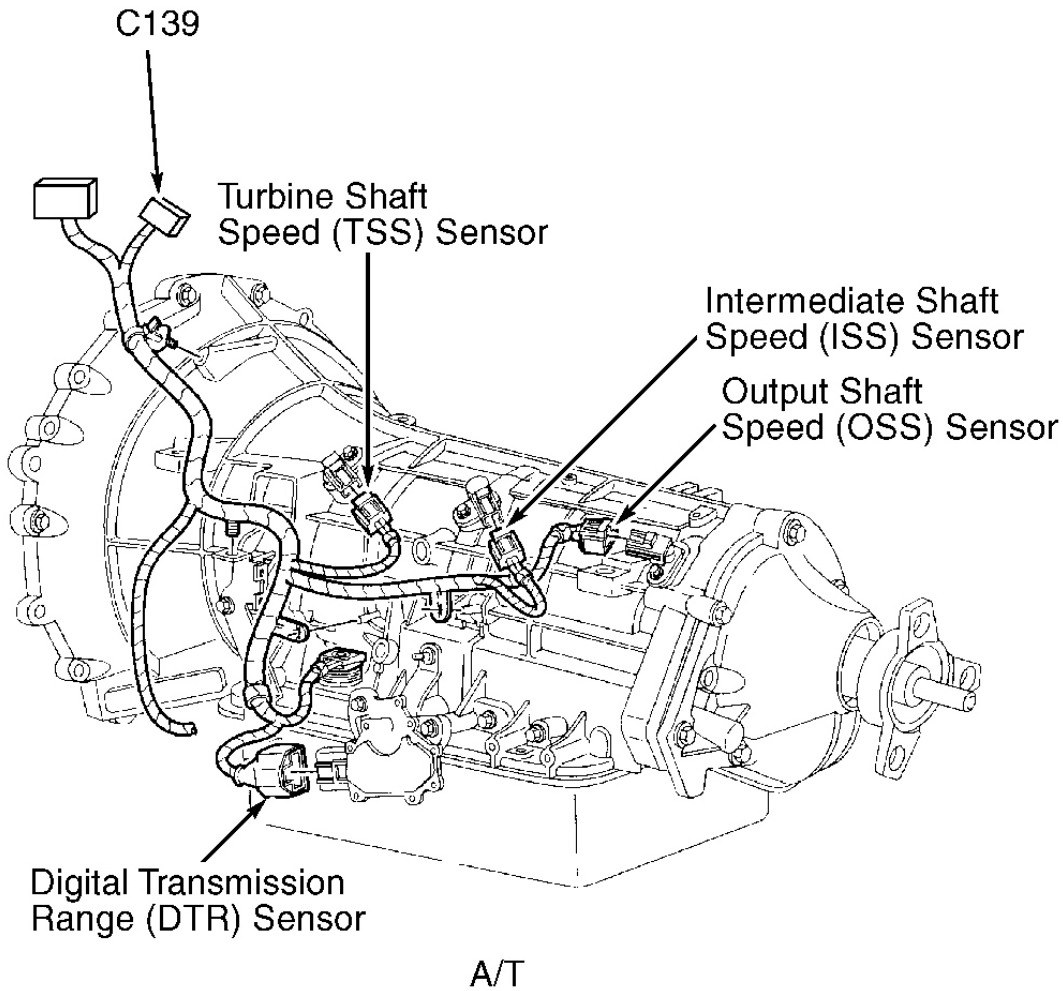
Fig. 7: Right Side Of Engine Compartment
Courtesy of FORD MOTOR CO.



RIGHT SIDE OF ENGINE COMPARTMENT

98F63839

Fig. 8: Right Side Of Engine Compartment
Courtesy of FORD MOTOR CO.



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Fig. 9: Left Side Of Transmission
Courtesy of FORD MOTOR CO.

2001 Lincoln LS

2001 FORD MOTOR CO. LS

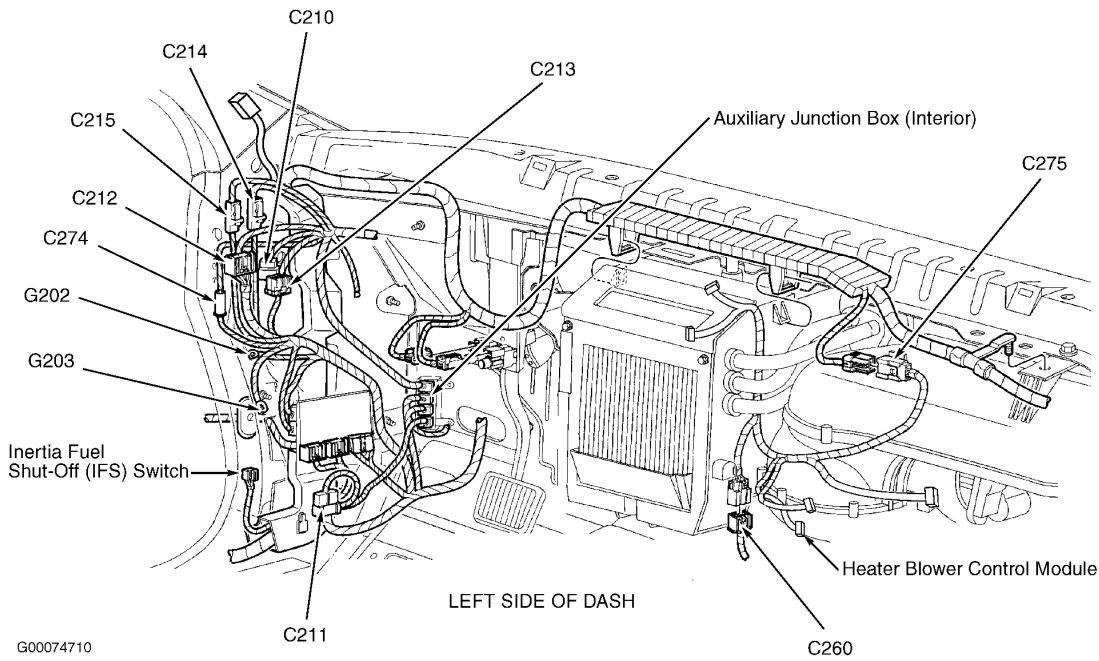


Fig. 10: Left Side Of Dash
Courtesy of FORD MOTOR CO.

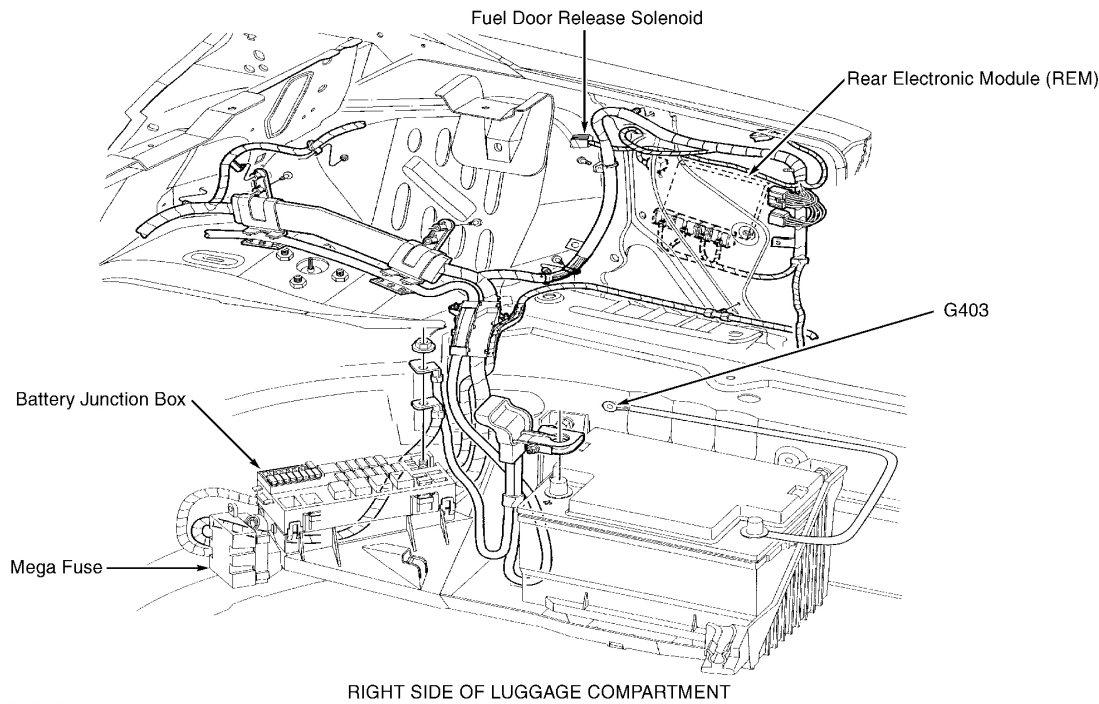


Fig. 11: Right Side Of Luggage Compartment
Courtesy of FORD MOTOR CO.

2001 ELECTRICAL

Fuses & Circuit Breakers - LS

IDENTIFICATION

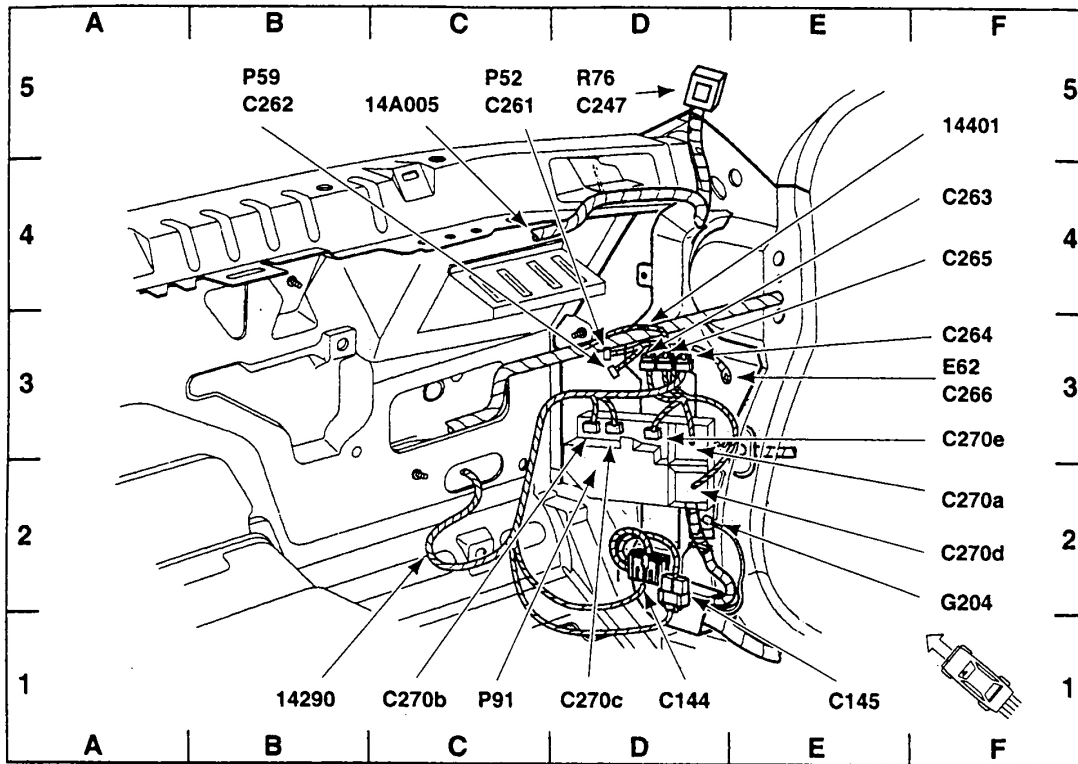
CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** article in **GENERAL INFORMATION** before disconnecting battery.

CENTRAL JUNCTION BOX

- NOTE:** Central junction box may also be referred to as passenger compartment fuse panel.
- NOTE:** Central junction box is located behind passenger's side kick panel. See Fig. 1.

2001 Lincoln LS

2001 ELECTRICAL Fuses & Circuit Breakers - LS



Dash panel, RH front view

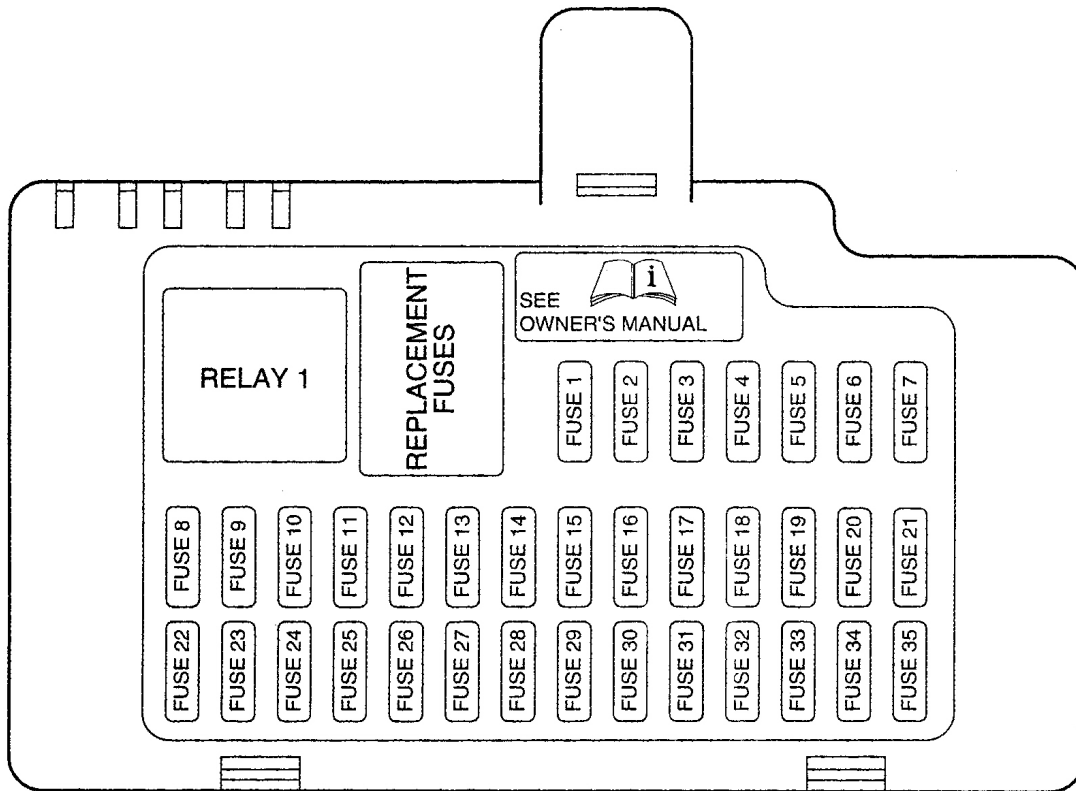
14A005	C 5	C270a	F 2
14290	B 1	C270b	C 1
14401	F 5	C270c	D 1
C144	D 1	C270d	F 2
C145	E 1	C270e	F 3
C247	D 5	E62 .. Footwell lamp, right front	F 3
C261	C 5	G204	F 2
C262	B 5	P52 .. Joint connector 1	C 5
C263	F 4	P59 .. Joint connector 2	B 5
C264	F 3	P91 .. Central Junction Box (CJB)	C 1
C265	F 4	R76 .. Window heater, right	D 5
C266	F 3		

G00097819

Fig. 1: Locating Instrument Panel Electrical Components
 Courtesy of FORD MOTOR CO.

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G00097820

Fig. 2: Identifying Central Junction Box Components
 Courtesy of FORD MOTOR CO.

Fuse/Relay Location	Fuse Amp Rating	Passenger Compartment Fuse Panel Description
1	5A	Starter Relay Coil
2	5A	Radio
3	5A	ABS/TCS/AdvanceTrac
4	5A	Cluster, PCM Relay, Fuel Pump Relay, REM, Transit Relay
5	5A	T/A Switch, O/D Cancel Switch, Autolamp Sensor, Heated Seat Modules
6	10A	OBD II
7	5A	DDM, DSM, Anti-theft LED, Security Horn, PCM, Power Mirror
8	5A	Right Front Turn, Right Front Repeater, Right Front Sidemarkers, Right Front Park Lamps
9	10A	Right Front Low Beam

G00097821

Fig. 3: Central Junction Box Legend (1 Of 2)
 Courtesy of FORD MOTOR CO.

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Fuse/Relay Location	Fuse Amp Rating	Passenger Compartment Fuse Panel Description
10	5A	Left Front Turn, Left Front Repeater, Left Front Sidemarker, Left Front Park Lamps
11	10A	Left Front High Beam
12	—	Not Used
13	5A	Cluster
14	10A	RCM, DATC
15	5A	Not Used (Spare)
16	5A	E/C Mirror, Heated Seat Controls, RSM (Rain Sensor Module)
17	5A	RCM, Alternator Warning Lamp
18	20A	Radio, CIA
19	15A	Tilt/Tele Motors
20	10A	FEM, DATC, Cluster, Brake Shift Interlock, REM
21	10A	Power Folding Mirrors
22	10A	DDM
23	10A	Right Front High Beam
24	5A	PATS
25	10A	Left Front Low Beam
26	10A	Wiper Relay, Windshield Washer
27	10A	Radio, Cellphone
28	5A	Security Horn
29	5A	Trailer Tow Ignition Sense, VEMS, FEM
30	5A	FEM
31	—	Not Used
32	20A	Cigar Lighter
33	10A	Switch Backlighting
34	10A	Not Used (Spare)
35	5A	Stop Lamp Signal

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Fig. 4: Central Junction Box Legend (2 Of 2)

Courtesy of FORD MOTOR CO.

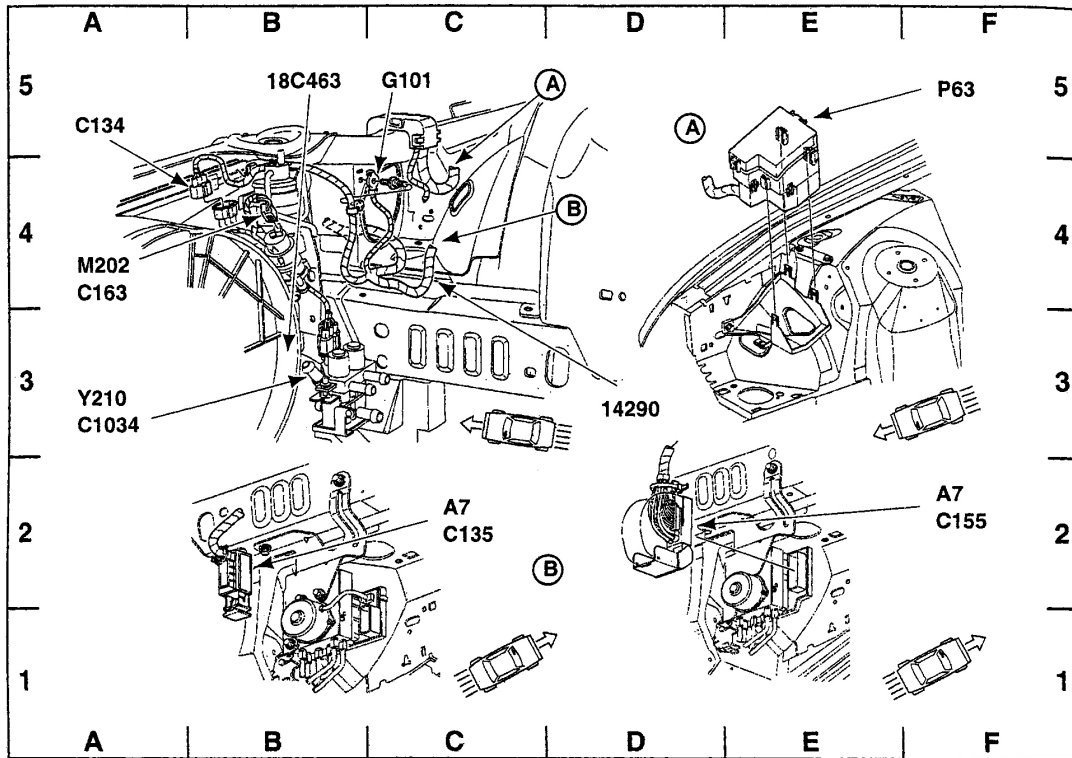
AUXILIARY JUNCTION BOX

NOTE: Auxiliary junction box may also be referred to as power distribution box.

NOTE: Auxiliary junction box is located in passenger's front corner of engine compartment. See Fig. 5.

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RH engine compartment

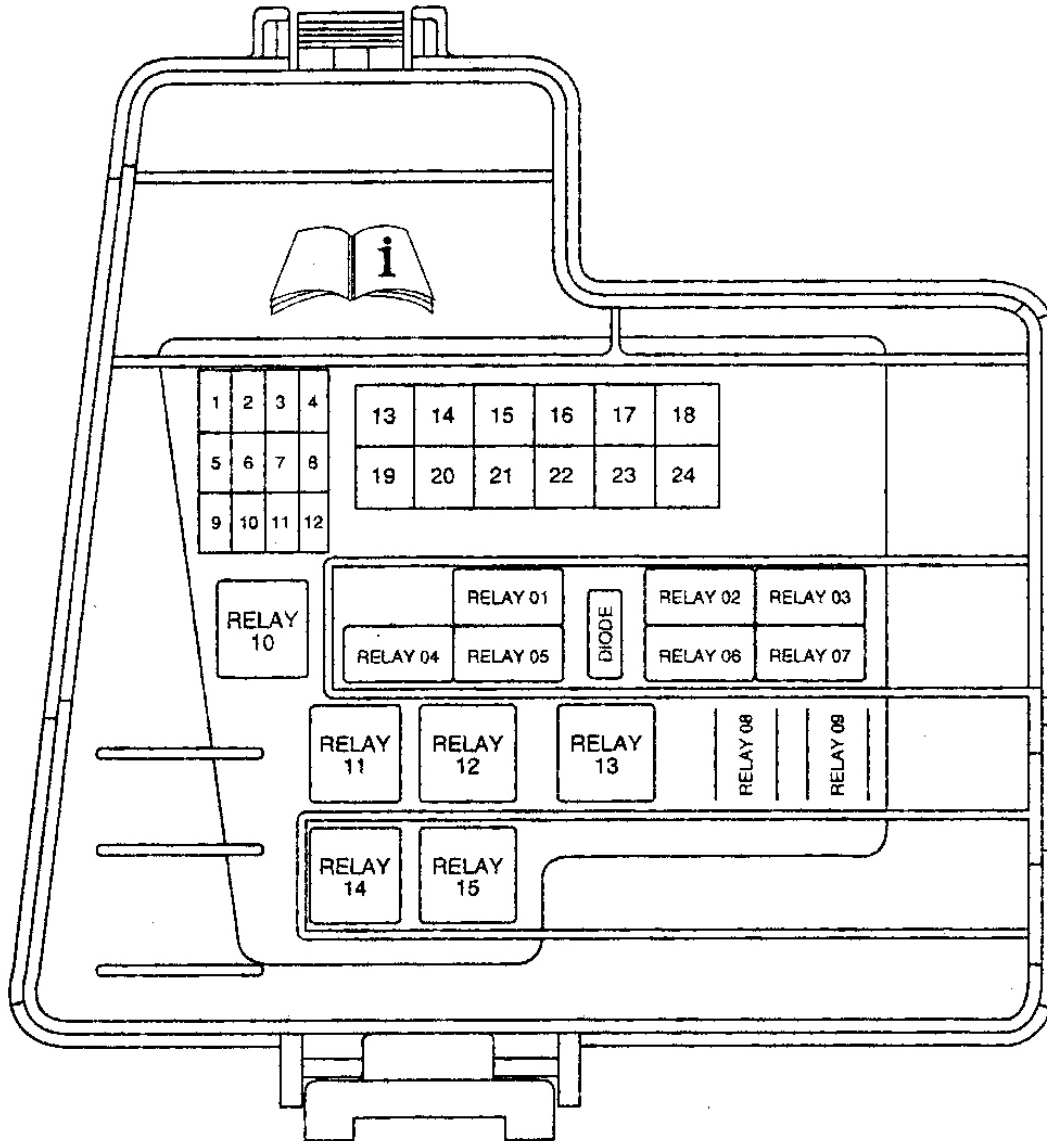
18C463	B 5	C163	A 4
14290	D 3	C1034	A 3
A7 ... ABS control module	C 2	G101	C 5
A7 ... ABS control module	F 2	M202 Auxiliary coolant pump motor	A 4
C134	A 5	P63 . Auxiliary Junction Box (AJB), underhood	F 5
C135	C 2	Y210 . Coolant control valve solenoid	A 3
C155	F 2		

G00097823

Fig. 5: Locating Engine Compartment Electrical Components
 Courtesy of FORD MOTOR CO.

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G00097824

Fig. 6: Identifying Auxiliary Junction Box Components
Courtesy of FORD MOTOR CO.

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Fuse/Relay Location	Fuse Amp Rating	Power Distribution Box Description
1	10A*	A/C Clutch
2	—	Not Used
3	15A*	Fog Lamp
4	15A*	Horn
5	20A*	Fuel Injectors
6	15A*	Transmission Solenoid
7	—	Not Used
8	—	Not Used
9	—	Not Used
10	—	Not Used
11	15A*	HEGO's
12	10A*	COP's

G00097825

Fig. 7: Auxiliary Junction Box Legend (1 Of 2)
Courtesy of FORD MOTOR CO.

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Fuse/Relay Location	Fuse Amp Rating	Power Distribution Box Description
13	30A**	Heated Wiper Park
14	30A**	ABS Module
15	—	Not Used
16	30A**	Blower Motor
17	20A**	Thermactor Air Pump (Low Emission Vehicles Only)
18	40A**	PCM
19	—	Not Used
20	30A**	Wiper Motor
21	30A**	Starter Solenoid
22	30A**	ABS Motor
23	—	Not Used (Fuse Plug)
24	—	Not Used
Relay 01	—	Wiper Hi/Lo
Relay 02	—	Wiper Park
Relay 03	—	COP's and HEGO's
Relay 04	—	Not Used
Relay 05	—	Auxiliary Coolant Pump (V8)
Relay 06	—	Horn
Relay 07	—	Fog Lamps
Relay 08	—	A/C Clutch
Relay 09	—	Wiper Run/Acc
Relay 10	—	Blower Motor
Relay 11	—	Not Used
Relay 12	—	Heated Wiper Park
Relay 13	—	Not Used
Relay 14	—	PCM Power
Relay 15	—	Starter Motor
Diode	—	PCM
*Mini fuses **Cartridge fuses		

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Fig. 8: Auxiliary Junction Box Legend (2 Of 2)

Courtesy of FORD MOTOR CO.

BATTERY JUNCTION BOX

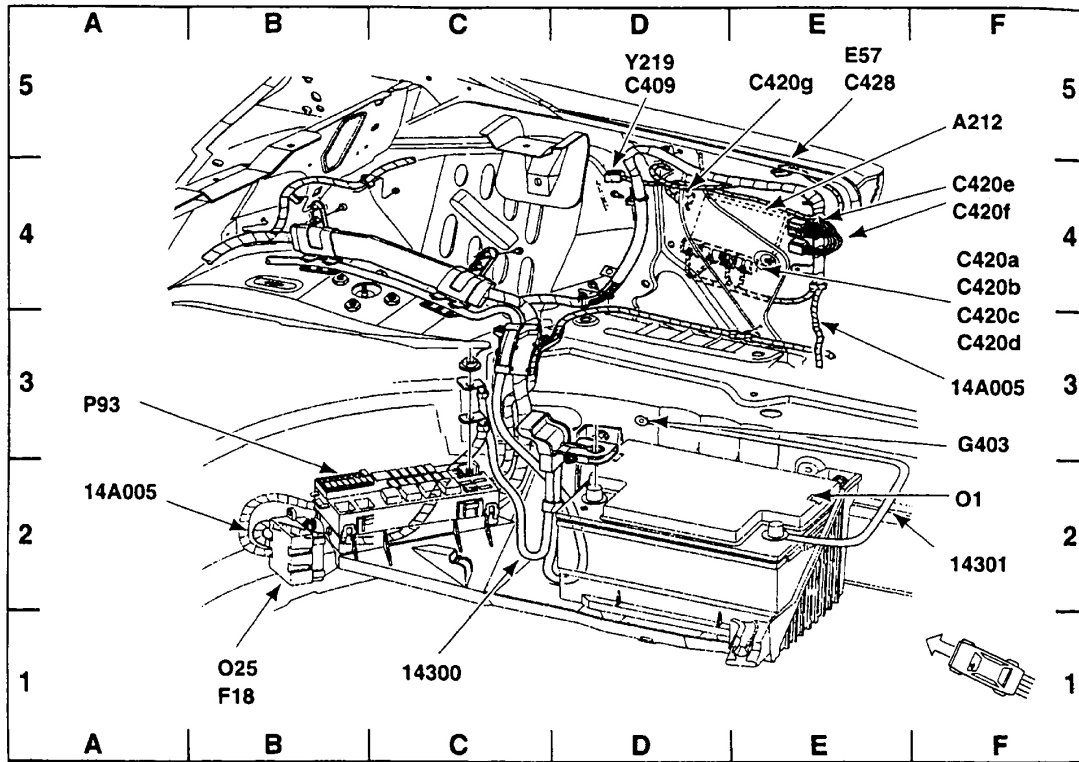
NOTE: Battery junction box may also be referred to as rear power distribution box.

NOTE: Battery junction box is located in passenger's side of trunk, near battery. See

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Fig. 9 .



Luggage compartment, RH side, front

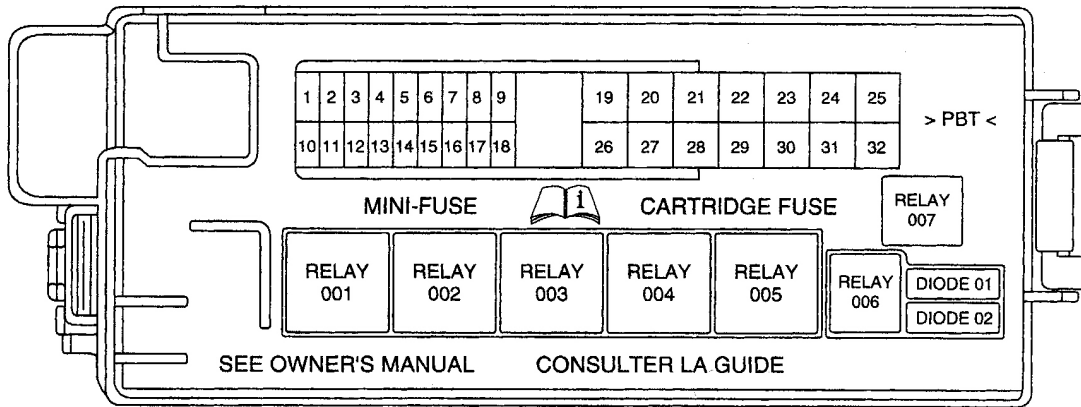
14A005	A 2	C420f	F 4
14A005	F 3	C420g	E 5
14300	C 1	C428	E 5
14301	F 2	E57 .. Luggage compartment lamp	E 5
A212 . Rear Electronic Module (REM)	F 5	F18	B 1
C409	D 5	G403	F 3
C420a	F 4	O1 ... Battery	F 2
C420b	F 4	O25 .. Mega fuse	B 1
C420c	F 3	P93 .. Battery Junction Box (BJB)	A 3
C420d	F 3	Y219 . Fuel door release solenoid	D 5
C420e	F 4		

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Fig. 9: Locating Electrical Components In Trunk
 Courtesy of FORD MOTOR CO.

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G00097828

Fig. 10: Identifying Battery Junction Box Components
Courtesy of FORD MOTOR CO.

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Fuse/Relay Location	Fuse Amp Rating	Power Distribution Box Description
1	15A*	Decklid Release Solenoid
2	10A*	Right Rear Turn Lamp
3	5A*	Left Rear Stop Lamp
4	10A*	Fuel Door Release Solenoid
5	10A*	Courtesy and Map Lamps
6	10A*	Left Rear Turn and Back-up Lamps
7	5A*	Right Rear Stop Lamp
8	10A*	Center High Mounted Stop Lamp
9	5A*	Heated Mirror
10	20A*	Powerpoint
11	15A*	Heated Seats
12	5A*	Transit Relay (if equipped)
13	—	Not Used
14	5A*	Phone, CD, VEMS
15	5A*	Alternator Sense
16	20A*	Moonroof
17	15A*	Fuel Pump
18	20A*	Subwoofer Amplifier
19	20A**	REM - Left Rear Window
20	20A**	DDM - Driver Window
21	20A**	Driver Lumbar, Power Seats
22	20A**	Ignition Switch
23	30A**	SSP4
24	30A**	SSP3
25	40A**	P-J/B
26	20A**	FEM - Front Passenger Window
27	30A**	SSP1
28	20A**	Passenger Lumbar, Power Seats
29	30A**	Rear Defroster
30	20A**	REM - Right Rear Window

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Fig. 11: Battery Junction Box Legend (1 Of 2)

Courtesy of FORD MOTOR CO.

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Fuse/Relay Location	Fuse Amp Rating	Power Distribution Box Description
31	20A**	Ignition Switch (V6 manual trans)
32	30A**	SSP2
Relay 001	—	SSP1
Relay 002	—	SSP4
Relay 003	—	Rear Defroster
Relay 004	—	SSP3
Relay 005	—	SSP2
Relay 006	—	Not Used
Relay 007	—	Fuel Pump
Diode 01	—	Not Used
Diode 02	—	Fuel Pump Motor
*Mini fuses **Maxi fuses		

G00097830

Fig. 12: Battery Junction Box Legend (2 Of 2)
Courtesy of FORD MOTOR CO.

2001 STARTING & CHARGING SYSTEMS**Generators & Regulators - LS****DESCRIPTION**

System consists of 110-amp generator, internal voltage regulator, battery, Powertrain Control Module (PCM), warning indicator, related fuses and wiring. PCM and generator communicate using pulse-width modulated signals. A dedicated line communicates desired charging rate from PCM to generator and a second dedicated line communicates load from generator to PCM.

Warning indicator should illuminate with ignition on, engine off. Warning indicator should not illuminate with ignition off, or with engine running. Generator and regulator cannot be serviced separately, and must be replaced as an assembly.

ADJUSTMENTS**BELT TENSION**

Vehicles are equipped with automatic drive belt tensioner. Drive belt does not require adjustment. Inspect condition and tension of generator drive belt prior to performing any on-vehicle charging system tests. Replace belt and/or repair tensioner mechanism if necessary.

TROUBLE SHOOTING

NOTE: See **TROUBLE SHOOTING** article in **GENERAL INFORMATION**.

Verify customer's concern. Verify battery condition. Inspect accessory drive belt and tensioner. Inspect battery junction box fuse No. 415 (5-amp). Inspect central junction box fuse No. 217 (5-amp). Check all connections for looseness or corrosion. If problem is found, repair as necessary. If problem is not found, perform self-diagnostics. See **SELF-DIAGNOSTIC SYSTEM**.

ON-VEHICLE TESTING**BATTERY DRAIN TEST**

1. Ensure junction box/fuse panels are accessible without turning on interior and hood lights. Drive vehicle over 30 MPH for at least 5 minutes. Park vehicle and allow to sit with ignition off for at least 40 minutes to allow electronic modules to power down. Go to next step.
2. Connect a fused jumper wire between negative battery cable and negative battery post. Disconnect negative battery cable from negative battery post, without breaking the jumper wire connection to prevent modules from resetting. Go to next step.

NOTE: **It is very important that continuity is not broken between negative battery post and negative battery cable when disconnecting battery cable or connecting ammeter. If continuity is broken, go to step 1 .**

3. Ensure ammeter is set to read milliamps with at least a 10 amp capability. Connect ammeter between negative battery cable and negative battery post. Remove fused jumper wire. Go to next step.

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2001 STARTING & CHARGING SYSTEMS Generators & Regulators - LS

4. If excessive current draw is present, pull fuses from battery/central junction box one at a time and note any current drop when each fuse is removed. DO NOT reinstall fuses until test is complete. Go to next step.
5. Check wiring diagrams for any circuits that run from battery without passing through battery/central junction box. Disconnect these circuits if current draw still exists.

BATTERY DRAINS THAT SHUT OFF WHEN BATTERY CABLE IS DISCONNECTED TEST

1. Perform battery drain test. See **BATTERY DRAIN TEST**. Ensure all doors are closed and accessories are off. Without starting engine, turn ignition switch to RUN position for a moment, and then turn ignition OFF. Wait a few minutes for illuminated entry lamps to turn off (if equipped).
2. Connect ammeter between negative battery cable and negative battery post. Disconnect negative battery cable from negative battery post, without breaking the ammeter connection to prevent modules from resetting. Read amperage draw.
3. Amperage draw should be less than 50 milliamps. If current draw exceeds 50 milliamps, remove fuses from battery/central junction box one at a time to locate problem circuit.

LOAD TEST

1. Ensure drive belt is in good condition. Replace belt as necessary. If belt is okay, connect charging system load tester in accordance with manufacturer's instructions. Start and run engine at 2000 RPM, and apply load until generator output levels off. Generator amperage should be at least 58 amps with engine at 2000 RPM. Go to next step.
2. Turn A/C system on. Turn blower speed to high. Turn headlights on to high beams. Voltage should increase a minimum of .5 volts. If voltage is as specified, system is operating properly at this time. If voltage is not as specified, perform **NO-LOAD TEST**.

NO-LOAD TEST

Switch tester to voltmeter function. Connect voltmeter positive lead to B+ terminal on generator and negative lead to ground. Turn all electrical accessories off. Start and run engine up to 2000 RPM. Read voltmeter when voltage stabilizes. Voltage should be 13-15 volts. If voltage is not as specified, repair by symptom. See **SYMPTOM INDEX** table under SYSTEM TESTS.

SELF-DIAGNOSTIC SYSTEM

Connect New Generation Star (NGS) tester to Data Link Connector (DLC). Using NGS tester, perform Powertrain Control Module (PCM) self-test. If any DTCs exist, perform appropriate test in accordance with DTC retrieved. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE. If no DTCs are present, repair by symptom. See **SYMPTOM INDEX** table under SYSTEM TESTS.

SYSTEM TESTS

SYMPTOM INDEX

Symptom	Perform Test
Battery Is Discharged Or Voltage Is Low	<u>A</u>
Warning Indicator On With Engine Running, System Not Charging	<u>B</u>
System Overcharges	<u>C</u>
Warning Indicator On With Engine Running, System Is Charging	<u>D</u>

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2001 STARTING & CHARGING SYSTEMS Generators & Regulators - LS

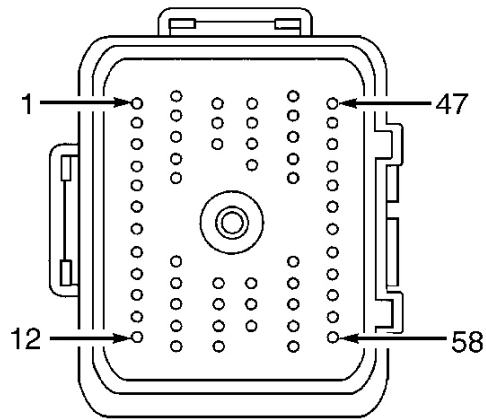
Warning Indicator Off With Ignition On	<u>E</u>
Warning Indicator Flickers, Or Is Intermittent	<u>F</u>
Generator Noisy	<u>G</u>
Radio Interference	<u>H</u>

TEST A: BATTERY IS DISCHARGED OR VOLTAGE IS LOW

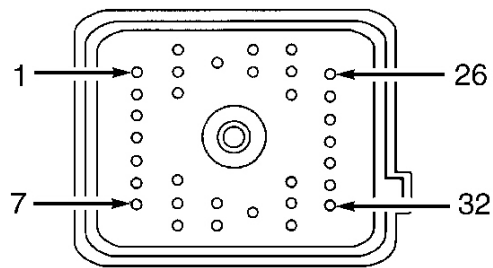
1. Perform generator load and no-load tests. See **LOAD TEST** and **NO-LOAD TEST** under ON-VEHICLE TESTING. If generator is okay, go to next step. If generator is not okay, perform **TEST B: WARNING INDICATOR ON WITH ENGINE RUNNING, SYSTEM NOT CHARGING** .
2. Perform **BATTERY DRAIN TEST** under ON-VEHICLE TESTING. If no excessive current draw was not found, go to next step. If any excessive current draw was found, repair as necessary.
3. Perform **BATTERY DRAINS THAT SHUT OFF WHEN BATTERY CABLE IS DISCONNECTED TEST** under ON-VEHICLE TESTING. If there are any current drains that shut off when the battery is disconnected, repair as necessary. If no drains were found, perform **TEST B: WARNING INDICATOR ON WITH ENGINE RUNNING, SYSTEM NOT CHARGING** .

TEST B: WARNING INDICATOR ON WITH ENGINE RUNNING, SYSTEM NOT CHARGING

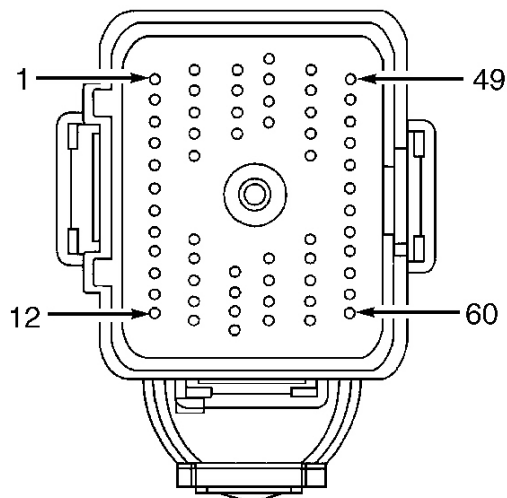
1. Connect New Generation Star (NGS) tester to Data Link Connector (DLC). Turn ignition on. Using NGS tester, perform Powertrain Control Module (PCM) self-test. If no DTCs are retrieved, go to next step. If any Diagnostic Trouble Codes (DTC) are retrieved, perform appropriate test in accordance with DTC retrieved. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.
2. Turn ignition off. Disconnect NGS tester. Disconnect generator 3-pin harness connector. Turn ignition on. Measure voltage between ground and Gray/Red wire terminal at generator harness connector. If voltage is present, go to next step. If voltage is not present, go to step 4 .
3. Turn ignition off. Disconnect PCM harness connector C175c. Measure resistance of Gray/Red wire between generator harness connector and terminal No. 28 at PCM harness connector C175c. See **Fig. 1** . If resistance is 5 ohms or less, go to next step. If resistance is greater than 5 ohms, repair open in Gray/Red wire between generator and PCM.
4. Connect PCM harness connector C175c. Check generator output. Perform **LOAD TEST** and **NO-LOAD TEST** under ON-VEHICLE TESTING. If generator is okay, go to next step. If generator is not okay, replace generator. See **GENERATOR** under REMOVAL & INSTALLATION.
5. Disconnect PCM harness connector C175c. Inspect harness connector for pushed out pins, corrosion or bent terminals. Repair as necessary. If harness connector is okay, reconnect and retest system operation. If fault is still present, replace PCM. Clear DTCs and repeat PCM self-test. If fault is still not present, system is operating correctly at this time.



C175a



C175b



C175c

G00011081

Fig. 1: Identifying Powertrain Control Module Harness Connector Terminals
 Courtesy of FORD MOTOR CO.

TEST C: SYSTEM OVERCHARGES

1. Connect New Generation Star (NGS) tester to Data Link Connector (DLC). Turn ignition on. Using NGS tester, perform Powertrain Control Module (PCM) self-test. If no DTCs are retrieved, go to next step. If any Diagnostic Trouble Codes (DTC) are retrieved, perform appropriate test in accordance with DTC retrieved. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

2. Turn ignition off. Disconnect NGS tester. Start engine. With engine running and all accessories turned off, measure voltage between battery terminals while varying engine speed. If voltage is less than 15 volts, go to next step. If voltage is greater than 15 volts, go to step 4 .
3. Turn ignition off. Disconnect generator 3-pin harness connector. Start engine. Check generator output. See **LOAD TEST** under ON-VEHICLE TESTING. If generator tests okay, go to next step. If generator does not test okay, replace generator. See **GENERATOR** under REMOVAL & INSTALLATION.
4. Measure voltage between ground and Red wire terminal at generator harness connector. If voltage is less than .5 volt from battery voltage, replace generator. See **GENERATOR** under REMOVAL & INSTALLATION. If voltage is greater than .5 volt from battery voltage, repair high resistance in Red wire. See **WIRING DIAGRAMS** .

TEST D: WARNING INDICATOR ON WITH ENGINE RUNNING, SYSTEM IS CHARGING

1. Connect New Generation Star (NGS) tester to Data Link Connector (DLC). Turn ignition on. Using NGS tester, perform Powertrain Control Module (PCM) self-test. If no DTCs are retrieved, go to next step. If any Diagnostic Trouble Codes (DTC) are retrieved, perform appropriate test in accordance with DTC retrieved. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.
2. Turn ignition off. Disconnect NGS tester. Start engine. With engine running and all accessories turned off, measure voltage between battery terminals while varying engine speed. If voltage is less than 15 volts, go to next step. If voltage is greater than 15 volts, perform **TEST B: SYSTEM OVERCHARGES** .
3. Turn ignition off. Disconnect generator 3-pin harness connector. Turn ignition on. Measure voltage between ground and Red wire terminal at generator harness connector. If battery voltage is present, go to next step. If voltage is not present, repair open or short in Red wire. See **WIRING DIAGRAMS** .
4. Turn ignition off. Disconnect PCM harness connector C175c. Turn ignition on and observe warning indicator. If warning indicator is not illuminated, go to next step. If warning indicator is illuminated, repair short to ground in Gray/Red wire between generator and PCM. See **WIRING DIAGRAMS** .
5. Turn ignition off. Reconnect PCM harness connector C175c. Disconnect generator 3-pin harness connector. Check generator output. See **LOAD TEST** under ON-VEHICLE TESTING. If generator tests okay, go to next step. If generator does not test okay, replace generator. See **GENERATOR** under REMOVAL & INSTALLATION.
6. Disconnect PCM harness connector C175c. Inspect harness connector for pushed out pins, corrosion or bent terminals. Repair as necessary. If harness connector is okay, reconnect and retest system operation. If fault is still present, replace PCM. Clear DTCs and repeat PCM self-test. If fault is still not present, system is operating correctly at this time.

TEST E: WARNING INDICATOR OFF WITH IGNITION ON

1. Connect New Generation Star (NGS) tester to Data Link Connector (DLC). Turn ignition on. Using NGS tester, perform Powertrain Control Module (PCM) self-test. If no DTCs are retrieved, go to next step. If any Diagnostic Trouble Codes (DTC) are retrieved, perform appropriate test in accordance with DTC retrieved. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.
2. Turn ignition off. Disconnect NGS tester and generator 3-pin harness connector. Turn ignition on. Connect a fused (15-amp) jumper wire between generator 3-pin Gray/Red wire terminal and ground. If warning indicator does not illuminate, go to next step. If warning indicator illuminates, replace generator. See **GENERATOR** under REMOVAL & INSTALLATION.
3. Disconnect PCM harness connector C175c. Inspect harness connector for pushed out pins, corrosion or bent terminals. Repair as necessary. If harness connector is okay, reconnect and retest system

operation. If fault is still present, replace PCM. Clear DTCs and repeat PCM self-test. If fault is still not present, system is operating correctly at this time.

TEST F: WARNING INDICATOR FLICKERS, OR IS INTERMITTENT

1. Connect New Generation Star (NGS) tester to Data Link Connector (DLC). Turn ignition on. Using NGS tester, perform Powertrain Control Module (PCM) self-test. If no DTCs are retrieved, go to next step. If any Diagnostic Trouble Codes (DTC) are retrieved, perform appropriate test in accordance with DTC retrieved. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.
2. Disconnect generator 3-pin harness connector. Inspect generator, battery and battery junction box for looseness, corrosion or bent terminals. Clean and tighten any loose connection. If connections are okay, reconnect generator harness connector and go to next step.
3. Start engine. With engine running, inspect battery junction box fuse No. 415 (5-amp), by wiggling fuse and observing warning indicator. If warning indicator flickers, repair loose fuse connection. Retest system operation. If warning indicator does not flicker, go to next step.
4. With engine running and all accessories turned off, measure voltage between battery terminals. If battery voltage is less than 15 volts, go to next step. If battery voltage is greater than 15 volts, perform **TEST B: SYSTEM OVERCHARGES** .
5. Turn ignition off. Disconnect generator 3-pin harness connector. Connect a fused (15-amp) jumper wire between generator 3-pin Gray/Red wire terminal and ground. Turn ignition on and observe warning indicator. If warning indicator illuminates, go to next step. If warning indicator does not illuminate, repair open in Gray/Red wire. See **WIRING DIAGRAMS** .
6. Turn ignition off. Connect generator harness connector. Turn ignition on and observe warning indicator. If warning indicator does not illuminate, go to next step. If warning indicator illuminates, system is operating correctly at this time. Inspect circuits for intermittent opens or shorts.
7. Disconnect PCM harness connector C175c. Inspect harness connector for pushed out pins, corrosion or bent terminals. Repair as necessary. If harness connector is okay, reconnect and retest system operation. If fault is still present, replace PCM. Clear DTCs and repeat PCM self-test. If fault is still not present, system is operating correctly at this time.

TEST G: GENERATOR NOISY

1. Turn ignition off. Check accessory drive belt for damage and correct installation. Check mounting brackets and pulleys for looseness and damage. If problem does not exist, go to next step. If problem exists, repair as necessary.
2. Check generator installation. Ensure all fasteners are tight. If problem does not exist, go to next step. If problem exists, repair as necessary.
3. Disconnect generator 3-pin harness connector. Start engine and let idle. Turn headlights on. Turn rear defogger on. Turn blower motor to high speed. If noise still exists, go to next step. If noise does not still exist, replace generator.
4. Turn ignition off. Connect generator harness connector. Start engine and let idle. Turn all accessories off. Using a stethoscope, check generator for unusual mechanical noise. If generator is source of noise, replace generator. If generator is not source of noise, isolate noise and repair as necessary.

TEST H: RADIO INTERFERENCE

Start engine and let idle. Tune radio to station where interference is present. Turn ignition off. Disconnect generator 3-pin harness connector. Start engine and let idle. If interference is still present, repair radio concern. If interference is not still present, replace generator.

REMOVAL & INSTALLATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** article in **GENERAL INFORMATION** before disconnecting battery.

GENERATOR

Removal & Installation (3.0L)

Disconnect negative battery cable. Remove drive belt from pulley. Raise and support vehicle. Remove bolts, pin-type retainers and lower splash shield. Remove 3 mounting bolts from generator. Hand support generator and rotate to access electrical connections. Disconnect wiring from generator. Remove generator. To install reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

Removal (3.9L)

Disconnect negative battery cable. Remove engine cover and air cleaner inlet tube. Remove drive belt from pulley. Raise and support vehicle. Remove 5 bolts and lower splash shield. Remove generator mounting bolts. Rotate generator to access B+ terminal, and remove nut. Slightly lower generator and disconnect harness connectors. Rotate and remove generator.

Installation

Position generator and connect harness connectors. Rotate generator to access B+ terminal, install cable and nut. Install pivot bolt and nut, leave loose. Install generator expanding bushing/bolt assembly and tighten to specification in 2 steps. Install remaining mounting bolts and tighten to specification. See **TORQUE SPECIFICATIONS** table. Install lower splash shield. Lower vehicle, install drive belt to generator pulley and air cleaner inlet tube. Reconnect negative battery cable.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Generator Mounting Bolts (3.0L)	33 (45)
Generator Mounting Bolts (3.9L)	
Pivot & Lower Mounting Bolts	35 (48)
Generator Expanding Bushing/Bolt Assembly	
Step 1	15 (20)
Step 2	Turn Additional 90 Degrees
	INCH Lbs. (N.m)
Battery Ground Cable Bolt	89 (10)
Generator B+ Terminal Nut	7 (.8)

WIRING DIAGRAMS

2001 Lincoln LS

2001 STARTING & CHARGING SYSTEMS Generators & Regulators - LS

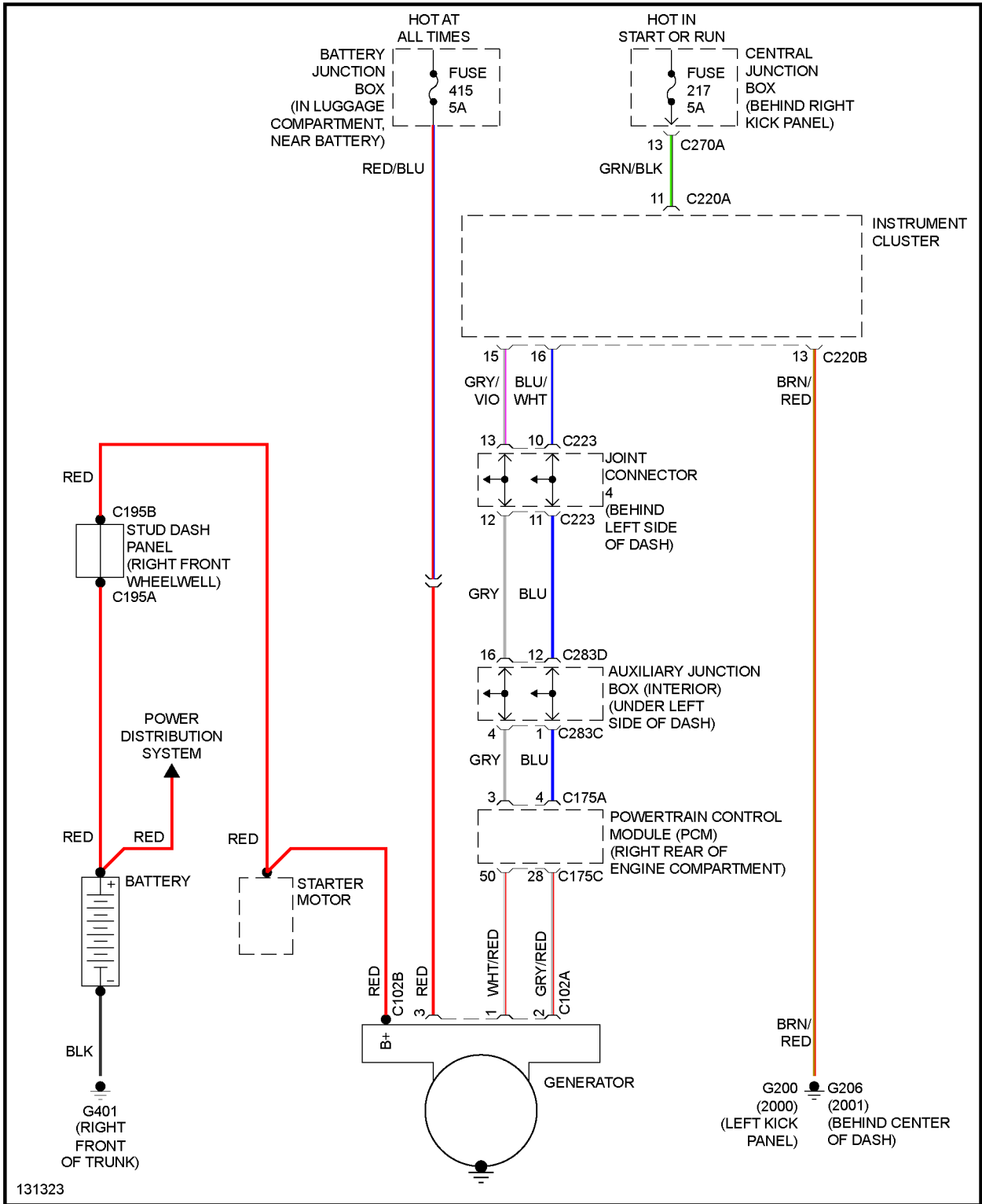


Fig. 2: Charging System Wiring Diagram (LS)

2001 Lincoln LS

2001 STARTING & CHARGING SYSTEMS Starters - LS

2001 STARTING & CHARGING SYSTEMS

Starters - LS

DESCRIPTION

The starter is a gear-reduction motor with an externally-mounted solenoid. Starting system consists of a starter motor, solenoid, battery, ignition switch, Digital Transmission Range (DTR) sensor, starter relay, and interconnecting cables and wires.

COMPONENT LOCATIONS

COMPONENT LOCATIONS

Component	Location
Auxiliary Junction Box	Under Left Side Of Dash
Battery Junction Box	Left Side Of Engine Compartment On Fenderwell
Central Junction Box	Behind Right Side Kick Panel
Inertia Fuel Shutoff Switch	Behind Left Side Kick Panel
Starter Motor	Lower Right Hand Corner Of Engine
Starter Relay	In Auxiliary Relay Box
Digital Transmission Range Sensor	Side Of Transmission

ADJUSTMENTS

DIGITAL TRANSMISSION RANGE SENSOR

1. Place transmission in Neutral. Raise and support vehicle. Remove catalytic converter. Remove heat shield. Mark front driveshaft flex coupling components to ensure installation is in same position. Using Driveshaft Coupler Torquing Wrenches (205-474), loosen driveshaft coupler nut, located in front of driveshaft bushing.
2. Remove front driveshaft flex coupling nuts. DO NOT remove flex coupling bolts. Slide driveshaft back to clear transmission flange. Support driveshaft. Support transmission. Remove transmission mount. Lower transmission to access Digital Transmission Range (DTR) sensor. Disconnect manual shift control cable.
3. Disconnect DTR harness connector. Loosen DTR sensor bolts. Using DTR Sensor Aligner (T97L-70010-A), align DTR sensor slots. Tighten DTR sensor bolts to specification. See **TORQUE SPECIFICATIONS** . To complete assembly, reverse removal procedure. Use marks to align components in original positions. Use Loctite on flex coupling nuts.

TROUBLE SHOOTING

Verify customer concern by operating starting system. Check battery for state of charge. Check cable connections at battery and starter motor. Ensure transmission is fully engaged in Park or Neutral. Check fuse No. 121 (30-amp) in auxiliary junction box, located underhood. Check fuse No. 22 (20-amp) in battery junction box, located on right side of trunk. Check fuse No. 201 (5-amp) in central junction box, located under right side of instrument panel. If problem exists, repair as necessary. If problem does not exist, repair by symptom. See **SYMPTOM INDEX** table under SYSTEM TESTS.

ON-VEHICLE TESTING

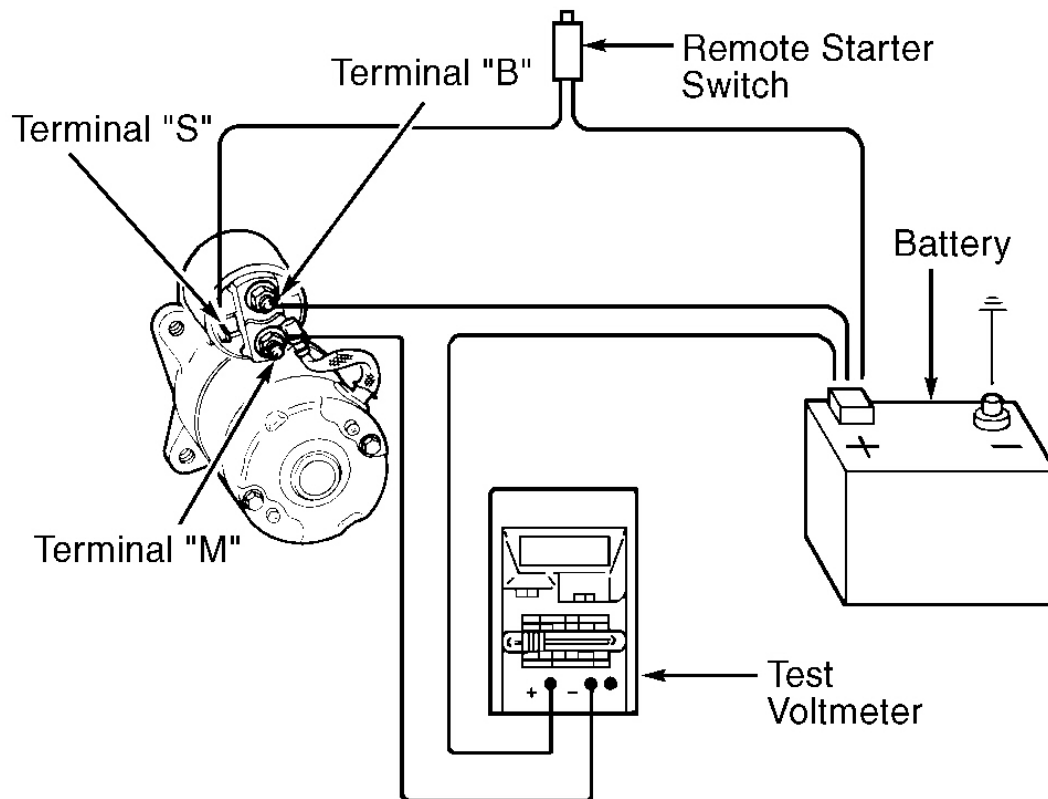
CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** article in **GENERAL INFORMATION** before disconnecting battery. Before testing starter, ensure transmission is in Park or Neutral.

CAUTION: Before testing starter, ensure transmission is in Park or Neutral.

VOLTAGE DROP TEST

NOTE: Make all DVOM connections at component terminal rather than at cable or wire end.

1. Verify battery condition. Battery voltage should be 12 volts or more. Load test battery at approximately one-half cold cranking amperage rating. See load tester manufacturer's instructions. If battery voltage is less than 12 volts or loaded battery voltage is less than 9.6 volts, service battery or charging system as necessary.
2. Disconnect inertia fuel shutoff switch to disable fuel system. Connect remote starter switch between starter solenoid terminal "S" (Gray wire) and positive battery post. See **Fig. 1**.



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Fig. 1: Testing Voltage Drop
 Courtesy of FORD MOTOR CO.

3. Connect positive DVOM lead to positive battery post, and negative lead to solenoid terminal "M" (solenoid-to-motor connection).
4. Engage remote starter switch. DVOM should indicate .8 volt or less. If DVOM indicates more than .8 volt, go to next step. If DVOM indicates .8 volt or less, go to **STARTER GROUND CIRCUIT TEST**.
5. Move negative DVOM lead to solenoid terminal "B". Engage remote starter switch. If DVOM still indicates more than .8 volt at terminal "B", go to next step. If DVOM indicates less than .8 volt, solenoid connections or contacts are bad. Clean solenoid terminals "B", "S" and "M". Repeat steps 2 - 5. If DVOM still indicates more than .8 volt at terminal "M" and less than .8 volt at terminal "B", solenoid contacts are bad. Replace starter motor. See **STARTER MOTOR** under REMOVAL & INSTALLATION.
6. Clean cables and connections at solenoid and battery. If DVOM still indicates more than .8 volt at terminal "B", replace battery cable.

NOTE: To locate excessive voltage drop, move DVOM negative lead toward battery, and check each connection point. When high DVOM reading disappears, problem is between last connection point and previous connection point.

STARTER GROUND CIRCUIT TEST

NOTE: Make all DVOM connections at component terminal rather than at cable or wire end.

1. Disconnect inertia fuel shutoff switch to disable fuel system. Connect remote starter switch between starter solenoid terminal "S" (Gray wire) and positive battery post. See **Fig. 2** . Using a digital DVOM set at lowest voltage scale, connect positive DVOM lead to starter housing, and negative lead to negative battery post.
2. Engage remote starter switch while observing DVOM. DVOM should indicate .5 volt or less. If DVOM indicates more than .5 volt, clean negative cable connections at battery and chassis. Also clean engine ground cable connections at front cover and engine mount bracket. If voltage drop is still excessive, repair or replace negative battery cable and/or engine ground cable as necessary. Repeat starter circuit test after repair to ensure problem has been corrected. If battery and cables test okay and starter motor still cranks slowly or not at all, replace starter motor. See **STARTER MOTOR** under REMOVAL & INSTALLATION.

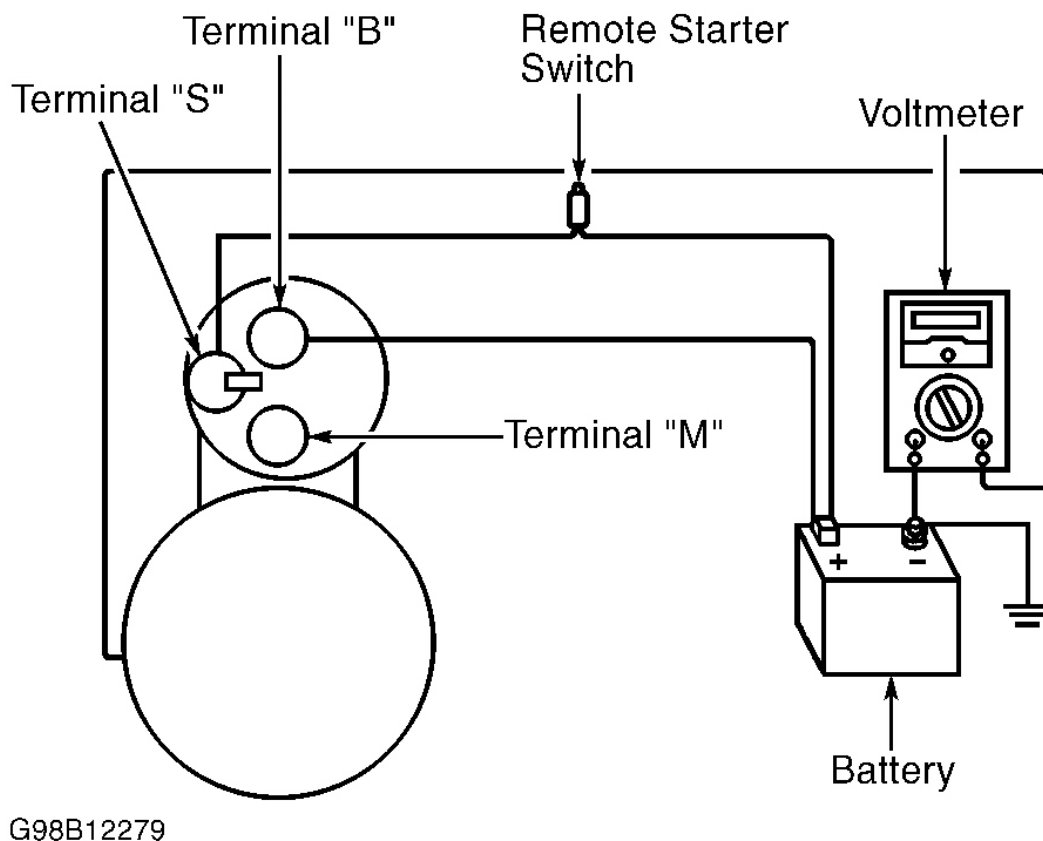


Fig. 2: Testing Ground Circuit
Courtesy of FORD MOTOR CO.

SYSTEM TESTS

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer

2001 Lincoln LS

2001 STARTING & CHARGING SYSTEMS Starters - LS

systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** article in **GENERAL INFORMATION** before disconnecting battery. Before testing starter, ensure transmission is in **Park or Neutral**.

SYMPTOM INDEX

Symptom	Perform Test
Engine Does Not Crank	<u>A</u>
Unusual Starter Noise	<u>B</u>
Engine Cranks Slowly	(1)
Starter Spins But Engine Does Not Crank	(2)
Engine Cranks With Clutch Pedal Not Applied	(3)

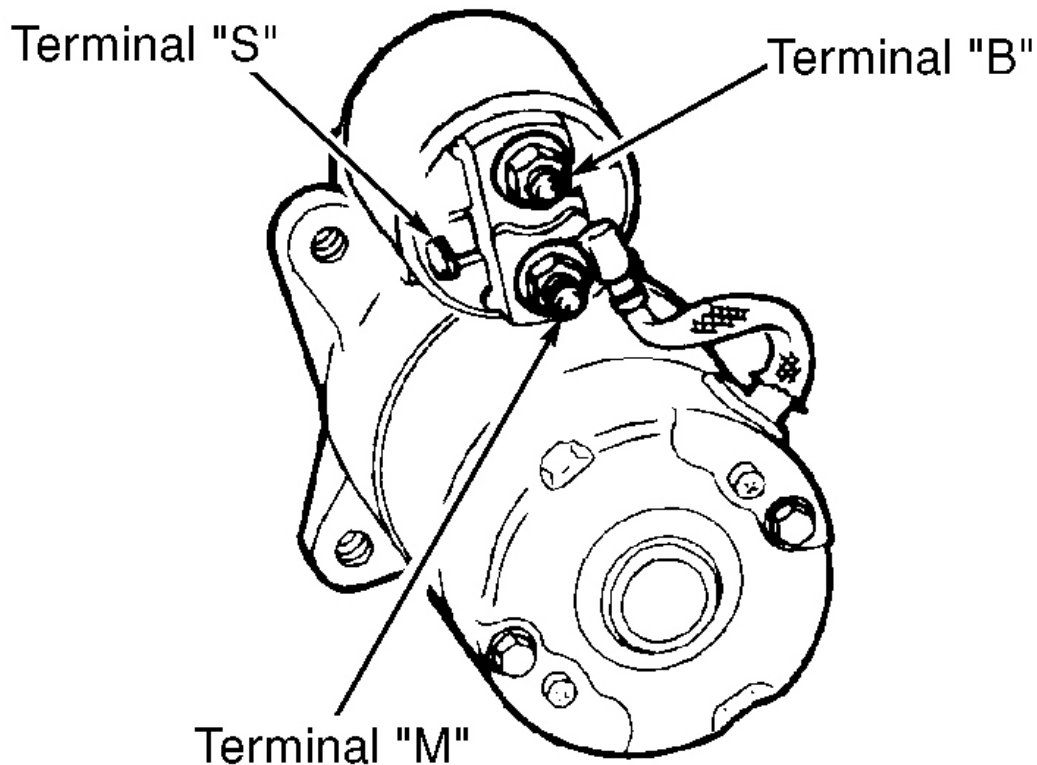
(1) Perform **VOLTAGE DROP TEST** under ON-VEHICLE TESTING.

(2) Inspect starter motor mounting. Inspect flywheel ring gear and starter motor gear for damaged and missing teeth. Repair or replace components as necessary.

(3) Install a new clutch pedal position switch.

TEST A: ENGINE DOES NOT CRANK

1. Check for Passive Anti-Theft System (PATS) Diagnostic Trouble Codes (DTC). See **PASSIVE ANTI-THEFT SYSTEMS - LS** article. If no PATS DTCs exist, go to next step. If any PATS DTCs exist, diagnose and repair as necessary.
2. Verify battery condition. Battery voltage should be 12 volts or more. Load test battery at approximately one-half cold cranking amperage rating. See load tester manufacturer's instructions. If battery is okay, go to next step. If battery voltage is less than 12 volts or loaded battery voltage is less than 9.6 volts, service battery or charging system as necessary. Check system operation.
3. Measure voltage between positive battery post and negative battery cable connection at engine block. If voltage is more than 10 volts, go to next step. If voltage is 10 volts or less, replace battery ground cable. Check system operation.
4. Measure voltage between positive battery post and starter motor case. If voltage is more than 10 volts, go to next step. If voltage is 10 volts or less, clean starter mounting flange and ensure starter is mounted properly. Check system operation.
5. Measure voltage between starter motor terminal "B" and ground. See **Fig. 3**. If voltage is more than 10 volts, go to next step. If voltage is 10 volts or less, replace battery positive cable. Check system operation.



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Fig. 3: Identifying Starter Solenoid Terminals
Courtesy of FORD MOTOR CO.

6. Connect a fused jumper wire to starter terminal "B". Momentarily touch other end of jumper wire to starter terminal "S". If starter cranked engine, go to next step. If starter did not crank engine, replace starter. See **STARTER MOTOR** under REMOVAL & INSTALLATION. Check system operation.
7. Disconnect starter harness connector "S" (Gray wire). Measure voltage between starter harness connector "S" (Gray wire) and ground while turning ignition switch to START position. If voltage is 10 volts or less, go to next step. If voltage is more than 10 volts, clean or repair "S" terminal and connector. Check system operation.
8. Remove starter relay from Auxiliary Junction Box (AJB), located underhood. On manual transmission models, have a helper depress clutch. On all models, measure voltage between starter relay cavity No. 86 and ground while turning ignition switch to START position. See **Fig. 4** . If voltage is more than 10 volts, go to next step. If voltage is 10 volts or less, go to step 17 .

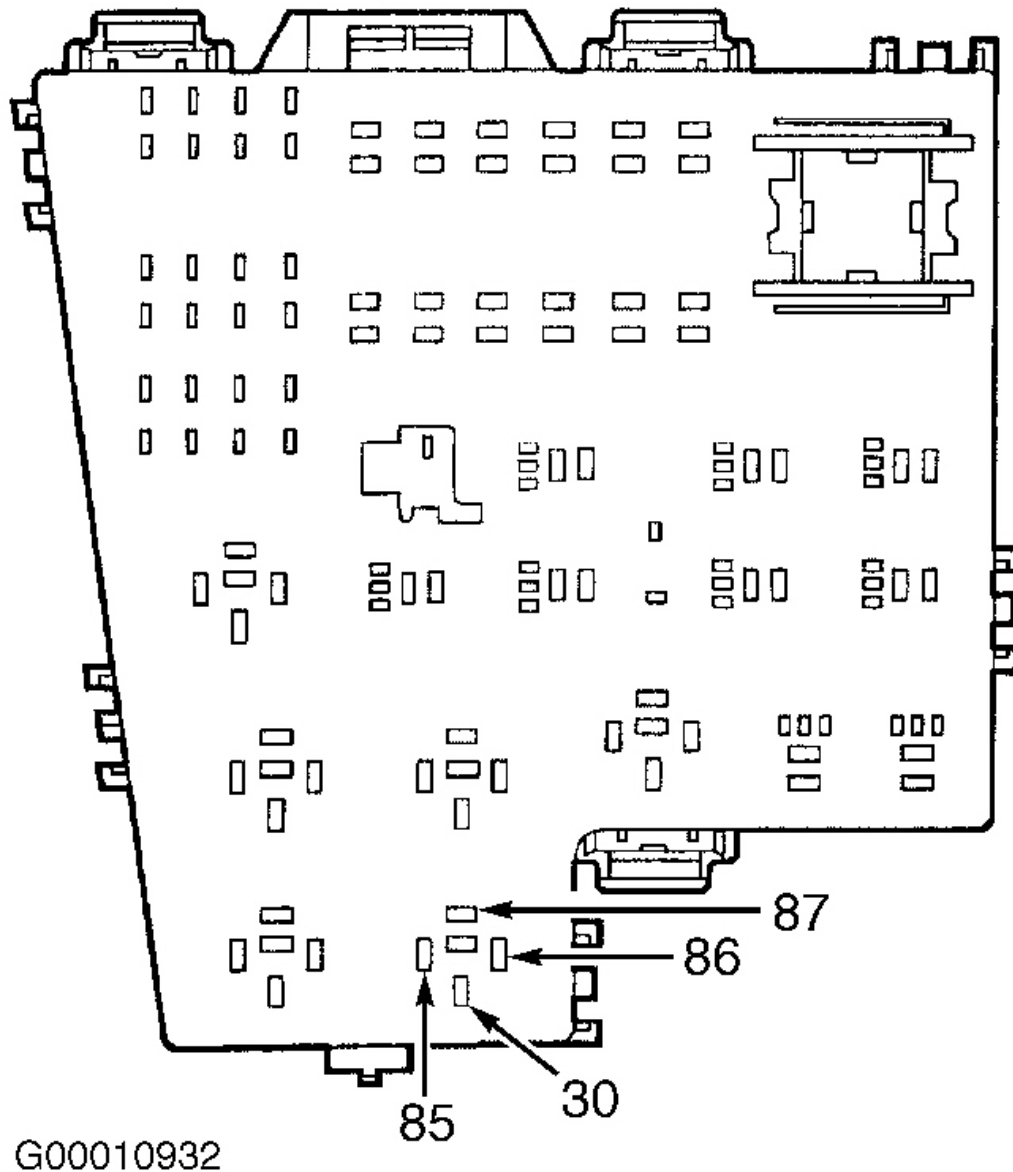


Fig. 4: Identifying Starter Relay Cavities
 Courtesy of FORD MOTOR CO.

9. On manual transmission models, have a helper depress clutch. On all models, measure resistance between starter relay cavity No. 85 and ground while turning ignition switch to START position. If resistance is 5 ohms or more, go to step 11 (M/T), or next step (A/T). If resistance is less than 5 ohms, go to step 14.
10. Disconnect 20-pin instrument cluster connector C220B. Measure resistance of Black/Yellow wire between starter relay cavity No. 85 and instrument cluster connector C220B terminal No. 18. See **Fig. 4** and **Fig. 5**. If resistance is less than 5 ohms, replace instrument cluster. See ANALOG INSTRUMENT PANELS - LS article. If resistance is 5 ohms or more, repair open on Black/Yellow wire. After repairs, check system operation.

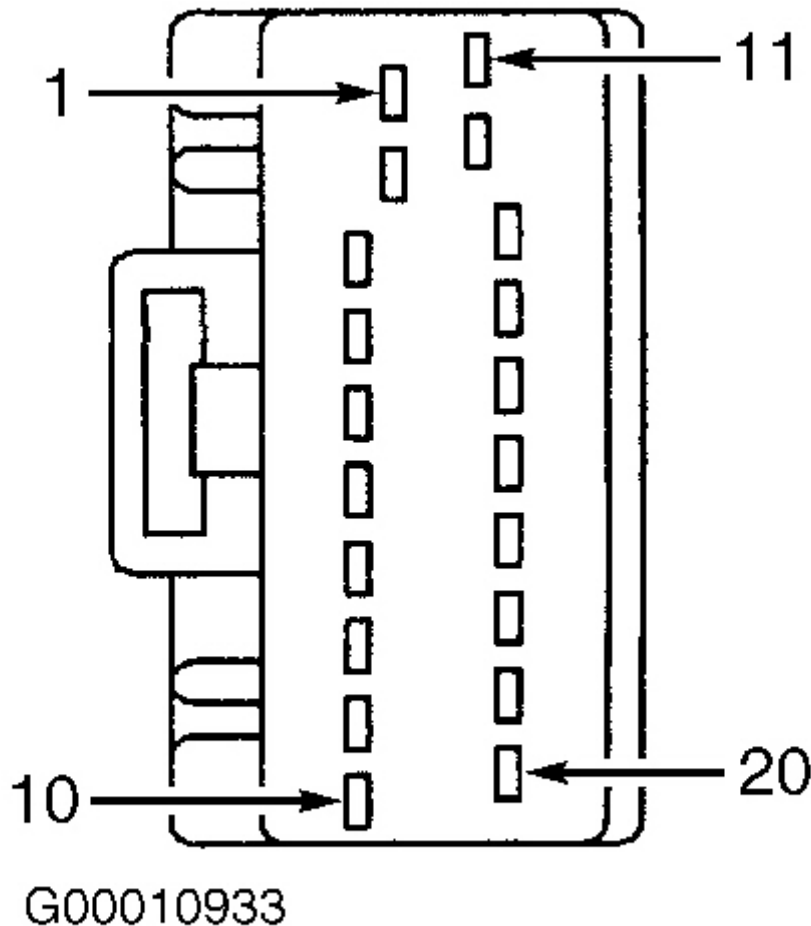


Fig. 5: Identifying Instrument Cluster Connector C220B Terminals
 Courtesy of FORD MOTOR CO.

11. Disconnect 2-pin Clutch Pedal Position (CPP) switch connector. Measure resistance between CPP switch harness connector terminal No. 2 (Black/Yellow wire) and ground while turning ignition switch to START position. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, go to step 13 .
12. Measure resistance of Black/Yellow wire between CPP harness connector terminal No. 1 and starter relay cavity No. 85. If resistance is less than 5 ohms, replace CPP switch. If resistance is 5 ohms or more, repair open in Black/Yellow wire. After repairs, check system operation.
13. Measure resistance of Black/Yellow wire between CPP switch harness connector terminal No. 2 and instrument cluster connector C220B terminal No. 18. If resistance is less than 5 ohms, replace instrument cluster. See ANALOG INSTRUMENT PANELS - LS article. If resistance is 5 ohms or more, repair open in Black/Yellow wire. After repairs, check system operation.
14. Measure voltage between starter relay cavity terminal No. 30 and ground. See **Fig. 4** . If voltage is more than 10 volts, go to next step. If voltage is less than 10 volts, repair open in power and distribution circuit to starter relay. See **WIRING DIAGRAMS** . Check system operation.

15. Disconnect starter terminal "S" connector (Gray wire). Measure resistance of Gray wire between starter relay cavity terminal No. 87 and starter harness connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in Gray wire. Check system operation.
16. Measure resistance between starter relay cavity terminal No. 87 (Gray wire) and ground. If resistance is less than 10,000 ohms, repair short to ground in Gray wire. If resistance is 10,000 ohms or more, replace starter relay. After repairs, check system operation.
17. Remove fuse No. 201 (5-amp), located in Central Junction Box (CJB). CJB is located under right side of instrument panel. Check fuse No. 201. If fuse is okay, go to next step. If fuse is faulty, go to step 24 .
18. Measure voltage between input side of fuse No. 201 cavity in CJB and ground while turning ignition switch to START position. If voltage is less than 10 volts, go to next step. If voltage is 10 volts or more, go to step [22](#) .
19. Disconnect 8-pin ignition switch connector C250. Measure voltage between ignition switch harness connector C250 terminal No. 1 (Red wire) and ground. See [Fig. 6](#) . If voltage is 10 volts or more, go to next step. If voltage is less than 10 volts, repair open power feed circuit to ignition switch. See [WIRING DIAGRAMS](#) . Check system operation.

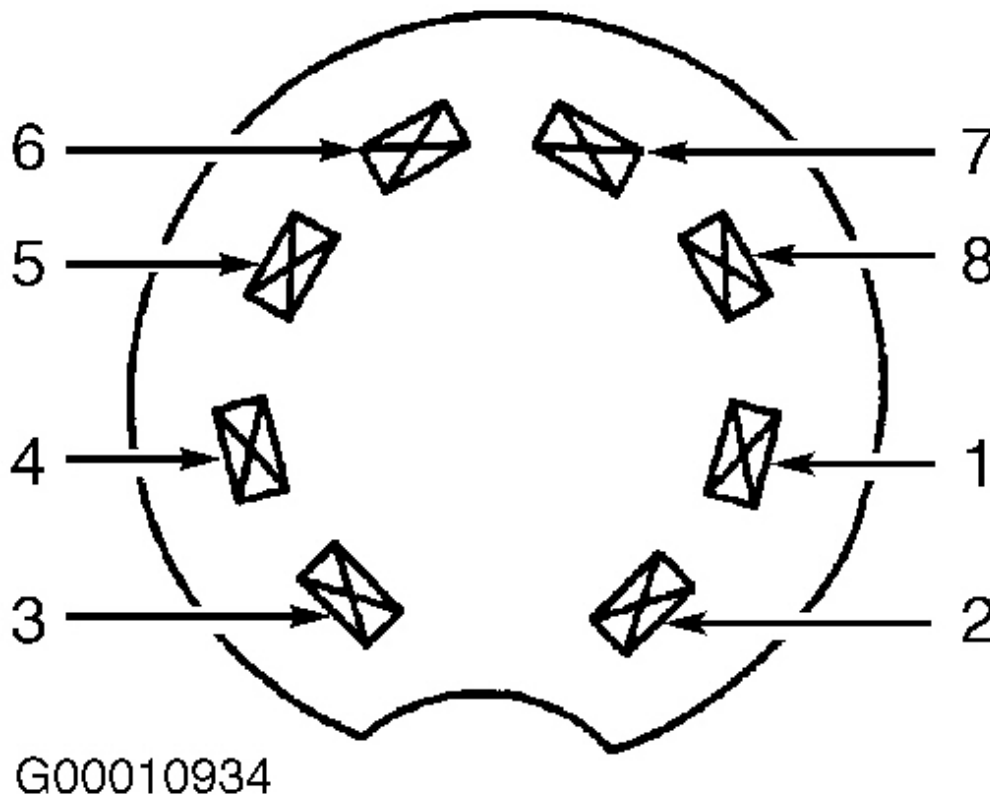
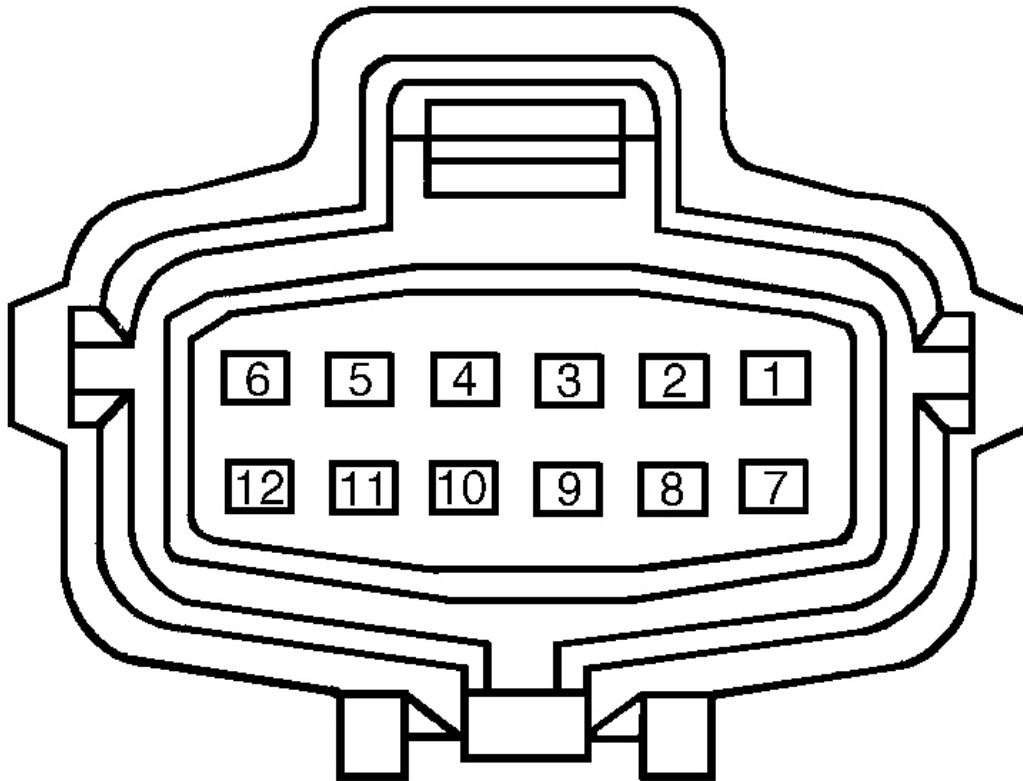


Fig. 6: Identifying Ignition Switch Connector Terminals
Courtesy of FORD MOTOR CO.

20. Measure resistance of Gray/Black wire between ignition switch harness connector C250 terminal No. 3 and input side of fuse No. 201 cavity in CJB. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or more, repair open in Gray/Black wire. Check system operation.
21. Measure resistance between ignition switch harness connector C250 terminal No. 3 (Gray/Black wire) and ground. If resistance is less than 10,000 ohms, repair short to ground in Gray/Black wire. If resistance is 10,000 ohms or more, replace ignition switch. After repairs, check system operation.
22. Install fuse No. 201 (5-amp) in CJB. Disconnect Digital Transmission Range (DTR) sensor connector. DTR is located on left side of transmission. Measure voltage between DTR sensor harness connector terminal No. 10 (Gray/Orange wire) and ground while turning ignition switch to START position. See **Fig. 7** . If voltage is 10 volts or more, go to next step. If voltage is less than 10 volts, repair open in Gray/Orange wire. Check system operation.



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Fig. 7: Identifying Digital Transmission Range Switch Harness Connector
Courtesy of FORD MOTOR CO.

23. Measure resistance of Gray wire between DTR harness connector terminal No. 12 and starter relay cavity No. 86. If resistance is less than 5 ohms, adjust DTR switch. See **DIGITAL TRANSMISSION RANGE SENSOR** under ADJUSTMENTS. If resistance is 5 ohms or more, repair open in Gray wire. After repairs, check system operation.
24. Measure resistance between output side of fuse No. 201 cavity in CJB (Gray/Orange wire) and ground. If resistance is 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms,

repair short to ground in Gray/Orange wire. Check system operation.

25. Measure resistance between DTR harness connector terminal No. 12 (Gray wire) and ground. If resistance is 10,000 ohms or more, go to next step. If resistance is less than 10,000 ohms, repair short to ground in Gray wire. Check system operation.
26. Connect DTR sensor connector. Install new fuse No. 201 (5-amp). Check system operation. If fuse fails, replace shorted DTR sensor. Recheck system operation.

TEST B: UNUSUAL STARTER NOISE

1. Verify starter is installed properly. Ensure bolts are tight. Repair as necessary and check system for normal operation. If starter is mounted properly, go to next step.
2. Connect remote starter switch between starter terminal "B" (Red wire) and starter motor terminal "S" (Gray wire). Engage starter motor and verify noise is coming from starter motor. If noise is coming from starter motor, go to next step. If noise is not coming from starter motor, diagnose engine mechanical concern. See appropriate article in ENGINES.
3. Remove starter motor. See **STARTER MOTOR** under REMOVAL & INSTALLATION. Inspect flywheel ring gear for wear or damage. If ring gear is okay, replace starter motor. If ring gear is worn or damaged, replace ring gear and inspect starter drive gear. If drive gear is also damaged, replace starter motor.

COMPONENT TESTS

STARTER RELAY

1. Remove starter relay from relay box. Check relay continuity. Continuity should exist between relay terminals No. 85 and 86, and between relay terminals No. 30 and 87a. See **Fig. 8**. Continuity should not exist between relay terminals No. 30 and 87. If continuity is as specified, go to next step. If continuity is not as specified, replace relay.
2. Using a jumper wire, apply battery voltage to relay terminal No. 85. Using a second jumper wire, ground relay terminal No. 86. Continuity should now exist between relay terminals No. 30 and 87. If continuity is not as specified, replace relay. If continuity is as specified, relay is okay at this time.

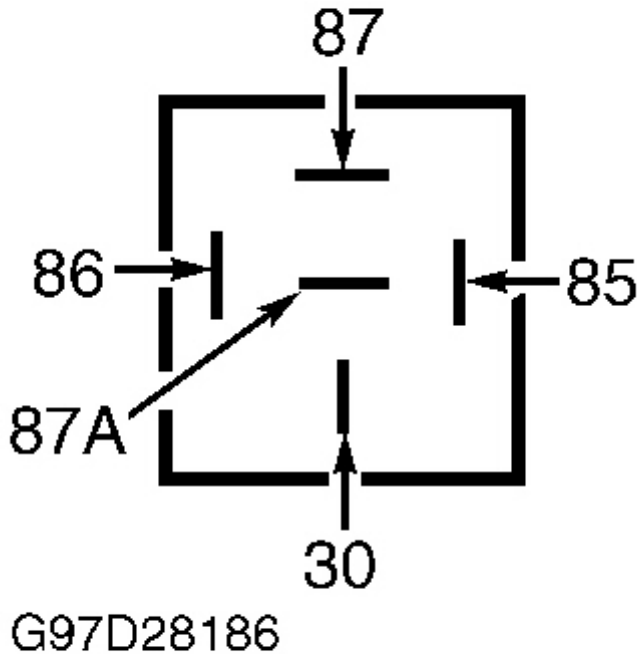


Fig. 8: Identifying Starter Relay Terminals
 Courtesy of FORD MOTOR CO.

REMOVAL & INSTALLATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** article in **GENERAL INFORMATION** before disconnecting battery.

STARTER MOTOR

Removal & Installation

Disconnect negative battery cable. Raise and support vehicle. Disconnect ground strap. Remove wiring. Remove starter bolts and starter. To install, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS**.

STARTER MOTOR SPECIFICATIONS

STARTER MOTOR SPECIFICATIONS

Application	Specification
Current Draw	

2001 Lincoln LS

2001 STARTING & CHARGING SYSTEMS Starters - LS

Normal Load	130-220 Amps
No Load	60-80 Amps
Starter Circuit Voltage Drop	0.5 Volt

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Driveshaft Flex Coupling Nuts	60 (81)
Starter Motor Mounting Bolts	18 (24)
Transmission Mount Bolts & Ground Cable Nut	41 (55)
	INCH Lbs. (N.m)
Battery Cable Clamp Bolt	62-89 (7-10)
DTR Sensor-To-Case Screws	89 (10)
Solenoid "B" Terminal Nut	106 (12)
Solenoid "S" Terminal Nut	53 (6)

WIRING DIAGRAMS

2001 Lincoln LS

2001 STARTING & CHARGING SYSTEMS Starters - LS

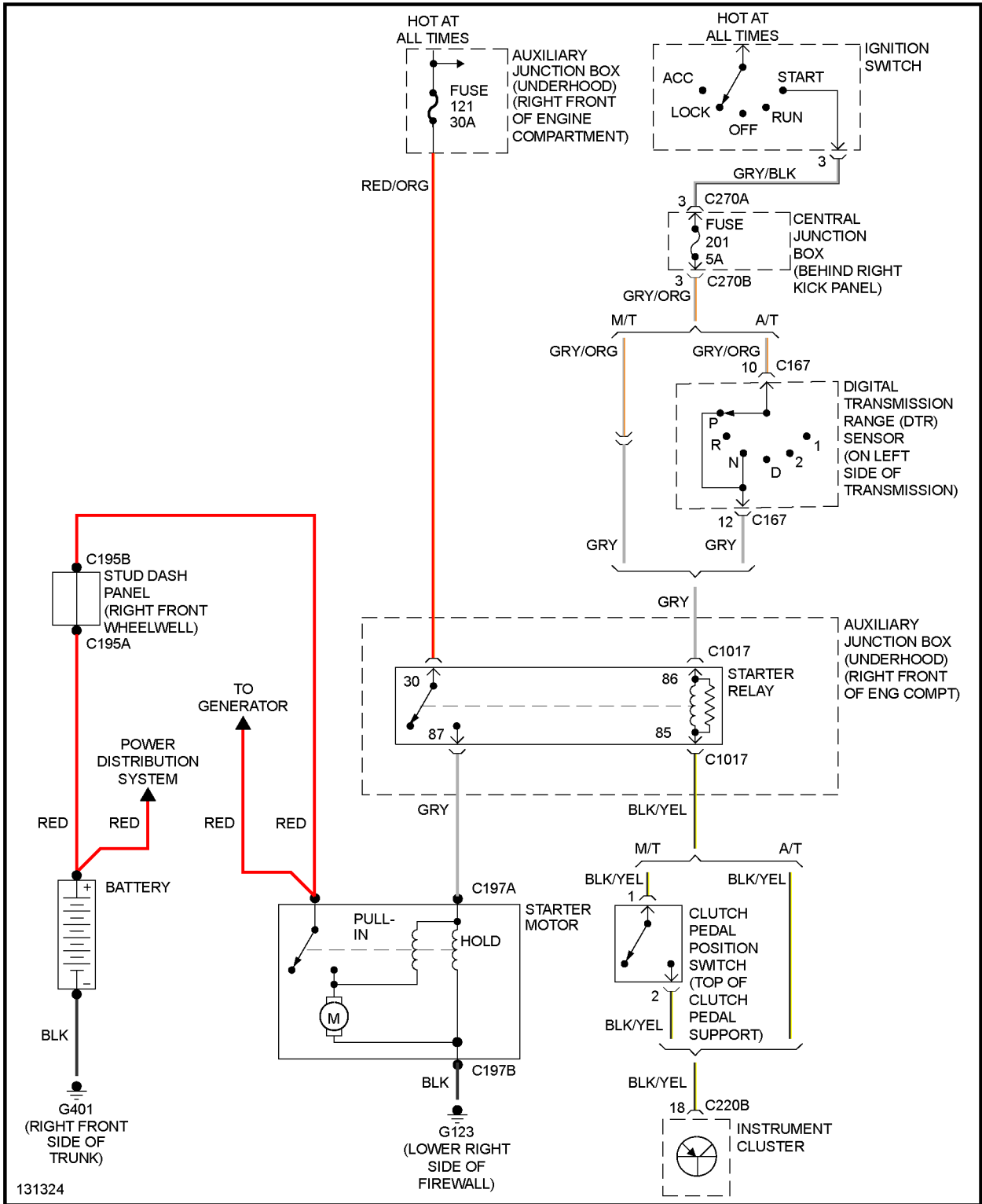


Fig. 9: Starter System Wiring Diagram (LS)

Powertrain Control/Emissions Diagnosis Manual

2001

On Board Diagnostics II

Introduction

Note: The descriptions and specifications contained in this manual were in effect at the time this manual was approved for publication. Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design without notice and without incurring obligation.

Important Safety Notice

Appropriate service methods and procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This manual provides general directions for performing service with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

Notes, Cautions, and Warnings

As you read through the procedures, you will come across NOTES, CAUTIONS and WARNINGS. Each one is there for a specific purpose. NOTES give you added information that will help you to complete a particular procedure. CAUTIONS are given to prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in those areas where carelessness can cause you personal injury. The following list contains some general WARNINGS that you should follow when you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Make sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK unless instructed otherwise for a specific operation. If you have a manual transmission, it should be in REVERSE (engine OFF) or NEUTRAL (engine ON) unless instructed otherwise for a specific operation. Place wood blocks (4" x 4" or larger) against the front and rear surfaces of the tires to help prevent the vehicle from moving.
- Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide poisoning.
- Keep yourself and your clothing away from moving parts when the engine is running, especially the drive belts.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, three-way catalytic converter and muffler.
- Do not smoke while working on a vehicle.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle.
- When it is necessary to work under the hood, keep hands and other objects clear of the radiator fan blades!

Preface

This manual provides a step-by-step approach for diagnosing drivability, emission and powertrain control system symptoms. Before beginning diagnosis, it may be helpful to reference any Technical Service

Bulletins (TSBs) or On-line Automotive Service Information System (OASIS) information when this is available.

Note: For Villager and 7.3L diesel, go to the VILLAGER or 7.3L DIESEL tab in this manual.

This manual is used in conjunction with the Body, Chassis, Electrical, Powertrain Workshop Manuals and the Wiring Diagram Manuals. The Workshop Manuals are used to provide additional diagnostics when directed by this manual. The Workshop Manuals are also used for component removal and replacement information. Refer to the Wiring Diagram Manuals for vehicle specific wiring information and component, connector and splice location.

The following is a description of the information contained in each section of this manual.

Section 1: Description And Operation

This section contains description and operation information on powertrain control systems and components. This section is designed to give the technician a general knowledge of the powertrain control system. It should be used when general information about the powertrain control system is desired, and is rarely referenced from other sections of the manual.

Section 2: Diagnostic Methods

The Diagnostic Methods section contains information on specific diagnostic tasks that are used during diagnosis. Descriptions of specific diagnostic methods are included, as well as detailed instructions on how to access or perform the tasks. This section provides the technician with step-by-step instructions for performing routine diagnostic tasks.

Section 3: Symptom Charts

All diagnosis begins in Section 3 with Step 1: PCM Quick Test. If the PCM Quick Test is completed and no DTCs are received, the technician may be directed to Step 2: No DTCs Present Symptom Chart Index (refer to [Section 3](#) for details). The No DTCs Present Symptom Chart Index contains the list of symptoms addressed in this manual, and will send the technician to the appropriate Step 3: No DTCs Present Symptom Chart. If no PCM DTCs are present and the vehicle symptom is not listed in the Step 2: No DTCs Present Symptom Chart Index, the technician should go the appropriate Workshop Manual to continue diagnosis.

Section 4: Powertrain DTC Charts and Description

Section 4 contains the Powertrain Diagnostic Trouble Code (DTC) "Go To" Charts. These charts will be referenced if a DTC is received in Section 3. Also included in this section are the Powertrain DTC descriptions and list of possible causes.

Section 5: Pinpoint Tests

All pinpoint tests are included in Section 5. Never enter a Pinpoint Test unless directed there. When directed to a Pinpoint Test, always read the information and look at the schematic included at the beginning of the Pinpoint Test.

Section 6: Reference Values

Section 6 contains the "Typical Diagnostic Reference Values" charts. The technician will be directed to these charts from Pinpoint Test Z in Section 5.

How To Use The Diagnostic Procedures

- Use the information about the vehicle driveability or emission concern to attempt to verify/re-create the symptom. Look for any vehicle modifications or aftermarket items that may contribute to the symptom. A check of any applicable TSBs or OASIS messages may be useful, if this information is available.
- Go to Section 3, Step 1: PCM Quick Test. Perform the PCM Quick Test step(s). Follow any notes as directed.
- If PCM Quick Test is completed, no DTCs were received and no special notes applied, go to Step 2: No DTCs Present Symptom Chart Index.
- Select the symptom that best describes the vehicle symptom (for multiple symptoms select the one that is most noticeable). Go to the Step 3: No DTCs Present Symptom Chart that is indicated. If no PCM DTCs are present and the vehicle's symptom is not listed in the No DTCs Present Symptom Chart Index, go to the appropriate Workshop Manual to continue diagnosis.
- The No DTCs Present Symptom Chart contains areas to be tested for diagnosis of the vehicle's symptom. The chart is arranged to place the higher probability, or easiest to test items toward the top of the chart. The technician, however, is not required to follow this order due to reasons such as variations in vehicle type, vehicle repair history or technician experience.
 - The System/Component column indicates the areas that will be tested. This column may also contain a quick system/component test.
 - The Reference column indicates where to go for the System/Component testing. All references are to pinpoint test steps in Section 5 of this manual unless noted otherwise. If referenced to a Pinpoint Test Step in this manual or a Workshop Manual section, go to the procedures. Follow the directions given in those procedures, including directions to other tests or sections. If a damaged part is found, repair/replace as directed. If no fault is found, and diagnosis in that area is complete, return to the No DTCs Present Symptom chart and continue to the next item.
 - If a quick system/component test is in the System/Component column, the reference column will indicate where to go if the test failed.
- During diagnosis, if directed to test a system/component that is not contained on that vehicle, proceed to the next step.
- If the No DTCs Present Symptom Chart for the vehicle symptom is completed and no fault is found, return to Step 2: No DTCs Present Symptom Chart Index to address the next most prominent symptom. If all diagnosis is complete and no fault is found, it may be helpful to go to Section 5, Pinpoint Test Step Z1, for further diagnosis.
- After service, restore vehicle by reconnecting any components, removing test equipment, etc. Verify that the vehicle is operating properly and the original complaint is eliminated. If a DTC was present, rerun Quick Test to verify repair and complete a PCM Reset to clear any Continuous Memory DTCs.

Note: If a symptom is determined to be intermittent, careful visual and physical underhood inspection of connectors, wiring harnesses, vacuum lines, components, etc. is required. The Customer Information Worksheet may contain more detailed symptom information. Before an in-depth diagnosis begins, start the engine and wiggle wires, tap on components, etc., while listening for an indication of a concern (such as rpm change or relay clicking).

Information about engine conditions is stored when a Diagnostic Trouble Code (DTC) that lights the Malfunction Indicator Lamp (MIL) is set. This information is called Freeze Frame Data and may be helpful in diagnosing intermittents. (Refer to Section 2, Freeze Frame Data, for more information.)

What's New In This Manual

The following is a list of changes to this manual for 2001:

New Vehicles:

- 2.3L 4V Ranger
- Escape
- 4.0L FFV Explorer Sport
- 4.6L Explorer/Mountaineer

- Blackwood

Note: The Blackwood and 150 pin PTEC PCM Explorer/Mountaineer, which are planned as 2002 models, are included in this manual to cover their early introduction.

Deleted Vehicles

- Contour/Mystique
- 3.0L Windstar

Other Changes

- New Thermal Manifold Absolute Pressure (TMAP) pinpoint test has been added to Section 5 (Pinpoint Test DM).
 - New Electric Exhaust Gas Recirculation (EGR) pinpoint test has been added to Section 5 (Pinpoint Test KD).
 - New Thermostat Heater Control (THTRC) pinpoint test has been added to Section 5 (Pinpoint Test KQ).
 - New Swirl Control Valve and Swirl Control Valve Monitor diagnostics have been added to Section 5 (Pinpoint Test HU).
 - A list of acronyms with their definitions has been included at the end of this section.
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Acronyms and Definitions

Note: This Acronyms and Definitions listing contains technical terms applicable to Ford Motor Company products. It is not intended to be an all—inclusive dictionary of components and their functions. If a detailed description of a particular system or component is desired, refer to the applicable section within this PC/ED Service Manual or consult the Workshop Manual for the specific vehicle being serviced.

2V: Two Valves per engine cylinder.

4V: Four Valves per engine cylinder.

ABS: Anti—lock Brake System.

A/C: Air Conditioning. A vehicle accessory system that modifies the passenger compartment air by cooling and dehydrating the air.

ACC: Air Conditioning Clutch. Indicates status of the A/C clutch.

ACCS: Air Conditioning Cycling Switch. Indicates status of the A/C cycling switch.

ACD: Air Conditioning Demand. A signal input to the PCM from the Air Conditioning control panel.

ACP: Air Conditioning Head Pressure or A/C cycling switch input state.

ACPSW: Air Conditioning Pressure Switch.

ACP V: Air Conditioning Head Pressure Volts. A voltage input to the PCM from the ACP switch or sensor.

ACR: Air Conditioning Relay. Commanded output controlled by the PCM and acts as an A/C cutout control during heavy acceleration.

A/D: Analog—to—Digital. Analog—to—Digital signal conversion.

ADC: See ATDC.

AFCM: Alternative Fuel Control Module.

AIR: Secondary Air Injection.

AIRB: Secondary Air Injection Bypass.

Air Diverter: Air Diverter Valve. Part of the EAIR system. Diverts fresh air to the exhaust system when the electric air pump is commanded on.

AIR EVAL: Air System Evaluated. Displays a YES or NO status indicating whether the Air System has been evaluated for OBD (On—Board Diagnostic) II purposes.

Air/Fuel Ratio: Air to fuel mixture ratio. An air/fuel mixture that is 14.7:1 is also called stoichiometry.

AIRM: Secondary AIR pump monitor.

Ambient Air Temperature: Temperature of the air surrounding an object.

Analog (Electrical/Electronic): An electrical signal that can obtain any value within the voltage limits of the signal.

ARB: Air Resource Board.

ARPMIDES: Ancillary RPM Desired. RPM required to maintain the vehicle speed commanded by Speed Control Command Switch (SCCS) inputs.

ASCII: American Standard Code for Information Interchange.

ATDC: After Top Dead Center. The location of the piston after it has reached the top of its stroke. Measured in degrees of crankshaft rotation.

AVOM: Analog Volt—Ohm Multimeter. Readings are indicated by a sweep hand on a printed scale, rather than a digital display.

AWD: All—Wheel Drive.

BARO: Barometric Pressure.

Base Idle: Idle rpm determined by the throttle lever hardset on the throttle body with the IAC solenoid disconnected.

Base Timing: Spark advance in degrees before top dead center of the base engine without any control from the PCM or ICM.

Battery Positive Voltage (B+): The positive (+) voltage from the battery or any circuit connected directly to the battery. Compare "Vehicle Power (VPWR)."

BATTEMP: Battery Temperature.

BJB: Battery Junction Box.

BOB: Breakout Box. A test device which connects in series to the PCM and PCM harness.

BPA: Brake Pedal Applied switch. Typically located on the braking system master cylinder. Can be hydraulic or electric.

BPP: Brake Pedal Position. Indicates the position of the brake pedal, based on input from the Brake Pedal Position (BPP) switch.

BRAKE _LMP or BRKL: Brake Warning Lamp Status. Activates the Brake Warning Lamp by applying voltage to the control line.

BTDC: Before Top Dead Center. The location of the piston before it has reached the top of its stroke. Measured in degrees of crankshaft rotation.

Bus + or Bus — : Multiplex circuits that carry SCP data from module to module and to the DLC.

CAC: Charge Air Cooler. Formerly known as Intercooler. A device which lowers the temperature of pressurized intake air.

CAFE: Corporate Average Fuel Economy. A set of federal requirements and regulations which govern fuel economy standards.

CANVNT: Canister Vent Solenoid.

Catalyst: Catalytic converter. An in—line exhaust system device used to reduce the level of engine exhaust emissions.

CAT EVAL: Catalyst System Evaluated. This item indicates YES when the Catalyst Efficiency Monitor has successfully completed.

CCM: Comprehensive Component Monitor.

CCRM: Constant Control Relay Module. A relay module that provides ON—OFF control of various EEC components.

CD A through J: Coil Driver 1 through 10.

Centralized Testing Facility: State government operation. Provides Inspection/Maintenance (IM) and safety inspections.

CGND or CSE GND: Case Ground. Provides a ground source for the PCM or ECU case.

CHT: Cylinder Head Temperature. Units are displayed in either degrees Fahrenheit or Centigrade.

CHTIL: Cylinder Head Temperature Indicator Lamp.

CHTV: Cylinder Head Temperature Voltage. The actual voltage drop across the CHT sensor thermistor.

CID: Cylinder Identification. PCM input signal from Camshaft Position Sensor.

CKP: Crankshaft Position. Senses the position of the crankshaft.

CKP+, CKP—: CKP+ is the Crankshaft Position (CKP) sensor signal wire. CKP— is the signal return.

CL: Closed Loop. An operating condition or mode which enables operation based on sensor feedback.

CMP: Camshaft Position. Indicates camshaft position.

CMPFM: Camshaft Position Failure Mode. Indicates when the PCM identifies a CID/CMP fault.

CMS: Catalyst Monitor Sensor. Downstream HO₂S.

CMVSS: Canadian Motor Vehicle Safety Standards.

CNG: Compressed Natural Gas.

CO: Carbon Monoxide. A colorless, odorless and toxic gas that is a component of auto exhaust emissions.

CO₂: Carbon Dioxide. A colorless, odorless gas that is a normal by—product of the combustion of fuel.

Coil: A device consisting of windings around an iron core. In a spark ignition system, designed to increase voltage.

Cold Soak: Time given to a vehicle to sit at a low temperature (typically below 68° F / 20° C) until the temperature of external and internal components stabilize.

CONT: Continuous Memory. The portion of KAM (keep alive memory) used to store DTCs generated during Continuous Memory Self—Test.

Continuous Memory Self—Test: A continuous test of the EEC system conducted by the PCM whenever the vehicle is operating.

CPP: Clutch Pedal Position. Indicates clutch pedal position.

CPP Switch: Clutch Pedal Position Switch. Located on the clutch pedal and detects when the

clutch pedal is depressed.

CQIS: Common Quality Indicator System.

CSE GND: Case Ground.

CT: Closed Throttle Mode. A mode when the PCM varies the pulse width of the fuel injectors to obtain the air/fuel mixture appropriate for closed throttle operation.

CTO: Clean Tach Output. Signal used to drive the instrument panel tachometer.

Data Communications Link: A communication path between various in—vehicle electronic modules. Accessed by scan tools through the Data Link Connector (DLC).

DC: 1. Direct Current. Electric current flowing in one direction. 2. Duty Cycle. The voltage measurement of ON time versus the full cycle period, expressed in percent.

DCL: Data Communication Link.

DI: Distributor Ignition. A system in which the ignition coil secondary circuit is sequenced by a distributor.

Digital: Controls process information by switching the current or voltage ON and OFF.

DLC: Data Link Connector. J1962 connector providing access to vehicle diagnostic information.

DOHC: Dual Overhead Cam. An engine configuration that uses two camshafts positioned above the valves.

DOL: Data Output Line. A circuit that sends certain information from the PCM to the instrument cluster.

DPFEGR: Differential Pressure Feedback Exhaust Gas Recirculation. System that uses a pressure transducer to control the operation of the EGR Vacuum Regulator Valve.

DRI: Deposit Resistant Injector. A fuel injector designed to prevent build—up of carbon and other unwanted deposits.

DRL: Daytime Running Lamps. A system that keeps the vehicle running lamps on at all times while the vehicle is operating.

DTM: Diagnostic Test Mode. A level of capability in an On—Board Diagnostic (OBD) system.

DTC: Diagnostic Trouble Code. An alpha/numeric identifier for a fault condition identified by the On—Board Diagnostic System.

DVOM: Digital Volt—Ohm Meter.

E—85: Fuel containing 85% ethanol alcohol.

EAIR: Electric Secondary Air Injection. A pump—driven system for providing secondary air using an electric air pump.

EAIM: Electric Secondary Air Pump circuit Monitor.

ECT: Engine Coolant Temperature. Displayed in either Fahrenheit or Centigrade.

ECTV: Engine Coolant Temperature Voltage. The actual voltage drop across the ECT sensor thermistor.

ECU: Electronic Control Unit. A module that handles the control strategy and monitors system inputs or outputs.

EEC: Electronic Engine Control system.

EEC—V: Fifth generation EEC system.

EFT: Engine Fuel Temperature.

EFTA: Bank 1 input. EFTA is displayed in either Fahrenheit or Centigrade.

EFTAV: Voltage drop across the EFTA (Bank 1) sensor thermistor.

EFTB: Bank 2 input. EFTB is displayed in either Fahrenheit or Centigrade.

EFTBV: Voltage drop across the EFTB (Bank 2) sensor thermistor.

EGR: Exhaust Gas Recirculation. A process in which a small amount of exhaust gas is routed into the combustion chamber.

EGR EVAL: Exhaust Gas Recirculation System Evaluated. EGR EVAL will display YES when the monitor is complete.

EGRMDS: Electric Exhaust Gas Recirculation Motor Desired position. The PID name used to operate the EGR valve with scan tool's output state control.

EGRS: EGR Shutoff. A normally closed solenoid that applies vacuum to the EGR valve when energized by the PCM.

EGRT: Exhaust Gas Recirculation Valve Temperature Sensor. A temperature sensor that is threaded into the bottom of the intake plenum.

EGR Vacuum Regulator: Controls vacuum to the EGR valve by a duty cycle signal from the PCM.

EGRVR: Exhaust Gas Recirculation Vacuum Regulator. Solenoid which varies the vacuum to the EGR valve by varying the duty cycle to the regulator.

EGRVRA: Exhaust Gas Recirculation Vacuum Regulator Actual (volt). The actual state of the commanded output.

EGRVRF: Exhaust Gas Recirculation Vacuum Regulator Fault. Represents whether a fault exists in the EGRV circuit.

EI: Integrated Electronic Ignition. An Electronic Ignition system that has the Ignition Control Module (ICM) integrated into the PCM.

EI—HDR: Electronic Ignition, High Data Rate. Formerly known as Electronic Distributorless Ignition System.

EI—LDR: Electronic Ignition, Low Data Rate. Formerly known as Distributorless Ignition System.

EMI: Electromagnetic Interference. Usually caused by ignition voltage spikes, solenoids, relay operation or noisy generator contacts.

EOL: End Of Line. A system designed specifically for use at assembly plants to make sure all new vehicles perform to design specifications.

EPA: Environmental Protection Agency (U.S. Government).

EPROM: Erasable Programmable Read—Only Memory. An electronic component in the PCM that requires the electronic storage of information.

ESOF: Electronic Shift—on—the—Fly.

EVAP: Evaporative Emissions. A system to prevent fuel vapor from escaping into the atmosphere.

EVAPCP: Evaporative Canister Purge Solenoid. Controls a solenoid which allows venting of the evaporative purge canister.

EVAPCPF: Evaporative Canister Purge Solenoid Fault. Identifies whether an electrical fault exists for the current commanded state.

EVAPCV: Evaporative Canister Vent Solenoid. Controls a solenoid which seals the EVAP system canister from atmospheric pressure during the EVAP OBD II Monitor test.

Evaporative Emissions Canister: An evaporative emission canister, containing activated charcoal which absorbs and holds fuel vapors.

EVAPPDC: Evaporative Canister Purge Duty Cycle. The duty cycle commanded to the Evap Canister Purge Solenoid by the PCM.

EVO: Electronic Variable Orifice.

EWP: Electric Water Pump.

Exciter Ring: A toothed or notched iron or steel disk, which is the moveable part of a wheel speed sensor.

FAN: Fan Speed. Used in conjunction with vehicles having multiple fan speed control. Displays OFF, LOW, or HIGH status.

FC: Fan Control.

FCS: Fuel Control Solenoid.

FCIL: Fuel Cap Off Indicator Lamp. Indicates that the fuel filler cap was not properly installed.

FEAD: Front End Accessory Drive.

FEPS: Flash EEPROM Programming Signal. 18 volt DC signal sent by the scan tool to initiate PCM reprogramming.

FF: 1. Flexible Fuel. A system capable of using a variety of fuels for vehicle operation. 2. A PID that displays the % alcohol content in fuel.

FF_LRN: Flex Fuel Learned. Displays when the PCM's Flex Fuel strategy has completed calculating the inferred alcohol content of fuel.

FFFM: Flexible Fuel Failure Mode. Indicates whether the current Flex Fuel Sensor reading (FF) is reliable or not. Displays a YES or NO.

FF_TEMP: Flexible Fuel Sensor — Temperature. Alcohol concentration derived from the signal pulse width.

FFV: Flexible Fuel Vehicle.

FIFO: First In First Out.

FILO: First In Last Out.

FIM: Fuel Indicator Module.

FLI: Fuel Level Input. Used by the Evap monitor to calculate fuel tank vapor volume. Displayed as a percentage.

FLI V: Fuel Level Input Voltage.

FMEM: Failure Mode Effects Management. Operating strategy that maintains limited vehicle function in the event of a PCM or EEC component failure.

FP: 1. Fuel Pump. Indicates whether the pump has been commanded ON or OFF by the PCM. 2. Fuel Pump (Modulated). Fuel pump duty cycle percentage.

FPDM: Fuel Pump Driver Module. A module that controls the electric fuel pump.

FPF: Fuel Pump Fault. Identifies whether a fault exists in the FP circuit.

FPM: Fuel Pump Monitor. Monitors the Fuel Pump / circuits for faults.

Freeze Frame: A block of memory containing the vehicle operating conditions at a specific time.

FRP: Fuel Rail Pressure. Based on FRP V.

FRP V: Fuel Rail Pressure Voltage. A voltage input to the PCM from the Fuel Rail Pressure Sensor.

FSC: Fail—Safe Cooling.

FSV: Fuel Shut—Off Valve. A component of Natural Gas Vehicles. This valve either allows or prevents Natural Gas flow to the fuel rail.

FSVF: Fuel Shut—Off Valve Fault. Indicates if there is a fault in the FSV circuit. Displayed as YES or NO.

FSVM: Fuel Shut—Off Valve Monitor. Monitors operation of the Fuel Shut—Off Valve / circuit.

FTP: Fuel Tank Pressure. Displayed as inches of water, kPa, or volts.

FTP V: Fuel Tank Pressure Voltage. From the FTP transducer.

FUEL PR: Fuel Pressure. Measurement of the force of the fuel delivered via the fuel pump.

FUEL PW: Fuel Pulse Width. Displays the commanded pulse width at time of last data update.

FUEL PW1: Fuel Injector Pulse Width #1. Corresponds to injectors normally affected by O2S1 (HEGO1).

FUEL PW2: Fuel Injector Pulse Width #2. Corresponds to injectors normally affected by O2S2 (HEGO2).

FUELSYS: Fuel System Status (OPEN/CLOSED Loop). Formerly known as LOOP.

Fuel Tank Vapor Valve: A valve mounted in the top of the fuel tank that vents excess vapor and pressure from the fuel tank into the Evaporative Emission Control System.

FWD: Front Wheel Drive.

GEM: Generic Electronic Module.

GEN: Generator.

GENF: Generator output fault.

GENFDC: Generator field control output.

GFS: Generator field signal monitor.

GND: Ground.

GPM: Grams Per Mile. Also known as Gallons Per Minute.

GPS: Global Positioning Satellite.

Green State Vehicle: Formally known as California Emissions. A vehicle that is equipped with California on—board diagnostics.

GSS: Gear Select Solenoid.

GVW: Gross Vehicle Weight.

Hall Effect: A process where current is passed through a small slice of semi—conductor material and a magnetic field to produce a small voltage in the semi—conductor.

Hard Fault: A fault currently present in the system.

HC: 1. Hydrocarbon. A by—product of combustion and a component of auto exhaust emissions. 2. High Compression.

HCF: Hydraulic Cooling Fan.

HCFD: Hydraulic Cooling Fan Drive.

HFC: Hydraulic Cooling Fan.

HFCF: High Fan Control Fault. Identifies if there is a fault in the HFC circuit.

HFP: High Fuel Pump.

HLOS: Hardware Limited Operating Strategy. A mode of operation where the PCM replaces output commands with fixed values in response to internal PCM malfunctions.

HO: High Output.

HO2S: Heated Oxygen Sensor. Formerly known as Heated Exhaust Gas Oxygen (HEGO) Sensor. Provides information on rich or lean exhaust conditions to the PCM.

Hot Soak: Period of time after an engine operates where localized combustion heat dissipates throughout the engine.

HTR, HTR11, HTR12, HTR21, HTR22, HTRX1, HTRX2: HO2S Heater. Heater element for the HO2S sensor.

Hydrogen: Chemical symbol H. Highly flammable gas.

Hz: Hertz. Cycles per second.

IAC: Idle Air Control. Electrical control of throttle bypass air.

IAT: Intake Air Temperature.

IATV: Intake Air Temperature Voltage. Actual voltage drop across the IAT sensor.

IAT2: Intake Air Temperature 2. Displayed in either Fahrenheit or Centigrade. Used on supercharged vehicles.

IAT2V: Intake Air Temperature 2 Voltage. Actual voltage drop across the IATV2 sensor.

IC: Integrated Circuit. A small semi—conductor device capable of doing many separate circuit functions.

ICM: Ignition Control Module. The module that controls the ignition system.

IFDM: Integrated Fuel Delivery Module.

IFS: Inertia Fuel Shutoff.

IGN GND: Ignition Ground.

Ignition: System used to provide high voltage spark for internal combustion engines.

IGN_KEY (IGKY): Ignition Key status.

IGN_SW (IGSW): Ignition Switch Position.

IMRC: Intake Manifold Runner Control. Controls airflow through the high—speed runners in the intake manifold.

IMRCM: Intake Manifold Runner Control Monitor. Monitors the IMRC / circuits for faults.

IMTV: Intake Manifold Tuning Valve. Controls airflow through runners in a split intake manifold.

INJ1, INJ2, INJ3, INJ4, INJ5, INJ6, INJ7, INJ8, INJ9, INJ10: Injector number or its signal output from the PCM.

Injector: A device for delivering metered pressurized fuel to the intake system or the cylinders.

Intake Air: Air drawn through a filter and distributed to each cylinder for use in combustion.

Intercooler: See CAC.

IPATS: Integrated Passive Anti—Theft System.

ISO: International Standards Organization.

KAM: Keep Alive Memory. A portion of the memory within the PCM that must have power even when the vehicle is not operating.

KAPWR: Keep Alive Power. Dedicated, unswitched power circuit that maintains KAM.

Key On Engine Off Self—Test: A test of the EEC system conducted by the PCM with power applied and the engine at rest.

Key On Engine Running Self—Test: A test of the EEC system conducted by the PCM with the engine running and the vehicle at rest.

KEYPWR: Key Power. Battery voltage supplied when the ignition key is in the ON position.

Knock: The sharp metallic sound produced when two combustion pressure fronts collide in the combustion chamber of an engine.

KOEC: Key On Engine Continuous.

KOEO: Key On Engine Off.

KOER: Key On Engine Running.

KPA: Kilopascal. Unit of pressure. 3.386 kPa = 1 inch of mercury (Hg.).

KPH: Kilometers Per Hour.

KS: Knock Sensor. Detects engine knock.

L: Liters. The unit of volume in the metric measuring system. One liter equals 1.06 quarts.

LEV: Low Emissions Vehicle.

LFC: Low Fan Control.

LFP: Low Fuel Pump. Reduced operating speed for multi—speed fuel pumps.

LIFO: Last In First Out.

LILO: Last In Last Out.

LONGFT1, LONGFT2: Long—Term Fuel Trim. Fuel flow adjustment determined by the PCM.

LOOP: Indicates OPEN or CLOSED loop status.

LPG: Liquefied Petroleum Gas.

LPLR: Low Pressure Low Resistance fuel injector.

M—85: Fuel containing 85% methanol alcohol.

MAF: Mass Air Flow. Used to measure the mass (weight) of the air entering the engine.

MAF RTN: Mass Air Flow Return. A return circuit for the MAF sensor.

MAP: Manifold Absolute Pressure. The internal pressure of the intake manifold.

MFC: Medium Fan Control.

MFI: Multiport Fuel Injection. A fuel—delivery system in which each cylinder is individually fueled.

MFP: Modulated Fuel Pump.

Microprocessor: A digital processor on a chip which performs arithmetic and control logic.

MIL: Malfunction Indicator Lamp. An indicator lamp alerting the driver of an emission related malfunction. May also read "CHECK ENGINE" or "SERVICE ENGINE SOON."

MISF: Misfire. Any event in the cylinder that causes a sudden change in acceleration of the crankshaft.

MON: Motor Octane Number.

Monolithic Substrate: The ceramic honeycomb structure used in the catalytic converter.

MSOF: Manual Shift—on—the—Fly.

MY: Model Year.

NA: Naturally Aspirated. Engine that is not supercharged or turbocharged.

NAAO: North American Automotive Operations.

NC: Normally Closed.

NG: Natural Gas. A system capable of using natural gas for vehicle operation.

NGS: New Generation STAR (Self—Test Automatic Readout) tester.

NGVM: Natural Gas Vehicle Module.

NO: Normally Open.

NO_x: Oxides of Nitrogen. Formed at high combustion temperatures.

NVH: Noise, Vibration, Harshness. A classification of vehicle concerns.

OASIS: On—line Automotive Service Information System.

OBD, OBD—II: On—Board Diagnostics, On—Board Diagnostics Second Generation. A system that monitors PCM input and output control signals.

On—Demand Test: Technician initiated "KOEO" and "KOER" tests performed by the PCM.

OC: Oxidation Catalytic converter. A catalytic converter system that reduces levels of HC and CO.

OCT ADJ: Octane Adjust. Compensating strategy that adjusts for changes in fuel octane.

OEM: Original Equipment Manufacturer.

OHC: OverHead Cam. An engine configuration that uses a single camshaft positioned above the valves.

OWL: Overheat Warning Lamp or its signal output from the PCM. Turns the TEMP warning lamp ON when engine oil temperature exceeds safe limits.

Open Circuit: A circuit which does not provide a complete path for flow of current.

OL: Open Loop. An operating condition based on instructions not modified by PCM feedback.

O₂ S 11/12/21/22: Oxygen Sensor and its relative position in the exhaust system. Detects oxygen content in exhaust gasses.

OSC: Output State Control.

OSS: Output Shaft Speed.

Ozone: A blue gaseous form of oxygen (O₃) formed naturally by electric discharge or exposure to ultraviolet radiation.

Particulate: Small solid matter found in exhaust gases, especially prevalent in diesel engines.

PATS: Passive Anti—Theft System.

PATSIL: Passive Anti—Theft System Indicator Light.

PATSIN: Passive Anti—Theft System Receive Signal.

PATSOUT: Passive Anti—Theft System Transmit Signal.

PATSTRT: Passive Anti—Theft System Starter Relay Control

PCM: Powertrain Control Module. Formerly known as the EEC (Electronic Engine Control) Processor.

PCV: Positive Crankcase Ventilation. A system which allows the controlled flow of crankcase vapors into the combustion chamber.

PF: Purge Flow. Amount of fuel vapor burned in the engine.

Photochemical: Term describing the action of light on air pollutants which results in creating smog.

PID: Parameter Identifier. Identifies an address in PCM memory which contains operating information.

Powertrain: Engine and transmission/transaxle components.

Pressure — Absolute: A pressure referenced to a perfect vacuum.

Pressure — Atmospheric: The pressure of the surrounding air at any given temperature and altitude. Sometimes called Barometric Pressure.

Pressure — Barometric: Pertaining to atmospheric pressure or the results obtained by a barometer.

Pressure — Differential: The pressure difference between two regions, such as between the intake manifold and atmospheric pressure.

Pressure — Gage: The amount by which absolute pressure exceeds the ambient atmospheric pressure.

PIP: Profile Ignition Pickup. Provides crankshaft position information for ignition synchronization.

Potentiometer: An adjustable resistance component commonly used as a sensor (Example: TP Sensor).

PPM: Parts Per Million. A measure used in emission analysis.

PROM: Programmable Read—Only Memory. Similar to ROM except without program instructions.

Protocol: A set of rules for the exchange of information on a network.

PSOM: Programmable Speedometer/Odometer Module. A module that processes vehicle speed information.

PSP: Power Steering Pressure. Indicates the pressure in the power steering system.

PSP V: Power Steering Pressure Input Voltage.

PTEC: PowerTrain Electronic Controller.

PTO: Power Take—Off.

PW: Pulse Width. The length of time an actuator, such as a fuel injector, remains energized.

PWM: Pulse Width Modulation. Controls the intensity of an output by varying the signal duty cycle.

PWR GND: Power Ground. The main ground circuit in the EEC system.

Quick Test: A series of diagnostic tests of the EEC system consisting of KOEO, KOER and Continuous Memory Self—Tests. Results are displayed as a series of DTCs.

RABS: Rear Antilock Brake System.

RAM: Random Access Memory. Memory into which information can be written as well as read.

REDOX: Reduction Oxidation Catalytic converter. A catalytic converter system designed to operate at high temperatures.

Regulator: Controls the alternator/generator field current to maintain proper battery charge. Contained within the PCM in smart charging applications.

Relay: An electromechanical device in which connections in one circuit are opened or closed by changes in another circuit.

REM: Rear Electronic Module.

Repetitive Spark: Multiple firings of individual spark plugs at engine speeds below 1000 RPM to improve idle quality and improve emissions.

RF: Radio Frequency.

RFI: Radio Frequency Interference.

RFS: Returnless Fuel System.

RM: Relay Module. A module containing two or more relays.

ROM: Read—Only Memory. Computer memory that can be accessed and utilized, but not altered.

RON: Research Octane Number.

Routine: A group of related tasks, such as a series of diagnostic tests.

RPM: Revolutions Per Minute.

RS: Reverse Switch.

RTN: Return. A dedicated sensor ground circuit.

RWD: Rear Wheel Drive.

SAE: Society of Automotive Engineers.

SBS: Supercharger Bypass Solenoid or its signal output from the PCM.

SC: Supercharged or Supercharger.

SCB: Supercharger Bypass Control. A system that allows manifold vacuum to be bled away from the supercharger wastegate actuator to allow for maximum boost.

SCBF: Supercharger Bypass Control Fault. Identifies whether a fault exists in the Supercharger Bypass circuit.

SCICP: Supercharger Intercooler Pump Control.

SCICPF: Supercharger Intercooler Pump Control Fault.

SCIPC: The PID to monitor the operation of the Supercharger and Charge Air Cooler pump.

SCP: Standard Corporate Protocol.

Self—Test: See Quick Test.

Sensor: A device that detects the value or change in a physical quantity, such as temperature, pressure or flow rate, and converts the data into an electrical signal.

SFI: Sequential Multiport Fuel Injection. A multiport fuel delivery system where each injector is individually energized and timed relative to its cylinder intake event.

Shield: A conducting sleeve that surrounds wires to be electronically isolated from electromagnetic interference (EMI).

Short Circuit: An undesirable condition in a circuit where it is terminated at a point other than that intended.

SHRT FT: Short—Term Fuel Trim. Fuel flow adjustment in response to the HO₂S sensor(s) input during closed—loop operation.

SIG RTN: Signal Return. A dedicated sensor ground circuit that is common to two or more sensors.

SIL: Shift Indicator Lamp.

Smart Driver: A PCM or ECU output driver that can detect faults (open or shorts) on its output circuit.

SME: Society of Manufacturing Engineers.

SOF: Shift—On—the—Fly.

SOHC: Single Overhead Cam.

Solenoid: A device consisting of an electrical coil which produces a magnetic field in a plunger and pulled to a central position.

ST: Scan Tool. A device that interfaces with and communicates information on a data link.

Stoichiometry: An air/fuel mixture that is neither too rich nor too lean. Stoichiometric ratio is 14.7 parts of air for every 1 part of fuel.

Switch: A device for making, breaking, or changing the connections in an electrical circuit.

TA: Traction Assist.

TACH: Tachometer.

TB: Throttle Body. A device that controls airflow through the engine via a butterfly valve, and has an air bypass channel around the throttle plate.

TC: 1. Traction Control. Combines anti—lock braking and axle torque reduction to control wheel slippage. 2. Turbocharger.

TDC: Top Dead Center.

Tear Tag: The two—piece adhesive label attached to the PCM to identify its calibration.

Thermistor: A temperature dependent resistor, like that used in CHT and ECT sensors.

Timing: Relationship between spark plug firing and piston position expressed in crankshaft degrees before (BTDC) or after (ATDC) top dead center of the compression stroke.

TMAP: Thermal Manifold Absolute Pressure Sensor. A MAP Sensor that includes a thermistor to measure intake air temperature.

TP: Throttle Position (sensor). A three—wire potentiometer that provides throttle angle and rate

information for the PCM.

TP V: Throttle Position Sensor Voltage.

Transducer: A device that receives energy from one medium and transfers it to another. For example, thermal energy is converted to an electrical signal through a temperature probe.

Transmissions/Transaxles:

Note: All related items are grouped under the general heading "TRANSMISSIONS" located at the end of this section.

TSB: Technical Service Bulletin. Notifies service personnel of any known vehicle concerns, procedures, or general service information.

Underspeed Mode: A control mode that prevents the engine from stalling in the event it stumbles while running. Also used during engine crank.

Vacuum: Manifold pressure that is reduced below the ambient atmospheric pressure.

Variable Reluctance: A process of passing a varying magnetic field through wire windings and inducing a voltage.

VCT: Variable Camshaft Timing.

VECI: Vehicle Emission Control Information label.

VIN: Vehicle Identification Number. A unique identification number given to every vehicle produced. Includes information about the year, model, engine, and plant origin of the vehicle.

VMV: Vapor Management Valve. Controls the flow of fuel vapors out of the carbon canister.

VOM: Volt—Ohm Meter. Readings are indicated by sweep hand on a printed scale rather than a digital (DVOM) display.

VPWR: Vehicle Power. A switched circuit that provides power to the EEC system. Compare "Battery Voltage (B+)."

VREF: Reference Voltage. A dedicated circuit that provides approximately a 5.0 volt signal used as a reference by certain sensors.

WAC: Wide Open Throttle A/C Cut—Off. Turns A/C system off during wide open throttle or certain other operating conditions.

Wastegate Control: A device that opens the wastegate in case of overboost from a turbocharger.

WOT: Wide Open Throttle. A condition of maximum airflow through the throttle body.

Zip Tube: Another name for "fresh air duct" or "air inlet duct".

T R A N S M I S S I O N S :

Note: The transmission naming convention is as follows:

- The first character, a number, is the number of forward gears.
- The second character, either the letter "F" or "R," represents front (transaxle) or rear (transmission) wheel drive.
- The next set of characters, a grouping of numbers, represents the design torque capacity of the transmission/transaxle (for example, "27" represents 270ft./lbs. in the 4F27E transaxle).
- The last character, if used, is one of the following:
 - "E" for electronic shift
 - "N" for non—synchronous shift
 - "S" for synchronous shift
 - "W" for wide ratio

4F27E: Also known as the FN Focus automatic transmission.

4F44E: Formerly known as the CD4E.

4F46S: Formerly known as the AX4S and regular—duty AXOD—E.

4F50N: Formerly known as the AX4N and heavy—duty AXOD—E.

4R44E: Formerly known as A4LD for 3.0L applications.

4R55E: Formerly known as A4LD for 4.0L applications.

4R70W: Formerly known as AOD—E.

4R100: Formerly known as E4OD.

5R44E: Formerly known as A5LD for 3.0L applications.

5R55E: Formerly known as A5LD for 4.0L applications.

5R55N: Lincoln LS automatic transmission.

5R55W: Wide—ratio truck transmission.

4x4L: 4x4 Low.

A/T: Automatic Transmission.

CCS: Coast Clutch Solenoid.

CCSF: Coast Clutch Solenoid Fault. Displays a YES if fault exists.

EPC: Electronic Pressure Control.

EPCV: Electronic Pressure Control Volts.

ESS: Electronic Shift Scheduling.

HCDSS: High Clutch Drum Speed Sensor. PCM input from the 4R44E and 4R55E.

M5OD: Manual 5—Speed transmission with overdrive (RWD).

M/T: Manual Transmission/Transaxle.

NPS: Neutral Pressure Switch or its signal input to the PCM.

OCS: Overdrive Cancel Switch.

OSS: Output Shaft Speed. Indicates rotational speed of the transmission output shaft.

PNP: Park/Neutral Position switch. Also known as Neutral Drive Switch (NDS), Neutral Gear Switch (NGS), and Transmission Switch Neutral (TSN).

REVERSE or REV: Transmission Reverse Switch Input.

SIL: Shift Indicator Lamp. A lamp that indicates the preferred shift points on select manual transmission/transaxle vehicles.

SS1/SS2/SS3: Shift solenoids. Devices that control the shifting in an automatic transmission.

TCC: Torque Converter Clutch. When energized, causes a mechanical engagement and disengagement of the Torque Converter Clutch.

TCIL: Transmission Control Indicator Lamp. Indicates that the TCS has been activated.

TCS: Transmission Control Switch. Modifies the operation of electronically controlled transmissions.

Torque converter: A device which by its design multiplies the torque in a fluid coupling between an engine and transmission/transaxle.

TFT: Transmission Fluid Temperature. Indicates temperature of transmission fluid.

Transaxle: A device consisting of a transmission and axle drive gears assembled in the same case. Front—wheel drive applications.

Transmission: A device which selectively increases or decreases the ratio of relative rotation between its input and output shafts. Rear—wheel drive applications.

TR: Transmission Range. The range in which the transmission is operating.

TR Sensor: Formerly known as Manual Lever Position Sensor (MLPS). Provides information to the PCM on the transmission range selector position.

TR V: Transmission Range Voltage.

TSS: Turbine Shaft Speed. Indicates rotational speed of the transmission turbine shaft.

VSS: Vehicle Speed Sensor. A magnetic pickup device that generates an AC signal that is proportional to vehicle speed.

Powertrain Control/Emissions Diagnosis Manual

2001

On Board Diagnostics II

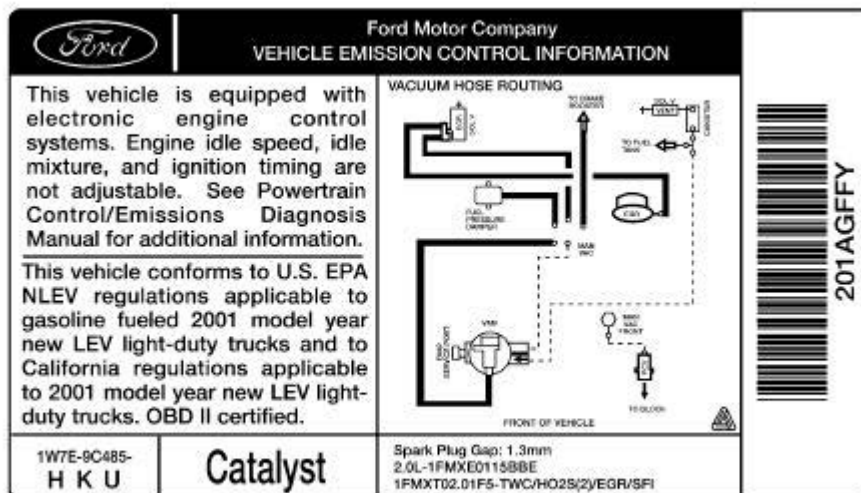
SECTION 1: Description and Operation

Choose an item on the left side to display section contents.

Vehicle Emission Control Information

Decal

Each vehicle has a decal (Figure 1) containing emission control information that applies specifically to the vehicle and engine. The specifications on the decal are critical to servicing emissions systems.



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Figure 1: Typical Vehicle Emission Control Information Decal.

Decal Location

Typical location of the decal will be on the underside of the hood or the radiator support sight shield.

Powertrain Base Calibration Information

Powertrain Base Calibration Information is located in the lower right corner of the Vehicle Certification Label. Only the Base Calibration will appear on this label (Figure 2). The Revision Level is no longer printed on the label; however, it can be found in On-Line Automotive Service Information System (OASIS). For the current model year Ford Motor Company is using two different Protocols which describe Powertrain Base Calibration. The Protocols are designed to provide worldwide standardization for vehicle calibration. If Electronic EC's strategy is two years old and carried over to the current model year, Protocol 1 is used (see table 1 below). One year old and new strategies for the current model year use Protocol 2 (see table 2 below). For more information on Vehicle Certification Label or Powertrain Calibration, refer to the Workshop Manual.



CALIBRATION LABEL
 WITHOUT REVISION LEVEL
 EXAMPLE: PROTOCOL 1

A0027467

Figure 2: Typical Vehicle Certification Label with Powertrain Calibration Information

Decal Location

Typical location of Vehicle Certification label is on LH door or door post pillar.

Calibration Code

Table 1: Protocol 1 — 1999 Strategy Carried Over To The 2001 Model Year

9 EQ M - B A A	
9	MODEL YEAR — Model year in which calibration was first introduced. Example: "9" = 1999
EQ	ENGINE CODE — Engine description. Example: "EQ" = 2.0L DOHC EFI NA I-4 Zeta
M	TRANSMISSION CODE — Transmission description. Example: "M" = manual, "A" = Automatic
B	EMISSION STANDARD — Designates the specific country emission standard. Example: "B" = U.S. California
A	DESIGN LEVEL — Design level assigned to the engine.
A ^a	REVISION LEVEL — Revision level of the calibration. Will advance as revisions occur.

^a not printed on label

Table 2: Protocol 2 — 2000 or 2001 Model Year Strategy

0 AJ 1 AA 6 A 00	
0	MODEL YEAR — Model year in which calibration was first introduced. Example: "0" = 2000
AJ	VEHICLE CODE — Vehicle line description. Example: "AJ" = CT120
1	TRANSMISSION CODE — Transmission description. Example: "1" = automatic, "2" = manual
AA	UNIQUE CALIBRATION — Designates different hardware to similar vehicles. Example: tires, drive ratios.
6	FLEET CODE — Describes fleet to which vehicle belongs to. Example: "6" = evaporative emissions fleet.
A	CERTIFICATION REGION — Lead region code where multiple regions are included in one

	Calibration. Example "A" = U.S. Federal
00 a	REVISION LEVEL — Revision level of the calibration. Will advance as revisions occur.

^a not printed on label

Engine/Evaporative Emission System Information

Manufacturers must use a standardized system for identifying their individual engine families. The system described below was developed by the Environmental Protection Agency (EPA) in 1991 to meet new regulatory requirements for 1994 and later model years.

The ENGINE FAMILY name and EVAPORATIVE FAMILY name consists of 12 characters each.

Both the engine family name and the evaporative family names are listed in the box on the emission decal as indicated in Figure 3 and 4, in the area marked as engine/evaporative family information. The first line is the spark plug information. The second line contains the engine size and the evaporative family name (12 characters). The third line contains the engine family name (12 characters) and other vehicle specific information.

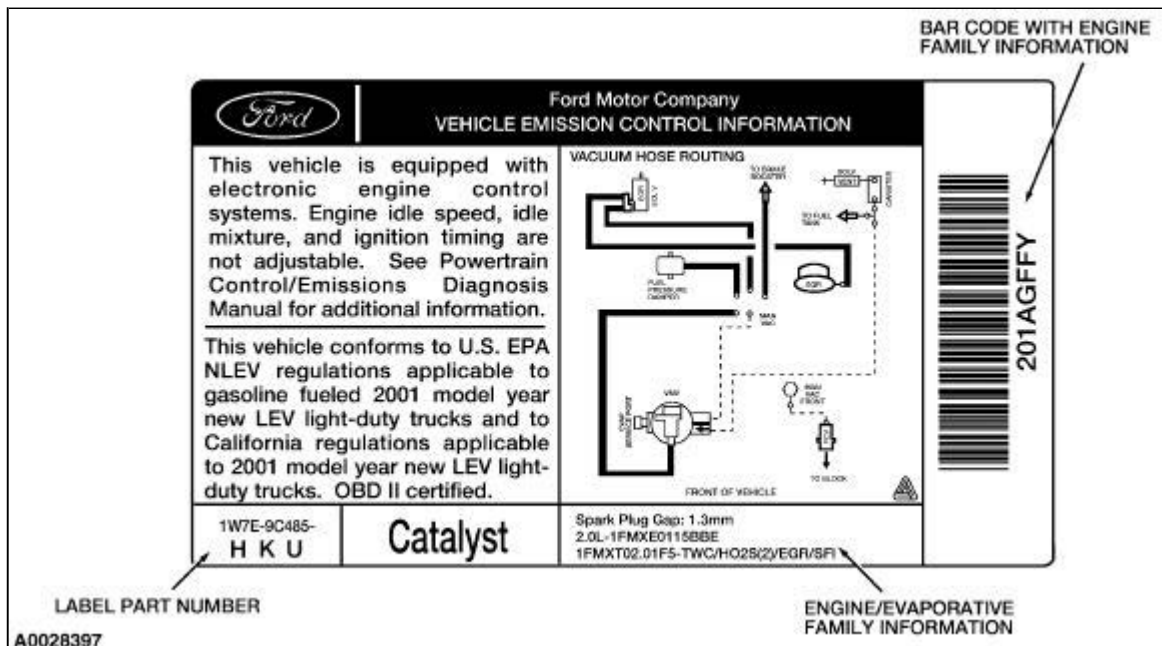


Figure 3: Typical Decal Used As An Example.

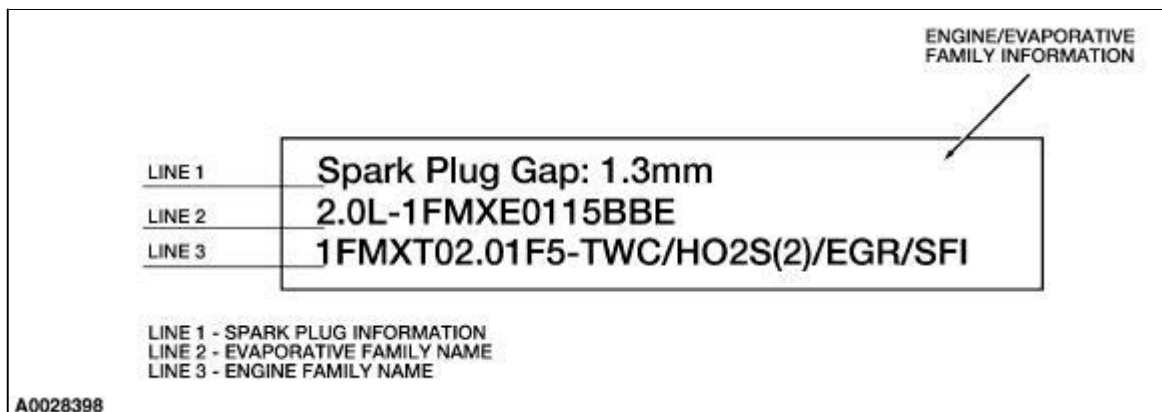


Figure 4.

ENGINE FAMILY NAME AND BAR CODE WORK SHEET

Char	My Year		Manufacturer			Type		Displacement				Class	Stands	Sales Area
	1		2	3	4	5		6	7	8	9			
	Code	Year				Code	Description							
	1	2001	F	M	X	N	Nonstandard Family	0	1 to 9		1 to 0	a	b	"F" Fed
	2	2002				V	Light Duty Vehicle							"C" Calif.
	3	2003				T	Light Duty Truck							"5" 50 Sts.
	4	2004				C	Motorcycle							
	5	2005				A	Calif Medium Duty Truck							
	6	2006				H	Heavy Duty Engine							
	7	2007				S	Small Nonroad					Addition Wild Cards For Character 12		
	8	2008				L	Large Nonroad					For Fed Use A and B, D-M; For Calif Use N-Z		
	9	2009				M	Marine					For 50S Use 2-4, 6-9.		
Family Name			F	M	X			0			*			

a Use Bar Code table A
b Use Bar Code table C or D

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Table ^a	Displacement		Class	Wild Card	Combustion/Fuel	California	Federal	Emis. Control
	(Liters)							
	1	2	A	Alpha/ Numeric	B	C	D	1
Character	1	2	3	4	5	6	7	8
Bar Code								

^a CARBs Standardized Codes. See Bar Codes

Table A

Class					
Federal and California Light Duty					
Code	Fuel	GVW	ALVW	LVW	Tier 1
V		LDV or CARB PC			LDV
1		0-6000	Any	0-3750	LDT 1
2			3751-5750	LDT 2	
3	Any		3751-5750	0-3750	LDT 3
4		>5750		LDT 4	
5			3751-5750	>3750	LDT 3
6			>5750	LDT 4	

Table A (Continued)

California Medium Duty			
	Designation	GVW	ALVW
G	MDV-1		0-3750
H	MDV-2		3751-5750
J	MDV-3	>6000	5751-8500
k	MDV-4		8501-10000
L	MDV-5		10001-14000
W	MDV (OPT)	8501-14000	N/A

Table A (Continued)

Heavy Duty or CFV Heavy Duty			
	Useful Life	Standard	Description GVW
A	LHDE	Light Duty	<10000
B	LHDE	<14K GVW	<19500 (HP 70-170)
C	LHDE	>14K GVW	<19500 (HP 70-170)
D	MHDE	>14K GVW	>19.5K-33K (HP 170-250)
E	HHDE	>14K GVW	33000 (HP >250)
F	HHDE	Urban Bus	HHDE Bus

Table A (Continued)

Fed. Heavy Light Duty and Calif. Med. Duty Truck		
	EPA LDT Class 6000-8500 GVW	Calif. MDT Class 6000-1400 GVW
M	3	H
N	4	J
P	5	H
R	6	J

Table A (Continued)

Fed. Heavy Duty and Calif. Med. Truck		
	EPA HDT Class >8500 GVW	Calif. MDT Class 6000-1400 GVW
S	A	K
T	B	W

Table B

NOTE: Use "Y" for Hybrid Electric and "Z" for Electric.

--	--	--	--	--	--

Otto Cycle Piston	Otto Cycle Rotary	Diesel	Two Stroke	Turbine	Fuel
G	R		2	T	Gasoline
		D	4	Q	Diesel
M		A			Methanol
E		B			Ethanol
			3	S	Methanol/ Ethanol
F					Flex Methanol- Gasoline
		H			Flex Methanol-Diesel
N		J			Other Flex (i.e. Dual Fuel or Bi Fuel)
C		K	5	U	LNG/CNG
L		P	6	V	LPG
	X				Other Fuels
			7	W	Flex

Table C

California Standards		
Code	Standard	In-Use
A	Tier 0	Full
B	Tier 1	Full
C	Tier 1	Alternative
D	TLEV	Full
E	TLEV	Alternative
F	LEV	Full
G	LEV	Alternative
H	ULEV	Full
J	ULEV	Alternative
K	SULEV	Full
L	SULEV	Alternative
M	ILEV	Full
N	ILEV+LEV	Full
P	ILEV+ULEV	Full
R	ILEV+SULEV	Full
S	ILEV+ZEV	Full
U	AB 956 (Young Bill)	See Character 7
Z	ZEV	Full
X	Use for Federal Application	N/A

Table D

Federal Standards		
Code	Standard	In-Use
A	Tier 0	Full
B	Tier 1	Full
C	Tier 1	Alternative
D	TLEV	Full
E	TLEV	Alternative
F	LEV	Full
G	LEV	Alternative
H	ULEV	Full
J	ULEV	Alternative
K	SULEV	Full
L	SULEV	Alternative
M	ILEV	Full
N	ILEV+LEV	Full
P	ILEV+ULEV	Full
R	ILEV+SULEV	Full
S	ILEV+ZEV	Full
Z	ZEV	Full
X	Use for Calif. Application	N/A

Table 1

Ignition Frequency				
Frequency	Code	Air Injec.	EGR	OBD
One Ignition Frequency per Two Engine Revolutions	A	no	no	no
	B	yes	no	no
	C	no	yes	no
	D	yes	yes	no
	E	no	no	yes
	F	yes	no	yes
	G	no	yes	yes
	H	yes	yes	yes
One Ignition Frequency Per One Engine Revolutions	S	no	no	no
	T	yes	no	no
	U	no	yes	no
	V	yes	yes	no
	W	no	no	yes
	X	yes	no	yes
	Y	no	yes	yes
	Z	yes	yes	yes

Evaporative Family Name Work Sheet

Char	Year		Manufacturer			Type		Canister Working Capacity				Wild Card		
	1		2	3	4	5		6	7	8	9	10	11	12
	Code	Year				Code	Description							
	1	2001	F	M	X	E	Evaporative (Use for Existing/ Enhanced)	a	a	a	a	alpha/numeric		
	2	2002												
	3	2003				R	Evaporative/ Refueling (Use for ORVR)							
	4	2004												
	5	2005												
	6	2006												
	7	2007												
	8	2008												
	9	2009												
Family Name			F	M	X									

a Total Grams in all canisters (Use 0 for each character not used for capacity starting with character 6)

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Sub-Code Categories and Reference Tables

NOTE: EPA/CARBs Standardized Sub-Codes. See Engine Family Sub-Codes.

Categories	Tables	Code
Fuel Type	Fuel Type 1 Fuel Type 2 Fuel Type 3	Use Table 4 Fuel Type 3 Fuel Type 4 Fuel Type 5
Vapor Storage System	(Use Table 15)	
Canister Housing	(Use Table 16)	
Canister Bottom	(Use Table 17)	
Purge	(Use Table 18)	
Combustion Cycle	(Use Table 3)	
Fuel Induction	(Use Table 19)	
Fuel Tank Material ^a	(Text Description)	
Sales Area	(Use Table 12)	
EVAP Standards MY	(Use MY)	
EVAP Standards Fuel Type	(Use Table 4)	
Gross Vehicle Weight Category	(Use Table 20)	

Standards

(Use Table 21)

^a Fuel tank must be described as plastic, metal, or both (one vehicle may have both plastic and metal tanks.) Separate EVAP families must be created for each.

Table 4

Fuel	
Code	Description
G	Gasoline
D	Diesel
M	Methanol
E	Ethanol
CNG	Compressed Natural Gas
LNG	Liquified Natural Gas
Z	Electric
O	Other
BI	Other Bi-Fuel
GM	Bi-Fuel, Gasoline/Methanol
DM	Bi-Fuel, Diesel/Methanol
CD	Bi-Fuel, CNG/Diesel
GE	Bi-Fuel, Gasoline/Ethanol

Table 12

Sales Area	
Code	Description
FA	Federal All Altitude
CA	1 Calif
NL	2 National LEV
CF	Clean Fuel Vehicle

Table 15

Vapor Storage System	
Code	Description
O	None
1	Canister
2	Crankcase
3	Air Cleaner
4	Canister and Crankcase
5	Crankcase and Air Cleaner
6	Canister and Air Cleaner
7	Canister, Crankcase and Air Cleaner

Table 16

Canister Housing	
Code	Description
P	Plastic
M	Metal
NA	Not Applicable

Table 17

Canister Bottom	
Code	Description
Y	Open
N	Closed
NA	Non Applicable

Table 18

Purge	
Code	Description
Y	Controlled
N	Not Controlled
NA	Non Applicable

Table 19

Fuel Induction	
Code	Description
1	Carbureted
2	Fuel Injection

Table 20

Gross Vehicle Weight	
Code	Description
FLDV	LDV (5/50K)
FLDTVT	LDV, LLDT (10/100K)
FLDT	LDT (11/120K)
FHLDTA	HLDT less than 30 gal (11/120K) (Gasoline/Methanol)
FHLDTB	HLDT equal to or more than 30 gal (11/120K) (Gasoline/Methanol)
FHLDT	HLDT (11/120K) CNG, LPG)

FHDV1	HDGV < 1400# GVW (8/110K) HDGV < 1400# GVW (10/110K)
FHDV2	HDGV > 1400# GVW (8/110K) HDGV > 1400# GVW (10/110K)
CVT	California Vehicle or Truck

Table 21

Standards	
Code	Description
EXIS	Existing
ENHA	Enhanced

Table 3

Combustion Cycle	
Code	Description
S	Otto Cycle Piston
R	Otto Cycle Rotary
D	Diesel Cycle
2	Two Stroke Cycle
T	Turbine
H	Hybrid Electric
E	Electric
A	Other

VECI Acronym Definitions

ALVW—Adjusted Loaded Vehicle Weight, (Curb Weight + GVWR) /2.
Averaging Bank/Trade—Used for Nox Credits on Heavy Duty Trucks Only.
BBL—Barrel.
CALIFORNIA ARB—California Air Resource Board.
CARB—California Air Resource Board.
CARB LEV—Low Emission Vehicle.
CARB TLEV—Transitional Low Emission Vehicle.
CARB ULEV—Ultra Low Emission Vehicle.
CARB ZEV—Zero Emission Vehicle.
CPI—Central Port Injection.
CI—Cylinder Injection.
CNG—Compressed Natural Gas.
EPA—Environmental.
EVAP—Evaporative Emissions.
GVW—Gross Vehicle Weight.
GVWR—Gross Vehicle Weight Rating, Curb weight plus payload.
HHDE—Heavy Heavy Duty Engine.
HHDE—Heavy Heavy Duty Diesel Engine.
MHDE—Medium Heavy Duty Diesel Engine.
MPI—Multi Port Injection.
LDDT—Light Duty Diesel Truck categories.
LDT—Light Duty Truck (gasoline) categories based on weight as defined in the table.
LDV—Light Duty Vehicle, generally passenger cars and light trucks under 6000 pounds GVWR.
LHDE—Light Heavy Duty Engine (several weight categories).
LVW—Loaded Vehicle Weight, curb weight plus 300 pounds.
MDT—Medium Duty Truck categories based on weight as defined in the table.
MDV—Medium Duty Vehicle.
MHDE—Medium Heavy Duty Engine.
MY—Model Year.
NCP—Non Compliance Penalty.
OBD—On-Board Diagnostic.
ORVR—On-Board Refueling Vapor Recovery.
PC—Passenger Car.
SI—Sequential Injection.
SULEV—Super Ultra Low Emission Vehicle.
Tier 0—California and Federal regulations effective prior to Tier 1 phase in dates.
Tier 1—California regulations beginning in 1993 model year and Federal regulations beginning in 1994 model year.
TBI—Throttle Body Injection.
LEV—Low Emission Vehicle.
ZEV—Zero Emission Vehicle.
ULEV—Ultra Low Emission Vehicle.
ILEV—Inherently Low Emission Vehicle.

On Board Diagnostics II Monitors

Overview

The California Air Resources Board (ARB) began regulating On Board Diagnostic (OBD) systems for vehicles sold in California beginning with the 1988 model year. The initial requirements, known as OBD I, required identifying the likely area of malfunction with regard to the fuel metering system, Exhaust Gas Recirculation (EGR) system, emission-related components and the Powertrain Control Module (PCM). A malfunction indicator lamp (MIL) labeled CHECK ENGINE or SERVICE ENGINE SOON was required to illuminate and alert the driver of the malfunction and the need to service the emission control system. A fault code or Diagnostic Trouble Code (DTC) was required to assist in identifying the system or component associated with the fault.

Starting with the 1994 model year, both CARB and Environmental Protection Agency (EPA) mandated enhanced OBD systems, commonly known as OBD-II. The objectives of the OBD-II system are to improve air quality by reducing high in-use emissions caused by emission-related malfunctions, reducing the time between the occurrence of a malfunction and its detection and repair, and assisting in the diagnosis and repair of emission-related problems. By the 1996 model year, all California passenger cars and trucks (up to 14,000 lb GVWR) and all federal passenger cars and trucks (up to 8,500 lb GVWR) are required to comply with either CARB-OBD II or EPA OBD requirements. These requirements apply to gasoline vehicles, diesel vehicles and are being phased in on alternative-fuel vehicles as well.

The OBD II system monitors virtually all emission control systems and components that can affect tailpipe or evaporative emissions. In most cases, malfunctions must be detected before emissions exceed 1.5 times the applicable 50K- or 100K-mile emission standards. If a system or component exceeds emission thresholds or fails to operate within a manufacturer's specifications, a DTC will be stored and the MIL will be illuminated within two driving cycles.

The OBD II system monitors for malfunctions either continuously, regardless of driving mode, or non-continuously, once per drive cycle during specific drive modes. A pending DTC is stored in the PCM Keep Alive Memory (KAM) when a malfunction is initially detected. This pending DTC may be erased on the third vehicle restart after two consecutive drive cycles with no malfunction. However if the malfunction is still present after two consecutive drive cycles, the MIL is illuminated. Once the MIL is illuminated, three consecutive drive cycles without a malfunction detected are required to extinguish the MIL. The DTC is erased after 40 engine warm-up cycles once the MIL is extinguished.

In addition to specifying and standardizing much of the diagnostics and MIL operation, OBD-II requires the use of a standard Diagnostic Link Connector (DLC), standard communication links and messages, standardized DTCs and terminology. Examples of standard diagnostic information are freeze frame data and Inspection Maintenance (IM) Readiness Indicators.

Freeze frame data describes data stored in KAM at the point the malfunction is initially detected. Freeze frame data consists of parameters such as engine rpm and load, state of fuel control, spark, and warm-up status. Freeze frame data is stored at the time the first malfunction is detected, however, previously stored conditions will be replaced if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.

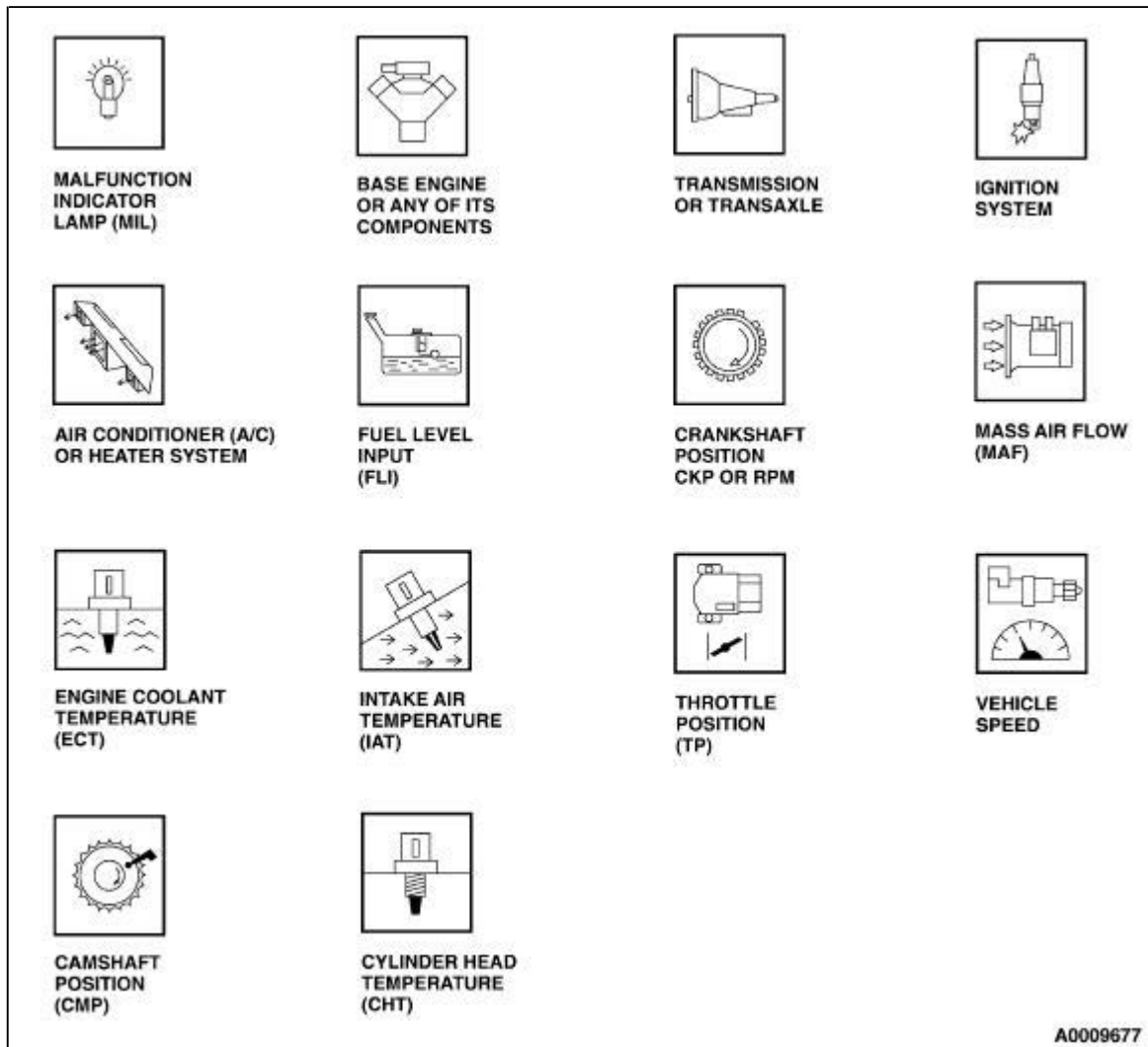
OBD II Inspection Maintenance (IM) Readiness indicators show whether all of the OBD II monitors have been completed since KAM was last cleared. Ford also stores a P1000 DTC to indicate that some monitors have not completed. In some states, it may be necessary to perform an OBD check in order to renew a vehicle registration. The IM Readiness indicators must show that all monitors have been completed prior to the OBD check.

This section provides a general description of each OBD II monitor. In these descriptions, the monitor strategy, hardware, testing requirements and methods are presented to provide an overall understanding of monitor operation. An illustration of each monitor is also provided. These illustrations

should be used as typical examples and are not intended to represent all possible vehicle configurations.

Each illustration depicts the PCM as the main focus with primary inputs and outputs for each monitor. The icons to the left of the PCM represent the inputs used by each of the monitor strategies to enable or activate the monitor. The components and subsystems to the right of the PCM represent the hardware and signals used while performing the tests and the systems being tested. The Comprehensive Component Monitor (CCM) illustration has numerous components and signals involved and is shown generically. When referring to the illustrations, match the numbers to the corresponding numbers in the monitor descriptions for a better comprehension of the monitor and associated DTC's.

These icons are used in the illustrations of the OBD II monitors and throughout this section.



Catalyst Efficiency Monitor - Federal Test Procedure

The Catalyst Efficiency Monitor uses an oxygen sensor before and after the catalyst to infer the hydrocarbon efficiency based on oxygen storage capacity of the catalyst. Under normal, close-loop fuel conditions, high efficiency catalysts have significant oxygen storage. This makes the switching frequency of the rear heated oxygen sensor (HO2S) very slow and reduces the amplitude of those switches as compared to the switching frequency and amplitude of the front HO2S. As the catalyst efficiency deteriorates, its ability to store oxygen declines. The post-catalyst or downstream HO2S signal begins to switch more rapidly with increasing amplitude, approaching the switching frequency and amplitude of the pre-catalyst or upstream HO2S.

All applications utilize an FTP-based (Federal Test Procedure) catalyst monitor. This simply means that the catalyst monitor must run during a standard FTP emission test as opposed to the 20-second steady state catalyst monitor used in 1994 through some 1996 vehicles. Two slightly different versions of the catalyst monitor are used in the 2001 model year.

Switch Ratio Method (1996 - 2001)

1. In order to assess catalyst oxygen storage, the monitor counts front and rear HO2S switches during part-throttle, close-loop fuel condition after the engine is warmed-up and inferred catalyst temperature is within limits. Front switches are accumulated in up to nine different air mass regions or cells although three air mass regions is typical. Rear switches are counted in a single cell for all air mass regions. When the required number of front switches has accumulated in each cell, the total number of rear switches is divided by the total number of front switches to compute a switch ratio. A switch ratio near 0.0 indicates high oxygen storage capacity, hence high HC efficiency. A switch ratio near 1.0 indicates low oxygen storage capacity, hence low HC efficiency. If the actual switch ratio exceeds a calibrated threshold switch ratio, the catalyst is considered failed.

Inputs from ECT or CHT (warm engine), IAT (not extreme ambient temperatures), MAF (greater than minimum engine load), VSS (within vehicle speed widow) and TP (at part-throttle) are required to enable the Catalyst Efficiency Monitor.

2. The DTCs associated with this test are DTC P0420 (Bank 1) and P0430 (Bank 2). Because an Exponentially Weight Moving Average algorithm is use for malfunction determination, up to six driving cycles may be required to illuminate the MIL during normal customer driving. If KAM is reset, a malfunction will illuminate the MIL in 2 drive cycles.

Index Ratio Method (some 2001 and beyond)

1. In order to assess catalyst oxygen storage, the catalyst monitor counts front HO2S switches during part-throttle, closed-loop fuel conditions after the engine is warmed-up and inferred catalyst temperature is within limits. Front switches are accumulated in up to three different air mass regions or cells. While catalyst monitoring entry conditions are being met, the front and rear HO2S signal lengths are continually being calculated. When the required number of front switches has accumulated in each cell, the total signal length of the rear HO2S is divided by the total signal length of the front HO2S to compute a catalyst index ratio. An index ratio near 0.0 indicates high oxygen storage capacity, hence high efficiency. A switch ratio near 1.0 indicates low oxygen storage capacity, hence low HC efficiency. If the actual index ratio exceeds the threshold index ratio, the catalyst is considered failed.

Inputs from ECT or CHT (warm engine), IAT (not extreme ambient temperatures), MAF (greater than minimum engine load), VSS (within vehicle speed widow) and TP (at part-throttle) are required to enable the Catalyst Efficiency Monitor.

2. The DTCs associated with this test are DTC P0420 (Bank 1) and P0430 (Bank 2). Because an Exponentially Weighted Moving Average algorithm is use for malfunction determination, up to six driving cycles may be required to illuminate the MIL during normal customer driving. If KAM is

reset, a malfunction will illuminate the MIL in 2 drive cycles.

If the catalyst monitor does not complete during a particular driving cycle, the already accumulated switch/signal data is retained in Keep Alive Memory and is used during the next driving cycle to allow the catalyst monitor a better opportunity to complete.

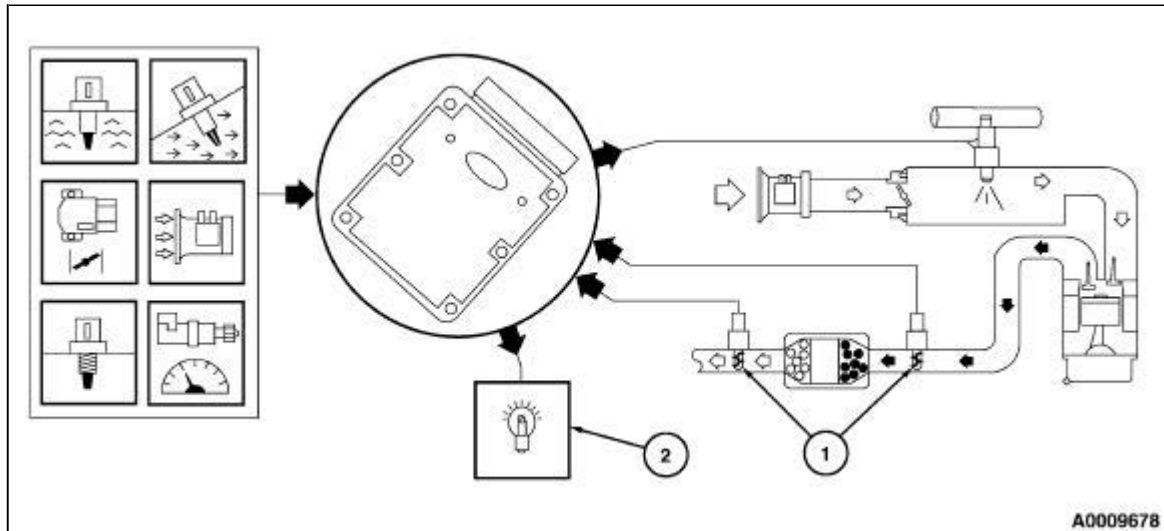


Figure 5: Catalyst Efficiency Monitor - Federal Test Procedure

Comprehensive Component Monitor

The Comprehensive Component Monitor (CCM) monitors for malfunctions in any powertrain electronic component or circuit that provides input or output signals to the PCM that can affect emissions and is not monitored by another OBD II monitor. Inputs and outputs are, at a minimum, monitored for circuit continuity or proper range of values. Where feasible, inputs are also checked for rationality, outputs are also checked for proper functionality.

CCM covers many components and circuits and tests them in various ways depending on the hardware, function, and type of signal. For example, analog inputs such as Throttle Position or Engine Coolant Temperature are typically checked for opens, shorts and out-of-range values. This type of monitoring is performed continuously. Some digital inputs like Vehicle Speed or Crankshaft Position rely on rationality checks - checking to see if the input value makes sense at the current engine operating conditions. These types of tests may require monitoring several components and can only be performed under appropriate test conditions.

Outputs such as the Idle Air Control solenoid are checked for opens and shorts by monitoring a feedback circuit or "smart driver" associated with the output. Other outputs, such as relays, require additional feedback circuits to monitor the secondary side of the relay. Some outputs are also monitored for proper function by observing the reaction of the control system to a given change in the output command. An Idle Air Control solenoid can be functionally tested by monitoring idle rpm relative to the target idle rpm. Some tests can only be performed under appropriate test conditions; for example, transmission shift solenoids can only be tested when the PCM commands a shift.

The following is an example of some of the input and output components monitored by the CCM. The components monitor may belong to the engine, ignition, transmissions, air conditioning, or any other PCM supported subsystem.

1. Inputs:

mass air flow (MAF) sensor, intake air temperature (IAT) sensor, engine coolant temperature (ECT) sensor, throttle position (TP) sensor, camshaft position (CMP) sensor, air conditioning pressure sensor (ACPS), fuel tank pressure (FTP) sensor.

2. Outputs:

fuel pump (FP), wide open throttle A/C cutout (WAC), idle air control (IAC), shift solenoid (SS), torque converter clutch (TCC) solenoid, intake manifold runner control (IMRC), EVAP canister purge valve, canister vent (CV) solenoid.

3. CCM is enabled after the engine starts and is running. A Diagnostic Trouble Code (DTC) is stored in Keep Alive Memory and the MIL is illuminated after two driving cycles when a malfunction is detected. Many of the CCM tests are also performed during on demand self-test.

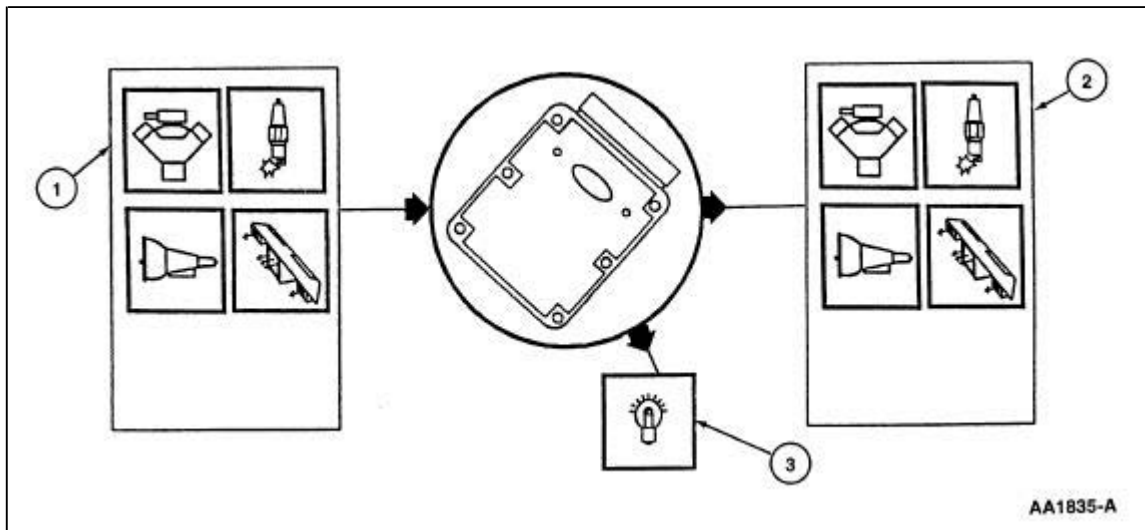


Figure 6: Comprehensive Component Monitor

Evaporative Emission (EVAP) Leak Check Monitor

The Evaporative Emission (EVAP) Leak Check Monitor is an on-board strategy designed to detect a leak from a hole (opening) equal to or greater than 1.016 mm (0.040 inch) in the Enhanced EVAP system. The proper function of the individual components of the Enhanced EVAP system as well as its ability to flow fuel vapor to the engine is also examined. The EVAP Leak Check Monitor relies on the individual components of the Enhanced EVAP system to apply vacuum to the fuel tank and then seal the entire Enhanced EVAP system from atmosphere. The fuel tank pressure is then monitored to determine the total vacuum lost (bleed-up) for a calibrated period of time. Inputs from the engine coolant temperature (ECT) or cylinder head temperature (CHT) sensor, intake air temperature (IAT) sensor, mass air flow (MAF) sensor, vehicle speed, fuel level input (FLI) and fuel tank pressure (FTP) sensor are required to enable the EVAP Leak Check Monitor.

Note: During the EVAP Leak Check Monitor Repair Verification Drive Cycle a PCM reset will bypass the minimum soak time required to complete the monitor. The EVAP Leak Check Monitor will not run if the key is turned off after a PCM reset. The EVAP Leak Check Monitor will not run if a MAF sensor failure is indicated. The EVAP Leak Check Monitor will not initiate until the Heated Oxygen Sensor (HO2S) Monitor has completed.

The EVAP Leak Check Monitor is executed by the individual components of the Enhanced EVAP system as follows:

1. The function of the EVAP canister purge valve is to create a vacuum on the fuel tank. A minimum duty cycle on the EVAP canister purge valve (75%) must be met before the EVAP Leak Check Monitor can begin.
2. The canister vent (CV) solenoid will close (100% duty cycle) with the EVAP canister purge valve at its minimum duty cycle to seal the Enhanced EVAP system from atmosphere and obtain a target vacuum on the fuel tank.
3. The fuel tank pressure (FTP) sensor will be used by the EVAP Leak Check Monitor to determine if the target vacuum on the fuel tank is being reached to perform the leak check. Some vehicle applications with the EVAP Leak Check Monitor use a remote in-line FTP sensor. Once the target vacuum on the fuel tank is achieved, the change in fuel tank vacuum for a calibrated period of time will determine if a leak exists.
4. If the initial target vacuum cannot be reached, DTC P0455 (gross leak detected) will be set. The EVAP Leak Check Monitor will abort and not continue with the leak check portion of the test.

For some vehicle applications: If the initial target vacuum cannot be reached after a refueling event and the purge vapor flow is excessive, DTC P0457 (fuel cap off) is set. If the initial target vacuum cannot be reached and the purge flow is too small, DTC P1443 (no purge flow condition) is set.

If the initial target vacuum is exceeded, a system flow fault exists and DTC P1450 (unable to bleed-up fuel tank vacuum) is set. The EVAP Leak Check Monitor will abort and not continue with the leak check portion of the test.

If the target vacuum is obtained on the fuel tank, the change in the fuel tank vacuum (bleed-up) will be calculated for a calibrated period of time. The calculated change in fuel tank vacuum will be compared to a calibrated threshold for a leak from a hole (opening) of 1.016 mm (0.040 inch) in the Enhanced EVAP system. If the calculated bleed-up is less than the calibrated threshold, the Enhanced EVAP system passes. If the calibrated bleed-up exceeds the calibrated threshold, the test will abort and rerun the test up to three times.

If the bleed-up threshold is still being exceeded after three tests, a vapor generation check must be performed before DTC P0442 (small leak detected) will be set. This is accomplished by returning the Enhanced EVAP system to atmospheric pressure by closing the EVAP canister purge valve and opening the CV solenoid. Once the FTP sensor observes the fuel tank is at

atmospheric pressure, the CV solenoid closes and seals the Enhanced EVAP system.

The fuel tank pressure build-up for a calibrated period of time will be compared to a calibrated threshold for pressure build-up due to vapor generation.

If the fuel tank pressure build-up exceeds the threshold, the leak test results are invalid due to vapor generation. The EVAP Leak Check Monitor will attempt to retest again.

If the fuel tank pressure build-up does not exceed the threshold, the leak test results are valid and DTC P0442 will be set.

5. If the 1.016 mm (0.40 inch) test passes, the test time is extended to allow the 0.508 mm (0.020 inch) test to run.

The calculated change in fuel vacuum over the extended time is compared to a calibrated threshold for a leak from a 0.508 mm (0.020 inch) hole (opening).

If the calculated bleed-up exceeds the calibrated threshold, vapor generation is run. If vapor generation passes (no vapor generation), an internal flag is set in the PCM to run a 0.508 mm (0.020 inch) test at idle (vehicle stopped).

On the next start following a long engine off period, the Enhanced EVAP system will be sealed and evacuated for the first 10 minutes of operation.

If the appropriate conditions are met, a 0.508 mm (0.020 inch) leak check is conducted at idle.

If the test at idles fails, a DTC P0456 will be set. There is no vapor generation test with the idle test.

Note: If the vapor generation is high on some vehicle Enhanced EVAP Systems, where the monitor does not pass, the result is treated as a no test. Thereby, the test is complete for the day.

6. The malfunction indicator lamp (MIL) is activated for DTCs P0442, P0455, P0456, P0457, P1443 and P1450 (or P446) after two occurrences of the same fault. The MIL can also be activated for any Enhanced EVAP system component DTCs in the same manner. The Enhanced EVAP system component DTCs P0443, P0452, P0453 and P1451 are tested as part of the Comprehensive Component Monitor (CCM).

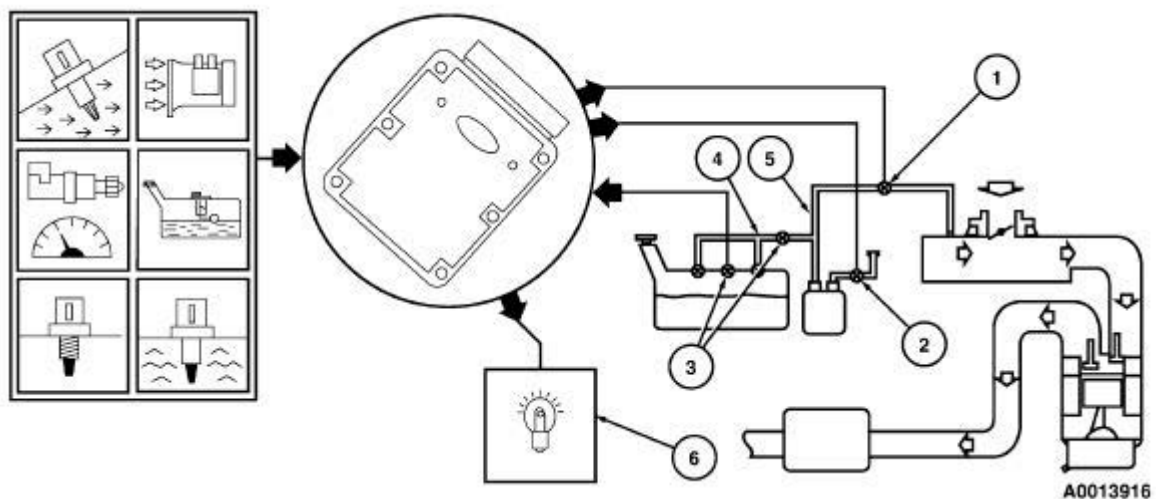


Figure 7: Evaporative Emission (EVAP) Leak Check Monitor

Exhaust Gas Recirculation (EGR) System Monitor—Differential Pressure Feedback EGR

The Differential Pressure Feedback EGR System Monitor is an on-board strategy designed to test the integrity and flow characteristics of the EGR system. The monitor is activated during EGR system operation and after certain base engine conditions are satisfied. Input from the ECT, CHT, IAT, TP and CKP sensors is required to activate the EGR System Monitor. Once activated, the EGR System Monitor will perform each of the tests described below during the engine modes and conditions indicated. Some of the EGR System Monitor tests are also performed during on demand self-test.

1. The differential pressure feedback EGR sensor and circuit are continuously tested for opens and shorts. The monitor looks for the Differential Pressure Feedback EGR circuit voltage to exceed the maximum or minimum allowable limits.

The DTCs associated with this test are DTCs P1400 and P1401.

2. The EGR vacuum regulator solenoid is continuously tested for opens and shorts. The monitor looks for an EGR Vacuum Regulator circuit voltage that is inconsistent with the EGR Vacuum Regulator circuit commanded output state.

The DTC associated with this test is DTC P1409.

3. The test for a stuck open EGR valve or EGR flow at idle is continuously performed whenever at idle (TP sensor indicating closed throttle). The monitor compares the Differential Pressure Feedback EGR circuit voltage at idle to the Differential Pressure Feedback EGR circuit voltage stored during key on engine off to determine if EGR flow is present at idle.

The DTC associated with this test is DTC P0402.

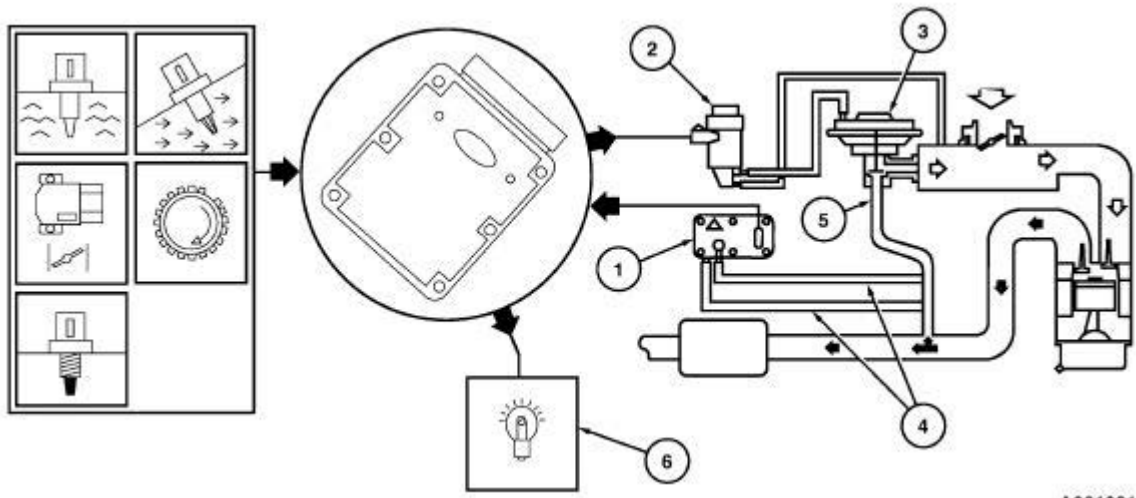
4. The differential pressure feedback EGR sensor upstream hose is tested once per drive cycle for disconnect and plugging. The test is performed with EGR valve closed and during a period of acceleration. The PCM will momentarily command the EGR valve closed. The monitor looks for the differential pressure feedback EGR sensor voltage to be inconsistent for a no flow voltage. A voltage increase or decrease during acceleration while the EGR valve is closed may indicate a fault with the signal hose during this test.

The DTC associated with this test is DTC P1405.

5. The EGR flow rate test is performed during a steady state when engine speed and load are moderate and EGR vacuum regulator duty cycle is high. The monitor compares the actual Differential Pressure Feedback EGR circuit voltage to a desired EGR flow voltage for that state to determine if EGR flow rate is acceptable or insufficient. This is a system test and may trigger a DTC for any fault causing the EGR system to fail.

The DTC associated with this test is DTC P0401. DTC P1408 is similar to P0401 but performed during KOER Self-Test conditions.

6. The MIL is activated after one of the above tests fails on two consecutive drive cycles.



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Figure 8: EGR System Monitor - Differential Pressure Feedback EGR

Electric Exhaust Gas Recirculation (EGR) System Monitor

The Electric EGR System Monitor is an on-board strategy designed to test the integrity and flow characteristics of the EGR system. The monitor is activated during EGR system operation and after certain base engine conditions are satisfied. Input from the ECT or CHT, IAT, TP, CPS, MAF, and MAP sensors is required to activate the EGR System Monitor. Once activated, the EGR System Monitor will perform each of the tests described below during the engine modes and conditions indicated. Some of the EGR System Monitor tests are also performed during on demand self-test

The Stepper Motor EGR Monitor consists of an electrical and functional test that checks the stepper motor and the EGR system for proper flow. The PCM controls the EGR valve by commanding from 0 to 52 discreet increments or "steps" to get the valve from fully closed to fully open. The stepper motor electrical test is a continuous check of the four electric stepper motor coils and circuits to the PCM. A malfunction is indicated if an open circuit, short to power, or short to ground has occurred in one or more of the stepper motor coils / circuits for a calibrated period of time. If a malfunction has been detected, the EGR system will be disabled, setting the KOER, and Cont. P0403 DTC. Additional monitoring will be suspended for the remainder of the driving cycle, or until the next engine startup.

After the vehicle has warmed up and normal EGR rates are being commanded by the PCM, the EGR flow check is performed. The flow test is performed once per drive-cycle when a minimum amount of EGR is requested and the remaining entry conditions required to initiate the test are satisfied. If a malfunction is detected, the EGR system as well as the EGR monitor is disabled until the next engine startup.

The EGR flow test is done by observing the behavior of two different values of MAP - the analog MAP sensor reading, and inferred MAP (MAP calculated from the Mass Air Flow Sensor, throttle position, rpm, etc.). During normal, steady-state operating conditions, EGR is intrusively commanded ON to a specified percentage. Then, EGR is commanded OFF. If the EGR system is working properly, there is a significant difference in both the observed and the calculated values of MAP, between the EGR-ON and the EGR-OFF states.

When the flow test entry conditions have been satisfied, EGR is commanded to flow at a calibrated test rate (about 10%). At this time, the value of MAP is recorded (EGR-ON MAP). The value of inferred MAP EGR-ON IMAP is also recorded. Next the EGR is commanded off (0%). Again, the value of MAP is recorded (EGR-OFF MAP). The value of EGR-OFF IMAP is also recorded. Typically, seven such ON/OFF samples are taken. After all the samples have been taken, the average EGR-ON MAP, EGR-ON IMAP, EGR-OFF MAP and EGR-OFF IMAP values are stored.

Next, the differences between the EGR-ON and EGR-OFF values are calculated:

- $\text{MAP-delta} = \text{EGR-ON MAP} - \text{EGR-OFF MAP}$ (analog MAP)
- $\text{IMAP-delta} = \text{EGR-ON IMAP} - \text{EGR-OFF IMAP}$ (inferred MAP)

If the sum of MAP-delta and IMAP-delta exceeds a maximum threshold or falls below a minimum threshold, a P0400 (high or low flow malfunction) is registered.

As an additional check, if the EGR-ON MAP exceeds a maximum threshold (BARO - a calibrated value), a P0400 low flow malfunction is registered. This check is performed to detect reduced EGR flow on systems where the MAP pickup point is not located in the intake manifold, but is located just upstream of the EGR valve in the EGR delivery tube.

Note: BARO is inferred at engine startup using the KOEO MAP sensor reading. It is updated during high, part-throttle or high rpm engine operation.

If the inferred ambient temperature is less than 20° F (-7° C), greater than 130° F (54° C), or the altitude is greater than 8,000 feet (BARO <22.5 " Hg), the EGR flow test cannot be reliably done. In these conditions, the EGR flow test is suspended and a timer starts to accumulate the time in these conditions. If the vehicle leaves these extreme conditions, the timer starts decrementing, and if conditions permit,

will attempt to complete the EGR flow monitor. If the timer reaches 500 seconds, the EGR flow test is disabled for the remainder of the current driving cycle and the EGR Monitor I/M Readiness bit will be set to a "ready" condition.

A DTC of P1408, like the P0400, will indicate a EGR flow failure (outside the minimum or maximum limits) but is only set during the KOER self test. The P0400 and P0403 are MIL codes, the P1408 is a non-MIL code.

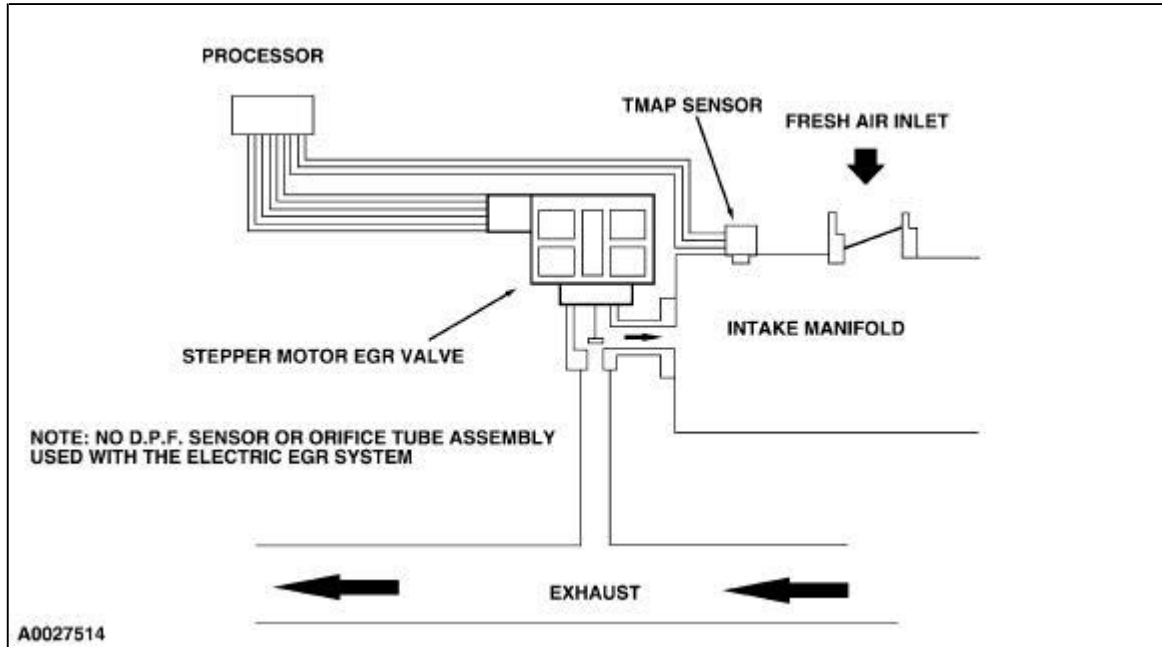


Figure 9: EEGR System Monitor - Electric EGR System

Fuel System Monitor

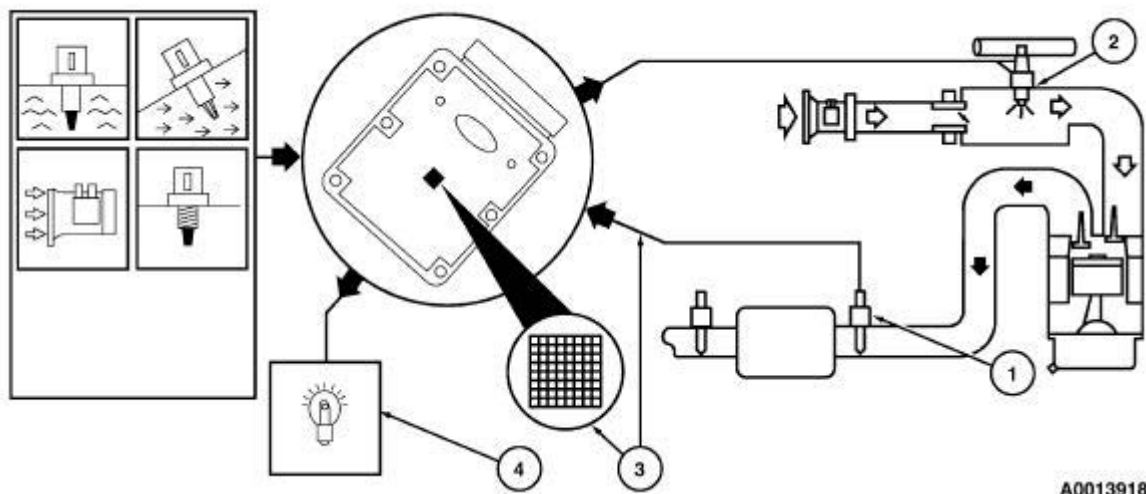
The Fuel System Monitor is an on-board strategy designed to monitor the fuel trim system. The fuel control system uses fuel trim tables stored in the PCM's Keep Alive Random Access Memory (RAM) to compensate for variability in fuel system components due to normal wear and aging. During closed-loop vehicle operation, the fuel trim strategy learns the corrections needed to correct a "biased" rich or lean fuel system. The correction is stored in the fuel trim tables. The fuel trim has two means of adapting; a Long Term Fuel Trim and a Short Term Fuel Trim. Long Term relies on the fuel trim tables and Short Term refers to the desired air/fuel ratio parameter "LAMBSE". Both are described in greater detail in this section under Powertrain Control Software, Fuel Trim. Input from the ECT or CHT, IAT, and MAF sensors is required to activate the fuel trim system, which in turn activates the Fuel System Monitor. Once activated, the Fuel System Monitor looks for the fuel trim tables to reach the adaptive clip and LAMBSE to exceed a calibrated limit. The Fuel System Monitor will store the appropriate DTC when a fault is detected as described below.

1. The heated oxygen sensor (HO2S) detects the presence of oxygen in the exhaust and provides the PCM with feedback indicating air/fuel ratio.
2. A correction factor is added to the fuel injector pulsewidth calculation according to the Long and Short Term Fuel Trims as needed to compensate for variations in the fuel system.
3. When deviation in the parameter LAMBSE increases, air/fuel control suffers and emissions increase. When LAMBSE exceeds a calibrated limit and the fuel trim table has clipped, the Fuel System Monitor sets a Diagnostic Trouble Code (DTC) as follows:

The DTCs associated with the monitor detecting a lean shift in fuel system operation are DTCs P0171 and P0174.

The DTCs associated with the monitor detecting a rich shift in fuel system operation are DTCs P0172 and P0175.

4. The MIL is activated after a fault is detected on two consecutive drive cycles.



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Figure 10: Fuel System Monitor

Heated Oxygen Sensor (HO2S) Monitor

The HO2S Monitor is an on-board strategy designed to monitor the HO2S sensors for a malfunction or deterioration which can affect emissions. The fuel control or upstream HO2S is checked for proper output voltage and response rate (the time it takes to switch from lean to rich or rich to lean). Downstream HO2S used for Catalyst Monitor are also monitored for proper output voltage. The following illustration shows that input is required from the ECT or CHT, IAT, MAF and CKP sensors to activate the HO2S Monitor. The Fuel System Monitor and Misfire Detection Monitor must also have completed successfully before the HO2S Monitor is enabled.

1. The HO2S sensor senses the oxygen content in the exhaust flow and outputs a voltage between zero and 1.0 volt. Lean of stoichiometric (air/fuel ratio of approximately 14.7:1), the HO2S will generate a voltage between zero and 0.45 volt. Rich of stoichiometric, the HO2S will generate a voltage between 0.45 and 1.0 volt. The HO2S Monitor evaluates both the upstream (fuel control) and downstream (Catalyst Monitor) HO2S for proper function.
2. Once the HO2S Monitor is enabled, the upstream HO2S signal voltage amplitude and response frequency are checked. Excessive voltage is determined by comparing the HO2S signal voltage to a maximum calibratable threshold voltage. A fixed frequency closed loop fuel control routine is executed and the upstream HO2S voltage amplitude and output response frequency are observed. A sample of the upstream HO2S signal is evaluated to determine if the sensor is capable of switching or has a slow response rate. A HO2S heater circuit fault is determined by turning the heater on and off and looking for a corresponding change in the Output State Monitor (OSM) and by measuring the current going through the heater circuit. The HO2S Monitor DTCs can be categorized as follows:

The DTCs associated with HO2S lack of switching are DTCs P1130, P1131, P1132, P1150, P1151 and P1152.

The DTCs associated with HO2S slow response rate are DTCs P0133 and P0153.

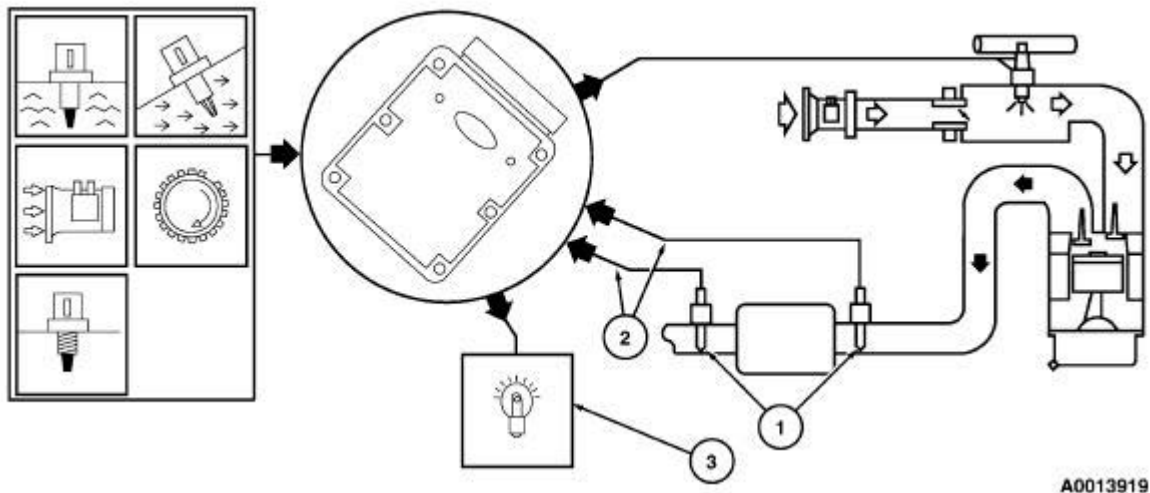
The DTCs associated with HO2S signal circuit malfunction are DTCs P0131, P0136, P0148, P0151 and P0156.

The DTCs associated with a HO2S heater circuit malfunction are DTCs P0135, P0141, P0155 and P0161.

The DTC associated with the downstream HO2S not running in on-demand is DTC P1127.

The DTCs associated with swapped HO2S connectors are DTCs P1128 and P1129.

3. The MIL is activated after a fault is detected on two consecutive drive cycles.



A0013919

Figure 11: Heated Oxygen Sensor Monitor

Misfire Detection Monitor

The Misfire Detection Monitor is an on-board strategy designed to monitor engine misfire and identify the specific cylinder in which the misfire has occurred. Misfire is defined as lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause. The Misfire Detection Monitor will be enabled only when certain base engine conditions are first satisfied. Input from the ECT or CHT, MAF and CKP sensors is required to enable the monitor. The Misfire Detection Monitor is also performed during on demand self-test.

1. The PCM synchronized ignition spark is based on information received from the CKP sensor. The CKP signal generated is also the main input used in determining cylinder misfire.
2. The input signal generated by the CKP sensor is derived by sensing the passage of teeth from the crankshaft position wheel mounted on the end of the crankshaft.
3. The input signal to the PCM is then used to calculate the time between CKP edges and also crankshaft rotational velocity and acceleration. By comparing the accelerations of each cylinder event, the power loss of each cylinder is determined. When the power loss of a particular cylinder is sufficiently less than a calibrated value and other criteria is met, then the suspect cylinder is determined to have misfired.
4. Misfire type A:

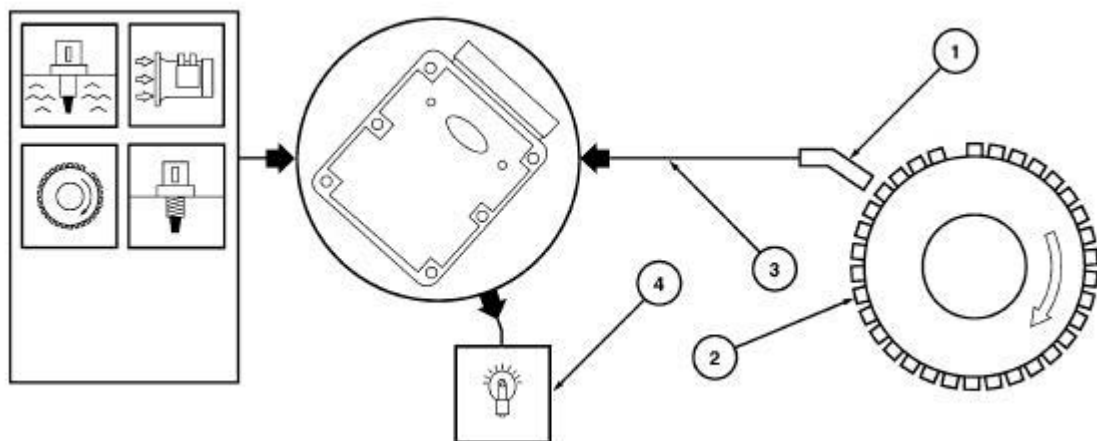
Upon detection of a Misfire type A (200 revolutions) which would cause catalyst damage, the MIL will blink once per second during the actual misfire, and a DTC will be stored.

Misfire type B:

Upon detection of a Misfire type B (1000 revolutions) which will exceed the emissions threshold or cause a vehicle to fail an inspection and maintenance tailpipe emissions test, the MIL will illuminate and a DTC will be stored.

The DTC associated with multiple cylinder misfire for a Type A or Type B misfire is DTC P0300.

The DTCs associated with an individual cylinder misfire for a Type A or Type B misfire are DTCs P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309 and P0310.



A0013920

Figure 12: Misfire Detection Monitor

PCV System Monitor

The PCV Monitor consists of a modified PCV system design. The PCV valve is installed into the rocker cover using a quarter-turn cam-lock design to prevent accidental disconnection. High retention force molded plastic lines are used from the PCV valve to the intake manifold. The diameter of the lines and the intake manifold entry fitting are increased so that inadvertent disconnection of the lines after a vehicle is serviced will cause either an immediate engine stall or will not allow the engine to be restarted.

Secondary Air Injection (AIR) System Monitor—Electric Secondary Air Injection Pump System

The Secondary Air Injection (AIR) System Monitor is an on-board strategy designed to monitor the proper function of the secondary air injection system. The AIR Monitor for the Electric Secondary Air Injection Pump system consists of two monitor circuits: an AIR circuit to diagnose concerns with the primary circuit side of the solid state relay (SSR), and an AIR Monitor circuit to diagnose concerns with the secondary circuit side of the SSR. A functional check is also performed that tests the ability of the AIR system to inject air into the exhaust. The functional check relies upon HO2S sensor feedback to determine the presence of air flow. The monitor is enabled during AIR system operation and only after certain base engine conditions are first satisfied. Input is required from the ECT, IAT, and CKP sensors and the HO2S Monitor test must also have passed without a fault detection to enable the AIR Monitor. The AIR Monitor is also activated during on demand self-test.

1. The AIR circuit is normally held high through the AIR bypass solenoid and SSR when the output driver is off. Therefore a low AIR circuit indicates a driver is always on and a high circuit indicates an open in the PCM.

The DTC associated with this test is DTC P0412.

2. The AIR Monitor circuit is held low by the resistance path through the AIR pump when the pump is off. If the AIR Monitor circuit is high there is either an open circuit to the PCM from the pump or there is power supplied to the AIR Pump. If the AIR Monitor is low when the pump is commanded on, there is either an open circuit from the SSR or the SSR has failed to supply power to the pump.

The DTCs associated with this test are DTCs P1413 and P1414.

3. The functional check may be done in two parts: at startup when the AIR pump is normally commanded on, or during a hot idle if the startup test was not able to be performed. The flow test relies upon the HO2S to detect the presence of additional air in the exhaust when introduced by the Secondary Air Injection system.

The DTC associated with this test is DTC P0411.

4. The MIL is activated after one of the above tests fail on two consecutive drive cycles.

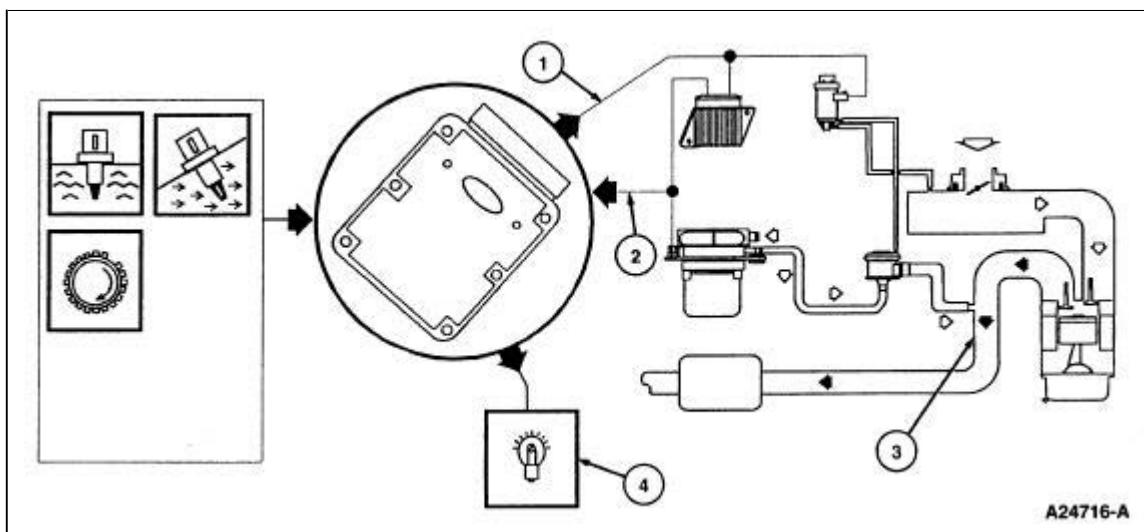


Figure 13: AIR System Monitor

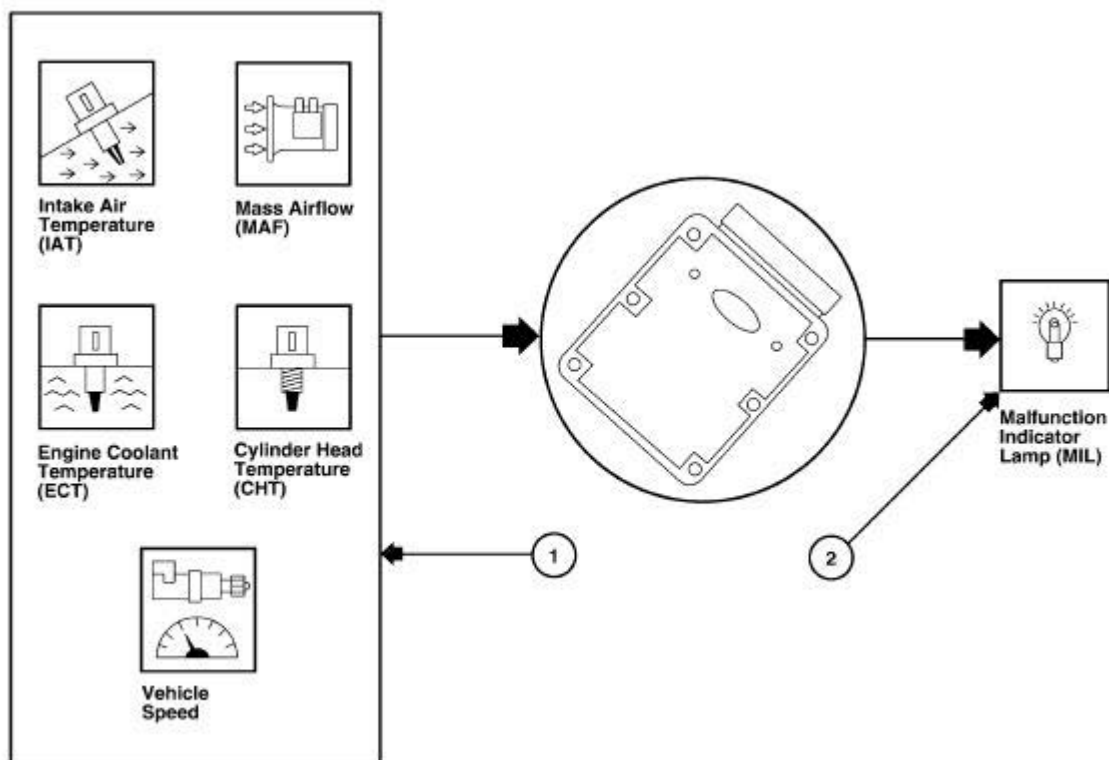
Thermostat Monitor

The Thermostat Monitor is designed to verify proper thermostat operation. This monitor will be phased in on certain applications beginning with the 2000 model year and replaces the original "Insufficient temperature for closed-loop test" (DTC P0125). This monitor will be executed once per drive cycle, after a two hour, engine-off soak period. If a malfunction is indicated by the thermostat monitor a diagnostic trouble code P0125 will be set and the malfunction indicator lamp will be illuminated.

The monitor checks to see if the engine is being operated in a manner that is generating sufficient heat. While the engine is at moderate load (greater than 30%) and the vehicle is moving (greater than 15 mph/24 km), the ECT or CHT should warm up in a predictable manner, therefore, a timer is incremented. The target timer value is based on ambient air temperature at start-up. If the timer exceeds the target time and the ECT or CHT has not warmed up to the target temperature, a malfunction is indicated.

The target temperature will be calibrated to the thermostat regulating temperature minus 20°F (11°C). For a typical 195°F (90°C) thermostat, the warm-up temperature would be calibrated to 175°F (79°C).

1. Inputs: ECT or CHT, IAT, engine LOAD (from MAF sensor) and vehicle speed input.
2. Output: MIL.



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Figure 14: Thermostat Monitor

Malfunction Indicator Lamp (MIL)

The malfunction indicator lamp (MIL) (Figure 15) alerts the driver that the powertrain control module (PCM) has detected an OBD II emission-related component or system fault. When this occurs, an OBD II Diagnostic Trouble Code (DTC) will be set.

- The MIL is located on the instrument cluster and is labeled CHECK ENGINE, SERVICE ENGINE SOON or ISO standard engine symbol (Figure 16).
- Power is supplied to the MIL whenever the ignition switch is in the RUN or START position.
- The MIL will remain on in the RUN/START mode as a bulb check during the instrument cluster proveout for approximately 4 seconds.
- If the MIL remains on after the bulb check:
 - The PCM illuminates the MIL for an emission related concern and a DTC will be present.
 - The instrument cluster will illuminate the MIL if the PCM does not send a control message to the instrument cluster.
 - The PCM is operating in the Hardware Limited Operation Strategy (HLOS).
 - The MIL circuit is shorted to ground.
- If the MIL remains off (during the bulb check):
 - Bulb is damaged.
 - MIL circuit is open.
- To turn off the MIL after a repair, a reset command from the Scan Tool must be sent, or three consecutive drive cycles must be completed without a fault.
- For any MIL concern, go to Section 3, Symptom Charts.
- If the MIL blinks at a steady rate, a severe misfire condition could possibly exist.
- If the MIL blinks erratically, an intermittent open B+ to the bulb or an intermittent short to ground in the MIL circuit exist. Also, the PCM can reset while cranking if battery voltage is low.

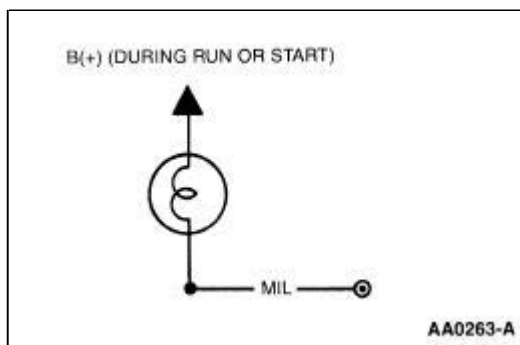
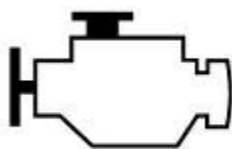


Figure 15: Malfunction Indicator Lamp (MIL)



A0013921

Figure 16: CHECK ENGINE, SERVICE ENGINE SOON or ISO Standard Engine Symbol

Electronic Engine Control (EC) System

Overview

The Electronic Engine Control (Electronic EC) system provides optimum control of the engine and transmission through the enhanced capability of the powertrain control module (PCM). The Electronic EC system also has an on-board diagnostics monitoring system (On Board Diagnostics II) with features and functions to meet federal regulations on exhaust emissions.

The Electronic EC system has two major divisions: hardware and software. The hardware includes the powertrain control module (PCM), natural gas vehicle (NGV) module, constant control relay module (CCRM), sensors, switches, actuators, solenoids, and interconnecting terminals. The software in the PCM provides the strategy control for outputs (engine hardware) based on the values of the inputs to the PCM. Electronic EC hardware and software are discussed in this section.

This section contains detailed descriptions of the operation of Electronic EC system input sensors and switches, output actuators, solenoids, relays and connector pins (including other power-ground signals).

The PCM receives information from a variety of sensor and switch inputs. Based on the strategy and calibration stored within the memory chip, the PCM generates the appropriate output. The system is designed to minimize emissions and optimize fuel economy and driveability. The software strategy controls the basic operation of the engine and transmission, provides the OBD II strategy, controls the malfunction indicator lamp (MIL), communicates to the scan tool via the data link connector (DLC), allows for Flash Electrically Erasable Programmable Read Only Memory (EEPROM), provides idle air and fuel trim, and controls Failure Mode Effects Management (FMEM).

Modifications to OBD II Vehicles

Modifications or additions to the vehicle may cause incorrect operation of the OBD II system. Anti-theft systems, cellular telephones and CB radios must be carefully installed. **Do not install these devices by tapping into or running wires close to powertrain control system wires or components.**

Powertrain Control Software

Multiplexing

The increased number of modules on the vehicle dictates a more efficient method of communication. Multiplexing is the process of communicating several messages over the same signal path. This process allows multiple modules to communicate with each other through the signal path (BUS+/BUS-). Modules communicate with the powertrain control module using Standard Corporate Protocol (SCP) which determines the priority in which the signals are sent. (Refer to Standard Corporate Protocol for more information.) Multiplexing reduces the weight of the vehicle by reducing electrical wiring.

Standard Corporate Protocol

The Standard Corporate Protocol (SCP) is a communication language used by Ford Motor Company for exchanging bi-directional messages (signals) between stand-alone modules and devices. Two or more signals can be sent over one circuit.

Included in these messages is diagnostic data that is output over the BUS+ and BUS - lines to the data link connector (DLC). This information is accessible with a scan tool. Information on this equipment is described in Section 2, Diagnostic Methods.

Flash Electrically Erasable Programmable Read Only Memory

The Flash Electrically Erasable Programmable Read Only Memory (EEPROM) is an Integrated Circuit (IC) within the PCM. This IC contains the software code required by the PCM to control the powertrain. One feature of the EEPROM is that it can be electrically erased and then reprogrammed without removing the PCM from the vehicle. If a software change is required to the PCM, the module no longer needs to be replaced, but can be reprogrammed at the dealership through the DLC.

Idle Air Trim

Idle Air Trim is designed to adjust the Idle Air Control (IAC) calibration to correct for wear and aging of components. When engine conditions meet the learning requirement, the strategy monitors the engine and determines the values required for ideal idle calibration. The Idle Air Trim values are stored in a table for reference. This table is used by the PCM as a correction factor when controlling idle speed. The table is stored in Keep Alive Random Access Memory (RAM) and retains the learned values even after the engine is shut off. A Diagnostic Trouble Code (DTC) is output if the Idle Air Trim has reached its learning limits.

Whenever an IAC component is replaced or cleaned or a service affecting idle is performed, it is recommended that Keep Alive RAM be cleared. This is necessary so the idle strategy does not use the previously learned Idle Air Trim values.

To clear Keep Alive RAM, refer to PCM Reset in Section 2. It is important to note that erasing DTCs with a scan tool does not reset the Idle Air Trim table.

Once Keep Alive RAM has been reset, the engine must idle for 15 minutes (actual time varies between strategies) to learn new idle air trim values. Idle quality will improve as the strategy adapts. Adaptation occurs in four separate modes. The modes are shown in the following table.

IDLE AIR TRIM LEARNING MODES

Transmission Range	Air Conditioning Mode
NEUTRAL	A/C ON
NEUTRAL	A/C OFF
DRIVE	A/C ON
DRIVE	A/C OFF

Fuel Trim

The fuel control system uses the fuel trim table to compensate for normal variability of the fuel system components caused by wear or aging. During closed loop vehicle operation, if the fuel system appears "biased" lean or rich, the fuel trim table will shift the fuel delivery calculations to remove the bias. The fuel system monitor has two means of adapting Short Term Fuel Trim (FT) and Long Term Fuel Trim (FT). Short Term FT is referred to as LAMBSE and Long Term FT references the fuel trim table.

Short Term Fuel Trim (Short Term FT) (displayed as SHRTFT1 and SHRTFT2 on the scan tool) is a parameter that indicates short-term fuel adjustments. Short Term FT is commonly referred to as LAMBSE. LAMBSE is calculated by the PCM from HO2S inputs and helps maintain a 14.7:1 air/fuel ratio during closed loop operation. This range is displayed in percentage (%). A negative percentage means that the HO2S is indicating RICH and the PCM is attempting to lean the mixture. Ideally, Short Term FT may remain near 0% but can adjust between -25% to +35%.

Long Term Fuel Trim (Long Term FT) (displayed as LONGFT1 and LONGFT2 on the scan tool) is the other parameter that indicates long-term fuel adjustments. Long Term FT is also referred to as Fuel Trim. Long Term FT is calculated by the PCM using information from the Short Term FT to maintain a 14.7:1 air/fuel ratio during closed loop operation. The Fuel Trim strategy is expressed in percentages. The range of authority for Long Term FT is from -35% to +35%. The ideal value is near 0% but variations of $\pm 20\%$ are acceptable. Information gathered at different speed load points are stored in fuel trim cells in the fuel trim tables, which can be used in the fuel calculation.

Short Term FT and Long Term FT work together. If the HO2S indicates the engine is running rich, the PCM will correct the rich condition by moving Short Term FT in the negative range (less fuel to correct for a rich combustion). If after a certain amount of time Short Term FT is still compensating for a rich condition, the PCM "learns" this and moves Long Term FT into the negative range to compensate and allows Short Term FT to return to a value near 0%.

As the fuel control and air metering components age and vary from nominal values, the fuel trim learns corrections while in closed loop fuel control. The corrections are stored in a table that is a function of engine speed and load. The tables reside in Keep Alive Random Access Memory (RAM) and are used to correct fuel delivery during open and closed loop. As changing conditions continue the individual cells are allowed to update for that speed load point. If, during the adaptive process, both Short Term FT and Long Term FT reach their high or low limit and can no longer compensate, the MIL is illuminated and a DTC is stored.

Whenever a fuel injector or fuel pressure regulator is replaced, Keep Alive RAM should be cleared. This is necessary so the PCM does not use the previously learned fuel trim values.

To clear Keep Alive RAM, refer to PCM Reset in Section 2, Diagnostic Methods.

Idle Speed Control Closed Throttle Determination

One of the fundamental criteria for entering rpm control is an indication of closed throttle. Throttle mode is always calculated to the lowest learned throttle position (TP) voltage seen since engine start. This lowest learned value is called "ratch," since the software acts like a one-way ratch. The ratch value

(voltage) is displayed as the TPREL PID. The ratch value is relearned after every engine start. Ratch will learn the lowest, steady TP voltage seen after the engine starts. In some cases, ratch can learn higher values of TP. The time to learn the higher values is significantly longer than the time to learn the lower values. The brakes must also be applied to learn the longer values.

All PCM functions are done using this ratch voltage, including idle speed control. The PCM goes into closed throttle mode when the TP voltage is at the ratch (TPREL PID) value. Increase in TP voltage, normally less than 0.05 volts, will put the PCM in part throttle mode. Throttle mode can be viewed by looking at the TP MODE PID. With the throttle closed, the PID must read C/T (closed throttle). Slightly corrupt values of ratch can prevent the PCM from entering closed throttle mode. An incorrect part throttle indication at idle will prevent entry into closed throttle rpm control, and could result in a high idle. Ratch can be corrupted by a throttle position sensor or circuit that "drops out" or is noisy, or by loose/worn throttle plates that close tight during a decel and spring back at a normal engine vacuum.

Fail-Safe Cooling Strategy

Only vehicles that have a cylinder head temperature (CHT) sensor will have the fail-safe cooling strategy. This strategy is activated by the PCM only in the event that an overheating condition has been identified. This strategy provides engine temperature control when the cylinder head temperature exceeds certain limits. The cylinder head temperature is measured by the CHT sensor. For additional information, refer to PCM Inputs for a description of the CHT sensor.

A cooling system failure such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Along with a CHT sensor, a special cooling strategy is used to prevent damage by allowing air cooling of the engine. The vehicle can be safely driven for a short time with some loss of performance.

Engine temperature is controlled by varying and alternating the number of disabled fuel injectors. This allows all cylinders to cool. When the fuel injectors are disabled, their respective cylinders work as air pumps, and this air is used to cool the cylinders. The more fuel injectors that are disabled, the cooler the engine runs, but the engine has less power.

Note: A wide open throttle (WOT) delay is incorporated if the CHT temperature is exceeded during WOT operation. At WOT, the injectors will function for a limited amount of time allowing the customer to complete a passing maneuver.

Before injectors are disabled, the fail-safe cooling strategy alerts the customer to a cooling system problem by moving the instrument cluster temperature gauge to the hot zone. Depending on the vehicle, other indicators, such as an audible chime or warning lamp, can be used to alert the customer of fail-safe cooling. If overheating continues, the strategy begins to disable the fuel injectors, a DTC is stored in the PCM memory, and a malfunction indicator light (MIL) (either CHECK ENGINE or SERVICE ENGINE SOON), comes on. If the overheating condition continues and a critical temperature is reached, all fuel injectors are turned off and the engine is disabled.

Failure Mode Effects Management

Failure Mode Effects Management (FMEM) is an alternate system strategy in the PCM designed to maintain engine operation if one or more sensor inputs fail.

When a sensor input is perceived to be out-of-limits by the PCM, an alternative strategy is initiated. The PCM substitutes a fixed value and continues to monitor the incorrect sensor input. If the suspect sensor operates within limits, the PCM returns to the normal engine operational strategy.

All FMEM sensors display a sequence error message on the scan tool. The message may or may not be followed by Key On Engine Off or Continuous Memory DTCs when attempting Key On Engine Running Self-Test Mode.

Engine RPM/Vehicle Speed Limiter

The powertrain control module (PCM) will disable some or all of the fuel injectors whenever an engine rpm or vehicle overspeed condition is detected. The purpose of the engine rpm or vehicle speed limiter is to prevent damage to the powertrain. The vehicle will exhibit a rough running engine condition, and the PCM will store a Continuous Memory DTC P1270. Once the driver reduces the excessive speed, the engine will return to the normal operating mode. No repair is required. However, the technician should clear the PCM and inform the customer of the reason for the DTC.

Excessive wheel slippage may be caused by sand, gravel, rain, mud, snow, ice, etc. or excessive and sudden increase in rpm while in NEUTRAL or while driving.

Powertrain Control Hardware

Constant Control Relay Module

The constant control relay module (CCRM) interfaces with the Electronic EC system to provide vehicle power (VPWR) to the powertrain control module (PCM) and the Electronic EC system, and for the control of the cooling fan and A/C clutch. The CCRM also contains the fuel pump driver module (FPDM) power supply relay, which supplies power to the FPDM. If any of the internal components of the CCRM fail, the entire unit must be replaced. The descriptions of the specific CCRM functions, as well as the Dual Function A/C high pressure switch are found under the individual hardware - PCM inputs and outputs in this section.

Fuel Pump Driver Module

Note: For the LS6/LS8, the FPDM functions are incorporated in the Rear Electronic Module (REM). Fuel pump operation is the same as applications using the stand-alone FPDM. The REM will, however, communicate diagnostic information through the BUS +/- circuits (SCP) instead of using a fuel pump monitor (FPM) circuit.

The fuel pump driver module (FPDM) receives a duty cycle signal from the PCM and controls the fuel pump operation in relation to this duty cycle. This results in variable speed fuel pump operation. The FPDM sends diagnostic information to the PCM on the fuel pump monitor circuit. For additional information, refer to PCM Outputs, Fuel Pump and PCM Inputs, Fuel Pump Monitor in this section.

Generic Electronic Module

For information on the generic electronic module, refer to the description of the Transfer Case 4x4 System in the vehicle drivetrain workshop manual.

Natural Gas (NG) Vehicle Module

The natural gas (NG) vehicle module (Figure 17) provides two functions. The first function operates the fuel injectors and is referred to as the injector driver module (IDM). The second function sends a fuel level indicator signal to drive the fuel gauge and is called the fuel indicator module (FIM). IDM NG vehicle fuel indicator driver signals are based on powertrain control module (PCM) fuel injector driver signals and are controlled directly by the corresponding injector drivers in the PCM. The IDM must be used to provide the NG fuel injectors with the required high current necessary for proper operation. The greater demand of NG fuel injector current warrants an increased size of the injector driver and increased heat dissipation. Given these conditions, the PCM would not be suitable for placement of these drivers. The IDM closely resembles the Electronic Engine Control IV PCM module in appearance.

The IDM injector drivers are capable of controlling the amount of current flow to each NG fuel injector. Once the fuel injector is open, the IDM NG fuel injector driver will reduce current flow sufficient to continue to hold the fuel injector open. This is done by the IDM in an effort to reduce heat. If the IDM driver does not detect the required peak current to initially open the NG fuel injector within a specified amount of time, the IDM driver will drop current to fuel injector hold open current.

The fuel indicator module (FIM) is not part of the powertrain control subsystem and will not be discussed here.

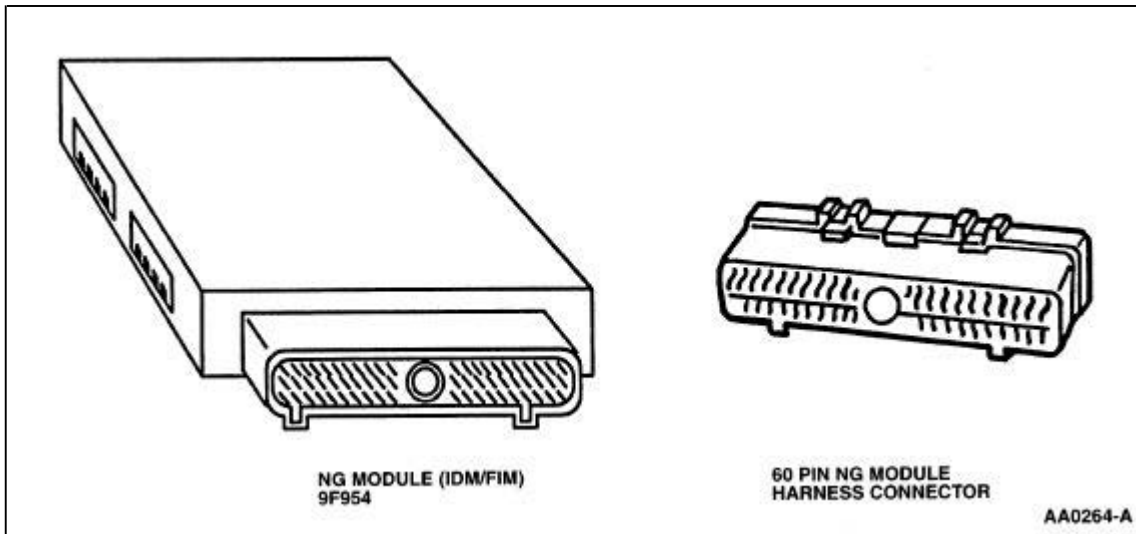


Figure 17: Natural Gas (NG) Vehicle Module

Powertrain Control Module

The center of the Electronic EC system is a microprocessor called the powertrain control module (PCM). LS6/LS8 and 2002 Explorer/Mountaineer applications use a 150-pin PCM (Figure 19). This PCM will have three separate electrical harness connectors. All other applications will continue to use the standard 104-pin PCM (Figure 18). The PCM receives input from sensors and other electronic components (switches, relays). Based on information received and programmed into its memory, the PCM generates output signals to control various relays, solenoids and actuators.

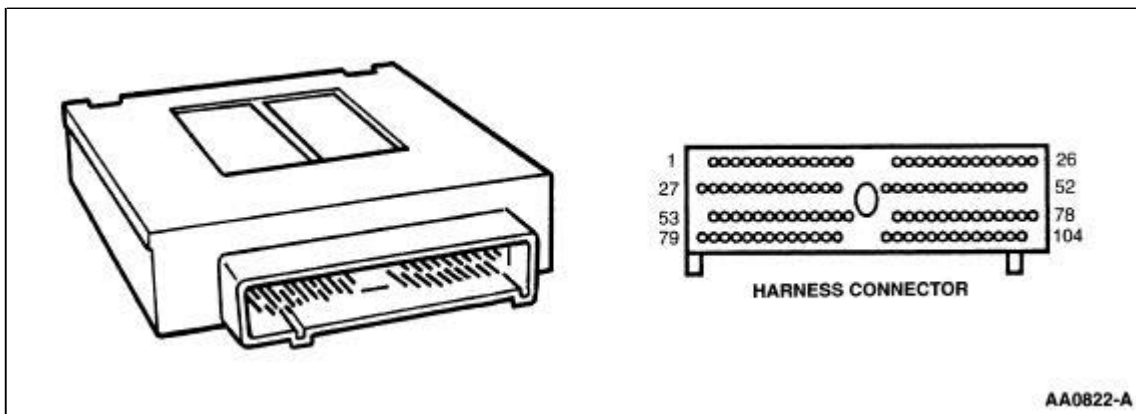


Figure 18: Typical Powertrain Control Module (PCM)

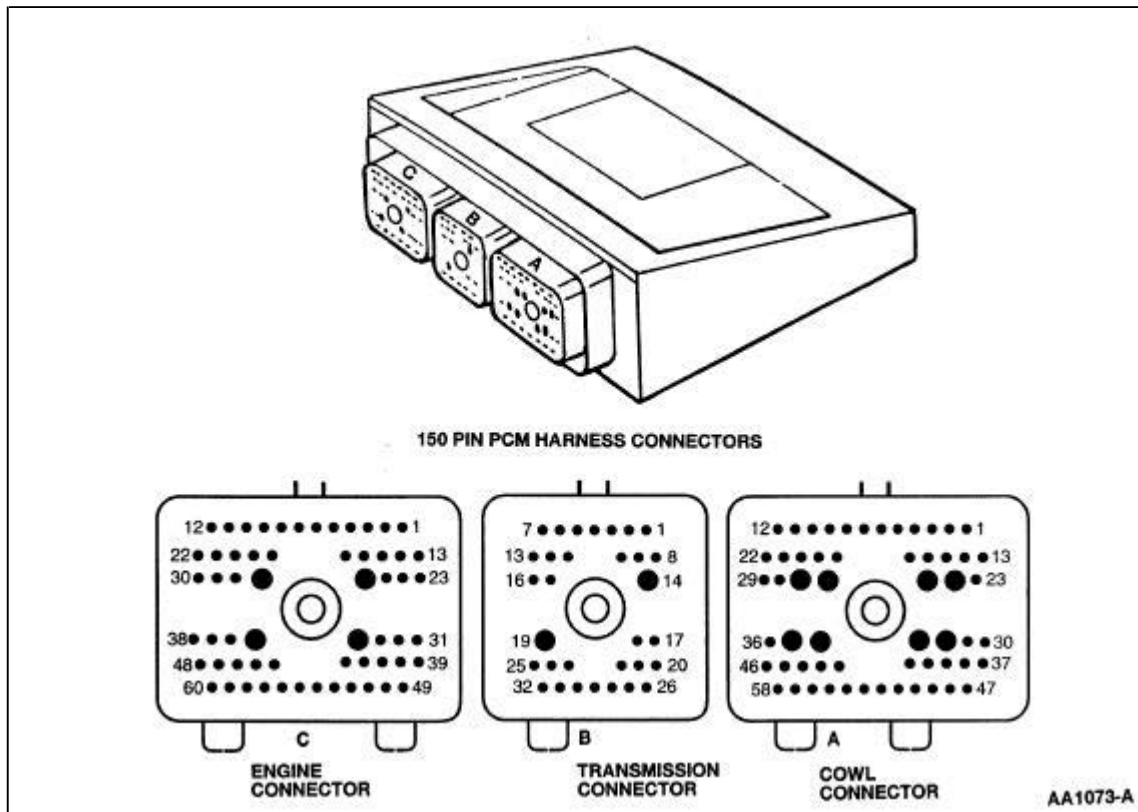


Figure 19: 150-Pin PCM

TABLE 1—150-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
VPWR	Voltage input to module	A-32
VPWR	Voltage input to module	A-33
PWRGND	Power ground	A-24
PWRGND	Power ground	A-25
PWRGND	Power ground	A-26
PWRGND	Power ground	A-27
CSEGND	Case ground	A-43
SIGRTN	Connector A signal return	A-17
SIGRTN	Connector B signal return	B-17
SIGRTN	Connector C signal return	C-17
VREF	Buffered 5V reference	A-20
VREF	Buffered 5V reference	C-20
KAPWR	Keep alive power	A-44
FEPS	Flash EPROM Programming Supply	A-13

Keep Alive Random Access Memory (RAM)

The PCM stores information in Keep Alive RAM (a memory integrated circuit chip) about vehicle operating conditions, and then uses this information to compensate for component variability. Keep Alive

RAM remains powered when the ignition switch is off so that this information is not lost.

Hardware Limited Operation Strategy (HLOS)

This system of special circuitry provides minimal engine operation should the PCM (mainly the central processing unit (CPU) or EEPROM) stop functioning correctly. All modes of Self-Test are not functional at this time. Electronic hardware is in control of the system while in HLOS.

HLOS Allowable Output Functions:

- Spark output controlled directly by the CKP signal.
- Fixed fuel pulse width synchronized with the CKP signal.
- Fuel pump relay energized.
- Idle speed control output signal functional.

HLOS Disabled Outputs To Default State:

- EGR solenoids
- No torque converter clutch lock-up

PCM Locations

- Focus - passenger side behind kick panel.
- Escort - passenger side under instrument panel.
- Cougar, Taurus/Sable, Windstar, 5.4L F-Series - behind glove compartment (access from engine compartment dash panel) on passenger side.
- Mustang - behind kick panel cover on passenger side, near instrument panel.
- Crown Victoria/Grand Marquis - behind kick panel cover on driver side, near instrument panel.
- Continental, Town Car - behind instrument panel (cowl), center to both driver and passenger sides.
- LS6/LS8 - above driver's feet, passenger side and near side cowl.
- Ranger, Escape - behind instrument panel (cowl), center to both driver and passenger sides.
- Explorer/Mountaineer - behind instrument panel (cowl), (access from engine compartment dash panel) on passenger side to center of vehicle.
- All other F-Series, Expedition/Navigator/Blackwood - lower dash panel on passenger side.
- Excursion - lower dash panel on driver side.
- All E-Series - lower dash panel on driver side.

Integrated Electronic Ignition System

The Integrated Electronic Ignition (EI) System consists of a crankshaft position (CKP) sensor, coil pack (s), connecting wiring, and PCM. The Coil On Plug (COP) Integrated EI System uses a separate coil for each spark plug and each coil is mounted directly onto the plug. The COP Integrated EI System eliminates the need for spark plug wires but does require input from the camshaft position (CMP) sensor.

Power and Ground Signals

Vehicle Power

When the ignition switch is turned to the START or RUN position, battery positive voltage (B+) is applied to the coil of the Electronic EC power relay. Since the other end of the coil is wired to ground, this

energizes the coil and closes the contacts of the Electronic EC power relay. Vehicle power (VPWR) is now sent to the PCM and the Electronic EC System as VPWR.

Vehicle Reference Voltage

The vehicle reference voltage (VREF) is a positive voltage (about 5.0 volts) that is output by the PCM. This is a consistent voltage that is used by the 3-wire sensors.

Mass Air Flow Return

The mass air flow return (MAF RTN) is a dedicated analog signal return from the mass air flow (MAF) sensor. It serves as a ground offset for the analog voltage differential input by the MAF sensor to the PCM.

Signal Return

The signal return (SIG RTN) is a dedicated ground circuit used by most Electronic EC sensors and some other inputs.

Power Ground

Power ground (PWR GND) is an electric current path return for VPWR voltage circuit. The purpose of the PWR GND is to maintain sufficient voltage at the PCM.

Gold Plated Pins

Note: Damaged gold terminals should only be replaced with new gold terminals.

Some engine control hardware has gold plated pins on the connectors and mating harness connectors to improve electrical stability for low current draw circuits and to enhance corrosion resistance. The electronic EC components equipped with gold terminals will vary by vehicle application.

PCM Inputs

Note: Transmission input, which are not described in this section are discussed in the respective transmission Workshop Manual.

Air Conditioning Cycling Switch

The air conditioning (A/C) cycling switch may be wired to either the ACCS or ACPSW PCM input. When the A/C cycling switch opens, the PCM will turn off the A/C clutch. For information on the specific function of the A/C cycling switch, refer to the Climate Control Group in the Workshop Manual.

The A/C cycling switch (ACCS) circuit to the PCM provides a voltage signal which indicates when the A/C is requested. When the A/C demand switch is turned on, and both the A/C cycling switch and the high pressure contacts of the A/C high pressure switch (if equipped and in circuit) are closed, voltage is supplied to the ACCS circuit at the PCM. Refer to the applicable Wiring Diagram Manual for vehicle specific wiring.

If the ACCS signal is not received by the PCM, the PCM circuit will not allow the A/C to operate. For additional information, refer to PCM outputs, wide open throttle air conditioning cutoff.

Note: Some applications do not have a dedicated (separate) input to the PCM indicating that A/C is requested. This information is received by the PCM through the BUS + and BUS - (SCP) communication.

Air Conditioning Pressure Sensor

The air conditioning pressure (A/C pressure) sensor (Figure 20) is located in the high pressure (discharge) side of the air conditioning A/C system. The A/C pressure sensor provides a voltage signal to the powertrain control module (PCM) that is proportional to the A/C pressure. The PCM uses this information for A/C clutch control, fan control and idle speed control.

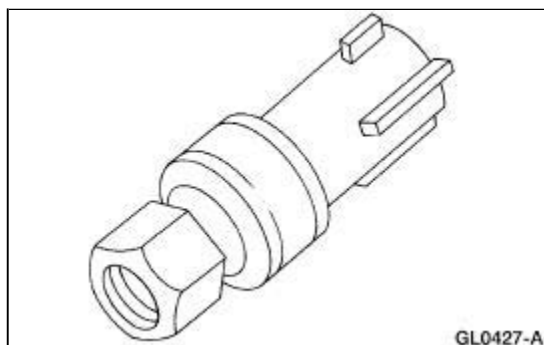
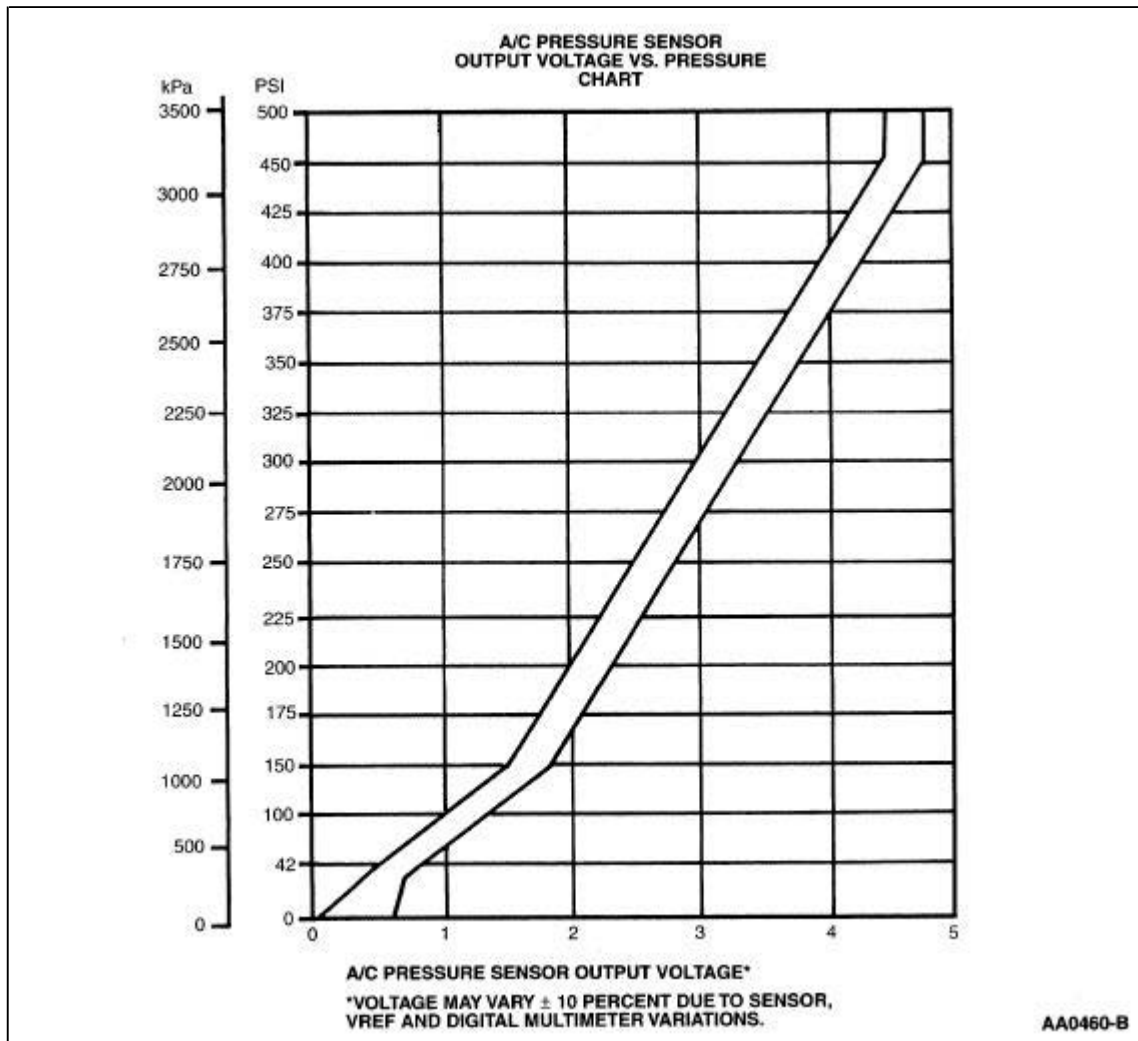


Figure 20: Typical Air Conditioning Pressure Sensor

Air Conditioning High Pressure Switch

The A/C high pressure switch is used for additional A/C system pressure control. The A/C high pressure switch is either dual function for two-speed electric fan applications or single function for all others.

For refrigerant containment control, the normally closed high pressure contacts open at a predetermined A/C pressure. This will result in the A/C turning off, preventing the A/C pressure from rising to a level that would open the A/C high pressure relief valve.

For fan control, the normally open medium pressure contacts close at a predetermined A/C pressure. This grounds the ACPSW circuit input to the PCM. The PCM will then turn on the high speed fan to help reduce the pressure.

For additional information, refer to the Climate Control Group in the Workshop Manual or the Wiring Diagram Manual.

Brake Pedal Position Switch

The brake pedal position (BPP) switch (Figure 21) is used by the PCM to disengage the transmission torque converter clutch and on some applications as an input to the idle speed control for idle quality. On most applications the BPP switch is hard wired to the PCM and supplies battery positive voltage (B+) when the vehicle brake pedal is applied. On other applications the BPP switch signal is broadcast over the SCP link via another module to be received by the PCM.

On applications where the BPP switch is hard wired to the PCM and stoplamp circuit, if all stoplamp bulbs are burned out (open), high voltage is present at the PCM due to a pull-up resistor in the PCM. This provides fail-safe operation in the event the circuit to the stoplamp bulbs has failed.

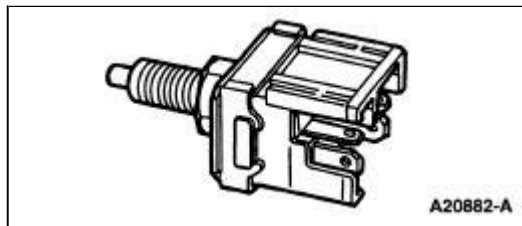


Figure 21: Brake Pedal Position Switch

Camshaft Position Sensor

The camshaft position (CMP) sensor detects the position of the camshaft. The CMP sensor identifies when piston No. 1 is on its compression stroke. A signal is then sent to the powertrain control module (PCM) and used for synchronizing the firing of sequential fuel injectors. The Coil On Plug (COP) Ignition applications also use the CMP signal to select the proper ignition coil to fire. The input circuit to the PCM is referred to as the CMP input or circuit.

There are two types of CMP sensors: the three pin connector Hall-effect type sensor (Figure 22) and the two pin connector variable reluctance sensor (Figure 23).

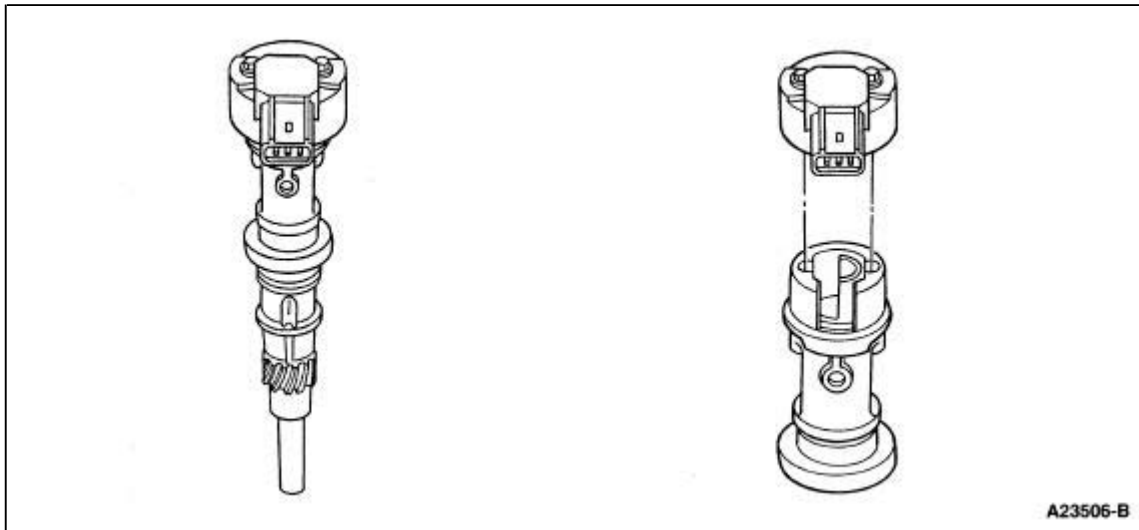


Figure 22: Typical Hall-Effect Sensor

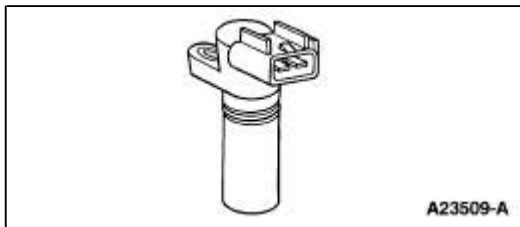


Figure 23: Typical Variable Reluctance Sensor

Clutch Pedal Position Switch

The clutch pedal position (CPP) switch (Figure 24) is an input to the PCM indicating the clutch pedal position and, in some manual transmission applications, both the clutch pedal engagement position and the gear shift position. The PCM provides a 5-volt reference (VREF) signal to the CPP switch and/or a park/neutral position (PNP) switch (on the CPP signal line). If the CPP switch (either or both CPP and PNP switches are closed) is closed, indicating the clutch pedal is engaged and the shift lever is in the NEUTRAL position, the output voltage (5 volts) from the PCM is grounded through the signal return line to the PCM, and there is 1 volt or less. One volt or less indicates there is a reduced load on the engine. If the CPP switch (or PNP switch on vehicle or both CPP and PNP switches open on the vehicle) is open, meaning the clutch pedal is disengaged (all systems) and the shift lever is not in NEUTRAL position (PNP switch systems), the input on the CPP signal to the PCM will be approximately 5 volts. Then, the 5-volt signal input at the PCM will indicate a load on the engine. The PCM uses the load information in mass air flow and fuel calculations.

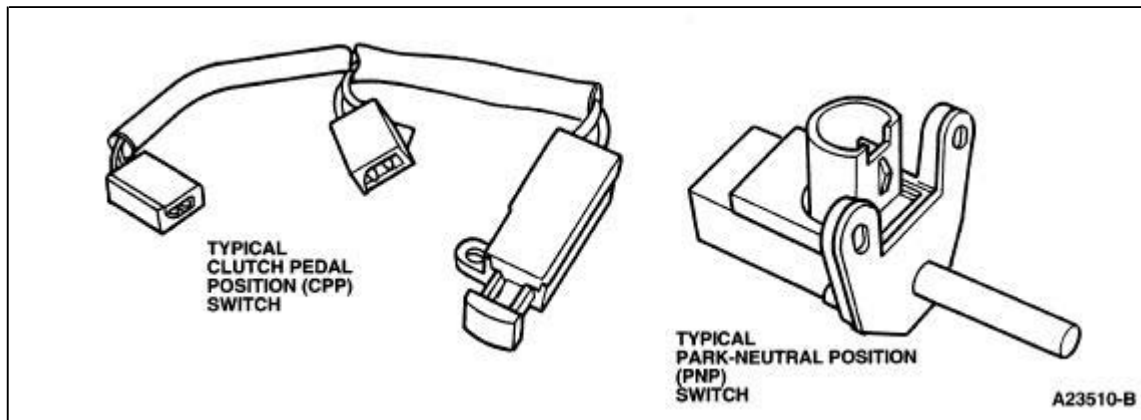


Figure 24: Clutch Pedal Position (CPP) Switch

Crankshaft Position Sensor (Integrated Ignition Systems)

The crankshaft position (CKP) sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the powertrain control module (PCM). The trigger wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L ten cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the trigger wheel, the CKP indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to fixed reference (Figure 25).

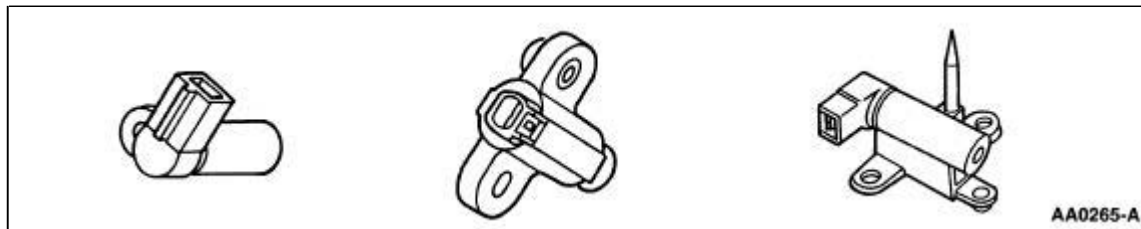


Figure 25: Three Different Types of Crankshaft Position (CKP) Sensors

Cylinder Head Temperature Sensor

The cylinder head temperature (CHT) sensor (Figure 26) is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as temperature increases, and increases as temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow.

Voltage that is dropped across a fixed resistor in series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The cylinder head temperature (CHT) sensor is installed in the aluminum cylinder head and measures the metal temperature. The CHT sensor can provide complete engine temperature information and can be used to infer coolant temperature. If the CHT sensor conveys an overheating condition to the PCM,

the PCM would then initiate a fail-safe cooling strategy based on information from the CHT sensor. A cooling system failure such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Using both the CHT sensor and fail-safe cooling strategy, the PCM prevents damage by allowing air cooling of the engine and limp home capability. For additional information, refer to Powertrain Control Software for Fail-Safe Cooling Strategy details.

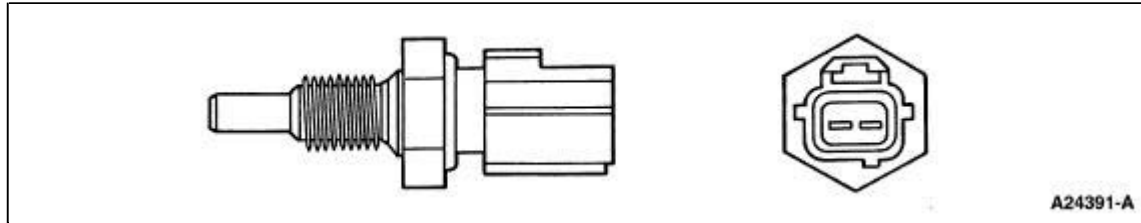


Figure 26: Cylinder Head Temperature (CHT) Sensor

Differential Pressure Feedback EGR Sensor

For information on the differential pressure feedback EGR sensor, refer to the description of the Exhaust Gas Recirculation Systems.

Engine Coolant Temperature

The engine coolant temperature (ECT) sensor (Figure 27) is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow.

Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The ECT measures the temperature of the engine coolant. The sensor is threaded into an engine coolant passage. The ECT sensor is similar in construction to the IAT sensor.



Figure 27: Engine Coolant Temperature (ECT) Sensor

Engine Fuel Temperature Sensor

The engine fuel temperature (EFT) sensor (Figure 28) is a thermistor device in which resistance

changes with temperature. The electrical resistance of a thermistor decreases as temperature increases, and increases as temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow.

Voltage that is dropped across a fixed resistor in series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The EFT sensor measures the temperature of the fuel near the fuel injectors. This signal is used by the PCM to adjust the fuel injector pulse width and meter fuel to each engine combustion cylinder.

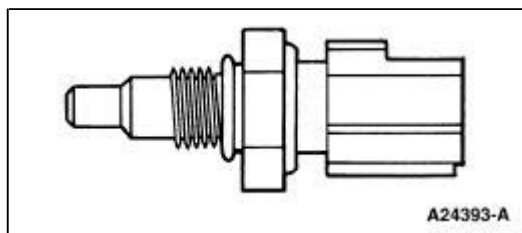


Figure 28: Engine Fuel Temperature (EFT) Sensor used on the 4.6L NG Crown Victoria

Engine Oil Temperature

The engine oil temperature (EOT) sensor (Figure 29) is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases and increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow.

Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The EOT measures the temperature of the engine oil. The EOT sensor is similar in construction to the engine coolant temperature (ECT) sensor. On some applications, EOT input to the PCM is used to initiate a soft engine shutdown. This prevents engine damage from occurring as a result of high oil temperature.



Figure 29: Engine Oil Temperature (EOT) Sensor

Flexible Fuel Sensor

The flexible fuel (FF) sensor (Figure 30) is a capacitive device that detects the dielectric constant, conductivity and temperature of the fuel being fed to the engine. From this information, the FF sensor generates a duty cycle frequency that it supplies to the PCM telling it the percentage of ethanol in the fuel.

In general, as the percentage of ethanol in the fuel mixture increases, the output frequency of the FF sensor signal increases. The relationship between ethanol alcohol percentage and duty cycle frequency is as follows:

Ethanol Alcohol Percentage	Duty Cycle Frequency
0 %	50 Hz
25 %	75 Hz
50 %	100 Hz
75 %	125 Hz
100 %	150 Hz

All duty cycle frequency values are +/-5%. It is important to note that currently no fuel with greater than 85% ethanol alcohol content is being produced. The PCM uses the percent ethanol information to calculate the correct A/F (air/fuel) ratio and spark advance for the vehicle.

Beginning in the 2001 model year, not all vehicles are equipped with flexible fuel sensors. On vehicles without flexible fuel sensors, the PCM calculates the A/F ratio based upon HO2S input signals.

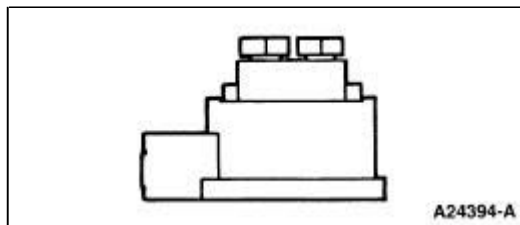


Figure 30: Flexible Fuel (FF) Sensor

Fuel Level Input

The fuel level input (FLI) is a hard wire signal input to the PCM from the fuel pump (FP) module. Refer to the description of the FLI in the On-Board Diagnostics II Monitors.

Fuel Pump Monitor

Applications Using a Fuel Pump Relay for Fuel Pump On/Off Control

The Fuel Pump Monitor (FPM) circuit is spliced into the fuel pump power (FP PWR) circuit and is used by the PCM for diagnostic purposes. The PCM sources a low current voltage down the FPM circuit. With the fuel pump off, this voltage is pulled low by the path to ground through the fuel pump. With the fuel pump off and the FPM circuit low, the PCM can verify that the FPM circuit and the FP PWR circuit are

complete from the FPM splice through the fuel pump to ground. This also confirms that the FP PWR or FPM circuits are not shorted to power. With the fuel pump on, voltage is now being supplied from the fuel pump relay to the FP PWR and FPM circuits. With the fuel pump on and the FPM circuit high, the PCM can verify that the FP PWR circuit from the fuel pump relay to the FPM splice is complete. It can also verify that the fuel pump relay contacts are closed and there is a B+ supply to the fuel pump relay.

Fuel Pump Driver Module Applications

The fuel pump driver module (FPDM) communicates diagnostic information to the powertrain control module (PCM) through the Fuel Pump Monitor (FPM) circuit. This information is sent by the FPDM as a duty cycle signal. The three duty cycle signals that may be sent are listed in the following table.

FUEL PUMP DRIVER MODULE DUTY CYCLE SIGNALS

Duty Cycle ^a	On Time (mSec)	Comments	FP_M PID (on some scan tools) ^b
50%	500	"All OK" output from FPDM. With this input, the PCM can verify that the FPDM is powered and able to communicate on the FPM circuit.	80-125%
25%	250	FPDM did not receive a Fuel Pump (FP) duty cycle command from the PCM, or the duty cycle that was received was invalid (refer to PCM Outputs, Fuel Pump).	15-60%
75%	750	The FPDM has detected a fault in the circuits between the fuel pump and FPDM.	250-400%

^a If a duty cycle meter and breakout box is used, be aware that these values may be reversed depending on the trigger setting of the specific meter (for example, 25% from FPDM may read as 75% on duty cycle meter depending on trigger setting).

^b Value will fluctuate randomly. It is ok for value to briefly go outside this range, then return.

Fuel Tank Pressure Sensor

For information on the fuel tank pressure (FTP) sensor, refer to the description of the Evaporative Emission Systems.

Fuel Rail Pressure Sensor

The fuel rail pressure (FRP) sensor (Figure 31) is a diaphragm strain gauge device in which resistance changes with pressure. The electrical resistance of a strain gauge increases as pressure increases, and decreases as pressure decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to pressure.

Strain gauge type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow.

Voltage that is dropped across a fixed resistor in series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The FRP sensor measures the pressure of the fuel near the fuel injectors. This signal is used by the PCM to adjust the fuel injector pulse width and meter fuel to each engine combustion cylinder.

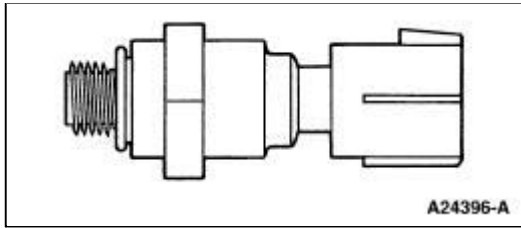


Figure 31: Fuel Rail Pressure (FRP) Sensor on the 4.6L NG Crown Victoria

The fuel rail pressure (FRP) sensor (Figure 32) senses the pressure difference between the fuel rail and the intake manifold. The return fuel line to the fuel tank has been deleted in this type of fuel system. The differential fuel/intake manifold pressure together with measured fuel temperature provides an indication of the fuel vapors in the fuel rail. Both differential pressure and temperature feedback signals are used to control the speed of the fuel pump. The speed of the fuel pump sustains fuel rail pressure which preserve fuel in its liquid state. The dynamic range of the fuel injectors increase because of the higher rail pressure, which allows the injector pulse width to decrease.

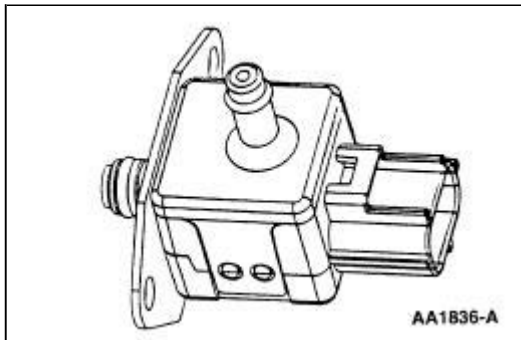


Figure 32: Fuel Rail Pressure (FRP) Sensor

Generator Monitor (Gen Mon)

For information on the generator monitor, refer to the description of the PCM/Controlled Charging System.

Generator Load

The Generator Load Input (GLI) circuit is used by the PCM to determine generator load on the engine. As generator load increases the PCM will adjust idle speed accordingly. This strategy helps reduce idle surges due to switching high current loads. The GLI signal is sent to the PCM from the voltage regulator/generator. The signal is a variable frequency duty cycle. Normal operating frequency is 40 - 250 Hz. Normal signal DC voltage (referenced to ground) is between 1.5 V (low generator load) and 10.5 V (high generator load).

Heated Oxygen Sensor

The heated oxygen sensor (HO2S) (Figure 33) detects the presence of oxygen in the exhaust and produces a variable voltage according to the amount of oxygen detected. A high concentration of oxygen (lean air/fuel ratio) in the exhaust produces a low voltage signal less than 0.4 volt. A low concentration of oxygen (rich air/fuel ratio) produces a high voltage signal greater than 0.6 volt. The HO2S provides feedback to the PCM indicating air/fuel ratio in order to achieve a near stoichiometric air/fuel ratio of

14.7:1 during closed loop engine operation. The HO₂S generates a voltage between 0.0 and 1.1 volts.

Embedded with the sensing element is the HO₂S heater. The heating element heats the sensor to temperatures of 800°C (1400°F). At approximately 300°C (600 °F) the engine can enter closed loop operation. The VPWR circuit supplies voltage to the heater and the PCM will complete the ground when the proper conditions occur. For model year 1998 a new HO₂S heater and heater control system are installed on some vehicles. The high power heater reaches closed loop fuel control temperatures. The use of this heater requires that the HO₂S heater control be duty cycled, to prevent damage to the heater. The 6 ohm design is **not** interchangeable with new style 3.3 ohm heater.

Town Car and Crown Victoria/Grand Marquis

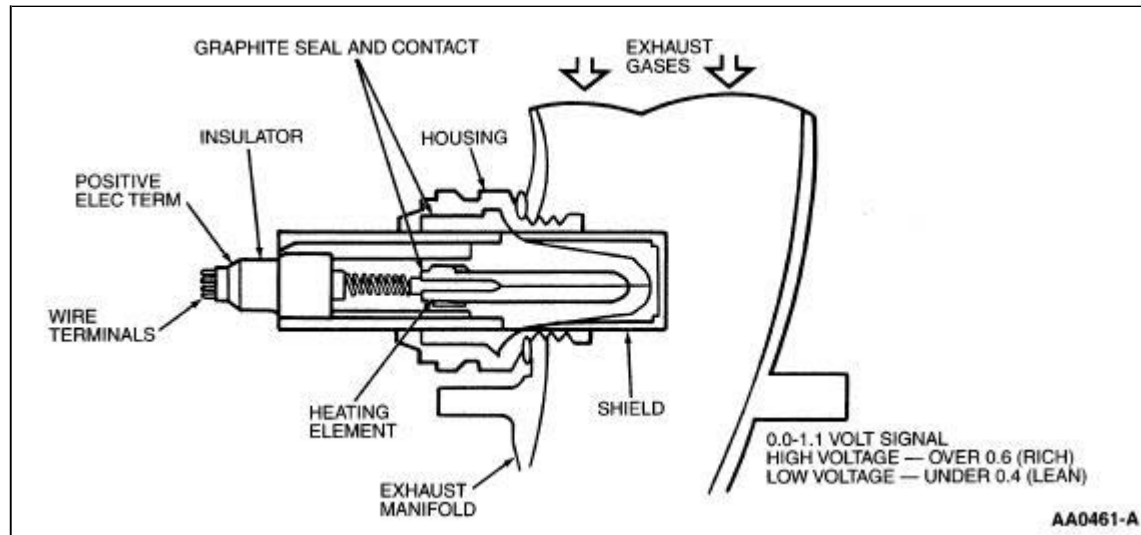


Figure 33: Heated Oxygen Sensor (HO₂S)

Intake Air Temperature Sensor

The intake air temperature (IAT) sensors (Figure 34) and integrated MAF type (Figure 37), are thermistor devices in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow.

Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The IAT provides air temperature information to the PCM. The PCM uses the air temperature information as a correction factor in the calculation of fuel, spark and MAF.

The IAT sensor provides a quicker temperature change response time than the ECT or CHT sensor.

Supercharged 5.4L Lightning vehicles use (2) IAT sensors. Both sensors operate as described above. However, one is located before the supercharger at the air cleaner for standard OBD II/cold weather input, while a second sensor (IAT2) is located after the supercharger in the intake manifold. The IAT2 sensor located after the supercharger provides air temperature information to the PCM to control border-line spark and to help determine intercooler efficiency.

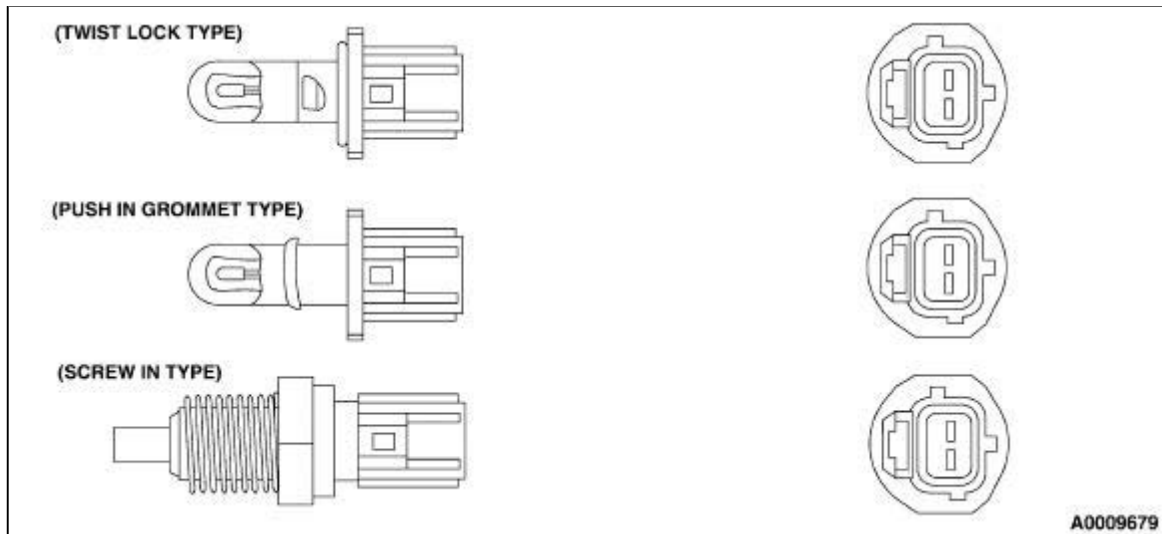


Figure 34: Intake Air Temperature (IAT)

Intake Manifold Runner Control

For information on the intake manifold runner control (IMRC), refer to the description of the Intake Air Systems.

Intake Manifold Swirl Control

For information on the intake manifold swirl control (IMSC), refer to the description of the Intake Air Systems.

Intake Manifold Tuning Valve

For information on the intake manifold tuning valve(IMTV), refer to the description of the Intake Air Systems.

Knock Sensor

The knock sensor (KS) (Figure 35) is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The PCM uses this signal to determine the presence of engine knock and to retard spark timing.

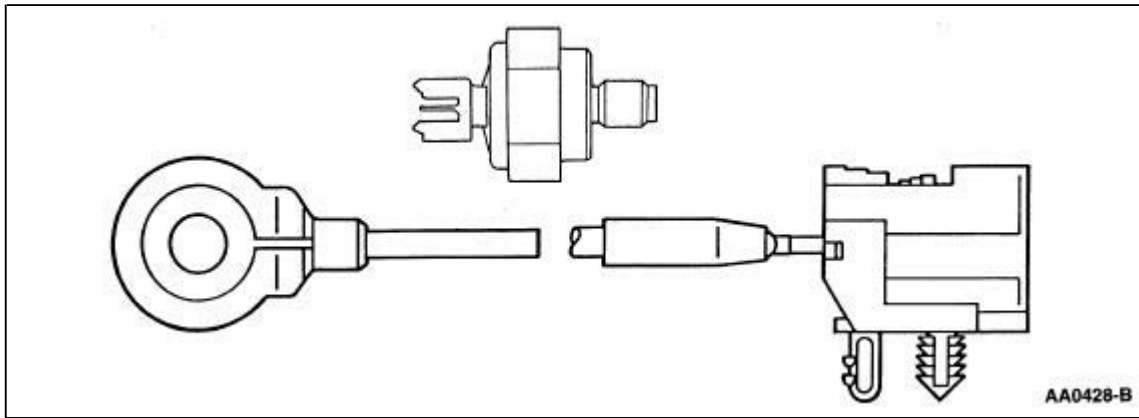


Figure 35: Two Types of Knock Sensor (KS)

Mass Air Flow Sensor

The mass air flow (MAF) sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above ambient temperature as measured by a constant cold wire (Figure 36). If the hot wire electronic sensing element must be replaced, then the entire assembly must be replaced. Replacing only the element may change the air flow calibration.

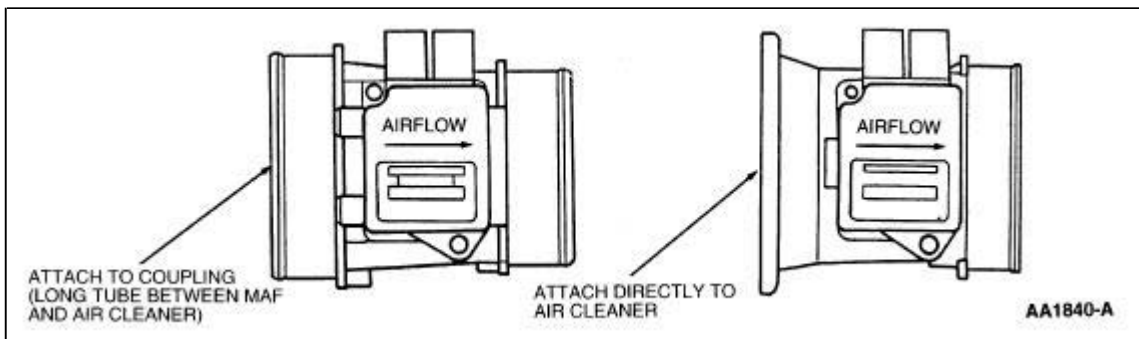


Figure 36: Typical Mass Air Flow (MAF) Sensor

The current required to maintain the temperature of the hot wire is proportional to the air mass flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio (Figure 37). This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

Some MAF sensors have integrated bypass technology (IBT) with an integrated intake air temperature (IAT) sensor. The present applications with IBT are: Focus, Escort (4V), 2.0L Cougar, Escape, Taurus/Sable, Windstar, Explorer/Mountaineer and E-Series.

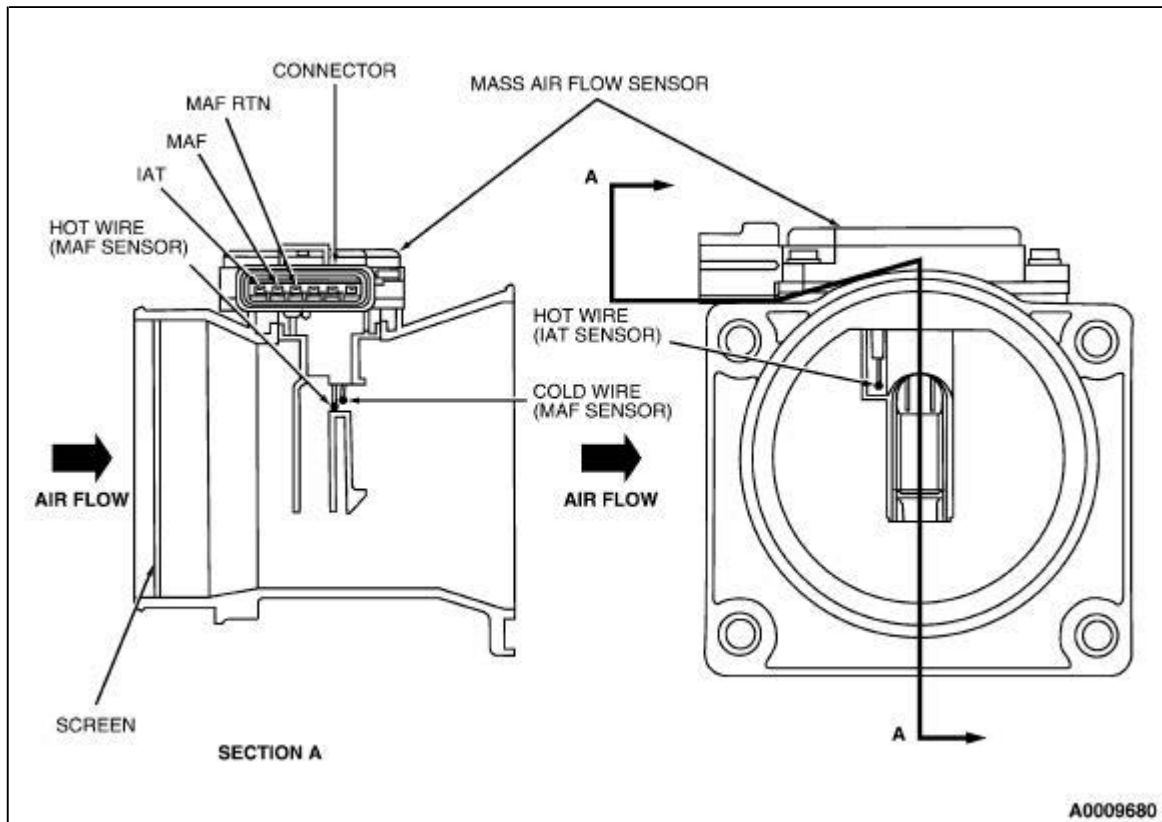


Figure 37: Diagram of Air Flow through Throttle Body contacting MAF sensor hot and cold wire (and IAT sensor wire where applicable) terminals.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly.

Output Shaft Speed Sensor

The Output Shaft Speed Sensor (OSS), provides the Powertrain Control Module (PCM) with information about the rotational speed of an output shaft. The (PCM) uses the information to control and diagnose powertrain behavior. In some applications, the sensor is also used as the source of vehicle speed. The sensor may be physically located in different places on the vehicle, depending upon the specific application. The design of each speed sensor is unique and depends on which powertrain control feature uses the information generated.

Power Steering Pressure Switch

The power steering pressure (PSP) switch (Figure 38) monitors the hydraulic pressure within the power steering system. The PSP switch is a normally closed switch that opens as the hydraulic pressure increases. The PCM uses the input signal from the PSP switch to compensate for additional loads on the engine by adjusting the idle rpm and preventing engine stall during parking maneuvers. Also, the PSP switch signals the PCM to adjust transmission electronic pressure control (EPC) pressure during the increased engine load, for example during parking maneuvers.

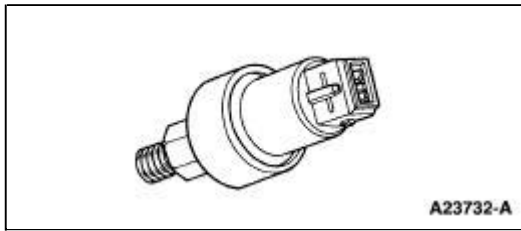


Figure 38: Power Steering Pressure (PSP) Switch

Power Steering Pressure Sensor

The power steering pressure (PSP) sensor (Figure 39) monitors the hydraulic pressure within the power steering system. The PSP sensor voltage input to the PCM will change as the hydraulic pressure changes. The PCM uses the input signal from the PSP sensor to compensate for additional loads on the engine by adjusting the idle rpm and preventing engine stall during parking maneuvers. Also, the PSP sensor signals the PCM to adjust transmission electronic pressure control (EPC) pressure during the increased engine load, for example during parking maneuvers.

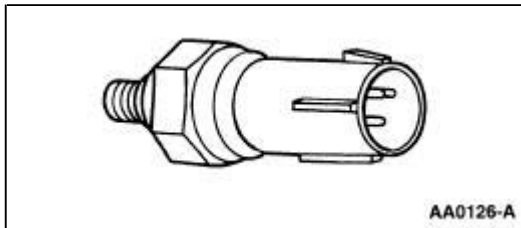


Figure 39: Power Steering Pressure (PSP) Sensor

Power Take-Off Switch and Circuit

The Power Take-Off (PTO) circuit (Figure 40) is used by the PCM to disable some of the OBD II Monitors during PTO operation. The PTO circuit normally carries low voltage. When the PTO switch is on/closed, B+ is supplied to the PTO input circuit indicating to the PCM that an additional load is being applied to the engine. If this action was not reported by the PTO circuit, a false Diagnostic Trouble Code may be stored.

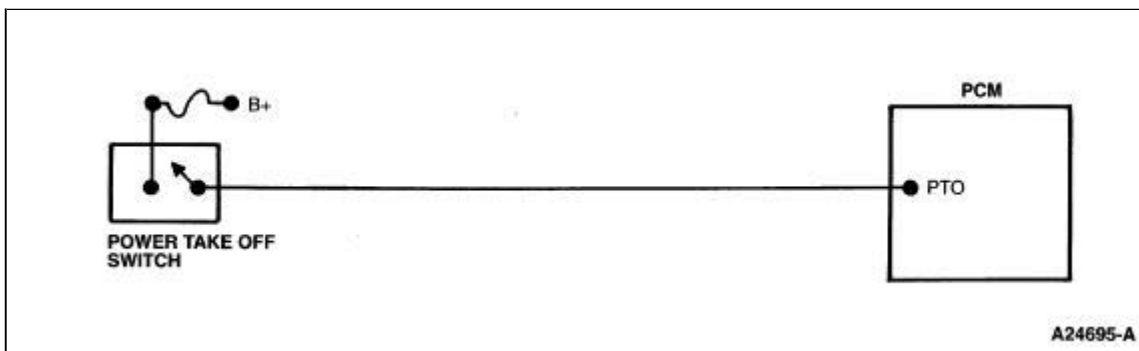


Figure 40: Power Take-Off (PTO) Switch and Circuit to PCM

Purge Flow Sensor

For information on the purge flow (PF) sensor, refer to the description of the Evaporative Emission Systems.

Thermal Manifold Absolute Pressure Sensor

The Thermal Manifold Absolute Pressure Sensor (TMAP) (Figure 41) consists of a manifold absolute pressure (MAP) sensor and an integrated thermistor. The thermistor part of the sensor is currently not being used. The MAP part of the sensor measures intake manifold air absolute pressure. The PCM uses information from the MAP sensor, throttle position (TP) sensor, mass air flow (MAF) sensor, engine coolant temperature (ECT) or cylinder head temperature (CHT) sensor and crankshaft position (CKP) sensor to determine how much exhaust gas is introduced into the intake manifold.

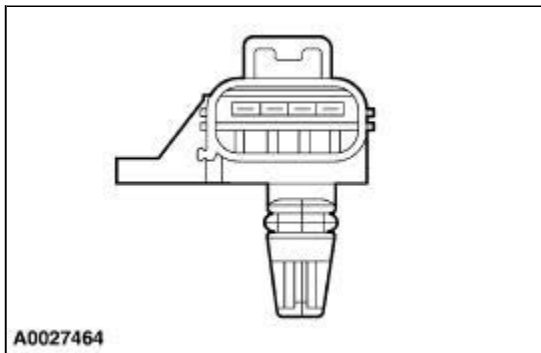


Figure 41: Thermal Manifold Absolute Pressure (TMAP) Sensor

Throttle Position Sensor

The throttle position (TP) sensor (Figure 42) is a rotary potentiometer sensor that provides a signal to the PCM that is linearly proportional to the throttle plate/shaft position. The sensor housing has a three-blade electrical connector that may be gold plated. The gold plating increases corrosion resistance on terminals and increases connector durability. The TP sensor is mounted on the throttle body. As the TP sensor is rotated by the throttle shaft, four operating conditions are determined by the PCM from the TP. Those conditions are closed throttle (includes idle or deceleration), part throttle (includes cruise or moderate acceleration), wide open throttle (includes maximum acceleration or de-choke on crank), and throttle angle rate.

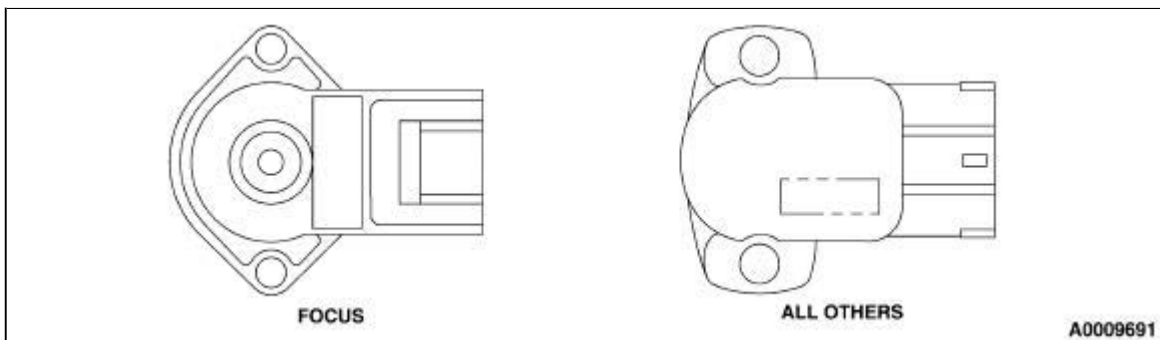


Figure 42: Typical Throttle Position (TP) Sensor

Transmission Control Switch

The transmission control switch (TCS) (Figures 43 and 44) signals the PCM with keypower whenever the TCS is pressed. On vehicles with this feature, the transmission control indicator lamp (TCIL) lights when the TCS is cycled to disengage overdrive. The operator of the vehicle controls the position of the TCS.

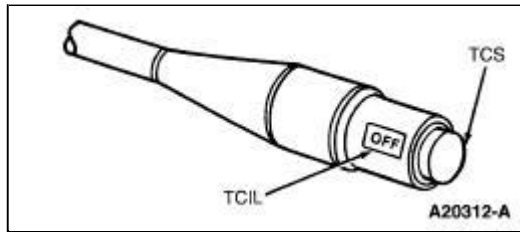


Figure 43: Transmission Control Switch (TCS)

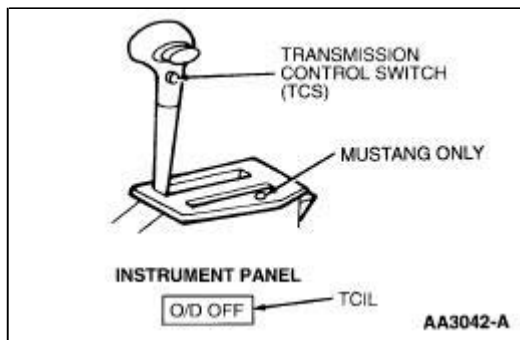


Figure 44: Transmission Control Switch (TCS)

Solid State Relay

For information on the solid state relay, refer to the description of the Secondary Air Injection Systems.

Vehicle Speed Sensor

The vehicle speed sensor (VSS) (Figure 45) is a variable reluctance or Hall-effect sensor that generates a waveform with a frequency that is proportional to the speed of the vehicle. If the vehicle is moving at a relatively low velocity, the sensor produces a signal with a low frequency. As the vehicle velocity increases, the sensor generates a signal with a higher frequency. The PCM uses the frequency signal generated by the VSS (and other inputs) to control such parameters as fuel injection, ignition control, transmission/transaxle shift scheduling and torque converter clutch scheduling.

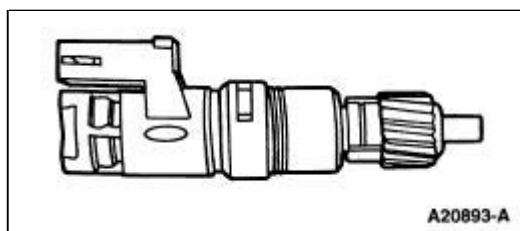


Figure 45: Typical Vehicle Speed Sensor (VSS)

4x4 Mode Switch

The generic electronic module (GEM) provides the PCM with an indication of 4x4L. This input is used to adjust the shift schedule. A 5.0 volt module pull-up indicates 4x4H or 2WD (Figure 44).



A0013922

Figure 46: Typical 4x4 Switch

PCM Outputs

Note: Transmission outputs which are not described in this section are discussed in the Transmission/Powertrain Group, transmission section in the Workshop Manual.

Canister Vent Solenoid

For information on the canister vent solenoid, refer to the description of the Evaporative Emission System.

Coil Pack

A coil in a coil pack (Figure 47) is turned on (for example is coil charging) by the PCM, and is turned off when firing two spark plugs at once. The spark plugs are paired so that as one spark plug fires on the compression stroke, the other spark plug fires on the exhaust stroke. The next time the coil is fired the order is reversed. The next pair of spark plugs fire according to the engine firing order.

Coil On Plug

The coil on plug (COP) (Figure 48) ignition operates similar to standard coil pack ignition except each plug has one coil per plug. COP has three different modes of operation: engine crank, engine running, and CMP Failure Mode Effects Management (FMEM).

Engine Crank/Engine Running

During engine crank the PCM will fire two spark plugs simultaneously. Of the two plugs simultaneously fired one will be under compression the other will be on the exhaust stroke. Both plugs will fire until camshaft position is identified by a successful camshaft position sensor signal. Once camshaft position is identified, only the cylinder under compression will be fired.

CMP FMEM

During CMP FMEM the COP ignition works the same as during engine crank. This allows the engine to operate without the PCM knowing if cylinder one is under compression or exhaust.

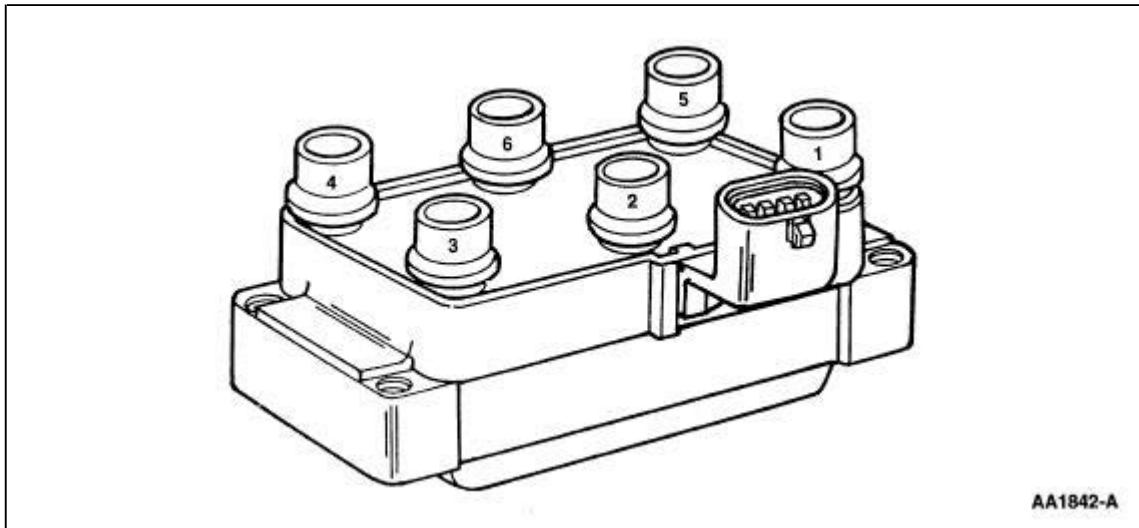


Figure 47: Six-Tower Coil Pack

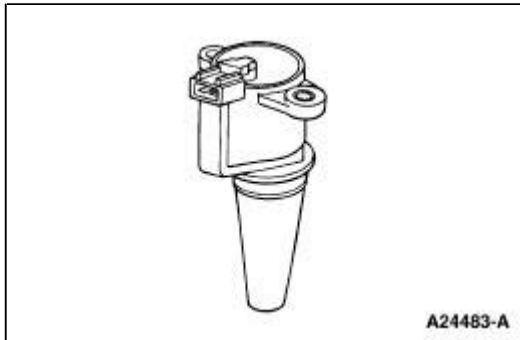


Figure 48: Coil On Plug

Engine Cooling Fan Control

The PCM monitors certain parameters (such as engine coolant temperature, vehicle speed, A/C on/off status, A/C pressure, etc) to determine engine cooling fan needs. The PCM controls the fan operation through the Fan Control (FC) (single speed fan applications), Low Fan Control (LFC), Medium Fan Control (MFC) and/or High Fan Control (HFC) outputs.

EGR Vacuum Regulator Solenoid

For information on the EGR vacuum regulator (EVR) solenoid, refer to the description of the Exhaust Gas Recirculation Systems.

Electric Secondary Air Injection Pump

For information on the electric secondary air injection pump, refer to the description of the Secondary Air Injection Systems.

Evaporative Emission Canister Purge Valve

For information on the Evaporative Emission (EVAP) canister purge valve, refer to the description of the Evaporative Emission Systems.

Fuel Cap Off Indicator Lamp

The Fuel Cap Off Indicator Lamp (FCIL) is an output signal that is controlled by the PCM and will illuminate when the strategy determines that there is a failure in the vapor management system due to the fuel filler cap not being sealed properly. This would be detected by the inability to pull vacuum in the fuel tank, after a fueling event.

Note: The Escape, Windstar, Mustang, Continental, Town Car and Lincoln LS6/LS8 do not have a dedicated (separate) output wire from the PCM to the instrument cluster. The PCM commands the FCIL on and off through the BUS +/- circuits (SCP).

Fuel Pump

Applications Using a Fuel Pump Relay for Fuel Pump On/Off Control

The Fuel Pump (FP) is a PCM output signal that is used to control the electric fuel pump. With the electronic EC power relay contacts closed, vehicle power (VPWR) is sent to the coil of the fuel pump relay. For electric fuel pump operation, the PCM grounds the FP circuit, which is connected to the coil of the fuel pump relay. This energizes the coil and closes the contacts of the relay, sending B+ through the FP PWR circuit to the electric fuel pump. When the ignition key is turned on, the electric fuel pump runs for about one second, but is then turned off by the PCM if engine rotation is not detected.

For applications with two speed fuel pumps, a normally closed low speed fuel pump relay (Figure 49) is wired into the fuel pump ground circuit. With the low speed fuel pump relay contacts in the normally closed position, there is no extra resistance in the ground circuit for high speed operation. For low speed fuel pump operation, the PCM will ground the Low Fuel Pump (LFP) circuit, which opens the relay contacts. With the relay contacts open, the fuel pump ground circuit now passes through a resistor that is wired into the circuit.

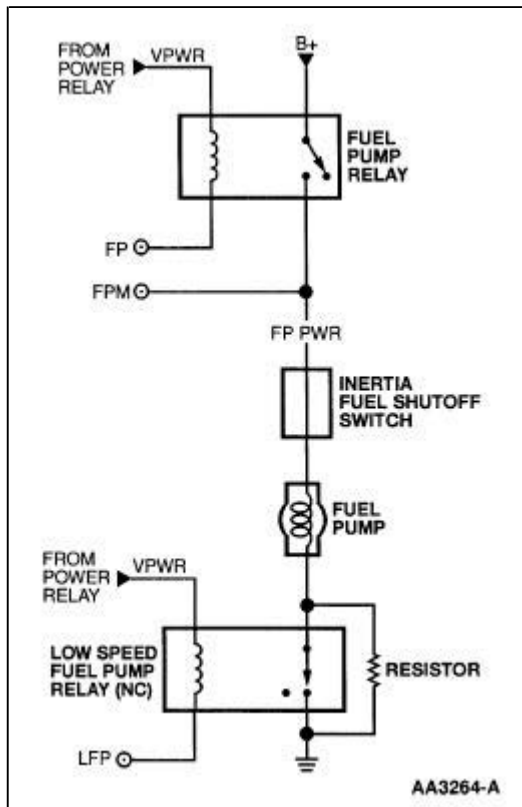


Figure 49: Low Speed Fuel Pump Relay Wiring

Fuel Pump Driver Module Applications (and Applications with Fuel Pump Functions Incorporated in Rear Electronic Module)

Note: For the LS6/LS8, the FPDM functions are incorporated in the Rear Electronic Module (REM). Fuel pump operation is the same as applications using the stand-alone FPDM. The REM will, however, communicate diagnostic information through the BUS +/- circuits (SCP) instead of using a fuel pump monitor (FPM) circuit.

The Fuel Pump (FP) signal is a duty cycle command sent from the powertrain control module (PCM) to the fuel pump driver module (FPDM) (Table 2). The FPDM uses the FP command to operate the fuel pump at the speed requested by the PCM or to turn the pump off.

TABLE 2—FUEL PUMP DUTY CYCLE OUTPUT FROM PCM

FP Duty Cycle Command	PCM Status	FPDM Actions
0-5%	PCM will not output this duty cycle.	Invalid FP duty cycle. FPDM will send 25% duty cycle signal on the fuel pump monitor (FPM) circuit. The fuel pump will be off.
5-51%	Normal operation.	FPDM will operate the fuel pump at the speed requested. "FP duty cycle" x 2 = pump speed % of full on. (for example FP duty cycle = 42%. 42x2=84. Pump is run at 84% of full on). FPDM will send 50% duty cycle signal on FPM circuit.
51-67.5%	PCM will not output this duty cycle.	Invalid FP duty cycle. FPDM will send 25% duty cycle signal on the fuel pump monitor (FPM) circuit. The fuel pump will be off.

67.5-82.5%	To request the fuel pump off, the PCM will output a 75% duty cycle.	Valid fuel pump off command from PCM. FPDM will not operate the fuel pump. FPDM will send a 50% duty cycle signal on the FPM circuit.
82.5-100%	PCM will not output this duty cycle.	Invalid FP duty cycle. FPDM will send 25% duty cycle signal on the FPM circuit. The fuel pump will be off.

NOTE: Also refer to PCM Inputs, Fuel Pump Monitor and Powertrain Control Hardware, Fuel Pump Driver Module.

Fuel Injectors

For information on the fuel injectors, refer to the description of the Fuel Systems.

Fuel Pressure Regulator Control Solenoid

For information on the fuel pressure regulator control (FPRC) solenoid, refer to the description of the Fuel Systems.

Generator Communication (Gen Com)

For information on the generator (Gen Com), refer to the description of PCM/Controlled Charging System.

Hydraulic Cooling Fan Drive

The system consists of an engine-driven pump with an integral solenoid (Figure 50) on the pump that is triggered by the powertrain control module (PCM). Fan speed is controlled by adjusting current to the solenoid, which then changes the fluid flow to the hydraulic motor. More current means the solenoid opens up, allowing higher pressure to increase the fan speed. The fan always turns due to solenoid current leakage, even in cold engine cases. The motor is driven by the pump. It contains a shaft on which the fan mounts. The motor also contains quick connect fittings for the high pressure lines. The cooler is similar to the power steering cooler (same purpose and function, to keep the fluid cool).

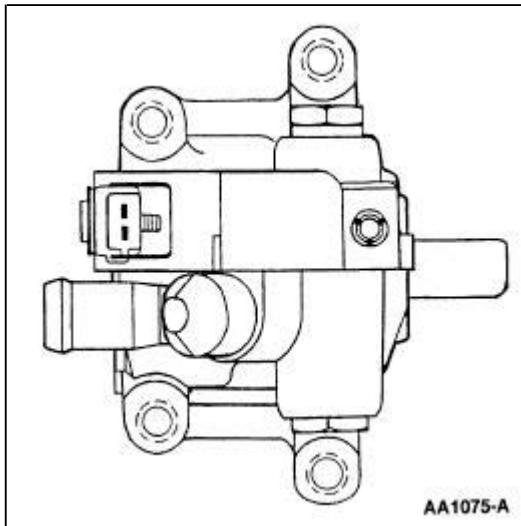


Figure 50: Hydraulic Cooling Fan Pump with Integral Solenoid

Idle Air Control Solenoid

For information on the idle air control solenoid, refer to the description of the Intake Air Systems.

Intake Manifold Runner Control

For information on the intake manifold runner control, refer to the description of the Intake Air Systems.

Intake Manifold Swirl Control

For information on the intake manifold swirl control, refer to the description of the Intake Air Systems.

Intake Manifold Tuning Valve

For information on the intake manifold tuning valve, refer to the description of the Intake Air Systems.

Secondary Air Injection Bypass Solenoid

For information on the secondary air injection bypass solenoid, refer to the description of the Secondary Air Injection Systems.

Solid State Relay

For information on the solid state relay, refer to the description of the Secondary Air Injection Systems.

Thermostat Heater Control

The primary objective for the thermostat heater control is for improvement in fuel economy and thermal

efficiency. The system consists of a high temperature (98°C/208°F in lieu of a 90°C/194°F) thermostat (Figure 51) that has a resistive heater within the wax element. The heater is controlled by the PCM dependent on engine speed, throttle position, engine load, vehicle speed, air charge temperature, transmission oil temperature and engine coolant temperature.

During low speed, low load and low air charge temperature conditions, the thermostat heater is OFF and the engine is allowed to operate at an elevated coolant temperature. This should result in lower internal friction and higher thermal efficiency, both leading to improved fuel economy.

During high speed, high load, high temperature conditions (air charge, transmission oil or engine coolant), the PCM output is energized with a duty cycle to the thermostat heater. This heats the wax and forces the thermostat to rapidly open wider allowing extra coolant to flow from the radiator. This will reduce the coolant temperature and improve with performance demand.

It should be noted that the heater is only capable of supplying a SMALL amount of additional heat to the wax element; it is NOT capable of opening the thermostat alone. The thermostat is 100% duty cycle for short calibrated time and then the duty cycle is reduced to a maximum of 70% on and 30% off.

Approximately, unheated, the thermostat will begin to open at a coolant temperature of 98°C (208°F) and will be fully open at 115°C (239°F). Energizing the heater will reduce the opening temperature to about 80°C (176°F) and the fully open temperature to 110°C (230°F).

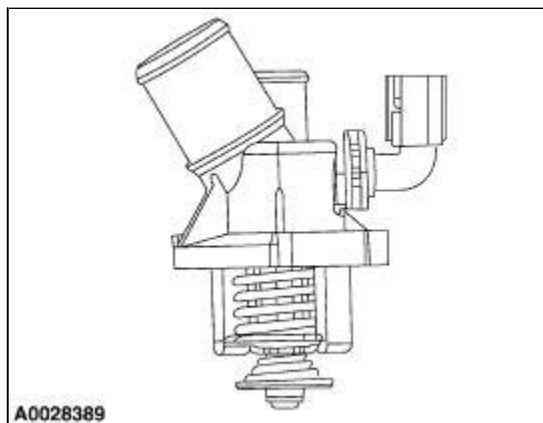


Figure 51: Thermostat Assembly with Heater Control

Transmission Control Indicator Lamp

The transmission control indicator lamp (TCIL) is an output signal from the PCM that controls the lamp on/off function depending on the engagement or disengagement of overdrive. Refer to Transmission Control Switch in Hardware PCM Inputs.

Wide Open Throttle A/C Cut-Off

The wide open throttle A/C cutoff relay (may be referred to as the A/C clutch relay) is normally open. There is no direct electrical connection between the A/C switch or EATC Module and the A/C clutch. The PCM will receive a signal indicating that A/C is requested (for some applications, this message is sent through the BUS + and BUS - circuits). When A/C is requested, the PCM will check other A/C related inputs that are available (such as ACP (SW), ACCS). If these inputs indicate A/C operation is OK, and the engine conditions are OK (such as coolant temperature, engine rpm, throttle position), the PCM will ground the WAC output, closing the relay contacts and sending voltage to the A/C clutch.

Vapor Management Valve

For information on the vapor management valve (EVAP canister purge valve), refer to the description of the Evaporative Emission Systems.

Powertrain Control Module - Vehicle Speed Output (VSO)

The PCM-VSO (Powertrain Control Module - Vehicle Speed Output) speed signal subsystem generates vehicle speed information for distribution to the vehicle's electrical/electronic modules and subsystems that require vehicle speed data. This subsystem senses the transmission output shaft speed with a sensor. The data is processed by the PCM, and distributed as a hard-wired signal or as a multiplexed data message.

The key features of the PCM-VSO system are to:

- Infer vehicle movement from the output shaft sensor signal
- Convert transmission output shaft rotational information to vehicle speed information
- Compensate for tire size and axle ratio with a programmed calibration variable
- Utilize a transfer case sensor for four wheel drive applications
- Distribute vehicle speed information as a multiplexed message and/or an analog signal

The signal from a non-contact shaft sensor (Output Shaft Sensor--OSS or Transfer Case Shaft Sensor--TCSS) mounted on the transmission (automatics, manuals, or 4X4 transfer cases) is sensed directly by the PCM. The PCM converts the OSS or TCSS information to 8000 pulses per mile, based on a tire and axle ratio conversion factor. This conversion factor is programmed into the PCM at the time the vehicle is assembled and can be reprogrammed in the field for servicing changes in the tire size and axle ratio. The PCM transmits the computed vehicle speed and distance traveled information to all the vehicle speed signal users on the vehicle. VSO information can be transmitted by a hard-wired interface between the vehicle speed signal user and the PCM, or by Speed and Odometer SCP multiplexed data messages.

The VSO hard -wired signal wave form is a DC square wave with a voltage level of 0 to VBAT. Typical output operating range is 2.22Hz per MPH (1.3808 Hz pr 1 Km/h). Multiplexed data for speed and distance data are transmitted as separate SCP messages over the SCP multiplex link.

Ignition Systems

Overview

The Ignition System is designed to ignite the compressed air/fuel mixture in an internal combustion engine by a high voltage spark from an ignition coil. The ignition system also provides engine timing information to the powertrain control module (PCM) for proper vehicle operation and misfire detection.

Integrated Electronic Ignition System

The Integrated Electronic Ignition (EI) system consists of a crankshaft position (CKP) sensor, coil pack (s), connecting wiring, and PCM. The Coil On Plug (COP) Integrated EI System uses a separate coil per spark plug and each coil is mounted directly onto the plug. The COP Integrated EI System eliminates the need for spark plug wires but does require input from the camshaft position (CMP) sensor. Operation of the components are as follows (Figure 52):

1. **Note:** Electronic Ignition engine timing is entirely controlled by the PCM. Electronic Ignition engine timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.

The CKP sensor is used to indicate crankshaft position and speed by sensing a missing tooth on a pulse wheel mounted to the crankshaft. The CMP sensor is used by the COP Integrated EI System to identify top dead center of compression of cylinder 1 to synchronize the firing of the individual coils.

2. The PCM uses the CKP signal to calculate a spark target and then fires the coil pack(s) to that target shown (Figure 53). The PCM uses the CMP sensor not shown in Figure 53 on COP Integrated EI Systems to identify top dead center of compression of cylinder 1 to synchronize the firing of the individual coils.
3. The coils and coil packs receive their signal from the PCM to fire at a calculated spark target. Each coil within the pack fires two spark plugs at the same time. The plugs are paired so that as one fires during the compression stroke the other fires during the exhaust stroke. The next time the coil is fired the situation is reversed. The COP system fires only one spark plug per coil and only on the compression stroke.

The PCM acts as an electronic switch to ground in the coil primary circuit. When the switch is closed, battery positive voltage (B+) applied to the coil primary circuit builds a magnetic field around the primary coil. When the switch opens, the power is interrupted and the primary field collapses inducing the high voltage in the secondary coil windings and the spark plug is fired. A kickback voltage spike occurs when the primary field collapses. The PCM uses this voltage spike to generate an Ignition Diagnostic Monitor (IDM) signal. IDM communicates information by pulsewidth modulation in the PCM.

4. The PCM processes the CKP signal and uses it to drive the tachometer as the Clean Tach Out (CTO) signal.

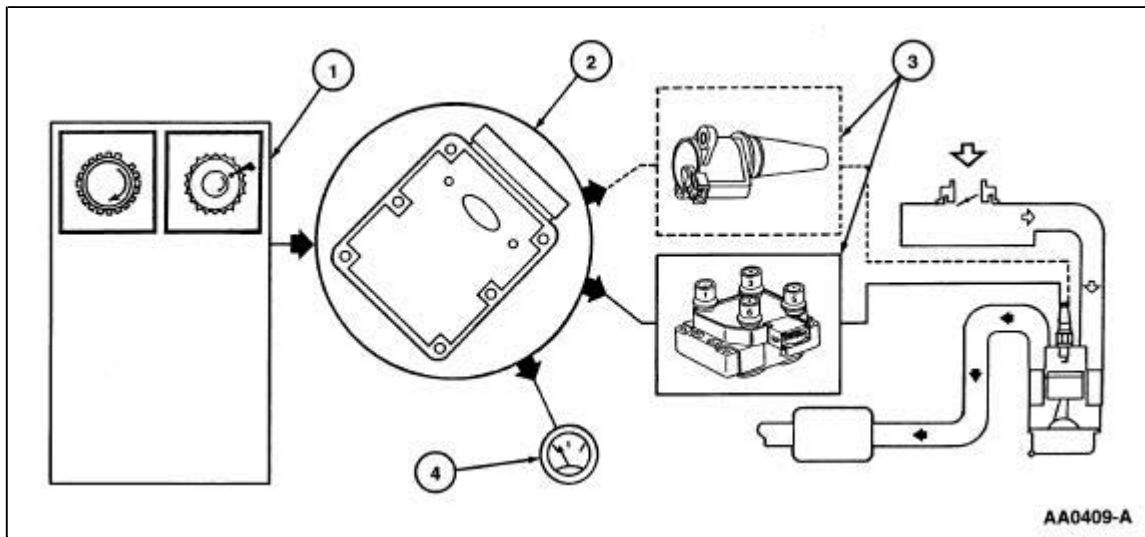


Figure 52: Ignition Systems—Integrated Electronic Ignition (Refer to the On-Board Diagnostics II System Overview for icon definitions.)

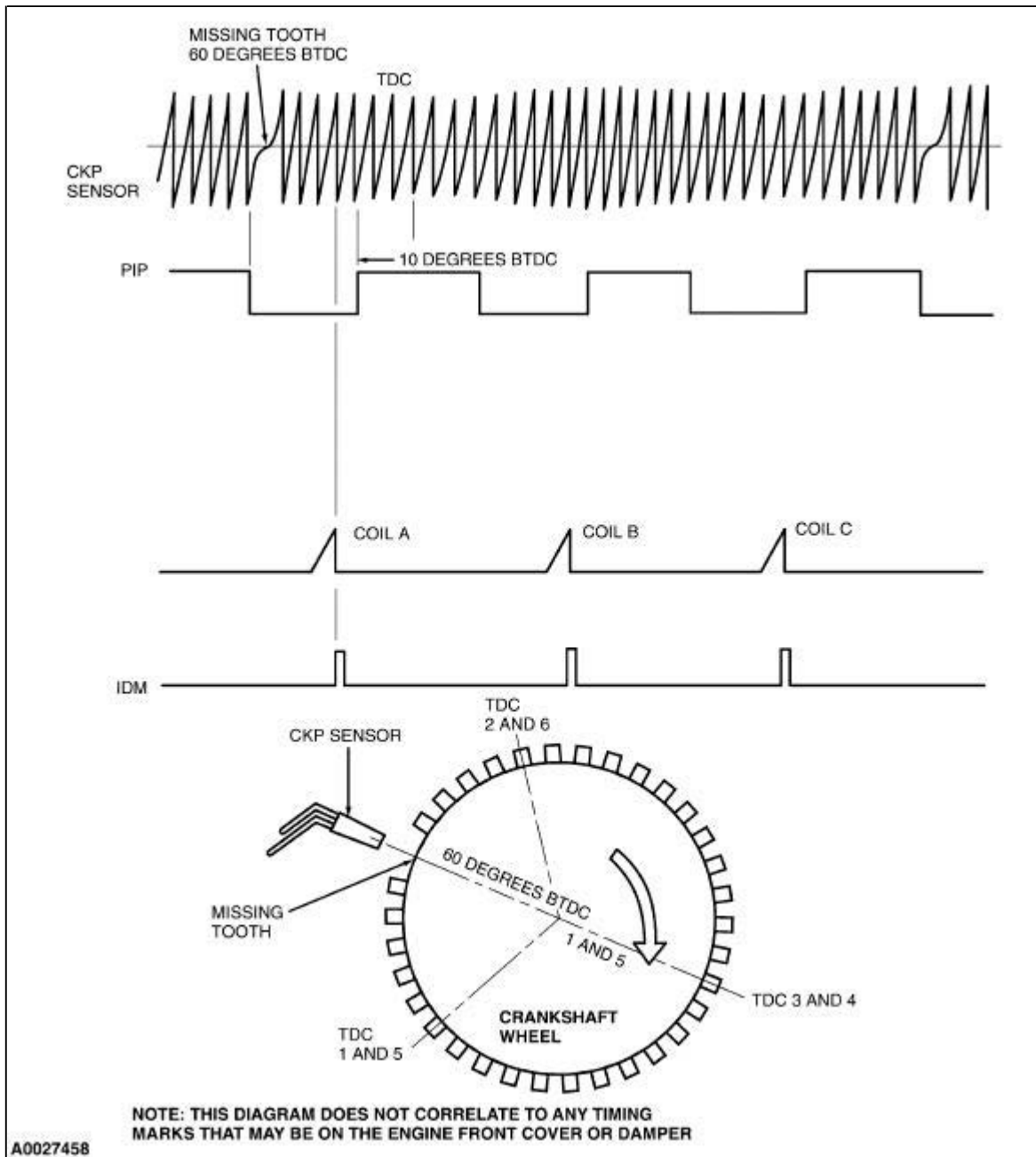


Figure 53: Six Cylinder Integrated Electronic (EI) Ignition Waveforms. Four, eight, and ten cylinder are similar.

Hardware

Crankshaft Position Sensor

The crankshaft position (CKP) sensor (Figure 54) is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the PCM. The pulse wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L ten cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference (Figure 51) for the CKP sensor configuration. The PCM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.

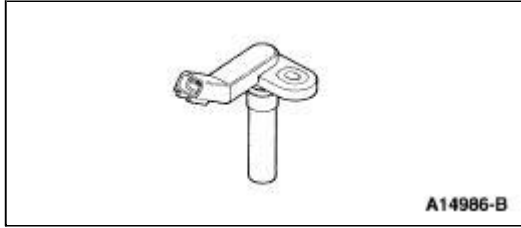


Figure 54: Typical Crankshaft Position (CKP) Sensor Actual Sensor May Vary

Camshaft Position Sensor

The camshaft position sensor (Figure 55) used by COP Integrated EI system is a magnetic transducer mounted on the engine front cover adjacent to the camshaft. By monitoring a target on the camshaft sprocket, the CMP sensor identifies cylinder one to the PCM. The COP Integrated EI system uses this information to synchronize the firing of the individual coils.

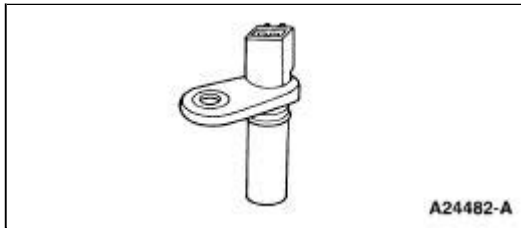


Figure 55: Camshaft Position (CMP) Sensor

Coil Pack

Coil packs come in four tower, Series 5 four tower, six-tower horizontal connector and Series 5 Six tower models. Two adjacent coil towers share a common coil and are called a matched pair. For six-tower coil pack (six cylinder) applications the matched pairs are 1 and 5, 2 and 6, and 3 and 4 (Figure 56) and (Figure 57). For four-tower coil pack (four cylinder) applications the matched pairs are 1 and 4, and 2 and 3 (Figure 58) and (Figure 59).

When the coil is fired by the PCM, spark is delivered through the matched pair towers to their respective spark plugs. The spark plugs are fired simultaneously and are paired so that as one fires on the compression stroke, the other spark plug fires on the exhaust stroke. The next time the coil is fired the situation is reversed. The next pair of spark plugs fire according to the engine firing order.

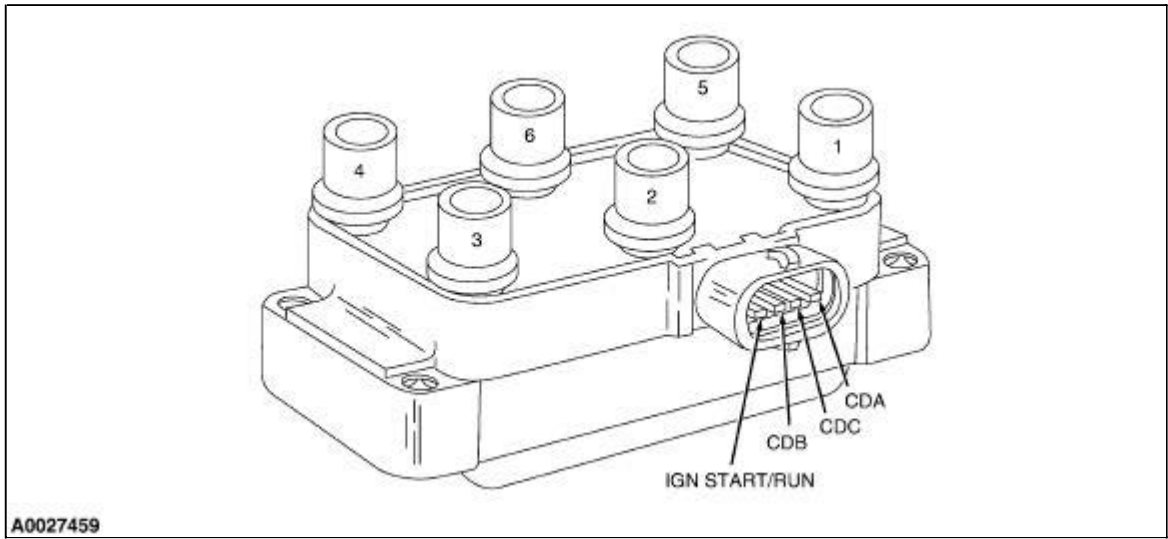


Figure 56: Horizontal Connector Six Tower Coil Pack for 4.0L Ranger, 4.0L Explorer Sport/Sport Trac and 4.0L Explorer/Mountaineer

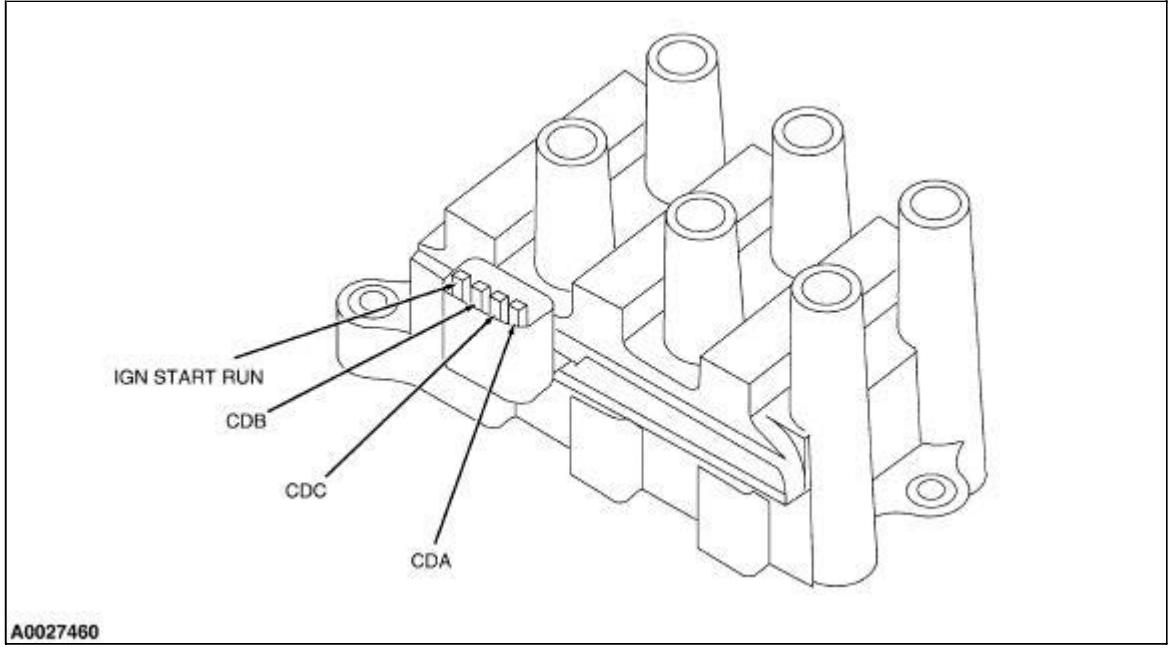


Figure 57: Series 5 Six Tower Coil Pack for 2.5L Cougar, Taurus/Sable, 3.8L Mustang, 3.0L Ranger, Windstar, 4.2L E/F Series

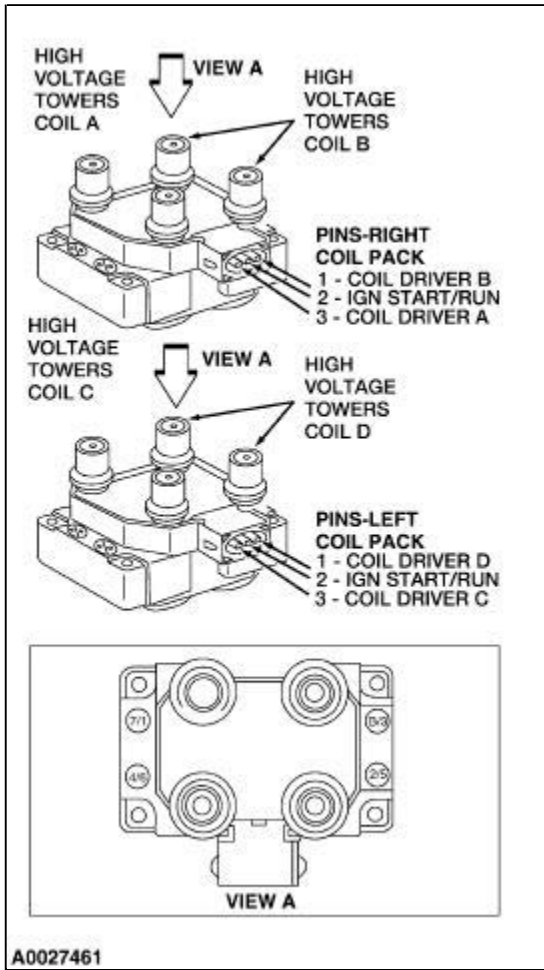


Figure 58: Four-Tower Coil Packs for Escort, Focus, 2.0L Cougar, 2.3L Ranger, 2.5L Ranger

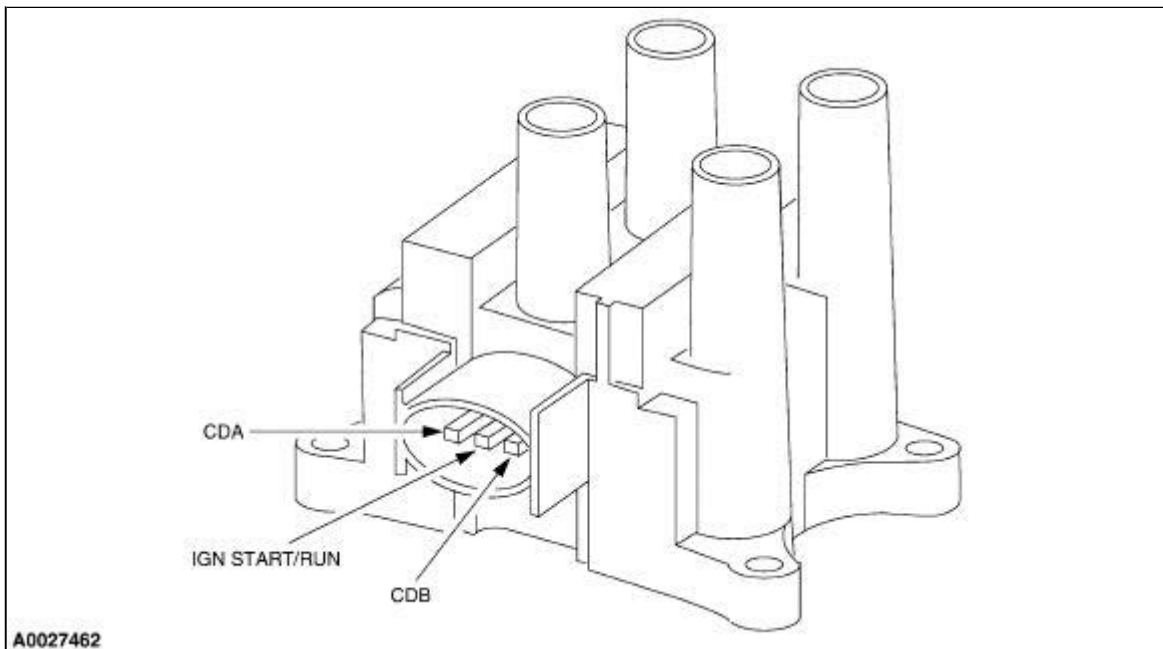


Figure 59: Series 5 Four Tower Coil Pack for 2.0L Escape

Coil On Plug

The coil on plug (COP) (Figure 60) ignition operates similar to standard coil pack ignition except each plug has one coil per plug. COP has three different modes of operation: engine crank, engine running, and CMP Failure Mode Effects Management (FMEM).

Engine Crank/Engine Running

During engine crank the PCM will fire two spark plugs simultaneously. Of the two plugs simultaneously fired one will be under compression the other will be on the exhaust stroke. Both plugs will fire until camshaft position is identified by a successful camshaft position sensor signal. Once camshaft position is identified only the cylinder under compression will be fired.

CMP FMEM

During CMP FMEM the COP ignition works the same as during engine crank. This allows the engine to operate without the PCM knowing if cylinder one is under compression or exhaust.

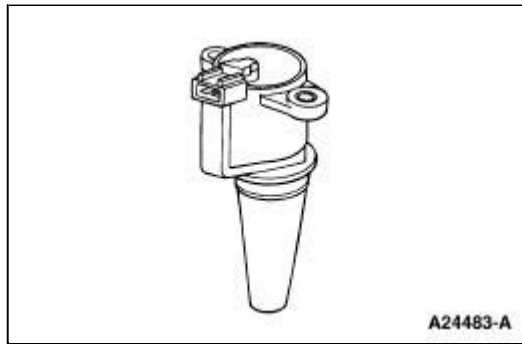


Figure 60: Coil On Plug for 3.0L Escape, LS6/LS8 , 4.6L Mustang, Crown Victoria/Grand Marquis, Town Car, Continental, 4.6L Explorer/Mountaineer, 4.6L/5.4L/6.8L E/F Series, Expedition, Navigator, Blackwood, Excursion

Fuel Systems

Overview

The fuel system supplies the Sequential Multiport Fuel Injection (SFI) fuel injectors with clean fuel at controlled pressure. The powertrain control module (PCM) controls the fuel pump and monitors the fuel pump circuit. The PCM also controls the duration of the on/off cycle providing correct timing of the fuel injectors. If the injectors have been replaced, it is necessary to clear learned values contained in the Keep Alive Random Access Memory (RAM) in the PCM. This can be done by disconnecting the battery or the PCM for five minutes. (Refer to Section 2, Powertrain Control Module (PCM) Reset, for more information.)

The three types of fuel systems used are:

- Returnable Fuel
- Mechanical Returnless Fuel
- Electronic Returnless Fuel

Returnable Fuel System

The fuel system consists of a fuel tank with a reservoir, fuel pump module, fuel supply lines, fuel filter(s), schrader/pressure test point, fuel rail, fuel injectors, and fuel pressure regulator. Operation of the system is as follows (refer to Figure 61 for all others):

1. The fuel delivery system uses the crankshaft position (CKP) sensor to signal the PCM that the engine is either cranking or running.
2. The fuel pump logic is defined in the Fuel System control strategy and is executed in the PCM. The PCM will ground the fuel pump relay for one second during key on and engine off. During crank the fuel pump relay is grounded as long as the PCM receives a CKP signal.
3. The fuel pump relay has a primary and a secondary circuit. The primary side is controlled by the PCM and the secondary side provides B+ to the fuel pump circuit when the relay is energized.
4. The inertia fuel shut-off (IFS) switch is used to de-energize the fuel delivery secondary circuit in the event of a collision. The IFS Switch is a safety device that should only be reset after a thorough inspection of the vehicle (following a collision).
5. The fuel injector is a solenoid-operated valve that meters fuel flow to each combustion cylinder. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by length of time the fuel injector is held open. The injector is normally closed and is operated by 12 volt VPWR from the power relay. The ground signal is controlled by the PCM.
6. A pressure test point valve (schrader valve) is located on the fuel rail. This is used to measure fuel injector supply pressure for service and diagnostic procedures. ON VEHICLES NOT EQUIPPED WITH A SCHRADER VALVE, USE ROTUNDA FUEL PRESSURE TEST KIT #134—R0087 OR EQUIVALENT.
7. The fuel pressure regulator is attached to the fuel rail downstream of the fuel injectors. It regulates fuel pressure supplied to the fuel injectors. The fuel pressure regulator is a diaphragm-operated relief valve. One side of the diaphragm senses fuel pressure and the other side is connected to the intake manifold vacuum. Fuel pressure is established by a spring preload applied to the diaphragm. Balancing one side of the diaphragm with manifold vacuum maintains a constant fuel pressure drop across the fuel injectors. Fuel pressure is high when engine vacuum is low. Excess fuel is bypassed through the fuel pressure regulator and returned through the fuel return line to the fuel tank.

8. There are four filtering or screening devices in the fuel delivery system. The fuel intake sock or screen is a fine, nylon mesh mounted on the intake side of the fuel pump. There is a fuel filter screen located at the fuel rail side of the fuel injector. A fuel filter/screen is located in the inlet side of the fuel pressure regulator. The fuel filter assembly is located between the fuel pump and the pressure test point/schrader valve.
9. The fuel pump (FP) module is a device that contains both fuel pump and fuel sender assembly. The fuel pump is located inside the reservoir and supplies fuel through the fuel pump module manifold to the engine and the fuel pump module jet pump.

Note: Some vehicles have the relay located in the Power Distribution Box.

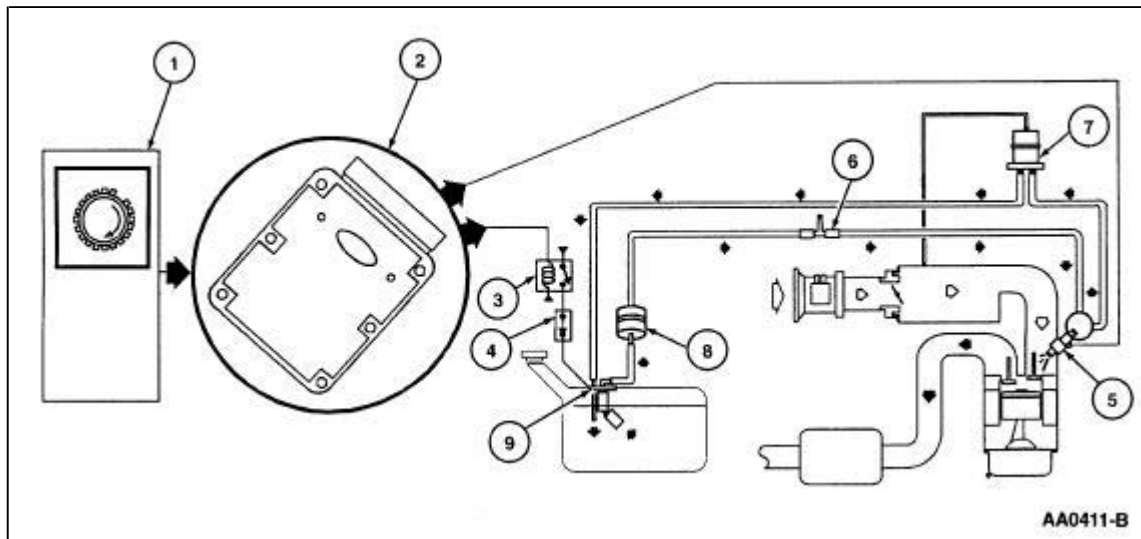


Figure 61: Fuel System - All others

Mechanical Returnless Fuel System

The fuel system consists of a fuel tank with reservoir, fuel pump, fuel pressure regulator, fuel filter, fuel supply line, fuel rail, fuel rail pulse damper, fuel injectors, and schrader/pressure test point. Operation of the system is as follows (Figure 62):

1. The fuel delivery system is enabled during crank or running mode once the PCM receives a crankshaft position (CKP) sensor signal.
2. The fuel pump logic is defined in the fuel system control strategy and is executed by the PCM.
3. The PCM grounds the fuel pump relay, which provides VPWR to the fuel pump.
4. The inertia fuel shut-off (IFS) switch is used to de-energize the fuel delivery secondary circuit in the event of collision. The IFS switch is a safety device that should only be reset after a thorough inspection of the vehicle (following a collision).
5. A pressure test point valve (schrader valve) is located on the fuel rail. This is used to measure fuel injector supply pressure for diagnostic procedures and repairs. ON VEHICLES NOT EQUIPPED WITH A SCHRADER VALVE, USE ROTUNDA FUEL PRESSURE TEST KIT #134—R0087 OR EQUIVALENT.
6. Located on the fuel rail is a pulse damper. The pulse damper reduces fuel system noise caused by the pulsing of the fuel injectors. The vacuum port located on the damper is connected to manifold vacuum to avoid fuel spillage in the event the pulse damper diaphragm were to rupture

(the pulse damper should not be confused with a fuel pressure regulator).

7. The fuel injector is a solenoid-operated valve that meters the fuel flow to each combustion cylinder. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open. The injector is normally closed and is operated by 12 volt VPWR from the power relay. The ground signal is controlled by the PCM.
8. There are three filtering or screening devices in the fuel delivery system. The intake sock is a fine, nylon mesh screen mounted on the intake side of the fuel pump. There is a fuel filter screen located at the fuel rail side of the fuel injector. The fuel filter assembly is located between the fuel pump and the pressure test point/schrader valve.
9. The fuel pump (FP) module contains the fuel pump, fuel pressure regulator and the fuel sender assembly. The fuel pressure regulator is attached to the fuel pump in the fuel pump module located in the fuel tank. It regulates fuel pressure supplied to the fuel injectors. The fuel pressure regulator is a diaphragm-operated relief valve. Fuel pressure is established by a spring preload applied to the diaphragm. Excess fuel is bypassed through the regulator and returned to the fuel tank.

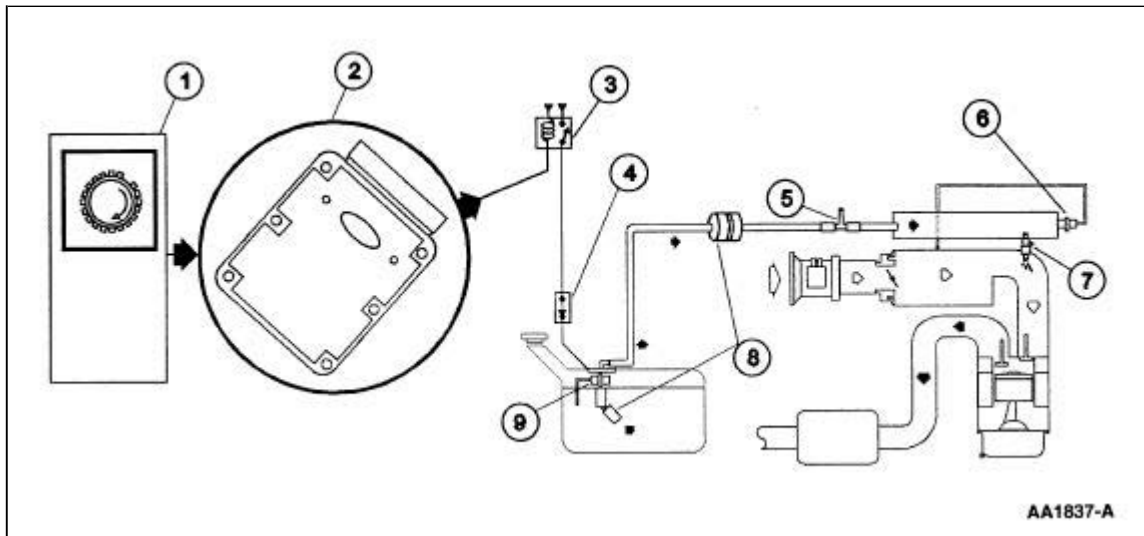


Figure 62: Fuel System—Mechanical Returnless

Electronic Returnless Fuel System

The fuel system consists of a fuel tank with reservoir, fuel pump, fuel rail pressure sensor, fuel filter, fuel supply line, engine fuel temperature sensor, fuel rail, fuel injectors, and schrader/pressure test point. Operation of the system is as follows (Figure 63) and (Figure 64):

1. The fuel delivery system is enabled during crank or running mode once the PCM receives a crankshaft position (CKP) sensor signal.
2. The fuel pump logic is defined in the fuel system control strategy and is executed by the PCM.
3. The PCM commands a duty cycle to the fuel pump driver module (FPDM).
4. The fuel pump driver module modulates the voltage to the fuel pump (FP) to achieve the proper fuel pressure. Voltage for the fuel pump is supplied by the power relay or FPDM power supply relay. (For additional information on FPDM operation, refer to PCM Outputs—Fuel Pump and PCM Inputs—FPM.)
5. The fuel rail pressure (FRP) sensor provides the PCM with the current fuel rail pressure. The

PCM uses this information to vary the duty cycle output to the FPDM to compensate for varying loads.

6. The engine fuel temperature (EFT) sensor measures current fuel temperatures in the fuel rail. This information is used to vary the fuel pressure and avoid fuel system vaporization.
7. The fuel injector is a solenoid-operated valve that meters the fuel flow to each combustion cylinder. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open. The injector is normally closed and is operated by 12 volt VPWR from the power relay. The ground signal is controlled by the PCM.
8. A pressure test point valve (schrader valve) is located on the fuel rail. This is used to measure fuel injector supply pressure for diagnostic procedures and repairs. ON VEHICLES NOT EQUIPPED WITH A SCHRADER VALVE, USE ROTUNDA FUEL PRESSURE TEST KIT #134—R0087 OR EQUIVALENT.
9. There are three filtering or screening devices in the fuel delivery system. The intake sock is a fine, nylon mesh screen mounted on the intake side of the fuel pump. There is a fuel filter screen located at the fuel rail side of the fuel injector. The fuel filter assembly is located between the fuel pump and the pressure test point/schrader valve.
10. The fuel pump (FP) module is a device that contains the fuel pump and the fuel sender assembly. The fuel pump is located inside the reservoir and supplies fuel through the fuel pump module manifold to the engine and the fuel pump module jet pump.
11. The inertia fuel shut-off (IFS) switch is used to de-energize the fuel delivery secondary circuit in the event of a collision. The IFS switch is a safety device that should only be reset after a thorough inspection of the vehicle (following a collision).

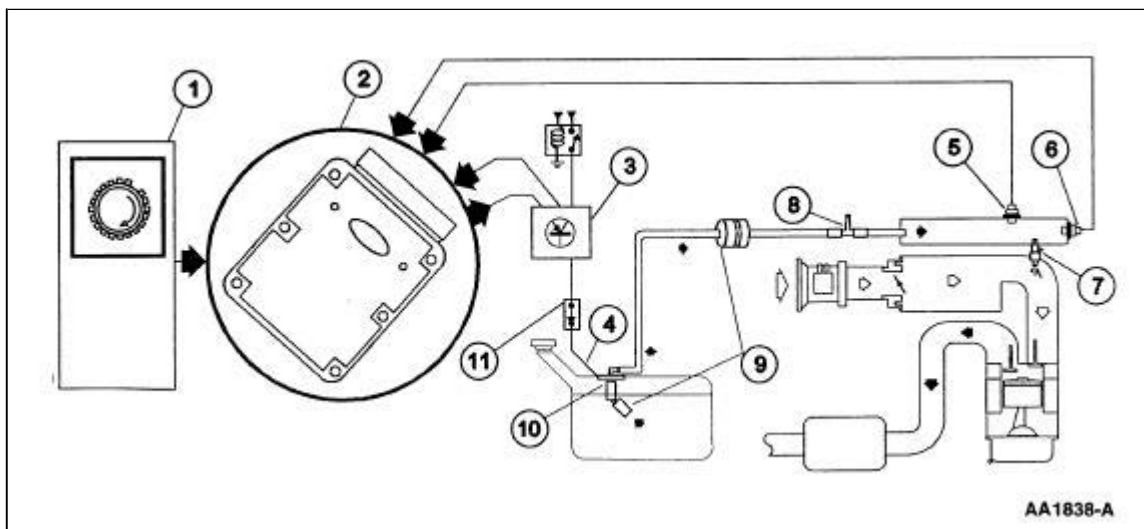


Figure 63: Fuel System—Electronic Returnless

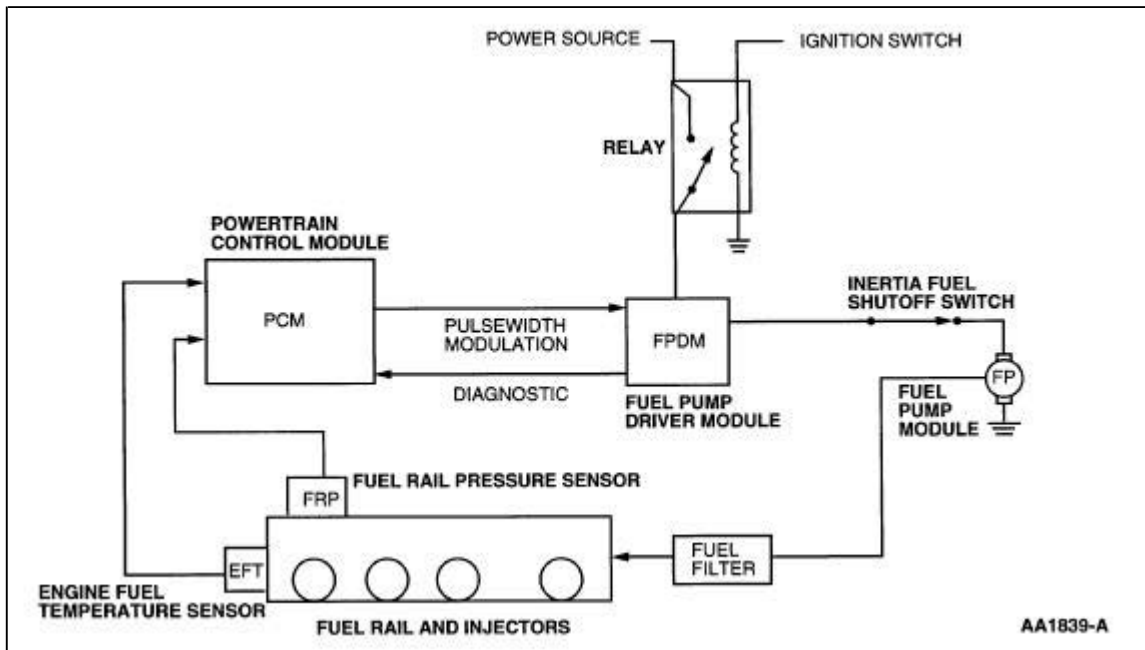


Figure 64: Typical Electronic Returnless Fuel System Schematic (NOTE: See wiring diagram for proper power source and relay usage.)

Fuel Pump and Reservoir

The fuel pump module (Figure 65) is mounted inside the fuel tank in a reservoir. The pump has a discharge check valve that maintains system pressure after the ignition key has been turned off to minimize starting concerns. The reservoir prevents fuel flow interruptions during extreme vehicle maneuvers with low tank fill levels.

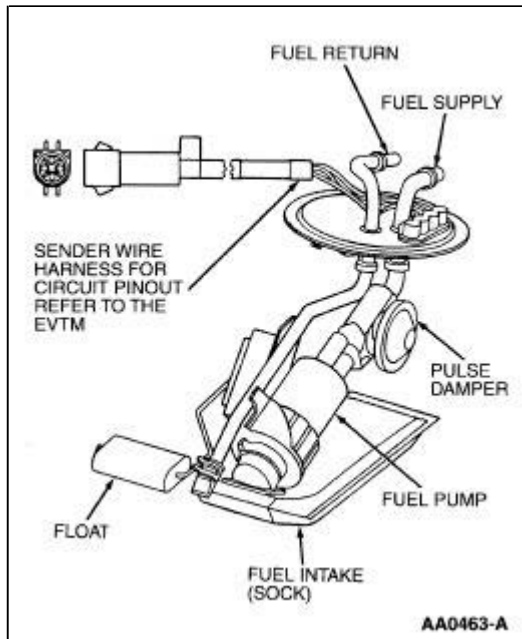


Figure 65: Fuel Pump Module

Fuel Pump Module

The fuel pump (FP) module (Figure 66),(Figure 67) and(Figure 68) is a device that contains the fuel

pump and sender assembly. The fuel pump is located inside the FP module reservoir and supplies fuel through the FP module manifold to the engine and FP module jet pump. The jet pump continuously refills the reservoir with fuel, and a check valve located in the manifold outlet maintains system pressure when the fuel pump is not energized. A flapper valve located in the bottom of the reservoir allows fuel to enter the reservoir and prime the fuel pump during the initial fill.

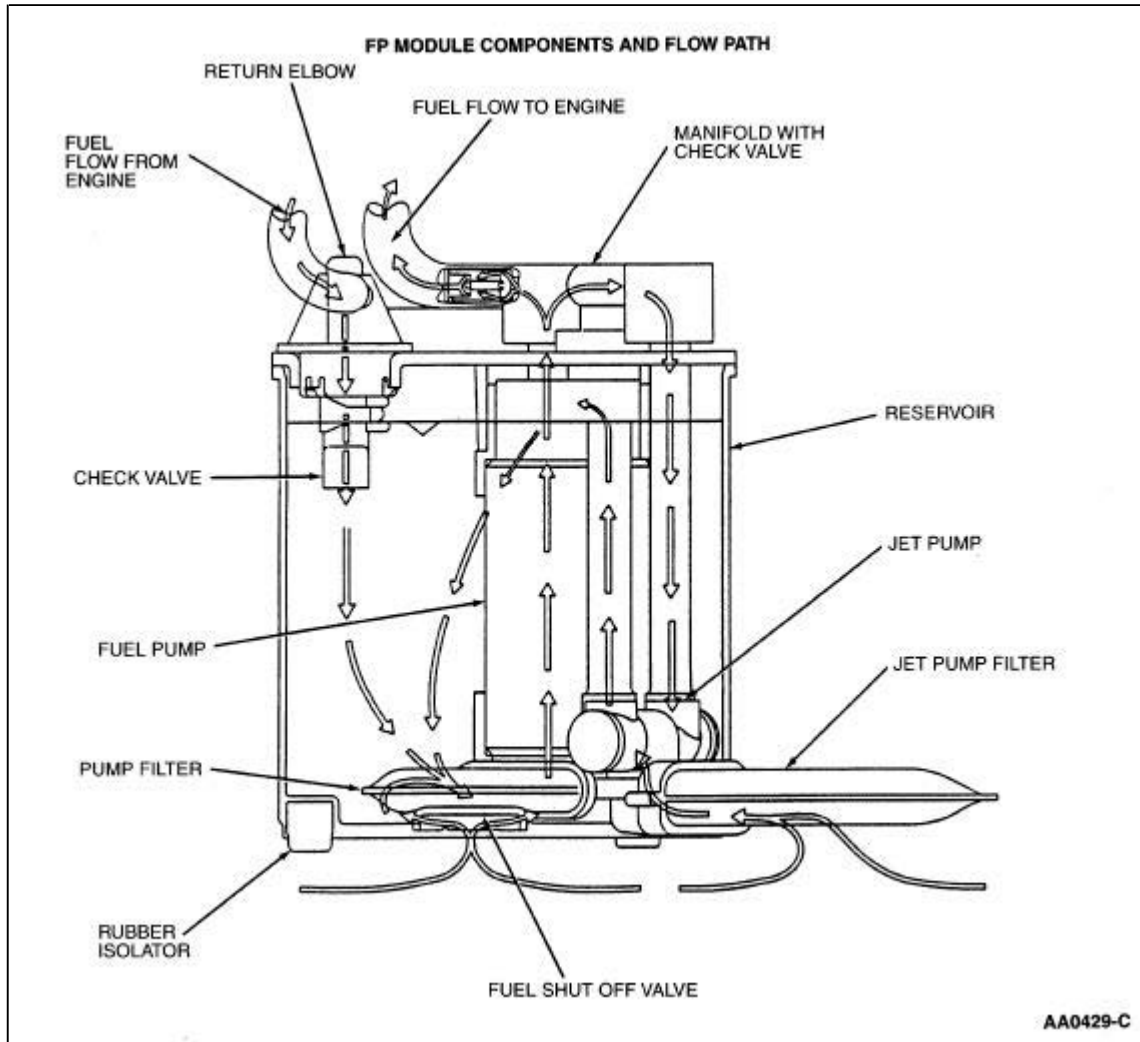


Figure 66: Fuel Pump Module (For Returnable Fuel Systems)

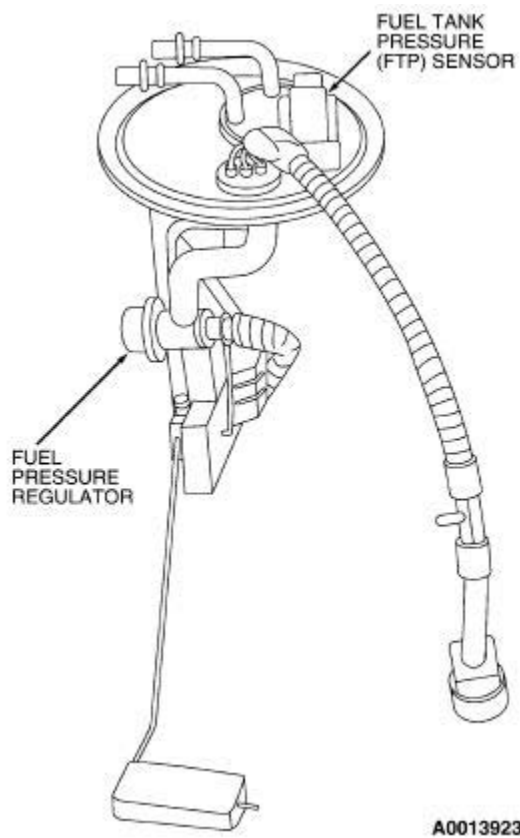


Figure 67: Mechanical Returnless Fuel Pump Module (FPM)

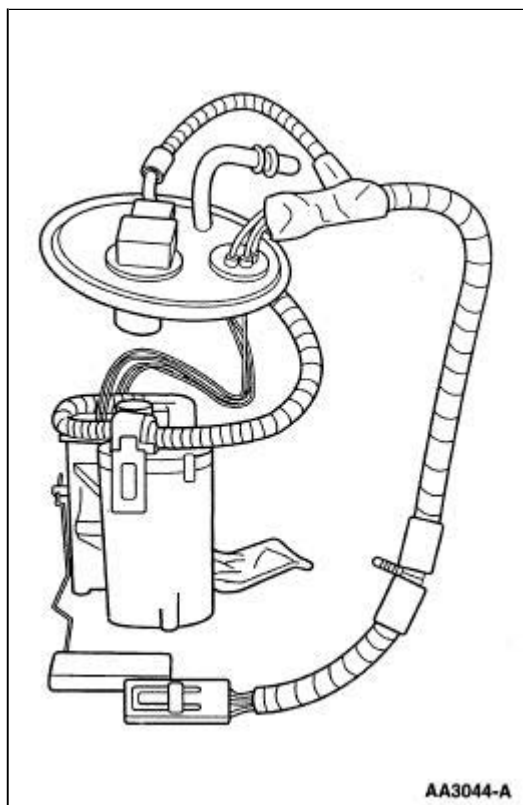


Figure 68: Electronic Returnless Fuel Pump Module (FPM)

Fuel Filters

The system contains four filtering or screening devices. Refer to the individual component pictorial for location.

1. The fuel intake sock or screen is a fine nylon mesh sock mounted on the intake side of the fuel pump. It is part of the assembly and cannot be serviced separately.
2. The filter/screen at the fuel rail port of the Injectors is part of the fuel injector assembly and cannot be serviced separately.
3. The filter/screen at fuel inlet side of the fuel pressure regulator is part of the regulator assembly and cannot be serviced separately.
4. The fuel filter assembly is located between the fuel pump (tank) and the pressure test point (schrader valve) or Injectors. This filter may be serviced.

Pressure Test Point

There is a pressure test point with a schrader fitting in the fuel rail that relieves fuel pressure and measures the fuel injector supply pressure for service and diagnostic procedures. Before servicing or testing the fuel system, read any CAUTION, WARNING, and HANDLING information. ON VEHICLES NOT EQUIPPED WITH A SCHRADER VALVE, USE ROTUNDA FUEL PRESSURE TEST KIT #134—R0087 OR EQUIVALENT.

Fuel Injector

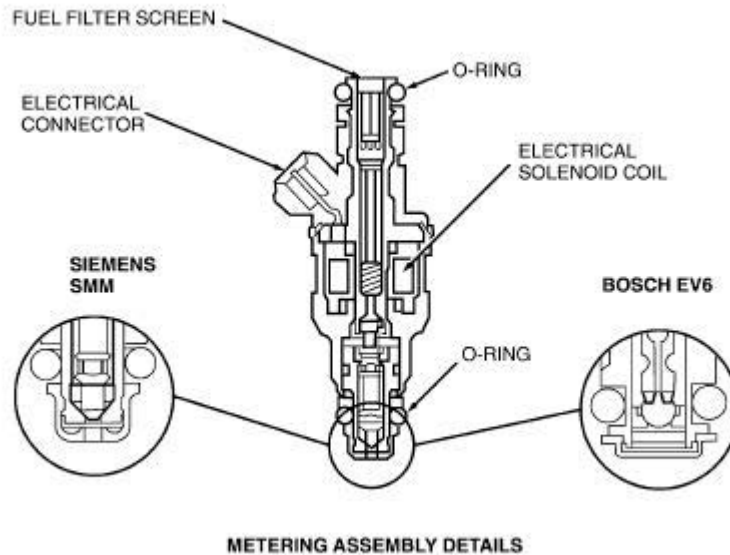
The fuel injector (Figure 69) is a solenoid-operated valve that meters fuel flow to the engine. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open.

The fuel injector is normally closed and is operated by 12 volt VPWR from the electronic engine control power relay. The ground signal is controlled by the PCM.



CAUTION: Do not apply battery positive voltage (B+) directly to the fuel injector electrical connector terminals. The solenoids may be damaged internally in a matter of seconds.

The injector is the deposit resistant injection (DRI) type and does not have to be cleaned. However, it can be flow checked and, if found outside of specification, the fuel injector should be replaced.



A0013924

Figure 69: Fuel Injectors

Fuel Pressure Regulator

The fuel pressure regulator (Figure 70) is attached to the fuel rail downstream of the fuel injectors. It regulates fuel pressure supplied to the fuel injectors. The regulator is a diaphragm-operated relief valve. One side of the diaphragm senses fuel pressure and the other side is connected to the intake manifold vacuum. Fuel pressure is established by a spring preload applied to the diaphragm. Balancing one side of the diaphragm with manifold vacuum maintains a constant fuel pressure drop across the fuel injectors. Fuel pressure is high when engine vacuum is low. Excess fuel is bypassed through the fuel pressure regulator and returned through the fuel return line to the fuel tank.

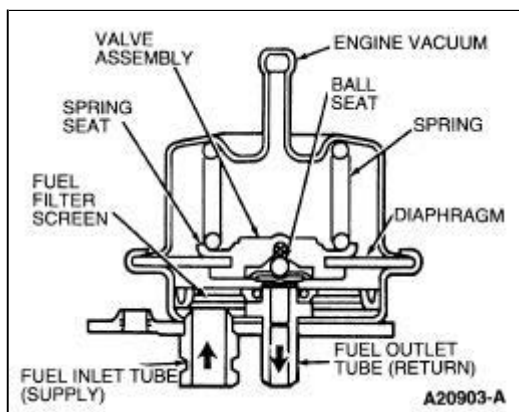


Figure 70: Fuel Pressure Regulator

Fuel Rail Pulse Damper

The fuel rail pulse damper (Figure 71) located on the fuel rail reduces fuel system noise caused by the pulsing of the fuel injectors. The vacuum port located on the damper is connected to manifold vacuum to avoid fuel spillage in the event the pulse damper diaphragm were to rupture. **(The pulse damper should not be confused with a fuel pressure regulator, it does not regulate fuel rail pressure.)**

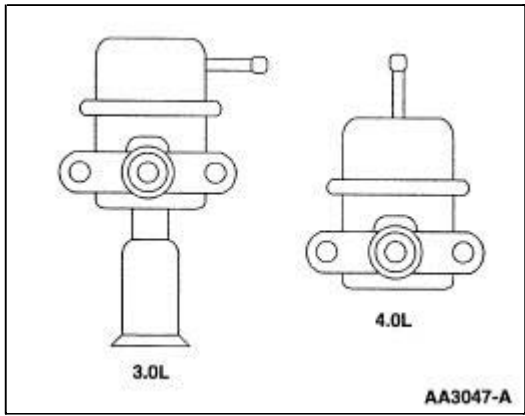


Figure 71: Pulse Damper

Inertia Fuel Shutoff (IFS) Switch

Inertia Fuel Shutoff (IFS) Switch

The inertia fuel shutoff (IFS) switch (Figure 72) is used in conjunction with the electric fuel pump. The purpose of the IFS switch is to shut off the fuel pump if a collision occurs. It consists of a steel ball held in place by a magnet. When a sharp impact occurs, the ball breaks loose from the magnet, rolls up a conical ramp and strikes a target plate which opens the electrical contacts of the switch and shuts off the electric fuel pump. **Once the switch is open , it must be manually reset before restarting the vehicle .** Refer to the Owner Guide for the location of the IFS.

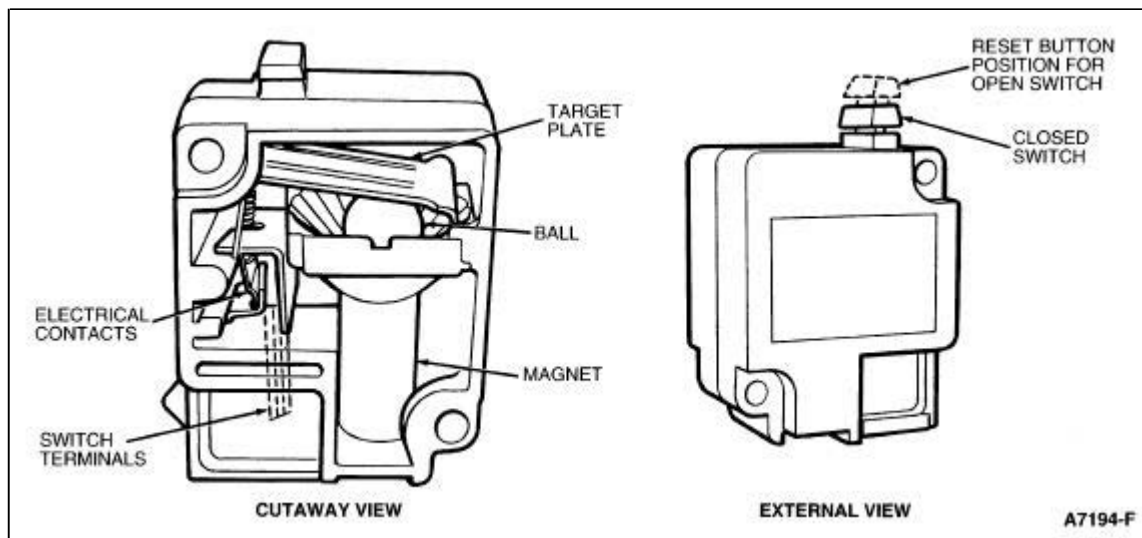


Figure 72: Inertia Fuel Shutoff (IFS) Switch

Natural Gas Fuel System

Overview

The Fuel System provides a means of transporting clean fuel from the fuel tank to the fuel injectors under a controlled pressure.

Natural Gas Fuel System

The fuel system consists of a fuel tank, fuel shut-off valve assemblies, fuel supply lines, fuel filter, schrader/service valve, manual fuel shut-off valve, fuel rail, and fuel pressure regulator. Operation of the system is as follows (Figure 73),(Figure 74) and (Figure 75):

1. The fuel delivery system uses the crankshaft position (CKP) sensor to signal the PCM that the engine is either cranking or running.
2. The fuel shut-off valve logic is defined in the Fuel System control strategy and is executed in the PCM. The PCM will ground the fuel pump relay for one second during key on and engine off. During crank the fuel pump relay is grounded as long as the PCM receives a signal from the CKP.
3. The fuel pump relay has a primary and a secondary circuit. The primary side is controlled by the PCM and the secondary side provides B+ to the fuel shut-off valve circuit when the relay is energized.
4. The inertia fuel shut-off (IFS) switch is used to de-energize the fuel delivery circuit in the event of a collision. The IFS switch is a safety device that should only be reset after a thorough inspection of the vehicle (following a collision).
5. The fuel injector is used to meter natural gas to each combustion cylinder. Although the NG fuel injector appears very similar to some gasoline fuel injectors, it is unique. Flow capacity of this fuel injector is 6 to 12 times as large as various gasoline fuel injectors.
6. The fuel tank shut-off solenoid valve is located in the fuel tank. The solenoid valves are on the same circuit as the fuel pump and utilize the same inertia fuel shut-off (IFS) switch as gasoline.
7. The high pressure fuel filter is used to protect the engine fuel system components. A natural gas coalescing and particulate filter is positioned on the high pressure side of the fuel system just prior to the fuel pressure regulator.
8. The fuel pressure regulator used on the NG vehicle is a single-staged pressure reducing regulator which expands natural gas from storage pressures of 1,379 to 20,685 kPa (200 to 3,000 psig) to engine fuel pressures of 724 to 862 kPa (105 to 125 psig).
9. The fuel rail shut-off valve is a normally closed solenoid actuated valve that opens when grounded by the PCM. The valve isolates the fuel injectors from fuel line pressure when the engine is not operating. The fuel rail shut-off valve is wired in parallel with the fuel tank shut-off solenoid valves.

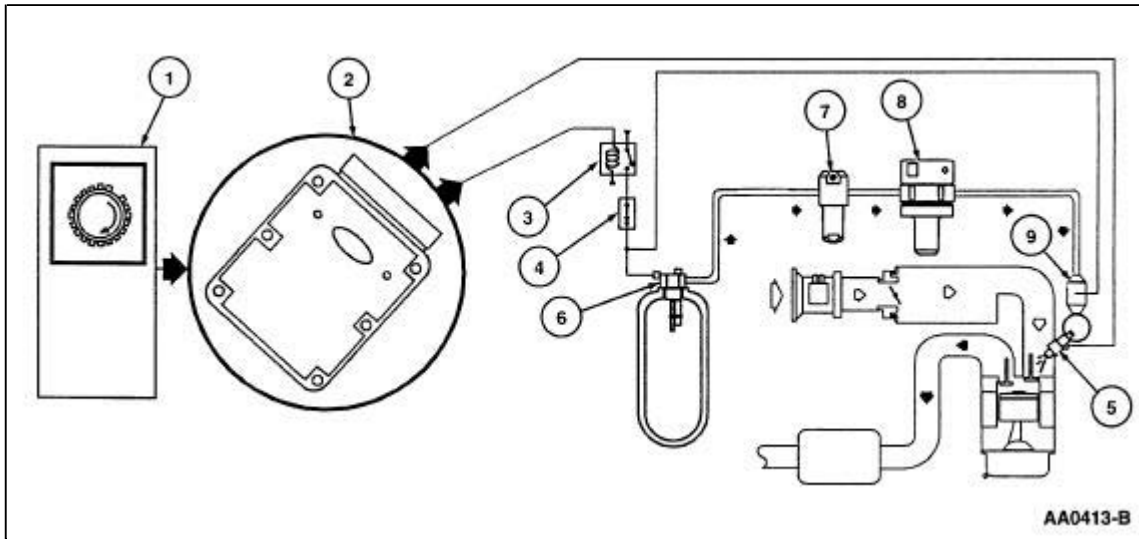


Figure 73: Natural Gas Fuel System

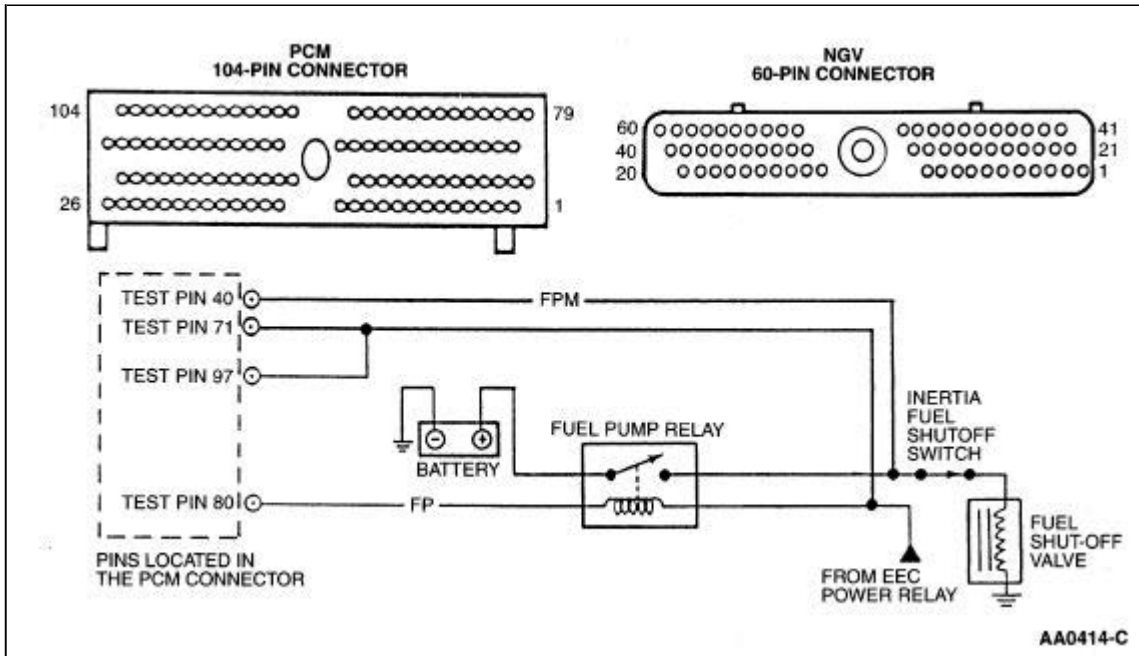


Figure 74: Natural Gas Fuel System Electrical Schematic—Typical

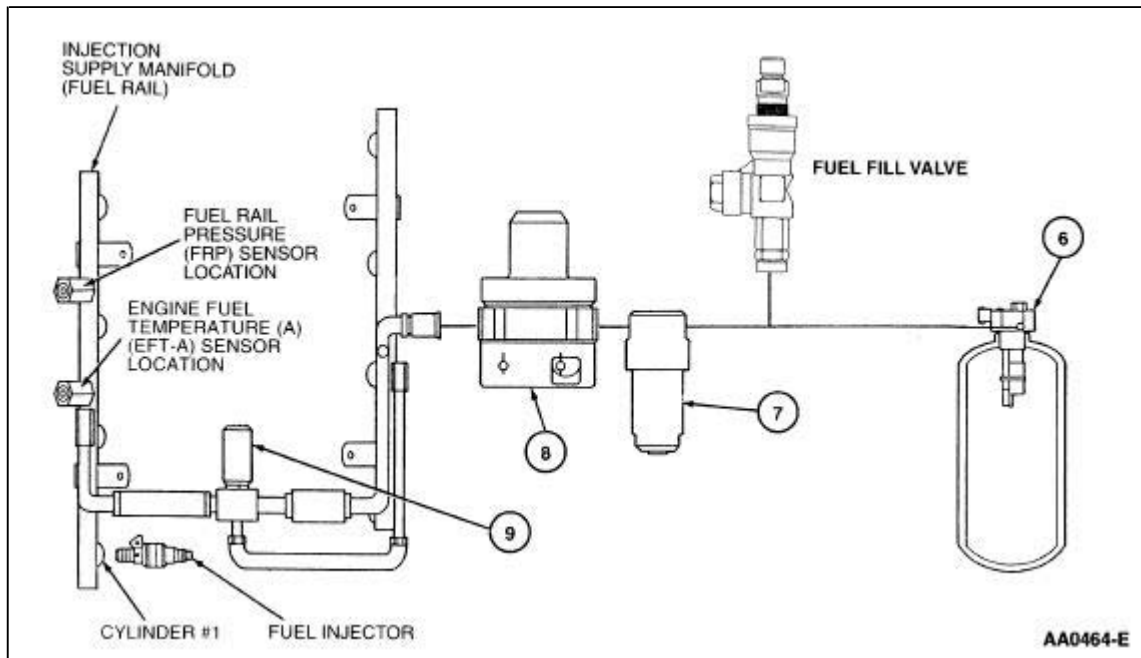


Figure 75: Natural Gas Fuel System

Hardware

Fuel Rail

The fuel rail (Figure 76) distributes low pressure fuel from the chassis supply line to each fuel injector. Fuel pressure at the top of each fuel injector is maintained within 1% of the other fuel injectors at all times; this is done with nearly symmetric flow paths. The fuel rail is also designed to have minimal flow restriction by increasing the cross-sectional flow area and reducing the flow path length. The fuel rail contains several other parts in assembly (PIA) components that perform crucial functions. These include:

- **Injection pressure sensor** which measures the pressure of the fuel near the fuel injectors. This signal is used by the PCM to adjust the fuel injector pulsewidth and meter fuel to each engine combustion cylinder.
- **Engine fuel temperature sensor** which measures the pressure of the fuel near the fuel injectors. This signal is used by the PCM to adjust the fuel injector pulsewidth and meter fuel to each engine combustion cylinder.
- **Low pressure solenoid shut-off valve** which isolates the fuel rail from the upstream fuel system when the engine is OFF. This minimizes the amount of fuel available to flow through the fuel injectors when the engine is off or leak from a damaged fuel rail during and after a crash. The valve is controlled by the PCM fuel shut-off valve circuit and contains an inertia switch. The valve is only on for one second after a key-on or whenever CKP signals are being received by the PCM.
- **Schrader/service valve** which provides a service port to the low pressure fuel system. This valve is needed to relieve the pressure in the system before and during service. This valve could also be used to monitor the pressure near the injectors during diagnostic procedures.

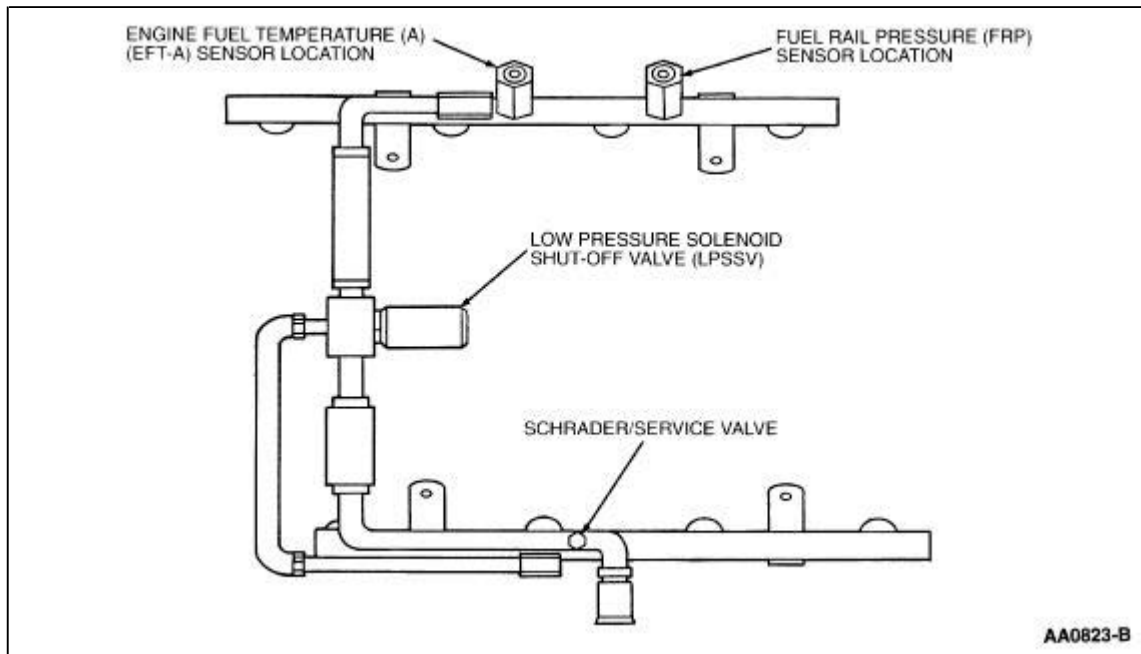


Figure 76: Fuel Rail Components

Fuel Injector(s)

The fuel injector (Figure 77) is a solenoid-operated valve that meters fuel flow to the engine. The fuel injector is opened and closed every other crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open.

The fuel injector is normally closed and is operated by 12 volt VPWR from the power relay. The ground signal is controlled by the PCM.

The fuel injectors are used to meter natural gas to each combustion cylinder. Although the natural gas fuel injectors appear very similar to some gasoline fuel injectors, they are unique. Flow capacity of these fuel injectors is 6 to 12 times as large as various gasoline fuel injectors. Electrical resistance is much lower than typical gasoline fuel injectors (4.6 ohms as opposed to 14.5 ohms). To accommodate this lower resistance, a fuel injector driver module is used to convert the PCM fuel injector driver signal to the signal required by the fuel injector.

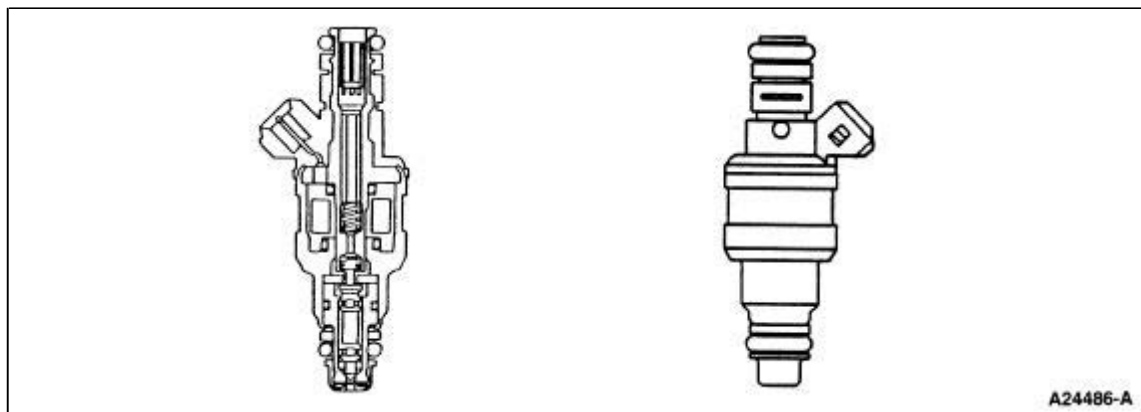


Figure 77: Fuel Injector

Fuel Pressure Regulator

The fuel pressure regulator (Figure 78) used in the Natural Gas fuel system is a single-stage pressure

reducing regulator which expands natural gas from storage pressures of 1,379 to 20,685 kPa (200 to 3,000 psig) to engine fuel injector pressures of 724 to 862 kPa (105 to 125 psig).

The regulator contains a pressure relief device, a 1,896 kPa (275 psig) check valve, which protects the low pressure fuel system. The low pressure fuel system no longer must fulfill the design requirements of the high pressure fuel system, therefore reducing cost, weight and complexity.

When gas expands, the fuel temperature drops significantly causing extreme cold temperatures (-177°C or -160°F) that may damage synthetic fuel system components as well as cause water vapor within the fuel to condense, freeze and plug the lines, valve and injectors. To prevent this, engine coolant is routed through the fuel pressure regulator to warm the fuel before it expands.

The regulator has an internal thermostat to control the flow of engine coolant. This prevents overheating and subsequent thinning of the fuel which may cause lean combustion. Outlet coolant flow is restricted by the thermostat when it rises above approximately 82°C (100°F).

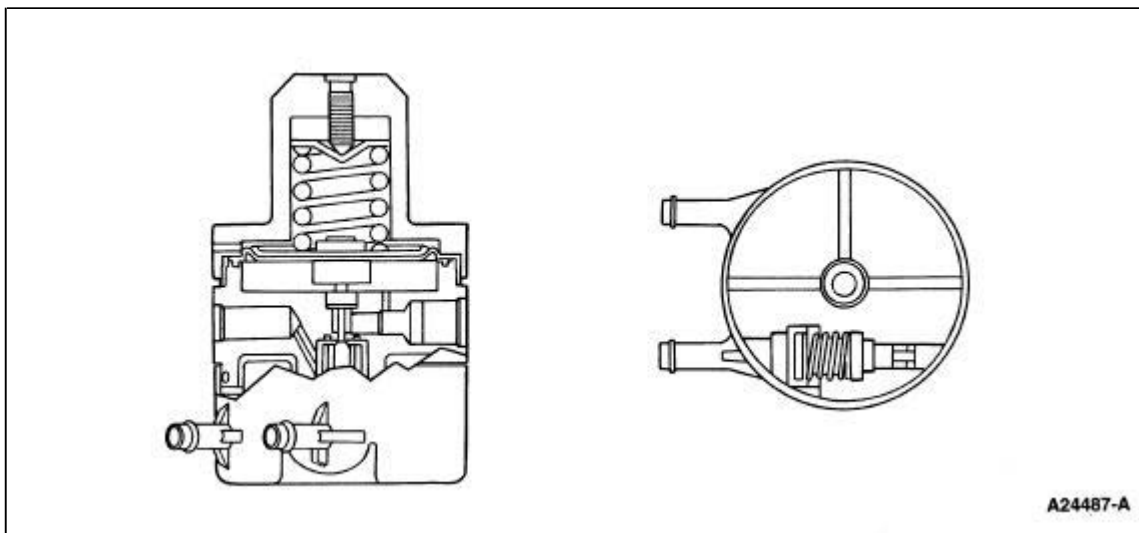


Figure 78: Fuel Pressure Regulator

High Pressure Fuel Filter

The high pressure fuel filter (Figure 79) is used to protect the engine fuel system components. A natural gas coalescing and particulate filter is positioned on the high pressure side of the fuel system just prior to the pressure regulator. The filter is part of the regulator assembly. The filter can be disassembled to service the element. The drain plug on the bottom of the housing can be removed to drain any water that accumulates.

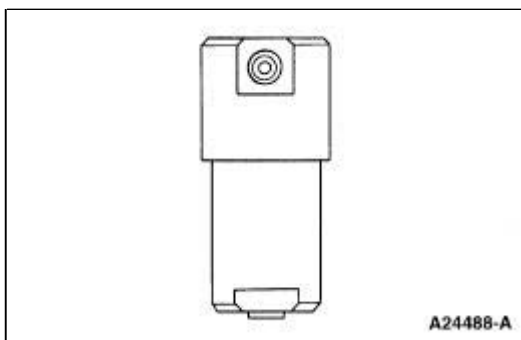


Figure 79: Fuel Filter

Fuel Lines and Fittings

A fuel line assembly (Figure 80) consists of flexible hose and/or stainless steel seamless tubing, end fittings and tube nuts. The hose is a conductive polytetrafluoroethylene (PTFE) liner reinforced with a stainless steel wire braided covering. The fittings are inserted into the hose ends and crimped into place. The stainless steel tubing contains end fittings which are brazed to the tube. There are high pressure fuel lines that are identified by either 1/4-inch or 3/8-inch outer diameter and a low pressure fuel line identified by a 1/2-inch outer diameter. The low pressure fuel line has a quick-connect at one end for connection to the fuel rail. The other fittings used on the natural gas vehicle to connect fuel components are SAE O-ring face seal tube fittings. There are two end types: an O-ring face seal end and a straight thread end. On tee and elbow fittings, a washer and a positionable nut are provided to aid in orientation of the fitting.

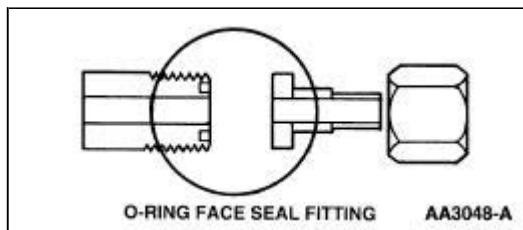


Figure 80: Fuel Line Assembly

Fueling Connector

Flange Assembly—Fuel Tank Fill

The flange assembly (Figure 81) is designed for 20,685 kPa (3,000 psi) service pressure and is the refueling connection to fill the vehicle. The assembly is mounted behind the fuel filler door and attached to the fuel filler housing, similar to a gasoline vehicle. This assembly consists of an NGVP1 type receptacle with a 150 micron filter (which can be serviced), a spring loaded check valve to allow filling of the vehicle and a manually opened bypass to provide safe venting of the fuel system. The vehicle is refueled by attaching the fuel station fill nozzle to the receptacle and locking into place.

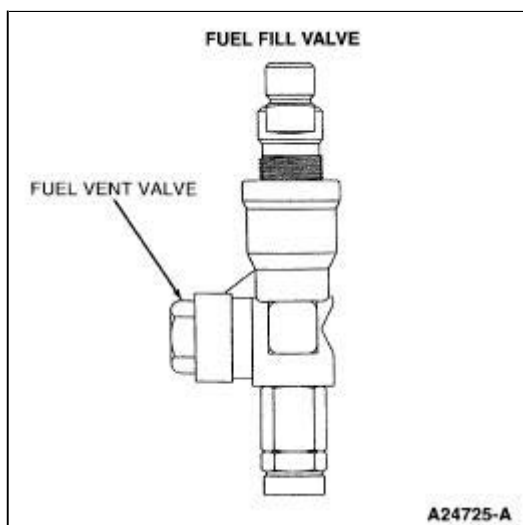


Figure 81: Flange Assembly

Fuel Tank Shutoff Valve

The fuel tank shutoff solenoid valve (Figure 82) is located in the fuel tank. The solenoid valves are on the same circuit as the gasoline fuel pump and utilize the same Inertia fuel shutoff (IFS) switch as gasoline. When the key is in the off position, the shutoff valves are closed and fuel in the tanks is isolated. During refueling, the shutoff valve acts as a check valve and allows flow due to pressure differential between the fuel being added from the fill station and the fuel in the tank.

The internal solenoid valves also have the capability of being "manually locked down." If, while servicing the vehicle, it becomes necessary to remove the fuel tank, the lock down feature provides an added measure of safety. In addition, the valve has an internal Canadian Gas Association (CGA) type 9 fusible link pressure relief device (PRD) that senses the internal fuel tank gas temperature. The contents in the tank are vented when the internal fuel tank gas temperature reaches 199°C (217°F) and melts the fusible link. The escaping gas is vented through a vent line to the atmosphere.

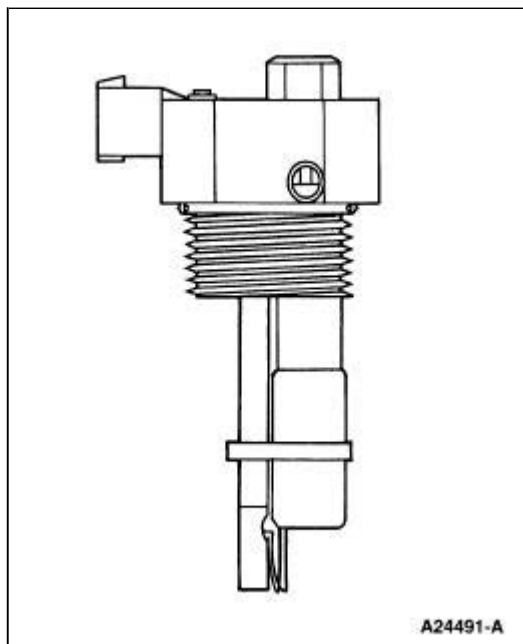


Figure 82: Fuel Tank Shutoff Valve

Inertia Fuel Shutoff (IFS) Switch

The inertia fuel shutoff (IFS) switch (Figure 83) is used in conjunction with electric fuel close valves. The purpose of the IFS switch is to close the fuel shut-off valves if a crash occurs. It consists of a steel ball held in place by a magnet. When a sharp impact occurs, the ball breaks loose from the magnet, rolls up a conical ramp and strikes a target plate which opens the electrical contacts of the switch and closes the electric fuel shut-off valve. **Once the switch is open, it must be manually reset before restarting the vehicle.** On some vehicles a fuel reset light illuminates. Refer to the Owner Guide for the location of the IFS.

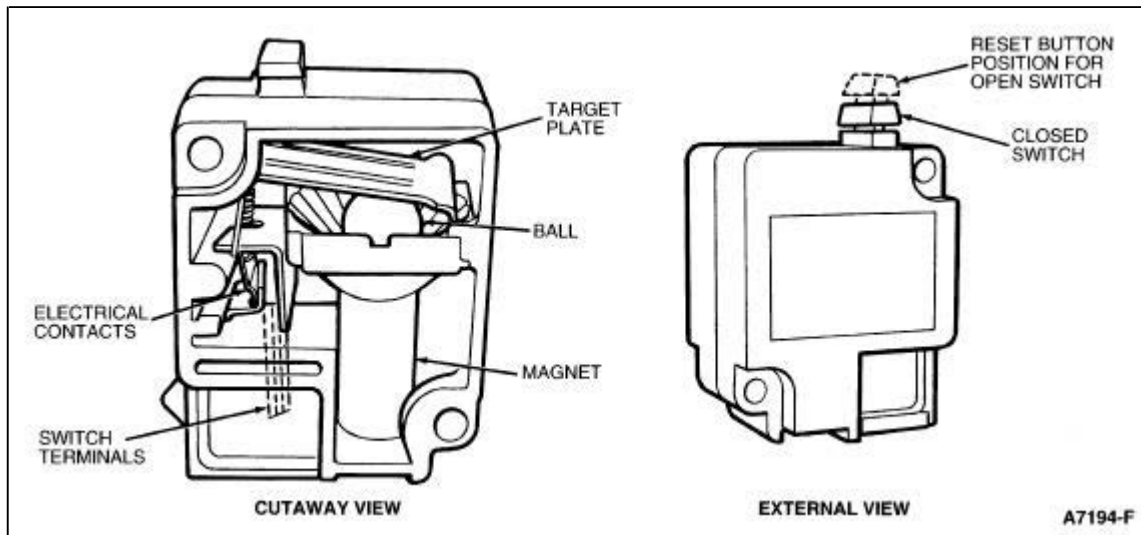



Figure 83: Inertia Fuel Shutoff (IFS) Switch

Reset Instructions

1. Turn key off.
2. Check for natural gas leaks in the engine compartment.
3. **Note:** In the closed position, the button can be depressed an additional 1.57 cm (1/16 inch) against a spring.

If no natural gas leak is apparent, reset the IFS by pushing the reset button on the top of the switch (refer to Owner Guide).

4. Turn key to on or start position for a few seconds, then off again.
5.  **WARNING: IF YOU SMELL NATURAL GAS AT ANY TIME OTHER THAN DURING FUELING, DO NOT RESET THE IFS SWITCH.**

Again, check for leaking natural gas.

Fuel Rail Shut-Off Valve

The fuel rail shut-off valve (Figure 84) is a normally closed solenoid actuated valve that opens when (along with all of the tank valves) Pin 80 is grounded by the PCM. The valve isolates the fuel injectors from fuel line pressure when the engine is off. Nominal resistance of the coil is 11 ohms. The fuel rail shut-off valve is wired in parallel with the four tank valves.

Fuel Rail Valve Circuit Operation

When the key is turned to the ON position, the power relay is turned on. The power relay provides power to the PCM and the control side of the fuel shut off valve relay. The relay provides voltage to the fuel rail valve. If the ignition switch is not turned to the START position, the PCM will shut off the fuel rail valve after one second. The PCM will open the valve (along with the four tank valves) to provide fuel while cranking. The valve will remain open when the engine is running unless the inertia fuel shut-off switch is "tripped."

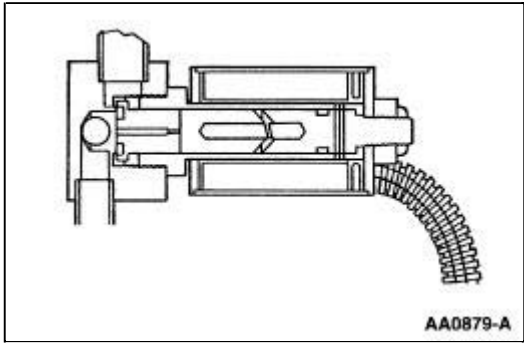


Figure 84: Fuel Rail Shut-Off Valve

Exhaust Gas Recirculation Systems

Overview

The Exhaust Gas Recirculation (EGR) system controls the oxides of nitrogen (NO_x) emissions. Small amounts of exhaust gases are recirculated back into the combustion chamber to mix with the air/fuel charge. The combustion chamber temperature is reduced, lowering NO_x emissions.

Differential Pressure Feedback EGR System

The Differential Pressure Feedback EGR system consists of a differential pressure feedback EGR sensor, EGR vacuum regulator solenoid, EGR valve, orifice tube assembly, powertrain control module (PCM) and connecting wires and vacuum hoses. Operation of the system is as follows (Figure 85):

1. The Differential Pressure Feedback EGR system receives signals from the engine coolant temperature (ECT) sensor, intake air temperature (IAT) sensor, throttle position (TP) sensor, mass air flow (MAF) sensor and crankshaft position (CKP) sensor to provide information on engine operating conditions to the PCM. The engine must be warm, stable and running at a moderate load and rpm before the EGR system is activated. The PCM deactivates EGR during idle, extended wide open throttle or whenever a failure is detected in an EGR component or EGR required input.
2. The PCM calculates the desired amount of EGR flow for a given engine condition. It then determines the desired pressure drop across the metering orifice required to achieve that flow and outputs the corresponding signal to the EGR vacuum regulator solenoid.
3. The EGR vacuum regulator solenoid receives a variable duty cycle signal (0 to 100%). The higher the duty cycle the more vacuum the solenoid diverts to the EGR valve.
4. The increase in vacuum acting on the EGR valve diaphragm overcomes the valve spring and begins to lift the EGR valve pintle off its seat, causing exhaust gas to flow into the intake manifold.
5. Exhaust gas flowing through the EGR valve must first pass through the EGR metering orifice. With one side of the orifice exposed to exhaust backpressure and the other to the intake manifold, a pressure drop is created across the orifice whenever there is EGR flow. When the EGR valve closes, there is no longer flow across the metering orifice and pressure on both sides of the orifice is the same. The PCM constantly targets a desired pressure drop across the metering orifice to achieve the desired EGR flow.
6. The differential pressure feedback EGR sensor measures the actual pressure drop across the metering orifice and relays a proportional voltage signal (0 to 5 volts) to the PCM. The PCM uses this feedback signal to correct for any errors in achieving the desired EGR flow.

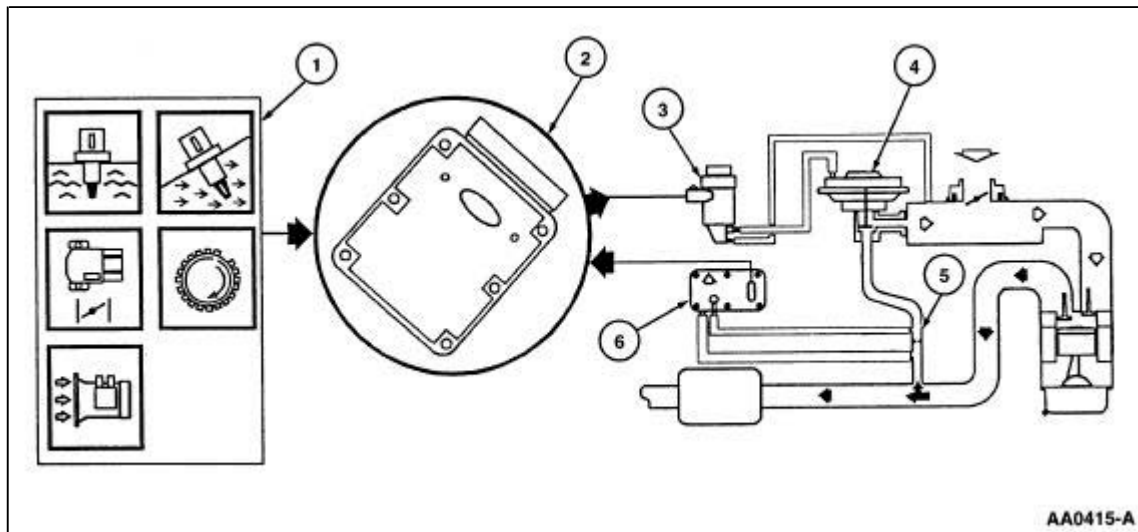


Figure 85: Differential Pressure Feedback EGR System Operation (Refer to the On-Board Diagnostics II System Overview for icon definitions.)

Hardware

Differential Pressure Feedback EGR Sensor

The differential pressure feedback EGR sensor (Figure 86) is a ceramic, capacitive-type pressure transducer that monitors the differential pressure across a metering orifice located in the orifice tube assembly. The differential pressure feedback sensor receives this signal through two hoses referred to as the downstream pressure hose (REF SIGNAL) and upstream pressure hose (HI SIGNAL). The HI and REF hose connections are marked on the aluminum differential pressure feedback EGR sensor housing for identification (note that the HI signal uses a larger diameter hose). The differential pressure feedback EGR sensor outputs a voltage proportional to the pressure drop across the metering orifice and supplies it to the PCM as EGR flow rate feedback.

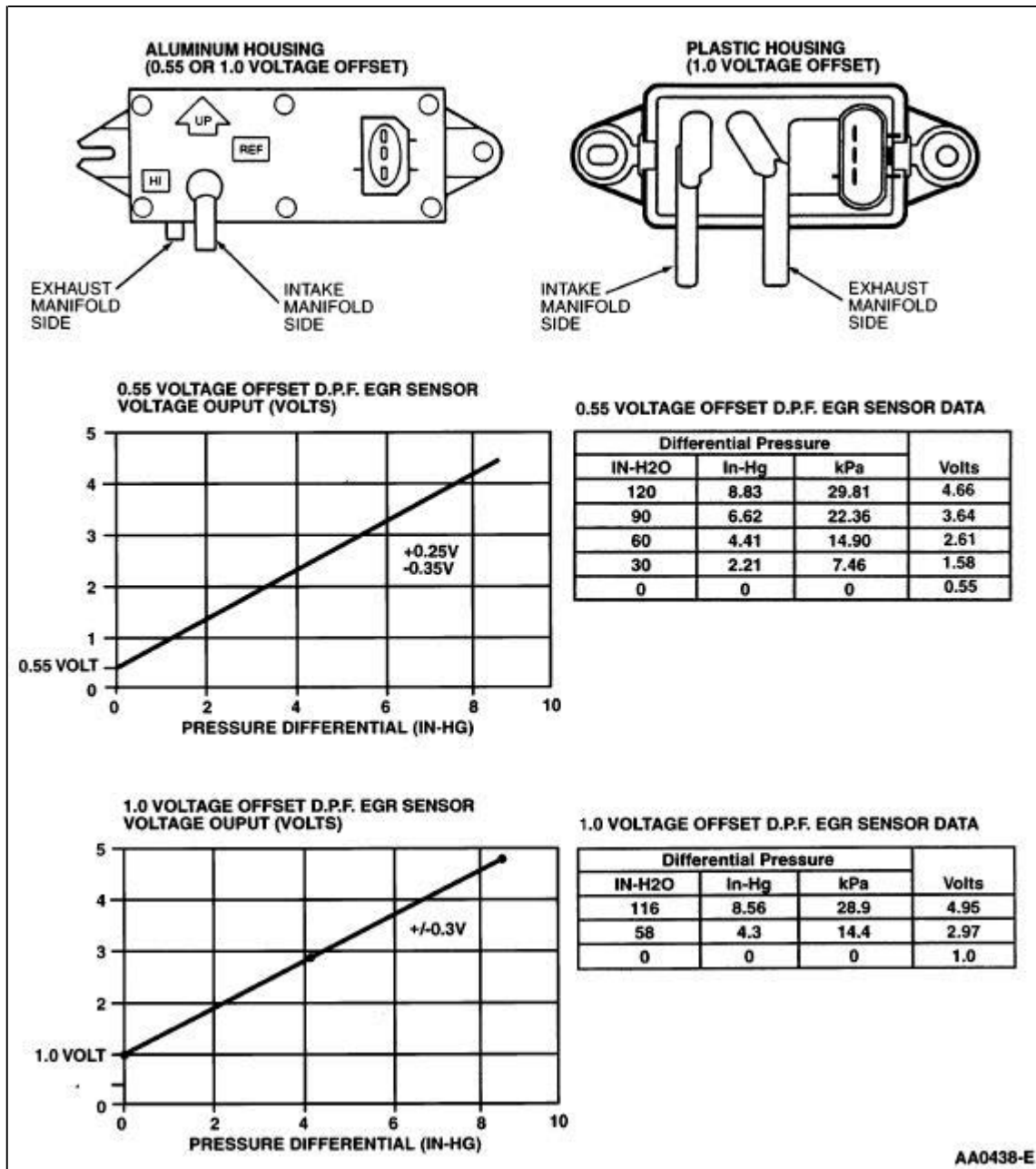
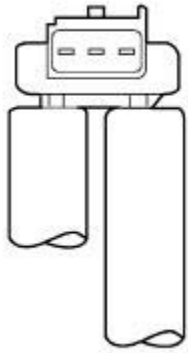


Figure 86: Differential Pressure Feedback EGR Sensor

Tube Mounted Differential Pressure Feedback EGR Sensor

The tube mounted differential pressure feedback EGR sensor (Figure 87) is identical in operation as the larger metal or plastic DPFE sensors and uses a 1.0 volt offset. The HI and REF hose connections are marked on the underside of the sensor.

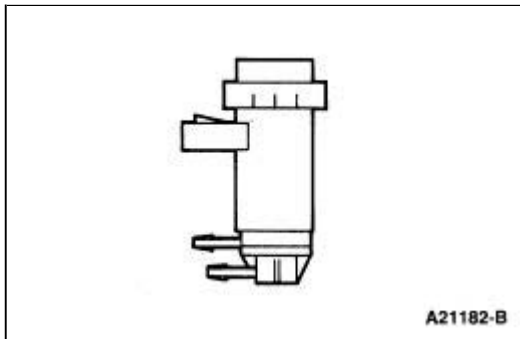


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Figure 87: Tube Mounted Differential Pressure Feedback EGR Sensor

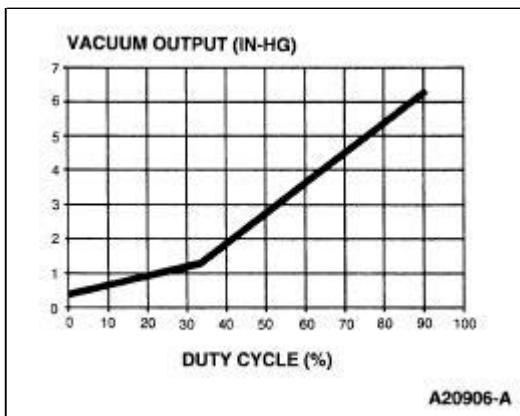
EGR Vacuum Regulator Solenoid

The EGR vacuum regulator solenoid (Figure 88) is an electromagnetic device which is used to regulate the vacuum supply to the EGR valve. The solenoid contains a coil which magnetically controls the position of a disc to regulate the vacuum. As the duty cycle to the coil increases, the vacuum signal passed through the solenoid to the EGR valve also increases. Vacuum not directed to the EGR valve is vented through the solenoid vent to atmosphere. Note that at 0% duty cycle (no electrical signal applied), the EGR vacuum regulator solenoid allows some vacuum to pass, but not enough to open the EGR valve.



A21182-B

Figure 88: EGR Vacuum Regulator Solenoid



A20906-A

EGR VACUUM REGULATOR SOLENOID DATA

Duty Cycle (%)	Vacuum Output					
	Minimum		Nominal		Maximum	
	In-Hg	kPa	In-Hg	kPa	In-Hg	kPa
0	0	0	.38	1.28	.75	2.53
33	.55	1.86	1.3	4.39	2.05	6.9
90	5.69	19.2	6.32	21.3	6.95	23.47
EGR Vacuum Regulator Resistance: 26-40 Ohms						

Exhaust Gas Recirculation Valve

The EGR valve (Figure 89) in the Differential Pressure Feedback EGR system is a conventional, vacuum-actuated EGR valve. The valve increases or decreases the flow of exhaust gas recirculation. As vacuum applied to the EGR valve diaphragm overcomes the spring force, the valve begins to open. As the vacuum signal weakens, at 5.4 kPa (1.6 in-Hg) or less, the spring force closes the valve. The EGR valve is fully open at about 15 kPa (4.5 in-Hg).

Since EGR flow requirement varies greatly, providing service specifications on flow rate is impractical. The on-board diagnostic system monitors the EGR valve function and triggers a Diagnostic Trouble Code if the test criteria is not met. The EGR valve flow rate is not measured directly as part of the field diagnostic procedures.

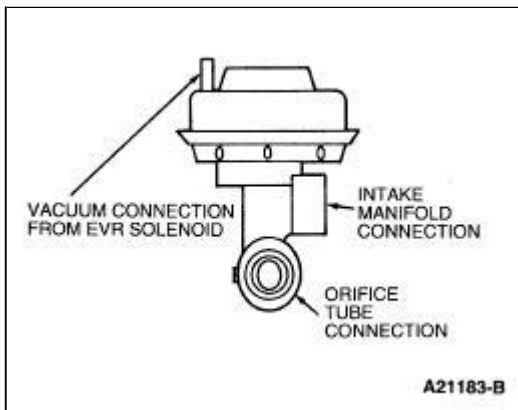
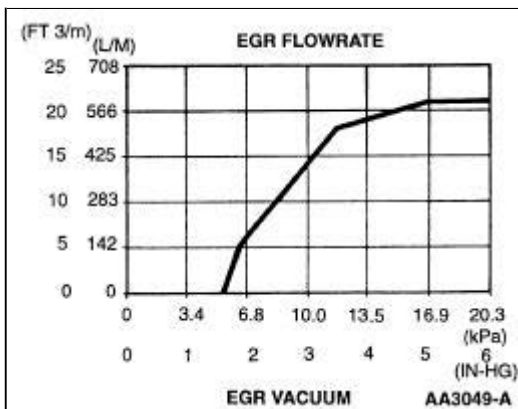


Figure 89: EGR Valve



Orifice Tube Assembly

The orifice tube assembly (Figure 90) is a section of tubing connecting the exhaust system to the intake manifold. The assembly provides the flow path for the EGR to the intake manifold and also contains the metering orifice and two pressure pick-up tubes. The internal metering orifice creates a measurable pressure drop across it as the EGR valve opens and closes. This pressure differential across the orifice is picked up by the differential pressure feedback EGR sensor which provides feedback to the PCM.

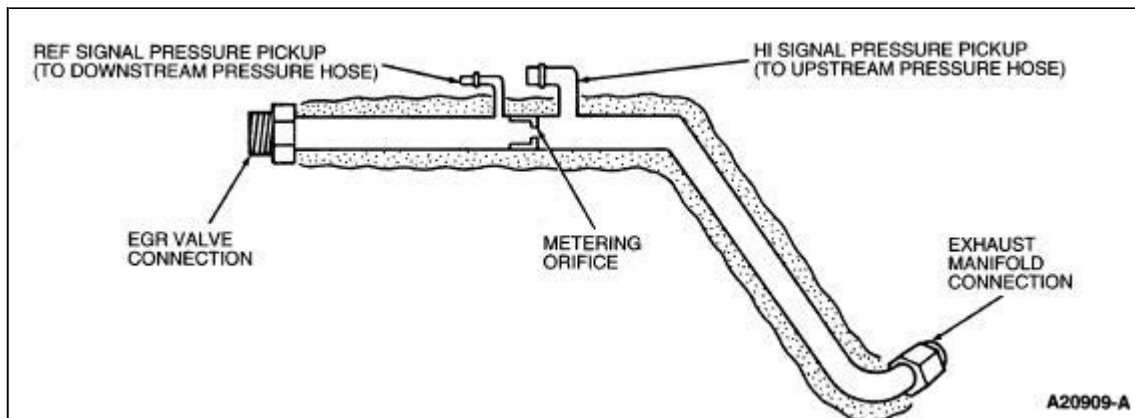


Figure 90: Orifice Tube Assembly

Electric Motor EGR System (EEGR)

Highlights of the Electric System

- EEGR valve is activated by an electric stepper motor not a vacuum motor (Rear of engine block).
- No vacuum diaphragm is used.
- No DPFE sensor is used.
- No Orifice Tube/Assembly is used.
- No EGR vacuum regulator solenoid is used.
- A new MAP sensor is used (called TMAP but the temperature function is not used at this time) (located on top of the valve cover).
- Engine coolant is routed through the assembly extending durability of the electric motor.

Overview

The electric EGR system uses exhaust gas recirculation to control the oxides of nitrogen (NO_x) emissions just like vacuum operated systems. The only difference is the way in which the exhaust gas is controlled.

The Electric EGR system consists of an electric motor/EGR valve integrated assembly, a PCM, and connecting wiring. Additionally a MAP sensor is also required. Operation of the system is as follows (Figure 91):

1. The EEGR system receives signals from the engine coolant temperature (ECT) or cylinder head temperature (CHT) sensor, throttle position (TP) sensor, mass air flow (MAF) sensor, crankshaft position (CKP) sensor and the manifold absolute pressure (MAP) sensor to provide information on engine operating conditions to the PCM. The engine must be warm, stable and running at a moderate load and rpm before the EEGR system is activated. The PCM will deactivate EGR during idle, extended wide open throttle or whenever a failure is detected in an EEGR component or EGR required input.
2. The PCM calculates the desired amount of EGR for a given set of engine operating conditions.

3. The PCM in turn will output signals to the EGR motor to move (advance or retract) a certain number of discrete steps. The electric stepper motor will directly actuate the EGR valve, independent of engine vacuum. The EGR valve is commanded from 0 to 52 discrete increments or "steps" to get the EGR valve from a fully closed to full or partially open position. The position of the EGR valve determines the EGR flow.
4. A MAP sensor is used to measure variations in manifold pressure as exhaust gas recirculation is introduced into the intake manifold. Variations in EGR being used will correlate to the MAP signal (increasing EGR will increase manifold pressure values).

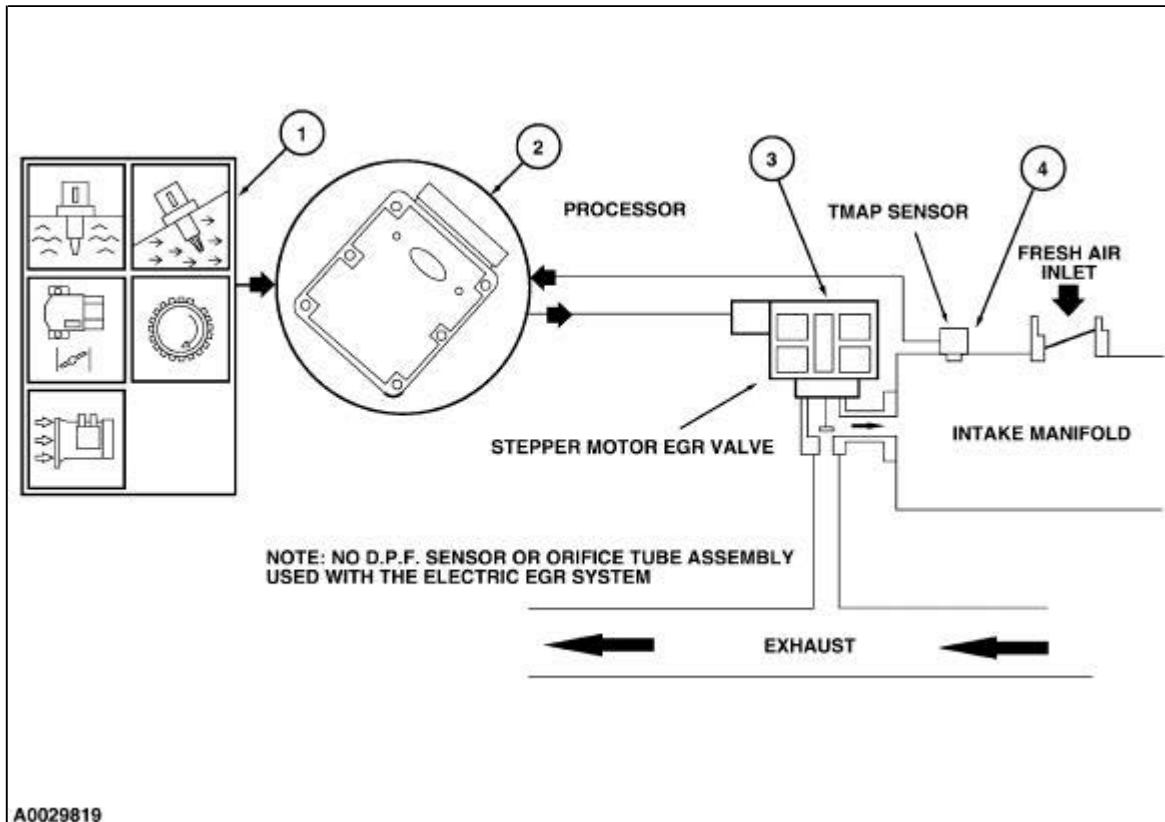


Figure 91: Electric EGR System

Hardware

The electric EGR valve (Figure 92) and (Figure 93) is a water cooled motor/valve assembly. The motor is commanded to move in 52 discrete steps as it acts directly on the the EGR valve. The position of the valve determines the rate of EGR. The built in spring works to close the valve (against the motor opening force).

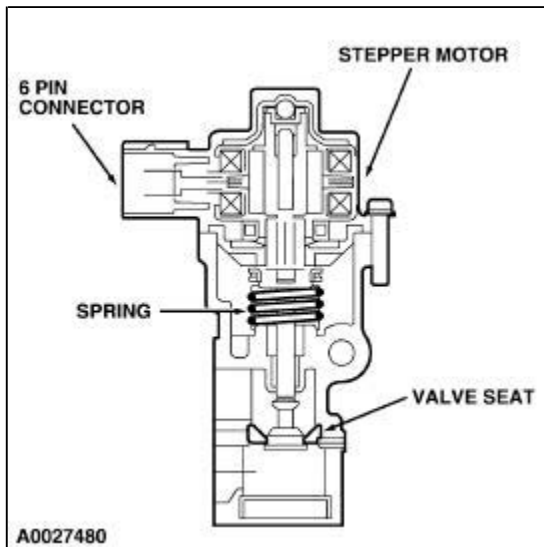


Figure 92: Electric EGR Motor/Valve Assembly

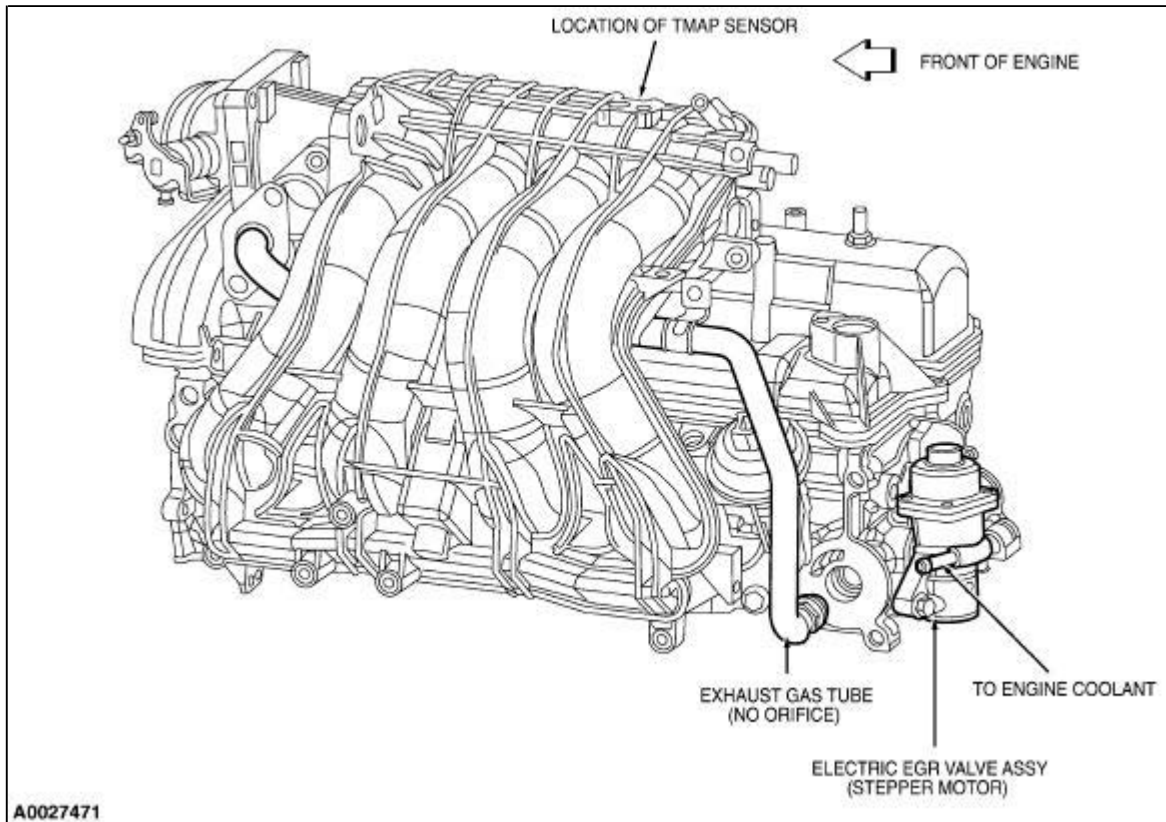


Figure 93: 2.3L Ranger Electric EGR

Evaporative Emission Systems

Overview

The Evaporative Emission (EVAP) system prevents fuel vapor build-up in the sealed fuel tank. Fuel vapors trapped in the sealed tank are vented through the vapor valve assembly on top of the tank. The vapors leave the valve assembly through a single vapor line and continue to the EVAP canister (located in the engine compartment, in the rear of vehicle near luggage compartment area or along the frame rail) for storage until the vapors are purged to the engine for burning.

There are two types of Evaporative Emission (EVAP) systems:

- The Enhanced Evaporative Emission (EVAP) system.
- The On-Board Refueling Vapor Recovery (ORVR) Evaporative Emission (EVAP) system.

Enhanced Evaporative Emission (EVAP) System

The Enhanced EVAP system (Figure 94) consists of a fuel tank, fuel filler cap, fuel tank mounted or in-line fuel vapor control valve, fuel vapor vent valve, EVAP canister, fuel tank mounted or fuel pump mounted or in-line fuel tank pressure (FTP) sensor, EVAP canister purge valve, intake manifold hose assembly, canister vent (CV) solenoid, powertrain control module (PCM) and connecting wires and fuel vapor hoses.

1. The Enhanced EVAP system uses inputs from the engine coolant temperature (ECT) sensor, the intake air temperature (IAT) sensor, the mass air flow (MAF) sensor, the vehicle speed sensor (VSS) and the fuel tank pressure (FTP) sensor to provide information about engine operating conditions to the PCM. The fuel level input (FLI) and FTP sensor signals to the PCM are used by the PCM to determine activation of the EVAP Monitor based on presence of vapor generation or fuel sloshing.
2. The PCM calculates a variable duty cycle based on the desired amount of purge vapor flow to the intake manifold for a given engine condition. The PCM can then output the duty cycle to the solenoid on the EVAP canister purge valve. The PCM uses the Enhanced EVAP system inputs to evacuate the system using the EVAP canister purge valve, seals the Enhanced EVAP system from atmosphere using the CV solenoid, and uses the FTP sensor to observe total vacuum lost for a period of time.
3. The canister vent (CV) solenoid seals the Enhanced EVAP system to atmosphere during the EVAP leak check Monitor.
4. The PCM outputs a variable duty cycle signal (between 0% and 100%) to the solenoid on the EVAP canister purge valve.
5. The fuel tank pressure (FTP) sensor monitors the fuel tank pressure during engine operation and continuously transmits an input signal to the PCM. During the EVAP monitor testing, the FTP sensor monitors the fuel tank pressure or vacuum bleed-up.
6. The fuel tank mounted fuel vapor vent valve assembly, fuel tank mounted fuel vapor control valve (or remote fuel vapor control valve) are used in the Enhanced EVAP system to control the flow of fuel vapor entering the engine. All of these valves also prevent fuel tank overfilling during refueling operation and prevent liquid fuel from entering the EVAP canister and the EVAP canister purge valve under any vehicle altitude, handling or rollover condition. The liquid/vapor fuel discriminator is part of the fuel vapor control valve assembly on Escort and Focus applications.
7. The Enhanced EVAP system, including all the fuel vapor hoses, can be checked when a leak is detected by the PCM. This can be done by pressurizing the system using Rotunda Evaporative Emission Tester kit 134-00056 or equivalent and the leak (frequency) detector included with the

kit.

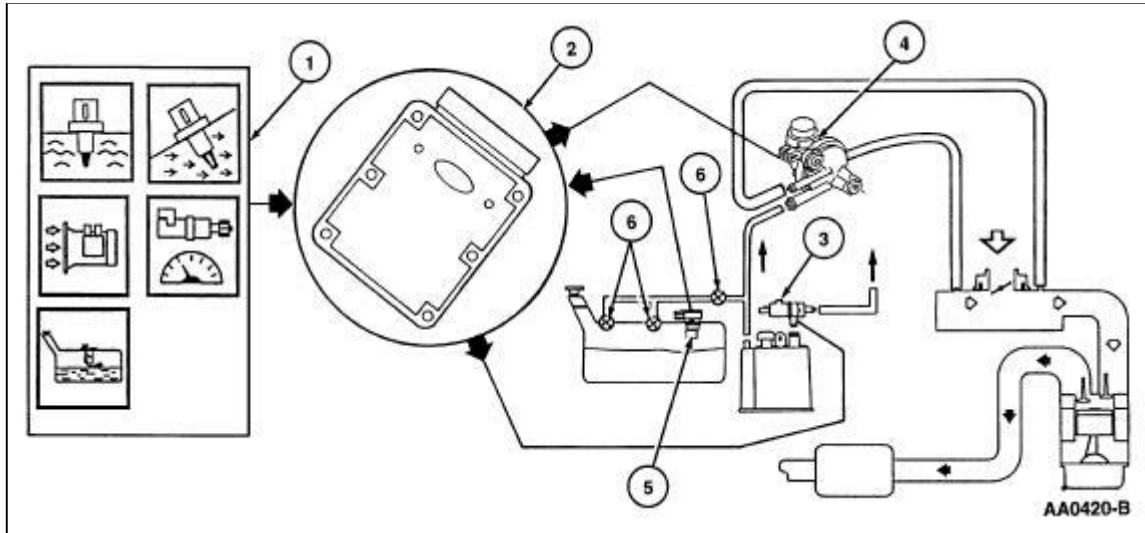


Figure 94: Enhanced Evaporative Emission System (Refer to the On-Board Diagnostics II System Overview for icon definitions.)

Hardware

EVAP Canister Purge Valve

The EVAP canister purge valve (Figure 95) and (Figure 96) is the part of the Enhanced EVAP system that is controlled by the PCM. This valve controls the flow of vapors (purging) from the EVAP canister to the intake manifold during various engine operating modes. The EVAP canister purge valve is normally closed valve.

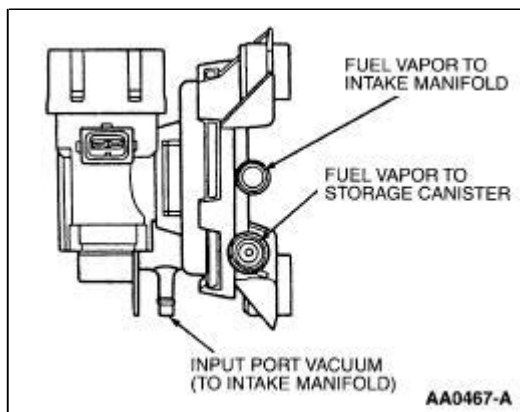


Figure 95: EVAP Canister Purge Valve

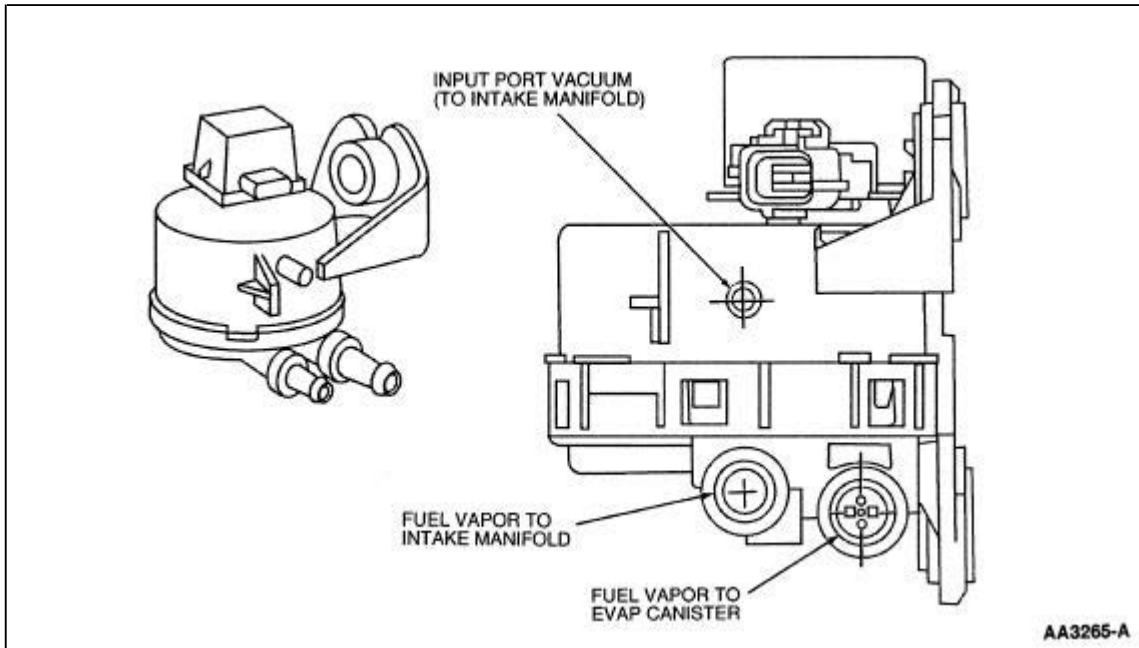


Figure 96: EVAP Canister Purge Valve (used on Focus, Escort, Taurus/Sable, Mustang and LS6/LS8)

Fuel Tank Pressure Sensor

The fuel tank pressure (FTP) sensor (Figure 97) or inline fuel tank pressure (FTP) sensor (Figure 98) is used to measure the fuel tank pressure during the EVAP monitor test on vehicles equipped with the Running Loss-type system. Also, it is used to control excessive fuel tank pressure by forcing the system to purge.

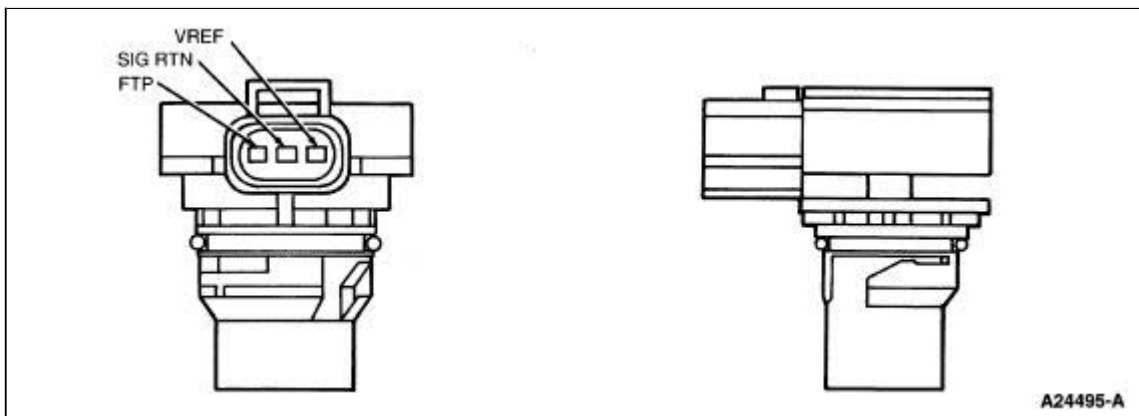


Figure 97: Fuel Tank Pressure (FTP) Sensor

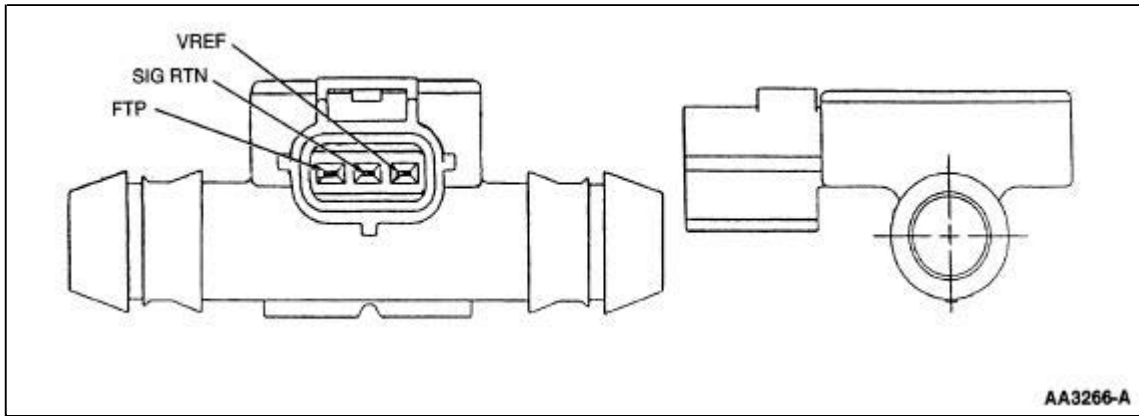


Figure 98: In-Line Fuel Tank Pressure (FTP) Sensor

Canister Vent Solenoid

During the Enhanced EVAP System test monitor, the canister vent (CV) solenoid (Figure 99) seals the EVAP canister from atmospheric pressure. This allows the EVAP canister purge valve to obtain the target vacuum in the fuel tank during the monitor run.

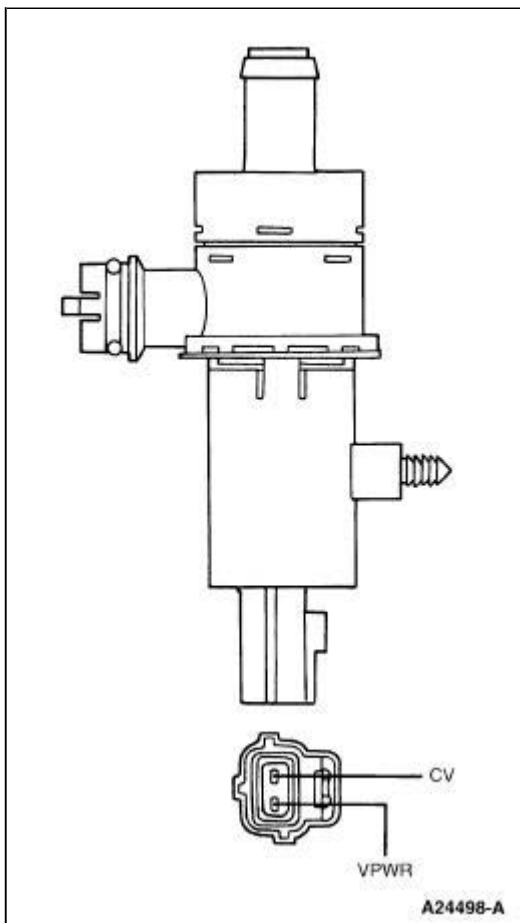


Figure 99: Typical Canister Vent (CV) Solenoid

Fuel Filler Cap

The fuel filler cap (Figure 100) is used to prevent fuel spill and close the evaporative emission/fuel system to atmosphere. Some vehicles may have a Fuel Cap Off Indicator Lamp (FCIL) in the instrument

cluster which will illuminate when there is a failure in the vapor management system that may be due to the fuel filler cap not being sealed.

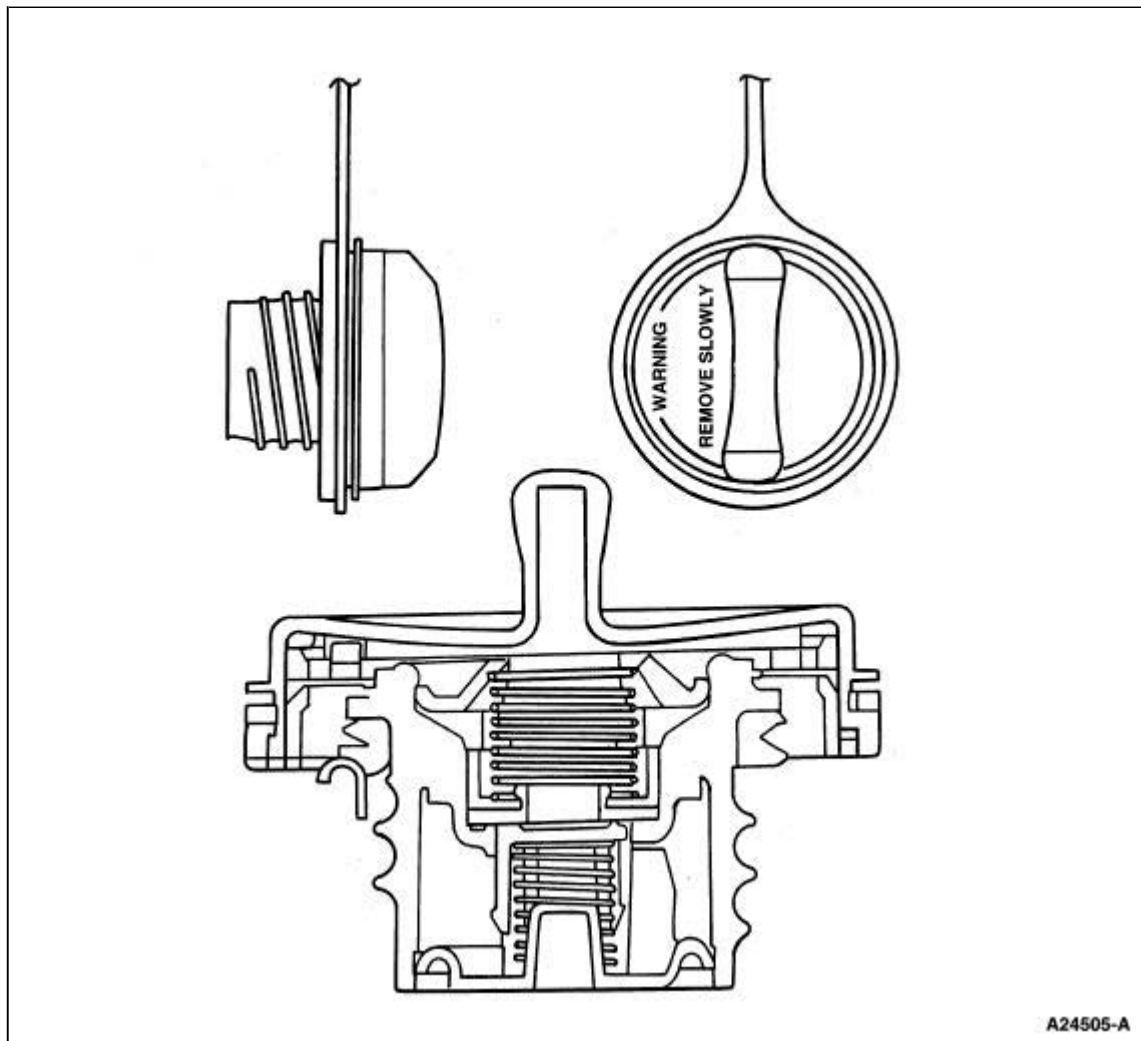


Figure 100: Fuel Filler Cap

Refer to the appropriate Workshop Manual for information on the following Evaporative Emission System components: fuel vapor control valve, fuel vapor vent valve assembly and fuel vapor separator assembly.

On-Board Refueling Vapor Recovery (ORVR) Evaporative Emission (EVAP) System

The basic elements forming the ORVR system (Figure 101), (Figure 102) and (Figure 103) operation are as follows when fuel is dispensed:

1. The fuel filler pipe forms a seal to prevent vapors from escaping the fuel tank, while liquid is entering the fuel tank (liquid in the one inch diameter tube blocks vapors from rushing back up the fuel filler pipe).
2. A fuel vapor control valve controls the flow of vapors out of the fuel tank (valve closes when liquid level reaches a height associated with the fuel tank usable capacity). This valve accomplishes the following:
 - a. Limits the total amount of fuel that can be dispensed into the fuel tank.

- b. Prevents liquid gasoline from exiting the fuel tank when submerged (and also when tipped well beyond a horizontal plane as part of the vehicle roll-over protection in road accidents).
 - c. Minimizes vapor flow resistance during anticipated refueling conditions.
3. Fuel vapor tubing connects the fuel vapor control valve to the EVAP canister. This routes the fuel tank vapors (displaced by the incoming liquid) to the EVAP canister.
 4. A check valve in the bottom of the fuel filler pipe prevents liquid from rushing back up the fuel filler pipe during the liquid flow variations associated with the filler nozzle shut-off.

Between refueling events, the EVAP canister is purged with fresh air so that it may be used again to store vapors accumulated engine soaks or subsequent refueling events. The vapors drawn off of the carbon in the EVAP canister are consumed in the engine.

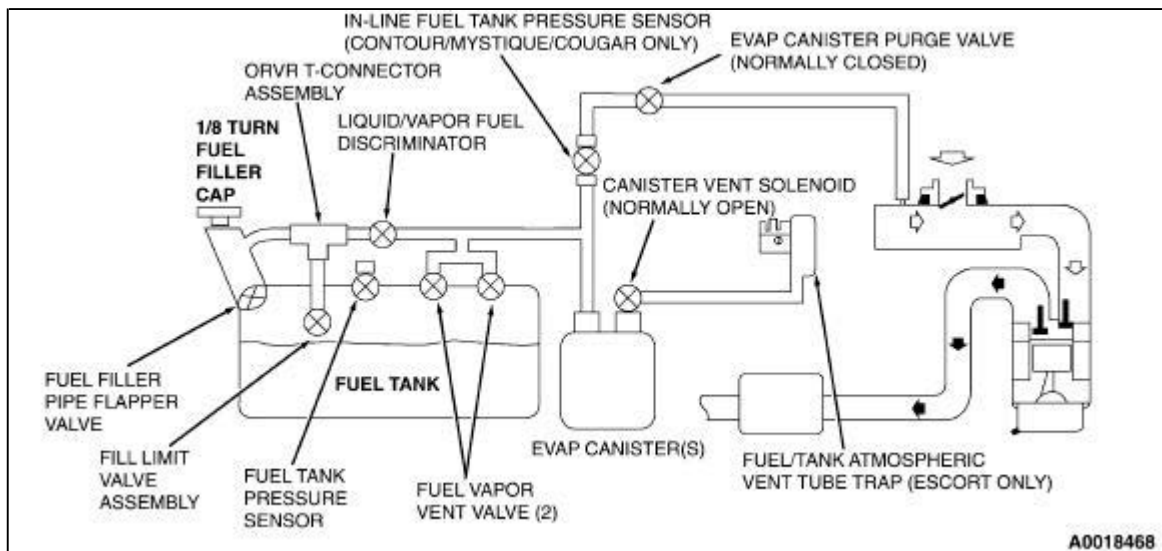


Figure 101: On-Board Refueling Vapor Recovery Evaporative Emission System Operation for Focus, Escort and Cougar

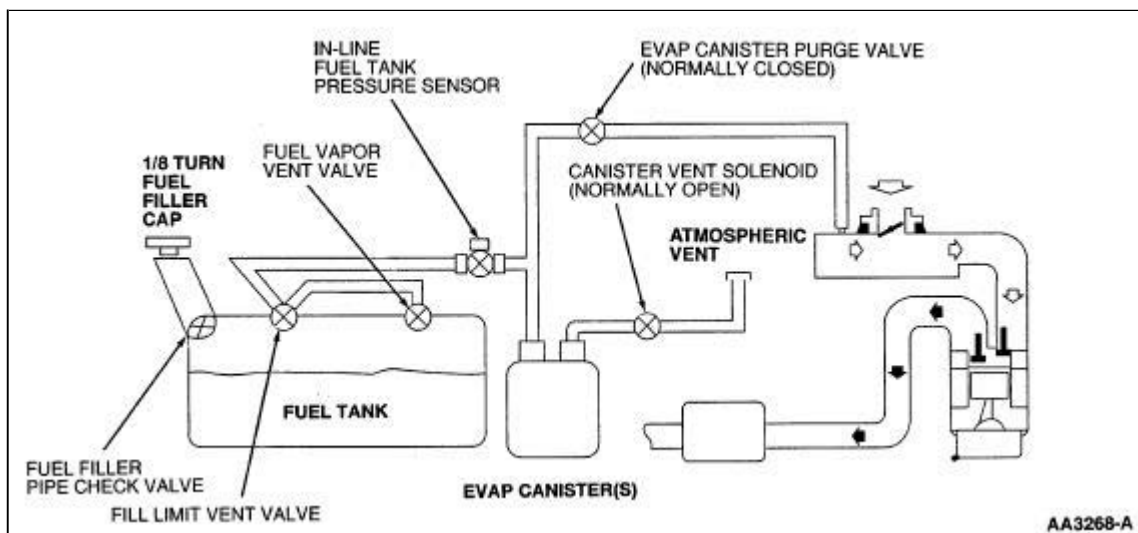


Figure 102: On-Board Refueling Vapor Recovery Evaporative Emission System Operation for LS6/LS8

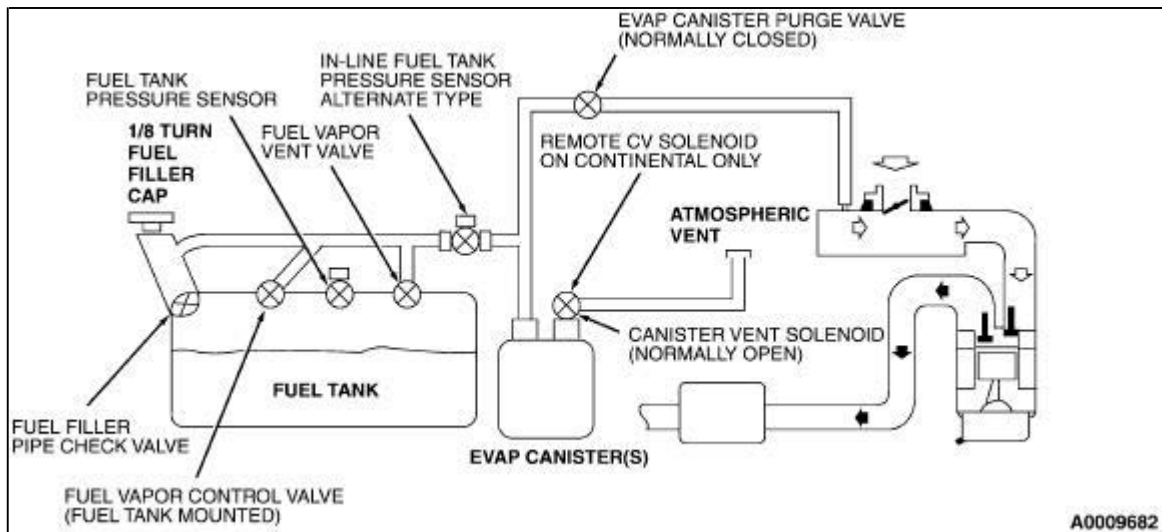


Figure 103: On-Board Refueling Vapor Recovery Evaporative Emission System Operation

Refer to Section 303-13 in the Workshop Manual for information on the following Evaporative Emission System components: liquid/vapor fuel discriminator, fuel filler pipe check valve, fill limit valve assembly, fill limit vent valve assembly, fuel filler pipe flapper valve, fuel vapor control valve (fuel tank mounted), ORVR T-connector assembly and EVAP canister.

Intake Air System

Overview

The Intake Air system (Figure 104) provides clean air to the engine, optimizes air flow and reduces unwanted induction noise. The Intake Air System consists of an air cleaner assembly, resonator assemblies and hoses. The main component of the intake air system is the air cleaner assembly. The air cleaner assembly houses the air cleaner element that removes potential engine contaminants, particularly abrasive types. The mass air flow (MAF) sensor is attached internally or externally to the air cleaner assembly and measures the quantity of air delivered to the engine combustion chamber. The MAF sensor can be serviced or replaced as an individual component. The intake air system also contains a sensor that measures the intake air temperature which may also be integrated with the MAF sensor. (Refer to Electronic EC Hardware - PCM Inputs for additional information on the MAF and IAT sensors.) Air induction resonators can be separate components or part of the intake air housing (i.e., conical air cleaner). The function of a resonator is to reduce induction noise. The air induction components are connected to each other and to the throttle body assembly with hoses.

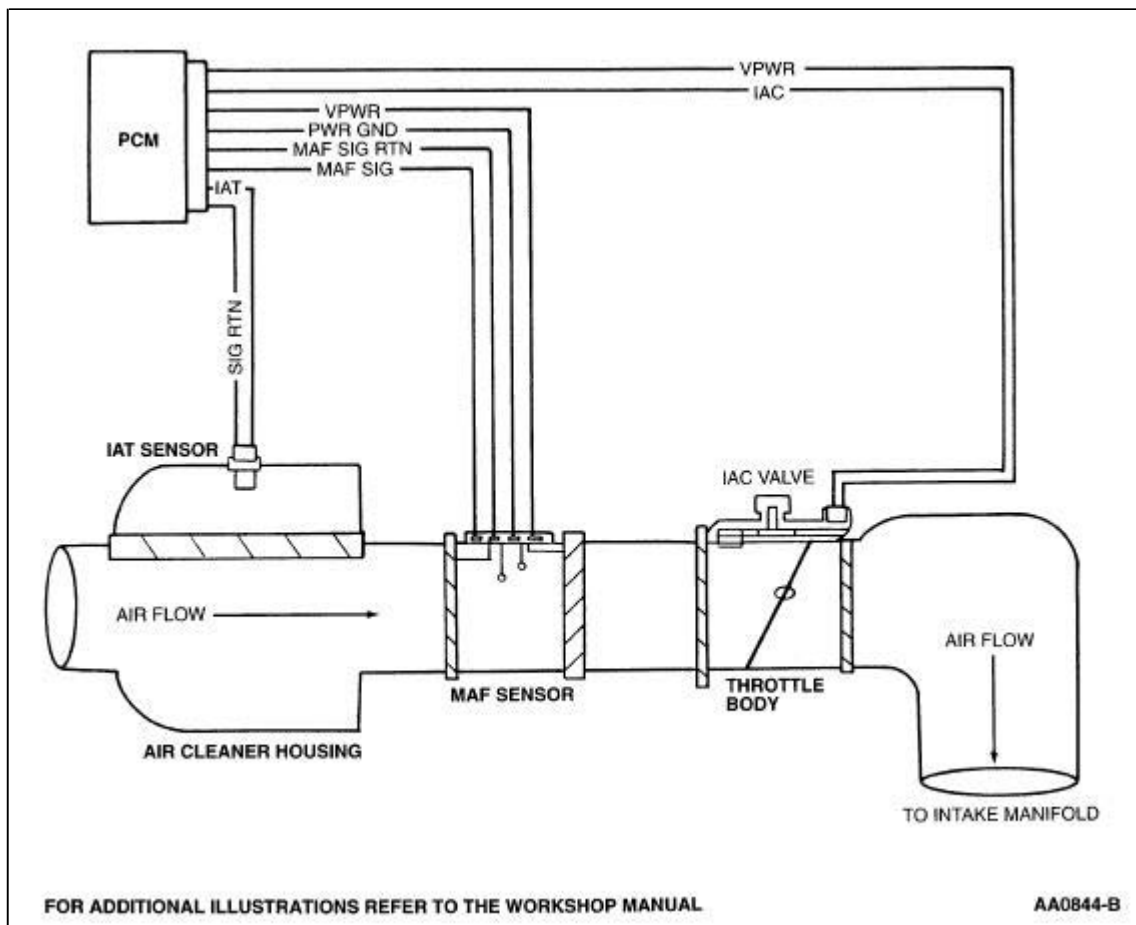


Figure 104: Intake Air System

Note: For additional illustrations, refer to the Workshop Manual.

There are three basic types of intake air sub-systems:

- Intake Manifold Runner Control (IMRC) electric actuated system
- Intake Manifold Swirl Control (IMSC) vacuum actuated system

- Intake Manifold Tuning Valve (IMTV)

These subsystems are used to provide increased intake airflow to improve torque, emissions and performance. The overall quantity of air metered to the engine is controlled by the throttle body.

Intake Manifold Runner Control (IMRC) Electric Actuated System

The Intake Manifold Runner Control (IMRC) Electric Actuated system (Figure 105) consists of a remote mounted motorized actuator with an attaching cable for each housing on each bank. Some applications will use one cable for both banks. The cable or linkage attaches to the housing butterfly plate levers. The 2.0L (2V) Focus/Escort IMRC uses a motorized actuator mounted directly to a single housing without the use of a cable. Each IMRC housing is an aluminum casting with two intake air passages for each cylinder. One passage is always open and the other is opened and closed with a butterfly valve plate. The housing uses a return spring to hold the butterfly valve plates closed. The motorized actuator houses an internal switch or switches, depending on the application, to provide feedback to the PCM indicating cable and butterfly valve plate position.

Below approximately 3000 rpm, the motorized actuator will not be energized. This will allow the cable to fully extend and the butterfly valve plates to remain closed. Above approximately 3000 rpm, the motorized actuator will be energized. The attaching cable will pull the butterfly valve plates into the open position. Some vehicles will activate the IMRC near 1500 rpm.



WARNING: SUBSTANTIAL OPENING AND CLOSING TORQUE IS APPLIED BY THIS SYSTEM. TO PREVENT INJURY, BE CAREFUL TO KEEP FINGERS AWAY FROM LEVER MECHANISMS WHEN ACTUATED.

1. The PCM uses the TP sensor and CKP signals to determine activation of the IMRC system. There must be a positive change in voltage from the TP sensor along with the increase in rpm to open the valve plates.
2. The PCM uses the information from the input signals to control the IMRC motorized actuator based upon rpm and changes in throttle position.
3. The PCM energizes the actuator to pull the butterfly plates open with the cable(s) or linkage.
4. The IMRC housing contain butterfly plates to allow increased air flow.

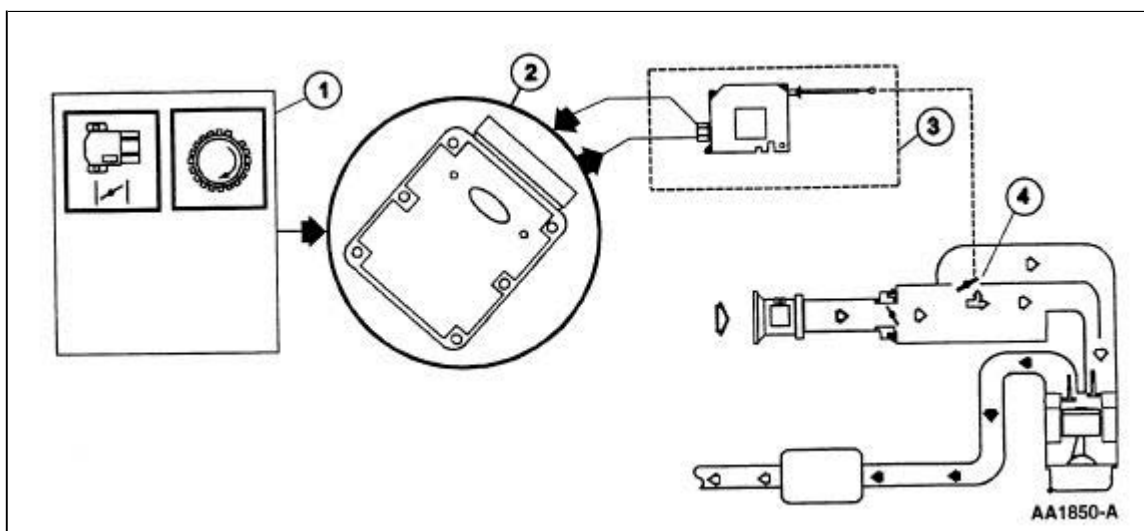


Figure 105: Intake Manifold Runner Control (IMRC) - Electric Actuated (Refer to the On Board Diagnostics II System Overview for Icon Definitions).

Intake Manifold Swirl Control (IMSC) Vacuum Actuated System

The Intake Manifold Swirl Control (IMSC) Vacuum Actuated system (Figure 106) consists of a manifold mounted vacuum actuator and a PCM controlled electric solenoid. The linkage from the actuator attaches to the manifold butterfly plate lever. The IMSC actuator and manifold are composite/plastic with a single intake air passage for each cylinder. The passage has a butterfly valve plate that blocks 60% of the opening when actuated, leaving the top of the passage open to generate turbulence. The housing uses a return spring to hold the butterfly valve plates open. The vacuum actuator houses an internal monitor circuit to provide feedback to the PCM indicating butterfly valve plate position.

Below approximately 3000 rpm, the vacuum solenoid will be energized. This will allow manifold vacuum to be applied and the butterfly valve plates to remain closed. Above approximately 3000 rpm, the vacuum solenoid will be de-energized. This will allow vacuum to vent from the actuator and the butterfly valve plates to open.



WARNING: SUBSTANTIAL OPENING AND CLOSING TORQUE IS APPLIED BY THIS SYSTEM. TO PREVENT INJURY, BE CAREFUL TO KEEP FINGERS AWAY FROM LEVER MECHANISMS WHEN ACTUATED.

1. The PCM monitors the TP sensor, CHT and CKP signals to determine activation of the IMSC system. There must be a positive change in voltage from the TP sensor along with the increase in rpm at the proper engine temperature to open the valve plates.
2. The PCM uses the information from the input signals to control the IMSC electric solenoid based upon changes in throttle position, engine temperature and rpm.
3. The PCM energizes the solenoid with the key on engine running, vacuum is then applied to the actuator to pull the butterfly plates closed.

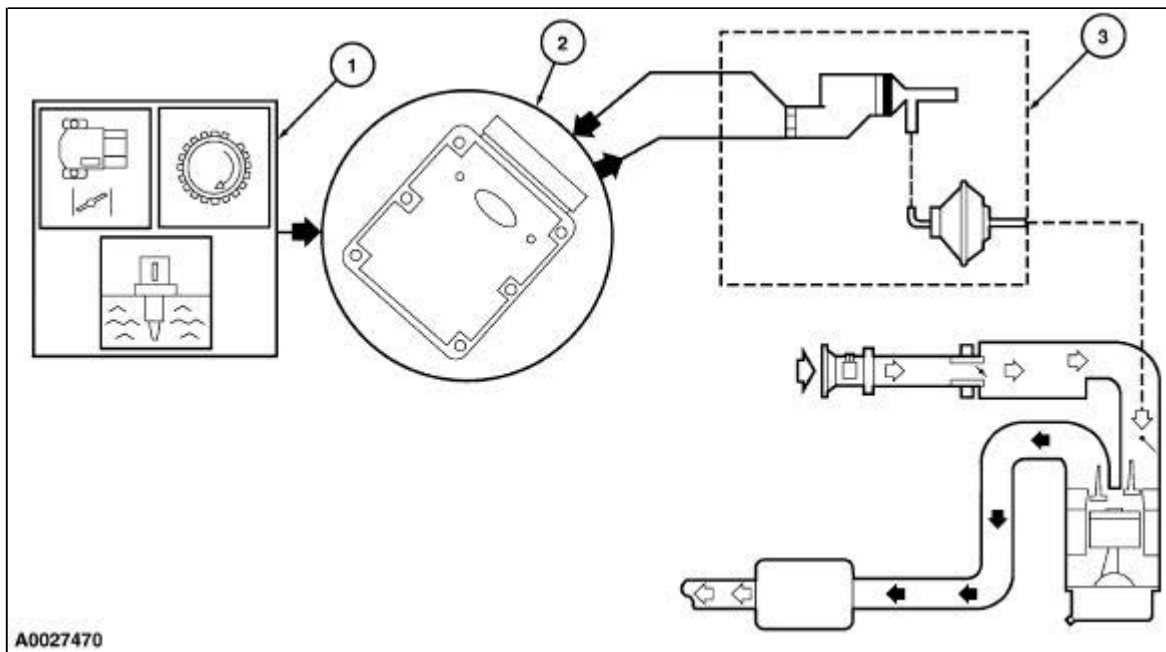


Figure 106: Intake Manifold Swirl Control (IMSC) -Vacuum Actuated (Refer to the On Board Diagnostics II System Overview for Icon Definitions.

Intake Manifold Tuning Valve (IMTV)

The intake manifold tuning valve (IMTV) (Figure 107) is a motorized actuated unit mounted directly to the intake manifold. The IMTV actuator controls a shutter device attached to the actuator shaft. There is no monitor input to the PCM with this system to indicate shutter position.

The motorized IMTV unit will not be energized below approximately 2600 rpm or higher on some vehicles. The shutter will be in the closed position not allowing airflow blend to occur in the intake

manifold. Above approximately 2600 rpm or higher, the motorized unit will be energized. The motorized unit will be commanded on by the PCM initially at a 100 percent duty cycle to move the shutter to the open position and then falling to approximately 50 percent to continue to hold the shutter open.

1. The PCM uses the TP sensor and CKP signals to determine activation of the IMTV system. There must be a positive change in voltage from the TP sensor along with the increase in rpm to open the shutter.
2. The PCM uses the information from the input signals to control the IMTV.
3. When commanded on by the PCM, the motorized actuator shutter opens up the end of the vertical separating wall at high engine speeds to allow both sides of the manifold to blend together.

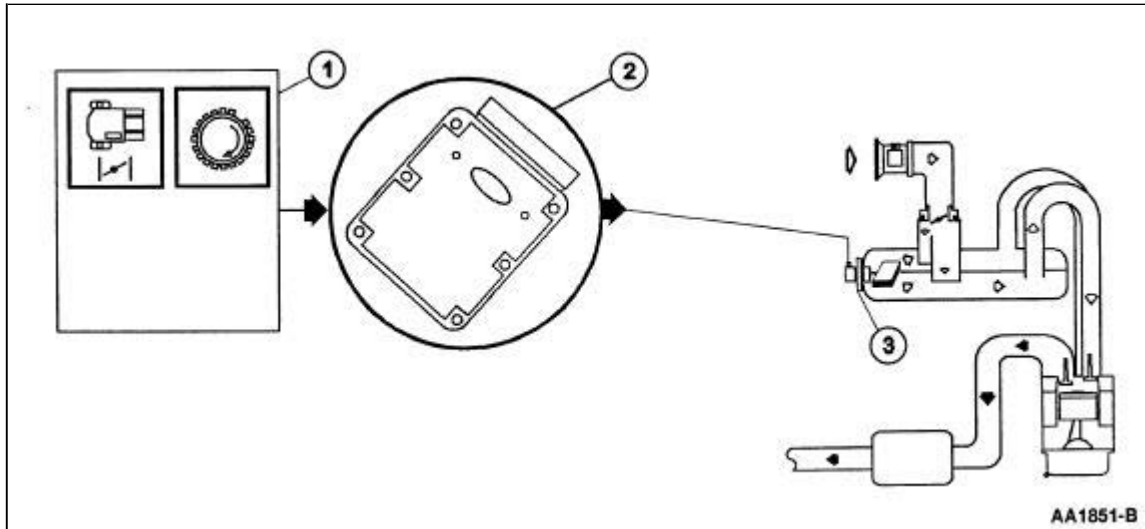


Figure 107: Intake Manifold Tuning Valve (IMTV) (Refer to the On-Board Diagnostics II System Overview for icon definitions.)

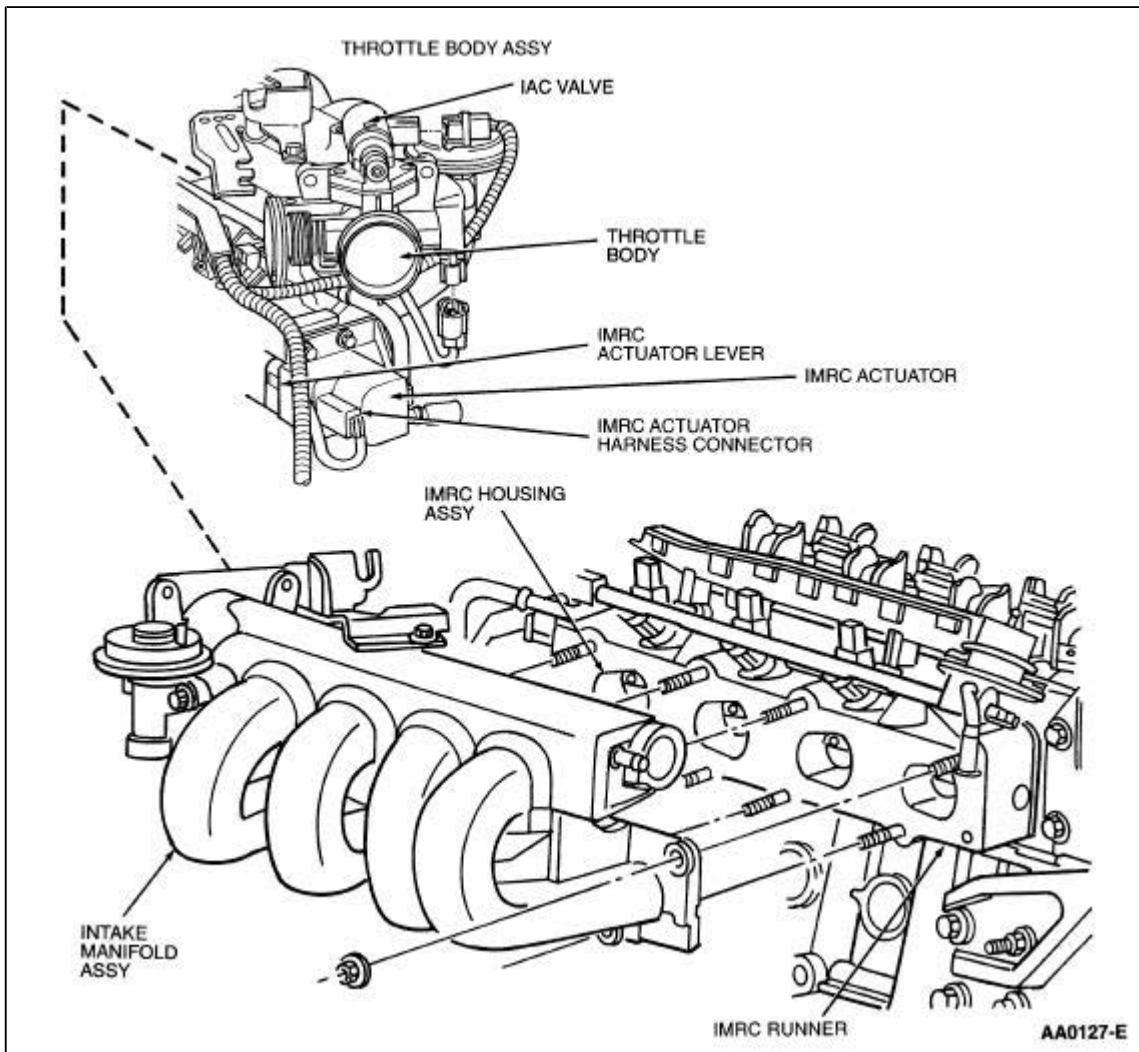


Figure 108: 2.0L 2V Focus/Escort Intake Air System

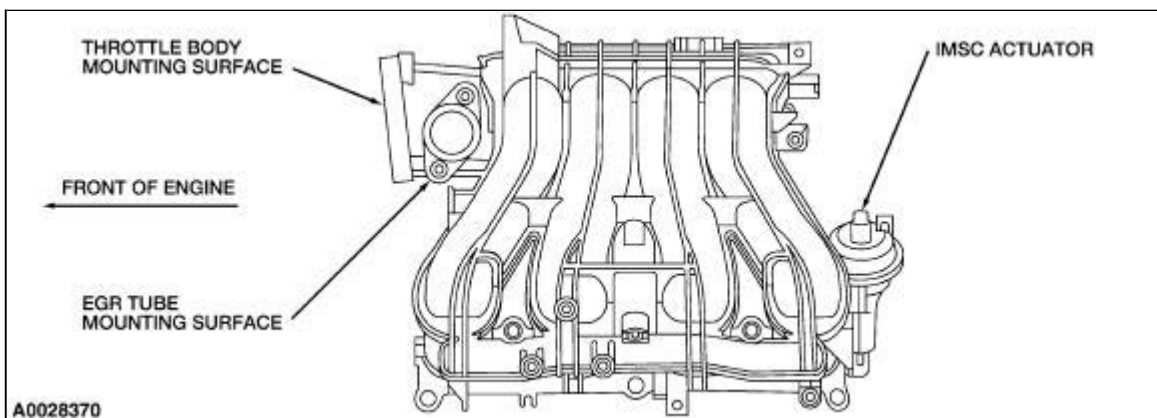


Figure 109: 2.3L 4V Ranger Intake Air System

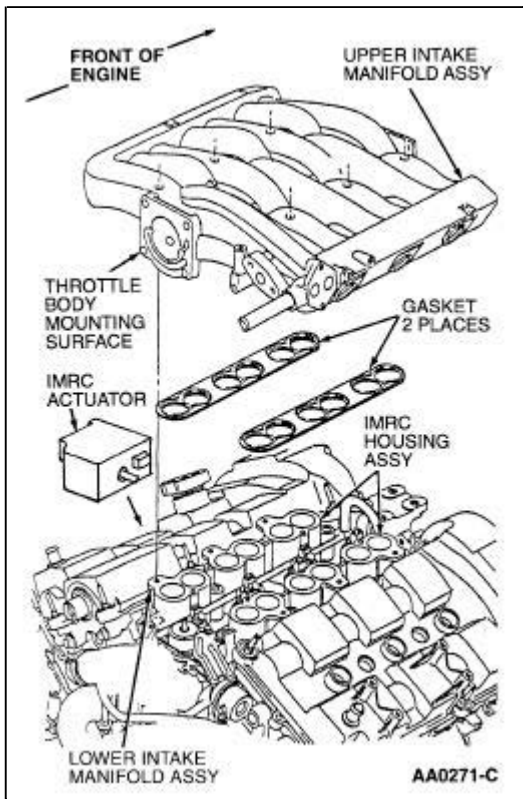


Figure 110: 2.5L Cougar Intake Air System

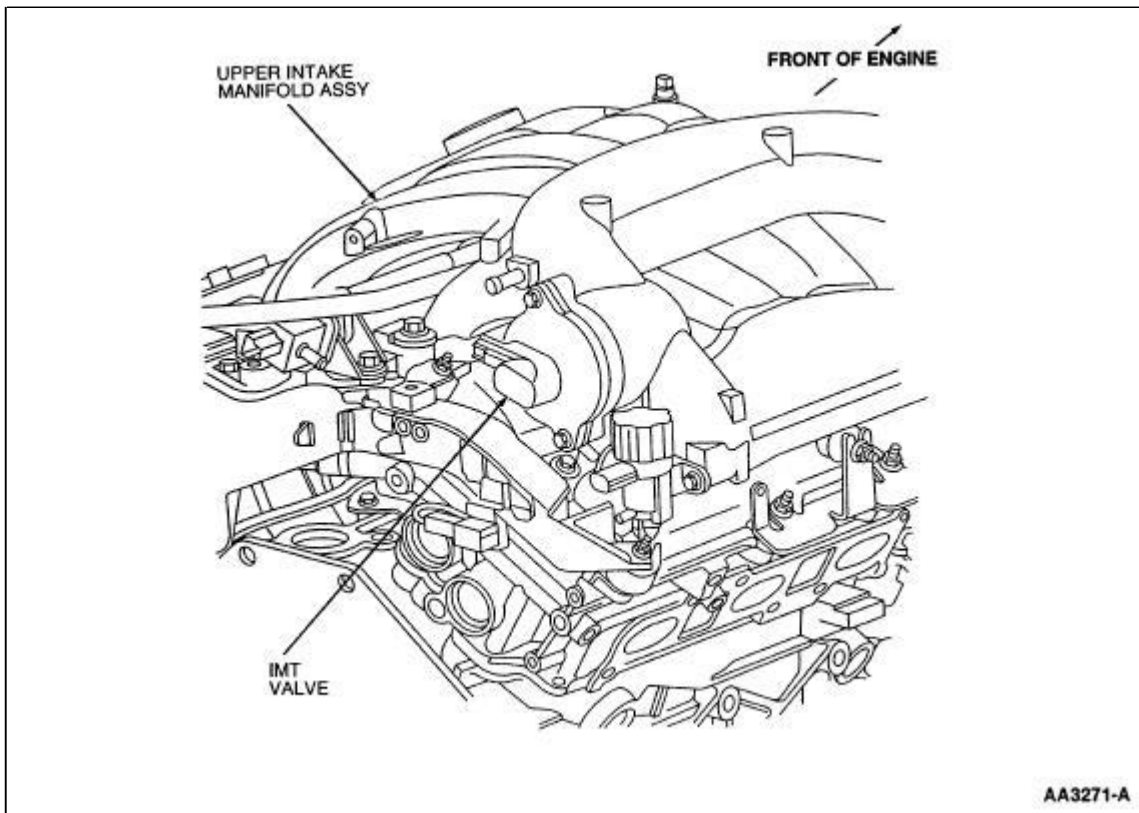


Figure 111: 3.0L LS6 Intake Air System

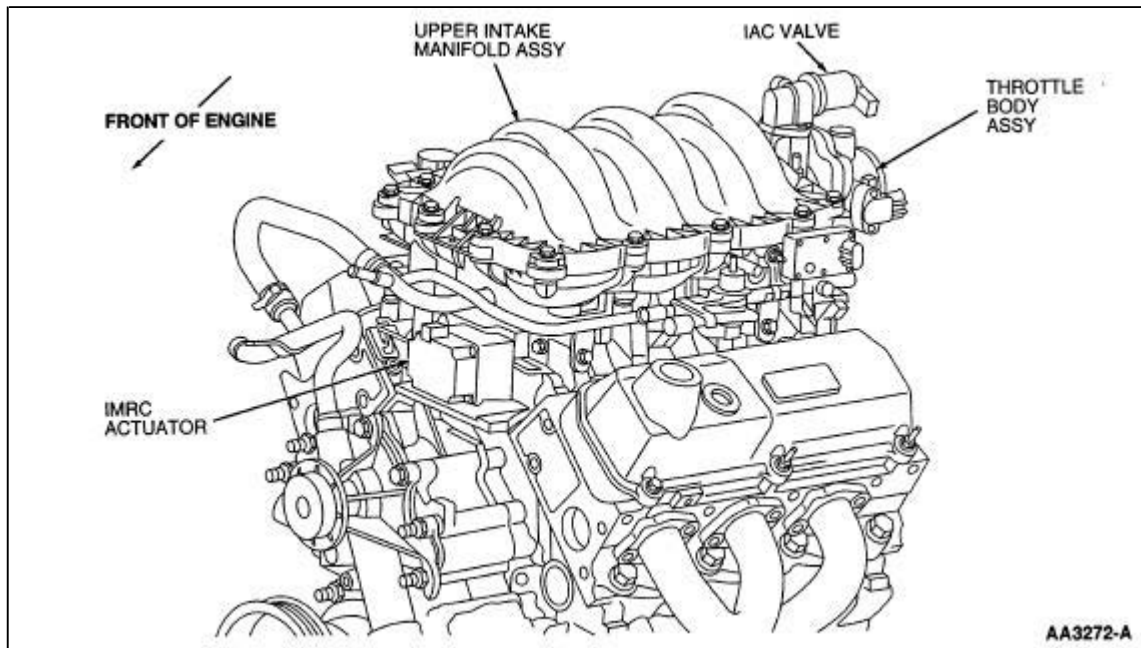


Figure 112: 3.8L Windstar Intake Air System

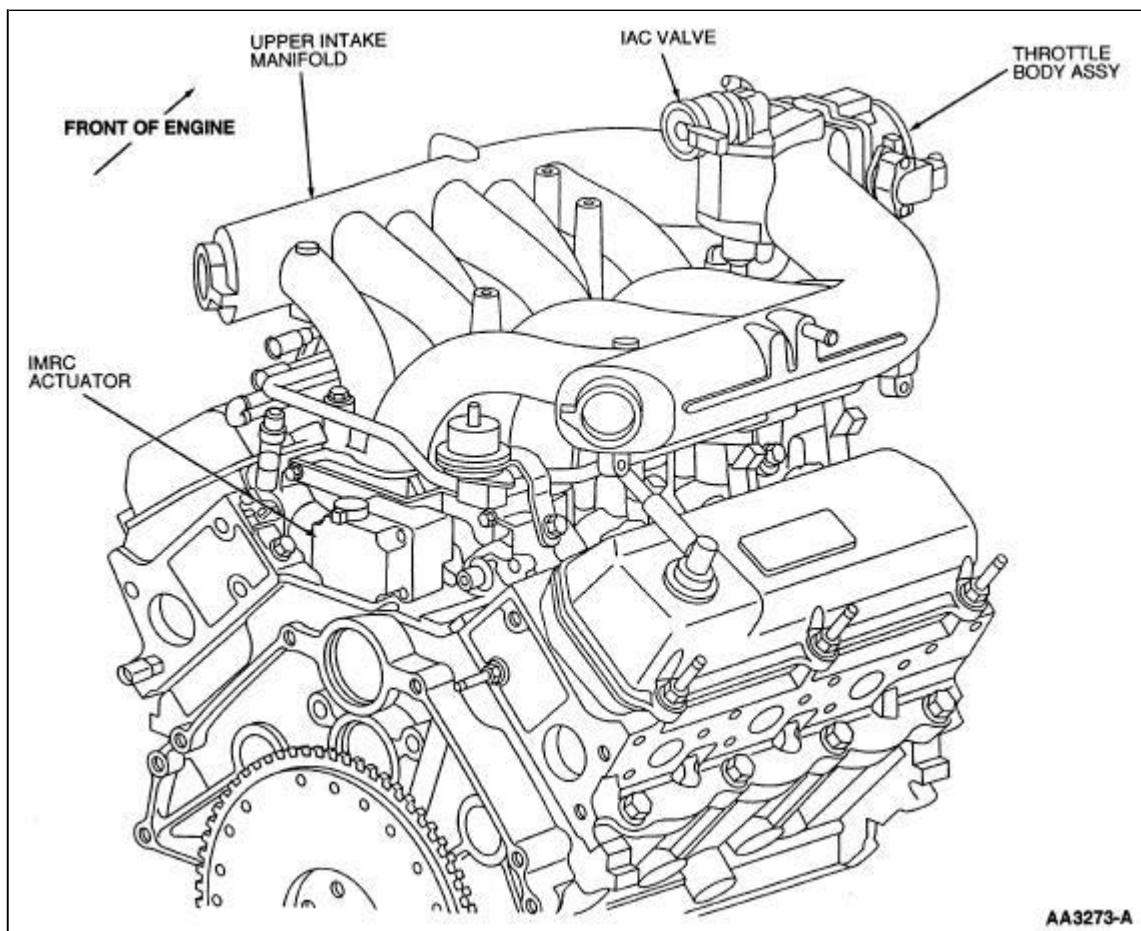


Figure 113: 4.2L E/F-Series Intake Air System

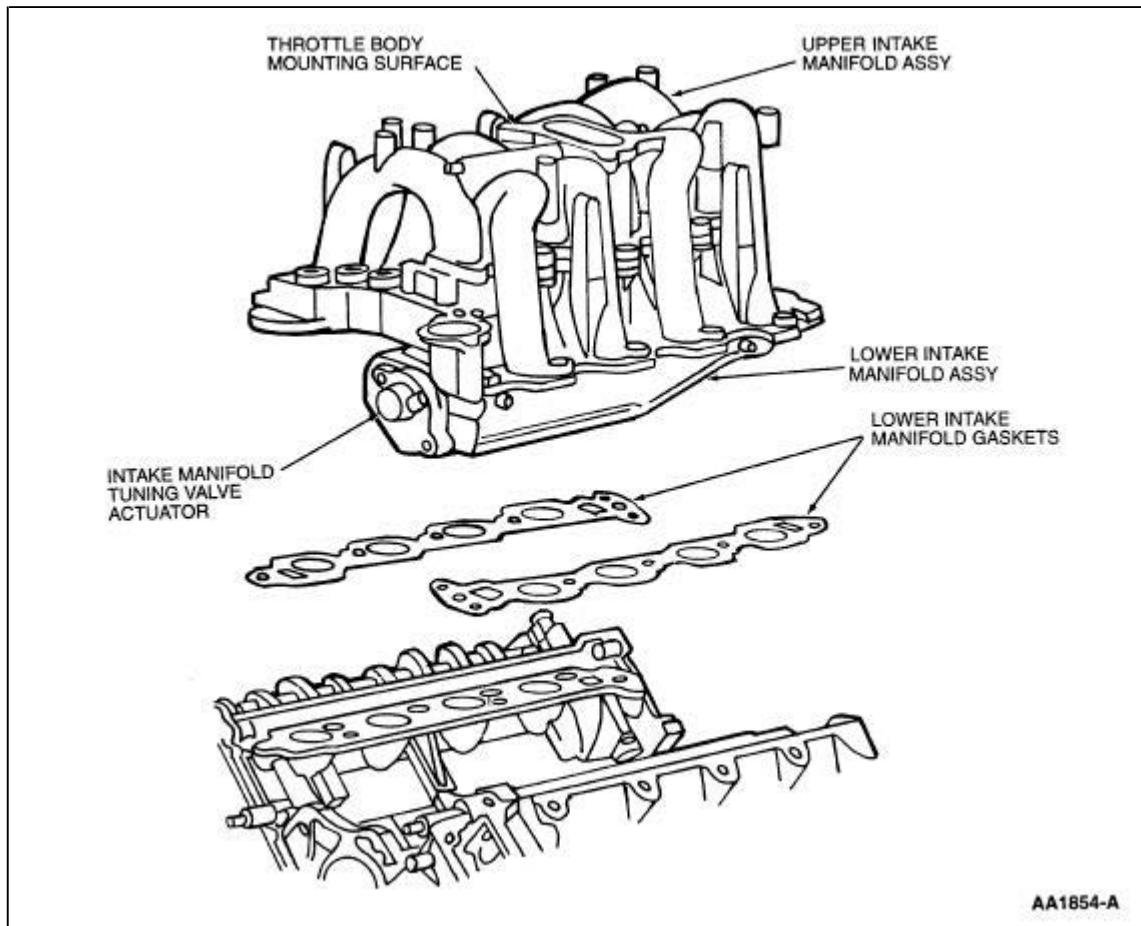


Figure 114: 4.6L E/F-Series Intake Air System

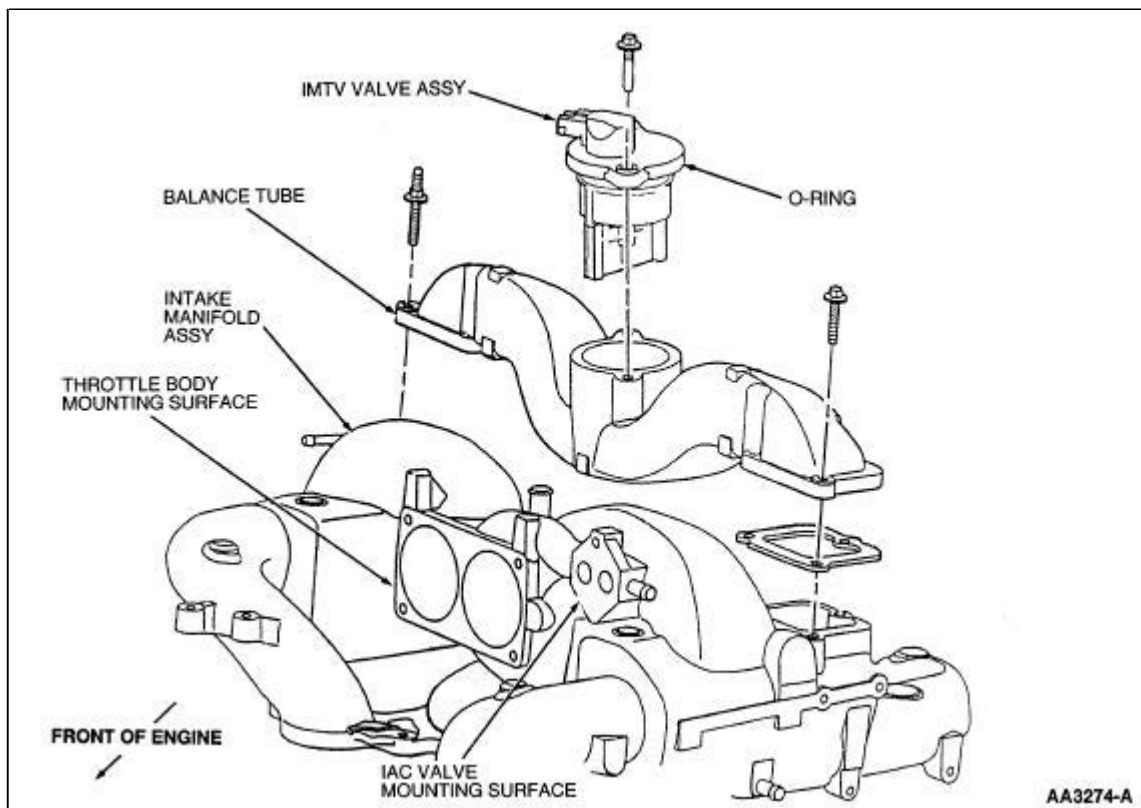


Figure 115: 5.4L (4V) Intake Air System

Throttle Body System Overview

The throttle body system meters air to the engine during idle, part throttle, and wide open throttle (WOT) conditions. The throttle body system consists of an Idle air control (IAC) valve assembly, idle air orifice, single or dual bores with butterfly valve throttle plates and a Throttle Position (TP) sensor. One other source of idle air flow is the Positive Crankcase Ventilation (PCV) system. The combined idle air flow (from idle air orifice IAC flow and PCV flow) is measured by the MAF sensor on all applications.

During idle, the throttle body assembly provides a set amount of air flow to the engine through the idle air passage and PCV valve. The IAC valve assembly provides additional air when commanded by the powertrain control module (PCM) to maintain the proper engine idle speed under varying conditions. The IAC valve assembly mounts directly to the throttle body assembly in most applications, but is remote-mounted to the intake manifold in some applications. Idle speed is controlled by the PCM and cannot be adjusted.

Note: The traditional idle air adjust procedure as well as throttle return screw are no longer used on OBD II applications.

Throttle rotation is controlled by a cam/cable linkage to slow the initial opening rate of the throttle plate. The TP sensor monitors throttle position and provides an electrical signal to the PCM. Some throttle body applications provide an air supply channel upstream of the throttle plate to provide fresh air to the Positive Crankcase Ventilation (PCV) or IAC systems. Other throttle body applications provide individual vacuum taps downstream of the throttle plate for PCV return, Exhaust Gas Recirculation (EGR), Evaporative Emission (EVAP), and miscellaneous control signals.

Throttle Body System Hardware

The major components of the throttle body assembly include the TP sensor, IAC valve assembly, and throttle body housing assembly.

Throttle Position Sensor

The TP sensor monitors throttle position and provides an electrical signal to the PCM. It is monitored by the OBD II system for component integrity, system functionality, and faults that can cause emissions levels to exceed standards set in government regulations. For additional information on the TP sensor, refer to Electronic EC System Hardware-PCM Inputs.

Idle Air Control Valve

The idle air control (IAC) valve assembly (Figure 117) and (Figure 118) controls engine idle speed and provides a dashpot function. The IAC valve assembly meters intake air around the throttle plate through a bypass within the IAC valve assembly and throttle body. The PCM determines the desired idle speed or bypass air and signals the IAC valve assembly through a specified duty cycle. The IAC valve responds by positioning the IAC valve to control the amount of bypassed air. The PCM monitors engine rpm and increases or decreases the IAC duty cycle in order to achieve the desired rpm.

On applications with air-assisted injectors, the IAC valve (Figure 119) also supplies a small amount of air into the path of the fuel injectors. The jet of air causes an increase in fuel atomization at low speed and light load conditions.

Note: The IAC Valve Assembly is NOT ADJUSTABLE and CANNOT BE CLEANED.

The IAC valve (part of throttle body assembly) has an internal diode on some applications. If the internal diode is measured in crossed terminal position with a digital multimeter, there will be an incorrect or negative reading. It is important that the mating component and harness connectors correctly oriented. Diagnostic procedures emphasize this importance.

The PCM uses the IAC valve assembly to control:

- No touch start
- Cold engine fast idle for rapid warm-up
- Idle (corrects for engine load)
- Stumble or stalling on deceleration (provides a dashpot function)
- Over-temperature idle boost.
- Air Assist to Injectors.

Throttle Body Housing

The throttle body housing assembly is a single piece of aluminum casting with an air passage and a butterfly throttle plate with linkage mechanisms. When the throttle plate is in the idle (or closed) position, the throttle lever arm should be in contact with the Throttle Return Stop. The throttle return stop prevents the throttle plate from contacting the bore and sticking closed. The setting also establishes the amount of air flow between the throttle plate and bore. To minimize the closed plate air flow, a special coating is applied to the throttle plate and bore to help seal this area. This sealant/coating also makes the throttle body resistant to engine intake sludge accumulation.

Features of the Throttle Body Assembly include:

1. Idle air control (IAC) valve assembly mounted directly to the throttle body assembly (some vehicles).
2. A pre-set stop to locate the WOT position.
3. An air supply channel upstream of the throttle plate to provide fresh air to the PCV system (some vehicles only).
4. Individual vacuum taps for PCV, EGR, EVAP and miscellaneous control signals (some vehicles only).
5. PCV air return (if applicable).
6. A throttle body-mounted throttle position (TP) sensor.
7. A sealant/coating on the throttle bore and throttle plate makes the throttle body air flow tolerant to engine intake sludge accumulation. These throttle body assemblies **MUST NOT BE CLEANED** and have a white/black attention decal (Figure 116) advising not to clean.

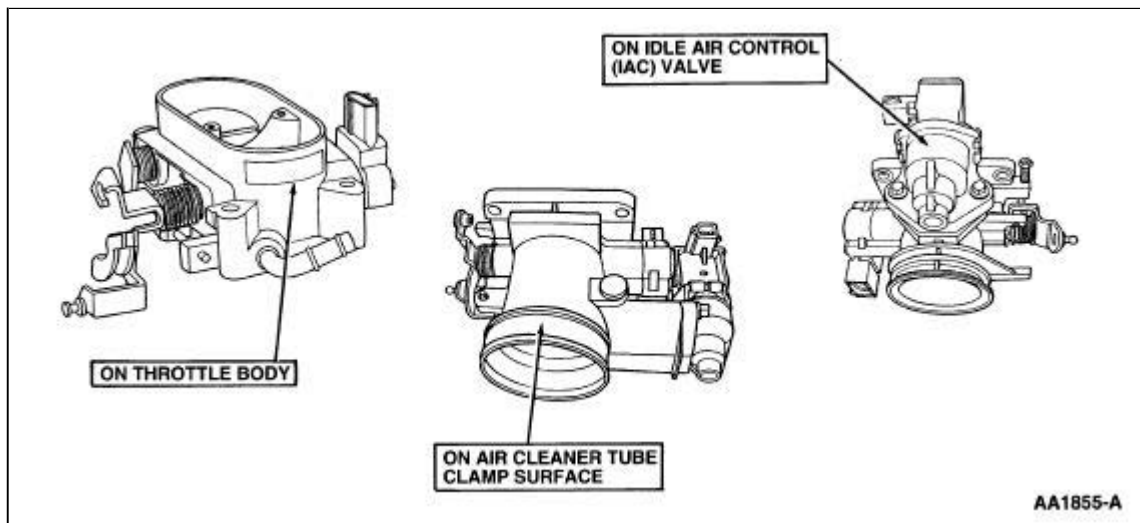


Figure 116: Typical Attention Decal Locations

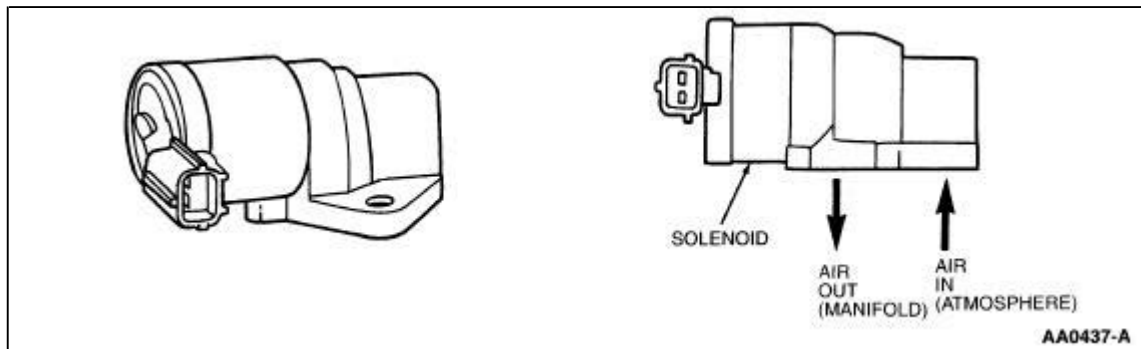


Figure 117: Nippondenso Idle Air Control (IAC) Valve Assembly

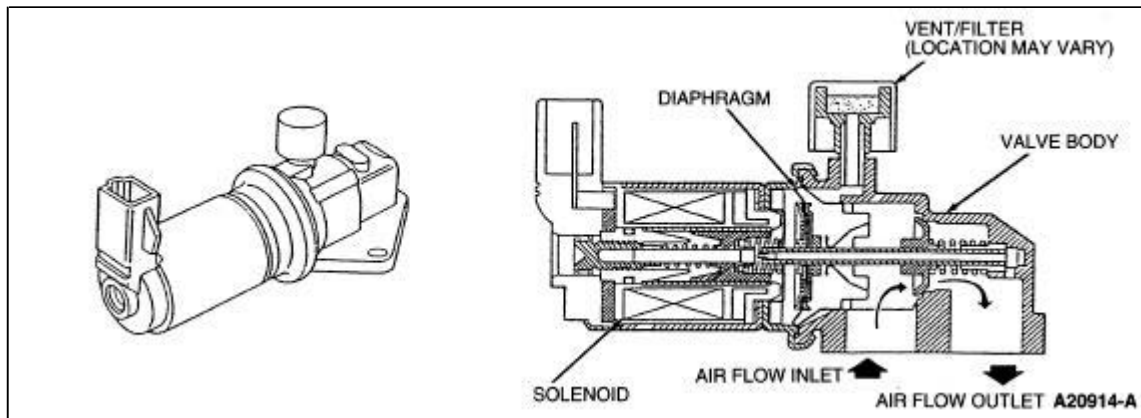


Figure 118: Hitachi Idle Air Control (IAC) Valve Assembly with Vent/Filter

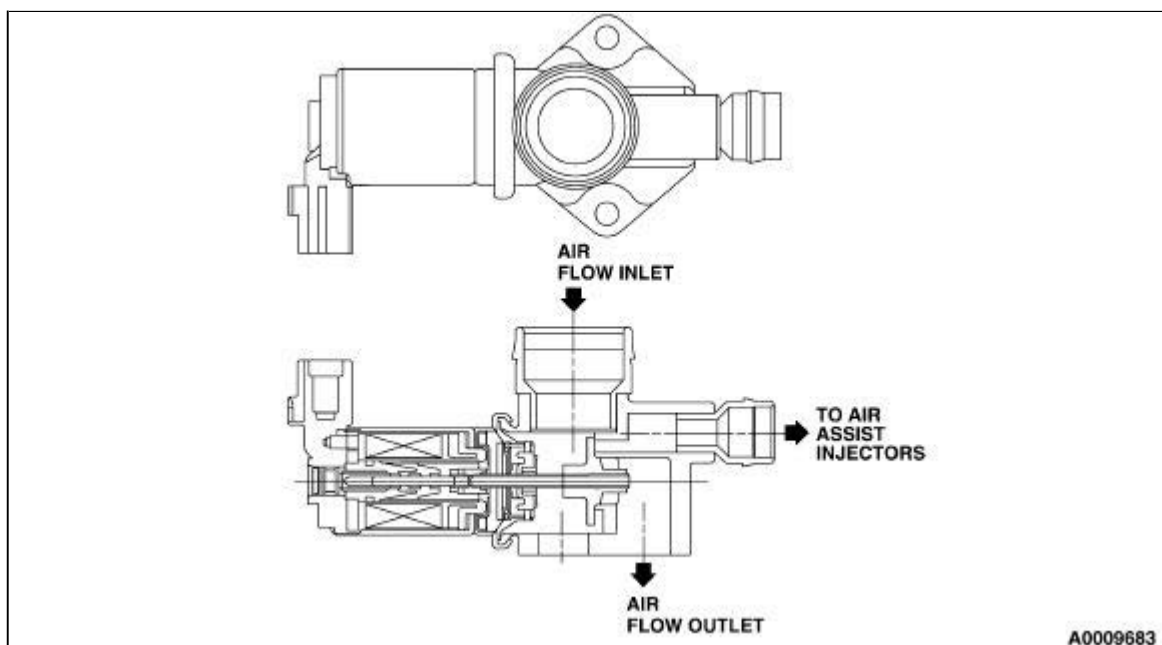


Figure 119: Hitachi Idle Air Control (IAC) Valve Assembly with Air-Assist Injectors

Secondary Air Injection (AIR) Systems

Overview

The Secondary Air Injection (AIR) system controls emissions during the first 20 to 120 seconds of engine operation by forcing air downstream into the exhaust manifolds to oxidize the hydrocarbons and carbon monoxide created by running rich at start up.

Electric Secondary Air Injection System

The Electric Secondary Air Injection (AIR) system consists of an electric AIR pump, single or dual combination check air injection diverter (AIR diverter) valve(s), an AIR bypass solenoid, a solid state relay, powertrain control module (PCM) and connecting wires and vacuum hoses (Figure 120).

1. The PCM requires ECT, IAT and CKP inputs to initiate Secondary Air Injection function.
2. When the engine is started, the strategy will determine when to enable the EAP. The PCM signals the solid state relay and the AIR bypass solenoid, after a (5 to 10) second delay, to begin system operation. Once the catalyst is lit-off, the PCM then signals the solid state relay to stop AIR system operation and to close the AIR bypass solenoid from supplying vacuum to the AIR diverter valve (s).
3. The solid state relay provides the start-up signal and will switch the high current required to operate the AIR pump.
4. The AIR bypass solenoid applies a vacuum to the AIR diverter valve(s) causing it to open and to allow air to flow into the exhaust manifolds.
5. The vacuum check valve controls vacuum bleed-off to solenoid.
6. The function of the splash cap if equipped is to provide the AIR pump with a source of dry air.
7. The electric AIR pump delivers the required amount of air to control emissions during engine operation. Air is forced into the exhaust manifolds to oxidize the hydrocarbons and carbon monoxide created by running rich at start up.

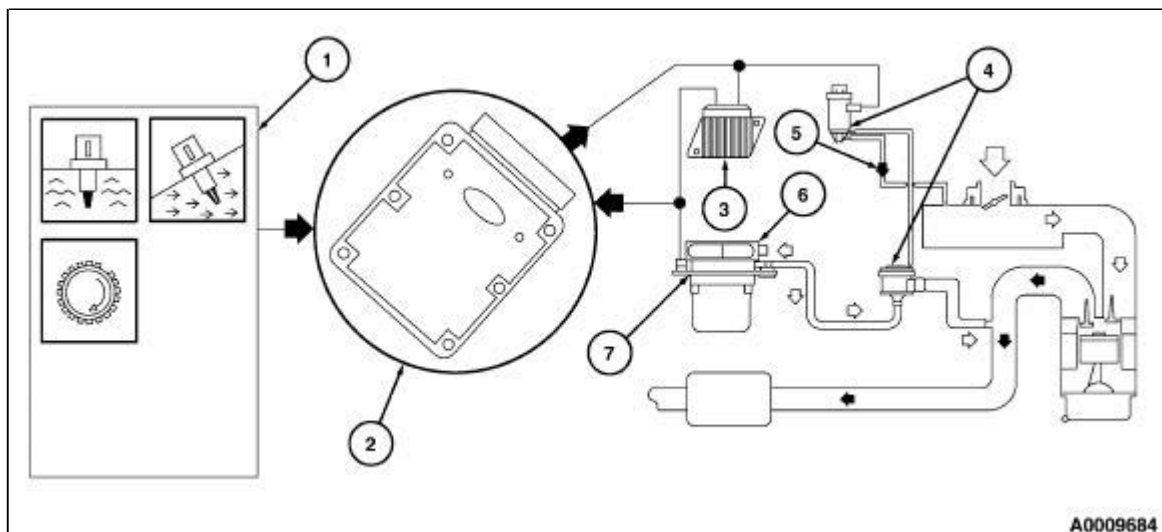


Figure 120: Dual or Single AIRD Valve Electric Secondary Air Injection (AIR) (Refer to the On-Board Diagnostics II System Overview for icon definitions.)

Hardware

Electric AIR Pump

The electric AIR pump (Figure 121) provides pressurized air to the Secondary Air Injection system. The electric AIR pump functions independently of rpm and is controlled by the PCM. The electric AIR pump is only used for short periods of time. Delivery of air is dependent on the amount of system backpressure and system voltage. The inlet system of the AIR pump incorporates a non-serviceable filter and splash cap which helps to guard against dirt and water.

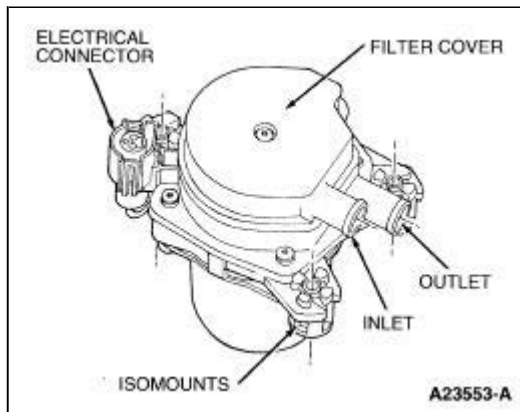


Figure 121: Electric Air Pump

AIR Bypass Solenoid

The secondary air injection bypass (AIR bypass) solenoid (Figure 122) is used by the PCM to control vacuum to the secondary air injection diverter (AIR diverter) valve. The AIR bypass solenoid is a normally closed solenoid. The AIR bypass solenoid also has a filtered vent feature to permit vacuum release.

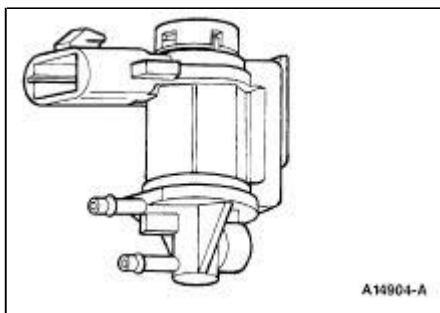


Figure 122: Secondary Air Injection Bypass Solenoid

AIR Diverter Valve

The secondary air injection diverter (AIR diverter) valve (Figure 123) is used with the electric AIR pump to provide on/off control of air to the exhaust manifold and catalytic converter. When the electric AIR pump is on and vacuum is supplied to the AIR diverter valve, the integral check valve disk passes the integral check valve disk. When the electric AIR pump is off, and vacuum is removed from the AIR diverter valve, the integral check valve disk is held on the seat and stops air from being drawn into the exhaust system and prevents the back flow of the exhaust into the Secondary Air Injection System.

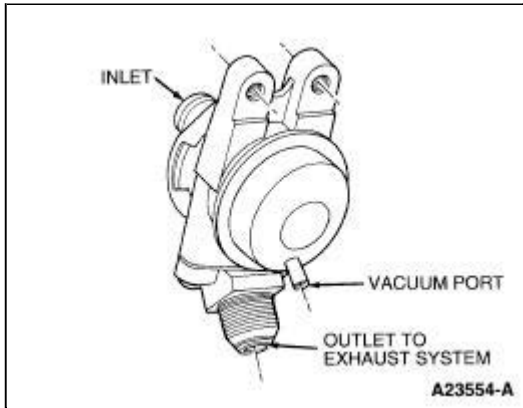


Figure 123: Air Injection Diverter (AIR Diverter) Valve

Solid State Relay

The solid state relay (Figure 124) switches the high current required for operation of the electric AIR pump. Input control to the solid state relay comes from the powertrain control module (PCM).

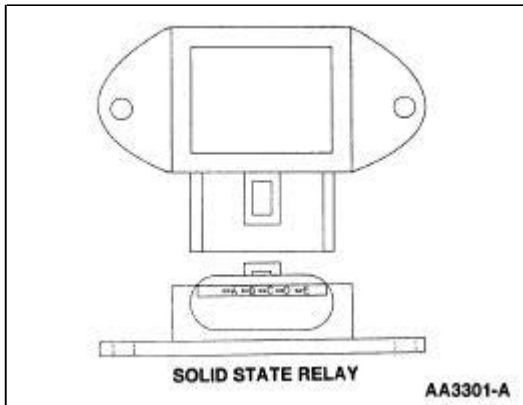


Figure 124: Solid State Relay

Vacuum Check Valves

A vacuum check valve (Figure 125) blocks air flow in one direction. It allows free air flow in the other direction. The check side of this valve will hold the highest vacuum registered on the vacuum side.

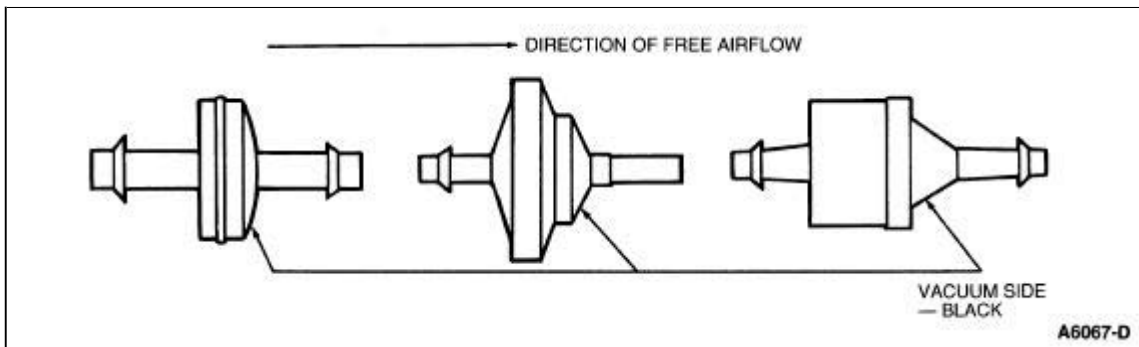


Figure 125: Vacuum Check Valve

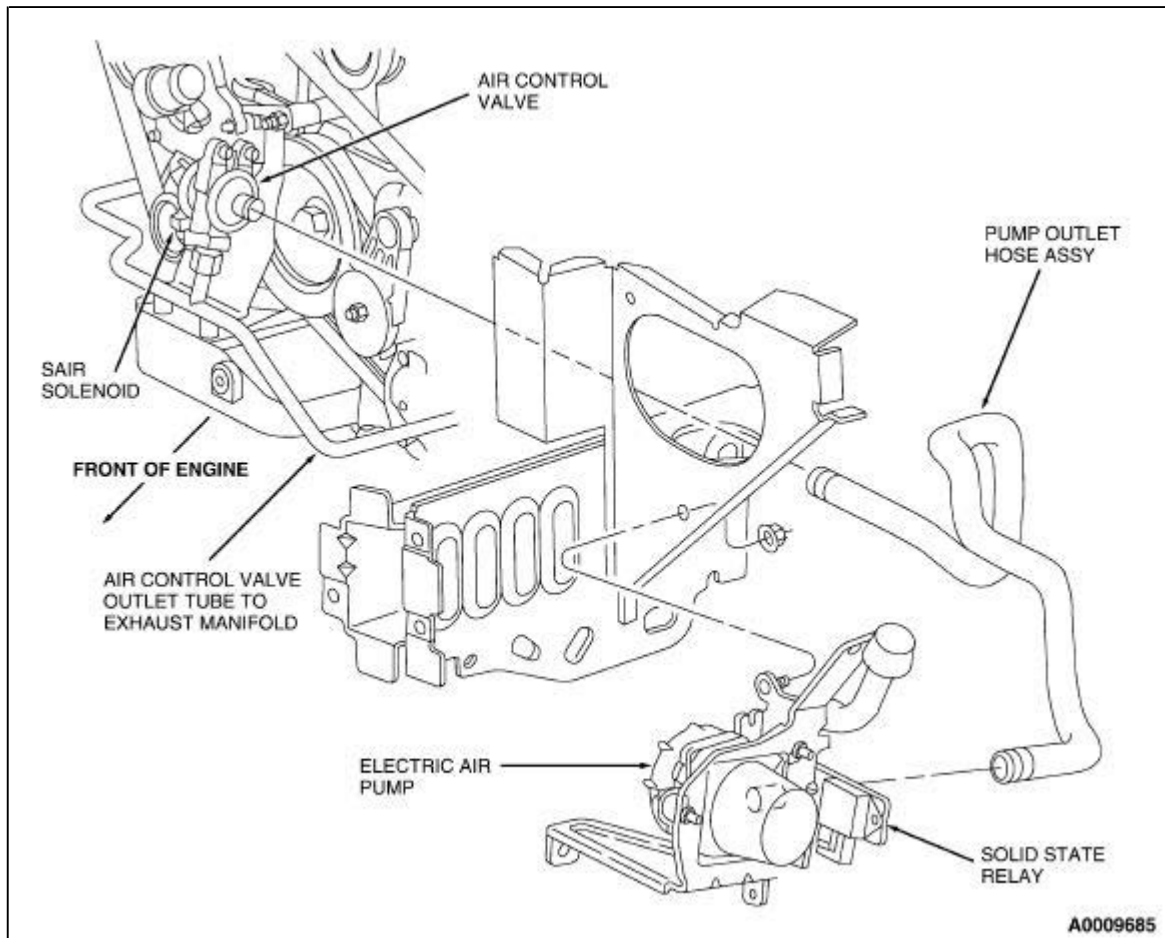


Figure 126: LS6

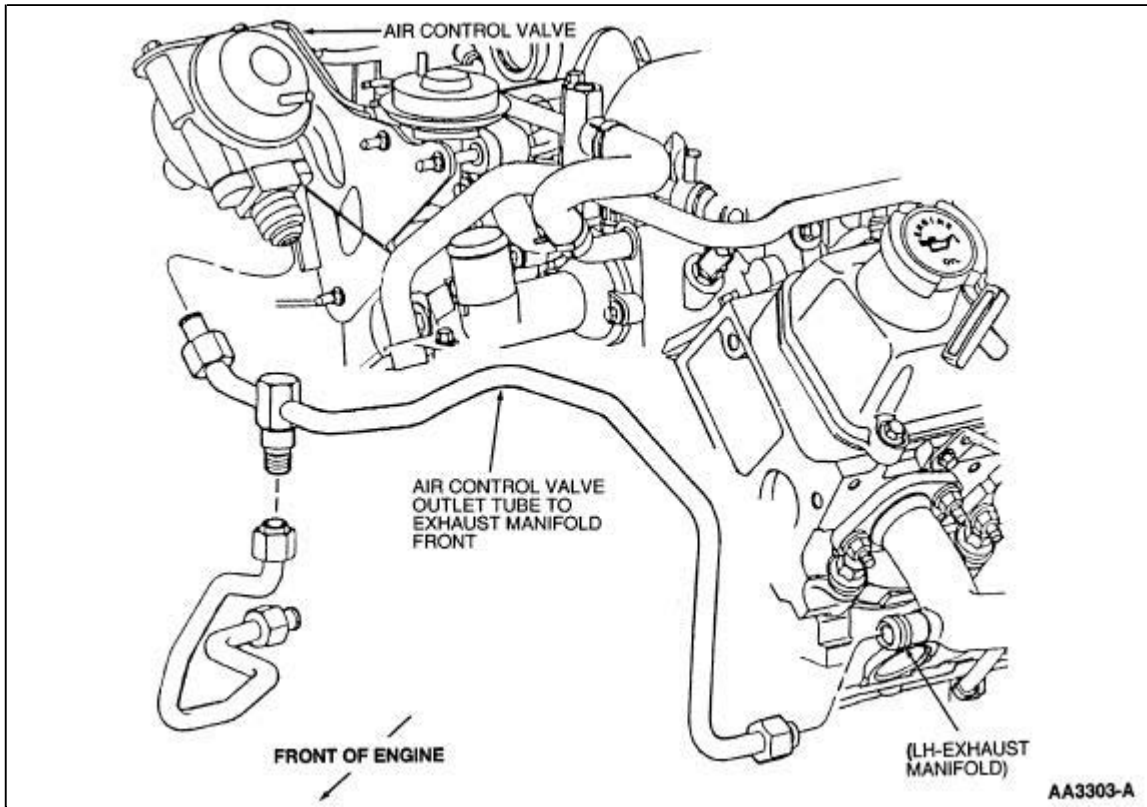


Figure 127: 3.8L Mustang (California)

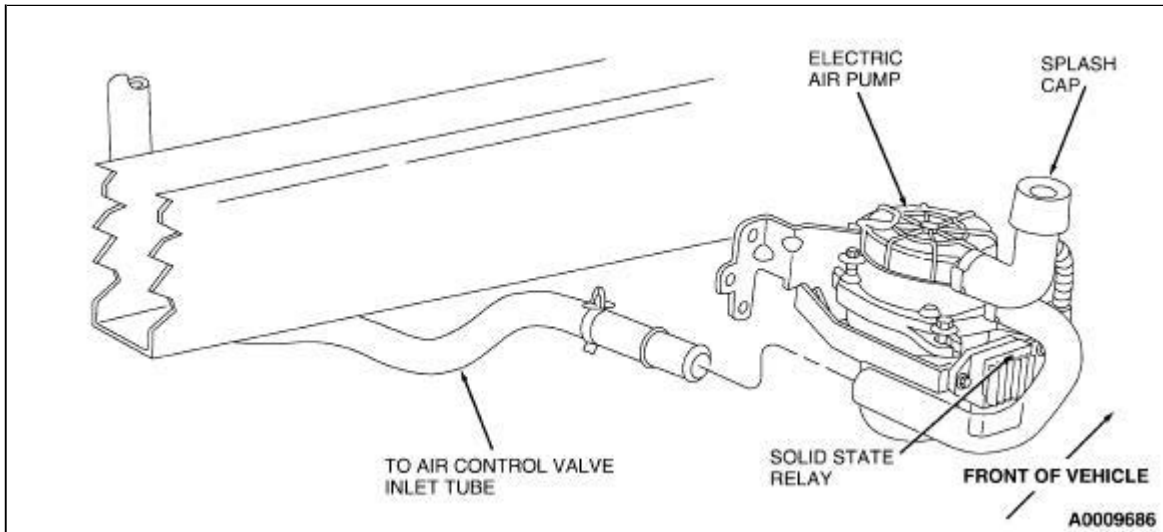


Figure 128: 3.8L Mustang (California)

Variable Cam Timing System

Overview

The Variable Cam Timing System allows the exhaust cam to advance and retard at varying engine speeds. The purpose of this is to reduce exhaust emissions and increase fuel economy. As the exhaust cam retards in relation to the crankshaft position, residual exhaust gases are left in the combustion chamber. The residual gases cool the combustion chamber and are inert when mixed with the incoming fresh charge of fuel and air. This results in better fuel economy and lower nitrogen oxides (NOx) and hydrocarbons (HC) the engine produces. The Exhaust Gas Recalculation System (EGR) is unnecessary on the 2.0L (4V) engine due to this feature.

Variable Cam Timing

The Variable Cam Timing (VCT) System consists of the control solenoid, five-tooth pulse ring (4+1) on exhaust camshaft, intake air temperature (IAT) sensor, engine coolant temperature (ECT) sensor, camshaft position (CMP) sensor, mass air flow (MAF) sensor, crankshaft position (CKP) sensor, powertrain control module (PCM) (Figure 129).

1. The powertrain control module (PCM) receives input signals from the intake air temperature (IAT) sensor, engine coolant temperature (ECT) sensor, camshaft position (CMP) sensor, mass air flow (MAF) sensor and crankshaft position (CKP) sensor for determining the operating conditions of the engine.
2. The Variable Cam Timing (VCT) system is enabled by the PCM when the proper conditions are met. The PCM disables the VCT system if a fault is detected.
3. The PCM calculates relative cam position using the CMP sensor and data from the (4+1) pulse ring mounted on the exhaust camshaft. Relative cam position is calculated by measuring the time between the rising edge of profile ignition pickup (PIP) and the falling edge of VCT pulse.
4. The PCM continually calculates a cam position error value based on the difference between the desired and actual position and a duty cycle is commanded for the VCT solenoid valve. Engine oil is allowed to flow to the VCT unit.
5. Oil flows to either side of the piston chamber changing a linear motion from the piston to a rotation motion from the helical mechanism in the VCT unit. During closed loop the PCM outputs a revised duty cycle to the VCT solenoid valve to correct for cam position error.

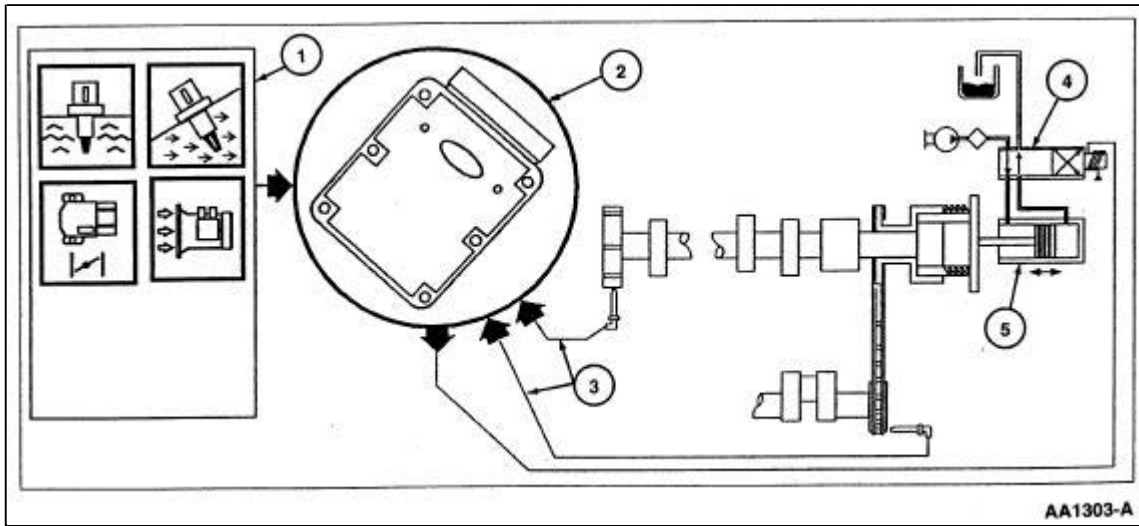


Figure 129: Variable Cam Timing System (Refer to the On-Board Diagnostics II System Overview for icon definitions.)

Hardware

Variable Cam Timing (VCT) Solenoid Valve

The VCT solenoid valve (Figure 130) is an integral part of the VCT system. The solenoid valve controls the flow of engine oil to the variable cam timing unit assembly. As the PCM duty cycles the solenoid valve, oil is allowed to flow to the VCT unit assembly and advance or retard the cam timing.

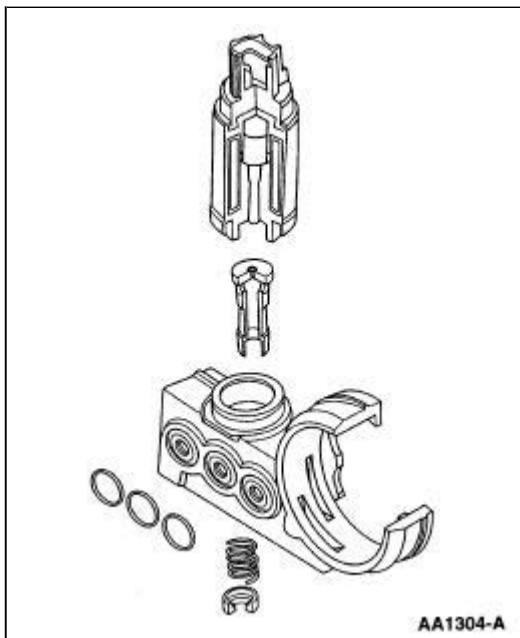


Figure 130: Variable Cam Timing (VCT) Solenoid Valve

Variable Cam Timing (VCT) Unit Assembly

The variable cam timing unit assembly (Figure 131) is coupled to the camshaft through a helical spline in the VCT unit chamber. When the flow of oil is shifted from one side of the chamber to the other, the differential change in oil pressure forces the piston to move linearly along the axis of the camshaft. This linear motion is translated into rotational camshaft motion through the helical spline coupling. A spring installed in the chamber is designed to hold the camshaft in the minimum overlap position (5 degrees)

when oil pressure is too low to maintain adequate position control. The camshaft is allowed to rotate up to 30 degrees.

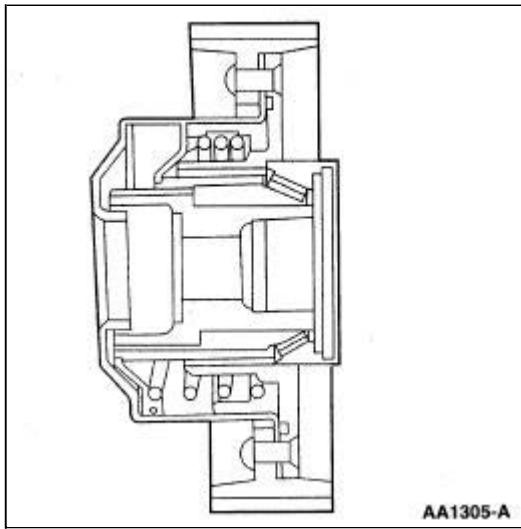


Figure 131: Variable Cam Timing Unit Assembly

Positive Crankcase Ventilation System

Overview

The Positive Crankcase Ventilation (PCV) System (Figure 132) cycles crankcase gases back through the engine where they are burned. The PCV valve regulates the amount of ventilating air and blow-by gas to the intake manifold and prevents backfire from traveling into the crankcase. The PCV valve should be mounted in a vertical position. On some applications, the PCV system is connected to the evaporative emission system (refer to the VECI decal).



CAUTION: Do not remove the PCV system from the engine. Removal of the PCV system will adversely affect the fuel economy and engine ventilation and result in shorter engine life.

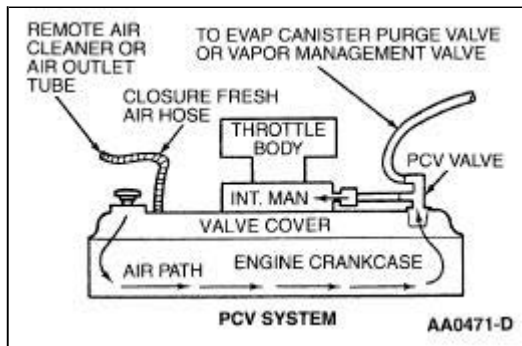


Figure 132: PCV System

Hardware

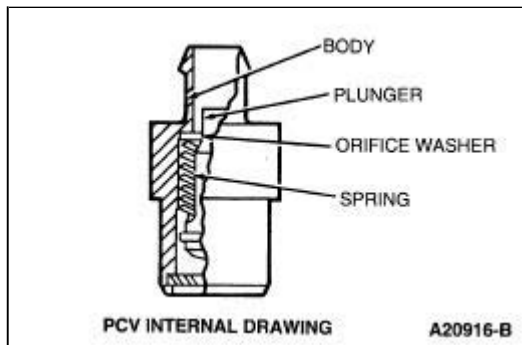


Figure 133: PCV Internal Drawing

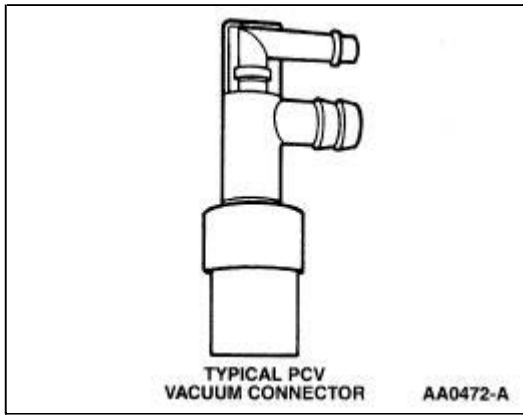


Figure 134: Typical PCV Vacuum Connector

Catalyst and Exhaust Systems

Overview

The Catalytic Converter and Exhaust systems (Figure 135) work together to control the release of harmful engine exhaust emissions into the atmosphere. The engine exhaust gas consists mainly of nitrogen (N), carbon dioxide (CO₂) and water vapor (H₂O). However, it also contains carbon monoxide (CO), oxides of nitrogen (NO_x), hydrogen (H), and various unburned hydrocarbons (HCs). CO, NO_x, and HCs are major air pollutants, and their emission into the atmosphere must be controlled.

The exhaust system generally consists of an exhaust manifold, front exhaust pipe, upstream heated oxygen sensor (HO₂S), rear exhaust pipe, downstream HO₂S, a muffler and an exhaust tailpipe. The catalytic converter is installed between the front and rear exhaust pipes. Catalytic converter efficiency is monitored by the On Board Diagnostic (OBD II) system. (Refer to OBD II Monitors to Catalyst Efficiency Monitor-Federal Test Procedure for specific information.)

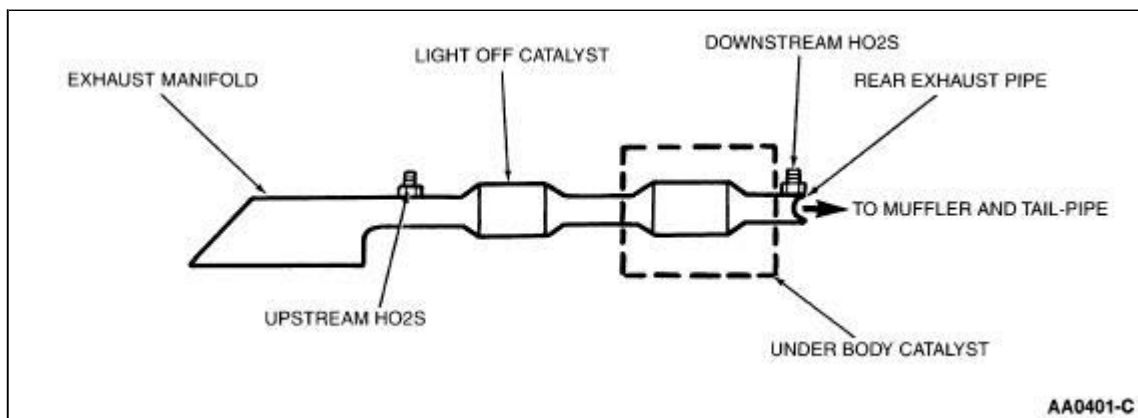


Figure 135: Generic Catalyst and Exhaust System

Catalytic Converter

A catalyst is a material that remains unchanged when it initiates and increases the speed of a chemical reaction. A catalyst will also enable a chemical reaction to occur at a lower temperature. The concentration of exhaust gas products released to the atmosphere must be controlled. The catalytic converter assists in this task. It contains a catalyst in the form of a specially treated honeycomb structure saturated with catalytically active precious metals. As the exhaust gases come in contact with the catalyst, they are changed into mostly harmless products. The catalyst initiates and speeds up heat producing chemical reactions of the exhaust gas components so they are used up as much as possible.

Exhaust System

The purpose of the exhaust system is to convey engine emissions from the exhaust manifold to the atmosphere. Engine exhaust emissions are directed from the engine exhaust manifold to the catalytic converter through the front exhaust pipe. An HO₂S is mounted on the front exhaust pipe before the catalyst. The catalytic converter reduces the concentration of carbon monoxide (CO), unburned hydrocarbons (HCs) and oxides of nitrogen (NO_x) in the exhaust emissions to an acceptable level. The reduced exhaust emissions are directed from the catalytic converter to a muffler through the rear exhaust pipe. Another HO₂S is mounted on the rear exhaust pipe. Lastly, the exhaust emissions are directed to the atmosphere through an exhaust tailpipe.

Hardware

The downstream HO₂S may be located after the light off catalyst or underbody catalyst. The underbody catalyst may be in-line with the light off catalyst, or the underbody catalyst may be common to two light off catalysts, forming a "Y" pipe configuration. For an exact configuration of the catalyst and exhaust system, refer to Exhaust System Section 309-00 in the Workshop Manual.

Three Way Catalytic Converter

The three way catalytic (TWC) converter contains either platinum (Pt) and rhodium (Rh) or palladium (Pd) and rhodium (Rh). The TWC converter catalyzes the oxidation reactions of unburned HCs and CO and the reduction reaction of NO_x. The three-way conversion can be best accomplished by always operating the engine air fuel/ratio at or close to stoichiometry.

Exhaust Manifold/Runners

The exhaust manifold runners collect exhaust gases from engine cylinders. The number of exhaust manifolds and exhaust manifold runners depends on the engine configuration and number of cylinders.

Exhaust Pipes

Exhaust pipes are usually treated during manufacturing with an anti-corrosive coating agent to increase the life of the product. The pipes serve as guides for the flow of exhaust gases from the engine exhaust manifold through the catalytic converter and the muffler.

Upstream Heated and Downstream Heated Oxygen Sensors

The HO₂S provide the powertrain control module (PCM) with voltage and frequency information related to the oxygen content of the exhaust gas. (Refer to the PCM Inputs for a description of how the HO₂S operates.)

In addition to providing the PCM with indications of how rich/lean the engine is operating, the upstream HO₂S signal serves as an input to the HO₂S monitor. The downstream HO₂S signal is an input to the Catalyst Efficiency monitor. (Refer to the OBD II Monitors for specific information on these monitors.)

Muffler

Mufflers are usually treated during manufacturing with an anti-corrosive coating agent to increase the life of the product. The muffler reduces the level of noise produced by the engine, and it also reduces the noise produced by exhaust gases as they travel from the catalytic converter to the atmosphere.

Supercharger and Intercooler Systems

Supercharger Bypass System

The Supercharger Bypass (SCB) System (Figure 137) allows the high pressure air at the outlet of the supercharger to vent back in the inlet of the supercharger, equalizing the pressure. This eliminates the boost (increased pressure that a supercharger produces) for times when supercharger function is undesirable. The components in this system are the vacuum bypass actuator (Figure 141) (which controls the bypass valve inside the supercharger), a supercharger (boost) bypass (SCB) solenoid (Figure 138) and a vacuum reservoir (Figure 139). The system normally operates with engine vacuum applied to the upper port of the vacuum bypass actuator, while the lower port references the air pressure in the clean air tube to cancel out any pressure difference in the intake air system. The actuator is set to open (bypassing the supercharger) during high vacuum engine conditions. As the throttle is opened, and engine vacuum decreases, the actuator closes to allow the supercharger to pressurize the air in the manifold. If an undesirable condition occurs in the engine, such as overheating or a critical Electric Engine Control (Electronic EC) sensor failure, the powertrain control module (PCM) also has the ability to control the SCB solenoid and direct the vacuum bypass actuator to bypass the supercharger. Once the engine condition has been corrected, the PCM allows the engine vacuum to control the vacuum bypass actuator.

Supercharger Assembly

The supercharger assembly (Figure 136) is a positive displacement pump. Its purpose is to supply an excess volume of intake air to the engine by increasing air pressure and density in the intake manifold. The supercharger assembly incorporates the bypass system to reduce air handling losses when boost is not required, resulting in better fuel economy. When integrated on the engine, the supercharger will increase torque across the entire engine operating range from 25 to 50 percent without compromising driveability or emissions. The supercharger is matched to the engine by its displacement and belt ratio, and can provide excess airflow at any engine speed. It contains two three-lobed rotors. The helical shape and specialized porting provide a smooth discharge flow and low level of noise during operation. The rotors are supported by ball bearings in front and needle bearings at the rear. The drive gears are pressed into place, therefore the supercharger is replaced as a unit, and is not serviceable.

Supercharger (Boost) Bypass Solenoid/(Thermactor Air Control Solenoid/Vacuum Valve Assembly)

The supercharger (boost) (SCB) solenoid (Figure 138) is used to control intake manifold vacuum to the vacuum bypass actuator. This part is replaced in field service diagnostics under the part name of a thermactor air control solenoid/vacuum valve assembly (part number 9H465). The PCM transmits an output signal to the SCB solenoid, thereby activating the solenoid to apply stored vacuum from the reservoir to the actuator, when an undesirable condition occurs in the engine. Once the engine condition has been corrected, the solenoid will be de-activated by the PCM, allowing engine intake manifold vacuum to control the actuator. The SCB solenoid is normally de-energized.

Vacuum Reservoir Assembly

The vacuum reservoir assembly (Figure 139) stores vacuum that is applied to the vacuum actuator when a condition such as overheating or a critical sensor failure is generated. This allows the vacuum actuator to bypass the supercharger.

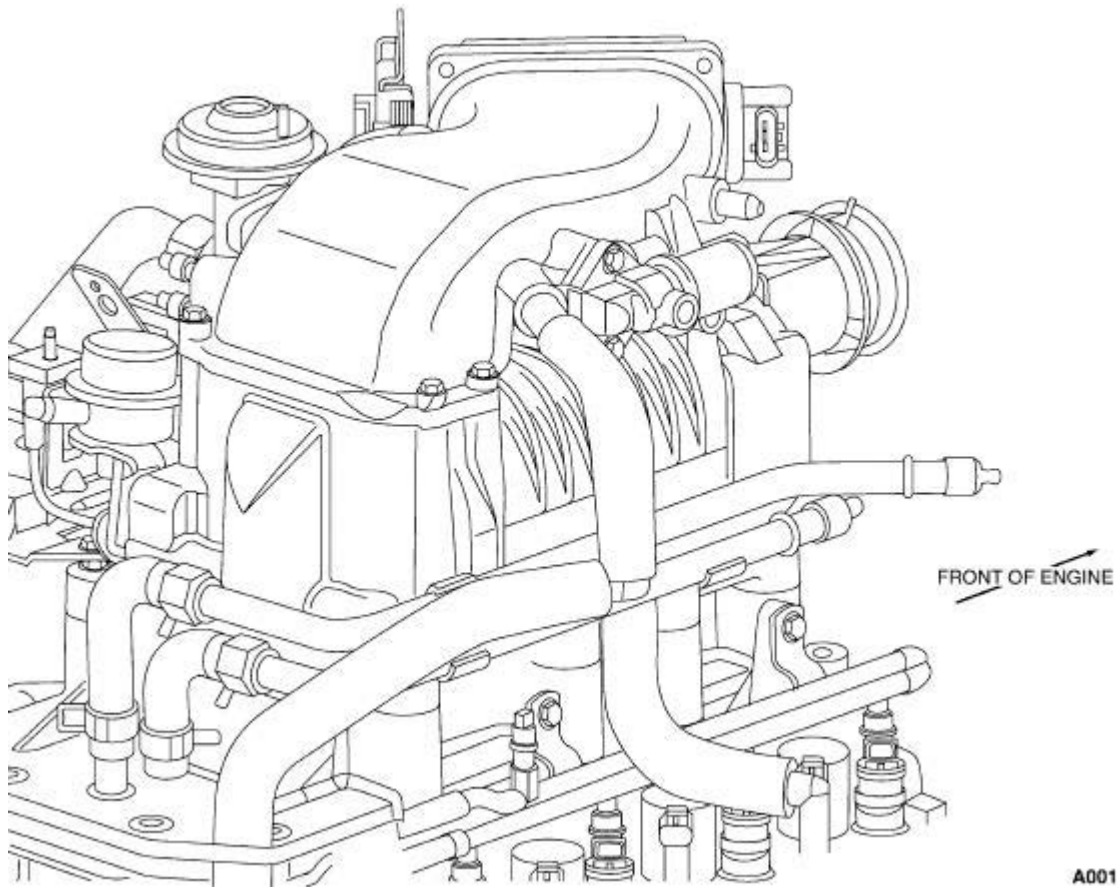


Figure 136: 5.4L Lightning Supercharger Assembly

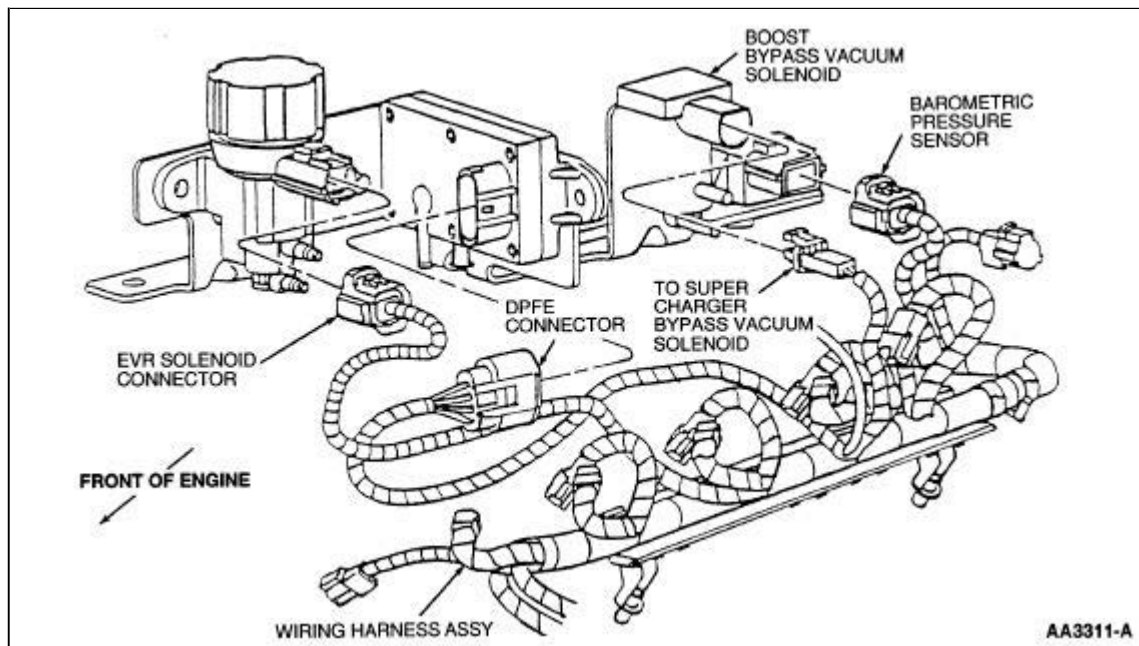


Figure 137: 5.4L Lightning Supercharger Controls—Wiring Harness Assembly

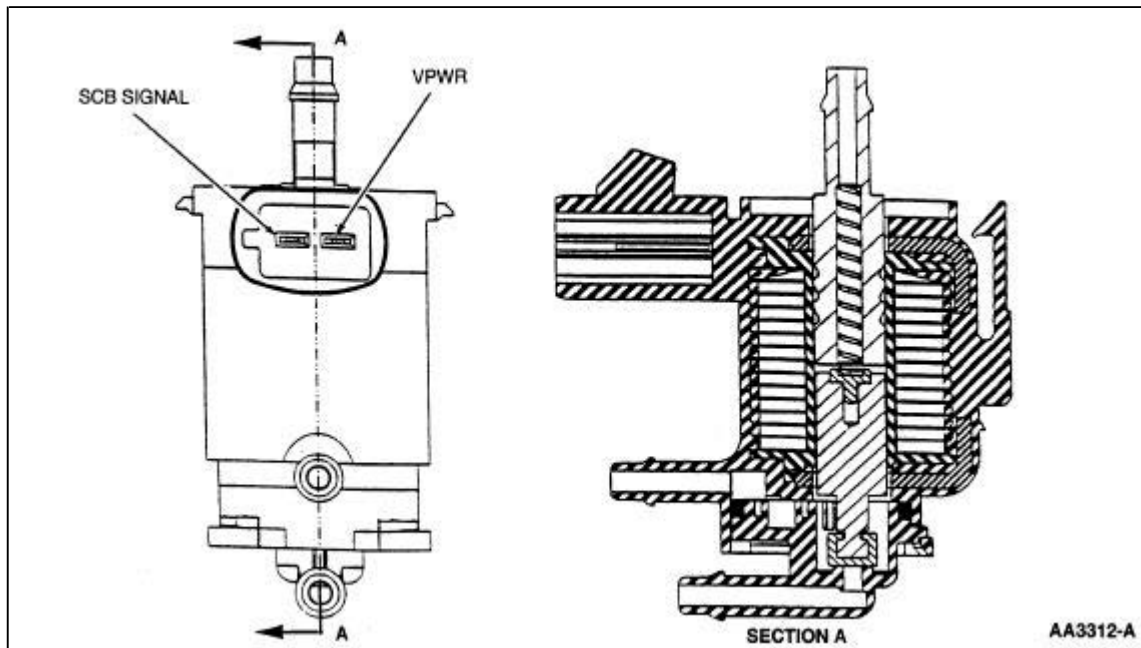


Figure 138: Supercharger (Boost) Bypass Solenoid (Thermactor Air Control Solenoid/Valve Assembly)

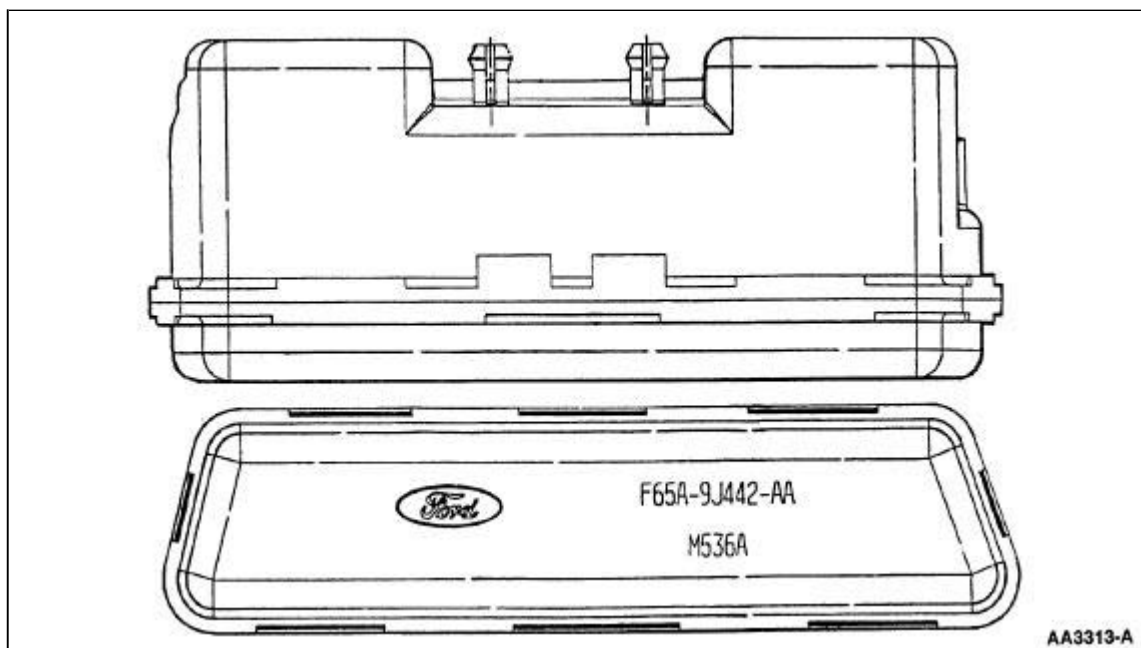


Figure 139: Vacuum Reservoir Assembly

Intercooler System

The Intercooler System (Figure 140 and Figure 141) is designed to cool the induction air, which has been heated by the supercharger. The removal of heat from the pressurized air going into the intercooler increases the air density, which improves combustion efficiency, engine horsepower and torque. The system consists of an additional radiator in the grille, a reservoir (independent from engine cooling system), an electric water pump, a heat exchanger (intercooler) located in the lower intake manifold and tubing to interconnect these components. The intercooler is positioned after the supercharger, directly in the flow of the intake air. As the heated air flows through the intercooler, heat is transferred to the coolant which is circulated back to the intercooler radiator to be cooled by the airflow through the grille. The intercooler pump is controlled by the powertrain control module (PCM) to maintain a desirable intake air temperature by a second intake air temperature (IAT2) sensor in the lower intake manifold.

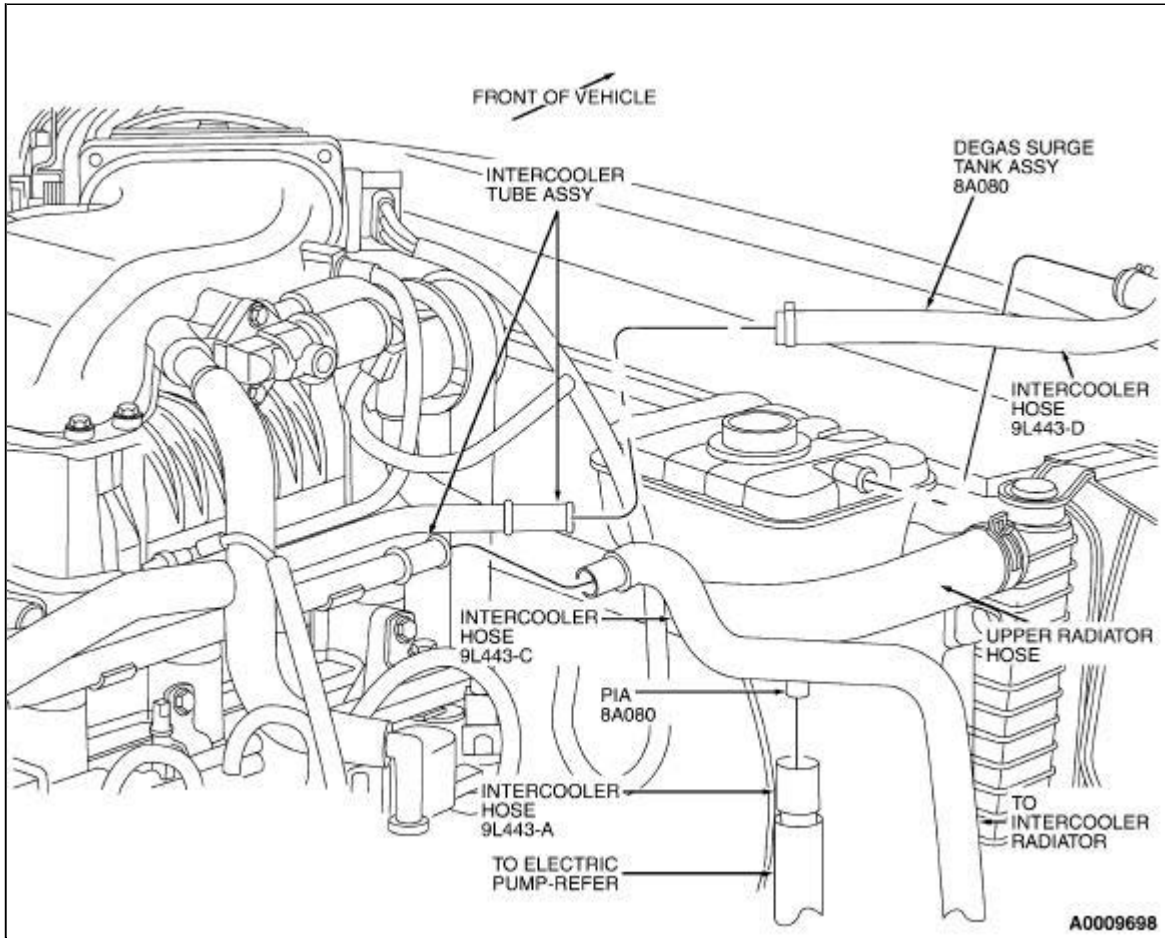


Figure 140: Intercooler Hoses

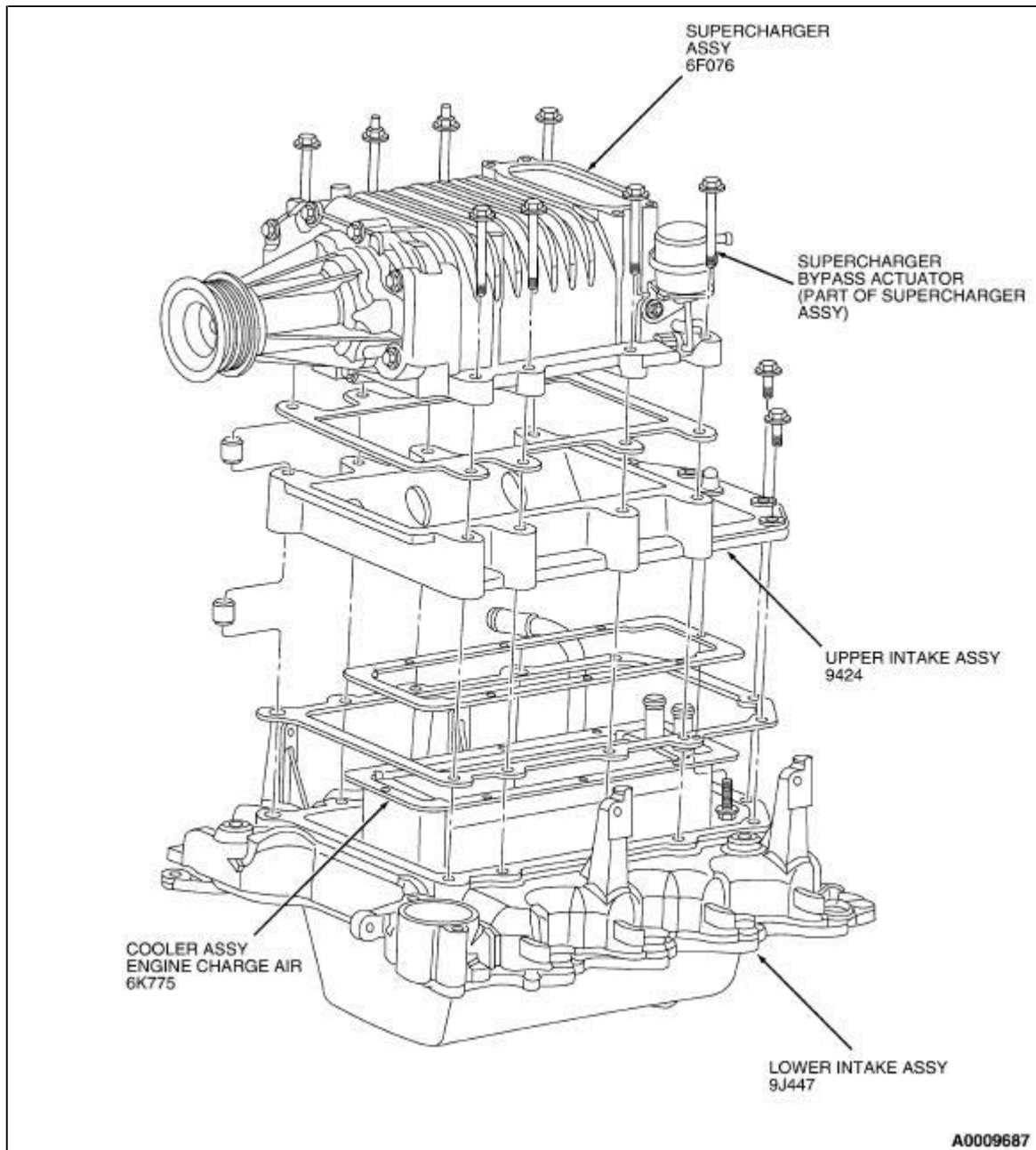


Figure 141: Unassembled Intercooler Hardware

PCM—Controlled Charging System

Overview

The PCM-Controlled charging system (Figure 142) provides many additional benefits over the current Integral Generator Regulator system. The first benefit is improved battery life. In an integral generator regulator system, the regulator set point is established by a temperature sensor in the regulator which estimates battery temperature. Field data has shown this approach lacks accuracy. With a PCM-controlled generator, the regulator voltage set point is determined by the PCM and communicated to the regulator via the generator communication line. The PCM will use a calibratable algorithm to estimate battery temperature. Improving battery temperature estimates will reduce battery damage caused by over- and undercharging.

The second benefit is improved engine performance. Whenever the PCM senses a wide-open throttle (WOT) condition, the PCM will momentarily lower the regulator voltage set point. This reduces the torque load of the generator on the engine and improves acceleration. The PCM has a calibratable time limit on this reduced voltage feature. This is to prevent the generator output from being cut back for an extended WOT period, which could cause battery discharge.

The third benefit is improved idle stability. In response to the PCM's generator communication signal, the regulator uses a generator monitor signal to provide feedback to the PCM. The generator monitor signal provides the PCM with charging system information. Specifically, it lets the PCM know when the charging system receives a transient electrical load which would normally affect idle stability. Because the PCM can anticipate additional loads, actions can be taken to minimize idle sag. The PCM can choose to either reduce the regulator set point or increase engine idle speed, both of which are calibratable features. In order to establish whether the regulator is accurately maintaining the desired voltage set point, the regulator uses a charging system voltage line to sense battery voltage at the rear power distribution box.

The fourth benefit is reduced cranking efforts. The PCM can reduce the mechanical load on the starter by initially commanding a low voltage set point. This may improve start times.

If the PCM detects a charging system error, it will broadcast a low voltage telltale (ON) command which tells the cluster to light the charge indicator. The charge indicator will be illuminated if the PCM fails to see a signal on the generator monitor line for a time period greater than 500 milliseconds. This telltale command will also be used to indicate over-voltage conditions detected by the PCM controlled generator.

Each time the ignition switch is cycled to the run position, the cluster will initiate a bulb check by illuminating the charge indicator. It is the PCM's responsibility to issue a low voltage telltale (OFF) command if the charging system is functioning properly. This message should be sent during Network Initialization in the voluntary phase (250 milliseconds to 450 milliseconds after the ignition switch is cycled to the run position). If a low voltage telltale (OFF) command is not received by the cluster, the cluster will continue to light the charge light indefinitely.

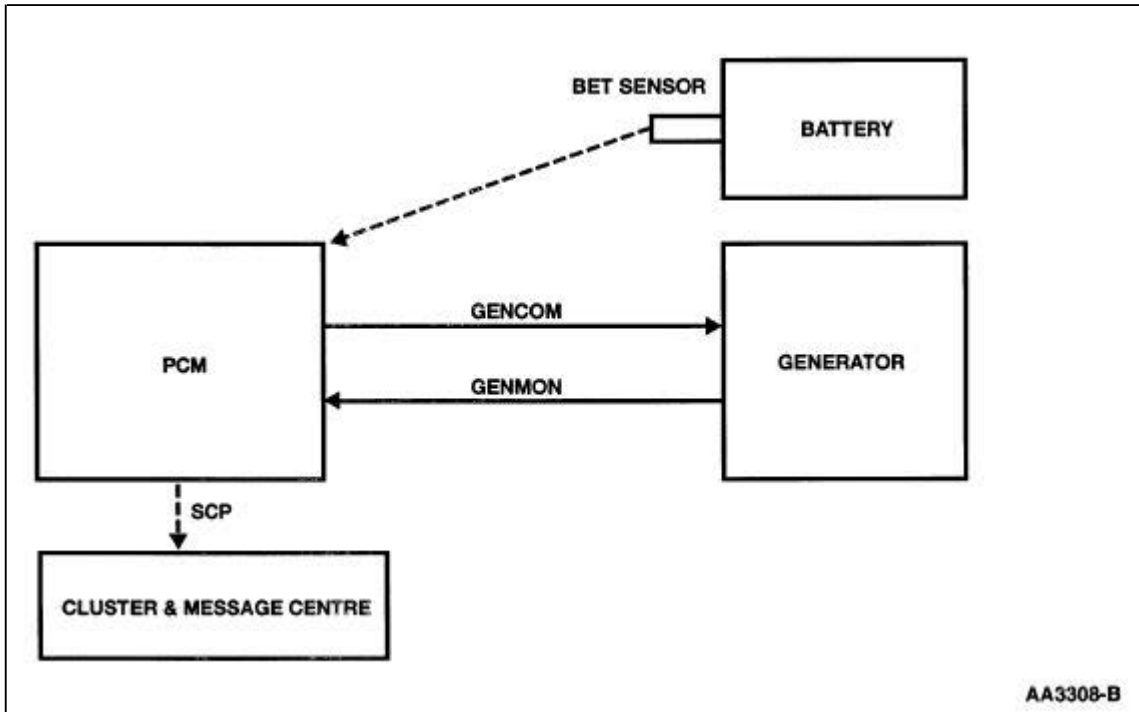


Figure 142: PCM Charging System Interfaces

Powertrain Control/Emissions Diagnosis Manual

2001

On Board Diagnostics II

SECTION 2: Diagnostic Methods

Choose an item on the left side to display section contents.

Diagnostic Methods

Overview

The Diagnostic Methods Section provides information on routine diagnostic tasks.

When following powertrain diagnostics on OBD II vehicles, the system may be checked by an off-board tester referred to as a scan tool. This section contains information for performing diagnostics with a scan tool. A scan tool has certain generic capabilities that are standard across the automotive industry in the United States. All functions are selected from a menu. Refer to the instruction manual provided by the tool manufacturer.

Diagnostic Tools

Below is an equipment list with corresponding part numbers:

REQUIRED EQUIPMENT:

- Rotunda Worldwide Diagnostic System (WDS) 418-F224 or scan tool with functionality described under Scan Tool Set-up and Functionality.
- Rotunda EEC-IV 60-Pin Breakout Box 418-005 (014-00322) or equivalent.
- Rotunda Evaporative Emission System Tester 310-F007 (134-00056) or equivalent.

RECOMMENDED EQUIPMENT:

- Rotunda EEC-V 104-Pin Breakout Box 418-049 (014-00950) or equivalent.
- Rotunda Vacuum/Pressure Tester 164-R0253 or equivalent. Range 0-101.3 kPa (0-30 in-Hg.) Resolution 3.4 kPa (1 in-Hg.)
- Rotunda Vacuum Tester 014-R1054 or equivalent. Range 0-101.3 kPa (0-30 in-Hg.)
- Rotunda Engine EAR Amplifier 107-R2100 or equivalent.
- Rotunda 73 III Automotive Meter 105-R0057 or equivalent. Input impedance 10 Megaohm minimum.
- Rotunda Electronic Ignition (EI) System Tester (Distributor/less Ignition System Tester) 418-F024 (007-00075) or equivalent.
- Dist Integrated EDIS Cable Option 418-F039 (007-00110) or equivalent.
- Series 100 Engine/Ignition Analyzer 010-01060 or equivalent.
- Spark Tester D81P-6666-A or equivalent.
- Non-powered Test Lamp.

OPTIONAL EQUIPMENT:

- Rotunda Auxiliary Adapter 418-F007 (007-00023) or equivalent.
 - Rotunda Pressure/Vacuum Adapter 418-F006 (007-00022) or equivalent.
 - Rotunda Fuel (Gasoline) pressure test kit 134-R0087 or equivalent (Use tool manufacturer's instructions. For specific applications, refer to Workshop Manual Group 3).
 - Rotunda Fuel Composition Test Kit 014-00770.
 - Fuel Injector Tester/Cleaner 164-R3759 or equivalent.
 - Rotunda NG Tool Kit 134-00114 or equivalent.
-

Scan Tool Set-up and Functionality

The scan tool must be connected to the data link connector (DLC) for communication with the vehicle.

The DLC is located in the passenger compartment. It is attached to the instrument panel and accessible from the driver's seat.

The DLC is rectangular in design and capable of accommodating up to 16 terminals. The connector has keying features to allow easy connection. The vehicle connector and the test equipment connector have latching features that ensure the test equipment connector will remain mated when properly connected.

The required scan tool functions are described below:

- Monitor, record and playback of PIDs
- Freeze frame PID data
- Diagnostic test modes (self test)/clear diagnostic DTCs (PCM reset)
- Output Test Mode
- Reset Keep Alive Memory
- Digital measurement system (multimeter functionality)
- Diagnostic monitoring test results (for OBD II on-board monitors)
- On board system readiness (OBD II monitor completion status)

Some of these functions are described in this section. Refer to the scan tool manufacturer's manual for specific information on scan tool set-up and operation.

Vehicle Check/Preparation

Before using the scan tool to perform any test, refer to the important Safety Notice located at the beginning of this manual and the necessary visual checks listed below.

Visual Checks

- Inspect the air cleaner and inlet duct.
- Check all engine vacuum hoses for damage, leaks, cracks, kinks and proper routing.
- Check Electronic EC system wiring harness for proper connections, bent or broken pins, corrosion, loose wires and proper routing.
- Check the powertrain control module (PCM), sensors and actuators for physical damage.
- Check the engine coolant for proper level and mixture.
- Check the transmission fluid level and quality.
- Make all necessary repairs before continuing with Quick Test.

Vehicle Preparation

- Perform ALL safety steps required to start and run vehicle tests. Apply parking brake, place shift lever firmly into PARK position (NEUTRAL on manual transmission) and block drive wheels.
 - Turn off ALL electrical loads: radios, lamps, A/C, blower and fans.
 - Start engine and bring up to normal operating temperature before running Quick Test.
-

Quick Test

Quick Test

Quick Test is divided into three specialized tests:

1. Key On Engine Off (KOEO) On-Demand Self-Test
2. Key On Engine Running (KOER) On-Demand Self-Test
3. Continuous Memory Self-Test

Quick Test checks the integrity and function of the Electronic EC System and outputs the test results when requested by a scan tool. Quick Test also provides a quick end check of the powertrain control system and is usually performed at the start of each diagnostic procedure with all accessories off. Quick Test is also performed at the end of most pinpoint tests for verification of repair and to make sure no other faults were incurred while repairing a previous fault. A system pass will be displayed when no DTCs are output and a scan tool communication error does not exist. System pass means that hardware monitored by the PCM is functioning within normal operating limits. Only a system pass, DTC or an incomplete OBDII drive cycle (P1000) will be displayed.

Key On Engine Off (KOEO) On-Demand Self-Test

Key On Engine Off (KOEO) On-Demand Self-Test is a functional test of the powertrain control module performed on demand with the key on and the engine off. This test will perform checks on certain sensor and actuator circuits. A fault must be present at the time of testing for the KOEO Self-Test to detect the fault. When a fault is detected, a Diagnostic Trouble Code (DTC) will be output on the data link at the end of the test when requested by a scan tool.

Key On Engine Running (KOER) On-Demand Self-Test

Key On Engine Running (KOER) On-Demand Self-Test is a functional test of the powertrain control module performed on demand with the key on engine running and vehicle stopped. A check of certain inputs and outputs is made during operating conditions and at normal temperature. The brake pedal position, transmission control and power steering switch tests are part of KOER On-Demand Self-Test and MUST be performed during this operation if applicable. These are described below. A fault must be present at the time of testing KOER On-Demand Self-Test to detect the fault. When a fault is detected, a Diagnostic Trouble Code (DTC) will be output on the data link at the end of the test when requested by a scan tool.

Brake Pedal Position Test

This tests the ability of the Electronic EC system to detect a change of state in the stoplight switch. Brake pedal MUST briefly be applied and released on all vehicles equipped with Brake Pedal Position input. This is done during KOER On-Demand Self-Test.

Transmission Control Switch Test

This tests the ability of the Electronic EC system to detect a change of state in the transmission control switch (TCS). Switch MUST briefly be cycled on all vehicles equipped with TCS input. This is done during KOER On-Demand Self-Test.

Power Steering Pressure Test

This tests the ability of the Electronic EC system to detect a change in power steering system fluid pressure. The steering wheel MUST briefly be turned at least 1/4 of a revolution on vehicles equipped with a power steering pressure (PSP) switch or sensor. This is done during KOER On-Demand Self-Test.

Continuous Memory Self-Test

Testing for Continuous Memory DTC's is a functional test of the powertrain control module performed under any condition (engine running or off) with the key on. Unlike the KOEO and KOER self tests, which can only be activated on demand, the Continuous Self Test is always active. A fault does not need to be present at the time of testing for Continuous DTC's and is therefore, especially valuable when diagnosing intermittent faults. This test will detect failures contributing to driveability or emission concerns. The vehicle may need to be driven or the OBDII Drive Cycle completed to allow the PCM to detect a fault. Refer to [Drive Cycles](#) for more information. When a fault is stored in memory, a Diagnostic Trouble Code (DTC) will be output on the data link at the end of the test when requested by a scan tool.

There are two types of Continuous DTC's. The first type is an emission related malfunction indicator lamp (MIL) code which will illuminate the CHECK ENGINE or SERVICE ENGINE SOON indicator in the instrument cluster. The second is a non emission related non-MIL code which will never illuminate the cluster indicator.

For emission related MIL codes, the PCM will store the DTC in continuous memory when a fault is detected for the first time. At this point the DTC will not illuminate the MIL and is now considered a pending code. The purpose of pending codes is to assist in repair verification by reporting a pending DTC after one drive cycle. If the same fault is detected after the next ignition start-run cycle, the emission related MIL code will illuminate the MIL. The MIL will remain on even if the fault is intermittent. The MIL will be extinguished if the fault is not present through three consecutive drive cycles or a PCM reset is performed. Also, an emission related pending MIL and non emission related (non-MIL) code will be erased after approximately 40-80 vehicle warm up cycles or a PCM reset.

Any scan tool that meets OBDII requirements can access Continuous Memory to retrieve emission related MIL DTC's. However, not all scan tools access pending and non emission related (non-MIL) DTC's in the same way.

During most diagnostic procedures in this manual, it is required that all DTC's be retrieved and cleared. Consult the instruction manual from the tool manufacturer for specific instructions.

Parameter Identification (PID)

Description

The Parameter Identification (PID) mode allows access to powertrain control module (PCM) information. This includes analog and digital signal inputs and outputs along with calculated values and system status. There are two types of PID lists available and both are used throughout this manual. The first is the Generic (J1979) OBDII PID list. This is a standard set of PIDs for all manufacturers all scan tools must be able to access. The second is a Ford specific (J2190) list which can be accessed by an adequate scan tool. When accessing any of these PIDs, the values will be continuously updated. The Generic or Ford PID list provides definitions and values in appropriate units. For more information, refer to the Society of Automotive Engineers (SAE) J2205 document.

Generic OBD II PID List

"X" in the "Freeze Frame" column denotes both a mode 1 and mode 2 PID (real time and freeze frame).

Freeze Frame	Acronym	Description	Measurement Units
	AIR	Secondary Air Status	ON/OFF
	CCNT	Continuous DTC Counter	Unitless
X	ECT	Engine Coolant Temperature	DEGREES
X	FUEL SYS1	Fuel System Feedback Control Status-Bank 1	OL/CL/OL DRIVE ^a / OL FAULT/ CL FAULT
X	FUEL SYS2	Fuel System Feedback Control Status-Bank 2	OL/CL/OL DRIVE ^a / OL FAULT/ CL FAULT
	IAT	Intake Air Temp	DEGREES
X	LOAD ^b	Calculated Engine Load	Percent
X	LONG FT1	Current BANK 1 fuel trim adjustment (kamref1) from stoichiometry which is considered LONG TERM.	Percent
X	LONG FT2	Current BANK 2 fuel trim adjustment (kamref2) from stoichiometry which is considered LONG TERM.	Percent
	MAF	Mass Air Flow Rate	GM/SEC-LB/ MIN
	O2S11	Bank 1 Upstream Oxygen Sensor (11)	VOLTS
	O2S12	Bank 1 Downstream Oxygen Sensor (12)	VOLTS
	O2S21	Bank 2 Upstream Oxygen Sensor (21)	VOLTS
	O2S22	Bank 2 Downstream Oxygen Sensor (22)	VOLTS
	OBD SUP	On-Board Diagnostic System	Cal. OBD II 50 States OBD II OBD I and OBD II OBD I None
	PTO	Power Take-Off Status	ON/OFF
X	RPM	Revolutions Per Minute	RPM

X	SHRT FT1	Current BANK fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
	SHRT FT1 ¹	Current BANK fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
	SHRT FT12 ²	Current BANK 1 fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
X	SHRT FT2	Current BANK 2 fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
X	SHRT FT21 ³	Current BANK 2 fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
X	SHRT FT22 ⁴	Current BANK 2 fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
	SPARKADV	Spark Advance Cylinder No. 1	DEGREES
X	TP	Throttle Position	Percent
X	VSS	Vehicle Speed Sensor	MPH-KM/H

^a OL = Open loop, have not satisfied conditions for closed loop.

^b Percent engine load adjusted for atmospheric pressure.

¹ Individual oxygen sensor fuel trim adjustment is not supported.

² Individual oxygen sensor fuel trim adjustment is not supported.

³ Individual oxygen sensor fuel trim adjustment is not supported.

⁴ Individual oxygen sensor fuel trim adjustment is not supported.

CL = Closed loop using O2S(s) as feedback for fuel control.

OL DRIVE = Open loop due to driving conditions (heavy accel).

OL FAULT = Open loop due to fault with all upstream O2S sensors.

CL FAULT = Closed loop fuel control, but fault with one upstream O2S sensor on dual bank vehicles.

Ford PID List

Acronym	PID #	Description	Ford Units
4X4L	1101 b2	Requested 4 Wheel Drive Input	ON/OFF
ACCS	1101 b0	Air Conditioning Cycling Switch Input	ON/OFF
ACP	1102 b0	A/C Head Pressure Switch Input	OPEN/CLOSED
ACP V	1638	A/C Head Pressure Switch Input	VOLTS
AIR	1104 b4	Secondary AIR Pump Control	ON/OFF
AIRM	110C b1	Secondary AIR Pump Monitor	ON/OFF
BARO	1127	Barometric Pressure (may be software determined)	Hz
BPP/BOO	1101 b1	Brake Pedal Position/Brake On-Off Switch Input	ON/OFF
CAMDCR	16CF	Commanded Duty Cycle for VCT Solenoid	%
CAMERRR	16CE	VCT Error in Crankshaft Degrees	DEGREES
CAS GND	16CO	PCM Case Ground	VOLTS
CCS	1105 b7	Coast Clutch Solenoid Control	ON/OFF

CHT	1624	Cylinder Head Temperature Input	DEGREES
CHT V	1685	Cylinder Head Temperature Input	VOLTS
CPP/PNP	1101 b3	Clutch Pedal/Park Neutral Position Switch Input	ON/OFF
DPFEGR	114E	Differential Pressure Feedback EGR Input	VOLTS
ECT	1139	Engine Coolant Temperature Input	DEGREES
ECT V	114D	Engine Coolant Temperature Input	VOLTS
EFTA	168E	Engine Fuel Temperature - Bank 1 Input	DEGREES
EFTA V	168D	Engine Fuel Temperature - Bank 1 Input	VOLTS
EFTB	169O	Engine Fuel Temperature - Bank 2 Input	DEGREES
EFTB V	168F	Engine Fuel Temperature - Bank 2 Input	VOLTS
EGRMDS	098E	Electric EGR Motor Commanded In Steps	Steps
EGRVR	113C	EGR Valve Vacuum Control	%
EOT	1310	Engine Oil Temperature Sensor Input	DEGREES
EOT V	16AF	Engine Oil Temperature Sensor Input	VOLTS
EOTF	16A9	Engine Oil Temperature Fault Detection	YES/NO
EPC	11C0	Transmission Line Pressure Control	PSI
EPC V	11B2	Transmission Line Pressure Control	VOLTS
EVAPCPF	162F b2	Evaporative Emissions Canister Purge Fault	YES/NO
EVAPCV	1167	Evaporative Emissions Canister Purge Vent Control	%
EVAPCVF	1630 b3	Evaporative Emissions Canister Purge Vent Fault	YES/NO
EVAPPDC	1166	Evaporative Emissions Canister Purge Control	%
EVAPPF	1627	Evaporative Purge Flow Input	VOLTS
EVAPVMA	1636	Evaporative Vapor Management Valve Internal Circuit Monitor	VOLTS
FF	16AB	Flex Fuel Sensor Input	%
FLI	16C1	Fuel Level Indicator Input	%
FLI V	16BF	Fuel Level Indicator Input	VOLTS
FP M	1673	Fuel Pump Secondary Monitor	%
FPF	162E b6	Fuel Pump Output Fault	YES/NO
FPM	110C b0	Fuel Pump Secondary Monitor	ON/OFF
FRP	168C	Engine Injector Pressure Input	PSI
FRP V	168B	Engine Injector Pressure Input	VOLTS
FSVF	1691 b1	Engine Fuel Solenoid Valve Fault	YES/NO
FSVM	1691 b2	Engine Fuel Solenoid Valve Secondary Monitor	ON/OFF
FTP	1687	Fuel Tank Pressure Input	in.H2O
FTP V	1639	Fuel Tank Pressure Input	VOLTS
FUELPW1	1141	Injector Pulse Width Bank 1	MILLISECONDS
FUELPW2	1142	Injector Pulse Width Bank 2	MILLISECONDS
GEAR	11B3	Transmission Gear Status	GEAR
GENF	0927 b2	Generator Output Fault Detection	YES/NO
GENFDC	16E8	Generator Field Control Output	%
GFS	0939	Generator Field Signal Monitor	%
HFC	1103 b3	High Speed Fan Control	ON/OFF
HFCF	162F b1	High Speed Fan Control Fault	YES/NO

HTR11	1631 b0	Bank 1 Upstream O2S Heater Control	ON/OFF
HTR11F	1631 b4	Bank 1 Upstream O2S Heater Circuit Fault	ON/OFF
HTR12	1631 b1	Bank 1 Downstream O2S Heater Control	ON/OFF
HTR12F	1631 b5	Bank 1 Downstream O2S Heater Circuit Fault	ON/OFF
HTR21	1631 b2	Bank 2 Upstream O2S Heater Control	ON/OFF
HTR21F	1631 b6	Bank 1 Downstream O2S Heater Circuit Fault	ON/OFF
HTR22	1631 b3	Bank 2 Downstream O2S Heater Control	ON/OFF
HTR22F	1631 b7	Bank 1 Downstream O2S Heater Circuit Fault	ON/OFF
HTRX1	1102 b1/6	O2S Upstream Heater Control	ON/OFF
HTRX2	1102 b2/7	O2S Downstream Heater Control	ON/OFF
IAC	1153	Idle Air Control	%
IAT	1123	Intake Air Temperature Input	DEGREES
IAT V	114A	Intake Air Temperature Input	VOLTS
IAT2	16A8	Intake Air Temperature Sensor 2 Input	DEGREES
IAT2 V	16A7	Intake Air Temperature Sensor 2 Input	VOLTS
IMRC	1103 b4	Intake Manifold Runner Control	ON/OFF
IMRC F	162F b6	Intake Manifold Runner Control Fault	YES/NO
IMRCM	1634	Intake Manifold Runner Control Monitor Input Bank 1	VOLTS
IMSC	1103 b4	Intake Manifold Swirl Control	ON/OFF
IMSC F	162F b6	Intake Manifold Swirl Control Fault	YES/NO
IMTV	1684	Intake Manifold Tuning Valve Control	%
IMTVF	162F b5	Intake Manifold Tuning Valve Fault	YES/NO
INJ1F-8F	162D b0- 7	Fuel Injector Primary Fault	YES/NO
INJ9F-10F	16EA b0- 1	Fuel Injector Primary Fault	YES/NO
KS1 V	16E6	Knock Sensor Input Bank 1	VOLTS
KS2 V	16E7	Knock Sensor Input Bank 2	VOLTS
LFC	1103 b2	Low Speed Fan Control	ON/OFF
LFCF	162F b0	Low Speed Fan Control Fault	YES/NO
LONGFT1	1156	Long Term Fuel Trim Bank 1	%
LONGFT2	1157	Long Term Fuel Trim Bank 2	%
MAF	1671	Mass Airflow Rate Input	GM/S
MAF V	1177	Mass Airflow Rate Input	VOLTS
MAF V	1633	Mass Airflow Rate Input	VOLTS
MFC	0967 b10	Medium Speed Fan Control	ON/OFF
MFCF	0967 b11	Medium Speed Fan Control Fault	YES/NO
MIL	1103 b5	Malfunction Indicator Lamp Control	ON/OFF
MP LRN	16DD b0	Misfire Wheel Profile Learned in KAM	YES/NO
OCTADJ	1102 b3	Octane Adjust Status	OPEN/CLOSED
OCTADJS	16EF b0	Octane Adjust Software Status	RETARD/NO RETARD
O2S11	1173	Bank 1 Upstream O2S Input	VOLTS

O2S12	1174	Bank 1 Downstream O2S Input	VOLTS
O2S21	1175	Bank 2 Upstream O2S Input	VOLTS
O2S22	1176	Bank 2 Downstream O2S Input	VOLTS
PIP	1102 b4	Profile Ignition Pickup Input	ON/OFF
PSP	1101 b7	Power Steering Pressure Switch Input	HIGH/LOW
PSP V	1626	Power Steering Pressure Input	VOLTS
PSP V	1625	Power Steering Pressure Input	VOLTS
PTO	160D b5	Power Take Off Status Input	ON/OFF
RCAM	16CD	VCT Solenoid Commanded in Crank Shaft Degrees	DEGREES
REV	1697 b0	Transmission Reverse Switch Input	ON/OFF
RPM	1165	Engine Speed Based Upon CKP Input	RPM
SCB	0964 b0	Supercharger Bypass Control	ON/OFF
SCBF	0964 b1	Supercharger Bypass Control Fault	YES/NO
SCICP	0964 b2	Supercharger Intercooler Pump Control	ON/OFF
SCICPF	0964 b3	Supercharger Intercooler Pump Control Fault	YES/NO
SS1	1105 b4	Shift Solenoid 1 Control	ON/OFF
SS2	1105 b5	Shift Solenoid 2 Control	ON/OFF
SS3	1105 b6	Shift Solenoid 3 Control	ON/OFF
TCC	11B0	Torque Converter Clutch Control	%
TCCA	110E b7	Torque Converter Clutch Control Internal Circuit Monitor	ON/OFF
TCIL	1104 b2	Transmission Control Indicator Lamp Clutch Control Status	ON/OFF
TCS	1101 b4	Transmission Clutch Converter Control Switch Input	ON/OFF
TFT	1674	Transmission Fluid Temperature Input	DEGREES
TFT V	11BD	Transmission Fluid Temperature Input	VOLTS
THTRC	0965	Thermostat Heater Control	%
TMAP	0945	Thermal Manifold Absolute Pressure	kPa
TP MODE	1125	Throttle Position Mode	C/T, P/T, WOT
TP V	1154	Throttle Position Input	VOLTS
TPB	1629	Secondary Throttle Position Input	VOLTS
TPREL	1169	Lowest Steady TP Voltage Since Engine Start (RATCH)	VOLTS
TR	11B6	Transmission Selector Position Input Status	POSITION
TR V	1151	Transmission Selector Position Input Status	VOLTS
TR D	16B5	Transmission Selector Position Input Status (Digital)	BINARY
TSS/ISS	11B4	Turbine Shaft Speed/Input Shaft Speed	RPM
VCTA	16B1 b6	VCT Control Circuit Monitor	ON/OFF
VCTENA	16B1 b5	Conditions Correct to Enable VCT	YES/NO
VPWR	1172	Vehicle Power Voltage	VOLTS
VREF	1155	Vehicle Reference Voltage	VOLTS
WAC	1104 b0	A/C Clutch Command	ON/OFF
WACF	162E b5	WOT A/C Primary Circuit Fault	YES/NO

Note: PID MP LRN must be set to YES before the Misfire Monitor will be enabled.

On-Board System Readiness

Description

All OBD II scan tools display the On-Board System Readiness (OSR) Test. The OSR will display the supported monitors on the vehicle and the status of all monitors (complete or not complete) at that time. Fuel, misfire and comprehensive component monitors run continuously and will always display "YES" status. Only a PCM reset or a keep alive RAM reset will cause the non-continuous monitors to reinitialize to "NO" status.

Freeze Frame Data

Description

Freeze Frame Data allows access to emission-related values from specific generic PIDs. These values are stored when an emission-related DTC is stored in Continuous Memory. This provides a snapshot of the conditions that were present when the DTC was stored. Once one set of freeze frame data is stored, this data will remain in memory even if another emission-related DTC is stored, with the exception of Misfire or Fuel System DTCs. Once freeze frame data for Misfire or Fuel System DTC is stored, it will overwrite any previous data, and freeze frame will not be further overwritten. When a DTC associated with the freeze frame is erased or a PCM memory reset is performed, new freeze frame data can be stored again. In the event of multiple emission-related DTCs in memory, always note the DTC for the freeze frame data.

FREEZE FRAME DATA TABLE

Acronym	Description	Measurement Units
ECT	Engine Coolant	DEGREES
FUELSYS1	Open/Closed Loop1	OL/CL/OL DRIVE/OL FAULT/CL FAULT
FUELSYS2	Open/Closed Loop2	OL/CL/OL DRIVE/OL FAULT/CL FAULT
LONGFT1	Long Term Fuel Bank1	PERCENT
LONGFT2	Long Term Fuel Bank2	PERCENT
LOAD	Calculated Load Value	PERCENT
RPM	Engine RPM	R/MIN
SHRTFT1	Short Term Fuel Bank1	PERCENT
SHRTFT2	Short Term Fuel Bank2	PERCENT
VSS	Vehicle Speed	MPH-KMH

Some unique parameters (PIDs) are stored in the Keep Alive Memory of the PCM to help in diagnosing the root cause of misfires. These PIDs are collectively called misfire freeze-frame (MFF) data. These parameters are separate from the generic freeze-frame data that is stored for every MIL code. They are used for misfire diagnosis only. The MFF data is more useful for misfire diagnosis than the normal diagnosis only. It is captured at the time of the highest misfire rate and not when the DTC is stored at the end of a 1000 or 200 revolution block. (Generic freeze-frame data for misfire can be stored minutes after the misfire actually occurred.)

Note: MFF PIDs are supported on all vehicles but may not be available on all scan tools because enhanced PID access may vary by scan tool manufacturer.

MISFIRE FREEZE-FRAME PIDs

PID Name	Description	PID #	Measurement Units
MFF RPM	Engine RPM at the time of misfire	16D3	RPM
MFF LOAD	Engine load at the time of misfire	16D4	PERCENT
MFF VS	Vehicle speed at the time of misfire	16D5	MPH/KPH
MFF IAT	Intake air temperature at the time of misfire	16D6	DEGREES
MFF SOAK	Engine-off soak time at the time of misfire	16D7	MINUTES

MFF RNTM	Engine running time at the time of misfire	16D8	SECONDS
MFF EGR	EGR DPFE sensor at the time of misfire	16D9	VOLTAGE
MFF TP	Throttle Position at time of misfire	16DA	VOLTAGE
MFF T CNT	Number of driving cycles at the time of misfire (at least one 1,000 rev block)	16DC	# TRIPS
MFF PNP	1= in drive during the time of misfire	16DD b1	MODE
MP LRN	1= Misfire wheel profile learned in KAM	16DD b0	YES/NO

Output Test Mode

Description

The Output Test Mode (OTM) aids in servicing output actuators associated with the PCM. This mode allows the technician to energize and de-energize most of the system output actuators on command. When entering OTM, the outputs can be turned off and on without activating the fan control. The low and high speed fan control(s) may be turned on separately without energizing the other outputs. This function is supported by each vehicle strategy and may not be available on all scan tools.

As a safety precaution, Output Test Mode will default to the off state after 10 minutes and fuel pump off after approximately 7-10 seconds. OTM will also turn off after the vehicle is started or after cycling the key off then on.



WARNING: SAFETY MUST BE OBSERVED WHEN USING OUTPUT TEST MODE:

- **WHEN ALL OUTPUTS ARE ON, THE ELECTRIC FUEL PUMP IS BRIEFLY ENERGIZED, SO MAKE SURE FUEL SYSTEM IS INTACT AND IS NOT BEING SERVICED AT THIS TIME.**
 - **WHEN LOW SPEED OR HIGH SPEED FAN CONTROL(S) ARE TURNED ON, MAKE SURE FAN BLADES ARE CLEAR OF ANY OBSTRUCTION.**
-

Powertrain Control Module (PCM) Reset

Description

All OBDII scan tools support the powertrain control module (PCM) reset.

The PCM Reset allows the scan tool to command the PCM to clear all emission-related diagnostic information. When resetting the PCM, a DTC P1000 will be stored in the PCM until all the OBD II system monitors or components have been tested to satisfy a drive cycle, without any other faults occurring. For more information about a drive cycle, refer to [Drive Cycles](#).

The following events occur when a PCM reset is performed:

- Clears the number of Diagnostic Trouble Codes (DTCs).
- Clears the DTCs.
- Clears the freeze frame data.
- Clears diagnostic monitoring test results.
- Resets status of the OBD II system monitors.
- Sets DTC P1000.

Resetting Keep Alive Random Access Memory (RAM)

Resetting Keep Alive RAM will return PCM memory to its default setting. Adaptive learning contents such as idle and fuel trim are included. A PCM Reset (described above) is also part of a KAM Reset.

After Keep Alive RAM has been reset, the vehicle may exhibit certain driveability concerns. It will be necessary to drive the vehicle to allow the PCM to relearn values for optimum driveability and performance.

This function may not be supported by all scan tools. Refer to scan tool manufacturer's instruction manual.

If an error message is received or the scan tool does not support this function, disconnecting the battery ground cable for a minimum of 5 minutes may be used as an alternative procedure.

Flash Electrically Erasable Programmable Read Only Memory — Flash EEPROM

Description

Flash Electrically Erasable Programmable Read Only Memory (EEPROM) is contained in an Integrated Circuit (IC) internal to the PCM. The EEPROM contains the vehicle strategy including calibration information specific to the vehicle and is capable of being reprogrammed or reflashed repeatedly.

As part of the calibration there is an area referred to as the Vehicle Identification (VID) block. The VID block must be programmed when replacing the PCM as described under Programming the VID Block for a Replacement PCM. Failure to perform this procedure may generate fault code: P1639, VID Block not programmed or is corrupt. The VID block in an existing PCM can also be tailored to accommodate various hardware changes made to the vehicle since production. Failure to perform this procedure properly may generate fault code: P1635, Tire/Axle Ratio out of Acceptable Range. This is described under Making Changes to the VID Block and also under Making Changes to the PCM Calibration. The VID block contains many items used by the strategy for a variety of functions. Some of these items include the VIN number, octane adjust, fuel octane, fuel type, vehicle speed limit, tire size, axle ratio, the presence of speed control and four wheel drive electronic shift on the fly versus manual shift on the fly. Only items applicable to vehicle hardware and supported by the VID block will be displayed on the scan tool.

When changing items in the VID block, the strategy will place range limits on certain items such as tire and axle ratio. The VID block is also limited to the number of times to be reconfigured. When this limit is reached, the scan tool will display a message indicating the need to flash the PCM again to reset the VID block.

Each of the procedures described below use the Worldwide Diagnostic System (WDS). Reprogramming can be performed by a local Ford dealer for any non Ford facility. There are other Enhanced Scan Tools that may have reprogramming capabilities available. Refer to the manufacturers users manual for details.

Programming the VID Block for a Replacement PCM

A new PCM will contain the latest strategy and calibration level for a particular vehicle. However, the VID block will be blank and will need programming. There are two procedures available. The first is an automatic data transfer from the old PCM to the new PCM and the second is manual data entry into the new PCM.

Automatic data transfer will be performed if the old PCM is capable of communicating. This is done by the use of a scan tool to retrieve data from the old PCM before removing it from the vehicle. The stored data can now be downloaded to the new PCM after it has been replaced.

Manual data entry must be performed if the old module is damaged and is incapable of communicating. Remove and replace the old PCM. You may be instructed to contact the "AS BUILT" data center for the information needed to manually update the VID block with the scan tool. Contact the center ONLY if the old PCM cannot be used or the data is corrupt. For Ford L-M technician's, contact your National Hotline for "AS Built" data. Non Ford technicians, use the Fed World website at "fedworld.gov". Select Auto Service Information and search for "Calibrations" or "Vehicle Calibrations" then specify vehicle manufacturer, model name and model year as required.

Making Changes to the VID Block

A PCM which is programmed may require changes to be made to certain VID information to accommodate vehicle hardware. Refer to PCM/Module Reprogramming on the Scan Tool.

Making Changes to the PCM Calibration

At certain times, the entire EEPROM will need to be completely reprogrammed. This is due to changes made to the strategy or calibration after production or the need to reset the VID block because it has reached its limit. Refer to PCM/Module Reprogramming on the Scan Tool.

Diagnostic Monitoring Test Results

The purpose of this test mode is to allow access to the results of OBD II monitor diagnostic test results. The test values that are stored at the time of the particular monitor completion are displayed when the particular test identification is requested. Refer to the following table for test information.

DIAGNOSTIC MONITORING TEST RESULTS TABLE

Module ID h ^a	Test ID h ^a	Component ID h ^a	Test Description
			Oxygen Sensor Monitor (01-0F)
10	01	11	Sensor Voltage Amplitude - Bank 1, Sensor 1
10	01	21	Sensor Voltage Amplitude - Bank 2, Sensor 1
10	02	11	Upstream Static Shift, Lean Shift on EGO11
10	02	11	Upstream Static Shift, Rich Shift on EGO11
10	02	21	Upstream Static Shift, Lean Shift on EGO21
10	02	21	Upstream Static Shift, Rich Shift on EGO21
10	03	01	Upstream Switchpoint
10	03	02	Downstream Switchpoint
			Catalyst Monitor (10-1F)
10	10	11	Rear to Front Switch Ratio Test - Bank 1 test
10	10	21	Rear to Front Switch Ratio Test - Bank 2 test
			Evaporative Monitor (21-2F)
10	21 ^b	00	Fuel Tank Pressure test - Low
10	21 ^b	00	Fuel Tank Pressure test - High
10	22 ^b	00	Evap-Phase 2 change in pressure test
10	23 ^b	00	Evap-Phase 4 change in pressure too large
10	24 ^b	00	Evap-Phase 4 change in pressure too small
10	25 ^b	00	Evap-Phase 4 pressure build test-upper limit
10	26	00	Phase 0 initial tank vacuum and minimum limit
10	26	00	Phase 0 initial tank vacuum and maximum limit
10	27	00	Phase 2 0.040" cruise leak check vacuum bleed-up and max 0.04" leak threshold
10	28	00	Phase 2 0.020" cruise leak check vacuum bleed-up and max leak threshold
10	29	00	EVAP-Phase 4 change in pressure too small
10	2A	00	Phase 4 vapor generation maximum change in pressure and maximum threshold
10	2B	00	Phase 4 vapor generation maximum absolute pressure rise and maximum threshold
10	2C	00	Phase 2 0.020" idle leak check vac bleed-up and max leak threshold
10	2D	00	Phase 2 0.020" idle leak check vacuum bleed-up and max no-leak threshold

			Secondary Air Monitor (30-3F)
10	30	11	O2S11 rich during flow test
10	30	21	O2S21 rich during flow test
10	30	12	O2S12 rich during flow test
10	31	00	O2Ss lean timer test
10	31	01	O2Ss lean timer test
			EGR System Monitor (41-4F)
10	41 ^b	11	Upstream hose disconnected test
10	41 ^b	12	Downstream hose disconnected test
10	45	20	Stuck Open Valve Test
10	49	30	EGR Flow Test
10	4B	30	Flow test
			Misfire Monitor (51-5F)
10	50	00	Total Misfires that exceeded threshold
10	53	01	Misfire rate per 200 revs for Cylinder 1/Type A
10	53	02	Misfire rate per 200 revs for Cylinder 2/Type A
10	53	03	Misfire rate per 200 revs for Cylinder 3/Type A
10	53	04	Misfire rate per 200 revs for Cylinder 4/Type A
10	53	05	Misfire rate per 200 revs for Cylinder 5/Type A
10	53	06	Misfire rate per 200 revs for Cylinder 6/Type A
10	53	07	Misfire rate per 200 revs for Cylinder 7/Type A
10	53	08	Misfire rate per 200 revs for Cylinder 8/Type A
10	53	09	Misfire rate per 200 revs for Cylinder 9/Type A
10	53	0A	Misfire rate per 200 revs for Cylinder 10/Type A
10	54	00	Highest misfire rate in 200 rev test/Type A
10	55	00	Highest misfire rate in 1000 rev test/Type B
10	56	00	Misfire monitor trip complete test

a = hexadecimal

b = These test IDs are signed values. Scan tool may display them as unsigned.

The conversion is done as follows:

If the value is > 32767 then complement (change 0's to 1's and 1's to 0's), add 1 and a negative sign.

Example:

50000 =	1100001101010000
Complement of 50000 =	0011110010101111
	+1
	0011110010110000

Signed Value =	-15536
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Drive Cycles

Description of OBD II Drive Cycle

The following procedure is designed to execute and complete the OBDII monitors and to clear the Ford P1000, I/M readiness code. To complete a specific monitor for repair verification, follow steps 1 through 4, then continue with the step described by the appropriate monitor found under the "OBDII Monitor Exercised" column. When the ambient air temperature is outside 4.4 to 37.8°C (40 to 100 °F), or the altitude is above 2438 meters (8000 feet), the EVAP monitor will not run. If the P1000 code must be cleared in these conditions, the PCM must detect them once (twice on some applications) before the EVAP monitor can be "bypassed" and the P1000 cleared. The EVAP "bypassing" procedure is described in the following drive cycle.

The OBDII Drive Cycle will be performed using a scan tool. Consult the instruction manual for each described function.

Note: A detailed description of a Powertrain Control Module (PCM) Reset is found in this section, refer to the table of contents.

Drive Cycle Recommendations

1. Most OBDII monitors will complete more readily using a "steady foot" driving style during cruise or acceleration modes. Operating the throttle in a "smooth" fashion will minimize the time required for monitor completion.
2. Fuel tank level should be between 1/2 and 3/4 fill with 3/4 fill being the most desirable.
3. The Evaporative Monitor can only operate during the first 30 minutes of engine operation. When executing the procedure for this monitor, stay in part throttle mode and drive in a smooth fashion to minimize "fuel slosh".



WARNING: STRICT OBSERVANCE OF POSTED SPEED LIMITS AND ATTENTION TO DRIVING CONDITIONS ARE MANDATORY WHEN PROCEEDING THROUGH THE FOLLOWING DRIVE CYCLES.

For best result, follow each of the following steps as accurately as possible:

OBDII Monitor Exercised	Drive Cycle Procedure	Purpose of Drive Cycle Procedure
Drive Cycle Preparation	1. Install scan tool. Turn key on with the engine off. Cycle key off, then on. Select appropriate Vehicle & Engine qualifier. Clear all DTC's/Perform a PCM reset.	Bypass engine soak timer. Resets OBDII Monitor status.
	2. Begin to monitor the following PIDs: ECT, EVAPDC, FLI (if available) and TP MODE. Start vehicle WITHOUT returning to Key Off.	
Prep for Monitor Entry	3. Idle vehicle for 15 seconds. Drive at 64 Km/h (40 MPH) until ECT is at least 76.7°C (170°F). 4. Is IAT within 4.4 to 37.8°C (40 to 100°F)? If not, complete the following steps, but note that step 14 will be required to "bypass" the EVAP monitor and clear the P1000.	Engine warm-up and provide IAT input to the PCM.
HEGO	5. Cruise at 64 Km/h (40 MPH) for at least 5 minutes.	Executes the

		HEGO monitor.
EVAP	6. Cruise at 72 to 104 Km/h (45 to 65 MPH) for 10 minutes (avoid sharp turns and hills). NOTE: To initiate the monitor TP MODE should = PT, EVAPDC must be > 75%, and FLI must be between 15 and 85%.	Executes the EVAP monitor (If IAT is within 4.4 to 37.8°C (40 to 100° F).
Catalyst	7. Drive in stop-and-go traffic conditions. Include five different constant cruise speeds, ranging from 40 to 72 Km/h (25 to 45 MPH) over a 10 minute period.	Executes the Catalyst Monitor.
EGR	8. From a stop, accelerate to 72 Km/h (45 MPH) at 1/2 to 3/4 throttle. Repeat 3 times.	Executes the EGR Monitor.
SEC AIR/CCM (Engine)	9. Bring the vehicle to a stop. Idle with transmission in drive (neutral for M/T) for 2 minutes.	Executes the ISC portion of the CCM.
CCM (Trans)	10. For M/T, accelerate from 0 to 80 Km/h (0 to 50 MPH), continue to step 11. For A/T, from a stop and in overdrive, moderately accelerate to 80 Km/h (50 MPH) and cruise for at least 15 seconds. Stop vehicle and repeat without overdrive to 64 Km/h (40 MPH) cruising for at least 30 seconds. While at 64 Km/h (40 MPH), activate overdrive and accelerate to 80 Km/h (50 MPH) and cruise for at least 15 seconds. Stop for at least 20 seconds and repeat step 10 five times.	Executes the transmission portion of the CCM.
Misfire & Fuel Monitors	11. From a stop, accelerate to 104 Km/h (65 MPH). Decelerate at closed throttle until 64 Km/h (40 MPH) (no brakes). Repeat this 3 times.	Allows learning for the misfire monitor.
Readiness Check	12. Access the On-Board System Readiness (OBDII monitor status) function on the scan tool. Determine whether all non-continuous monitors have completed. If not, go to step 13.	Determines if any monitor has not completed.
Pending Code Check and EVAP Monitor "Bypass" Check	13. With the scan tool, check for pending codes. Conduct normal repair procedures for any pending code concern. Otherwise, rerun any incomplete monitor. If the EVAP monitor is not complete AND IAT was out of the 4.4 to 37.8 °C (40 to 100 ° F) temperature range in step #4, or the altitude is over 2438 m. (8000 ft.), the EVAP "bypass" procedure must be followed. Proceed to Step 14.	Determines if a pending code is preventing the clearing of P1000.
EVAP Monitor "Bypass"	14. Park vehicle for a minimum of 8 hours. Repeat steps 2 through 12. DO NOT REPEAT STEP 1.	Allow the "bypass" counter to increment to two.

Intermittent Diagnostic Techniques

Intermittent diagnostic techniques help find and isolate the root cause of intermittent faults associated with the Electronic Engine Control System. The information is organized to help find the fault and perform the repair. The process of finding and isolating an intermittent starts with recreating a fault symptom, accumulating PCM data and comparing that data to typical values, then analyzing the results. Refer to the scan tool users manual for functions described below.

Before proceeding, be sure that:

- Customary mechanical system tests and inspections do not reveal a concern. (Remember, mechanical component conditions can make a PCM system react abnormally.)
- Technical Service Bulletins (TSBs) and OASIS messages, if available, are reviewed.
- Quick Test and associated Diagnostic Subroutines have been completed without finding a fault, and the symptom is still present.

Recreating the Fault

Recreating the fault is the first step in isolating the cause of the intermittent symptom. A thorough investigation should start with the customer information worksheet located in the back of the book. If Freeze Frame Data is available, it may help in recreating the conditions at the time of a Malfunction Indicator Lamp Diagnostic Trouble Code (MIL DTC). Listed below are some of the conditions for recreating the fault:

CONDITIONS TO RECREATE FAULT

Engine Type Conditions	Non-Engine Type Conditions
Engine Temperature	Ambient Temperature
Engine rpm	Moisture Conditions
Engine Load	Road Conditions (smooth-bumpy)
Engine idle/accel/decel	

Accumulating PCM Data

PCM data can be accumulated in a number of ways. This includes circuit measurements with a DVOM or scan tool PID data. Acquisition of PCM PID data using a scan tool is one of the easiest ways to gather information. Gather as much data as possible when the fault is occurring to prevent improper diagnosis. Data should be accumulated during different operating conditions and based on the customer description of the intermittent fault. Compare this data with the known good data values located in Section 6 in the [Typical Diagnostic Reference Values](#). This will require recording data in four conditions for comparison: 1) KOEO, 2) HOT IDLE, 3) 48 km/h (30 mph) and 4) 89 km/h (55 mph).

Analyzing Data From Playback of Stored PIDs

Look for abnormal events or values that are clearly incorrect. Inspect the signals for abrupt or unexpected changes. For example, during a steady cruise most of the sensor values should be relatively stable. Sensors such as TP, MAF and RPM that change abruptly when the vehicle is traveling at a constant speed are clues to a possible fault area.

Look for agreement in related signals. For example, if TP is changed during acceleration, a corresponding change should occur in IAC, RPM and SPARK ADV PID.

Make sure the signals act in proper sequence. An increase in rpm after the TP is increased is expected. However, if rpm increases without a TP change, then a fault may exist.

Table Format (Figure 1): Scroll through the PID data while analyzing the information. Look for sudden drops or spikes in the values. (Refer to the following TP example). Notice the major jump in the TP voltage while scrolling through the information. This example would require a smooth and progressive accelerator pedal travel during a key on and engine off mode.

Graph Format (Figure 2): Scroll through the PID data while analyzing the information. Look for sudden drops or spikes in the linear lines showing the transformation of values to the line graph. (Refer to the following TP example.) This example would require a smooth and progressive accelerator pedal with the key on and the engine off.

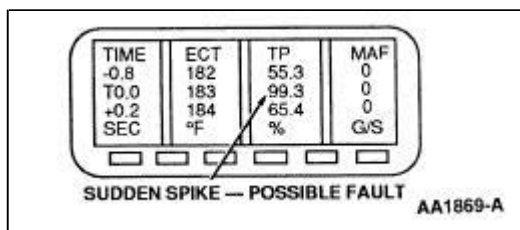


Figure 1: Table Format

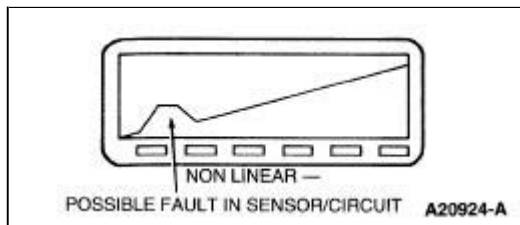


Figure 2: Graph Format

Peripheral Inputs

Some signals may require certain peripherals or auxiliary tools for diagnosis. These tools include the Auxiliary Adapter and Pressure/Vacuum Adapter. In some cases, these devices can be inserted into the measurement jacks of the scan tool or multimeter. For example, connecting an electronic fuel pressure gauge to monitor and record the fuel pressure voltage reading and capturing the data would help find the fault.

Comparing PCM Data

After the PCM values have been acquired, it is necessary to determine the fault area. Typically, it will require the comparison of the actual values from the vehicle to the typical values from the Typical Diagnostic Reference Values in Section 6. The charts apply to different vehicle applications (i.e., model, engine, transmission, etc.).

Basic Circuit Checks

Description

Basic circuit checks help to minimize pinpoint test steps by providing a procedure to diagnose harness faults associated with the Electronic Engine Control (EC) System. The following techniques provide helpful reminders for diagnosing open circuits (continuity), shorts to ground and shorts to power.

NOTE:

- The suspect circuit must be isolated before testing.
- When disconnecting any harness connector, always inspect for damaged or pushed out pins, corrosion and loose wires. Repair as necessary.
- The digital multimeter must be set to the correct scale.
- The techniques do not apply in all situations, therefore, it is necessary to follow each pinpoint test step accurately and completely.
- General resistance and voltage values are specified below. Always use the pinpoint test values if they differ.
- Always turn the key to the OFF position unless directed otherwise by the pinpoint test.

Each of the following procedures will require the powertrain control module (PCM) and component to be disconnected to isolate the harness.

Open Circuit (Continuity)

Disconnect PCM. Measure the harness resistance between the suspect circuit at the harness connector and the appropriate PCM harness connector pin or PCM breakout box (if available). The resistance must be less than 5.0 ohms.

Shorts to Ground

Measure the harness resistance between the suspect circuit at the harness connector and a reliable ground (B-, chassis gnd or PWR GND at the PCM breakout box, if available). The resistance must be greater than 10,000 ohms.

Shorts to Power

Key ON to power up circuit. Measure voltage between the suspect circuit at the harness connector and a reliable ground. The voltage must be less than 1.0 volt.

Powertrain Control/Emissions Diagnosis Manual

2001

On Board Diagnostics II

SECTION 3: Symptom Charts

Choose an item on the left side to display section contents.

QT: Step 1: PCM Quick Test

QT1 PERFORM PCM QUICK TEST

Note: If the vehicle was brought in with an emission compliance failure symptom, GO directly to Section 5; GO to [EM1](#).

- Complete preliminary checks looking for obvious concerns that may relate to the symptom. Check items such as those listed:
 - Related electrical connectors or fuses
 - Vacuum lines (leaks, routing)
 - Air intake system (leaks, restrictions)
 - Fuel quality (octane, contamination, winter/summer blend)
 - Cooling system (engine operating at proper temperature)
- Access any related OASIS or TSB information (if available).
- Complete PCM Quick Test to access any DTCs. Note any Key On Engine Off, Key On Engine Running (if engine runs) and Continuous Memory (MIL and non-MIL) DTCs.

Note: If unable to access DTCs, or any scan tool communication concern exists, GO to [QA1](#) in Section 5. For additional information on retrieving MIL and non-MIL DTCs, refer to Section 2, [Diagnostic Methods](#) (Continuous Memory Self-Test).

Were any DTCs present?

Yes	No
<p>If engine runs rough at idle and Key On Engine Running or Continuous Memory DTC(s) are present:</p> <p>GO to Quick Test QT2 to check injector fault PIDS.</p> <p>All Others:</p> <p>GO to Section 4 (Diagnostic Trouble Code (DTC) Charts) for direction to service DTC(s) after noting the following:</p> <p>Service DTCs in the following order (for each mode, begin diagnosis with the first DTC output).</p> <ol style="list-style-type: none"> 1. Any KOEO DTC(s) 2. Any KOER DTC(s) 3. Any Continuous Memory DTC(s) (retrieve any available Freeze Frame Data)(disregard any identical/related Continuous DTC(s) of DTC(s) already serviced). 	<p>GO to Step 2: NO DTC(s) PRESENT SYMPTOM CHART INDEX for direction to proper STEP 3 Chart.</p> <p>Note: If symptom is not listed, REFER to applicable Workshop Manual or GO to Z1 in Section 5 (for intermittent PCM system diagnostics).</p>

QT2 ENGINE RUNS ROUGH AT IDLE WITH KEY ON ENGINE RUNNING OR

CONTINUOUS MEMORY DTC(s): CHECK INJECTOR FAULT (INJxF) PID(s)

Note: An injector circuit fault could result in unrelated DTC(s) being received from the PCM.

- Key on, engine off.
- Access the INJxF PIDs (the "x" indicates the injector number). There will be one INJxF PID for each engine cylinder.

Do any of the INJxF PIDs indicate "Yes"?

Yes	No
<p>An injector circuit fault exists. KEY OFF. Disregard DTC(s).</p> <p>For Natural Gas applications: GO to HA60.</p> <p>All Others: GO to H56.</p>	<p>No fault detected by injector fault PIDs. KEY OFF. GO to Quick Test QT1 and follow the YES Action To Take for all others.</p>

Step 2: No DTC(s) Present Symptom Chart Index

Driveability

System/Symptom		Oasis Number	Chart Number
Starting Concerns	Hard Start/Long Crank/Erratic Start/Erratic Crank	602300	Chart Number: 2
	Stall After Start	—	Chart Number: 1
	No Start/Normal Crank	603300	Chart Number: 3
Unique Idle Concerns	Slow Return to Idle	617400	Chart Number: 4
	Rolling Idle	618400	Chart Number: 1
	Fast Idle	619400	Chart Number: 5
	Low/Slow Idle	—	Chart Number: 6

Driveability - Performance While Driving Concerns

System/Symptom		Oasis Number	Chart Number
Stalls/Quits	Idle, Acceleration, Cruise	607x00	Chart Number: 1
	Deceleration	607700	Chart Number: 6
Runs Rough		608x00	Chart Number: 1
Misses		609x00	Chart Number: 1
Buck/Jerk		610x00	Chart Number: 1
Hesitation/Stumble		611x00	Chart Number: 1
Surge		612x00	Chart Number: 1
Backfires		613x00	Chart Number: 7
Lack/Loss of Power		614x00	Chart Number: 8
Spark Knock		615x00	Chart Number: 9

Note: OASIS identifiers (the "x" means any number (1-9) can be used) xxx4xx=during idle, xxx5xx=during acceleration, xxx6xx=during cruise, xxx7xx=during deceleration.

Additional Driveability Concerns

System/Symptom	Oasis Number	Chart Number
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Diesels/Runs On	621000	Chart Number: 5
Poor Fuel Economy	622000	Chart Number: 10
Emissions Compliance	623000	Chart Number: 11
Malfunction Indicator Lamp (MIL) Concern	698298	Chart Number: 12

Electrical

System/Symptom		Oasis Number	Chart Number
Warning Indicators	Malfunction Indicator Lamp (MIL)	698298	Chart Number: 12
	Transmission Control Indicator Lamp (TCIL)	698298	Chart Number: 12
	Temperature Warning Indicator Lamp or Gauge (applications with CHT sensor only)	—	Chart Number: 12
	Shift Indicator Lamp (SIL)	698298	Chart Number: 12
	Check Fuel Cap Indicator Lamp	—	Chart Number: 12
Climate Control	Lack of A/C cooling, A/C not functioning	208200	Chart Number: 21
	A/C always on and/or A/C compressor runs continuously	—	Chart Number: 21
	A/C does not cut off under WOT conditions (Mustang only)	—	Chart Number: 21
Instrumentation	Tachometer Inoperative	—	Chart Number: 14
	Speedometer/odometer Inoperative	—	Chart Number: 14

Engine

System/Symptom		Oasis Number	Chart Number
Oil System Concerns	High Oil Consumption	—	Chart Number: 15
	Leaks	—	Chart Number: 15
Cooling System Concerns	Electric cooling fan(s) does not operate (low, medium and/or high speed)	—	Chart Number: 16
	Hydraulic cooling fan does not operate (LS6/8)	—	Chart Number: 16
	Electric or hydraulic cooling fan always runs	—	Chart Number: 17
Exhaust System Concerns	Visible smoke	—	Chart Number: 18
	Odor (sulfur or "rotten egg" smell)	—	Chart Number: 22

Fuel System Concerns	Odor, engine compartment	—	<u>Chart Number: 19</u>
Engine Noise (under hood)		497000	<u>Chart Number: 20</u>

Driveline

System/Symptom		Oasis Number	Chart Number
Manual Transmission Concern	Shift Indicator Lamp (SIL)	505000	<u>Chart Number: 12</u>
Automatic Transmission Shift Concerns	A/T upshift concern	501000	<u>Chart Number: 13</u>
	A/T downshift concern	502000	<u>Chart Number: 13</u>
	Engagement concern	503000	<u>Chart Number: 13</u>

Step 3: No DTC(s) Present Symptom Charts

Chart 1

- Starting Concerns: Stalls After Start
- Stalls/Quits: Idle, Acceleration, Cruise
- Runs Rough
- Misses
- Buck/Jerk
- Hesitation/Stumble
- Surge
- Unique Idle concerns: Rolling Idle

Note: For stalls on passenger car applications, engine may stall if left running while refueling. Advise customer to turn engine off while refueling to avoid contamination or damage to the EVAP system.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
<p>Check The Following PIDs:</p> <ul style="list-style-type: none"> ■ DPFEGR (if equipped) (hot idle value within 0.15V of KOEO value) ■ LONGFT1 / LONGFT2 (value between -20 and +20) ■ VPWR (value between 10.5 and 17.0 volts, and within 0.5 volts of battery voltage) 	<p>DPFEGR PID value not within 0.15V of KOEO value: GO to HE100</p> <p>LONGFT1 / LONGFT2 value low (-): Continue diagnosis. Concentrate checks in areas that would cause the engine to run rich.</p> <p>LONGFT1 / LONGFT2 value high (+): Continue diagnosis. Concentrate checks in areas that would cause the engine to run lean.</p> <p>VPWR not between 10.5 and 17.0 volts: Go to the Charging System - General Information Section 414-00 of the Workshop Manual.</p> <p>VPWR between 10.5 and 17.0 volts, but not within 0.5 of battery voltage: CHECK B(+) supply to power relay (or CCRM). CHECK VPWR circuit between PCM and power relay or CCRM. CHECK PWR GND circuits.</p>
<p>For vehicles that run rough at idle: With the key on, engine off, check the INJxF PIDs (the "x" indicates the injector number, there will be one INJxF PID for each engine cylinder). All INJxF PIDs must indicate "NO".</p>	<p>INJxF PID(s) indicate "yes" (an injector circuit fault is indicated): Natural Gas applications: GO to HA60 All others: GO to H56</p>
<p>For engine now starts but stalls in PARK or NEUTRAL: If engine will start and run normally at part throttle, check Idle Air Control (IAC) System.</p>	<p>Engine will start and run normally, instead of stalling, at part throttle: GO to KE2</p>
<p>Mass Air Flow (MAF) Sensor</p>	<p>GO to DC25</p>

Secondary Ignition System	GO to JB1
Fuel Delivery System	For Natural Gas Applications: GO to HB1 All Others: GO to HC1
Exhaust System	GO to HF1
PCV System	GO to HG1
Natural Gas applications with rough idle: Injector circuits between NG module and injectors.	GO to HA57
EVAP System	Check for EVAP system blockages (engine stalls) or leaks (other symptoms). REFER to Evaporative Emissions, Section 303-13 in the Workshop Manual.
Automatic Transmission	Automatic Transaxle/Transmission - Section 307-01 of the Workshop Manual
Base Engine	Engine System - General Information, Section 303-00 of the Workshop Manual
Intake Air System	GO to HU1
Continental, LS6/LS8, Windstar: A/C pressure sensor input to PCM	GO to DS22
Additional Testing	GO to Z1
Additional Checks: NOTE: Some applications have a PID that will indicate whether the PCM is reducing torque (095E b0), and if so, why the torque is being reduced (095Eb1-13). <ul style="list-style-type: none"> ■ Correct PCM vehicle identification (VID) block information (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)) ■ Be aware of engine RPM/speed limiting functions of the PCM (look for incorrect high vehicle speed signal from ABS, VSS or OSS) ■ Verify fuel cap is properly tightened, and not physically damaged. ■ Drivelines ■ Manual transmission/clutch ■ Charging System ■ Traction control system (if equipped) ■ A/C system (for surge with A/C on) ■ Speed control system (for surge with speed control on) ■ A/C compressor diode, if equipped (for rolling idle) 	Applicable section in Workshop Manual.

Chart 2

Starting Concerns:

- Hard Start/Long Crank

- Erratic Start/Erratic Crank

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Battery Condition and Current Draw	Visual, Charging System - General Information Section 414-00 in the Workshop Manual.
Secondary Ignition System	GO to JB1
Fuel Delivery System	For Natural Gas Applications: GO to HB1 All Others: GO to HC1
Exhaust System	GO to HF1
PCV System	GO to HG1
EVAP System	Check for EVAP system blockages (engine stalls) or leaks (other symptoms). REFER to the Evaporative Emissions, Section 303-13 in the Workshop Manual.
Intake Air System	GO to HU1
Starting System	Starting System, Section 303-06 in the Workshop Manual.
Contaminated MAF Sensor	Visual Check
F-150 Lightning (5.4L SC) only: Check high speed fuel pump secondary circuits.	GO to KA70
Additional Testing	GO to Z1

Chart 3

Starting Concerns:

- No Start, Normal Crank

Note: Extended cranking because of a no start can load the exhaust system with raw fuel, damaging the catalytic converter after the engine starts. For applications with Secondary Air Injection (AIR) Systems, perform the following after the no start has been repaired: Disconnect the electric secondary air injection (AIR) solid state relay, run the engine until the surplus fuel is used up, and reconnect the relay (disconnecting the relay may set a Continuous Memory PCM DTC that will need to be cleared).

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Add-on Anti-Theft Devices	Visual, check with customer.
Fuel/Ignition	For LS6/LS8: GO to KB85 . All others: GO to A1 .
If engine will not start now: If engine will not start at closed throttle, but will start and run normally at part throttle, check Idle Air	Engine will now start and run normally at part throttle: GO to KE2

Control (IAC) System.	
Exhaust System (restrictions)	GO to <u>HF1</u>
Base Engine	Engine System - General Information Section 303-00 of the Workshop Manual.
Additional Testing	GO to <u>Z1</u>

Chart 4

Unique Idle Concerns:

- Slow Return To Idle

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Vacuum Leaks, Throttle Body	Visual
PCV System	GO to <u>HG1</u>
Intake Air System (air leaks)	GO to <u>HU1</u>

Chart 5

Unique Idle Concerns:

- Fast Idle

Additional Driveability Concerns:

- Diesels/Runs On

Note: If vehicle runs normally after the ignition key is turned OFF, check for damaged ignition switch, IGN RUN circuit short to power, VPWR circuit short to power, etc. Refer to applicable Wiring Diagram and/or Workshop Manual.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Base engine air leaks, including proper sealing of intake manifold and components attached to intake air (such as the EGR valve or IAC valve).	Visual, Engine System - General Information Section 303-00 of the Workshop Manual.
Verify engine operates at normal temperature.	Visual (refer to Symptom Index, or Engine Cooling, Section 303-03 of Workshop Manual to diagnose any cooling system concerns that are present).
Fast idle concerns: Key on, engine off, monitor TP MODE PID while wiggling TP sensor circuits. TP MODE PID can also be monitored during vehicle drive. With	TP Mode PID is not C/T with throttle closed: NOTE: At vehicle start, the TP REL will begin at about 1.25 volts, and count down to the lowest TP V value seen since engine start. If the TP V value

throttle closed, TP MODE PID must be C/T (closed throttle).	<p>goes below the "normal" range, then increases again, TPREL will set to the lower voltage. If TP V is about 0.04 volts greater than the TPREL value at closed throttle, the PCM will go into part throttle mode.</p> <p>Monitor TP V and TPREL PIDs for sudden changes while checking for intermittent TP circuit/connector concerns. Also check for loose/worn throttle plates. If no concern is found, GO to <u>Z1</u> in Section 5.</p>
Intake Air System (air leaks)	GO to <u>HU1</u>
Additional Testing	GO to <u>Z1</u>

Chart 6

Unique Idle Concerns:

- Low/Slow Idle

Stalls/Quits

- Deceleration

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Verify fuel filler cap is properly tightened	Visual
For A/T with Stalls/Quits on deceleration: Transmission	Automatic Transaxle/Transmission, Section 307-01 of the Workshop Manual (Diagnosis By Symptom: Torque Converter Concerns)
For Low idle with A/C on (4.6/5.4L/6.8L E-Series): Check ACCS PID with A/C on and engine running (PID should indicate ON when A/C clutch is engaged). (On applications where the PCM cannot control the A/C clutch on and off, the PCM uses the ACCS circuit to determine additional load on the engine.)	ACCS PID does not indicate ON with A/C clutch engaged: GO to <u>KM10</u>
Fuel Delivery System	Natural Gas Applications: GO to <u>HB1</u> All Others: GO to <u>HC1</u>
Intake Air System	GO to <u>HU1</u>
Base Engine	Engine System - General Information, Section 303-00.
Additional Testing	GO to <u>Z1</u>

Chart 7

Backfires

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Secondary Ignition	GO to JB1
Fuel Delivery System	Natural Gas Applications: GO to HB1 All Others: GO to HC1
Base Engine	Engine System - General Information, Section 303-00 of the Workshop Manual.
Exhaust System	GO to HF1
Additional Testing	GO to Z1

Chart 8

Lack/Loss of Power

Note: Verify symptom is reported under normal driving conditions without excessive engine/vehicle load. Also, be aware of the engine rpm/speed limiting functions of the PCM.

Note: For applications with knock sensor, a lack of power may result when the vehicle is operated with a breakout box installed at the PCM. The KS circuits are not shielded in the breakout box, and KS signal noise may be noticed by the PCM. If this happens, spark timing will be retarded and a lack of power may result.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
<ul style="list-style-type: none"> ■ Automatic Transmission Fluid ■ Throttle Linkage ■ Air cleaner element 	Visual
Check the Following PIDS: <ul style="list-style-type: none"> ■ DPFEGR (if equipped) (hot idle value within 0.15V of KOEO value) ■ LONGFT1 / LONGFT2 (value between -20 and +20) ■ For 4.6L E/F Series, 5.4L 4V Navigator/Blackwood: IMTVF with both Key On Engine Off, and with transmission in PARK/NEUTRAL and engine rpm greater than 3000 rpm (PID should indicate NO in both situations). 	DPFEGR PID value not within 0.15V of KOEO value: GO to HE100 LONGFT1 / LONGFT2 value low (-): Continue diagnosis. Concentrate checks in areas that would cause the engine to run rich. LONGFT1 / LONGFT2 value high (+): Continue diagnosis. Concentrate checks in areas that would cause the engine to run lean. IMTVF PID indicates YES: GO to HU65
Fuel Delivery System	Natural Gas Applications: GO to HB1

	All others: GO to HC1
Secondary Ignition	GO to JB1
Mass Air Flow (MAF) Sensor	GO to DC25
Exhaust System	GO to HF1
Base Engine	Engine System - General Information, Section 303-00 of the Workshop Manual
Automatic Transmission	Automatic Transaxle/Transmission, Section 307-01 of the Workshop Manual (Diagnosis by Symptom - Poor Performance)
Brake System (brake drag or binding)	Brake System - General Information, Section 206-00 of the Workshop Manual
Mustang only: Check for lack of A/C cutoff under wide open throttle conditions.	Audible (listen for A/C clutch to disengage during a brief wide open throttle, then re-engage a few seconds after returning to idle). Follow Symptom Chart 21 if A/C does not cutoff.
F-150 Lightning (5.4 SC): Supercharger bypass system	GO to KJ13
F-150 Lightning (5.4L SC): Check high speed fuel pump secondary circuits	GO to KA70
Additional Testing	GO to Z1
Additional Checks: NOTE: Some applications have a PID that will indicate whether the PCM is reducing torque (095E b0), and if so, why the torque is being reduced (095E b1-13). <ul style="list-style-type: none"> ■ Customer driving habits ■ Correct PCM vehicle identification (VID) block information (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)) ■ IMRC linkage (if equipped) ■ Clutch (M/T) ■ Charging System ■ Engine RPM/speed limiting functions of the PCM (look for incorrect high vehicle speed signal from ABS, VSS or OSS) 	Visual. Appropriate Group of the Workshop Manual.

Chart 9

Spark Knock

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)

Verify engine operates at normal temperature	Visual (refer to Symptom Index or Engine Cooling Section 303-03 of the Workshop Manual, to diagnose any cooling system concerns that are present).
Verify correct coolant level and coolant concentration	Refer to Engine Cooling Section 303-03 for proper fill concentrations and fill procedures.
Mass Air Flow (MAF) Sensor	GO to DC25
Base Engine	Engine System - General Information Section 303-00 of the Workshop Manual
Fuel Delivery System	For Natural Gas Applications: GO to HB1 All Others: GO to HC1
Secondary Ignition System	GO to JB1
PCV System	GO to HG1
Knock Sensor (if equipped)	GO to DG15
Engine Oil Quality	Visual
Additional Testing	GO to Z1

Chart 10

Poor Fuel Economy

Note: Since driving styles can have a significant influence on fuel economy, verify the concern before starting an in-depth diagnosis. Also, the following external factors could contribute to "poor fuel economy" conditions:

- Stop/go driving
- Improper tire pressure/size
- Vehicle loads (such as trailer towing)
- Extended winter warm-up conditions
- High speed driving

- Improper axle ratio
- Road/weather conditions
- Aftermarket add-ons
- Short run operations
- Customer expectations

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Transmission Fluid Level	Visual
Check The Following PIDs: <ul style="list-style-type: none"> ■ DPFEGR (if equipped) (hot idle value within 0.15V of KOEO value) ■ LONGFT1 / LONGFT2 (value between -20 and +20) ■ VPWR (value between 10.5 and 17.0 volts, and within 0.5 volts of 	DPFEGR PID value not within 0.15V of KOEO value: GO to HE100 LONGFT1 / LONGFT2 value low (-): Continue diagnosis. Concentrate checks in areas that would cause the engine to run rich.

battery voltage)	<p>LONGFT1 / LONGFT2 value high (+): Continue diagnosis. Concentrate checks in areas that would cause the engine to run lean.</p> <p>VPWR not between 10.5 and 17.0 volts: Go to the Charging System - General Information Section 414-00 of the Workshop Manual.</p> <p>VPWR between 10.5 and 17.0 volts, but not within 0.5 of battery voltage: CHECK B(+) supply to power relay (or CCRM). CHECK VPWR circuit between PCM and power relay or CCRM. CHECK PWR GND circuits.</p>
Verify engine operates at normal temperature	Visual (refer to Symptom Index, or Engine Cooling Section 303-03 of the Workshop Manual, to diagnose any cooling system concerns that are present).
Secondary Ignition System	GO to JB1
Fuel System	<p>For Natural Gas Applications: GO to HB1</p> <p>All Others: GO to HC1</p>
Exhaust System	GO to HF1
Automatic Transmission	Automatic Transaxle/Transmission Section 307-01 of the Workshop Manual (Diagnosis by Symptom - Poor Performance)
PCV System	GO to HG1
<p>Additional Checks:</p> <ul style="list-style-type: none"> ■ Correct PCM vehicle identification (VID) block information (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)) ■ Brake drag ■ Base engine concerns ■ Incorrect PCV valve ■ Contaminated MAF sensor ■ Intake air system 	Appropriate section in Workshop Manual
Additional Testing	GO to Z1

Chart 11

Emissions Compliance

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Emissions Related Systems	GO to EM1

Chart 12

Warning Indicators:

- MIL
- TCIL
- SIL
- Temperature Warning Indicator Lamp or Gauge (applications with CHT sensor)
- Check Fuel Cap Indicator Lamp

Note:

- If the symptom is both "MIL on" AND "exhaust emission test failure", GO directly to Chart 11.
- If engine is a no start, GO directly to Chart 3.
- If engine runs rough at idle, GO directly to Chart 1.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Verify fuel filler cap is properly tightened	Visual
Trucks with Power Takeoff (PTO) and MIL concern: PTO input to PCM	GO to FB3
MIL always on when engine is running (no DTCs): MIL circuits	For Focus, Mustang, Town Car, Continental, LS6/LS8, Escape, Windstar, F-150, Expedition and Navigator/Blackwood: Instrument Cluster, Section 413-01 of the Workshop Manual. All Others: GO to NB1
TCIL always on when engine is running (no DTCs): TCIL circuits	For Focus, Mustang, Town Car, Continental, LS6/LS8, and Windstar: Instrument Cluster, Section 413-01 of the Workshop Manual. All Others: GO to TB6
MIL never on (including the bulb check when the engine is first started): MIL circuits	For Focus, Mustang, Town Car, Continental, LS6/LS8, Escape, Windstar, F-150, Expedition and Navigator/Blackwood: Instrument Cluster, Section 413-01 of the Workshop Manual. All others: GO to NB2
TCIL never on: TCIL circuits	For Focus, Mustang, Town Car, Continental, LS6/LS8 and Windstar: Instrument Cluster, Section 413-01 of the Workshop Manual. All others: GO to TB8
Temperature Warning Indicator Lamp or Gauge concerns (applications with CHT sensor only): Engine cooling system or lamp circuits	If engine is overheating: Engine Cooling, Section 303-03 of the Workshop Manual. Be aware that since a PCM DTC was not received, the PCM has not attempted to turn the lamp on. If engine operates at normal temperature: GO to DL40

SIL always on or off: SIL circuits	GO to KL1
Check Fuel Cap Indicator Lamp Always on or off: Check fuel indicator lamp circuits	For Mustang, Town Car, Continental, LS6/LS8, Escape, Windstar and Explorer/Mountaineer (w/150 pin PCM): Instrument Cluster, Section 413-01 of the Workshop Manual. All others: Indicator Lamp Always On: GO to HX88 Indicator Lamp Always Off: GO to HX89
Additional Testing	GO to Z1

Chart 13

Automatic Transmission Concerns:

- Upshift
- Downshift
- Engagement

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Transmission	Automatic Transaxle/Transmission Section 307-01 of the Workshop Manual
Additional Tests	GO to Z1

Chart 14

Instrumentation:

- Tachometer Inoperative
- Speedometer Inoperative

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Tachometer Inoperative Applications with CTO circuit from PCM pin 48: CTO circuit from PCM	GO to JH1
Speedometer/odometer Inoperative Applications with Manual Shift On The Fly (MSOF) transfer case using a Transfer Case Speed Sensor (TCSS):	GO to DP30
Instrumentation	Instrument Cluster, Section

Chart 15

Oil System Concerns:

- High Oil Consumption
- Leaks

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
PCV System	GO to HG1
Base Engine	Engine System - General Information Section 303-00 of the Workshop Manual
Additional Checks <ul style="list-style-type: none"> ■ External leaks ■ Proper dipstick ■ Proper oil viscosity 	Visual

Chart 16

Cooling System Concerns:

- Electric Cooling Fan(s) Does Not Operate (Low, Medium and/or High Speed)
- Hydraulic Cooling Fan Does Not Operate (LS6/8)

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Electric or Hydraulic Cooling Fan Components	<p>For Escort and Mustang: GO to X40</p> <p>For LS6/LS8: GO to KH1</p> <p>All Others: GO to KF25</p>
Cooling System	Engine Cooling, Section 303-03 of the Workshop Manual

Chart 17

Cooling System Concerns:

- Electric or Hydraulic Cooling Fan(s) Always Runs

Note: This chart is intended to only diagnose an electric or hydraulic cooling fan that always runs with a

"cool" engine and the A/C and defroster off.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Cooling fan circuits and ACPSW or ACP circuits	For Escort and 4.6L Mustang: GO to X80 For 3.8L Mustang: GO to X82 For Continental and Windstar: GO to KF63 For LS6/LS8: GO to KH1 All Others: GO to KF60
Cooling System	Engine Cooling, Section 303-03 of the Workshop Manual

Chart 18

Exhaust System Concerns:

- Smoke

Note: Black smoke indicates a rich fuel mixture, blue smoke indicates burning oil, and white smoke indicates water in the combustion chamber.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Base Engine	Engine System - General Information Section 303-00 of the Workshop Manual
Black Smoke: Fuel Delivery System	For Natural Gas Applications: GO to HB1 All Others: GO to HC1
Black Smoke: Ignition System	GO to JB1
Blue Smoke: PCV System	GO to HG1

Chart 19

Fuel System Concerns:

- Odor, Engine Compartment

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)

Natural Gas Applications: Fuel Delivery System	GO to HB16
EVAP System	Check for EVAP system leaks. REFER to Evaporative Emissions, Section 303-13 in the Workshop Manual.
Fuel System	Visual (refer to Fuel Tank and Lines, section 310-01 of the Workshop Manual for system description)

Chart 20

Engine Noise (under hood)

Note: Attempt to identify source of noise. If noise is from source other than those listed below, refer to Symptom Index (for noise such as spark knock) or applicable Workshop Manual section.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Snap noise that may be due to secondary ignition arcing: Secondary Ignition System	For Coil On Plug Ignition Systems: Check condition of spark plug boots. All Others: GO to JB1

Chart 21

Climate Control:

- Lack of Cooling (A/C)/ A/C Not Functioning
- A/C Always On
- A/C Compressor Runs Continuously
- A/C Does Not CUT-OFF Under WOT Conditions (Mustang only)

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Mustang only: A/C electrical circuits	For lack of A/C cooling or A/C not functioning: GO to X98 (Mustang) For A/C always on: GO to X140 (Mustang) For A/C does not CUT-OFF under WOT conditions: GO to X130 (Mustang)
A/C System	If sent here from Workshop Manual with WACF PID displaying YES (fault indicated): GO to Section 4 , Powertrain Diagnostic Trouble Code (DTC) Charts and follow direction for KOEO DTC P1460. All others: Climate Control System, General Information section 412-00 of the Workshop Manual

Chart 22

Exhaust System Concerns

- Odor (Sulfur, Rotten Egg Smell)

Note: A slight sulfur smell may be normal. Catalysts with less than 8,000-16,000 kilometers (5,000-10,000 miles)(new vehicle or replaced catalyst) are likely to have a sulfur smell due to the highly active state of new catalysts. Replacing the catalyst can actually make the symptom worse.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Check for any driveability or exhaust smoke symptoms	Refer to STEP 2: NO DTC(s) PRESENT SYMPTOM Chart INDEX for direction to repair other symptoms.
Fuel Delivery System	For Natural Gas Applications: GO to HB1 All others: GO to HC1
EVAP System	Check for EVAP system leaks. REFER to the Evaporative Emissions, Section 303-13 in the Workshop Manual.
Fuel Source	Talk with customer. Since sulfur content can vary in different fuels, suggest trying a different fuel source.

Powertrain Control/Emissions Diagnosis Manual

2001

On Board Diagnostics II

SECTION 4: Powertrain DTC Charts and Descriptions

Choose an item on the left side to display section contents.

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code (DTC)	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
Bxxxx	All	See Note 16	See Note 16	See Note 16
Cxxxx	All	See Note 8	See Note 8	See Note 8
P0102	All	—	GO to DC2	GO to DC2
P0103	All	GO to DC20	GO to DC20	GO to DC20
P0106	All	GO to DQ1	GO to DQ1	GO to DQ1
P0107	2.3L Ranger	GO to DM1	GO to DM1	GO to DM1
P0107	Others	GO to DQ1	GO to DQ1	GO to DQ1
P0108	2.3L Ranger	GO to DM1	GO to DM1	GO to DM1
P0108	Others	GO to DQ1	GO to DQ1	GO to DQ1
P0109	2.3L Ranger	GO to DM1	GO to DM1	GO to DM1
P0109	Others	GO to DQ1	GO to DQ1	GO to DQ1
P0112	All	GO to DA20	GO to DA20	GO to DA90
P0113	All	GO to DA10	GO to DA10	GO to DA90
P0116	Vehicles with CHT Sensor Vehicles with ECT Sensor	— —	— —	GO to DL80 GO to DA80
P0117	Vehicles with CHT Sensor Vehicles with ECT Sensor	GO to DL20 GO to DA20	GO to DL20 GO to DA20	GO to DL90 GO to DA90
P0118	Vehicles with CHT Sensor Vehicles with ECT Sensor	GO to DL10 GO to DA10	GO to DL10 GO to DA10	GO to DL90 GO to DA90
P0121	All	—	GO to DH22	GO to DH22
P0122	All	GO to DH11	GO to DH11	GO to DH11
P0123	All	GO to DH8	GO to DH8	GO to DH8
P0125	Vehicles with CHT Sensor Vehicles with ECT Sensor	— —	— —	GO to DL110 GO to DA100

P0127	5.4L SC Lightning	GO to <u>DU30</u>	GO to <u>DU30</u>	GO to <u>DU30</u>
P0131	All	—	—	GO to <u>H27</u>
P0133	All	—	—	GO to <u>H20</u>
P0135	NGV	GO to <u>HA30</u>	GO to <u>HA30</u>	GO to <u>HA30</u>
	All Others	GO to <u>H30</u>	GO to <u>H30</u>	GO to <u>H30</u>
P0136	All	—	—	GO to <u>H80</u>
P0141	NGV	GO to <u>HA30</u>	GO to <u>HA30</u>	GO to <u>HA30</u>
	All Others	GO to <u>H25</u>	GO to <u>H25</u>	GO to <u>H25</u>
P0148	All	—	—	GO to <u>HC1</u>
P0151	All	—	—	GO to <u>H27</u>
P0153	All	—	—	GO to <u>H20</u>
P0155	NGV	GO to <u>HA30</u>	GO to <u>HA30</u>	GO to <u>HA30</u>
	All Others	GO to <u>H30</u>	GO to <u>H30</u>	GO to <u>H30</u>
P0156	All	—	—	GO to <u>H80</u>
P0161	NGV	GO to <u>HA30</u>	GO to <u>HA30</u>	GO to <u>HA30</u>
	All Others	GO to <u>H25</u>	GO to <u>H25</u>	GO to <u>H25</u>
P0171	NGV	—	—	GO to <u>HA41</u>
	All Others	—	—	GO to <u>H41</u>
P0172	NGV	—	—	GO to <u>HA41</u>
	All Others	—	—	GO to <u>H41</u>
P0174	NGV	—	—	GO to <u>HA41</u>
	All Others	—	—	GO to <u>H41</u>
P0175	NGV	—	—	GO to <u>HA41</u>
	All Others	—	—	GO to <u>H41</u>
P0176	All	—	GO to <u>DE1</u>	GO to <u>DE20</u>
P0180	All	GO to <u>DB2</u>	GO to <u>DB2</u>	GO to <u>DB8</u>
P0181	All	GO to <u>DB1</u>	GO to <u>DB1</u>	—
P0182	NGV	GO to <u>DB2</u>	GO to <u>DB2</u>	GO to <u>DB8</u>
P0183	All	GO to <u>DB2</u>	GO to <u>DB2</u>	GO to <u>DB7</u>
P0190	All	GO to <u>DD11</u>	GO to <u>DD11</u>	GO to <u>DD15</u>
P0191	All	GO to <u>DD17</u>	GO to <u>DD17</u>	GO to <u>DD17</u>
P0192	All	GO to <u>DD1</u>	GO to <u>DD1</u>	GO to <u>DD15</u>
P0193	All	GO to <u>DD7</u>	GO to <u>DD7</u>	GO to <u>DD15</u>
P0201	All	GO to <u>H56</u>	GO to <u>H56</u>	GO to <u>H56</u>

P0202	All	GO to H56	GO to H56	GO to H56
P0203	All	GO to H56	GO to H56	GO to H56
P0204	All	GO to H56	GO to H56	GO to H56
P0205	All	GO to H56	GO to H56	GO to H56
P0206	All	GO to H56	GO to H56	GO to H56
P0207	All	GO to H56	GO to H56	GO to H56
P0208	All	GO to H56	GO to H56	GO to H56
P0209	All	GO to H56	GO to H56	GO to H56
P0210	All	GO to H56	GO to H56	GO to H56
P0211	All	GO to H56	GO to H56	GO to H56
P0212	All	GO to H56	GO to H56	GO to H56
P0217	5.4L SC Lightning	GO to DL100	GO to DL100	GO to DL100
P0218	All	See Note 3	See Note 3	See Note 3
P0230	NGV	GO to KC1	GO to KC1	GO to KC40
	All Others	GO to KA1	GO to KA1	GO to KA40
P0231	NGV	GO to KC20	GO to KC20	GO to KC35
	All Others	GO to KA20	GO to KA20	GO to KA35
P0232	NGV	GO to KC10	GO to KC10	GO to KC30
	All Others	GO to KA10	GO to KA10	GO to KA30
P0234	5.4L SC Lightning	GO to KJ1	GO to KJ1	GO to KJ1
P0243	5.4L SC Lightning	GO to KJ6	GO to KJ6	GO to KJ6
P0298	LS6/LS8	—	—	GO to DA130
P0300	All	—	GO to HD1	GO to HD1
P0301	All	—	GO to HD1	GO to HD1
P0302	All	—	GO to HD1	GO to HD1
P0303	All	—	GO to HD1	GO to HD1
P0304	All	—	GO to HD1	GO to HD1
P0305	All	—	GO to HD1	GO to HD1
P0306	All	—	GO to HD1	GO to HD1
P0307	All	—	GO to HD1	GO to HD1
P0308	All	—	GO to HD1	GO to HD1
P0309	All	—	GO to HD1	GO to HD1
P0310	All	—	GO to HD1	GO to HD1
P0320	All	GO to NC1	—	GO to NC1
P0325	Taurus/Sable 4.6L E-Series	—	GO to DG15	GO to DG15
	All others	—	GO to DG1	GO to DG1
P0326	Taurus/Sable 4.6L E-Series	—	GO to DG15	GO to DG15

	All others	—	GO to <u>DG1</u>	GO to <u>DG1</u>
P0330	Taurus/Sable	—	GO to <u>DG15</u>	GO to <u>DG15</u>
	4.6L E-Series	—	GO to <u>DG15</u>	GO to <u>DG15</u>
	All Others	—	GO to <u>DG1</u>	GO to <u>DG1</u>
P0331	Taurus/Sable	—	GO to <u>DG15</u>	GO to <u>DG15</u>
	4.6L E-Series	—	GO to <u>DG15</u>	GO to <u>DG15</u>
	All Others	—	GO to <u>DG1</u>	GO to <u>DG1</u>
P0340	All	—	GO to <u>DR1</u>	GO to <u>DR1</u>
P0350	All	—	GO to <u>JB1</u>	GO to <u>JB1</u>
P0351	w/Coil Pack	—	GO to <u>JE1</u>	GO to <u>JE1</u>
	w/Coil-On-Plug	—	GO to <u>JF1</u>	GO to <u>JF1</u>
P0352	w/Coil Pack	—	GO to <u>JE1</u>	GO to <u>JE1</u>
	w/Coil-On-Plug	—	GO to <u>JF1</u>	GO to <u>JF1</u>
P0353	w/Coil Pack	—	GO to <u>JE1</u>	GO to <u>JE1</u>
P0353	w/Coil-On-Plug	—	GO to <u>JF1</u>	GO to <u>JF1</u>
P0354	w/Coil Pack	—	GO to <u>JE1</u>	GO to <u>JE1</u>
	w/Coil-On-Plug	—	GO to <u>JF1</u>	GO to <u>JF1</u>
P0355	All	—	GO to <u>JF1</u>	GO to <u>JF1</u>
P0356	All	—	GO to <u>JF1</u>	GO to <u>JF1</u>
P0357	All	—	GO to <u>JF1</u>	GO to <u>JF1</u>
P0358	All	—	GO to <u>JF1</u>	GO to <u>JF1</u>
P0359	All	—	GO to <u>JF1</u>	GO to <u>JF1</u>
P0360	All	—	GO to <u>JF1</u>	GO to <u>JF1</u>
P0400	2.3L Ranger	GO to <u>KD9</u>	GO to <u>KD9</u>	GO to <u>KD9</u>
P0401	All	—	—	GO to <u>HE70</u>
P0402	All	—	GO to <u>HE20</u>	GO to <u>HE20</u>
P0403	2.3L Ranger	—	GO to <u>KD1</u>	GO to <u>KD1</u>
P0411	All	GO to <u>HM7</u>	GO to <u>HM7</u>	GO to <u>HM7</u>
P0412	All	GO to <u>HM1</u>	GO to <u>HM1</u>	GO to <u>HM1</u>
P0420	All	—	—	GO to <u>HF1</u>
P0430	All	—	—	GO to <u>HF1</u>
P0442	All	—	—	See Note 15
P0443	All	GO to <u>HX2</u>	GO to <u>HX2</u>	GO to <u>HX1</u>
P0451	All	—	—	GO to <u>Z1</u>
P0452	All	GO to <u>HX26</u>	GO to <u>HX26</u>	GO to <u>HX26</u>
P0453	All	GO to <u>HX33</u>	GO to <u>HX33</u>	GO to <u>HX33</u>
P0455	All	—	—	See Note 15
P0456	All	—	—	See Note 15
P0457	All	—	—	GO to <u>HX43</u>

P0460	All	GO to HX76	GO to HX76	GO to HX76
P0461	All	—	—	GO to Z1
P0500	Cougar	—	—	GO to DP5
	LS6/LS8, Continental, Town Car, Windstar	See Note 12	See Note 12	See Note 12
	2.5L Ranger, Explorer/Mountaineer (104 PIN PCM ONLY), 5.4L, 6.8L F-Series O/8500	—	—	GO to DF1
	5.4L, 6.8L Excursion	—	—	GO to DF1
	F-Series U/8500 4x4 MSOF	—	—	GO to DP30
	All Others	—	—	GO to DP1
P0501	Cougar	—	—	GO to DP5
	LS6/LS8, Continental, Town Car, Windstar	See Note 12	See Note 12	See Note 12
	2.5L Ranger, Explorer/ Mountaineer (104 PIN PCM ONLY), 5.4L, 6.8L F-Series O/8500	—	—	GO to DF1
	5.4L, 6.8L Excursion	—	—	GO to DF1
	All Others	—	—	GO to DP1
P0503	LS6/LS8, Continental, Town Car, Windstar	See Note 12	See Note 12	See Note 12
	All Others	—	—	GO to DP20
P0505	All	—	GO to KE2	—
P0552	All	GO to DT2	GO to DT2	GO to DT10
P0553	All	GO to DT2	GO to DT2	GO to DT10
P0602	All	See Note 11	See Note 11	See Note 11
P0603	All	GO to QB1	—	—
P0605	All	See Note 14	See Note 14	See Note 14
P0703	Continental, Town Car	GO to FD2	GO to FD1	—
P0703	All Others	GO to FD2	GO to FD1	GO to FD3
P0704	Ranger, Explorer	GO to TA1	—	GO to TA1
	Expedition	GO to TA1	—	GO to TA1
	E/F-Series	GO to TA1	—	GO to TA1
	All Others	GO to TA5	—	GO to TA5
P0705	All	See Note 3	See Note 3	See Note 3
P0707	All	See Note 3	See Note 3	See Note 3
P0708	All	See Note 3	See Note 3	See Note 3
P071x	All	See Note	See Note 3	See Note 3

		3		
P072x	All with Automatic Trans. All with Manual Trans.	— —	— —	See Note 3 GO to <u>TJ1</u>
P073x P074x	All All	— See Note 3	— See Note 3	See Note 3 See Note 3
P075x	All	See Note 3	See Note 3	See Note 3
P076x	All	See Note 3	See Note 3	See Note 3
P077x	All	—	—	See Note 3
P078x	All	—	—	See Note 3
P079x	All	See Note 3	See Note 3	See Note 3
P0812	All	—	—	GO to <u>TH1</u>
P0813	All	—	—	See Note 3
P0815 P0840	All All	— See Note 3	— See Note 3	See Note 3 See Note 3
P1000	All	See Note 1	See Note 1	GO to <u>QC1</u>
P1001 P1100	All All	— —	GO to <u>QA1</u> —	— GO to <u>DC16</u>
P1101	All	GO to <u>DC3</u>	GO to <u>DC1</u>	—
P1112	All	—	—	GO to <u>DA90</u>
P1114	5.4L SC Lightning	GO to <u>DU20</u>	GO to <u>DU20</u>	GO to <u>DU20</u>
P1115	5.4L SC Lightning	GO to <u>DU10</u>	GO to <u>DU10</u>	GO to <u>DU10</u>
P1116	Vehicles with CHT Sensor Vehicles with ECT Sensor	GO to <u>DL1</u> GO to <u>DA1</u>	GO to <u>DL1</u> GO to <u>DA1</u>	— —
P1117	Vehicles with CHT Sensor Vehicles with ECT Sensor	— —	— —	GO to <u>DL90</u> GO to <u>DA90</u>
P1120	All	GO to <u>DH3</u>	GO to <u>DH3</u>	GO to <u>DH3</u>
P1121	All	—	GO to <u>DH15</u>	GO to <u>DH15</u>
P1124	All	GO to <u>DH1</u>	GO to <u>DH1</u>	—
P1125	All	—	—	GO to <u>DH20</u>
P1127	NGV All Others	— —	GO to <u>HA90</u> GO to <u>H100</u>	— —
P1128	NGV All Others	— —	GO to <u>HA100</u> GO to <u>H110</u>	— —
P1129	NGV All Others	— —	GO to <u>HA100</u> GO to <u>H110</u>	— —

P1130	NGV All Others	— —	— —	GO to HA40 GO to H40
P1131	NGV All Others	— —	GO to HA40 GO to H40	GO to HA40 GO to H40
P1132	NGV All Others	— —	GO to HA40 GO to H40	GO to HA40 GO to H40
P1137	All	—	GO to H80	—
P1138	All	—	GO to H80	—
P1150	NGV All Others	— —	— —	GO to HA40 GO to H40
P1151	NGV All Others	— GO to H40	GO to HA40 GO to H40	GO to HA40 GO to H40
P1152	NGV All Others	— —	GO to HA40 GO to H40	GO to HA40 GO to H40
P1157	All	—	GO to H80	—
P1158	All	—	GO to H80	—
P1168	NGV	—	—	GO to DD16
P1169	NGV	—	—	GO to DD16
P1180	NGV	—	—	GO to HB17
P1181	NGV	—	—	GO to HB17
P1183	LS6/LS8	—	—	GO to DA111
P1184	LS6/LS8	GO to DA110	GO to DA110	GO to DA110
P1229	5.4L SC Lightning	GO to KP1	GO to KP1	GO to KP1
P1232	All	GO to KA45	GO to KA45	GO to KA60
P1233	LS6/LS8	See Note 10	See Note 10	See Note 10
	All Others	GO to KB1	GO to KB1	GO to KB1
P1234	LS6/LS8	See Note 10	See Note 10	See Note 10
	All Others	GO to KB1	GO to KB1	GO to KB1
P1235	All	GO to KB30	GO to KB30	GO to KB30
P1236	All	GO to KB30	GO to KB30	GO to KB30
P1237	All	GO to KB47	GO to KB47	GO to KB47
P1238	All	GO to KB47	GO to KB47	GO to KB47
P1244	All	—	GO to FH1	GO to FH1
P1245	All	—	GO to FH1	GO to FH1
P1246	Cougar	—	GO to FH1	GO to FH1
P1246	All Others	—	GO to HY1	GO to HY1

P1260	All	—	—	GO to <u>QD1</u>
P1270	All	—	—	GO to <u>ND1</u>
P1285	All	GO to <u>DL30</u>	GO to <u>DL30</u>	GO to <u>DL30</u>
P1288	All	GO to <u>DL1</u>	GO to <u>DL1</u>	GO to <u>DL1</u>
P1289	All	GO to <u>DL5</u>	GO to <u>DL5</u>	GO to <u>DL90</u>
P1290	All	GO to <u>DL5</u>	GO to <u>DL5</u>	GO to <u>DL90</u>
P1299	All	—	—	GO to <u>DL100</u>
P1309	CMP (Variable Reluctance)	—	—	GO to <u>HD41</u>
P1380	CMP (Hall Effect) All	— GO to <u>HK2</u>	— GO to <u>HK2</u>	GO to <u>HD40</u> GO to <u>HK1</u>
P1381	All	—	—	GO to <u>HK11</u>
P1383	All	—	—	GO to <u>HK11</u>
P1400	All	GO to <u>HE1</u>	GO to <u>HE1</u>	GO to <u>HE1</u>
P1401	All	GO to <u>HE10</u>	GO to <u>HE10</u>	GO to <u>HE10</u>
P1405	All	—	—	GO to <u>HE50</u>
P1406	All	—	—	GO to <u>HE60</u>
P1408	All Others	—	GO to <u>HE71</u>	—
P1409	2.3L Ranger All	— GO to <u>HE110</u>	GO to <u>KD9</u> GO to <u>HE110</u>	— GO to <u>HE120</u>
P1413	All	GO to <u>HM19</u>	GO to <u>HM19</u>	GO to <u>HM19</u>
P1414	All	GO to <u>HM27</u>	GO to <u>HM27</u>	GO to <u>HM27</u>
P1432	2.3L Ranger	GO to <u>KQ10</u>	GO to <u>KQ10</u>	GO to <u>KQ10</u>
P1443	All	—	—	See Note 15
P1450	All	—	—	GO to <u>HX18</u>
P1451	All	GO to <u>HX65</u>	GO to <u>HX65</u>	GO to <u>HX65</u>
P1460	CCRM All Others	GO to <u>X105</u> GO to <u>KM1</u>	GO to <u>X105</u> GO to <u>KM1</u>	GO to <u>X120</u> GO to <u>KM30</u>
P1461	All	GO to <u>DS1</u>	GO to <u>DS1</u>	GO to <u>DS1</u>
P1462	All	GO to <u>DS10</u>	GO to <u>DS10</u>	GO to <u>DS10</u>
P1463	All	—	—	GO to <u>DS20</u>
P1464	CCRM All Others	GO to <u>X124</u> GO to <u>KM19</u>	GO to <u>X124</u> GO to <u>KM19</u>	— —
P1469	All	—	—	GO to <u>X115</u>

P1474	LS6/LS8	GO to <u>KH1</u>	GO to <u>KH1</u>	GO to <u>KH1</u>
	CCRM All Others	GO to <u>X20</u> GO to <u>KF1</u>	GO to <u>X20</u> GO to <u>KF1</u>	GO to <u>X30</u> GO to <u>KF10</u>
P1477	All	GO to <u>KF1</u>	GO to <u>KF1</u>	GO to <u>KF15</u>
P1479	CCRM	GO to <u>X15</u>	GO to <u>X15</u>	GO to <u>X35</u>
	3.0L Escape All Others	GO to <u>KF7</u> GO to <u>KF1</u>	GO to <u>KF7</u> GO to <u>KF1</u>	GO to <u>KF20</u> GO to <u>KF20</u>
P1500	All	—	—	GO to <u>DP25</u>
P1501	All	—	GO to <u>DP15</u>	—
P1502	Cougar	—	—	GO to <u>DP5</u>
	LS6/LS8, Continental, Town Car,	—	—	See Note 12
	Windstar	—	—	See Note 12
	2.5L Ranger, 5.4L, 6.8L F-Series O/8500	—	—	GO to <u>DF1</u>
	5.4L, 6.8L Excursion	—	—	GO to <u>DF1</u>
	F-Series U/8500 4x4 MSOF All Others	— —	— —	GO to <u>DP30</u> GO to <u>DP1</u>
P1504	All	GO to <u>KE2</u>	GO to <u>KE2</u>	GO to <u>KE2</u>
P1506	All	—	—	GO to <u>KE20</u>
P1507	All	—	GO to <u>KE2</u>	GO to <u>KE2</u>
P1516	All	GO to <u>HU15</u>	—	GO to <u>HU15</u>
P1517	All	GO to <u>HU15</u>	—	GO to <u>HU15</u>
P1518	All	GO to <u>HU15</u>	GO to <u>HU15</u>	GO to <u>HU15</u>
P1519	All	GO to <u>HU15</u>	GO to <u>HU15</u>	GO to <u>HU15</u>
P1520	All	GO to <u>HU15</u>	GO to <u>HU15</u>	GO to <u>HU15</u>
P1549	All	GO to <u>HU65</u>	—	GO to <u>HU65</u>
P1550	All	GO to <u>DT2</u>	GO to <u>DT1</u>	—
P1565	All	See Note 9	See Note 9	See Note 9
P1566	All	See Note 9	See Note 9	See Note 9
P1567	All	See Note 9	See Note 9	See Note 9
P1568	All	See Note 9	See Note 9	See Note 9
P1572	LS6/LS8, Explorer/Mountaineer (150 PIN PCM)	—	—	GO to <u>FD3</u>
P1605	All	GO to <u>QB1</u>	—	—

P1633	All	GO to <u>QB1</u>	GO to <u>QB1</u>	GO to <u>QB1</u>
P1635	All	—	—	See Note 11
P1636	All with Automatic Transmission	See Note 18	See Note 18	See Note 18
P1639	All	See Note 11	See Note 11	See Note 11
P1640	BI-Fuel Vehicles	—	—	See Note 13
P1641	All	GO to <u>KB47</u>	GO to <u>KB47</u>	GO to <u>KB47</u>
P1650	All	GO to <u>FF1</u>	GO to <u>FF1</u>	—
P1651	All	—	—	GO to <u>FF10</u>
P1700	All	—	—	See Note 3
P1701	All	—	—	See Note 3
P1702	All	See Note 3	See Note 3	See Note 3
P1703	All	GO to <u>FD2</u>	GO to <u>FD1</u>	—
P1704	All	See Note 3	—	See Note 3
P1705	Escort(M.T.) All Others(A.T.)	GO to <u>TA5</u> See Note 3	GO to <u>TA5</u> See Note 3	— —
P1709	Escort(M.T.) All Others (M.T.)	GO to <u>TA5</u> GO to <u>TA1</u>	— —	GO to <u>TA5</u> GO to <u>TA1</u>
P1709	All (A.T.)	See Note 3	—	See Note 3
P171x	All	See Note 3	See Note 3	See Note 3
P1728	All	—	—	See Note 3
P1729	All	—	—	GO to <u>TG1</u>
P173x	All	See Note 3	See Note 3	See Note 3
P174x	All	See Note 3	See Note 3	See Note 3
P175x	All	See Note 3	See Note 3	See Note 3
P176x	All	See Note 3	See Note 3	See Note 3
P177x	All	See Note 3	See Note 3	See Note 3
P1780	All	—	GO to <u>TB1</u>	—
P1781	All	GO to <u>TG1</u>	—	—
P1783	All	—	—	See Note 3
P1784	All	—	—	See Note 3
P1785	All	—	—	See Note 3
P1786	All	—	—	See Note 3

P1787	All	—	—	See Note 3
P1788	All	See Note 3	—	See Note 3
P179x	All	See Note 3	See Note 3	See Note 3
P18xx	All	See Note 17	See Note 17	See Note 17
P1789	All	See Note 3	—	See Note 3
P1900	All with Automatic Trans.	—	—	See Note 3
	All with Manual Trans.	—	—	GO to TJ1
P1901	All	—	See Note 3	See Note 3
Pxxxx	All	See Note 2	See Note 2	See Note 2
Uxxxx	All	—	—	See Network DTC's Chart

Note: "x" = any number 0 thru 9

Note 1: DTC P1000 is ignored in KOEO AND KOER Self-Test. Disregard the DTC P1000 and continue as directed.

Note 2: For "P" DTCs not listed in this chart; refer to the customer's symptom to determine applicable Workshop Manual section for diagnosis.

Note 3: Go to the Workshop Manual Powertrain Group, Transmission Section to perform complete diagnosis.

Note 8: Go to the applicable Section of the Workshop Manual to diagnose the Chassis DTC.

Note 9: Go to the Vehicle Speed Control Section 310-03 of the Workshop Manual.

Note 10: Go to the Workshop Manual for REM (REAR ELECTRONICS MODULE) self-test/diagnostics.

Note 11: The vehicle ID block (VID) needs to be reprogrammed. For instructions refer to [Section 2](#), Flash VID Block Procedure.

Note 12: Vehicle speed information is provided by the anti-lock brake system. Go to Workshop Manual Section 206-09 Anti-Lock Control to perform complete diagnosis.

Note 13: See BI-Fuel Service Manual for instruction on how to retrieve DTCs from secondary module. (See P1640 Diagnostic Trouble Code (DTC) Descriptions for additional information.)

Note 14: Be sure to check for aftermarket performance products before replacing PCM. (If replacement is necessary refer to Section 2, [Flash Electrically Erasable Programmable Read Only Memory \(EEPROM\)](#).)

Note 15: Go to the Evaporative Emissions, Section 303-13 of the Workshop Manual.

Note 16: Go to the applicable Section of the Workshop Manual to diagnose the Body DTC. For LS6/LS8 with B2172, begin diagnosis in [Section 3](#).

Note 17: Go to the Transfer Case, Section 308-07 of the Workshop Manual.

Note 18: DTC P1636 indicates the PCM has lost communication with the Inductive Signature Chip.

Replace PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM))

Network DTCs Chart

DTC	Description	Action
U1020	SCP Invalid or Missing Data for Air Conditioning Clutch	Go to Workshop Manual Section 412-00, Climate Control ^a
U1039	SCP Invalid or Missing Data for Vehicle Speed	Go to Workshop Manual Section 206-09, Anti-Lock Control ^a
U1041	SCP Invalid or Missing Data for Vehicle Speed	Go to Workshop Manual Section 206-09, Anti-Lock Control ^a
U1051	SCP Invalid or Missing Data for Brakes	Go to Workshop Manual Section 417-01, Exterior Lighting ^a
U1089	SCP Invalid or Missing Data for Suspension	Go to Workshop Manual Section 204-05, Vehicle Dynamic Suspension ^a
U1098	SCP Invalid or Missing Data for Vehicle Speed Control	Go to Workshop Manual Section 310-03, Vehicle Speed Control ^a
U1130	SCP Invalid or Missing Data for Fuel System	Go to Workshop Manual Section 413-01, Instrument Cluster ^a
U1131	SCP Invalid or Missing Data for Fuel System	Go to Workshop Manual Section 413-01, Instrument Cluster ^a
U1147	SCP Invalid or Missing Data for Vehicle Security	Go to Workshop Manual Section 419-01, Anti-Theft ^a
U1243	SCP Invalid or Missing Data for Exterior Environment	Go to Workshop Manual Section 412-00, Climate Control ^a
U1262	SCP Communication Bus Fault - Perform Network Communications Test	Go to Workshop Manual Section 418-00, Module Communications Network
U1341	SCP Invalid or Missing Data for Function Read Vehicle Speed	Go to Workshop Manual Section 412-00, Climate Control ^a
U1451	SCP Invalid or Missing Data for Anti-Theft module	Go to Workshop Manual Section 419-01, Anti-Theft ^a
U2195	SCP Invalid or Missing Data for SCLM status	Go to Workshop Manual Section 211-05, Steering Column Switches ^a
UXXXX	"U" DTCs received during Self-test of another module.	GO to PC/ED <u>Section 3</u> , QT1 PCM Quick Test

^a PERFORM On-Board Diagnostics for the associated SCP module.

Diagnostic Trouble Code (DTC) Descriptions

DTC	Description	Possible Causes	Diagnostic Aides
P0102 - Mass Air Flow (MAF) Circuit Low Input	The MAF sensor circuit is monitored by the PCM for low air flow (or voltage) input through the comprehensive component monitor (CCM). If during key ON engine running the air flow (or voltage) changes below a minimum calibrated limit, the test fails.	<ul style="list-style-type: none"> • MAF sensor disconnected • MAF circuit open to PCM • VPWR open to MAF sensor • PWR GND open to MAF sensor • MAF RTN circuit open to PCM • MAF circuit shorted to GND • Intake air leak (near MAF sensor) • A closed throttle indication [throttle position (TP) sensor system] • Damaged MAF sensor • Damaged PCM 	A MAF V PID (MAF PID) reading less than 0.23 volts (Refer to equivalent grams/second chart in GO to Pinpoint Test DC) in continuous memory or key ON and engine running indicates a hard fault.
P0103 - Mass Air Flow (MAF) Circuit High Input	The MAF sensor circuit is monitored by the PCM for high air flow (or voltage) input through the comprehensive component monitor (CCM). If during key ON engine OFF or key ON engine running the air flow (or voltage) changes above a maximum calibrated limit, the test fails.	<ul style="list-style-type: none"> • MAF sensor screen is blocked • MAF circuit shorted to VPWR • Damaged MAF sensor • Damaged PCM 	A MAF V PID (MAF PID) reading less than 4.6 volts (Refer to equivalent grams/second chart in GO to Pinpoint Test DC) in continuous memory or key ON and engine running indicates a hard fault.
P0106 - Barometric (BARO) Pressure Sensor Circuit Performance	Baro sensor input to the PCM is monitored and is not within the calibrated value.	<ul style="list-style-type: none"> • Slow responding BARO sensor • Electrical circuit failure • Damaged BARO sensor • Damaged PCM 	<ul style="list-style-type: none"> • VREF voltage should be between 4.0 and 6.0 volts • PID reading is in frequency
P0107 - BARO/MAP Sensor Low Voltage Detected	Sensor operating voltage is less than 0.25 volts (VREF), as a result it failed below the minimum allowable calibrated parameter.	<ul style="list-style-type: none"> • Open in the circuit, or short to ground • VREF circuit open, or short to ground • Damaged BARO/MAP sensor • Damaged PCM 	<ul style="list-style-type: none"> • VREF should be greater than 4.0 volts • PID reading is in frequency/volts
P0108 - BARO/MAP Sensor High Voltage Detected	Sensor operating voltage is greater than 5.0 volts (VREF), as a result it failed above maximum allowable calibrated parameter.	<ul style="list-style-type: none"> • VREF shorted to VWPR • BARO/MAP signal shorted to VPWR • Damaged BARO/MAP sensor • Damaged PCM 	VREF should be less than 6.0 volts. PID reading is in frequency/Volts

P0109 - BARO/MAP Sensor Circuit Intermittent	The sensor signal to the PCM is failing intermittently.	<ul style="list-style-type: none"> • Loose electrical connection • Damaged BARO/MAP sensor 	Check harness and connection.
P0112 - Intake Air Temperature (IAT) Circuit Low Input	Indicates the sensor signal is less than Self-Test minimum. The IAT sensor minimum is 0.2 volts or 121°C (250°F).	<ul style="list-style-type: none"> • Grounded circuit in harness • Damaged sensor • Improper harness connection • Damaged PCM 	IAT V PID reading less than 0.2 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault.
P0113 - Intake Air Temperature (IAT) Circuit High Input	Indicates the sensor signal is greater than Self-Test maximum. The IAT sensor maximum is 4.6 volts or -50°C (-58°F).	<ul style="list-style-type: none"> • Open circuit in harness • Sensor signal short to power • Damaged sensor • Improper harness connection • Damaged PCM 	IAT V PID reading greater than 4.6 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault.
P0116 - Engine Coolant Temperature Circuit Range/Performance Failure	<p>Indicates the engine coolant temperature rationality test has failed. The PCM logic that sets this DTC indicates that engine coolant temperature sensor (ECT or CHT) drifted higher than the nominal sensor calibration curve and could prevent one or more OBD II monitors from executing. The PCM runs this logic after an engine off "calibrated soak period (typically 6 hours). This soak period allows the Intake Air Temperature (IAT) and engine coolant temperature (CHT or ECT) to stabilize and not differ by more than a calibrated value. DTC P0116 is set when all of the following conditions are met:</p> <ul style="list-style-type: none"> • Engine coolant temperature at engine start 	<ul style="list-style-type: none"> • Engine Coolant Temperature (ECT) or Cylinder Head Temperature (CHT) sensor • Coolant System Concern 	Ensure IAT and engine coolant temperature are similar when engine is cold. Also ensure engine coolant temperature sensor (ECT or CHT) and actual engine operating temperature are the same.

	<p>exceeds IAT at engine start by more than a calibrated value, typically 30° F (1°C).</p> <ul style="list-style-type: none"> • Engine coolant temperature exceeds a calibrated value, typically 225F (107C). • The Fuel, Heated Oxygen Sensor, Catalyst and Misfire monitors have not completed. • Calibrated timer to set DTC P0116 has expired. 		
P0117 - Engine Coolant Temperature (ECT) Circuit Low Input	<p>Indicates the sensor signal is less than Self-Test minimum. The ECT sensor minimum is 0.2 volts or 121°C (250°F). Note on some vehicles that are not equipped with an ECT sensor, CHT can be used and can set this DTC.</p>	<ul style="list-style-type: none"> • Grounded circuit in harness • Damaged sensor • Improper harness connection • Damaged PCM 	<p>ECT V PID reading less than 0.2 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault.</p>
P0118 - Engine Coolant Temperature (ECT) Circuit High Input	<p>Indicates the sensor signal is greater than Self-Test maximum. The ECT sensor maximum is 4.6 volts or -50°C (-58° F). Note on some vehicles that are not equipped with an ECT sensor, CHT can be used and can set this DTC.</p>	<ul style="list-style-type: none"> • Open circuit in harness • Sensor signal short to power • Damaged PCM • Improper harness connection • Damaged sensor 	<p>ECT V PID reading greater than 4.6 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault.</p>
P0121 - Throttle Position (TP) Circuit Performance Problem	<p>The TP sensor circuit is monitored by the PCM for a non closed throttle position at idle. If</p>	<ul style="list-style-type: none"> • Binding throttle linkage • Damaged throttle body • TP circuit open to PCM • Damaged TP sensor • SIG RTN circuit open to TP 	<p>Drive vehicle, bring to a stop, turn key OFF. Start vehicle, run key ON engine running self-test at idle. Access KOER</p>

	key ON engine running self-test terminates upon placing the transmission range selector in gear (DRIVE or REVERSE) or when closing the throttle (idle) after opening it (in PARK or NEUTRAL) the TP closed throttle position is not attained, the test fails.	sensor	diagnostic trouble codes on scan tool.
P0122 - Throttle Position (TP) Circuit Low Input	The TP sensor circuit is monitored by the PCM for a low TP rotation angle (or voltage) input through the comprehensive component monitor (CCM). If during key ON engine OFF or key ON engine running the TP rotation angle (or voltage) changes below a minimum calibrated limit, the test fails.	<ul style="list-style-type: none"> • TP sensor not seated properly • TP circuit open to PCM • VREF open to TP sensor • TP circuit short to GND • Damaged TP sensor • Damaged PCM 	A TP PID (TP V PID) reading less than 3.42% (0.17 volt) in key ON engine OFF, continuous memory or key ON engine running indicates a hard fault.
P0123 - Throttle Position (TP) Circuit High Input	The TP sensor circuit is monitored by the PCM for a high TP rotation angle (or voltage) input through the comprehensive component monitor (CCM). If during key ON engine OFF or key ON engine running the TP rotation angle (or voltage) changes above maximum calibrated limit, the test fails.	<ul style="list-style-type: none"> • TP sensor not seated properly • TP circuit short to PWR • VREF short to PWR • SIG RTN circuit open to TP sensor • Damaged TP sensor • Damaged PCM 	A TP PID (TP V PID) reading greater than 93% (4.65 volts) in key ON engine OFF, continuous memory or key ON engine running indicates a hard fault.
P0125 - Insufficient Coolant Temperature For Closed Loop Fuel Control	Indicates the ECT or CHT sensor has not achieved the required temperature level to enter closed loop operating conditions within a specified amount	<ul style="list-style-type: none"> • Insufficient warm up time • Low engine coolant level • Leaking or stuck open thermostat • Malfunctioning ECT sensor • Malfunctioning CHT sensor 	Refer to Thermostat Monitor in Section 1, Description and Operation, for system information.

	of time after starting engine.		
P0127 - Intake Air Temperature Too High	Indicates that IAT2 sensor has detected a potential abnormality in the intercooler system. This condition will cause the boost from the supercharger to be bypassed to avoid potential engine damage.	<ul style="list-style-type: none"> • Blockage of heat exchangers • Low fluid level • Fluid leakage • Intercooler pump or relay failure • Crossed intercooler coolant lines 	Monitor IAT2 PID. Typical IAT2 temperature should be greater than IAT1. Refer to Section 6 : Reference Values for ranges.
P0131 - HO2S Sensor Circuit Out of Range Low Voltage (HO2S-11)	The HO2S sensor is monitored for a negative voltage known as characteristic shift downward (CSD). If the sensor is thought to be switching from 0 volts to -1 volts during testing, the PCM will use this input and remain in fuel control.	<ul style="list-style-type: none"> • Contaminated HO2S (water, fuel, etc) • Crossed HO2S signal/signal return wiring 	
P0133 - HO2S Sensor Circuit Slow Response (HO2S-11)	The HEGO Monitor checks the HO2S Sensor frequency and amplitude. If during testing the frequency and amplitude were to fall below a calibrated limit, the test will fail.	<ul style="list-style-type: none"> • Contaminated HO2S sensor. • Exhaust leaks. • Shorted /open wiring. • Improper fueling. • MAF sensor. • Deteriorating HO2S sensor. • Inlet air leaks. 	Access HO2S test results from the Generic OBD-II menu to verify DTC.
P0135 - HO2S Sensor Circuit Malfunction (HO2S-11)	During testing the HO2S Heaters are checked for opens/shorts and excessive current draw. The test fails when current draw exceeds a calibrated limit and/or an open or short is detected.	<ul style="list-style-type: none"> • Short to VPWR in harness or HO2S. • Water in harness connector. • Open VPWR circuit. • Open GND circuit. • Low battery voltage. • Corrosion or poor mating terminals and wiring • Damaged HO2S heater. • Damaged PCM. 	<ul style="list-style-type: none"> ■ Wiring. ■ Damaged HO2S heater. ■ Damaged PCM.
P0136 - HO2S Sensor Circuit Malfunction (HO2S-12)	The downstream HO2S sensor(s) are continuously checked for maximum and minimum voltages. The test fails when the voltages fail to meet the calibrated limits.	<ul style="list-style-type: none"> • Pinched, shorted, and corroded wiring and pins. • Crossed sensor wires. • Exhaust leaks. • Contaminated or damaged sensor. 	

P0141 - HO2S Sensor Circuit Malfunction (HO2S-125)	See DTC P0135		
P0148 - Fuel Delivery Error	At least one bank lean at wide open throttle.	<ul style="list-style-type: none"> • Severely restricted fuel filter. • Severely restricted fuel supply line. 	
P0151 - HO2S Sensor Circuit Out of Range Low Voltage (HO2S-21)	See DTC P0131		
P0153 - HO2S Sensor Circuit Slow Response (HO2S-21)	See DTC P0133		
P0155 - HO2S Sensor Circuit Malfunction (HO2S-21)	See DTC P0135		
P0156 - HO2S Sensor Circuit Malfunction (HO2S-22)	See DTC P0136		
P0161 - HO2S Sensor Circuit Malfunction (HO2S-22)	See DTC P0135		
P0171 - System to Lean (Bank 1)	The Adaptive Fuel Strategy continuously monitors fuel delivery hardware. The test fails when the adaptive fuel tables reach a rich calibrated limit.	<p>For lean and rich DTCs:</p> <ul style="list-style-type: none"> • Fuel system • Excessive fuel pressure. • Leaking/contaminated fuel injectors. • Leaking fuel pressure regulator. • Low fuel pressure or running out of fuel. • Vapor recovery system. • Induction system: <ul style="list-style-type: none"> ■ Air leaks after the MAF. ■ Vacuum Leaks. ■ PCV system. ■ Improperly seated engine oil dipstick. • EGR system: <ul style="list-style-type: none"> ■ Leaking gasket. ■ Stuck EGR valve. ■ Leaking diaphragm or EVR. • Base Engine: <ul style="list-style-type: none"> ■ Oil overfill. ■ Cam timing. ■ Cylinder compression. ■ Exhaust leaks before or near the HO2Ss. 	A SHRTFT-1,2 PID value between -25% to +35% and a LONGFT-1,2 PID value between -35% to +35% is acceptable. Reading beyond these values indicate a failure.
P0172 - System to Rich (Bank 1)	The Adaptive Fuel Strategy	See Possible Causes for DTC P0171	See Diagnostic Aides for DTC P0171

	continuously monitors the fuel delivery hardware. The test fails when the adaptive fuel tables reach a lean calibrated limit.		
P0174 - System to Lean (Bank 2)	The Adaptive Fuel Strategy continuously monitors the fuel delivery hardware. The test fails when the adaptive fuel tables reach a rich calibrated limit.	See Possible Causes for DTC P0171.	See Diagnostic Aides for DTC P0171
P0175 - System to Rich (Bank 2)	The Adaptive Fuel Strategy continuously monitors the fuel delivery hardware. The test fails when the adaptive fuel tables reach a lean calibrated limit.	See Possible Causes for DTC P0171.	See Diagnostic Aides for DTC P0171
P0176 - Flexible Fuel (FF) Sensor Circuit Malfunction	The FF sensor input signal to PCM is continuously monitored. The test fails when the signal falls out of a maximum or minimum calibrated range.	<ul style="list-style-type: none"> • Open or short in FF sensor VPWR circuit • Open in battery ground to FF sensor circuit • Open in FF sensor signal circuit • Short to ground in FF sensor signal circuit • Fuel contamination • Short to VPWR in FF sensor battery ground circuit • Short to VPWR in FF sensor signal circuit • Fuel separation • Damaged FF sensor • Damaged PCM 	A flex fuel (FF) PID reading of 0 Hz with the key ON and engine OFF or with engine at idle indicates a hard fault.
P0180 - Engine Fuel Temperature Sensor A Circuit Low Input (EFT)	The comprehensive component monitor (CCM) monitors the EFT sensor circuit to the PCM for low and high voltage. If voltage were to fall below or exceed a calibrated limit and amount of time during testing, the test will fail.	<ul style="list-style-type: none"> • Open or short in harness. • Low ambient temperature operation. • Improper harness connection. • Damaged EFT sensor. • Damaged PCM. 	Verify EFT-PID value to determine open or short.
P0181 - Engine Fuel Temperature Sensor A Circuit Range/ Performance (EFT)	The comprehensive component monitor (CCM) monitors the EFT Temperature for	<ul style="list-style-type: none"> • Open or short in harness. • Low ambient temperature operation. • Improper harness connection. • Damaged EFT sensor. 	Verify EFT-PID value to determine open or short.

	acceptable operating temperature. If during testing voltage were to fall below or exceed a calibrated limit, a calibrated amount of time the test will fail.	<ul style="list-style-type: none"> • Damaged PCM. 	
P0182 - Engine Fuel Temperature Sensor A Circuit Low Input (EFT)	The comprehensive component monitor (CCM) monitors the EFT sensor circuit to the PCM for low voltage. If voltage were to fall below a calibrated limit and amount of time during testing, the test will fail.	<ul style="list-style-type: none"> • Short in harness. • VREF open or shorted. • Low ambient temperature operation. • Improper harness connection. • Damaged EFT sensor. • Damaged PCM. 	Verify EFT-PID and VREF values to determine open or short.
P0183 - Engine Fuel Temperature Sensor A Circuit High Input (EFT)	The comprehensive component monitor (CCM) monitors the EFT sensor circuit to the PCM for high voltage. If voltage were to exceed a calibrated limit and a calibrated amount of time during testing, the test will fail.	<ul style="list-style-type: none"> • Open or short to PWR in harness. • Damaged EFT sensor. • Improper harness connection. • Damaged PCM. 	Verify EFT-PID value to determine open or short.
P0186 - Engine Fuel Temperature Sensor B Circuit Range/Performance (EFT)	See DTC P0181.		
P0187 - Engine Fuel Temperature Sensor B Circuit Low Input (EFT).	See DTC P0182.		
P0188 - Engine Fuel Temperature Sensor B Circuit High Input (EFT)	See DTC P0183.		
P0190 - Fuel Rail Pressure Sensor Circuit Malfunction (FRP)	The comprehensive component monitor (CCM) monitors the FRP sensor to the PCM for VREF voltage. The test fails when the VREF voltage from the PCM drops to a voltage less than a	<ul style="list-style-type: none"> • VREF open in harness. • VREF open in sensor. • VREF open in PCM. 	Verify VREF voltage between 4.0 and 6.0V.

	minimum calibrated value.		
P0191 - Fuel Rail Pressure Sensor Circuit Performance (FRP)	The comprehensive component monitor (CCM) monitors the FRP pressure for acceptable fuel pressure. The test fails when the fuel pressure falls below or exceeds a minimum/maximum calibrated value for a calibrated period of time.	<ul style="list-style-type: none"> • High fuel pressure. • Low fuel pressure. • Damaged FRP sensor. • Excessive resistance in circuit. • Low or no fuel. 	A FRP PID value during KOER of 138 kpa (20 psi) and 413 kpa (60 psi) for gasoline or 586 kpa (85 psi) and 725 kpa (105 psi) for natural gas vehicles (NG) is acceptable.
P0192 - Fuel Rail Pressure Sensor Circuit Low Input (FRP)	The comprehensive component monitor (CCM) monitors the FRP sensor circuit to the PCM for low voltage. If voltage were to fall below a calibrated limit and amount of time during testing, the test will fail.	<ul style="list-style-type: none"> • FRP signal shorted to SIG RTN or PWR GND. • FRP signal open (NG only) • Low fuel pressure (NG only) • Damaged FRP sensor. • Damaged PCM. 	A FRP PID value during KOER or KOEO less than 0.3 volts for gasoline or 0.5 volts for natural gas vehicles (NG) would indicate a hard fault.
P0193 - Fuel Rail Pressure Sensor Circuit High Input (FRP)	The comprehensive component monitor (CCM) monitors the FRP sensor circuit to the PCM for high voltage. If voltage were to fall below a calibrated limit and a calibrated amount of time during testing, the test will fail.	<ul style="list-style-type: none"> • FRP signal shorted to VREF or VPWR. • FRP signal open (gasoline only) • Low fuel pressure (NG only) • Damaged FRP sensor. • Damaged PCM. • High fuel pressure (caused by damaged fuel pressure regulator) NG. 	A FRP PID value during KOER or KOEO less than 0.3 volts for gasoline or 0.5 volts for natural gas vehicles (NG) would indicate a hard fault.
P0201 through P0212 - Cylinder #1 through Cylinder #12 Injector Circuits	The comprehensive component monitor (CCM) monitors the operation of the fuel injector drivers in the PCM. The test fails when the fuel injector does not operate electrically even though the harness assembly and fuel injectors test satisfactorily.	<ul style="list-style-type: none"> • Faulty fuel injector driver within the PCM. 	PID Data Monitor INJ1F-INJ12F fault flags = YES.
P0217 - Engine Coolant Over-Temperature Condition	Indicates an engine overheat condition was detected by the	<ul style="list-style-type: none"> • Engine cooling system concerns. • Low engine coolant level. • Base engine concerns. 	Monitor CHT PID for overheat condition. Typical CHT temperature should be close to cooling

	<p>cylinder head temperature (CHT) sensor. This condition will cause the boost from the supercharger to be bypassed to avoid potential engine damage.</p>		<p>system thermostat opening specification.</p>
<p>P0230 - Fuel Pump Primary Circuit Malfunction</p>	<p>NOTE: For natural gas applications, the following description applies to the fuel shutoff valve (FSV) circuit.</p> <p>The PCM monitors the fuel pump (FP) circuit output from the PCM. The test fails if: With the FP output commanded ON (grounded), excessive current draw is detected on the FP circuit; or with the FP output commanded OFF, voltage is not detected on the FP circuit (the PCM expects to detect VPWR voltage coming through the fuel pump relay coil to the FP circuit).</p>	<ul style="list-style-type: none"> • Open or shorted fuel pump (FP) circuit • Open VPWR circuit to fuel pump relay • Damaged fuel pump relay • Damaged PCM 	<ul style="list-style-type: none"> • When the FPF PID reads YES, a fault is currently present. • An open circuit or short to ground can only be detected with the fuel pump commanded OFF. • A short to power can only be detected with the fuel pump commanded ON. • During KOEO and KOER self-test, the fuel pump output command will be cycled ON and OFF.
<p>P0231 - Fuel Pump Secondary Circuit Low</p>	<p>NOTE: For natural gas applications, the following description applies to the fuel shutoff valve monitor (FSVM) and the fuel shutoff valve power (FSV PWR) circuits.</p> <p>The PCM monitors the fuel pump monitor (FPM) circuit. The test fails if the PCM commands the fuel pump ON and B+ voltage is not detected on the FPM circuit.</p>	<ul style="list-style-type: none"> • Open B+ circuit to the fuel pump relay • Open FP PWR circuit between the fuel pump relay and its connection to the FPM circuit • Damaged fuel pump relay • Damaged PCM (engine will start) • For 4.6L Mustang, open FP PWR circuit from low speed fuel pump relay, through resistor to FPM splice (engine will start) • For 5.4L SC Lightning, damaged IFS switch, IFS switch relay, or concern with related circuits. 	<p>During KOEO self-test, the PCM will command the fuel pump ON so this test can be performed.</p>
<p>P0232 - Fuel Pump Secondary Circuit High</p>	<p>NOTE: For natural gas applications, the following description applies to</p>	<ul style="list-style-type: none"> • Inertia fuel shutoff (IFS) switch not reset or electrically open • Open circuit between the fuel pump and the FPM connection to the FP PWR 	<p>Continuous memory P0232 can be set if the IFS switch was tripped, then reset, or if the fuel pump circuit is activated when the PCM expected</p>

	<p>the fuel shutoff valve monitor (FSVM) and the fuel shutoff valve power (FSV PWR) circuits. The PCM monitors the fuel pump monitor (FPM) circuit. This test fails when the PCM detects voltage on the FPM circuit while the fuel pump is commanded OFF. The FPM circuit is wired to a pull-up voltage inside the PCM. The FPM circuit will go high if, with the key ON and the fuel pump commanded OFF, the FPM/FP PWR circuit loses its path to ground through the fuel pump. The FPM circuit will also go high if the FPM/FP PWR circuit is shorted to power.</p>	<p>circuit</p> <ul style="list-style-type: none"> • Poor fuel pump ground • Fuel pump electrically open • Fuel pump secondary circuits short to power • Fuel pump relay contacts always closed • Open FPM circuit between PCM and connection to FP PWR circuit • Damaged low speed fuel pump relay or concern with related circuits (if equipped). • Damaged PCM 	<p>the circuit to be off (i.e. fuel system test or prime procedure).</p>
<p>P0234 - Supercharger Overboost Condition</p>	<p>The PCM disables (bypasses) the supercharger boost and sets a diagnostic trouble code (DTC) to keep from damaging the</p>	<ul style="list-style-type: none"> • Brake torque (brake on and throttle at wide open) • Transmission oil temperature (TOT) exceeds calibrated threshold • Engine over temperature • Ignition misfire exceeds calibrated threshold 	<p>Check for other diagnostic trouble codes accompanying the P0234 or check appropriate and available PIDs related to above possible causes.</p>

	powertrain (engine or transmission) during potential harmful operating conditions.	<ul style="list-style-type: none"> • Knock sensor (KS) failure or knock detected • Low speed fuel pump relay not switching 	
P0243 - Supercharger (Boost) Bypass Solenoid Circuit Malfunction	The PCM monitors the supercharger (boost) bypass (SCB) solenoid circuit for an electrical failure. The test fails when the signal moves outside the minimum or maximum allowable calibrated parameters for a specified SCB solenoid duty cycle (100% or 0%) by PCM command.	<ul style="list-style-type: none"> • VPWR circuit open to SCB solenoid • SCB solenoid circuit shorted to PWR GND or CHASSIS GND • Damaged SCB solenoid • SCB solenoid circuit open • SCB solenoid circuit shorted to VPWR • Damaged PCM 	Disconnect SCB solenoid. Connect test lamp to SCB solenoid harness connector. Cycle SCB driver in PCM by Output Test Mode. Test lamp cycle on and off - SCB solenoid is suspect. Test lamp always on - SCB signal short in harness or PCM. Test always off - SCB signal or VPWR open in harness or PCM.
P0298 - Engine Oil Over Temperature Condition	Indicates the Engine Oil Temperature Protection strategy in the PCM has been activated. This will temporarily prohibit high engine speed operation by disabling injectors, therefore reducing the risk of engine damage from high engine oil temperature. Note: On engines which are equipped with an oil temperature sensor, the PCM reads oil temperature to determine if it is excessive. When an oil temperature sensor is not present, the PCM uses an oil algorithm to infer actual temperature. Engine shutdown strategy function is the same on vehicles with and without oil temperature sensors.	<ul style="list-style-type: none"> • Very high engine rpm for extended period of time. • Over-heating condition. • Malfunction EOT sensor or circuit (vehicles w/EOT sensor). • Base engine concerns. 	Engine operating in high rpm range, due to improper gear selection. May cause Lack/Loss of Power or Surge customer concern.
P0300 - Random Misfire	The random misfire DTC indicates	<ul style="list-style-type: none"> • Camshaft position sensor (CMP) 	One or more EGR passages may be

	multiple cylinders are misfiring or the PCM cannot identify which cylinder is misfiring.	<ul style="list-style-type: none"> • Low fuel: less than 1/8 tank • Stuck open EGR valve • Blocked EGR passages 	blocked or partially blocked. If this is the case the Misfire Detection Monitor will indicate the EGR port to check for possible blockage.
P0301 through P0310 - Misfire Detection Monitor	The misfire detection monitor is designed to monitor engine misfire and identify the specific cylinder in which the misfire has occurred. Misfire is defined as lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause.	<ul style="list-style-type: none"> • Ignition system • Fuel injectors • Running out of fuel • EVAP canister purge valve • Fuel pressure • Evaporative emission system • Base engine 	The MIL will blink once per second when a misfire is detected severe enough to cause catalyst damage. If the MIL is on steady state, due to a misfire, this will indicate the threshold for emissions was exceeded and cause the vehicle to fail an inspection and maintenance tailpipe test.
P0320 - Ignition Engine Speed Input Circuit Malfunction	The ignition engine speed sensor input signal to PCM is continuously monitored. The test fails when the signal indicates that two successive erratic profile ignition pickup (PIP) pulses have occurred.	<ul style="list-style-type: none"> • Loose wires/connectors. • Arcing secondary ignition components (coil, wires and plugs) • On board transmitter (2-way radio) 	The DTC indicates that two successive erratic PIP pulses occurred.
P0325 - Knock Sensor 1 Circuit Malfunction (Bank 1)	See DTC P0326		
P0326 - Knock Sensor 1 Circuit Range/Performance (Bank 1)	The knock sensor detects vibrations upon increase and decrease in engine rpm. The knock sensor generates a voltage based on this vibration. Should this voltage go outside a calibrated level a DTC will set.	<ul style="list-style-type: none"> • Knock sensor circuit short to GND • Knock sensor circuit short to PWR • Knock sensor circuit open • Damaged knock sensor • Damaged PCM 	A knock sensor voltage greater than 0.5V with the key ON and engine OFF indicates a hard fault.
P0330 - Knock Sensor 2 Circuit Malfunction (Bank 2)	See DTC P0331		
P0331 - Knock Sensor 2 Circuit Range/performance (Bank 2)	The knock sensor detects vibration upon increase and decrease in engine rpm. The knock sensor generates a	<ul style="list-style-type: none"> • Knock sensor circuit short to GND • Knock sensor circuit short to PWR • Damaged knock sensor • Damaged PCM 	A knock sensor voltage greater than 0.5V with the key ON and engine OFF indicates a hard fault.

	voltage based on this vibration. Should this voltage go outside a calibrated level a DTC will set.	<ul style="list-style-type: none"> • Knock sensor circuit open 	
P0340 - Camshaft Position (CMP) Sensor Circuit Malfunction	The test fails when the PCM can no longer detect the signal from the CMP sensor.	<ul style="list-style-type: none"> • CMP circuit open • CMP circuit short to GND • CMP circuit short to PWR • SIG RTN open (VR sensor) • CMP GND open (Hall effect sensor) • CMP misinstalled (Hall effect sensor) • Damaged CMP sensor shielding • Damaged CMP sensor • Damaged PCM 	Harness routing, harness alterations, improper shielding, or electrical interference from other improperly functioning systems may have intermittent impact on the CMP signal.
P0350 - Ignition Coil (Undetermined) Primary/ Secondary Circuit Malfunction	Each ignition primary circuit is continuously monitored. The test fails when the PCM does not receive a valid IDM pulse signal from the ignition module (integrated in PCM).	<ul style="list-style-type: none"> • Open or short in Ignition START/RUN circuit • Open coil driver circuit • Coil driver circuit shorted to ground • Damaged coil • Damaged PCM • Coil driver circuit shorted to VPWR 	
P0351 Through P0360 - Ignition Coil A through J Primary/ Secondary Circuit Malfunction	Each ignition primary circuit is continuously monitored. The test fails when the PCM does not receive a valid IDM pulse signal from the ignition module (integrated in PCM).	<ul style="list-style-type: none"> • Open or short in Ignition START/RUN circuit • Open coil driver circuit in harness • Coil driver circuit shorted to ground • Damaged coil • Damaged PCM • Coil driver circuit shorted to PWR 	
P0400 EGR Flow Failure (outside the minimum or maximum limits)	The EEGR system is monitored once per drive cycle during steady state conditions above 48 mph . The test will fail when a malfunction is detected by PCM calculations indicating the EGR flow is less or greater than expected.	<ul style="list-style-type: none"> • EEGR valve stuck open or closed • Connector to EEGR not seated • EEGR motor windings shorted or open circuited • No power to EEGR • Harness open or shorted to power or ground • Vacuum signal to MAP restricted or leaking • MAF sensor signal erroneous • Damaged PCM • Carbon build up in EEGR valve seat area • One or more sensor not responding or out of range 	All of the following sensors input data to the PCM for proper operation of the EEGR system: ECT, CPS, IAT, MAF, TP, MAP. Any DTC relating to these sensors must be resolved prior to addressing P0400 code.
P0401 - EGR Flow Insufficient Detected	The EGR system is monitored during steady state driving	<ul style="list-style-type: none"> • Vacuum supply • EGR valve stuck closed • EGR valve leaks vacuum 	Perform KOER self-test and look for DTC P1408 as an indication of a hard

	<p>conditions while the EGR is commanded on. The test fails when the signal from the DPF EGR sensor indicates that EGR flow is less than the desired minimum.</p>	<ul style="list-style-type: none"> • EGR flow path restricted • EGRVR circuit shorted to PWR • VREF open to D.P.F. EGR sensor • D.P.F. EGR sensor downstream hose off or plugged • EGRVR circuit open to PCM • VPWR open to EGRVR solenoid • D.P.F. EGR sensor hoses both off • D.P.F. EGR sensor hoses reversed • Damaged EGR orifice tube • Damaged EGRVR solenoid • Damaged PCM 	<p>fault. If P1408 is not present, look for contamination, restrictions, leaks, and intermittents.</p>
<p>P0402 - EGR Flow Excessive Detected</p>	<p>The EGR system is monitored for undesired EGR flow during idle. The EGR monitor looks at the DPF EGR signal at idle and compares it to the stored signal measured during key ON and engine OFF. The test fails when the signal at idle is greater than at key ON engine OFF by a calibrated amount.</p>	<ul style="list-style-type: none"> • EGR valve stuck open • Plugged EGR vacuum regulator solenoid vent • Plugged EGR tube • Slow responding D.P.F. EGR sensor • Damaged DPF EGR sensor • Improper vacuum hose connection • Plugged vacuum hoses • EGRVR circuit shorted to ground • Damaged EGR vacuum regulator solenoid • Damaged PCM 	<p>A DPFEGR PID reading that is greater at idle than during key ON and engine OFF by 0.5 volt or a rough engine idle, may indicate a hard fault.</p>
<p>P0403 EEGR Electric Motor Windings Or Circuits To The PCM Shorted Or Open</p>	<p>The EEGR system is continuously monitored to check the 4 EEGR motor coils, circuits, and the PCM for opens, shorts to power and ground. If a malfunction is detected the EEGR system will be disabled and additional monitoring will be suspended for the remainder of the drive until the next drive cycle.</p>	<ul style="list-style-type: none"> • EEGR motor windings open • Connector to EEGR not seated • Open circuit in harness from PCM to EEGR • Open circuit in PCM • Short circuit in EEGR motor • Short circuit in harness from PCM to EEGR • Short circuit in PCM 	<p>If an intermittent condition is suspected the most effective method of wiring fault isolation is to use the wiggle test method while measuring for shorts and open circuits.</p>
<p>P0411 - Secondary Air Injection (AIR) system upstream flow</p>	<p>See DTC P1411</p>		
<p>P0412 - Secondary Air Injection System (AIR) circuit malfunction</p>	<p>The PCM attempts to control when air is injected in the exhaust. The DTC</p>	<ul style="list-style-type: none"> • AIR circuit open • AIR bypass solenoid fault • Damaged PCM • AIR circuit short to power 	<p>The AIR circuit is normally held high through the AIR bypass solenoid and SSR when</p>

	indicates a Secondary Air injection system AIR circuit fault.	<ul style="list-style-type: none"> • Solid state relay fault • Damaged AIR pump 	the output driver is off. Therefore, a low AIR circuit indicates a driver is always on and a high circuit indicates an open in the PCM.
P0420 - Catalyst System Efficiency Below Threshold (Bank 1)	Indicates Bank 1 catalyst system efficiency is below the acceptable threshold	<ul style="list-style-type: none"> • Use of leaded fuel • Damaged HO2S • Malfunctioning ECT • High fuel pressure • Damaged exhaust manifold • Damaged catalytic converter • Oil contamination • Cylinder misfiring • Downstream HO2S wires improperly connected • Damaged exhaust system pipe • Damaged muffler/tailpipe assembly • Retarded spark timing 	Compare HO2S upstream and downstream switch rate and amplitude. Under normal closed loop fuel conditions, high efficiency catalysts have oxygen storage which makes the switching frequency of the downstream HO2S very slow and reduces the amplitude of those switches as compared to the upstream HO2S. As catalyst efficiency deteriorates, its ability to store oxygen declines and the downstream HO2S signal begins to switch more rapidly with increase amplitude, approaching the switching rate and amplitude of the upstream HO2S. Once beyond an acceptable limit the DTC is set.
P0430 - Catalyst System Efficiency Below Threshold (Bank 2)	Indicates Bank 2 catalyst system efficiency is below the acceptable threshold.	<ul style="list-style-type: none"> • Use of leaded fuel • Damaged HO2S • Malfunctioning ECT • High fuel pressure • Damaged exhaust manifold • Damaged catalytic converter • Oil contamination • Cylinder misfiring • Downstream HO2S wires improperly connected • Damaged exhaust system pipe • Damaged muffler/tailpipe assembly • Retarded spark timing 	Compare HO2S upstream and downstream switch rate and amplitude. Under normal closed loop fuel conditions, high efficiency catalysts have oxygen storage which makes the switching frequency of the downstream HO2S very slow and reduces the amplitude of those switches as compared to the upstream HO2S. As catalyst efficiency deteriorates, its ability to store oxygen declines and the downstream HO2S signal begins to switch more rapidly with increase amplitude, approaching the switching rate and amplitude of the upstream HO2S. Once beyond an acceptable limit the DTC is set.
P0442 - EVAP Control System	The PCM monitors the complete	<ul style="list-style-type: none"> • After-market EVAP hardware (such as fuel filler 	

Leak Detected (Small Leak)	EVAP control system for presence of a small fuel vapor leak. The system failure occurs when a fuel vapor leak from an opening as small as 1.016 mm (0.04 inch) is detected by the EVAP running loss monitor test.	cap) non-conforming to required specifications <ul style="list-style-type: none"> • Small holes or cuts in fuel vapor hoses/tubes • Canister vent solenoid stays partially open on closed command • Damaged, cross-threaded or loosely installed fuel filler cap • Loose fuel vapor hose/tube connections to EVAP system components • EVAP system component seals leaking (EVAP canister purge valve, fuel tank pressure sensor, canister vent solenoid, fuel vapor control valve tube assembly or fuel vapor vent valve assembly) 	
P0443 - EVAP Control System Canister Purge Valve Circuit Malfunction	The PCM monitors the EVAP canister purge valve circuit for an electrical failure. The test fails when the signal moves outside the minimum or maximum allowable calibrated parameters for a specified purge duty cycle by PCM command.	<ul style="list-style-type: none"> • VPWR circuit open • EVAP canister purge valve circuit shorted to GND • Damaged EVAP canister purge valve • EVAP canister purge valve circuit open • EVAP canister purge valve circuit shorted to VPWR • Damaged PCM 	Monitor EVAPPDC PID and voltage between EVAP canister valve signal and PWR GND in output test mode with key ON engine OFF (or in key ON engine RUNNING mode). EVAPPDC PID at 0% and voltage less than 1.0 volts (or EVAPPDC PID at 100% and voltage less than 0.5 volts) indicates a hard fault.
P0451 - FTP Sensor Circuit Noisy	The fuel tank pressure changes greater than 14 inches of H ₂ O in 0.10 seconds.	<ul style="list-style-type: none"> • Intermittent open or short in the FTP sensor or the FTP sensor signal. 	Monitor FTP PID and does it change from above 15 inches of H ₂ O to below a minus (-) 15 inches of H ₂ O often in 1.0 minute.
P0452 - FTP Sensor Circuit Low Voltage Detected	The PCM monitors the EVAP control system FTP sensor input signal to the PCM. The test fails when the signal average drops below a minimum allowable calibrated parameter.	<ul style="list-style-type: none"> • Contamination internal to FTP sensor connector • Damaged PCM • FTP circuit shorted to GND or SIG RTN • Damaged FTP sensor 	FTP V PID reading less than 0.22 volt with key ON and engine OFF or during any engine operating mode indicates a hard fault.
P0453 - FTP Sensor Circuit High Voltage Detected	The PCM monitors the EVAP control system FTP sensor input signal to the PCM. The test fails when the signal average jumps	<ul style="list-style-type: none"> • FTP circuit open • VREF shorted to VPWR • Damaged PCM • FTP circuit shorted to VREF or VPWR • SIG RTN circuit open • Damaged FTP sensor 	FTP V PID reading greater than 4.50 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault.

	above a minimum allowable calibrated parameter.		
P0455 - EVAP Control System Leak Detected (No Purge Flow or Large Leak)	The PCM monitors the complete EVAP control system for no purge flow, the presence of a large fuel vapor leak or multiple small fuel vapor leaks. The system failure occurs when no purge flow (attributed to fuel vapor blockages or restrictions), a large fuel vapor leak or multiple fuel vapor leaks are detected by the EVAP running loss monitor test with the engine running (but not at idle).	<ul style="list-style-type: none"> • After-market EVAP hardware (such as fuel filler cap) non-conforming to required specifications • Disconnected or cracked fuel EVAP canister tube, EVAP canister purge outlet tube or EVAP return tube • EVAP canister purge valve stuck closed • Damaged EVAP canister • Damaged or missing fuel filler cap • Insufficient fuel filler cap installation • Loose fuel vapor hose/tube connections to EVAP system components • Blockages or restrictions in fuel vapor hoses/tubes (items also listed under disconnections or cracks) • Fuel vapor control valve tube assembly or fuel vapor vent valve assembly blocked • Canister vent (CV) solenoid stuck open • Mechanically inoperative fuel tank pressure (FTP) sensor 	Check for audible vacuum noise or significant fuel odor in the engine compartment or near the EVAP canister and fuel tank.
P0456 - EVAP Control System Leak Detected (Very Small Leak)	The PCM monitors the complete EVAP control system for the presence of a very small fuel vapor leak. The system failure occurs when a fuel vapor leak from an opening as small as 0.508 mm (0.020 inch) is detected by the EVAP running loss monitor test.	<ul style="list-style-type: none"> • Very small holes or cuts in fuel vapor hoses/tubes. • Loose fuel vapor hose/tube connections to EVAP system components. • EVAP system component seals leaking (refer to Possible Causes under DTC P0442). 	
P0457 - EVAP Control System Leak Detected (Fuel Filler Cap Loose/Off)	A fuel tank pressure change of lesser than a minus (-) 7 inches of H ₂ O in 30 seconds has occurred after refueling; or there is excessive purge (fuel vapor) flow greater than 0.06 pounds per minute.	<ul style="list-style-type: none"> • Fuel filler cap not installed on refueling (storing continuous memory DTC) and "check Fuel Cap" light may also be illuminated. • Fuel filler cap missing, loose or cross-threaded. 	Check for missing fuel filler cap or integrity of the cap. If OK, clear continuous memory DTCs and re-initiate EVAP Emission Running Loss Monitor Drive Cycle.

P0460 - Fuel Level Sensor Circuit Malfunction	<p>The PCM monitors the fuel level input (FLI) circuit for electrical failure. The test fails when the signal moves outside the minimum or maximum allowable calibrated parameters for a specified fuel fill percentage in the fuel tank.</p>	<ul style="list-style-type: none"> • Empty fuel tank • Fuel pump (FP) module stuck open • Incorrectly installed fuel gauge • Damaged instrument cluster • CASE GND circuit open • FLI shorted to VPWR • Damaged PCM • Overfilled fuel tank • Fuel pump (FP) module stuck closed • Damaged fuel gauge • FLI circuit open • FLI circuit shorted to CASE GND or PWR GND • CSE GND shorted to VPWR 	<p>Monitor FLI PID and FLI V PID in key ON engine RUNNING. FLI PID at 25% fill (with non matching fuel gauge) and FLI V PID less than 0.90 volts [for FLI PID at 75% fill (with non matching fuel gauge) and FLI V PID greater than 2.45 volts] indicates a hard fault.</p>
P0500 - Vehicle Speed Sensor (VSS) Malfunction	<p>Indicates the powertrain control module (PCM) detected an error in the vehicle speed information. Vehicle speed data is received from either the vehicle speed sensor (VSS), transfer case speed sensor (TCSS), anti-lock brake system (ABS) control module, generic electronic module (GEM), or central timer module (CTM). If the engine rpm is above the torque converter stall speed (automatic transmission) and engine load is high, it can be inferred that the vehicle must be moving. If there is insufficient vehicle speed data input, a malfunction is indicated and a DTC is set. On most vehicle applications the malfunction indicator lamp (MIL) will be triggered when this DTC is set.</p>	<ul style="list-style-type: none"> • Open in VSS+/VSS- harness circuit. • Open in TCSS signal or TCSS signal return harness circuit. • Short to GND in VSS harness circuit. • Short to GND in TCSS harness circuit. • Short to PWR in VSS harness circuit. • Short to PWR in TCSS harness circuit. • Open or short in the vehicle speed circuit(s) (VSC) between the PCM and appropriate control module. • Damaged VSS or TCSS. • Damaged wheel speed sensors. • Damaged wheel speed sensor harness circuits. • Damage in module(s) connected to VSC/VSS circuit. • Damage drive mechanism for VSS or TCSS. 	<p>Monitor VSS PID while driving vehicle. This DTC is set when the PCM detects a sudden loss of vehicle speed signal over a period of time. If vehicle speed data is lost, check the source of where the vehicle speed input originates from: VSS, TCSS, ABS, GEM or CTM. Note: On some MSOF applications, VSS and TCSS PID can be monitor. However if no TCSS PID is available and VSS PID is zero, TCSS circuitry frequency must be checked for loss of sensor signal. If another vehicle electronic module has generated the P0500 and the vehicle does not receive its vehicle speed input from one of the above mention sources (VSS, TCSS, ABS, GEM or CTM). Check the PCM for Output Shaft Speed Sensor (OSS) DTCs. On OSS applications the PCM uses the OSS to calculated the vehicle speed. If no OSS DTCs are found check for correct PCM configuration. Check PCM configuration for correct tire size and axle ratio.</p>
P0501 - Vehicle Speed Sensor (VSS) Range/	<p>Indicates the powertrain control module (PCM)</p>	<ul style="list-style-type: none"> • Refer to possible causes for P0500. 	<p>Refer to diagnostic aids for P0500.</p>

Performance	detected an error in the vehicle speed information. This DTC is set the same way as P0500, however the malfunction indicator lamp (MIL) is not triggered.		
P0503 - Vehicle Speed Sensor (VSS) Intermittent	Indicates poor or noisy VSS performance. Vehicle speed data is received from either the vehicle speed sensor (VSS), transfer case speed sensor (TCSS), anti-lock brake system (ABS) control module, generic electronic module (GEM), or central timer module (CTM).	<ul style="list-style-type: none"> Noisy VSS/TCSS input signal from Radio Frequency Interference/ Electro-Magnetic Interference (RFI/EMI) external sources such as ignition components or charging circuit. Damaged VSS or driven gears. Damaged TCSS. Damaged wiring harness or connectors. Malfunction in module(s) or circuit connected to VSS/TCSS circuit. After market add-on. 	Monitor VSS PID while driving vehicle, check for intermittent vehicle speed indication. Verify ignition and charging system are functioning correctly.
P0505 - Idle Air Control System Malfunction	The PCM attempts to control engine speed during KOER self-test. The test fails when the desired rpm could not be reached or controlled during the self-test.	<ul style="list-style-type: none"> IAC circuit open VPWR to IAC solenoid open IAC circuit shorted to PWR Air inlet is plugged Damaged IAC valve Damaged PCM 	The IAC solenoid resistance is from 6 to 13 ohms.
P0552 - Power Steering Pressure (PSP) Sensor Circuit Malfunction	The PSP sensor input signal to the PCM is continuously monitored. The test fails when the signal is open or shorted to ground.	<ul style="list-style-type: none"> PSP sensor damaged SIG RTN circuit open or shorted VREF circuit open or shorted PSP sensor signal circuit open or shorted Damaged PCM 	The DTC indicates the PSP sensor circuit is open or shorted to ground.
P0553 - Power Steering Pressure (PSP) Sensor Circuit Malfunction	The PSP sensor input signal to PCM is continuously monitored. The test fails when the signal is shorted to power.	<ul style="list-style-type: none"> PSP sensor damaged SIG RTN circuit shorted to power VREF circuit shorted to power PSP sensor signal circuit shorted to power Damaged PCM 	The code indicates the PSP sensor circuit is shorted to power.
P0602 - Control Module Programming Error	This Diagnostic Trouble Code (DTC) indicates programming error within Vehicle ID block (VID).	<ul style="list-style-type: none"> VID data corrupted by the scan tool during VID reprogramming 	Using the scan tool, reprogram the VID block. If PCM does not allow reprogramming of the VID block, reflashing PCM will be required.
P0603 - Powertrain	Indicates the PCM	<ul style="list-style-type: none"> Reprogramming 	If KAPWR is interrupted

Control Module KAM Test Error	has experienced an internal memory fault. However there are external items that can cause this DTC.	<ul style="list-style-type: none"> • Battery terminal corrosion • KAPWR to PCM interrupt/open • Loose battery connection • Damaged PCM 	to the PCM because of a battery or PCM disconnect, DTC can be generated on the first power-up.
P0605 - PCM read only memory (ROM) error	Indicates the PCM ROM has been corrupted.	<ul style="list-style-type: none"> • An attempt was made to change the calibration. • Module programming error. • Damaged PCM 	<ul style="list-style-type: none"> ■ Reprogram or update calibration. ■ Reprogram VID block (use as built data). ■ Check for other DTC's or drive symptoms for further action.
P0703 - Brake Switch Circuit Input Malfunction	Indicates PCM did not receive a brake pedal position (BPP) input.	<ul style="list-style-type: none"> • Open or short in BPP circuit • Open or short in stoplamp circuits • Damaged PCM • Malfunction in module(s) connected to BPP circuit. (Rear Electronic Module [REM] Windstar and LS6/LS8 or Lighting Control Module (LCM) Continental and Town Car. • Damaged brake switch • Misadjusted brake switch 	Check for proper function of stoplamps. Follow correct Self-Test procedures, refer to Section 2 of Quick Test.
P0704 - Clutch Pedal Position Switch Malfunction	When the clutch pedal is depressed the voltage goes to low. If the PCM does not see this change from high to low the DTC is set.	<ul style="list-style-type: none"> • CPP circuit short to PWR • Damaged CPP switch • CPP circuit open in the SIGRTN • Damaged PCM 	When depressing the CPP switch the voltage should cycle from 5.0V down.
P0720 - Insufficient input from Output Shaft Speed sensor	The output shaft speed sensor inputs a signal to the PCM, based on the speed of the output shaft of the transmission. The PCM compares this signal with the signal of the VSS or TCSS and determines correct tire size and axle gear ratio.	<ul style="list-style-type: none"> • OSS sensor circuit short to GND • OSS sensor circuit short to PWR • OSS sensor circuit open • Damaged OSS sensor • Damaged PCM 	Verify sensor signal output varies with vehicle speed.
P0721 - Noise interference on Output Shaft Speed sensor signal	The output shaft speed sensor signal is very sensitive to noise. This noise distorts the input to the PCM.	<ul style="list-style-type: none"> • Wiring misrouted • After market add-on • Wiring damaged • Wiring insulation wear 	<ul style="list-style-type: none"> ■ Check routing of harness. ■ Check wiring and connector for damage.
P0722 - No signal from Output Shaft Speed sensor	The output shaft speed sensor failed to provide a	<ul style="list-style-type: none"> • Damaged OSS connector • Damaged OSS sensor, or not installed properly 	

	signal to the PCM upon initial movement of vehicle.	<ul style="list-style-type: none"> • Harness intermittently shorted or open 	
P0723 - Output Shaft Speed sensor circuit intermittent failure	The output shaft speed sensor signal to the PCM is irregular or interrupted.	<ul style="list-style-type: none"> • Harness connector not properly seated • Harness intermittently shorted, or open • Harness connector damaged • OSS sensor damaged, or not installed properly 	<ul style="list-style-type: none"> ■ Verify harness and connector integrity ■ Verify OSS sensor proper installation
P0812 - Reverse Switch (RS) input circuit malfunction	The DTC indicates that the voltage is high when it should be low.	<ul style="list-style-type: none"> • Transmission shift not indicating neutral while in KOEO Self-Test • RS circuit short to PWR • Damaged reverse switch • RS circuit open or short to SIGRTN • Damaged PCM 	Check RS PID while exercising shift lever in and out of reverse.
P1000 - Monitor Testing Not Complete	The on board diagnostic II (OBD II) monitors are performed during the OBD II Drive Cycle. The DTC will be stored in continuous memory if any of the OBD II monitors do not complete.	<ul style="list-style-type: none"> • Vehicle is new from the factory • Battery or PCM had recently been disconnected • An OBD II monitor failure had occurred before completion of an OBD II drive cycle • PCM DTCs have recently been cleared with a scan tool • PTO circuit is shorted to VPWR or B+ or PTO is on during testing 	The DTC does not need to be cleared from the PCM except to pass an inspection/maintenance test.
P1001 - KOER Not Able To Complete, KOER Aborted	This Non-MIL (Malfunction Indicator Lamp) code will be set when Key On Engine Running (KOER) Self-Test does not complete in the time intended.	<ul style="list-style-type: none"> • Incorrect Self-Test Procedure. • Unexpected response from Self-Test monitors. • rpm out of specification. 	Rerun Self-Test following QT1 in Section 3 , Symptom Charts, STEP 1: PCM Quick Test.
P1100 - Mass Air Flow (MAF) Sensor Intermittent	The MAF sensor circuit is monitored by the PCM for sudden voltage (or air flow) input change through the comprehensive component monitor (CCM). If during the last 40 warm-up cycles in key ON engine running the PCM detects a voltage (or air flow) change beyond the minimum or maximum	<ul style="list-style-type: none"> • Poor continuity through the MAF sensor connectors • Poor continuity through the MAF sensor harness • Intermittent open or short inside the MAF sensor. 	While accessing the MAF V PID on the scan tool, lightly tap on the MAF sensor or wiggle the MAF sensor connector and harness. If the MAF V PID suddenly changes below 0.23 volt or above 4.60 volts, an intermittent fault is indicated.

	calibrated limit, a continuous memory diagnostic trouble code (DTC) is stored.		
P1101 - Mass Air Flow (MAF) Sensor Out of Self-Test Range	The MAF sensor circuit is monitored by the PCM for an out of range air flow (or voltage) input. If during key ON engine OFF the air flow voltage signal is greater than 0.27 volts the test fails. Likewise, if during key ON engine running, an air flow voltage signal is not within 0.46 volt to 2.44 volts, the test fails. For voltage to air flow gm/sec conversion, GO to Pinpoint Test DC and refer to Voltage To Mass Air Flow Conversion Table.	<ul style="list-style-type: none"> • Low battery charge • MAF sensor partially connected • MAF sensor contamination • PWR GND open to MAF sensor • MAF RTN circuit open to PCM • Damaged MAF sensor • Damaged PCM 	A MAF V PID reading greater than 0.27 volts (KOEO) or a MAF V PID reading outside the 0.46 volt to 2.44 volts range (KOER) indicates a hard fault.
P1112 - Intake Air Temperature (IAT) Sensor Intermittent	Indicates IAT sensor signal was intermittent during the comprehensive component monitor.	<ul style="list-style-type: none"> • Damaged harness • Damaged sensor • Damaged harness connector • Damaged PCM 	Monitor IAT on scan tool, look for sudden changes in reading when harness is wiggled or sensor is tapped.
P1114 - Intake Air Temperature 2 Circuit Low Input	Indicates the sensor signal is less than Self-Test minimum. The IAT2 sensor minimum is 0.2 volts.	<ul style="list-style-type: none"> • Grounded circuit in harness • Improper harness connection • Damaged sensor • Damaged PCM 	Monitor IAT2 PID. Typical IAT2 temperature should be greater than IAT1. Refer to Section 6 : Reference Values for ranges.
P1115 - Intake Air Temperature 2 Circuit High Input	Indicates the sensor signal is greater than Self-Test maximum. The IAT2 sensor maximum is 4.6 volts.	<ul style="list-style-type: none"> • Open circuit in harness • Sensor signal short to power • Improper harness connection • Damaged sensor • Damaged PCM 	Monitor IAT2 PID. Typical IAT2 temperature should be greater than IAT1. Refer to Section 6 : Reference Values for ranges.
P1116 - Engine Coolant Temperature (ECT) Sensor Out of Self-Test Range	Indicates the ECT sensor is out of Self-Test range. Correct range is 0.3 to 3.7 volts.	<ul style="list-style-type: none"> • Overheating condition • Malfunctioning thermostat • Damaged ECT sensor • Low engine coolant • Damaged harness connector • Damaged PCM 	Engine coolant temperature must be greater than 10°C (50°F) to pass the KOEO Self-Test and greater than 82° C (180°F) to pass the KOER Self-Test.
P1117 - Engine Coolant Temperature (ECT)	Indicates ECT circuit became intermittently open	<ul style="list-style-type: none"> • Damaged harness • Damaged sensor • Damaged PCM 	Monitor ECT on scan tool, look for sudden changes in reading when

Sensor Intermittent	or shorted while engine was running.	<ul style="list-style-type: none"> • Damaged harness connector • Low engine coolant 	harness is wiggled or sensor is tapped.
P1120 - Throttle Position (TP) Sensor Out of Range Low (RATCH too Low)	The TP sensor circuit is monitored by the PCM for a low TP rotation angle (or voltage) input below the closed throttle position through the comprehensive component monitor (CCM). If during key ON engine OFF or key ON engine running the TP rotation angle (or voltage) remains within the calibrated self-test range but falls between 3.42 and 9.85% (0.17 and 0.49 volt), the test fails.	<ul style="list-style-type: none"> • TP circuit with frayed wires • Corrosion on TP circuit connectors • VREF open to TP sensor • VREF short to SIG RTN • TP sensor loose pins 	A TP PID (TP V PID) between 3.42 and 9.85% (0.17 and 0.49 volt) in key ON engine OFF, continuous memory or key ON engine running indicates a hard fault.
P1121 - Throttle Position (TP) Sensor Inconsistent with MAF Sensor	The PCM monitors a vehicle operation rationality check by comparing sensed throttle position to mass air flow readings. If during key ON engine running self-test the comparison of the TP sensor and MAF sensor readings are not consistent with calibrated load values, the test fails and a diagnostic trouble code is stored in continuous memory.	<ul style="list-style-type: none"> • Air leak between MAF sensor and throttle body • TP sensor not seated properly • Damaged TP sensor • Damaged MAF sensor 	Drive vehicle and exercise throttle and TP sensor in all gears. A TP PID (TP V PID) less than 4.82 % (0.24 volt) with a LOAD PID greater than 55% or a TP V PID greater than 49.05% (2.44 volts) with a LOAD PID less than 30% indicates a hard fault.
P1124 - Throttle Position (TP) Sensor Out of Self-Test Range	The TP sensor circuit is monitored by the PCM for an out of range TP rotation angle (or voltage) input. If during key ON engine OFF or key ON engine running the TP rotation angle (or voltage) reading is less than 13.27% (0.66 volt) or greater than 23.52% (1.17	<ul style="list-style-type: none"> • Binding or bent throttle linkage • TP sensor not seated properly • Throttle plate below closed throttle position • Throttle plate/screw misadjusted • Damaged TP sensor • Damaged PCM 	A TP PID (TP V PID) reading not between 13.27 and 23.52% (0.66 and 1.17 volts) in key ON engine OFF or key ON engine running indicates a hard fault.

	volts), the test fails.		
P1125 - Throttle Position (TP) Sensor Intermittent	The TP sensor circuit is monitored by the PCM for sudden TP rotation angle (or voltage) input change through the comprehensive component monitor (CCM). If during the last 80 warm-up cycles in key ON engine running the PCM detects a TP rotation angle (or voltage) changes beyond the minimum or maximum calibrated limit, a continuous diagnostic trouble code (DTC) is stored.	<ul style="list-style-type: none"> • Poor continuity through the TP sensor connectors • Poor continuity through the TP harness • Intermittent open or short inside the TP sensor 	While accessing the TP V PID on the scan tool, lightly tap on the TP sensor or wiggle the TP sensor connector and harness. If the TP V PID suddenly changes below 0.49 volt or above 4.65 volts, an intermittent fault is indicated.
P1127 - Exhaust Not Warm Enough, Downstream Sensor Not Tested	The HEGO monitor uses an exhaust temperature model to determine when the HO2S heaters are cycled ON. The test fails when the inferred exhaust temperature is below a minimum calibrated value.	<ul style="list-style-type: none"> • Engine not operating long enough prior to performing KOER self-test. • Exhaust system too cool. 	Monitor HO2S Heater PIDs to determine their ON/OFF state. DTC P1127 will be present if the exhaust is not hot.
P1128 - Upstream Oxygen Sensors Swapped from Bank to Bank (HO2S-11-21)	The HEGO monitor checks and determines if the HO2S signal response for a fuel shift corresponds to the correct engine bank. The test fails when a response from the HO2S(s) being tested is not indicated.	<ul style="list-style-type: none"> • Crossed HO2S harness connectors (upstream). • Crossed HO2S wiring at the harness connectors (upstream). • Crossed HO2S wiring at the 104-pin harness connectors (upstream). 	
P1129 - Downstream Oxygen Sensors Swapped from Bank to Bank (HO2S-12-22)	The HEGO monitor checks and determines if the HO2S signal response for a fuel shift corresponds to the correct engine bank. The test fails when a response from the HO2S(s) being tested is not	<ul style="list-style-type: none"> • Crossed HO2S harness connectors (downstream). • Crossed HO2S wiring at the harness connectors (downstream). • Crossed HO2S wiring at the 104-pin harness connectors (downstream). 	

	indicated.		
P1130 - Lack of HO2S-11 Switch, Fuel Trim at Limit	The HEGO Sensor is monitored for switching. The test fails when the HO2S fails to switch due to circuit or fuel at or exceeding a calibrated limit.	<p>Electrical:</p> <ul style="list-style-type: none"> • Short to VPWR in harness or HO2S • Water in harness connector • Open/Shorted HO2S circuit • Corrosion or poor mating terminals and wiring • Damaged HO2S • Damaged PCM <p>Fuel System:</p> <ul style="list-style-type: none"> • Excessive fuel pressure • Leaking/contaminated fuel injectors • Leaking fuel pressure regulator • Low fuel pressure or running out of fuel • Vapor recovery system <p>Induction System:</p> <ul style="list-style-type: none"> • Air leaks after the MAF • Vacuum Leaks • PCV system • Improperly seated engine oil dipstick <p>EGR System:</p> <ul style="list-style-type: none"> • Leaking gasket • Stuck EGR valve • Leaking diaphragm or EVR <p>Base Engine:</p> <ul style="list-style-type: none"> • Oil overfill • Cam timing • Cylinder compression • Exhaust leaks before or near the HO2S(s) 	A fuel control HO2S PID switching across 0.45 volt from 0.2 to 0.9 volt indicates a normal switching HO2S.
P1131 - Lack of HO2S-11 Switch, Sensor Indicates Lean	A HEGO sensor indicating lean at the end of a test is trying to correct for an over-rich condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time.	See Possible Causes for DTC P1130	
P1132 - Lack of HO2S-11 Switch, Sensor Indicates Rich	A HEGO sensor indicating rich at the end of a test is trying to correct for an over-lean condition. The test fails when the fuel control system no	See Possible Causes for DTC P1130	

	longer detects switching for a calibrated amount of time.		
P1137 - Lack of HO2S-12 Switch, Sensor Indicates Lean	The downstream HO2S sensors are forced rich and lean and monitored by the PCM. The test fails if the PCM does not detect the output of the HO2S in a calibrated amount of time.	<ul style="list-style-type: none"> • Pinched, shorted, and corroded wiring and pins • Crossed sensor wires • Exhaust leaks • Contaminated or damaged sensor 	
P1138 - Lack of HO2S-12 Switch, Sensor Indicates Rich	See DTC P1137		
P1150 - Lack of HO2S-21 Switch, Fuel Trim at Limit	See DTC P1130		
P1151 - Lack of HO2S-21 Switch, Sensor Indicates Lean	A HEGO sensor indicating lean at the end of a test is trying to correct for an over-rich condition. The test fails when fuel control system no longer detects switching for a calibrated amount of time.	See Possible Causes for DTC P1130	
P1152 - Lack of HO2S-21 Switch, Sensor Indicates Rich	A HEGO sensor indicating rich at the end of a test is trying to correct for an over-lean condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time.	See Possible Causes for DTC P1130	
P1157 - Lack of HO2S-22 Switch, Sensor Indicates Lean	See DTC P1137		
P1158 - Lack of HO2S-22 Switch, Sensor Indicates Rich	See DTC P1137		
P1168 - Fuel Rail Pressure Sensor in Range But Low	The comprehensive component monitor (CCM) monitors the FRP pressure for acceptable fuel	<ul style="list-style-type: none"> • Low fuel pressure • Damaged FRP sensor • Excessive resistance in circuit • Low or no fuel 	<p>A FRP PID value below 551 kpa (80 psi) indicates a failure</p> <ul style="list-style-type: none"> • Low or no fuel

	pressure. The test fails when the fuel pressure falls below a calibrated value.		A FRP PID value greater than 896 kpa (130 psi) indicates a failure
P1169 - Fuel Rail Pressure (FRP) Sensor in Range But High	The comprehensive component monitor (CCM) monitors the FRP pressure for acceptable fuel pressure. The test fails when the fuel pressure falls below or exceeds a minimum/maximum calibrated value for a calibrated period of time.	<ul style="list-style-type: none"> • High fuel pressure • Low fuel pressure • Damaged FRP sensor • Excessive resistance in circuit 	
P1180 - Fuel Delivery System - Low	The PCM receives fuel tank pressure (FTP) information from the natural gas module (NG), which uses the information to infer fuel rail pressure (FRP). The test fails when the inferred pressure is less than a minimum calibrated value.	<ul style="list-style-type: none"> • Restriction in the fuel line • Plugged fuel filter 	
P1181 - Fuel Delivery System - High	The PCM receives fuel tank pressure (FTP) information from the natural gas module (NG), which uses the information to infer fuel rail pressure (FRP). The test fails when the inferred pressure is higher than a maximum calibrated value.	<ul style="list-style-type: none"> • Fuel pressure regulator 	
P1183 - Engine Oil Temperature (EOT) Sensor Circuit Malfunction	Indicates EOT circuit became intermittently open or shorted while engine was running.	<ul style="list-style-type: none"> • Damaged harness • Damaged sensor • Damaged harness connector • Damaged PCM 	EOT V PID reading less than 0.2 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault short to ground. EOT V PID reading greater than 4.5 volts with key ON and engine OFF or during any engine operating mode indicates an open circuit hard fault.
P1184 - Engine Oil	Indicates EOT	<ul style="list-style-type: none"> • Damaged harness 	Engine should be at

Temperature (EOT) Sensor Out of Self-Test Range	signal was out of Self-Test range. Correct range for KOER is 0.3-1.2 volts.	<ul style="list-style-type: none"> • Damaged sensor • Damaged harness connector • Damaged PCM 	operating temperature before running self-test.
P1229 - Supercharger Intercooler Pump (ICP) Pump Not Operating	The ICP DTC will be set when the PCM is calling for the pump to be operating but no current is being detected.	<ul style="list-style-type: none"> • Pump motor open circuited • Pump relay coil open • Open circuit between relay and pump • Damaged PCM • Pump motor shorted • Open circuit between PCM and relay • Poor pump ground connection 	Check for voltage at relay, check fuse in power feed, check ground connection of pump motor, PID reading is on/off.
P1232 - Low Speed Fuel Pump Primary Circuit Malfunction	The PCM monitors the low speed fuel pump (LFP) primary circuit output from the PCM. The test fails if: When the LFP circuit is commanded on (grounded), excessive current draw is detected on the LFP circuit; or when the LFP circuit is commanded off, voltage is not detected on the LFP circuit (the PCM expects to detect VPWR voltage coming through the low speed fuel pump relay coil to the LFP circuit).	<ul style="list-style-type: none"> • Open or shorted low fuel pump (LFP) circuit • Open VPWR to low speed fuel pump relay • Damaged low speed fuel pump relay • Damaged PCM 	<ul style="list-style-type: none"> ■ An open circuit or short to ground can only be detected with the low speed fuel pump. ■ A short to power can only be detected with the low speed fuel pump commanded on. ■ During KOEO and KOER Self-Test, the low speed fuel pump output command will be cycled on and off.
P1233 - Fuel System Disabled or Offline	<p>LS6/LS8: For LS6/LS8, P1233 indicates the PCM is not receiving the fuel level information on SCP from the rear electronics module (REM). Refer to the Workshop Manual Section 413-01 for diagnostics.</p> <p>All Others: The PCM monitors the fuel pump monitor (FPM) circuit from the fuel pump driver module (FPDM). With the key on,</p>	<ul style="list-style-type: none"> • Inertia fuel shutoff (IFS) switch needs to be reset • Open FPDM ground circuit • Open or shorted FPM circuit • Damaged IFS switch • Damaged FPDM • Damaged PCM • Also for Escort/Tracer and Mustang: <ul style="list-style-type: none"> ■ Open FPDM PWR circuit ■ Open B+ circuit to constant control relay module (CCRM) pin 11 ■ Open ground to CCRM pin 18 (Mustang) ■ Damaged CCRM • Also for Continental: <ul style="list-style-type: none"> ■ Open VPWR circuit to 	The PCM expects to see one of the following duty cycle signals from the FPDM on the FPM circuit: 1) 50% (500 msec on, 500 msec off), all OK. 2) 25% (250 msec on, 750 msec off), FPDM did not receive a fuel pump (FP) duty cycle command from the PCM, or the duty cycle that was received was invalid. 3) 75% (750 msec ON, 250 OFF), the FPDM has detected a fault in the circuits between the FPDM and the fuel pump.

	the FPDM continuously sends a duty cycle signal to the PCM through the FPM circuit. The test fails if the PCM stops receiving the duty cycle signal.	FPDM	
P1234 - Fuel System Disabled or Offline	See DTC P1233. P1234 is identical to P1233 except P1234 will not illuminate the MIL.		
P1235 - Fuel Pump Control Out Of Range	Note: For LS6/LS8, the FPDM functions are incorporated in the Rear Electronics Module (REM). Also, the REM does not use a FPM circuit. Diagnostic information will be sent through SCP. Indicates that the FPDM has detected an invalid or missing FP circuit signal from the PCM. The FPDM will send a message to the PCM through the FPM circuit, indicating that this failure has been detected. The PCM will set the DTC when the message is received.	<ul style="list-style-type: none"> ● FP circuit open or shorted ● Damaged FPDM. ● Damaged PCM 	The FPDM sends a 25% duty cycle (250 msec ON, 750 msec OFF) through the FPM circuit to the PCM while the fault is being detected by the FPDM. If the fault is no longer detected, the PDM will return to sending an "all OK" (50% duty cycle) message to the PCM. The PCM will keep P1235 stored in Continuous Memory.
P1236 - Fuel Pump Control Out Of Range	See DTC P1235. P1236 is identical to P1235 except P1236 will not illuminate the MIL.		
P1237 - Fuel Pump Secondary Circuit Malfunction	Note: For LS6/LS8, the FPDM functions are incorporated in the rear electronics module (REM). Also, the REM does not use a FPM circuit. Diagnostic information will be set through SCP. Indicates that the FPDM has	<ul style="list-style-type: none"> ● Open or shorted FP PWR circuit ● Open FP RTN circuit to FPDM ● Open or shorted circuit in the fuel pump ● Locked fuel pump rotor ● Damaged FPDM ● For LS6/LS8, circuits associated with the Fuel Pump relay 	<ul style="list-style-type: none"> ■ The FPDM sends a 75% duty cycle (750 msec ON, 250 msec OFF) through the FPM circuit to the PCM while the fault is being detected by the FPDM. If the fault is no longer detected, the PCM will return to sending an "all OK" (50% duty

	detected a fuel pump secondary circuit fault. The FPDM will send a message to the PCM through the FPM circuit, indicating that this failure has been detected. The PCM will set the DTC when the message is received.		cycle) message to the PCM. The PCM will keep P1237 stored in Continuous Memory. <ul style="list-style-type: none"> ■ The FPDM controls pump speed by supplying a "variable" ground on the RTN circuit.
P1238 - Fuel Pump Secondary Circuit Malfunction	See DTC P1237. P1238 is identical to P1237 except P1238 will not illuminate the MIL.		
P1244 - Generator Load Input Low	The PCM monitors the GLI circuit, and will set the DTC when the input is below calibrated limit for a calibrated amount of time.	<ul style="list-style-type: none"> ● GLI circuit open or short ● Damaged voltage regulator/generator ● Damaged PCM 	Verify operation of charging system.
P1245 - Generator Load Input High	The PCM monitors the GLI circuit, and will set the DTC when the input is above a calibrated limit for a calibrated amount of time.	<ul style="list-style-type: none"> ● GLI circuit open or short ● Damaged voltage regulator/generator ● Damaged PCM 	Verify operation of charging system.
P1246 - Generator Load Input (2.0L Cougar)	The PCM monitors the GLI circuit, and will set the DTC when the input is not within a calibrated limit for a calibrated amount of time.	<ul style="list-style-type: none"> ● GLI circuit concern. ● Damaged voltage regulator/generator ● Damaged PCM. 	<ul style="list-style-type: none"> ● Verify operation of charging system. ● Verify battery is at proper charge.
P1246 - Generator Load Input Failed (All Others)	The PCM monitors generator load from the generator/regulator in the form of frequency. The frequency range is determined by the temperature of the voltage regulator where 97% represents full load, below 6% means no load.	<ul style="list-style-type: none"> ● Generator circuit short to GND ● Generator circuit short to PWR ● Generator circuit open ● Generator drive mechanism ● Damaged generator/regulator assembly ● Damaged PCM 	<ul style="list-style-type: none"> ■ Verify battery voltage is 14.5V. ■ Verify generator/regulator has the correct part number.
P1260 - Theft Detected - Vehicle Immobilized	Indicates that the passive anti-theft system (PATS) has determined a theft	<ul style="list-style-type: none"> ● Previous theft condition ● Anti-Theft System failure 	Theft indicator flashing rapidly or on solid when ignition switch is in the ON position. Check anti-

	condition existed and the engine is disabled. This DTC is a good indicator to check the PATS for DTCs.		theft system for DTCs. Typical vehicle symptoms are: Start/Stall or Crank/No Start. NOTE: No crank symptom only on vehicles equipped with PATS starter disable feature.
P1270 - Engine RPM/Vehicle Speed Limiter	Indicates the vehicle has been operated in a manner which caused the engine or vehicle to exceed a calibration limit. The engine rpm and vehicle speed are continuously monitored by the PCM. The DTC is set when the rpm or speed fall out of calibrated range. For additional information on the engine rpm/vehicle speed limiter, refer to Section 1, <u>Electronic Engine Control (EC) System</u> , Powertrain Control Software.	<ul style="list-style-type: none"> • Wheel slippage (water, ice, mud and snow) • Excessive engine rpm in Neutral • Vehicle drive at a high rate of speed 	The DTC indicates the vehicle has been operated in a manner which caused the engine or vehicle speed to exceed a calibrated limit.
P1285 - Cylinder Head Over Temperature Sensed	Indicates an engine overheat condition was sensed by the cylinder head temperature sensor.	<ul style="list-style-type: none"> • Low engine coolant level • Base engine concerns • Engine cooling system concerns • CHT sensor concern 	On some applications when this fault occurs the Engine Temperature warning indicator will illuminate and/or force the temperature gauge to full H (Hot) zone by grounding the engine temperature warning circuit.
P1288 - Cylinder Head Temperature (CHT) Sensor Circuit Out of Self-Test Range	Indicates the CHT sensor is out of Self-Test range. Engine not at operating temperature.	<ul style="list-style-type: none"> • Cold engine • Engine overheating • Damaged harness connector • Damaged PCM • Low engine coolant level • Damaged CHT sensor 	Bring engine to operating temperature. If cold, re-run self-test. If engine over-heats check cooling system.
P1289 - Cylinder Head Temperature (CHT) Sensor Circuit High Input (PCM STRATEGIES UP TO AND INCLUDING 1998)	Indicates a CHT sensor circuit malfunction (shorted).	<ul style="list-style-type: none"> • Grounded circuit in CHT harness • Damaged CHT sensor • Improper harness connection • Damaged PCM 	CHT V PID reading less than 0.2 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault. Note: DTC P0117 may also be reported when this DTC is set, either of these DTC's will activate the

			MIL light.
P1289 - Cylinder Head Temperature (CHT) Sensor Circuit High Input (PCM STRATEGIES 1999 AND BEYOND)	Indicates a CHT sensor circuit malfunction (open).	<ul style="list-style-type: none"> • Open circuit in CHT harness • Damaged CHT sensor • Improper harness connection • Damaged PCM 	CHT V PID reading greater than 4.6 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault. Note: DTC P0118 may also be reported when this DTC is set, either of these DTC's will activate the MIL light.
P1290 - Cylinder Head Temperature (CHT) Sensor Circuit Low Input (PCM STRATEGIES UP TO AND INCLUDING 1998)	Indicates a CHT sensor circuit malfunction (open).	<ul style="list-style-type: none"> • Open circuit in CHT harness • Damaged CHT sensor • Improper harness connection • Damaged PCM 	CHT V PID reading greater than 4.6 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault. Note: DTC P0118 may also be reported when this DTC is set, either of these DTC's will activate the MIL light.
P1290 - Cylinder Head Temperature (CHT) Sensor Circuit Low Input (PCM STRATEGIES 1999 AND BEYOND)	Indicates a CHT sensor circuit malfunction (shorted).	<ul style="list-style-type: none"> • Grounded circuit in CHT harness • Damaged CHT sensor • Improper harness connection • Damaged PCM 	CHT V PID reading greater than 4.6 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault. Note: DTC P0118 may also be reported when this DTC is set, either of these DTC's will activate the MIL light.
P1299 - Cylinder Head Over Temperature Protection Active	Indicates an engine overheat condition was detected by the cylinder head temperature (CHT) sensor. An FMEM Strategy called Fail-safe Cooling was activated to cool the engine.	<ul style="list-style-type: none"> • Engine cooling system concerns • Low engine coolant level • Base engine concerns 	Refer to Section 1, Powertrain Control Software , for more information on Fail-safe Cooling Strategy and cylinder head temperature sensor.
P1309 - Misfire Monitor Disabled	When the misfire monitor is disabled, usually due to the input signal generated by the camshaft position (CMP) sensor, by sensing the passage of teeth from the CMP wheel.	<ul style="list-style-type: none"> • Camshaft position sensor • Powertrain control module • ECT, MAF, and CKP sensors 	Verify the CMP is installed correctly and not out of synchronization.
P1380 - Variable Cam Timing Solenoid A Circuit Malfunction	The comprehensive component monitor (CCM) monitors	<ul style="list-style-type: none"> • Open or short VCT circuit • Open VPWR circuit • Damaged PCM • Open or short VCT solenoid 	DTC P1380 is a VCT circuit check. Testing should include wires, solenoid coil and PCM.

	the VCT circuit to the PCM for high and low voltage. If during testing voltage was to fall below a calibrated limit a calibrated amount of time the test will fail.	valve	
P1381 - Variable Cam Timing Over-advanced (Bank 1)	The comprehensive component monitor (CCM) monitors the VCT position for an over-advanced camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an advanced position.	<ul style="list-style-type: none"> • Cam timing improperly set • No oil flow to the VCT piston chamber • Low oil pressure • VCT solenoid valve stuck closed • Camshaft advance mechanism binding (VCT unit) 	P1381 DTC is a check of the VCT unit. Testing should not include electrical checks. Diagnostics and repair for the VCT unit are located in the Workshop Manual.
P1383 - Variable Cam Timing Over-retarded (Bank 1)	The comprehensive component monitor (CCM) monitors the VCT position for over-retarded camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an retarded position.	<ul style="list-style-type: none"> • Cam timing improperly set • Continuous oil flow to the VCT piston chamber • VCT solenoid valve stuck open • Camshaft advance mechanism binding (VCT unit) 	DTC P1383 is a check of the VCT unit. Testing should not include electrical checks. Engine will idle rough, hard starting and may stall. Diagnostics and repair for the VCT unit are located in the Workshop Manual.
P1400 - DPF EGR Sensor Circuit Low Voltage Detected	The EGR monitor checks the DPF EGR sensor signal to the PCM for low voltage. The test fails when the average voltage to the PCM drops to a voltage less than the minimum calibrated value.	<ul style="list-style-type: none"> • DPF EGR circuit short to GND • Damaged DPF EGR sensor • VREF short to GND • Damaged PCM 	A DPF EGR PID reading less than 0.2 volt with the key ON and engine OFF or running, indicates a hard fault.
P1401 - DPF EGR Sensor Circuit High Voltage Detected	The EGR monitor checks the DPF EGR sensor signal to the PCM for high voltage. The test fails when the average voltage to the PCM goes to a voltage greater than the maximum calibrated value.	<ul style="list-style-type: none"> • DPF EGR circuit open • VREF short to PWR • Damaged DPF EGR sensor • DPF EGR circuit short to PWR • SIG RTN circuit open • Damaged PCM 	A DPF EGR PID reading greater than 4.5 volts with the key ON and engine OFF or running, indicates a hard fault.
P1405 - DPF EGR	While driving, the	<ul style="list-style-type: none"> • Upstream hose is 	<ul style="list-style-type: none"> ■ Look for signs of

Sensor Upstream Hose Off or Plugged	<p>EGR monitor commands the EGR valve closed and checks the differential pressure across the EGR orifice. The test fails when the signal from the DPF EGR sensor indicates EGR flow is in the negative direction.</p>	<p>disconnected</p> <ul style="list-style-type: none"> ● Upstream hose is plugged (ice) ● Plugged or damaged EGR tube 	<p>water or icing in hose</p> <ul style="list-style-type: none"> ■ Verify hose connection and routing (no excessive dips) ■ Verify DPF EGR sensor proper mounting and function (view DPF EGR PID while applying and releasing vacuum directly to sensor with a hand pump)
P1406 - DPF EGR Sensor Downstream Hose Off or Plugged	<p>While driving, the EGR monitor commands the EGR valve closed and checks the differential pressure across the EGR orifice. The test fails when the signal from the DPF EGR sensor continues to indicate EGR flow even after the EGR valve is commanded closed.</p>	<ul style="list-style-type: none"> ● Downstream hose is disconnected ● Downstream hose is plugged (ice) ● Plugged or damaged EGR tube 	<ul style="list-style-type: none"> ■ Look for signs of water or icing in hose ■ Verify connection and routing (no excessive dips) ■ Verify DPF EGR sensor proper mounting and function (view DPF EGR PID while applying and releasing vacuum directly to sensor with a hand pump)
P1408 - EGR Flow Out of Self-Test Range (Non MIL)	<p>This test is performed during the KOER on demand self-test only. The EGR system is commanded ON at a fixed engine speed. The test fails and the DTC is output when the measured EGR flow falls above or below the required calibration .</p>	<p>For vacuum activated systems see Possible Causes for DTC P0401. For electric motor system see Possible Causes DTC P0400.</p>	<p>For Electric EGR, use the output state control function of the scan tool and monitor the MAP PID (MAP) and the EEGR PID (EGRMDS) while commanding the EEGR on. If EGR is introduced into the engine at idle, the rpm will drop or stall out. For vacuum systems see Diagnostic Aids for P0401.</p>
P1409 - EGR Vacuum Regulator Solenoid Circuit Malfunction	<p>This test checks the electrical function of the EGRVR solenoid. The test fails when the EGRVR circuit voltage is either too high or too low when compared to the expected voltage range. The EGR system must be enabled for the test to be completed.</p>	<ul style="list-style-type: none"> ● EGRVR circuit open ● VPWR open to EGRVR solenoid ● EGRVR circuit short to VPWR or GND ● Damaged EGRVR solenoid ● Damaged PCM 	<p>The EGR vacuum regulator solenoid resistance is from 26 to 40 ohms.</p>

P1411 - Secondary Air Injection (AIR) system downstream flow	The secondary air injection system does not detect the presence of air in the exhaust when introduced by the secondary air injection system	<ul style="list-style-type: none"> • Electric AIR Pump • Hose from AIR pump leak • AIR bypass solenoid leak/blocked • Hose from AIR pump blocked • AIR bypass solenoid stuck open/closed 	In order to test the AIR pump, it must be capable of driving the HO2S lean.
P1413 Secondary Air Injection System Monitor Circuit Low	The secondary air injection system monitor circuit is low, indicating the electrical AIR pump is off although the electrical AIR pump was commanded on by the PCM.	<ul style="list-style-type: none"> • Open B+ circuit • Open AIR circuit • Damaged PCM • Air circuit short to ground • Damaged AIR pump • Damaged solid state relay 	The AIR monitor circuit is held low by the resistance path through the AIR pump when the pump is off. Also, look for open circuit from SSR to AIR pump.
P1414 Secondary Air Injection System Monitor Circuit High	The secondary air injection system monitor circuit is high, indicating the electrical AIR pump is on although the electrical AIR pump was commanded off by the PCM.	<ul style="list-style-type: none"> • Open AIR monitor circuit from the pump • AIR circuit short to power • Damaged solid state relay • Open AIR pump ground • Damaged AIR pump • Damaged PCM 	
P1432 - Thermostat Heater Control (THTRC) Circuit Failure	The Comprehensive component monitor (CCM) monitors the THTRC circuit to the PCM for high and low voltage. If during testing; voltage was to fall below a calibrated limit for a calibrated amount of time the test will fail and set the DTC and MIL.	<ul style="list-style-type: none"> • Open or shorted THTRC circuit • Open VPWR • Open or shorted thermostat assembly • Damaged PCM 	DTC P1432 is a THTRC circuit check. Testing should include wire harness, thermostat heater and PCM.
P1443 - Very Small Or No Purge Flow Condition	A fuel tank pressure change greater than a minus (-) 7 inches of H ₂ O in 30 seconds has occurred with purge (fuel vapor) flow less than 0.02 pounds per minute.	<ul style="list-style-type: none"> • Blocked fuel vapor hose between EVAP canister purge valve and FTP sensor. • Blocked fuel vapor hose between EVAP canister purge valve and engine intake manifold. • Blocked vacuum hose between EVAP canister purge valve-solenoid and engine intake manifold. • EVAP canister purge valve stuck closed (mechanically). 	Check for blockages between the fuel tank, EVAP canister purge valve and engine intake manifold. Check obstructions in the EVAP canister purge valve diaphragm and ports.
P1450 - Unable to Bleed Up Fuel Tank	Monitors the fuel vapor vacuum and	<ul style="list-style-type: none"> • Blockages or kinks in EVAP canister tube or EVAP 	

Vacuum	<p>pressure in the fuel tank. The system failure occurs when the EVAP running loss monitor detects excessive fuel tank vacuum with the engine running (but not at idle).</p>	<p>canister purge outlet tube (between fuel tank, EVAP canister purge valve and EVAP canister)</p> <ul style="list-style-type: none"> ● Fuel filler cap stuck closed (no vacuum relief) ● Contaminated fuel vapor elbow on EVAP canister ● Restricted EVAP canister ● CV solenoid stuck open (partially or fully) ● Plugged CV solenoid filter ● EVAP canister purge valve stuck open ● VREF circuit open (harness near FTP sensor, FTP sensor or PCM) ● Damaged FTP sensor 	
P1451 - EVAP Control System Canister Vent Solenoid Circuit Malfunction	<p>Monitors the canister vent (CV) solenoid circuit for an electrical failure. The test fails when the signal moves outside the minimum or maximum allowable calibrated parameters for a specified canister vent duty cycle by PCM command.</p>	<ul style="list-style-type: none"> ● VPWR circuit open ● CV solenoid circuit shorted to PWR GND or CHASSIS GND ● Damaged CV solenoid ● CV solenoid circuit open ● CV solenoid circuit shorted to VPWR ● Damaged PCM 	<ul style="list-style-type: none"> ■ Monitor EVAPCV PID and voltage between canister vent solenoid signal and PWR GND in output test mode with key ON engine OFF (or in key ON engine RUNNING mode) ■ EVAPCV PID at 0% and voltage less than 1.0 volt (or EVAPCV PID at 100% and voltage greater than 0.5 volt) indicates a hard fault
P1460 - Wide Open Throttle A/C Cutout Primary Circuit Malfunction	<p>NOTE: For applications that use a normally open relay to control the A/C clutch, the following description applies to the A/C clutch relay control circuit. Monitors the wide open throttle A/C cutoff (WAC) circuit output from the PCM. The test fails if: When the PCM grounds the WAC circuit, excessive current draw is detected on the WAC circuit; or with the WAC circuit not grounded by the PCM, voltage is</p>	<ul style="list-style-type: none"> ● Open or shorted WAC circuit ● Damaged WAC relay (or CCRM) ● Open VPWR circuit to WAC relay ● Damaged PCM 	<ul style="list-style-type: none"> ■ When the WACF PID reads YES, a fault is currently present ■ An open circuit or short to ground can only be detected when the PCM is not grounding the circuit ■ A short to power can only be detected when the PCM is grounding the circuit ■ During KOEO and KOER self-test, the WAC circuit will be cycled ON and OFF ■ Verify A/C and defrost were OFF during KOEO and KOER self-test

	not detected on the WAC circuit (the PCM expects to detect VPWR voltage coming through the WAC relay coil to the WAC circuit).		(Check ACCS PID to verify) <ul style="list-style-type: none"> ■ If vehicle is not equipped with A/C, DTC P1460 can be ignored
P1461 - Air Conditioning Pressure Sensor (ACP) Sensor High Voltage Detected	ACP inputs a voltage to the PCM. If the voltage is above a calibrated level the DTC will set.	<ul style="list-style-type: none"> ● ACP sensor circuit short to PWR ● ACP circuit open ● Damaged PCM ● ACP circuit short to VREF ● ACP circuit short to SIGRTN ● Damaged ACP sensor 	Verify VREF voltage between 4.0 and 6.0V.
P1462 - Air Conditioning Pressure Sensor (ACP) Sensor Low Voltage Detected	ACP inputs a voltage to the PCM. If the voltage is below the calibrated level the DTC will set.	<ul style="list-style-type: none"> ● ACP circuit short to GND or SIGRTN ● VREF circuit open ● Damaged PCM ● Open ACP circuit ● Damaged ACP sensor 	Verify VREF voltage between 4.0 and 6.0V.
P1463 - Air Conditioning Pressure Sensor (ACP) Insufficient Pressure Change	Each time the A/C clutch engages, the PCM is looking for a pressure change in the refrigerant. If the change in pressure is outside of the calibration the DTC will set.	<ul style="list-style-type: none"> ● A/C system mechanical failure ● Open ACP or VREF circuit ● A/C sensor damaged ● A/C system electrical failure ● A/C clutch always engaged 	Verify A/C system function, including refrigerant charge.
P1464 - A/C Demand Out Of Self-Test Range	Indicates the ACCS input to the PCM was high during Self-Test.	<ul style="list-style-type: none"> ● A/C was on during self-test ● A/C Clutch PWR circuit short to power (applications with N/C WAC relay contacts) ● ACCS circuit short to power ● Damaged A/C demand switch ● Damaged WAC relay (or CCRM) ● Damaged PCM 	If A/C or defrost were on during self-test, turn off and rerun test.
P1469 - Low A/C Cycling Period	Indicates frequent A/C compressor clutch cycling.	<ul style="list-style-type: none"> ● Mechanical A/C system concern (such as low refrigerant charge, damaged A/C cycling switch) ● Intermittent open between the cycling pressure switch and pin 41 (ACCS) to the PCM ● Intermittent open in IGN RUN circuit to cycling pressure switch (if applicable) 	<ul style="list-style-type: none"> ■ An intermittent open circuit, although possible, is unlikely ■ This test was designed to protect the transmission. In some strategies, the PCM will unlock the torque converter during A/C clutch engagement. If a concern is present that results in frequent A/C clutch cycling, damage could occur if the torque converter was cycled at

			these intervals. This test will detect this condition, set the DTC and prevent the torque converter from excessive cycling.
P1474 - Low Fan Control (LFC) Primary Circuit Failure	Monitors the low fan control (LFC) (fan control [FC] for one speed fan application) primary circuit output from the PCM. The test fails if: When the PCM grounds the LFC/FC circuit, excessive current draw is detected on the LFC/FC circuit; or with the LFC/FC circuit not grounded by the PCM, voltage is not detected on the LFC/FC circuit (the PCM expects to detect VPWR voltage coming through the low speed FC relay [or CCRM] coil to the LFC/FC circuit).	<ul style="list-style-type: none"> ● Open or shorted LFC/FC circuit ● Open VPWR circuit to low speed FC relay ● Damaged low speed FC relay (or CCRM) ● Damaged PCM 	<ul style="list-style-type: none"> ■ When the LFCF PID reads YES, a fault is currently present ■ An open circuit or short to ground can only be detected when the PCM is not grounding the LFC/FC circuit ■ A short to power can only be detected when the PCM is grounding the LFC/FC circuit. ■ During KOEO and KOER Self-Test, the LFC/FC circuit will be cycled on and off
P1474 - Hydraulic Cooling Fan Primary Circuit Failure (HCF)	This test checks the electrical function of the (HCF) primary circuit. The test fails if: the PCM detects voltage either too high or too low when compared to the expected voltage range on the (HCF) primary circuit.	<ul style="list-style-type: none"> ● HCF circuit open ● HCF circuit short to power ● HCF circuit short to ground ● Damaged HCF solenoid ● Damaged PCM 	The HCF solenoid is integrated in the HCF pump which looks like a power steering pump. The electrical resistance of the solenoid windings is nominally 10 ohms.
P1477 - Medium Fan Control (MFC) Primary Circuit Failure	Monitors the medium fan control (MFC) primary circuit output from the PCM. The test fails if: With the MFC output commanded on (grounded), excessive current draw is detected on the MFC circuit; or with the MFC circuit commanded off, voltage is not	<ul style="list-style-type: none"> ● Open or shorted MFC circuit ● Open IGN START/RUN circuit to medium speed FC relay ● Damaged medium speed FC relay ● Damaged PCM 	<ul style="list-style-type: none"> ■ Same as P1479, except with MFC circuit and MFCF PID (for early build Escape, MFCF and MFC PIDs may not be available) ■ Using Output Test Mode on scan tool, when commanding the low speed fan on, the PCM will also activate the medium speed fan

	detected on the MFC circuit (the PCM expects to detect IGN START/RUN voltage coming through the medium speed FC relay coil to the MFC circuit).		output.
P1479 - High Fan Control (HFC) Primary Circuit Failure	Monitors the high fan control (HFC) primary circuit output from the PCM. The test fails if: With the HFC output commanded on (grounded), excessive current draw is detected on the HFC circuit; or with the HFC circuit commanded off, voltage is not detected on the HFC circuit (the PCM expects to detect VPWR voltage coming through the high speed FC relay [or CCRM] coil to the HFC circuit).	<ul style="list-style-type: none"> • Open or shorted HFC circuit • Open VPWR circuit to high speed FC relay • Damaged high speed FC relay (or CCRM) • Damaged PCM 	<ul style="list-style-type: none"> ■ When the HFCF PID reads YES, a fault is currently present ■ An open circuit or short to ground can only be detected when the PCM is not grounding the HFC circuit ■ A short to power can only be detected when the PCM is grounding the HFC circuit ■ During KOEO and KOER self-test, the HFC circuit will be cycled on and off
P1500 - Vehicle Speed Sensor (VSS) Intermittent	Indicates the VSS input signal was intermittent. This DTC is set when a VSS fault interferes with other OBDII tests, such as Catalyst efficiency monitor, EVAP monitor, HO2S monitor, etc.	<ul style="list-style-type: none"> • Intermittent VSS connections • Intermittent open in VSS harness circuit(s) • Intermittent short in VSS harness circuit(s) • Damaged VSS • Damaged PCM 	
P1501 - Vehicle Speed Sensor (VSS) Out of Self Test Range	Indicates the VSS input signal is out of Self Test range. If the PCM detects a VSS input signal any time during Self Test, a DTC P1501 will be set and the test will abort.	<ul style="list-style-type: none"> • Noisy VSS input signal from Radio Frequency Interference/ Electro-Magnetic Interference (RFI/EMI) external sources such as ignition wires, charging circuit or after market equipment. 	Check for VSS input to be 0 mph when vehicle transmission is in Park.
P1502 - Vehicle Speed Sensor (VSS) Intermittent	Indicates the powertrain control module (PCM) detected an error in the vehicle speed information. Vehicle speed data	<ul style="list-style-type: none"> • Refer to possible causes for P0500. 	Refer to diagnostic aids for P0500.

	<p>is received from either the vehicle speed sensor (VSS), transfer case speed sensor (TCSS), anti-lock brake system (ABS) control module, generic electronic module (GEM), or central timer module (CTM). This DTC is set the same way as P0500. However, it is intended to flash the transmission control indicator lamp (TCIL) for first time VSS circuit error/malfunctions.</p>		
<p>P1502 - Vehicle Speed Sensor (VSS) Intermittent (TCIL illuminates)</p>	<p>Indicates the powertrain control module (PCM) detected an error in the vehicle speed information. Vehicle speed data is received from either the vehicle speed sensor (VSS), anti-lock brake system (ABS) control module, generic electronic module (GEM), or central timer module (CTM). This DTC is set the same way as P0500. However, it is intended to flash the transmission control indicator lamp (TCIL) for first time VSS circuit error/malfunctions.</p>	<p>Refer to possible causes for P0500</p>	<p>Refer to diagnostic aides for P0500</p>
<p>P1504 - Idle Air Control (IAC) Circuit Malfunction</p>	<p>This DTC is set when the PCM detects an electrical load failure on the IAC output circuit.</p>	<ul style="list-style-type: none"> ● IAC circuit open ● VPWR to IAC solenoid open ● IAC circuit short to PWR ● IAC circuit short to GND ● Damaged IAC valve ● Damaged PCM 	<ul style="list-style-type: none"> ■ The IAC solenoid resistance is from 6 to 13 ohms.
<p>P1506 - Idle Air Control (IAC) Overspeed Error</p>	<p>This DTC is set when the PCM detects engine idle speed that is greater than the desired rpm.</p>	<ul style="list-style-type: none"> ● IAC circuit short to GND ● Damaged IAC valve ● IAC valve stuck open ● Vacuum leaks ● Failed EVAP system ● Damaged PCM 	<p>Disconnect IAC valve and look for little or no change in engine rpm as an indication of a stuck or damaged valve.</p>

P1507 - Idle Air Control (IAC) Underspeed Error	<p>This DTC is set when the PCM detects engine idle speed that is less than the desired rpm.</p>	<ul style="list-style-type: none"> ● IAC circuit open ● IAC circuit short to PWR ● VPWR to IAC solenoid open ● Air inlet is plugged ● Damaged IAC solenoid ● Damaged PCM 	<ul style="list-style-type: none"> ■ The IAC solenoid resistance is from 6 to 13 ohms ■ Disconnect IAC valve and look for no change in engine rpm as an indication of a stuck or damaged valve
P1516 - Intake Manifold Runner Control Input Error (Bank 1)			
P1517 - Intake Manifold Runner Control Input Error (Bank 2)	<p>The IMRC system is monitored for failure during continuous or key ON engine OFF self-test. Each DTC will distinguish the corresponding failed bank for IMRC actuator assemblies with dual monitor switches. The test fails when the signal on the monitor pin is outside an expected calibrated range.</p>	<ul style="list-style-type: none"> ● Mechanical concern - bind, seize, damage or obstruction of IMRC hardware 	<ul style="list-style-type: none"> ■ An IMRCM PID reading at closed throttle that is less than VREF may indicate a fault ■ An IMRCM PID reading near 1 volt or greater with engine rpm of at least 3000 may indicate a fault
P1518 - Intake Manifold Runner Control Malfunction (Stuck Open)	<p>The IMRC system is monitored for failure during continuous, key ON engine OFF or key ON engine running self-test. The test fails when the signal on the monitor pin is less than an expected calibrated range at closed throttle.</p>	<ul style="list-style-type: none"> ● IMRC monitor signal circuit shorted to PWR GND or SIG RTN ● Damaged IMRC actuator ● Damaged PCM 	<p>An IMRCM PID reading approximately near 1 volt at closed throttle may indicate a fault</p>
P1519 - Inlet Manifold Runner Control Malfunction (Stuck Closed)	<p>The IMRC system is monitored for failure during continuous, key ON engine OFF or key ON engine running self-test. The test fails when the signal on the monitor pin is more than an expected calibrated range with IMRC activated.</p>	<ul style="list-style-type: none"> ● IMRC monitor circuit open ● IMRC control circuit open ● IMRC monitor circuit short to VREF ● IMRC monitor return circuit open ● Damaged IMRC actuator ● IMRC VPWR circuit open ● Damaged PCM 	<p>An IMRCM PID reading at VREF with engine rpm of at least 3000 may indicate a fault.</p>

P1549 - Intake Manifold Communication Control Circuit Malfunction	The IMCC or intake manifold tuning (IMT) valve system is monitored for failure during continuous or key ON engine OFF self-test. The test fails when the PCM detects a concern with IMT valve output circuit.	<ul style="list-style-type: none"> • Open IMT valve circuit • Open VPWR circuit • Shorted IMT valve circuit • Damaged IMT valve • Damaged PCM 	<ul style="list-style-type: none"> ■ An IMT valve fault PID (IMTVF) displaying YES status may indicate a fault
P1550 - Power Steering Pressure (PSP) Sensor Malfunction	The PSP sensor input signal to PCM is continuously monitored. The test fails when the signal falls out of a maximum or minimum calibrated range.	<ul style="list-style-type: none"> • PSP sensor damaged • Damaged PCM 	<ul style="list-style-type: none"> ■ The DTC indicates the PSP sensor is out of Self-Test range.
P1572 - Brake Pedal Switch Circuit	Indicates that the brake input rationality test for brake pedal position (BPP) and brake pressure applied (BPA) switches has failed. One or both inputs to the PCM did not change when it was expected to.	<ul style="list-style-type: none"> • Misadjusted brake switch • Blown fuse • Damaged BPP switch • Damaged BPA switch • Open or short in BPP circuit • Open or short in BPA circuit • Damaged PCM 	Check for proper function of stoplamps and speed control operation. Follow correct Self-Test procedures, refer to Section 2 Quick Test.
P1605 - Keep Alive Memory Test Failure	Indicates the PCM has experienced an internal memory test failure. However there are external items that can cause this DTC.	<ul style="list-style-type: none"> • Reprogramming • Battery terminal corrosion • Damaged PCM • KAPWR to PCM interrupt/open • Loose battery connection 	If KAPWR is interrupted to the PCM, because of a battery or PCM disconnect, DTC can be generated on the first power-up.
P1633 - Keep Alive Power Voltage Too Low	Indicates that the Keep Alive Power (KAPWR) circuit has experienced a power interrupt.	<ul style="list-style-type: none"> • Open KAPWR circuit • Damaged PCM • Intermittent KAPWR Circuit 	
P1635 - Tire/Axle Ratio Out Of Acceptable Range	This Diagnostic Trouble Code (DTC) indicates the tire and axle information contained in Vehicle ID block (VID) does not match vehicle hardware.	<ul style="list-style-type: none"> • Incorrect tire size • Incorrect axle ratio • Incorrect VID configuration parameters 	Using the scan tool, view the tire and axle parameters within the VID. They must match vehicle hardware.
P1636 - Inductive	Indicates the PCM	<ul style="list-style-type: none"> • PCM Damaged 	

Signature Chip Communication Error	has lost communication with the Inductive Signature Chip.		
P1639 - Vehicle ID Block Not Programed Or Is Corrupt	This diagnostic trouble code (DTC) indicates that the vehicle ID (VID) block is not programed or the information within is corrupt.	<ul style="list-style-type: none"> • New PCM • Incorrect PCM • Incorrect VID configuration 	Using an enhanced scan tool, reprogram the PCM to the most recent calibration available.
P1640 - Powertrain DTC's Available in Another Module	Vehicles using a secondary Engine Control Module can request that the Powertrain Control Module illuminate the Check Engine Light when a failure occurs which affect emission.	<ul style="list-style-type: none"> • DTCs stored in a secondary module, which requested the MIL to be turned on. 	Call-up PID address 0946 to determine secondary module requesting MIL illumination. Once secondary module is determined request DTCs from module.
P1650 - Power Steering Pressure (PSP) Switch Malfunction	In Key On, Engine Off Self-Test, this DTC indicates the PSP input to the PCM is high. In Key On, Engine Running Self-Test, this DTC indicates that the PSP input did not change state.	<ul style="list-style-type: none"> • Steering wheel must be turned during Key On, Engine Running Self-Test • PSP switch/shorting bar damaged • SIG RTN circuit open • PSP circuit open or shorted to SIGRTN • PCM damaged 	
P1651 - Power Steering Pressure (PSP) Switch Signal Malfunction	The PCM counts the number of times vehicle speed transitions from 0 to a calibratable speed. After a calibratable number of speed transitions the PCM expects that the PSP input should have changed. This DTC is set if the transition is not detected.	<ul style="list-style-type: none"> • Vehicle towed with engine running • Power steering hydraulic concern was repaired but DTC was not erased • PSP switch/shorting bar damaged • SIG RTN circuit open • PSP circuit open or shorted to SIGRTN • PCM damaged 	<ul style="list-style-type: none"> ■ Check, if possible, if vehicle was towed or power steering service was performed. ■ Observe PSP V PID while checking wires for intermittents.
P1703 - Brake Switch Out of Self-Test Range	Indicates that during Key On Engine Off (KOEO) Self-Test, BPP signal was high. Or during Key On Engine Running (KOER) Self -Test, the BPP signal did not cycle high and	<ul style="list-style-type: none"> • Open or short in (BPP) circuit • Open or short in stoplamp circuits • Damaged PCM • Malfunction in module(s) connected to BPP circuit (Rear Electronic Module [REM] Windstar and LS6/LS8 and Lighting 	Check for proper function of stoplamps. Follow correct Self-Test procedures, refer to Section 2, <u>Quick Test</u> .

	low.	Control Module (LCM) Continental and Town Car	
P1705 - Transmission Range Sensor Out of Self-Test Range		<ul style="list-style-type: none"> • Damaged Brake Switch • Misadjusted Brake Switch 	
P1709 - Park/Neutral Position Switch Out of Self-Test Range	The DTCs indicate that the voltage is high when it should be low.	<ul style="list-style-type: none"> • PNP/ CPP circuit short to PWR • Damaged PNP or CPP switch • PNP/ CPP circuit open in the SIGRTN • Damaged PCM 	When exercising either the PNP or CPP switch the voltage should cycle from 5.0V to low
P1729 - 4x4L Switch Malfunction	The 4x4L switch is an ON/OFF. If the PCM does not see low voltage when the switch is ON a DTC will set.	<ul style="list-style-type: none"> • 4x4L harness open or shorted • Damaged electronic shift module • Damaged PCM 	Verify the 4x4L switch cycles ON/OFF.
P1780 - Transmission Control Switch Out of Self-Test Range	During KOER self-test the TCS has to be cycled, if not cycled a DTC is set.	<ul style="list-style-type: none"> • TCS circuit short or open • Damaged TCS switch • Damaged PCM 	Verify the TCS switch cycles ON/OFF
P1781 - 4x4L Switch Out of Self-Test Range	The 4x4L switch is an ON/OFF. If the PCM does not see low voltage when the switch is on a DTC will set.	<ul style="list-style-type: none"> • 4x4L harness open or shorted • Damaged electronic shift module • Damaged PCM 	Verify the 4x4L switch cycles ON/OFF
P1900 - Output Shaft Speed sensor circuit intermittent failure	See DTC P0723		

Powertrain Control/Emissions Diagnosis Manual

2001

On Board Diagnostics II

SECTION 5: Pinpoint Tests

Choose an item on the left side to display section contents.

A: No Start Introduction

A: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Spark (as related to Electronic Engine Control)
- Powertrain Control Module (PCM) (12A650)



WARNING: STOP THIS TEST AT THE FIRST SIGN OF A FUEL LEAK AND SERVICE AS REQUIRED.

No open flame — No smoking during fuel delivery checks.

A: Pinpoint Tests →

A: No Start

← A: Introduction

A1 CHECK PASSIVE ANTI-THEFT SYSTEM (SECURILOCK)

Note: This vehicle may have an anti-theft system, which may be activated, causing the no start condition. Verify by viewing anti-theft indicator light on instrument panel or a Diagnostic Trouble Code (DTC P1260) may be present.

- Verify anti-theft system.

Is the system activated?

Yes	No
REFER to Electrical Anti-Theft, Section 419-01 in the Workshop Manual for diagnosis and testing.	GO to <u>A2</u> .

A2 ATTEMPT TO CRANK ENGINE

Note: Verify inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to Owner Guide for location.

Does engine crank?

Yes	No
GO to <u>A3</u> .	REFER to the Starting Systems, Section 303-06 in the Workshop Manual.

A3 IDENTIFY TYPE OF NO START

Note: The purpose of this Test Step is to identify intermittent No Starts in order to guide the technician to the proper repair procedure.

Does the vehicle start now?

Yes	No
Vehicle is an intermittent No Start. GO to <u>Z2</u> .	Natural gas vehicles: KEY OFF. GO to <u>HA47</u> . All others: KEY OFF. GO to <u>A4</u> .

A4 CHECK VREF VOLTAGE TO THROTTLE POSITION (TP) SENSOR

- Disconnect TP sensor.
- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuit at the TP sensor harness connector. GO to Pinpoint Test DH to refer to the schematic.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. RECONNECT TP sensor. GO to <u>A5</u> .	KEY OFF. GO to <u>C1</u> .

A5 CHECK FLASH EPROM POWER SUPPLY (FEPS) CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on, engine off.
- Measure voltage between Pin 13 at the data link connector and battery negative post.
- (Refer to the Wiring Diagrams for connector location.)

Is voltage greater than 9.0 volts?

Yes	No
REPAIR short to power.	For coil-on-plug vehicles: KEY OFF. GO to <u>A17</u> . All others: KEY OFF. GO to <u>A6</u> .

A6 CHECK RPM IN THE PCM

Note: The scan tool must be connected to a reliable power source that is powered with the key in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged.

- Access RPM PID.
- While viewing the RPM PID, crank engine.

Does the RPM PID indicate cranking speed?

Yes	No
KEY OFF. GO to <u>JB1</u> . To check ignition. If OK: Natural Gas Vehicles : GO to <u>A9</u> . All others: GO to <u>A7</u> .	KEY OFF. GO to <u>JD1</u> .

A7 CHECK FUEL PRESSURE



WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN PINPOINT TEST HC WARNING, CAUTION, AND HANDLING.

- Release the fuel pressure.
- Install fuel pressure tester.
- Scan Tool connected.
- Key on, engine off.
- Enter Output Test Mode (refer to [Section 2](#)) and run the fuel pump to obtain maximum fuel pressure.

Is fuel pressure at the specified pressure (use the fuel pressure chart in Pinpoint Test HC)?

Yes	No
GO to A8 .	KEY OFF. GO to HC1 .

A8 CHECK FUEL PRESSURE LEAKDOWN

- GO to Pinpoint Test [HC](#) and observe WARNING, CAUTION AND HANDLING.
- Fuel pressure tester installed.
- Scan Tool connected.
- Key on, engine off.
- Access Output Test Mode and run fuel pump to obtain maximum fuel pressure.
- Exit Output Test Mode.
- Verify fuel pressure remains within 34 kPa (5 psi) of the maximum pressure for 1 minute after turning pump off.

Does fuel pressure remain within 34 kPa (5 psi)?

Yes	No
KEY OFF. GO to A9 .	KEY OFF. GO to HC1 .

A9 CHECK FUEL INJECTORS FOR VPWR

Note: Check at least two fuel injectors, one on each bank. A no start condition can exist only if greater than 50% of the fuel injectors are without VPWR.

- Disconnect any two fuel injectors.
- Key on.
- Measure VPWR circuit voltage at fuel injector harness connectors.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. Natural Gas Vehicles: GO to A15 . All Others: GO to A10 .	REPAIR VPWR circuit.

A10 CHECK FUEL INJECTORS ABILITY TO DELIVER FUEL

- Connect fuel pressure gauge to Schrader valve.
- Cycle key several times.
- Locate and disconnect the inertia fuel shutoff (IFS) switch.
- Monitor pressure gauge while cranking the engine for at least five seconds.

Is there a pressure drop greater than 34 kPa (5 psi) while cranking the engine?

Yes	No
The electronic engine control system is not the cause of the no start. RETURN to Section 3 , Symptom Chart for further diagnosis.	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

A15 CHECK FUEL PRESSURE ON NATURAL GAS VEHICLES

- Connect scan tool to DLC.
- Access FRP PID (fuel pressure).
- Record fuel pressure.
- Connect fuel pressure gauge to Schrader valve.
- Key on, engine off.
- Record fuel pressure.

Is fuel pressure between 552 and 827 kPa (80 and 120 psi) on the Scan Tool and fuel pressure gauge?

Yes	No
KEY OFF. GO to A16 .	KEY OFF. GO to HB1 .

A16 CHECK INJECTOR SIGNAL FROM NGV MODULE

Note: This test requires a standard 12 volt test lamp. A properly operating system will show a dim glow.

- Connect test lamp between the injector signal circuit and VPWR circuit pin at the injector harness.
- Crank engine.

Does test lamp have a dim glow while cranking?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). GO to A6 .	No light or continuously bright light. GO to HA47 .

A17 CHECK PCM DRIVER TO COILS

- Connect incandescent test lamp between B+ and each coil driver circuit at the harness connector.
- Crank engine.

Does lamp blink consistently and brightly (one blink per engine revolution)?

Yes	No
KEY OFF. GO to <u>A7</u> .	KEY OFF. GO to <u>JD1</u> .

B: Electronic Engine Control (EC) Power Relay Introduction

B: Pinpoint Tests →

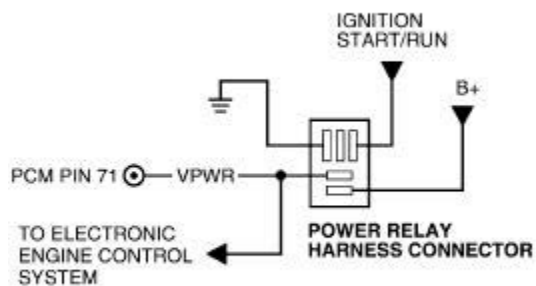
Note

This Pinpoint Test is intended to diagnose the following:

- Harness Circuits: Vehicle Power (VPWR), Ignition Start/Run, Power Relay Ground, Battery Positive Voltage (B+)
- Power Relay (12A646)

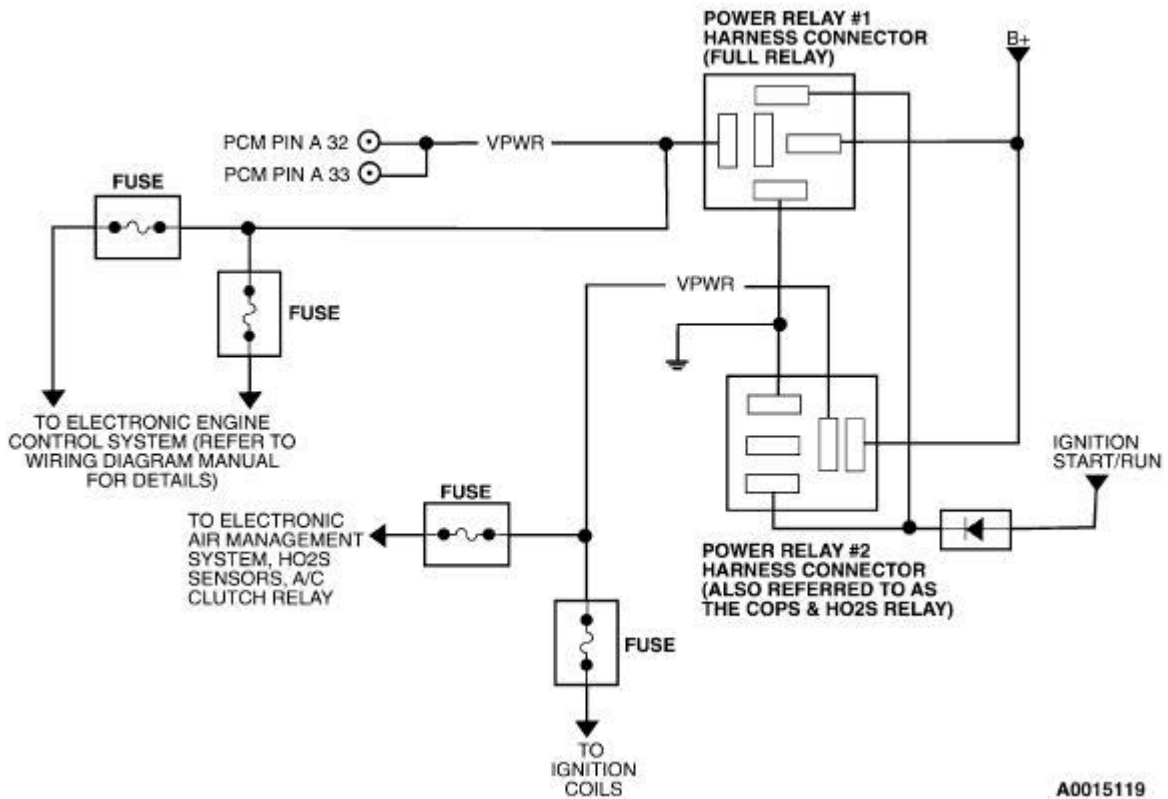
Pinpoint Test Schematics and Connectors

Focus, Cougar, Taurus/Sable, Escape

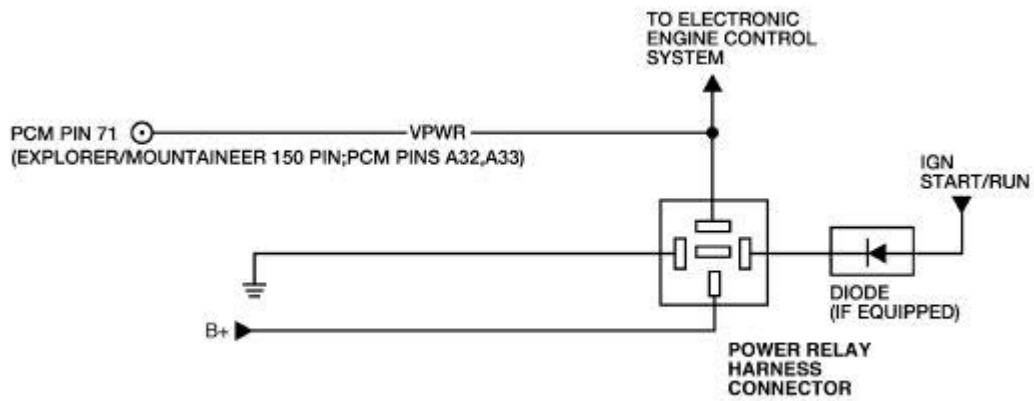


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LS6/LS8



All Others



A0027463

Note: The IGN START/RUN and GROUND circuits, and/or the B+ and VPWR circuits may be reversed in the harness connector. Refer to the Wiring Diagram Manual for more information.

B: Electronic Engine Control (EC) Power Relay

← B: Introduction

B1 VPWR CHECK AT IAC VALVE FAILED IN PINPOINT TEST C: CHECK FOR OPEN VPWR CIRCUIT

- Idle air control (IAC) valve disconnected.
- Disconnect scan tool from DLC.
- Disconnect electronic engine control power relay (referred to here as "power relay").
- Measure resistance of VPWR circuit between IAC valve harness connector and power relay harness connector.

Is resistance less than 5.0 ohms?

Yes	No
RECONNECT IAC valve. GO to B2 .	REPAIR open VPWR circuit between the power relay and the splice to the IAC valve.

B2 CHECK B+ AND IGN START/RUN VOLTAGE TO POWER RELAY

- Measure B+ circuit voltage at the power relay harness connector.
- Key on.
- Measure IGN START/RUN circuit voltage at power relay harness connector.

Are both voltages greater than 10.5 volts?

Yes	No
GO to B3 .	KEY OFF. B+ or IGN START/RUN circuit fault. CHECK condition of related fuse (s)/diode. If OK, REPAIR open circuit. If fuse is damaged, check IGN START/RUN or B+ and VPWR circuits for short to ground before replacing.

B3 CHECK GROUND CIRCUIT TO POWER RELAY

- Measure voltage between B+ and the ground circuits at the power relay harness connector.

Is voltage greater than 10.5 volts?

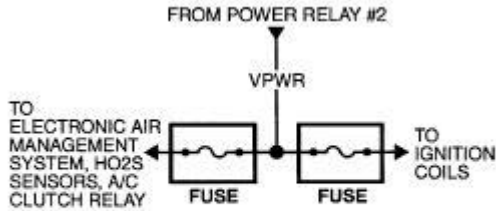
Yes	No
REPLACE power relay.	REPAIR open ground circuit.

B5 LS6/LS8 VPWR CHECK FAILED: CHECK FUSE

Note: The electronic engine control power relay #2 supplies VPWR to two separately fused circuits. Refer to the applicable Wiring Diagrams to determine fuse locations.

- Remove and inspect VPWR circuit fuse that goes to the component where VPWR check failed.

Is the fuse OK?



AA3310-A

Yes	No
GO to <u>B6</u> .	CHECK VPWR circuit for short to ground between fuse and applicable component. REPAIR as necessary. REPLACE fuse.

B6 CHECK FOR POWER TO OTHER VPWR CIRCUIT FUSE CONNECTED TO POWER RELAY #2

- Remove and inspect other VPWR circuit fuse that goes to the components supplied by the power relay #2. Service as necessary.
- Key on, engine off.
- Measure voltage to both VPWR circuit fuse harness connectors supplied by the power relay #2.

Are both voltages greater than 10.5 volts?

Yes	No
REPAIR open circuit between fuse and component where VPWR check failed.	<p>If both voltages were less than 10.5 volts:</p> <p>KEY OFF. GO to <u>B7</u>.</p> <p>If only one voltage was less than 10.5 volts:</p> <p>REPAIR open circuit between fuse and splice.</p>

B7 CHECK VPWR CIRCUIT CONTINUITY BETWEEN FUSE AND POWER RELAY #2

- Disconnect power relay #2.
- Measure resistance of the VPWR circuit between the power relay #2 harness connector and the harness connector either fuse.

Is resistance less than 5.0 ohms?

Yes	No
GO to <u>B2</u> . Make all indicated checks at power relay #2.	REPAIR open VPWR circuit between splice and power relay #2.

C: Reference Voltage Introduction

C: Pinpoint Tests →

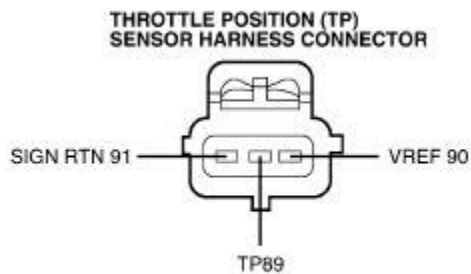
Note

This Pinpoint Test is intended to diagnose the following:

- Sensor harness circuits: SIG RTN, VREF
- 3-wire sensors: throttle position (TP) sensor, differential pressure feedback EGR sensor, A/C pressure (ACP) sensor, fuel tank pressure (FTP) sensor, power steering pressure (PSP) sensor, fuel rail pressure (FRP) sensor and barometric (BARO) pressure sensor.
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

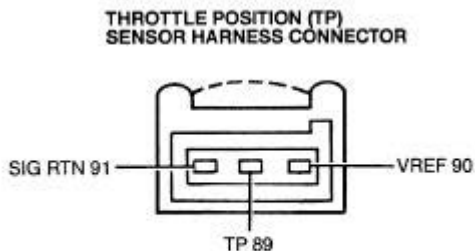
2.0L 4V Focus



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

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2.0L 4V Escort , 2.0LCougar

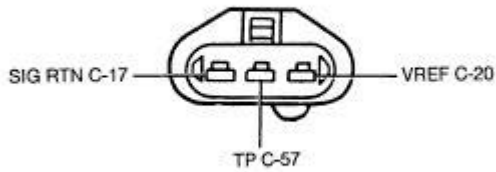


NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

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LS6/LS8

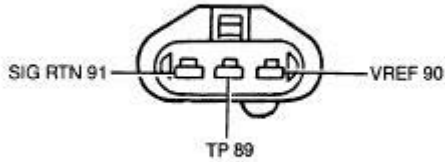
**THROTTLE POSITION (TP)
SENSOR HARNESS CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE AA4399-A**

All Others

**THROTTLE POSITION (TP)
SENSOR HARNESS CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE AA4400-A**

SENSORS CONNECTED TO VREF

Applications	TP	EGR	FTP	ACP	PSP	FRP	BARO
Escape	X	D.P.F. EGR	X				
3.0L FFV Taurus	X	D.P.F. EGR					
2.5L Cougar	X	D.P.F. EGR	X				
Mustang, Ranger	X	D.P.F. EGR	X			X	
Taurus/Sable Town Car	X X	D.P.F. EGR D.P.F. EGR	X X				
Explorer/Mountaineer	X	D.P.F. EGR	X				
Focus	X	D.P.F. EGR	X			X	
Crown Victoria (except NGV)	X X	D.P.F. EGR D.P.F. EGR	X X				
Grand Marquis, Lightning	X	X	X			X	X
E/F-Series (except NGV), Expedition/Navigator/ Excursion	X X	D.P.F. EGR D.P.F. EGR	X X				
LS6/LS8 Windstar, Continental	X X	D.P.F. EGR D.P.F. EGR	X X	X X		X	
2.0L 4V Escort	X		X	X	X	X	
2.0L 2V Escort 2.0L Cougar	X X	D.P.F. EGR D.P.F. EGR	X X		X X	X	

Crown Victoria w/NGV	X	D.P.F. EGR	X			X	
5.4L E/F Series w/NGV	X		X			X	

C: Pinpoint Tests →

C: Reference Voltage

← C: Introduction

C1 CHECK VREF CIRCUIT FOR SHORT TO PWR IN HARNESS

- Disconnect TP sensor.
- Key on.
- Measure voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is VREF greater than 6.0 volts?

Yes	No
KEY OFF. GO to C35 (to check VREF for short to power).	GO to C2 .

C2 CHECK VOLTAGE ON BATTERY

- Measure voltage across battery terminals.

Is voltage greater than 10.5 volts?

Yes	No
GO to C3 .	Key off. REFER to Battery and Charging, Section 414-00 in the Workshop Manual to service discharged battery.

C3 CHECK VOLTAGE BETWEEN B+ AND SIG RTN

- Disconnect sensor where VREF check failed.
- Measure voltage between SIG RTN circuit and battery positive post at the appropriate sensor harness connector.

Is voltage greater than 10.5 volts and within 1.0 volt of battery voltage?

Yes	No
GO to C4 .	SIG RTN/PWR GND fault present. GO to C25 .

C4 CHECK VREF VOLTAGE THROUGH PCM ON TP PID

Note: Vehicles with 150 pin processor and multiple DTCs output, GO to [C5](#) for VREF concerns.

- Attempt to access the TP PID.

Can the PID be accessed?

--	--

Yes	No
KEY OFF. GO to <u>C20</u> (to check VREF for opens).	GO to <u>C5</u> (to check for VPWR, and VREF for shorts).

C5 CHECK VPWR VOLTAGE TO IAC VALVE

- Disconnect TP sensor.
- Disconnect idle air control (IAC) valve.
- Key on.
- Measure voltage between the VPWR circuit at the IAC valve harness connector and the battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
RECONNECT IAC valve. For 2.0L Escort, Cougar, 5.4L E/F-Series with NGV: GO to <u>C7</u> . All Others: GO to <u>C6</u> .	VPWR is not present. RECONNECT TP sensor. For application with Power Relay inside CCRM: GO to <u>X1</u> . All others: GO to <u>B1</u> .

C6 CHECK VREF CIRCUIT SHORT TO SIG RTN IN THE D.P.F. EGR OR EGR VALVE POSITION SENSOR

- TP sensor disconnected.
- Disconnect D.P.F. EGR or EGR valve position sensor.
- Key on.
- Measure voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. REPLACE D.P.F. EGR sensor or EGR valve position sensor.	For 3.0L FFV Taurus: GO to <u>C12</u> . For all others: GO to <u>C7</u> .

C7 CHECK VREF CIRCUIT SHORT TO SIG RTN IN FTP SENSOR

- TP and D.P.F. EGR sensors disconnected.
- Disconnect FTP sensor.
- Key on.

- Measure voltage between the VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. REPLACE the FTP sensor.	<p>For applications with an A/C Pressure (ACP) sensor:</p> <p>GO to <u>C8</u>.</p> <p>For applications with PSP:</p> <p>GO to <u>C9</u>.</p> <p>For applications with FRP only:</p> <p>GO to <u>C10</u>.</p> <p>All Others:</p> <p>GO to <u>C12</u>.</p>

C8 CHECK VREF CIRCUIT SHORT TO SIG RTN IN ACP SENSOR

- TP (FTP where applicable) and D.P.F. EGR sensor disconnected.
- Disconnect ACP sensor.
- Key on.
- Measure voltage between the VREF and SIG RTN circuits at the TP sensor harness connector.
- Key off.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. REPLACE the ACP sensor.	<p>For application with FRP:</p> <p>GO to <u>C10</u>.</p> <p>All others:</p> <p>GO to <u>C12</u>.</p>

C9 CHECK VREF CIRCUIT SHORT TO SIG RTN IN PSP SENSOR

- TP, FTP, ACP where applicable and D.P.F. EGR sensors disconnected.
- Disconnect PSP sensor.
- Key on.
- Measure voltage between the VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
	<p>For applications with FRP:</p> <p>GO to <u>C10</u>.</p>

KEY OFF. REPLACE the PSP sensor.

All others:

GO to C12.

C10 CHECK VREF CIRCUIT SHORT TO SIG RTN IN FRP SENSOR

- TP, FTP, ACP and PSP where applicable and D.P.F. EGR sensors disconnected.
- Disconnect fuel rail pressure (FRP) sensor.
- Measure voltage between the VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. REPLACE the FRP sensor.	KEY OFF. For applications with BARO: GO to <u>C11</u> . All others: GO to <u>C12</u> .

C11 CHECK VREF CIRCUIT SHORT TO SIG RTN IN BARO SENSOR

- TP, D.P.F. EGR, FTP, and FRP disconnected.
- Disconnect barometric (BARO) pressure sensor.
- Measure voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. REPLACE BARO sensor.	KEY OFF. GO to <u>C12</u> .

C12 CHECK VPWR VOLTAGE TO PCM

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- TP sensor disconnected.
- All other sensors wired to VREF disconnected from previous test steps (if necessary, refer to Sensors Connected To VREF chart at the beginning of this pinpoint test).
- PCM disconnected.
- Key on.
- Measure voltage between VPWR and PWR GND circuits at the PCM harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to <u>C13</u> .	KEY OFF. REPAIR open VPWR circuit between PCM and splice to IAC valve.

C13 CHECK VREF VOLTAGE FOR SHORT TO GROUND OR SIG RTN

- TP sensor disconnected.
- All other sensors wired to VREF disconnected.
- Disconnect PCM.
- Disconnect Scan Tool from DLC.
- Measure resistance between VREF and SIG RTN, PWR GND circuits at the PCM harness connector. (Vehicles with 150 pin processor, measure to both VREF pins.)

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR VREF short to ground.

C20 CHECK VREF CIRCUIT FOR OPEN IN HARNESS

- Sensor where VREF check failed disconnected.
- Disconnect PCM.
- Measure resistance of VREF circuit between PCM harness connector pin and appropriate sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
KEY OFF. REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open VREF circuit. REFER to the EVTM and DTCs received to help pinpoint the location of the open.

C25 CHECK SIG RTN/PWR GND THROUGH PCM ON TP PID

- Key on.
- Attempt to access the TP PID.

Can the PID be accessed?

Yes	No
GO to C26 .	GO to C28 .

C26 ARE KOEO DTCs PRESENT FOR TWO OR MORE SENSORS/SWITCHES CONNECTED TO THE SIG RTN CIRCUIT?

Are KOEO DTCs present for two or more sensors/switches connected to the SIG RTN circuit? (Refer to the Electrical and Vacuum Troubleshooting Manual, Engine Controls.)

Yes	No
KEY OFF. GO to C27 .	KEY OFF. REPAIR open SIG RTN circuit to the sensor where the VREF check failed.

C27 CHECK SIG RTN CIRCUIT FOR OPEN IN HARNESS

- Scan Tool disconnected.
- Sensor where VREF check failed disconnected.
- Disconnect PCM.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and appropriate sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
RECONNECT sensor. GO to C28 .	REPAIR open SIG RTN circuit. REFER to the EVTM and DTCs received to help pinpoint the location of the open.

C28 CHECK PWR GND CIRCUITS FOR OPEN IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance of PWR GND circuits between the PCM harness connector pin and the battery negative post.

Is each resistance less than 5.0 ohms?

Yes	No
GO to C29 .	REPAIR open circuit.

C29 CHECK GROUND CIRCUITS FOR OPEN IN HARNESS

- Measure resistance of ground circuits between SIG RTN and PWR GND circuits at the PCM harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	Repair SIG RTN/PWR GND circuits in harness.

C35 CHECK VREF CIRCUIT FOR SHORT TO PWR

- Sensor where VREF check failed disconnected.
- Disconnect all other sensors connected to VREF (refer to Sensors Connected to VREF chart at beginning of this pinpoint test).
- Disconnect PCM.
- Key on.
- Measure voltage between the VREF circuit at the TP sensor harness connector and the battery negative post.

Is voltage less than 0.5 volts?

Yes	No
KEY OFF. REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	KEY OFF. REPAIR VREF short to power in harness.

DA: Intake Air Temperature (IAT)/Engine Coolant Temperature (ECT)/Engine Oil Temperature (EOT) Sensors

Introduction

DA: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Intake air temperature (IAT) sensor (12A697)
- Integrated intake air temperature (IAT) sensor (12B579)
- Engine coolant temperature (ECT) sensor (12A648)
- Engine oil temperature (EOT) sensor (12A648)
- Harness circuits: IAT, ECT, EOT and SIG RTN
- Powertrain control module (PCM) (12A650)

The term "applicable" is used in this pinpoint test and refers to the temperature sensor indicated by the DTC. Example: ECTV, IATV, EOTV.

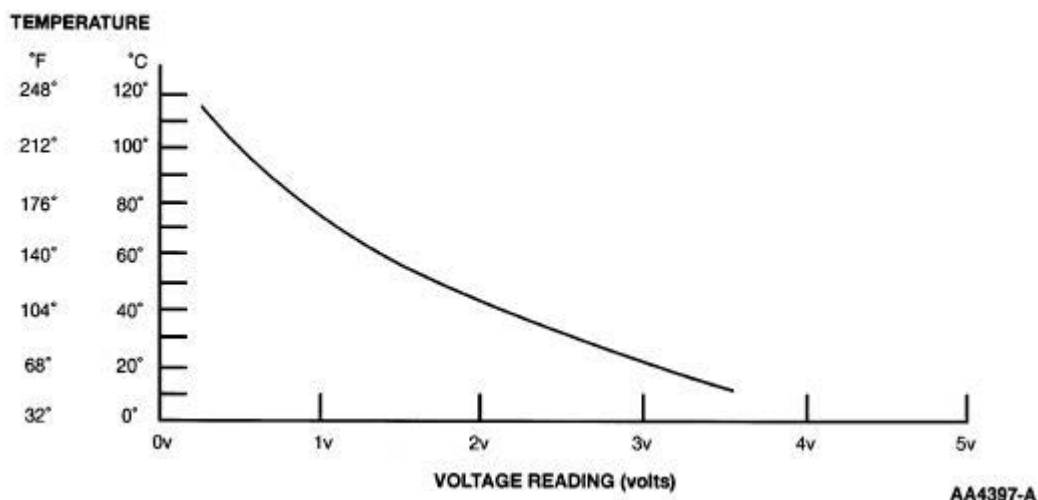
Tables and Graphs

Note: Engine coolant temperature must be greater than 10°C (50°F) to pass the KOEO Self-Test and greater than 82°C (180°F) to pass the KOER Self-Test. To accomplish this, the engine must be at normal operating temperature.

Ambient temperature must be above 10°C (50°F) to receive acceptable input from the intake air temperature (IAT) sensor.

Engine oil temperature must be greater than 10°C (50°F) to pass the KOEO Self-Test and greater than 66°C (150°F) to pass the KOER Self-Test.

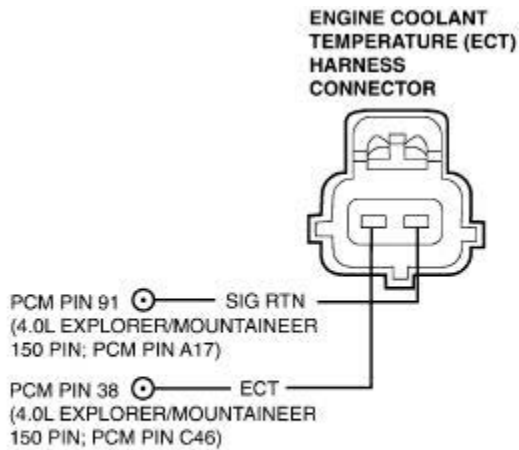
Voltage values were calculated for VREF = 5.0 volts. These values can vary 15 percent due to sensor and VREF variations.



TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values		
°C	°F	Voltage (volts)		Resistance
		Focus	All Others	K ohms
120	248	0.28	0.27	1.18
110	230	0.36	0.35	1.55
100	212	0.47	0.46	2.07
90	194	0.61	0.60	2.80
80	176	0.80	0.78	3.84
70	158	1.05	1.02	5.37
60	140	1.37	1.33	7.70
50	122	1.77	1.70	10.97
40	104	2.23	2.13	16.15
30	86	2.74	2.60	24.27
20	68	3.26	3.07	37.30
10	50	3.73	3.51	58.75
0	32	4.14	3.91	95.85
-10	14	4.45	4.15	160.31

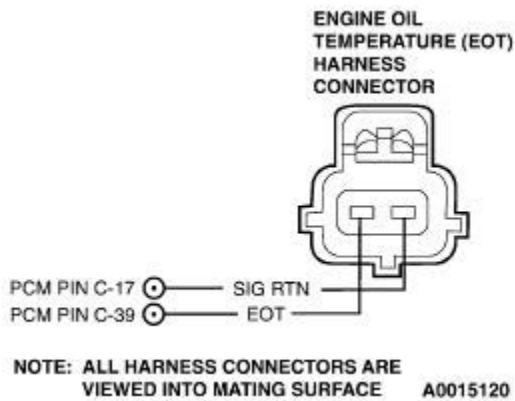
Pinpoint Test Schematics and Connectors



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

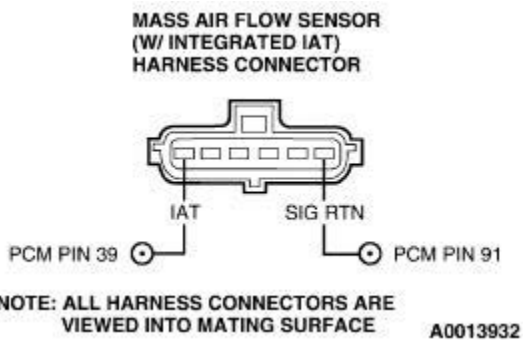
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LS6/LS8 (If equipped)



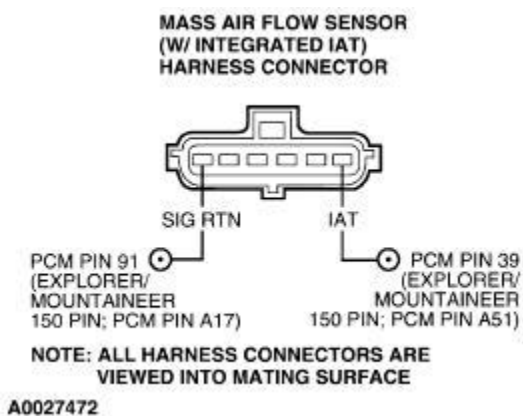
Focus, 2.0L Cougar

Note: On some applications the integrated IAT/MAF sensor connector is located inside the air cleaner assembly.



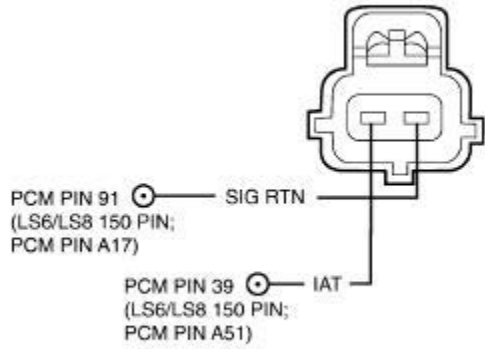
Escort 4V, Taurus/Sable, FF Taurus, 3.8L Mustang, Windstar, 2.3L/3.0L/4.0L Ranger, Escape, Explorer/Mountaineer, Explorer Sport/Sport Trac, Econoline, Excursion, 5.4L/6.8L F250/F350/F450

Note: On some applications the integrated IAT/MAF sensor connector is located inside the air cleaner assembly.



All Others

**INTAKE AIR
(IAT) SENSOR
HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**

A0027474

DA: Intake Air Temperature (IAT)/Engine Coolant Temperature (ECT)/Engine Oil Temperature (EOT) Sensors

← DA: Introduction

DA1 DTC P1116: CHECK OPERATION OF ECT SENSOR

- Run engine at 2000 rpm until engine temperature becomes stabilized.
- **No Starts:**
 - GO to [DA3](#).
- **Vehicles that stall:**
 - Return to [Section 3](#), Symptom Charts.
- Check that upper radiator hose is hot and pressurized.
- Rerun Key On Engine Running (KOER) Self-Test.

Is DTC P1116 present?

Yes	No
KEY OFF. GO to DA2 .	Engine was not at closed loop operating conditions. REPAIR any other DTCs as necessary.

DA2 CHECK VREF VOLTAGE TO TP SENSOR

- Disconnect throttle position (TP) sensor.

Note: GO to Pinpoint Test [DH](#) and refer to **Pinpoint Test Schematics and Connectors** for TP harness connector pin-out information.

- Key on, engine off.
- Measure the voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 volts and 6.0 volts?

Yes	No
There is sufficient VREF voltage. RECONNECT TP sensor. GO to DA3 .	GO to C1 .

DA3 CHECK TEMPERATURE SENSOR RESISTANCE WITH ENGINE OFF

- Disconnect ECT sensor.
- Measure ECT sensor resistance. Refer to the chart at the beginning of this Pinpoint Test for resistance specifications.

Is resistance within specification?

Yes	No

<p>For ECT sensor with a No Start:</p> <p>Do not repair DTC P1116 at this time. RETURN to <u>Section 3</u>, Symptom Charts.</p> <p>For symptoms of cooling fan concerns, overheating and lack of heat, do not repair DTC P1116. REPAIR next DTC. If no other DTC exists, RETURN to <u>Section 3</u>, Symptom Charts.</p> <p>All others:</p> <p>GO to <u>DA4</u>.</p>	<p>REPLACE suspect sensor.</p>
--	--------------------------------

DA4 CHECK TEMPERATURE SENSOR RESISTANCE WITH ENGINE RUNNING

Note: Verify that engine is at operating temperature before taking ECT readings.

- Run engine for two minutes at 2000 rpm.
- Measure temperature sensor resistance. Refer to the chart at the beginning of this Pinpoint Test for resistance specifications.

Is resistance within specification?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>). RESTORE vehicle.	REPLACE suspect sensor.

DA10 DTC P0118 OR P0113: CHECK VOLTAGE BETWEEN VREF AND SIG RTN

- Disconnect throttle position (TP) sensor.

Note: GO to Pinpoint Test DH and refer to **Pinpoint Teat Schematics and Connectors** for TP harness connector pin-out information.

- Key on, engine off.
- Measure the voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 volts and 6.0 volts?

Yes	No
GO to <u>DA11</u> .	GO to <u>C1</u> .

DA11 SIMULATE OPPOSITE SIGNAL TO PCM

- With applicable temperature sensor disconnected, connect a jumper wire between the sensor signal and SIG RTN circuits at the temperature sensor harness connector.
- Key on.

Note: If a scan tool communication concern exists, remove jumper wire immediately and GO to [DA13](#).

- Access applicable temperature sensor voltage PID.

Is the applicable temperature sensor voltage PID less than 0.2 volts (greater than 120°C/248°F)?

Yes	No
REPLACE suspect sensor.	REMOVE jumper wire. GO to DA12 . KEY OFF.

DA12 CHECK TEMPERATURE SENSOR SIGNAL AND SIG RTN CIRCUITS FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers on this pinpoint test cover page.

- Disconnect PCM.
- Measure resistance of sensor signal circuit between PCM harness connector pin and applicable sensor harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and applicable temperature sensor harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
REPLACE PCM.	REPAIR open circuits.

DA13 CHECK TEMPERATURE SENSOR SIGNAL FOR SHORT TO VREF IN HARNESS

- Key off.
- Disconnect PCM.
- Measure resistance between applicable temperature sensor signal and VREF circuits at the PCM harness connector.

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short to VREF.

DA20 DTC P0112 OR P0117: SIMULATE OPPOSITE SIGNAL TO PCM

- Disconnect harness from applicable temperature sensor.
- Connect scan tool.
- Key on.
- Access applicable temperature sensor voltage PID.

Is the applicable temperature sensor voltage PID greater than 4.2 volts (less than -40°C/-40°F)?

Yes	No
REPLACE sensor.	GO to DA21 .

DA21 CHECK VREF VOLTAGE TO TP SENSOR

- Disconnect throttle position (TP) sensor.

Note: GO to Pinpoint Test [DH](#) and refer to **Pinpoint Test Schematics and Connectors** for TP harness connector pin-out information.

- Key on, engine off.
- Measure the voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
There is sufficient VREF voltage. RECONNECT TP sensor. GO to DA22 . KEY OFF.	GO to C1 .

DA22 CHECK TEMPERATURE SIGNAL CIRCUIT FOR SHORT TO GROUND IN HARNESS

Note: Refer to the PCM connector pin numbers on this pinpoint test cover page.

- Disconnect PCM.
- Measure resistance between sensor signal and SIG RTN circuits and then between sensor signal and PWR GND circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

DA80 P0116: CHECK TEMPERATURE SENSOR RESISTANCE WITH ENGINE OFF

Note: Verify that engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. Refer to [Diagnostic Trouble Code \(DTC\) Descriptions](#), in Section 4 for information concerning P0116.

- Key on, engine off.
- Disconnect ECT sensor.
- Measure ECT sensor resistance. Refer to the chart at the beginning of this Pinpoint Test for resistance specifications.

Is resistance within specification?

Yes	No

GO to [DA81](#).

REPLACE suspect sensor.

DA81 P0116: CHECK TEMPERATURE SENSOR RESISTANCE WITH ENGINE RUNNING

Note: Verify that engine is at operating temperature before taking ECT readings.

- Run engine for two minutes at 2000 rpm.
- Measure temperature sensor resistance. Refer to the chart at the beginning of this Pinpoint Test for resistance specifications.

Is resistance within specification?

Yes	No
Fault is not present at this time. COMPLETE OBDII Drive Cycle to determine if Fuel, HEGO, Catalyst and Misfire monitors can be executed (REFER to Section 2, Drive Cycles). Retest if necessary.	REPLACE suspect sensor.

DA90 DTCS P0112, P1112, P0113, P0117, P1117 OR P0118: INTERMITTENT CHECK

- Connect scan tool.
- Key on.
- Monitor the applicable temperature sensor voltage PID.
- While observing the PID, complete the following:
 - Tap on the sensor to simulate road shock.
 - Wiggle the sensor connector.

Is there any large change in the voltage reading?

Yes	No
Key OFF. DISCONNECT and INSPECT connectors. If OK, REPLACE the sensor. For Continuous DTCs P1112 and P1117, COMPLETE OBDII Drive Cycle to verify repair (REFER to Section 2, Drive Cycles).	GO to DA91 .

DA91 CHECK ELECTRONIC ENGINE CONTROL (EC) WIRING HARNESS

- Still monitoring PID.
- While observing the appropriate PID, complete the following:
 - Hold the sensor harness close to the sensor connector. Wiggle, shake and bend small sections of wiring harness while working toward the PCM.

Is there any change in the voltage reading?

Yes	No
ISOLATE fault. REPAIR as necessary. For	

Continuous DTCs P1112 and P1117, COMPLETE OBDII Drive Cycle to verify repair (REFER to Section 2, Drive Cycles).	GO to DA92 .
---	------------------------------

DA92 CHECK PCM AND VEHICLE HARNESS CONNECTOR

- Disconnect PCM.
- Disconnect sensor connector.

Are connectors and terminals OK?

Yes	No
Fault is not present at this time. For Continuous Memory DTCs P1112 and P1117, COMPLETE OBDII Drive Cycle (REFER to Section 2, Drive Cycles).	REPAIR as necessary. For Continuous Memory DTCs P1112 or P1117, COMPLETE OBDII Drive Cycle to verify repair (REFER to Section 2, Drive Cycles).

DA100 DTC P0125: CHECK ENGINE COOLANT LEVEL

Diagnostic Trouble Code (DTC) P0125 indicates the ECT sensor has not achieved the required temperature level to enter closed loop operating conditions within a specified amount of time after starting engine. This DTC will light the MIL.

Possible causes:

- Insufficient warm up time.
- Leaky or stuck open thermostat.
- Low engine coolant level.
- Malfunctioning ECT sensor.



WARNING: TO AVOID PERSONAL INJURY, DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STREAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENDED SLIGHTLY.

- Check engine coolant level.

Is the engine coolant level fill correct?

Yes	No
REFER to Engine Cooling, Section 303-03 in the Workshop Manual for further diagnostics.	FILL engine coolant to proper level. COMPLETE OBDII Drive Cycle to verify repair (REFER to Section 2, Drive Cycles).

DA110 DTC P1184: CHECK OPERATION OF EOT TEMP SENSOR

- Connect scan tool.
- Run engine at 2000 rpm until engine temperature becomes stabilized.
- Run Key On Engine Running (KOER) Self-Test.

Is DTC P1184 present?

Yes	No
GO to DA111 .	Engine oil temperature was not at operating temperature. REPAIR any other DTCs as necessary.

DA111 DTC P1183, P1184 OR P0298: CHECK TEMPERATURE SENSOR SIGNAL

- Connect scan tool.
- Key on.
- Access EOTV PID.

Is EOTV PID less than 0.3 volts?

Yes	No
GO to DA112 .	GO to DA115 .

DA112 SIMULATE OPPOSITE EOT SIGNAL TO PCM

- Still monitoring PID.
- Disconnect EOT sensor.

Is EOTV PID greater than 4.2 volts?

Yes	No
REPLACE suspect sensor.	GO to DA113 .

DA113 CHECK EOT SIGNAL CIRCUIT FOR SHORT TO GROUND IN HARNESS

Note: Refer to the PCM connector pins numbers on this pinpoint test cover page.

- Disconnect PCM.
- Measure resistance between EOT and SIG RTN circuits and then between EOT and PWR GND circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

DA115 CHECK FOR HIGH EOT SIGNAL

- Still monitoring PID.

Is EOTV PID greater than 4.2 volts?

Yes	No
GO to DA116.	GO to DA120.

DA116 SIMULATE LOW SIGNAL TO PCM

- Disconnect EOT temperature sensor.
- Connect a jumper wire between the sensor signal and SIG RTN circuits at the temperature sensor harness connector.
- Key on.
- Access EOTV PID.

Is EOTV PID less than 0.3 volts?

Yes	No
REPLACE suspect sensor.	KEY OFF. GO to DA117.

DA117 CHECK TEMPERATURE SENSOR SIGNAL AND SIG RTN CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pins numbers on this pinpoint test cover page.

- Disconnect PCM.
- Measure resistance of EOT circuit between PCM harness connector pin and EOT sensor harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and EOT sensor harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuits.

DA120 INTERMITTENT EOT SENSOR CHECK

- Still monitoring PID, complete the following:
 - Tap on sensor to simulate road shock.
 - Wiggle the sensor connector.

Is there any large change in the PID reading?

Yes	No
KEY OFF. DISCONNECT and INSPECT connector. If OK, REPLACE the sensor.	GO to DA121.

DA121 CHECK EOT ELECTRONIC ENGINE CONTROL (EC) WIRING HARNESS

- Still monitoring PID, complete the following:
 - Wiggle, shake and bend small sections of wiring harness while working from the sensor to the PCM.

Is there any large change in the PID reading?

Yes	No
ISOLATE fault. REPAIR as necessary.	Fault is not present at this time. For Continuous Memory DTCs, COMPLETE OBDII Drive Cycle (REFER to Section 2, Drive Cycles).

DA130 DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION

- Engine oil temperature protection strategy in the PCM has been activated.
 - Check for overheating condition and base engine concerns.

Is there any overheating or base engine concerns?

Yes	No
ISOLATE fault. REPAIR as necessary. REFER to Engine System — General Information, Section 303-00 in the Workshop Manual.	GO to DA131 .

DA131 CHECK FOR EOT SENSOR HARDWARE

- Engine oil temperature protection strategy in the PCM can be activated with or without an EOT sensor.

Does vehicle have an EOT sensor?

Yes	No
GO to DA111 .	IDENTIFY customer driving habits. Advise customer improper transmission gear selection and high rpm for extended period will initialize engine protection strategy.

DB: Engine Fuel Temperature (EFT) Sensor Introduction

DB: Pinpoint Tests →

Note

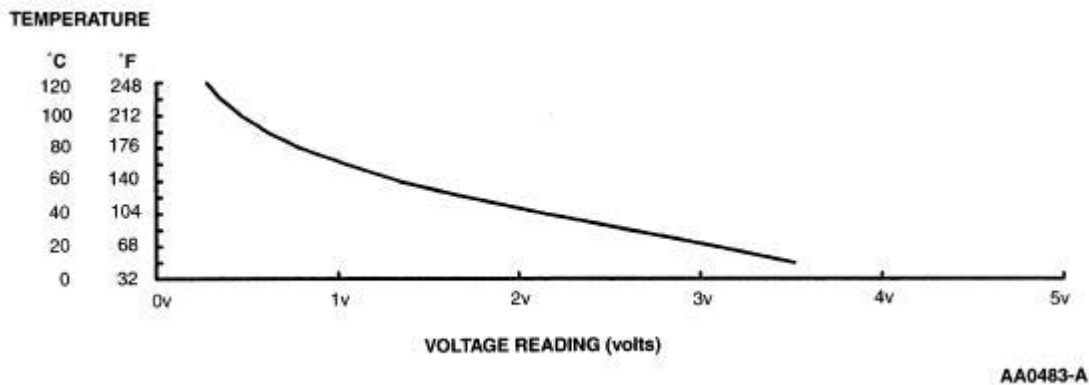
This Pinpoint Test is intended to diagnose the following:

- Engine Fuel Temperature (EFT) Sensor (9F951)
- Harness Circuits: EFT and SIG RTN
- Powertrain Control Module (PCM) (12A650)

Tables and Graphs

Note: The engine fuel temperature (EFT) sensor will operate within the range of -40°C to 135°C (-40°F to 275°F).

Table and Graph voltage values are calculated for VREF=5.0 volts. These values may vary up to 15% due to sensor and VREF variations.

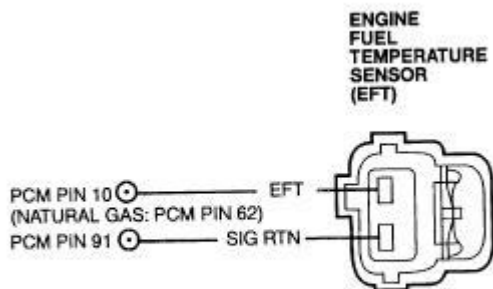


ENGINE FUEL TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Engine Fuel Temperature (EFT) Sensor Values	
°C	°F	Voltage (volts)	Resistance (K ohms)
150	302	0.13	0.56
135	275	0.19	0.81
120	248	0.27	1.18
110	230	0.35	1.55
100	212	0.46	2.07
90	194	0.60	2.80
80	176	0.78	3.84
70	158	1.02	5.37

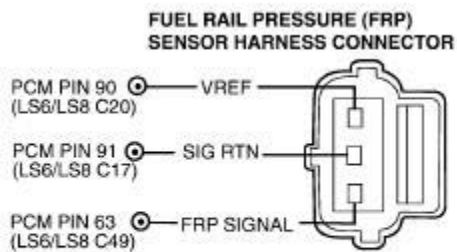
60	140	1.33	7.70
50	122	1.70	10.97
40	104	2.13	16.15
30	86	2.60	24.27
20	68	3.07	37.30
10	50	3.51	58.75
-40	-40	4.54	92.5

Pinpoint Test Schematics and Connectors



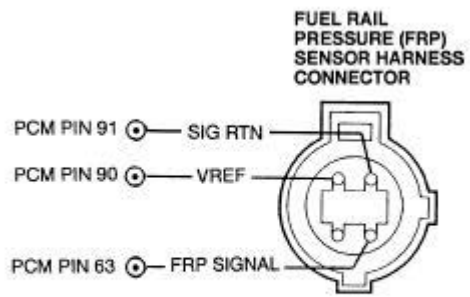
NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE AA1865-D

Gasoline Vehicles



A0015123

Natural Gas Vehicles



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4808-A

DB: Pinpoint Tests ➔

DB: Engine Fuel Temperature (EFT) Sensor

← DB: Introduction

DB1 DTC P0181 CHECK FOR KOER DTCS

- Start engine and bring up to operating temperature.
- Check for KOER DTCs.

Is DTC P0182 or P0183 present during KOER?

Yes	No
For DTC P0181 with DTC P0182 or P0183. GO to <u>DB2</u> .	For DTC P0181 only. COMPLETE an OBD-II Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>). GO to <u>DB2</u> .

DB2 DTC P0180, P0181, P0182 and P0183: VERIFY ELECTRICAL FAULT CONDITION BY SIMULATING OPPOSITE SIGNAL TO PCM

- Disconnect engine fuel temperature sensor.
- Access EFTA-V PID value.
- Install jumper across terminals at the vehicle harness connector.

Note: If a scan tool communication concern exists, remove jumper wire immediately and GO to DB5.

- Record new reading.

Is the original reading of the EFTA-V PID with the harness disconnected greater than 4.5 volts or (-40°C/-40°F) and less than 0.21 volt or (135°C/275 °F) with the jumper installed?

Yes	No
KEY OFF. REPLACE EFTA sensor. REFER to Electronic Engine Controls, Section 303-14 in the Workshop Manual.	KEY OFF. FOR EFTA-V reading less than 4.54 volts with harness disconnected and jumper removed: GO to <u>DB3</u> . FOR DTC P0182: GO to <u>DB3</u> . FOR EFTA-V reading greater than 0.2 volt with harness disconnected and jumper installed: GO to <u>DB5</u> . FOR DTC P0183: GO to <u>DB5</u> .

DB3 CHECK VREF CIRCUIT VOLTAGE AT FRP SENSOR

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect fuel rail pressure (FRP) sensor.
- Key on, engine off.

- Measure voltage between VREF and SIG RTN at the fuel rail pressure (FRP) sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
GO to <u>DB4</u> .	GO to <u>C1</u> .

DB4 CHECK EFT CIRCUIT FOR SHORT TO SIG RTN IN HARNESS

- Disconnect PCM.
- Measure resistance between EFT and SIG RTN circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

DB5 CHECK EFT SIGNAL FOR SHORT TO VREF

- Temperature sensor disconnected.
- PCM disconnected.
- Measure resistance between EFT and VREF circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
GO to <u>DB6</u> .	LOCATE and REPAIR short to VREF.

DB6 CHECK EFT SIGNAL AND SIG RTN CIRCUITS FOR OPEN IN HARNESS

- Measure resistance of EFT circuit between PCM harness connector pin and EFT sensor harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and EFT sensor harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR open circuits.

DB7 DTCS P0180, P0181, P0182 and P0183: INTERMITTENT CHECK

- Key on.

- Access EFT-A PID.
- While monitoring EFT-A PID, perform the following: Tap on the sensor to simulate road shock. Wiggle the sensor connector.

Was there any change in the temperature reading?

Yes	No
DISCONNECT and INSPECT connectors. If OK, REPLACE the sensor.	GO to <u>DB8</u> .

DB8 WIGGLE TEST OF SENSOR WIRING HARNESS

- While monitoring EFT-A PID, hold the vehicle harness close to the sensor connector. Wiggle, shake and bend small sections of wiring harness while working toward the PCM.

Was there any change in the temperature reading?

Yes	No
REPAIR as necessary.	Fault is not present at this time.



DC: Mass Air Flow (MAF) Sensor Introduction

DC: Pinpoint Tests →

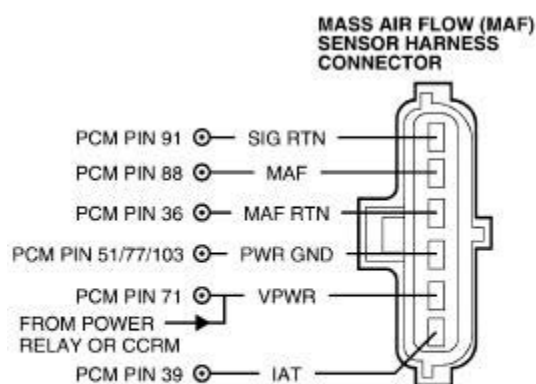
Note

This Pinpoint Test is intended to diagnose the following:

- Mass Air Flow (MAF) Sensor (12B579)
- Harness Circuits: MAF SIG, MAF RTN, Vehicle Power (VPWR), and Power Ground (PWR GND)
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

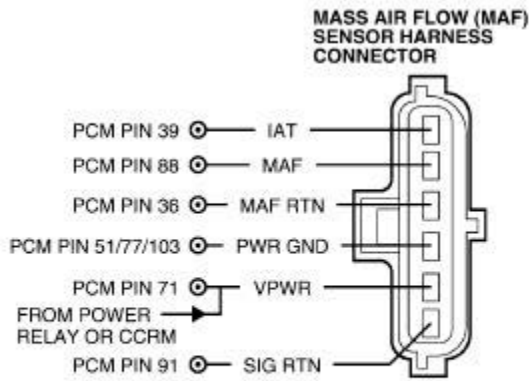
Focus, 2.0L Cougar



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0009917

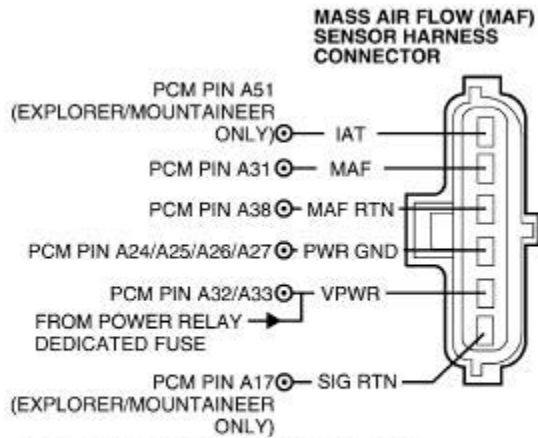
3.8L Mustang, Taurus/Sable, FF Taurus, Windstar, Ranger, Escape, Explorer/Mountaineer (104 Pin PCM), Explorer Sport/Sport Trac, Econoline, Excursion, 5.4L/6.8L F250/F350/450



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0009916

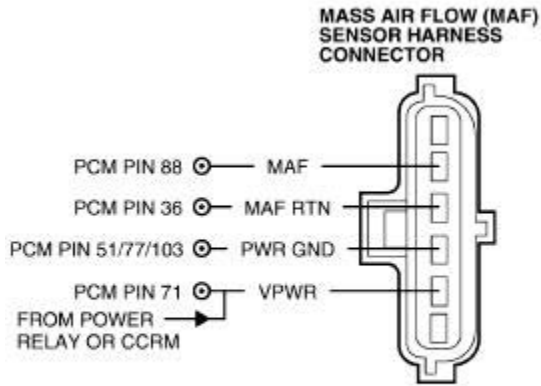
LS6/LS8, Explorer/Mountaineer (150 Pin PCM)



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

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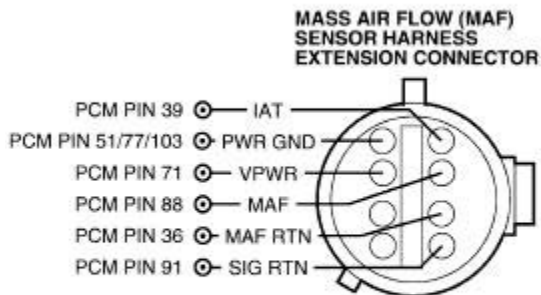
All Others



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

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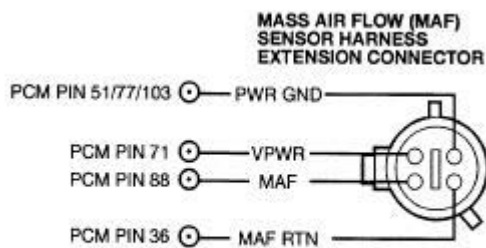
Escort (4V)



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

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Escort (2V)



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA3318-B

Tables and Chart

BAROMETRIC PRESSURE REFERENCE CHART

Barometric Pressure (in. Hg.)	Barometric Pressure (kPa)	BARO/MAP PID (Hz)	Altitude Above Sea Level (ft)
3.5	11.8	89.3	
5	16.9	92.8	
10	33.8	104.6	
15	50.7	117.0	14,000
20	67.5	129.6	10,000
21	70.9	132.5	9,000
22	74.3	135.4	8,000
23	77.7	138.3	7,000
24	81.1	141.1	6,000
25	84.4	144.0	5,000
26	87.8	146.9	4,000
27	91.2	149.8	3,000
28	94.6	152.8	2,000
29	97.9	155.8	1,000
30	101.3	158.9	0 (sea level)
31	104.7	162.0	
31.875	107.7	164.7	

DC: Pinpoint Tests →

DC: Mass Air Flow (MAF) Sensor

← DC: Introduction

DC1 DTC P1101: CHECK FOR MAF SENSOR CONTINUOUS MEMORY DTCs

- Drive vehicle for 6 to 10 minutes.
- Rerun KOER, KOEO Self-Test and retrieve Continuous Memory DTCs.

Is a Continuous Memory DTC present with the KOER DTC P1101?

Yes	No
For Continuous Memory DTC P0102: GO to DC2 . For Continuous Memory DTC P0103: GO to DC20 . All other Continuous Memory DTCs: GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts .	KEY OFF. GO to DC3 .

DC2 DTC P0102: CHECK MAF SENSOR SIGNAL LOW INPUT TO PCM

- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in air outlet tube, worn gaskets between MAF sensor and air cleaner assembly. Repair as necessary.
- Start engine and bring to idle.
- If a KOER DTC P0505 is present, go to Section 4, Powertrain [Diagnostic Trouble Code \(DTC\) Charts](#). For A/T vehicles, if the engine stalls and cannot maintain an idle, GO to [DC7](#).
- Run engine up 1500 rpm for 5 seconds, then bring it back to idle.
- Access MAF V PID.

Is MAF V PID less than 0.23 volt?

Yes	No
KEY OFF. GO to DC4 .	KEY OFF. GO to DC3 .

DC3 DTC P1101: CHECK FOR MAF SENSOR SIGNAL OUT OF SELF-TEST RANGE

Note: DTC P1101 can be generated by a low charged vehicle battery or the garage exhaust ventilation system. Repair battery as necessary. Then remove ventilation system and properly vent to outside atmosphere. Rerun KOEO Self-Test.

- Verify MAF sensor is connected. If not, repair as necessary.
- Key on, engine running.

- Access MAF V PID.

Is MAF V PID between 0.46-2.44 volts?

Yes	No
Unable to identify fault at this time. GO to <u>Z1</u> .	KEY OFF. GO to <u>DC4</u> .

DC4 CHECK VPWR VOLTAGE TO MAF SENSOR

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect MAF sensor.
- Key on, engine off.
- Measure voltage between VPWR circuit at the MAF sensor harness connector and battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
GO to <u>DC5</u> .	REPAIR open circuit. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, <u>Powertrain Control Module (PCM) Reset</u>).

DC5 CHECK PWR GND CIRCUIT BETWEEN MAF SENSOR AND POWER RELAY

- Measure voltage between PWR GND circuit at the MAF sensor harness connector and battery positive post.

Is voltage greater than 10.0 volts?

Yes	No
KEY OFF. GO to <u>DC6</u> .	REPAIR open circuit. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, <u>Powertrain Control Module (PCM) Reset</u>).

DC6 CHECK VPWR CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of VPWR circuit between PCM harness connector pin (or on 150PIN PCM, the VPWR fuse to the power relay) and MAF sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to <u>DC7</u> .	REPAIR open circuit. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, <u>Powertrain Control Module (PCM)</u>

Reset).

DC7 CHECK MAF CIRCUIT SHORT TO PWR GND OR MAF RTN IN THE HARNESS

- PCM disconnected.
- Disconnect scan tool from DLC.
- Measure resistance between MAF and PWR GND circuits at the MAF sensor harness connector.
- Measure resistance between MAF and MAF RTN circuits at the MAF sensor harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
GO to <u>DC8</u> .	REPAIR short circuit. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, <u>Powertrain Control Module (PCM) Reset</u>).

DC8 CHECK MAF RTN CIRCUIT SHORT TO PWR GND IN THE HARNESS

- Measure resistance between MAF RTN and PWR GND circuits at the MAF sensor harness connector.

Is the resistance greater than 10,000 ohms?

Yes	No
RECONNECT scan tool to DLC. GO to <u>DC9</u> .	REPAIR short circuit. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, <u>Powertrain Control Module (PCM) Reset</u>).

DC9 CHECK MAF CIRCUIT VOLTAGE CYCLING INTEGRITY

- Reconnect PCM.
- Key on, engine off.
- Access MAF V PID.
- Record the MAF V PID reading.
- Jumper MAF RTN and PWR GND circuits at the MAF sensor harness connector.
- Jumper MAF and VPWR circuits at the MAF sensor harness connector.

Does the MAF V PID change from less than 0.23 volt (closer to zero volts) to greater than 4.50 volts?

Yes	No
REPLACE MAF sensor. RESET Keep Alive Random Access Memory (RAM)(REFER to Section 2, <u>Powertrain Control Module (PCM) Reset</u>).	For DTC P1101 without P0102 present: KEY OFF. GO to <u>DC11</u> . For DTC P0102: KEY OFF. GO to <u>DC10</u> .

DC10 CHECK MAF CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of MAF circuit between PCM harness connector pin and MAF sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to DC11 .	REPAIR open circuit. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset).

DC11 CHECK PWR GND CIRCUIT FOR OPEN IN HARNESS

- PCM disconnected.
- Disconnect scan tool from DLC.
- Measure resistance of PWR GND circuit between MAF sensor harness connector and battery negative post.

Is resistance less than 10 ohms?

Yes	No
RECONNECT scan tool. GO to DC12 .	REPAIR open circuit. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset).

DC12 CHECK MAF RTN FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Measure resistance of MAF RTN circuit between PCM harness connector pin and MAF sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuit. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset).

DC16 DTC P1100: CHECK MAF CIRCUIT FOR INTERMITTENT VOLTAGE TO PCM

- Start engine and bring it to idle.
- If a stable idle is not at least 700 rpm, GO to [Section 3](#) , Symptom Charts.

- Run throttle up to 1500 rpm for 5 seconds, and bring back to idle.
- Access MAF V PID while completing the following:
 - Lightly tap on MAF sensor and wiggle harness connector to simulate road shock.

Is MAF V PID changing below the minimum 0.23 volt or above a maximum 4.60 volts?

Yes	No
INSPECT MAF sensor connector. If OK, REPLACE the MAF sensor. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset).	GO to DC17 .

DC17 CHECK FOR MAF SENSOR CIRCUIT FOR INTERMITTENT OPENS OR SHORTS

- Again access the MAF V PID.
- Key on, engine off.
- Complete the following:
 - Grasp the MAF sensor harness and MAF sensor harness connector.
 - Shake and bend a small section of the harness all the way to the dash panel.
 - Wiggle, shake and bend the harness from the dash panel to the PCM.

Is the MAF V PID reading changing below the minimum 0.23 volt or above the maximum 4.60 volts?

Yes	No
REPAIR as necessary. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset).	Unable to duplicate or identify fault at this time. GO to Z1 .

DC20 DTC P0103: CHECK MAF SENSOR SIGNAL HIGH INPUT TO PCM

Note: DTC P0103 can be generated by foreign material blocking the MAF sensor screen causing an air flow restriction. If contaminants are found on the screen, check air cleaner element installation in air cleaner housing and proper sealing of air cleaner and air tubes before proceeding. Rerun Quick Test after service.

- Start engine and bring to idle.
- If a KOER DTC P0505 is present, GO to Section 4, Powertrain [Diagnostic Trouble Code \(DTC\) Charts](#). For 2.5L A/T Ranger that stalls and cannot maintain an idle, REPLACE PCM (refer to Section 2, [Flash Electrically Erasable Programmable Read Only Memory \(EEPROM\)](#)).
- Run throttle up to 1500 rpm for 5 seconds, and bring it back to idle.

Note: MAF V PID is greater than 4.60 volts.

- Access MAF V PID.
- Key off.
- Disconnect MAF sensor.
- Jumper PWR GND and MAF RTN circuits at the MAF sensor harness connector.
- Key on, engine running.
- Again access MAF V PID.

Did MAF V PID drop from the previous reading to below 0.23 volt?

Yes	No
REMOVE jumper. REPLACE MAF sensor. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, <u>Powertrain Control Module (PCM) Reset</u>).	KEY OFF. REMOVE jumper. GO to <u>DC21</u> .

DC21 CHECK MAF CIRCUIT FOR SHORT TO VPWR IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Key on, engine off.
- Measure voltage between MAF and PWR GND circuits at the PCM harness connector.

Is voltage less than 1.0 volt?

Yes	No
<p>If an idle concern is not present:</p> <p>REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).</p> <p>If a fault was not detected and an idle concern is still present:</p> <p>Disregard DTC P0102 at this time. RETURN to <u>Section 3</u> , Symptom Charts.</p>	REPAIR short circuit.

DC25 DTC P0171, P0172, P0174, P0175, P1131, P1132, P1151, P1152, P1130, P1150 OR LEAN DRIVEABILITY CONCERNS: CHECK CONDITIONS RELATED TO MAF SENSOR

Note: Most weather service reports are a local barometric pressure that has been corrected to sea level. However, the BARO PID reports the actual barometric pressure for the altitude the vehicle is being diagnosed in. Local weather conditions (high or low pressure areas) will change the local barometric pressure by several inches of mercury [+/- 3 Hz. (+/- 1 in.Hg.)].

- Verify the MAF sensor is connected. If not, repair as necessary.
- Key on, engine running.
- Access the BARO, LONGFT1, LONGFT2 and MAF V PIDs on fully warmed-up engine.
- Check that the BARO PID is approximately the same as the barometric pressure reading for the location, day and altitude the vehicle is being diagnosed at.
 - BARO PID values in Keep Alive Memory require updating at high throttle openings. If vehicle is driven down from higher altitudes for diagnosing, complete three or four heavy accelerations at greater than half-throttle to allow BARO PID to update.
 - BARO PID must be within +/- 6 Hz. (+/- 2 in.Hg.) of the altitude value in Barometric Pressure Reference Chart (at the beginning of this pinpoint test).
 - Make BARO PID comparisons to Barometric Pressure Reference Chart or daily airport barometric pressure reports, if available.
- Check that the LONGFT1 and LONGFT2 PIDS for all injector banks at idle is not more negative than -12%.

- Check that the MAF V PID at idle and neutral is not greater than 30% of the normal MAF V listed in [Section 6](#), Reference Values (or not greater than 1.1 volts).

Are two of the above three checks OK?

Yes	No
<p>For DTC P0171, P0172, P0174, P0175, P1131, P1132, P1151, P1152, P1130 or P1150 : GO to H42 (or GO to HA42 for natural gas vehicles only). For driveability symptoms without DTCs : RETURN to Section 3, Symptom Charts for further diagnosis.</p>	<p>KEY OFF. GO to DC26.</p>

DC26 CHECK TO ISOLATE MAF SENSOR FROM LEAN DRIVEABILITY OCCURENCE

Note: Due to increasingly stringent emission/OBD II requirements, a fuel system DTC on some vehicles will be generated without a noticeable driveability concern with or without the MAF sensor disconnected. Under these conditions, if the BARO, LONGFT1, LONGFT2 and MAF V PID indicates a MAF sensor concern, replace the MAF sensor.

- Disconnect the MAF sensor.
- Key on, engine running.
- Drive the vehicle.

Is the lean driveability symptom (lack of power, spark knock/detonation, buck/jerk or hesitation/surge on acceleration) gone?

Yes	No
<p>REPLACE MAF sensor.</p> <p>RESET Keep Alive random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset).</p> <p>VERIFY a symptom no longer exists.</p>	<p>For DTC P0171, P0172, P0174, P0175, P1131, P1132, P1151, P1152, P1130 or P1150 : GO to H42 (or GO to HA42 for natural gas vehicles only).</p> <p>For lean driveability symptoms listed without DTCs : RETURN to Section 3, Symptom Charts for further diagnosis.</p>

DD: Fuel Rail Pressure (FRP) Sensor Introduction

DD: Pinpoint Tests →

Note

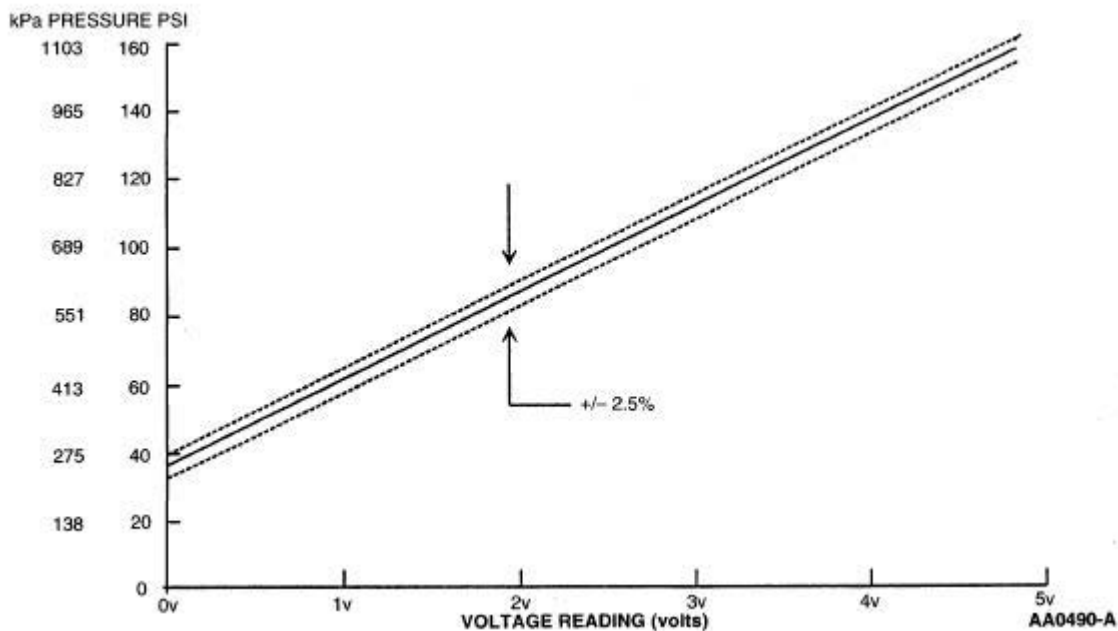
This Pinpoint Test is intended to diagnose the following:

- Fuel Rail Pressure (FRP) Sensor (9F972)
- Harness Circuits: FRP and SIG RTN
- Powertrain Control Module (PCM) (12A650)

Tables and Graphs

Voltage values were calculated for VREF = 5.0 volts. These values may vary 15 percent due to sensor and VREF variations.

Natural Gas Vehicles

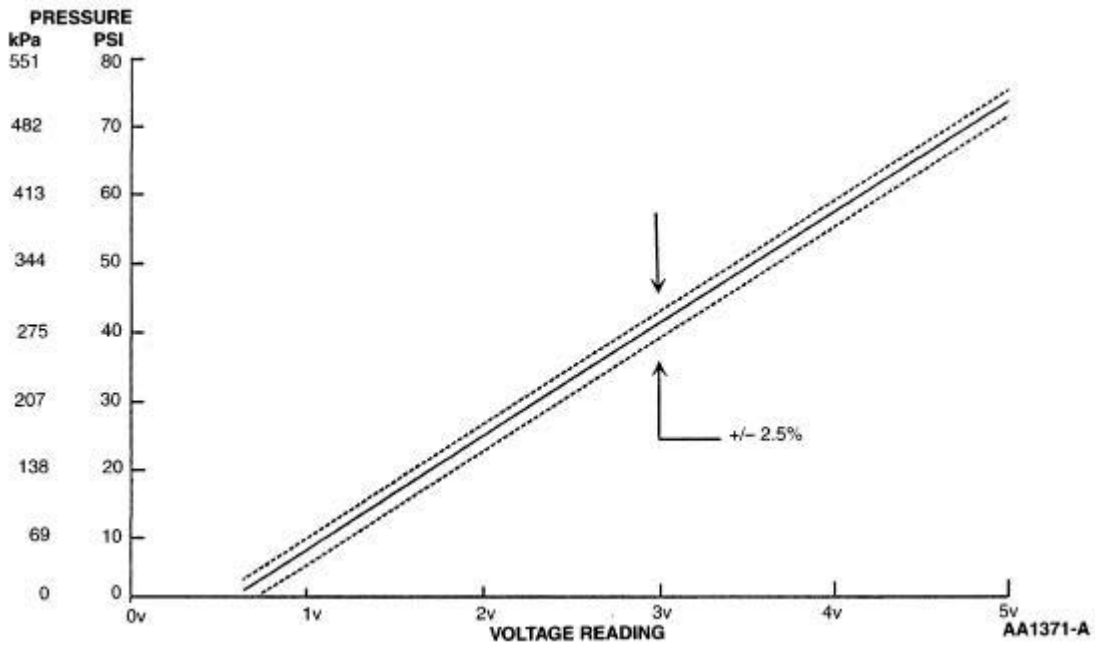


Natural Gas Vehicles — FUEL RAIL PRESSURE SENSOR VOLTAGE AND PRESSURE SPECIFICATIONS

Fuel Rail Pressure (FRP) Sensor		
Voltage (dcv)	Pressure (psi)	Pressure (kPa)
4.5	150	1034
4.1	140	965

3.7	130	896
3.3	120	827
2.9	110	758
2.5	100	689
2.1	90	620
1.7	80	551
1.3	70	482
0.9	60	413
0.5	50	344
0.1	40	275
0	37.6	259

Gasoline Vehicles

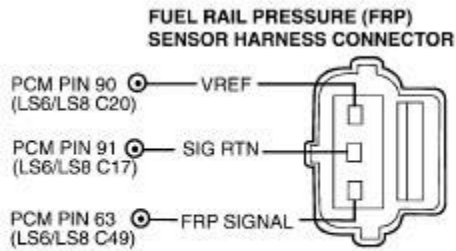


Gasoline Vehicles — FUEL RAIL PRESSURE SENSOR EXPECTED VOLTAGE

Voltage (dcv)	Pressure (kPa)	Pressure (psi)
4.5	482	70
3.9	413	60
3.4	344	50
2.8	275	40
2.2	207	30
1.6	138	20
1.1	69	10
0.5	0	0

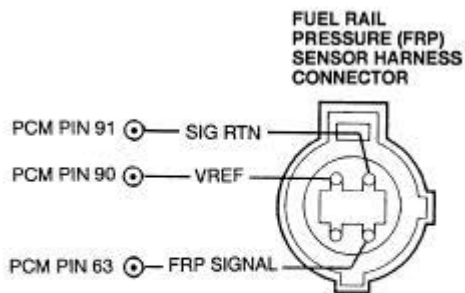
Pinpoint Test Schematics and Connectors

Gasoline Vehicles



A0015123

NG Vehicles



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**

AA4808-A

DD: Fuel Rail Pressure (FRP) Sensor

← DD: Introduction

DD1 DTC P0192: VERIFY DTC WITH FRP PID

- Key on, engine off.
- Verify there is sufficient fuel (NG only).
- Access FRP PID.

Is the FRP PID voltage less than 0.2 volt?

Yes	No
KEY OFF. For NG vehicles: GO to DD2 . All others: Fault is present, GO to DD3 .	Fault is intermittent. GO to DD13 .

DD2 CHECK FUEL PRESSURE (NATURAL GAS)

- Install fuel pressure gauge.
- Key on engine running.
- Obtain a pressure reading.

Is the fuel pressure reading greater than 345 kPa (50 psi)?

Yes	No
KEY OFF. GO to DD3 .	GO to HB1 .

DD3 GENERATE OPPOSITE SIGNAL

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect FRP harness connector.
- Natural Gas Vehicles: Jumper FRP SIG pin to VREF pin at the FRP sensor harness connector.

Note: If any scan tool communication concern exists, remove jumper and GO to [DD24](#).

- Key on, engine off.
- Access FRP V PID.

Is the FRP V PID voltage greater than 4.6 volts?

Yes	No
REPLACE FRP sensor. REFER to Electronic	

Engine Controls, Section 303-14 in the Workshop Manual.

GO to DD4.

DD4 CHECK VREF VOLTAGE TO FRP SENSOR

- Measure voltage between VREF and SIG RTN circuits at the FRP sensor harness connector.

Is the voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. GO to <u>DD5</u> .	GO to <u>C1</u> .

DD5 CHECK FRP CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of FRP circuit between PCM harness connector pin and FRP sensor harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
GO to <u>DD6</u> .	REPAIR open circuit.

DD6 CHECK FRP CIRCUIT FOR SHORTS TO SIG RTN AND PWR GND IN HARNESS

- Measure resistance between FRP and SIG RTN circuits at the PCM harness connector.
- Measure resistance of FRP circuit at the PCM harness connector and battery negative post.

Are both resistances greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

DD7 DTC P0193: CHECK FUEL PRESSURE PID VALUE

- Key on.
- Access and monitor FRP V PID.

Is the FRP V PID voltage greater than 4.5 for NG and 4.8 for all others?

Yes	No
KEY OFF.	

For gasoline vehicles: GO to <u>DD8</u> . For NG vehicles: GO to <u>DD9</u> .	Fault is intermittent. GO to <u>DD14</u> .
--	--

DD8 CHECK FUEL RAIL PRESSURE SENSOR FOR FUEL LEAKS

- Remove vacuum hose from fuel rail pressure sensor.
- Inspect sensor and hose for fuel.

Is fuel present?

Yes	No
REPLACE fuel rail pressure sensor.	GO to <u>DD10</u> .

DD9 CHECK FUEL PRESSURE (NATURAL GAS)

- Install fuel pressure gauge.
- Key on, engine running.
- Obtain a pressure reading.

Is the fuel pressure reading greater than 1034 kPa (150 psi)?

Yes	No
KEY OFF. GO to <u>HB1</u> .	KEY OFF. GO to <u>DD10</u> .

DD10 ATTEMPT TO INDUCE OPPOSITE FRP SIGNAL

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect FRP sensor.
- Jumper FRP pin to SIG RTN pin at the FRP sensor harness connector.
- Key on, engine off.
- Access FRP V PID.

Note: If any scan tool communication concern exists, remove jumper and GO to DD24.

Is the FRP V PID voltage less than 0.2 volt?

Yes	No
KEY OFF. REPLACE fuel rail pressure (FRP) sensor. REFER to the Electronic Engine Controls, Section 303-14 in the Workshop Manual.	KEY OFF. GO to <u>DD12</u> .

DD11 DTC P0190: CHECK VREF TO FRP SENSOR

Note: Before proceeding to the following test step, a complete inspection of the fuel system for external leaks must be completed. Repair any leaks before continuing. Verify fuel level before beginning test steps.

- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the FRP sensor harness connector.

Is the voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. GO to DD13 .	KEY OFF. GO to DD12 .

DD12 CHECK FRP, SIG RTN AND VREF CIRCUITS FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of FRP circuit between PCM pin and FRP sensor harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and FRP sensor harness connector.
- Measure resistance of VREF circuit between PCM harness connector pin and FRP sensor harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to DD13 .	REPAIR open circuit.

DD13 CHECK FRP SENSOR RESISTANCE

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Measure resistance between FRP pin and VREF pin at the FRP sensor.
- Measure resistance between FRP pin and SIG RTN pin at the sensor.

Is each resistance between 30K - 40K ohms?

Yes	No
<p>For continuous memory DTC P0190 only:</p> <p>GO to DD15.</p> <p>For DTC P0192:</p> <p>REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p> <p>DTC P0193:</p> <p>GO to DD14.</p>	REPLACE FRP sensor.

DD14 CHECK FRP CIRCUIT FOR SHORT TO VREF AND VPWR IN HARNESS

- Disconnect PCM.
- Measure resistance between FRP and VPWR circuits at the PCM harness connector.
- Measure resistance between FRP and VREF circuits at the PCM harness connector.

Are both resistances greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

DD15 WIGGLE TEST THE FRP SENSOR CIRCUIT WHILE MONITORING FRP PID FOR SUDDEN VALUE CHANGE

- Access FRP V PID.
- While monitoring FRP V PID, tap on the FRP sensor; then wiggle the wiring while looking for sudden changes in the PID voltage as an indication of an intermittent fault.

Is a fault indicated?

Yes	No
REPAIR as necessary.	Unable to duplicate/identify fault at this time. GO to Z1 .

DD16 KOEO, KOER DTC P0191 AND CONTINUOUS DTCS P0191 P1168 P1169: CHECK FUEL PRESSURE

Note: For Natural Gas Vehicles, if vehicle is a no-start, GO to [HB1](#).

- Key on.
- Verify there is sufficient fuel (one eighth tank or greater).
- Key off.
- Fuel pressure gauge connected.
- Key on engine off.

Note: for fuel pressure specifications, refer to the **Fuel Delivery System Test Information Chart** in the beginning of **HC**.

Is the fuel pressure within range for the vehicle being diagnosed?

Yes	No
GO to DD17 .	REMOVE pressure gauge. GO to HC1 for gasoline or GO to HB1 for NG vehicles.

DD17 CHECK FUEL PRESSURE WITH FRP PID

- Connect scan tool.

- Install fuel pressure gauge.
- Key on.
- Access and monitor FRP PID.

Is the FRP pressure reading within 10 psig of the fuel pressure gauge reading?

Yes	No
<p>For DTCS P1168 or P1169: Complete PCM Reset to clear DTCS (REFER to Section 2, Powertrain Control Module (PCM) Reset). DRIVE vehicle 3-5 minutes at a steady speed state. CHECK for Continuous Memory DTC P1168 or P1169. If P1168 or P1169 is displayed, GO to DD18.</p> <p>For DTC P0191 in Continuous Memory only: GO to DD15.</p> <p>All others: RERUN Quick Test.</p>	<p>For NG vehicle: GO to DD18.</p> <p>All others: GO to DD19.</p>

DD18 VERIFY FUEL RAIL SOLENOID SHUT-OFF VALVE OPERATES

- Key on.
- Access and enter the Output Test Mode.
- Cycle output ON and then OFF several times.

Is a click felt or heard from the fuel rail solenoid shut-off valve?

Yes	No
<p>KEY OFF. EXIT Output Test Mode. RECONNECT solenoid valve. GO to DD19.</p>	<p>KEY OFF. GO to DD22.</p>

DD19 CHECK VREF VOLTAGE TO FRP SENSOR

- Disconnect FRP sensor.
- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the FRP sensor harness connector.

Is the voltage reading between 4.0 and 6.0 volts?

Yes	No
<p>KEY OFF. GO to DD20.</p>	<p>GO to C1.</p>

DD20 CHECK FRP CIRCUIT RESISTANCE

Note: Refer to the PCM connector pin numbers at the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of FRP circuit between PCM harness connector pin and the FRP sensor harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and FRP sensor

harness connector.

- Measure resistance of VREF circuit between PCM harness connector pin and FRP sensor harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to DD21 .	REPAIR as necessary.

DD21 MONITOR FRP V PID WITH SCAN TOOL

- Key on, engine off.
- Access FRP V PID.

Is the FRP V PID value less than 0.2 volt for NG, and greater than 4.8 volts for all others?

Yes	No
REPLACE FRP sensor.	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

DD22 CHECK FSV PWR VOLTAGE TO FUEL RAIL SOLENOID SHUT-OFF VALVE HARNESS CONNECTOR

- Disconnect the fuel rail solenoid shut-off valve at the harness connector.
- Key on.
- Access and enter Output Test Mode on the scan tool.
- Select: ALL ON.

Note: Measurement must be made within 7 seconds of activating test mode.

- Measure voltage between the FSV PWR circuit at the fuel rail solenoid shut-off valve harness connector and battery negative post.

Is the voltage reading greater than 10.5 volts?

Yes	No
GO to DD23 .	KEY OFF. REPAIR open circuit.

DD23 CHECK GROUND CIRCUIT FOR OPEN IN HARNESS

- Measure resistance between the ground circuit at the fuel rail solenoid shut-off valve harness connector and battery negative post.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE fuel rail solenoid shut-off valve.	REPAIR open circuit.

DD24 CHECK VREF VOLTAGE TO FRP SENSOR

- Disconnect FRP sensor.
- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the FRP harness connector.

Is the voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. GO to DD25 .	VREF is out of range. GO to C1 .

DD25 CHECK FOR FRP SIGNAL CIRCUIT SHORTED TO SIG RTN VREF OR PWR GND IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Disconnect scan tool from DLC.
- FRP disconnected.
- Measure resistance between FRP and SIG RTN circuits at the PCM harness connector.
- Measure resistance between FRP and VREF circuits at the PCM harness connector.
- Measure resistance between FRP circuit at the PCM harness connector and battery negative post.

Is the resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short.

DE: Flexible Fuel (FF) Sensor Introduction

DE: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

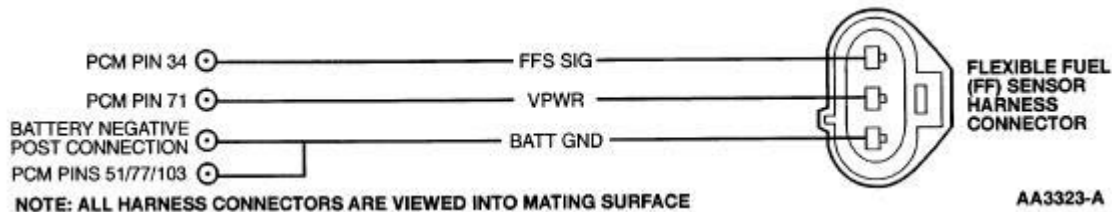
- Flexible Fuel (FF) sensor (9C044)
- Harness circuits: FF SIG, Vehicle Power (VPWR) and Power Ground (PWR GND)
- Powertrain Control Module (PCM) (12A650)

Warning

THE FUEL SYSTEM IS PRESSURIZED WHEN THE ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHEN WORKING ON THE FUEL SYSTEM. BECOME FAMILIAR WITH THE WARNING AND SAFE FUEL HANDLING PRACTICES IN PINPOINT TEST HB BEFORE SERVICING.

Pinpoint Test Schematics and Connectors

All with Flex Fuel Sensor Hardware(not sensorless application)



DE: Pinpoint Tests →

DE: Flexible Fuel (FF) Sensor

← DE: Introduction

DE1 DTC P0176: CHECK VPWR VOLTAGE TO FF SENSOR

Note: To determine whether the vehicle being serviced is an ethanol or methanol application, look at the calibration sticker on the door jamb. A prefix of 610 C indicates an ethanol vehicle. A prefix of 610 G indicates a methanol vehicle. Another method is to refer to the fuel filler door; it will read either METHANOL or ETHANOL.

- Disconnect FF sensor.
- Key on.
- Measure VPWR circuit voltage between the VPWR circuit at the FF sensor harness connector and battery negative post.

Is the voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to DE2 .	VPWR circuit fault. KEY OFF. CHECK condition of related fuses/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK VPWR circuit for short to ground. REPAIR as necessary.

DE2 CHECK BATTERY GROUND CIRCUIT FOR OPEN IN HARNESS

- Measure resistance between battery ground circuit at the FF sensor harness connector and battery negative post.

Is resistance less than 10,000 ohms?

Yes	No
GO to DE3 .	REPAIR open circuit.

DE3 CHECK FF SENSOR SIGNAL CIRCUIT FOR OPEN IN HARNESS

- Measure resistance between FF sensor signal circuit at PCM harness connector and FF sensor signal circuit at the FF sensor harness connector.

Is resistance less than 5 ohms?

Yes	No
GO to DE4 .	REPAIR open circuit.

DE4 CHECK FF SENSOR SIGNAL CIRCUIT FOR SHORT TO POWER

- Disconnect scan tool.
- Disconnect PCM.
- Measure resistance between FF sensor signal and VPWR circuits at PCM harness connector.

Is resistance greater than 10,000 ohms?

Yes	No
GO to <u>DE5</u> .	REPAIR short circuit.

DE5 CHECK FF SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND

- Measure resistance between FF sensor signal and PWR GND circuits at PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
GO to <u>DE6</u> .	REPAIR short circuit.

DE6 CHECK FF SENSOR DEDICATED FAILURE MODE PID

- Flex fuel sensor connected.
- Connect scan tool.
- Connect PCM.
- Key on, engine running.

Is the FFFM PID indicating an ON condition?

Yes	No
Possible FF sensor damage. GO to <u>DE7</u> .	<p>KEY OFF. For Ethanol Vehicles:</p> <p>If you know the percentage of ethanol in the fuel of the vehicle, GO to <u>DE10</u>.</p> <p>For Methanol Vehicles:</p> <p>If you know the percentage of methanol in the fuel of the vehicle, GO to <u>DE11</u>.</p> <p>If you do not know the percentage of ethanol or methanol in the fuel, GO to <u>DE8</u>.</p>

DE7 CHECK FF SENSOR FREQUENCY

- Access the FF PID and record the PID frequency value.

Is the FF PID indicating a value within 40-160 Hz?

Yes	No
KEY OFF. The FF sensor output does not indicate a failure.	

For Ethanol Vehicles:

If you know the percentage of ethanol in the fuel of the vehicle, GO to DE10.

For Methanol Vehicles:

If you know the percentage of methanol in the fuel of the vehicle, GO to DE11.

If you do not know the percentage of ethanol or methanol in the fuel, GO to DE8.

KEY OFF. GO to DE12.

DE8 DETERMINE SEPARATION POINT OF WATER/METHANOL (OR WATER/ETHANOL) AND GASOLINE IN THE FUEL

Note: This step requires the Rotunda Fuel Composition Test Kit 014-00770 or equivalent.

- Fill beaker with 5 ml of clean water.
- Place the hose end of the fuel drain hose assembly in gas can.
- Connect fuel drain hose assembly to fuel pressure relief valve. Turn connector clockwise to tighten. Turn ON/OFF valve clockwise to open.
- Key on.
- Allow 22 ml of fuel to drain into the gas can.
- Pour 20 ml of the fuel into 25 ml graduated cylinder.
- Pour enough water from the beaker into the 25 ml graduated cylinder to bring total volume to 24 ml.
- Insert stopper plug in opening of 25 ml graduated cylinder. Hold it in place as you shake cylinder to mix water and fuel. Allow liquid to stand and separate.

Note: After about three minutes, the methanol and water (or ethanol and water) will mix together and settle to the bottom of the cylinder. The gasoline will rise to the top.

- Record the level on the graduated cylinder where the methanol/water (or ethanol/water) mixture and gasoline meet.

Have all of the steps been completed?

Yes	No
KEY OFF. RECONNECT fuel pressure relief valve. GO to <u>DE9</u> .	KEY OFF. COMPLETE all steps before continuing. Gasoline and water will separate. However, if the fuel does not appear to separate, then the fuel is either 100% methanol or a mixture of methanol and water.

DE9 CALCULATE PERCENTAGE OF METHANOL (OR ETHANOL) IN THE FUEL

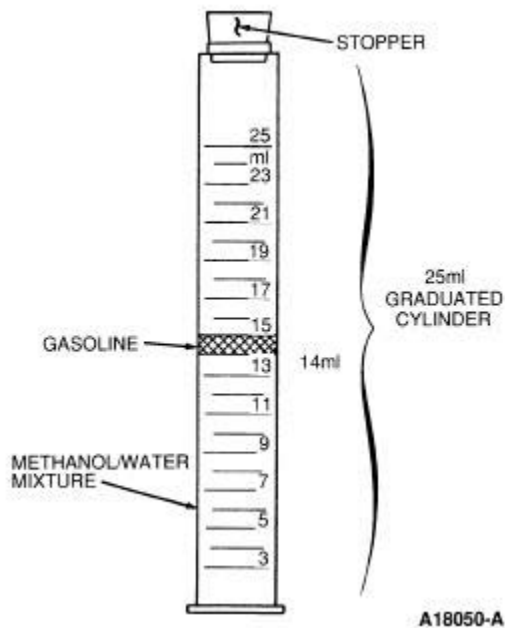
- Use the following equation to calculate and record the percentage of methanol (or ethanol) in the fuel sample collected in step **DE8** :

$$\text{Percent methanol (or ethanol)} = (A - 4) \times 5$$

Note: The letter A in the above equation equals the level on the graduated cylinder recorded from step **DE8** where the methanol/water (or ethanol/water) mixture and gasoline meet; see illustration

below.

- EXAMPLE: If the reading from step **DE8** is 14 ml then the percentage of methanol (or ethanol) in the fuel mixture is $(14 - 4) \times 5$, which equals 50. Therefore, the percentage of methanol (or ethanol) in the fuel mixture is 50.

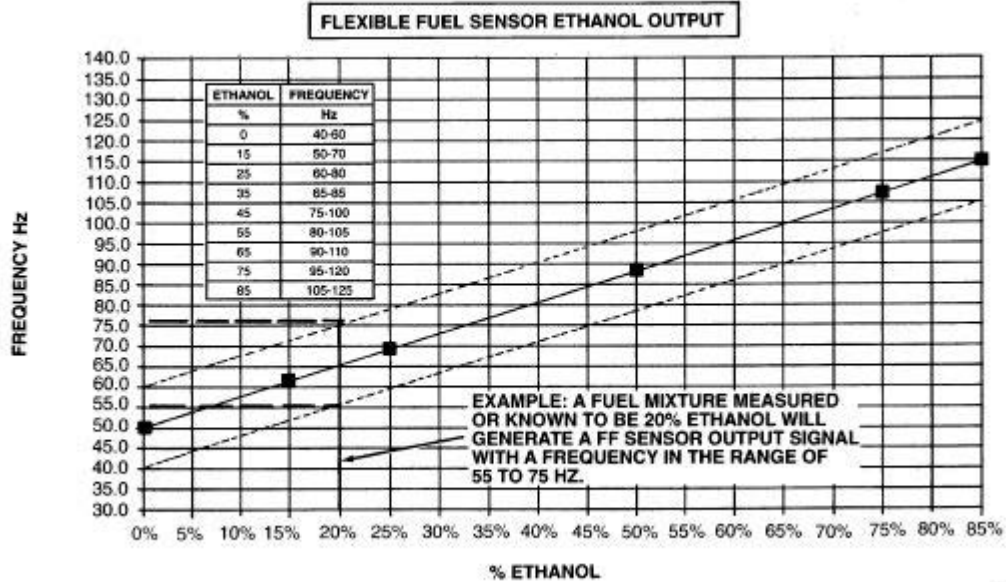


Has the percentage of methanol (or ethanol) in the fuel mixture been determined?

Yes	No
<p>The results are accurate to +/- 10%. POUR any remaining fuel back into the vehicle via the fuel filler.</p> <p>For ethanol vehicles: GO to <u>DE10</u>.</p> <p>For methanol vehicles: GO to <u>DE11</u>.</p>	<p>COMPLETE the determination of the methanol (or ethanol) percentage before continuing.</p>

DE10 CHECK FF SENSOR OPERATION: ETHANOL BLEND FUEL

- Key on, engine running.
- Access the FF PID and record frequency.
- Using chart below, determine the corresponding frequency range for the known percentage of ethanol.



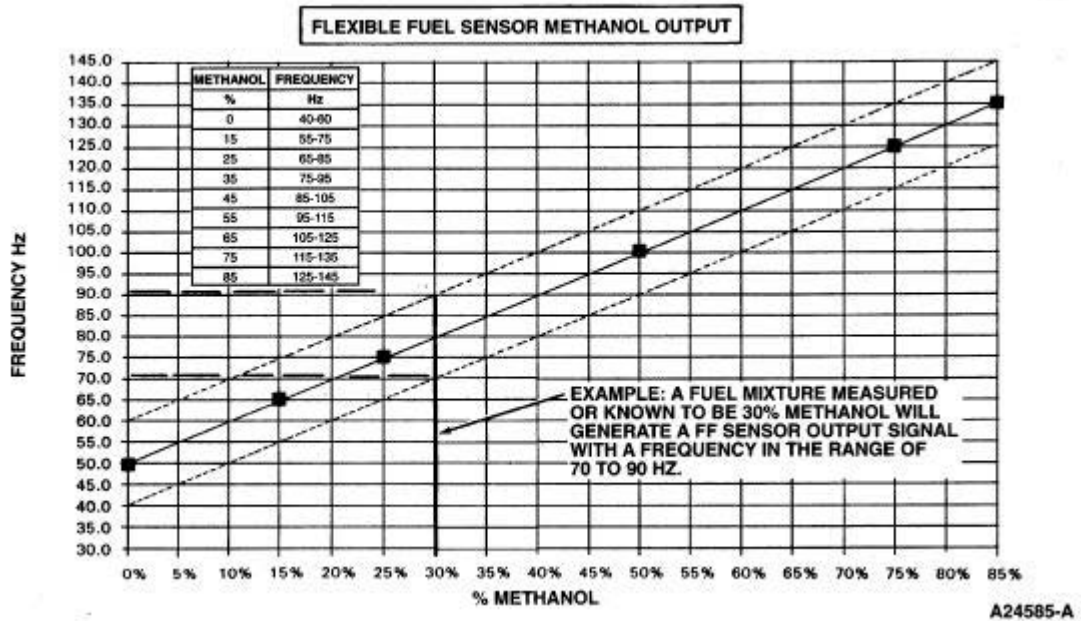
A24584-A

Is the FF PID value within the frequency range shown on the chart?

Yes	No
KEY OFF. REPLACE the PCM.	KEY OFF. Either the FF sensor is not operating properly or the fuel is contaminated. LOWER and DRAIN the fuel tank and refill with known ethanol blend. START and RUN engine to purge the old fuel from the fuel rails, then GO to <u>DE10</u> . If output frequency still does not match the known ethanol fuel blend, REPLACE the FF sensor.

DE11 CHECK FF SENSOR OPERATION: METHANOL FUEL BLEND

- Key on, engine running.
- Access the FF PID and record frequency.
- Using the chart below, determine the corresponding frequency range for the known percentage of methanol.



Is the FF PID value within the frequency range shown on the chart?

Yes	No
KEY OFF. REPLACE the PCM.	KEY OFF. Either the FF sensor is not operating properly or the fuel is contaminated. LOWER and DRAIN the fuel tank and refill with known methanol blend. START and RUN engine to purge the old fuel from the fuel rails, then GO to <u>DE11</u> . If output frequency still does not match the known methanol fuel blend, REPLACE the FF sensor.

DE12 CHECK PCM FUNCTION

- Disconnect FF sensor.
- Connect scan tool.
- Access the FF PID.
- Using the NGS signal simulator, or equivalent tool, feed a 100 Hz signal into the FFS signal circuit at the FF sensor harness connector.
- Key on.

Is the FF PID reflecting the frequency input signal?

Yes	No
KEY OFF. REPLACE FF sensor.	KEY OFF. REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).

DE20 DTC P0176: COMPLETE KOER SELF-TEST

- Output all KOER self-test DTCs.

Note: Ignore all other DTCs output at this time.

Is P0176 output in KOER?

Yes	No
KEY OFF. GO to <u>DE1</u> and ADDRESS the KOER DTC.	KEY OFF. The FF sensor circuit fault is intermittent. GO to <u>Z1</u> .

DF: Vehicle Speed Circuit Check Introduction

DF: Pinpoint Tests →

Note

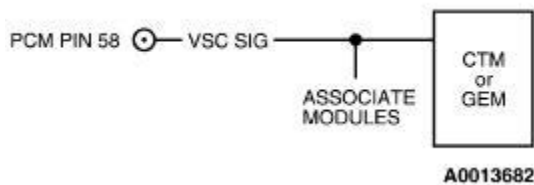
This Pinpoint Test is intended to diagnose the following:

- Harness circuits: vehicle speed circuit signal (VSC SIG), vehicle speed circuit ground (VSC GND)
- Powertrain control module (PCM) (12A650)

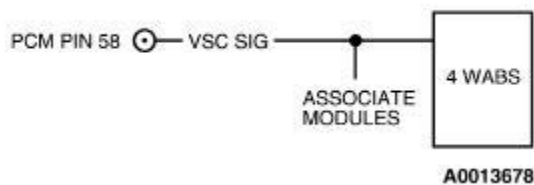
For additional information on the Anti-Lock Brake System and its circuits, refer to **Brake System, Anti-Lock** in the Workshop Manual and Wiring Diagram Manual.

Pinpoint Test Schematic and Connectors

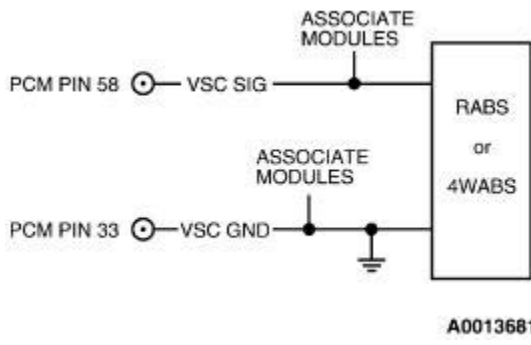
2.5L Ranger



Explorer/Mountaineer (104 PIN PCM ONLY)



5.4L, 6.8L Excursion, 5.4L, 6.8L F-Series 0/8500 GVW



DF: Pinpoint Tests →

DF: Vehicle Speed Circuit Check

← DF: Introduction

DF1 DTC P0500/P0501/P1502: CHECK VEHICLE SPEED PID

- Powertrain control module (PCM) detected an error in the vehicle speed information received from the anti-lock brake system (ABS) control module, generic electronic module (GEM) or central timer module (CTM).

Note: When diagnosing the VSC signal to the PCM refer to the chart below to determine which module sends the VSC signal to the PCM.

Vehicle Applications	Module Application(s)
2.5L Ranger	GEM or CTM
4.0L/5.0L Explorer/ Mountaineer	4WABS (w/ 4 wheel Anti-Lock Brake System)
5.4L/6.8L F-Series	4WABS (w/ 4 wheel Anti-Lock Brake System) or RABS (w/ rear wheel only Anti-Lock Brake System)
5.4L/6.8L Excursion	4WABS (w/ 4 wheel Anti-Lock Brake System)

- Key on.
- Connect scan tool.
- Access VSS PID.
- Obeying all local traffic laws, complete the following:
 - Take the vehicle to a suitable location and gradually increase the vehicle speed to 80 km/h (50 mph), while observing the VSS PID mph values.

Did the VSS PID value match the speed at which you were traveling?

Yes	No
KEY OFF. The VSS PID value was as expected. The fault that produced DTC is intermittent. GO to <u>DF5</u> .	KEY OFF. The VSS PID value was not as expected. GO to <u>DF2</u> .

DF2 CHECK VSC FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.
- Disconnect appropriate control module (ABS, GEM, or CTM).
- Key on.
- Measure voltage between VSC SIG circuit at PCM harness connector and ground.
- **For Excursion and F-Series:**
 - Also measure voltage between VSC GND circuit at PCM harness connector and ground.
- Key off.

Was voltage(s) less than 1.0 volt?

--	--

Yes	No
GO to DF3 .	GO to DF6 .

DF3 CHECK FOR OPEN VSC BETWEEN PCM AND CTM, GEM, OR ABS CONTROL MODULE

- Measure resistance of VSC circuit between PCM harness connector pin and the appropriate control module connector.
- For Excursion and F-Series:
 - Also measure resistance of VSC GND circuit between PCM harness connector pin and ground.

Is (each) resistance less than 5.0 ohms?

Yes	No
GO to DF4 .	REPAIR open circuit(s). GO to DF7 and COMPLETE VSC Repair Verification Drive Cycle.

DF4 CHECK VSC FOR SHORTS TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between ground and VSC SIG circuit at the PCM harness connector.
- For Excursion and F-Series:
 - Also measure resistance between VSC SIG and VSC GND circuits at the PCM harness connector.

Is (each) resistance greater than 10,000 ohms?

Yes	No
RESTORE vehicle. REFER to Anti-Lock Control, Section 206-09 in the Workshop Manual, for further diagnosis of the ABS control module, its speed sensors and its wheel speed sensor harness circuits. If those components are working properly, REPLACE the PCM (refer to)Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u> .GO to DF7 and COMPLETE VSC Repair Verification Drive Cycle.	GO to DF6 .

DF5 VISUAL INSPECTION

- Visually inspect the vehicle speed circuit harness circuits for any potential failures. Use the following check list for reference:
 - Loose harness connection of vehicle speed circuits at the appropriate control module.
 - Loose harness connection of vehicle speed circuits at the PCM.
 - Incorrect harness routing of vehicle speed circuits.

Note: Refer to Wiring Diagrams Manual for harness, module and connector location.

Did the visual inspection reveal any potential failure?

Yes	No
REPAIR fault as necessary. GO to <u>DF7</u> and COMPLETE VSC Repair Verification Drive Cycle.	Unable to duplicate or identify fault at this time. REFER to Anti-Lock Control, Section 206-09 in the Workshop Manual, for diagnosis of intermittent control module and wheel speed sensor concern.

DF6 VERIFY IF VSC IS SHORTED IN HARNESS OR ANOTHER MODULE

- Determine which, if any, modules are connected to the VSC (Refer to Wiring Diagrams Manual). If no other modules are connected to the VSC, GO to the "YES" Action To Take.
- One at a time, disconnect the modules associated with the VSC. After disconnecting each module, again test for short circuit (Refer to test step that sent you here). Repeat until each associated module has been disconnected or the short circuit has been eliminated.

Did the short circuit remain after all associated modules were disconnected?

Yes	No
REPAIR short circuit. GO to <u>DF7</u> and COMPLETE VSC Repair Verification Drive Cycle.	REFER to the Workshop Manual for further diagnosis of appropriate module. After repair, RESTORE vehicle. GO to <u>DF7</u> and COMPLETE VSC Repair Verification Drive Cycle.

DF7 VSC REPAIR VERIFICATION DRIVE CYCLE

Warm engine to operating temperature. Complete the VSC Repair Verification Drive Cycle at least three times as described below:

AUTOMATIC TRANSMISSIONS:

- Place transmission range selector lever in DRIVE range.
- Obey all local traffic laws.
- Accelerate heavily to 56 km/h (35 mph).
- Coast down to an idle and stop the vehicle.
- Shut the engine off.
- After the drive cycle is completed, retrieve any Continuous Memory DTCs.

MANUAL TRANSMISSIONS:

- Shift to second from first gear.
- Obey all local traffic laws.
- Accelerate moderately to 64 km/h (40 mph).
- Coast down to an idle and stop the vehicle.
- After the drive cycle is completed, retrieve any Continuous Memory DTCs.

Were any Continuous Memory DTCs generated during the drive cycle?

Yes	No
Testing is not complete. The repair has not been verified. REPAIR DTC(s). REFER to	Testing is complete. The repair has been

Section 4, Powertrain Diagnostic Trouble
Code (DTC) Charts.

verified.

DG: Knock Sensor (KS) Introduction

DG: Pinpoint Tests →

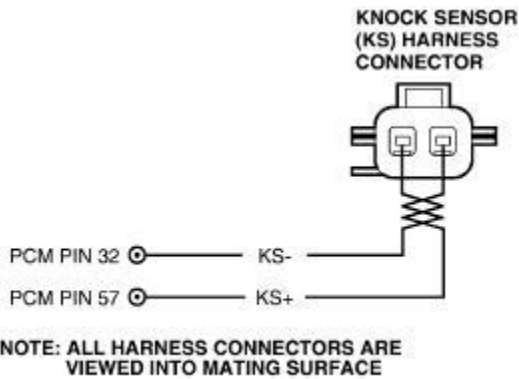
Note

This Pinpoint Test is intended to diagnose the following:

- Knock sensor (12A699)
- Harness circuits: KS and SIG RTN
- Powertrain control module (PCM) (12A650)

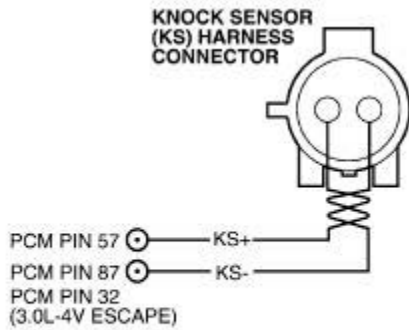
Pinpoint Test Schematics and Connectors

3.0L-4V Taurus/Sable



A0029831

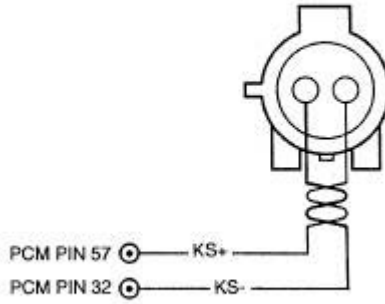
2.0L-4V Escape, 2.0L-2V Escort, 2.0L-2V Focus



A0028371

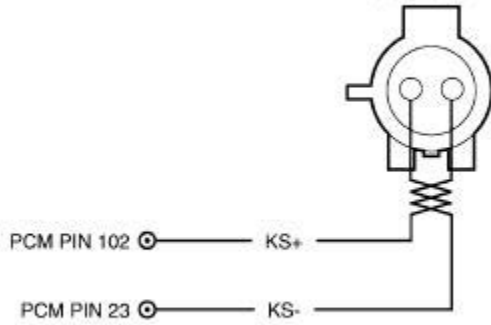
Continental, 4.6L-4V Mustang

**BANK 1
CYL 1-4
KNOCK SENSOR
(KS) HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4811-A

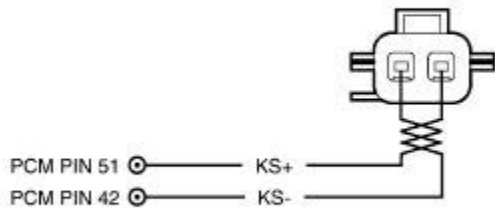
**BANK 2
CYL 5-8
KNOCK SENSOR
(KS) HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**
A0029830

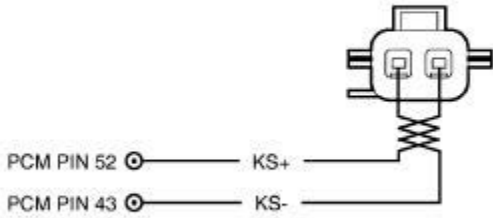
LS8

**BANK 1
CYL 1-4
KNOCK SENSOR
(KS) HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**
A0031606

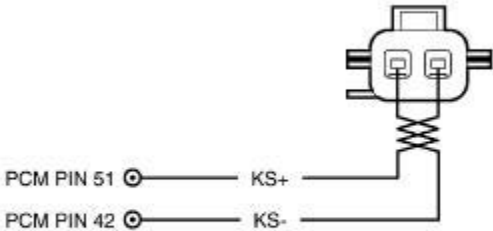
**BANK 2
CYL 5-8
KNOCK SENSOR
KS (HARNESS)
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**
A0031607

LS6

**KNOCK SENSOR
(KS) HARNESS
CONNECTOR**

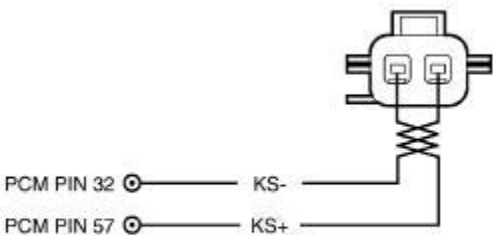


**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**

A0029832

All Others

**KNOCK SENSOR
(KS) HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**

A0029831

DG: Knock Sensor (KS)

← DG: Introduction

DG1 DTC P0330, P0331 (KS2), DTC P0325, P0326 (KS1): CHECK VOLTAGE BETWEEN SENSOR AND SIG RTN

- Verify that KS is connected and installed properly. Then complete comprehensive repair verification drive cycle. Refer to Section 2, [Drive Cycles](#).
- Key on, engine off.
- Access KS PID.
- Read dc voltage.

Is the KS PID less than 0.5 volts?

Yes	No
KEY OFF. GO to DG2 .	GO to DG5 .

DG2 CHECK KS SENSOR RESISTANCE

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect KS, measure resistance through the KS harness connector pins
- **For 4.2L:** Measure resistance between (KS+) and (KS-) at the knock sensor.

Is resistance between 4.39 and 5.35 megaohms?

Yes	No
For Town Car, 5.4L E/F-Series (HD), and 6.8L E/F-Series: GO to DG6 .	For resistance greater than 5.35 megaohms: GO to DG3 .
All others: GO to DG7 .	For resistance less than 4.39 megohm: GO to DG4 .

DG3 CHECK FOR OPEN OF KS CIRCUIT BETWEEN KS SIGRTN AND SHIELD IN HARNESS

- Disconnect PCM.
- Measure resistance of the KS+ circuit between the PCM harness connector pin and the KS harness connector.
- **For 4.2L:**
- Measure resistance of KS- circuit between the PCM harness connector pin and the KS connector.
- Where applicable, measure resistance of shield between the PCM harness connector and the shield pin at the KS connector.

Is each resistance less than 5.0 ohms?

Yes	No
REPLACE KS.	REPAIR open circuit. COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, Drive Cycles .)

DG4 CHECK KS CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect PCM.
- Measure resistance between the KS- circuit at the PCM harness connector and chassis GND.
- Measure resistance between the KS+ circuit at the PCM harness connector and chassis GND.
- **For 4.2L Only:**
- Measure resistance between the KS- and KS+ at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
GO to DG7 .	SERVICE short circuit. COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, Drive Cycles .)

DG5 CHECK KS CIRCUITS FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.
- Key on.
- Measure voltage between the KS+ circuit at the PCM harness connector and battery negative post.
- **For 4.2L Only:**
- Measure voltage between the KS- circuit at the PCM harness connector and battery negative post.

Is each voltage less than 0.5 volt?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, Drive Cycles .)	SERVICE short circuit. COMPLETE Comprehensive Component Repair Verification Drive Cycle. (Refer to Section 2, Drive Cycles .)

DG6 CHECK SHIELD CIRCUIT RESISTANCE

- Disconnect PCM.
- Measure resistance of the KS shield between the PCM harness connector pin and the KS harness connector.

Is resistance less than 5.0 ohms?

Yes	No

GO to [DG7](#). COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, [Drive Cycles](#).)

REPAIR open circuit. COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, [Drive Cycles](#).)

DG7 CHECK PCM FOR SHORT TO GROUND

- Measure resistance between KS+ and SIG RTN circuits at the KS harness connector.
- **For 4.2L Only:**
- Measure resistance between KS+ and KS- circuits at the PCM harness connector.

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE KS. If concern is still present, REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, Drive Cycles .)	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, Drive Cycles .)

DG15 DTC P0325, P0326 (KS1), DTC P0330, P0331 (KS2): CHECK KS SENSOR VOLTAGE

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Access KS PID.
- Key on, engine off.

Is the KS PID between 2.2 and 2.6 volts?

Yes	No
KEY OFF. GO to DG16 .	GO to DG18 .

DG16 CHECK KS CIRCUIT FOR INTERMITTENT FAULT

- Key on.
- While viewing the voltmeter, grasp the vehicle harness as close to the knock sensor(s) as possible. Shake and bend a small section of the harness from the KS sensor to the PCM.
- Tap the PCM and KS connectors if possible.

Is KS reading changing?

Yes	No
ISOLATE fault and SERVICE as required. COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, Drive Cycles .)	GO to DG17 .

DG17 CHECK FOR KS VOLTAGE INCREASE

- Start and run engine.
- Monitor voltage at the knock sensor at idle and at 3000 rpm.

Does the AC voltage reading increase?

Yes	No
For symptom only: RETURN to Section 3 . All others with DTC: REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, Drive Cycles .)	GO to DG18 .

DG18 CHECK KS CIRCUIT FOR OPEN IN HARNESS

- PCM disconnected.
- Disconnect suspect KS.
- Measure resistance of the KS+ signal circuit between the PCM harness connector pin and the KS harness connector.
- Measure resistance of the SIG RTN circuit between the PCM harness connector and the KS harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to DG19 .	REPAIR open circuit. COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, Drive Cycles .)

DG19 CHECK KS CIRCUIT FOR SHORT TO GROUND

- Measure resistance of the KS+ circuit between the PCM harness connector pin and chassis GND.

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE suspect KS. COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, Drive Cycles .)	REPAIR short circuit. COMPLETE Comprehensive Component Repair Verification Drive Cycle. (REFER to Section 2, Drive Cycles .)

DH: Throttle Position (TP) Sensor Introduction

DH: Pinpoint Tests →

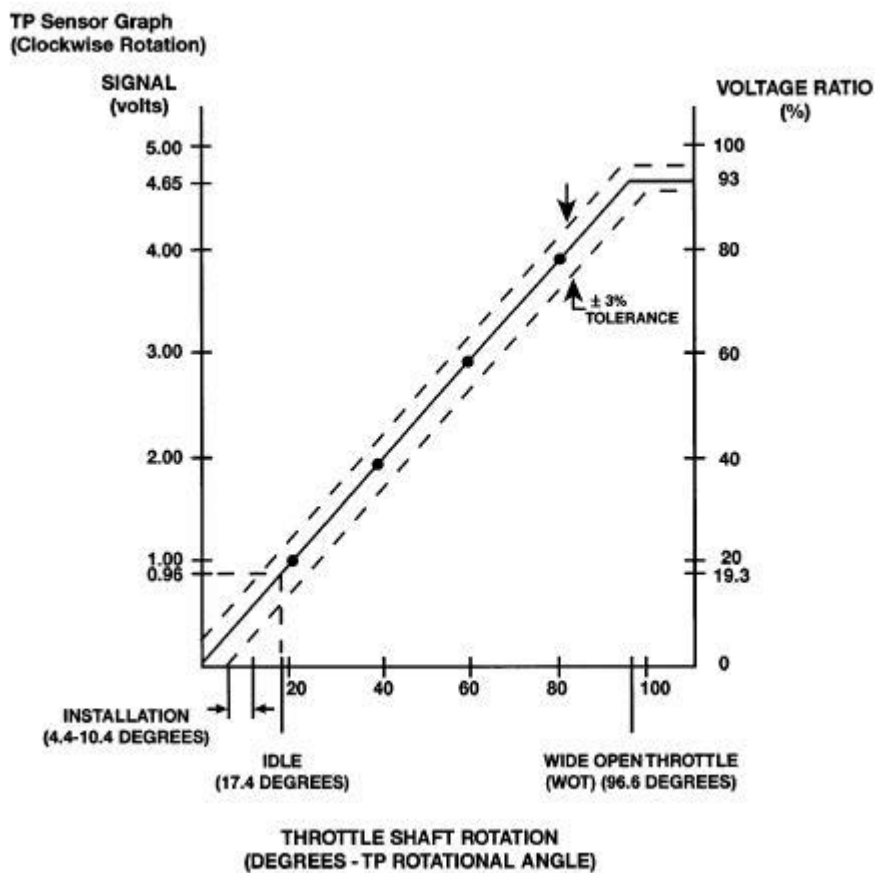
Note

This Pinpoint Test is intended to diagnose the following:

- Throttle Position (TP) Sensor (9B989)
- Binding and sticking Throttle Linkage
- Harness Circuits: TP, SIG RTN, VREF, Vehicle Power (VPWR), Power Ground (PWR GND)
- Powertrain Control Module (PCM) (12A650)

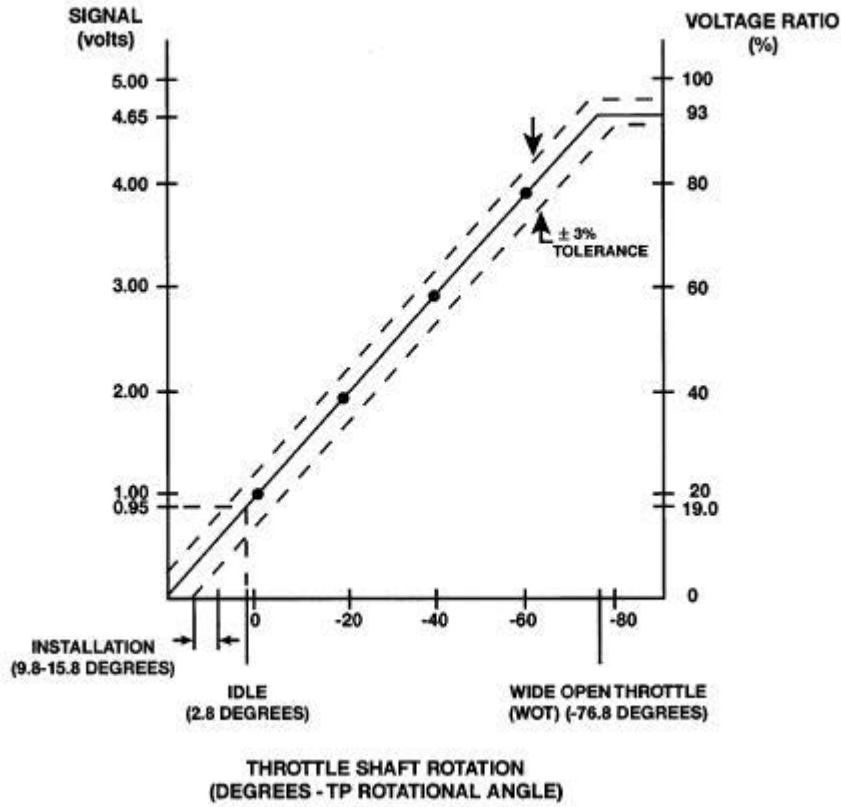
Graphs

Note: The normal range of the throttle angle measurement for the throttle position (TP) sensor is 0 to 96.6 degrees.



AA3324-B

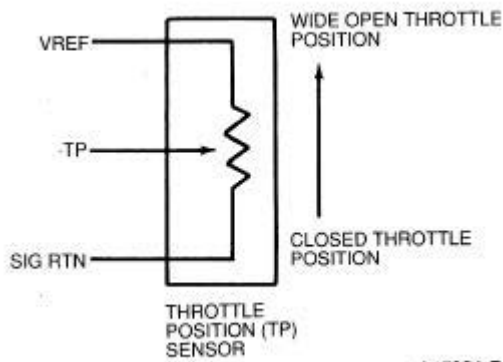
**TP Sensor Graph
(Counter Clockwise Rotation)**



AA3325-B

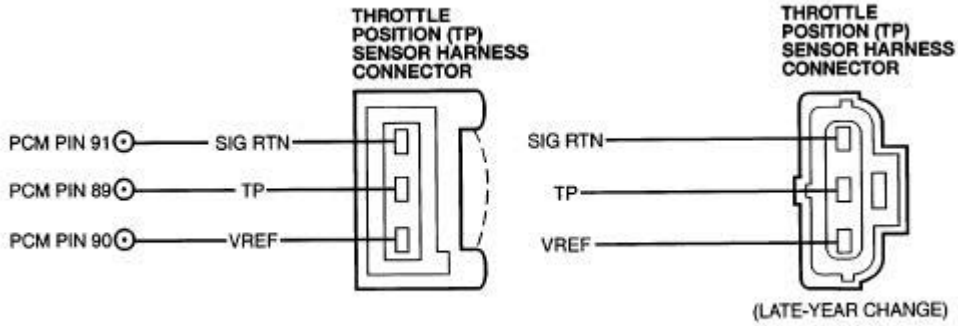
Pinpoint Test Schematics and Connectors

Contacting TP Sensor



A15921-B

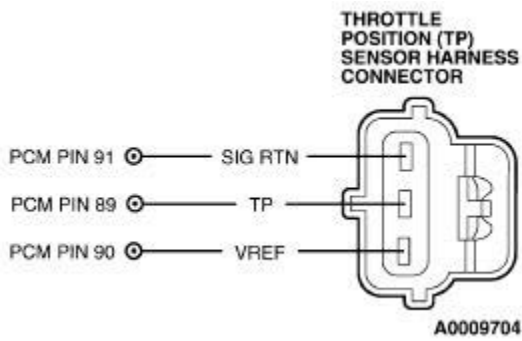
2.0L (4V) Escort, 2.0L Cougar



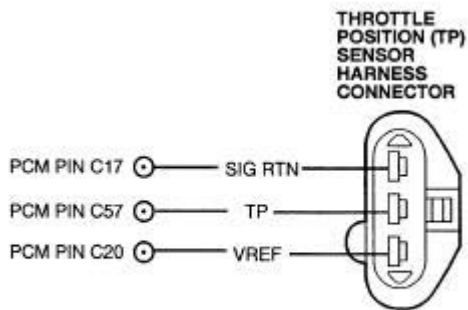
NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA4569-B

2.0L (4V) Focus, 2.3L Ranger



LS6/LS8, Explorer/Mountaineer (150 Pin PCM)

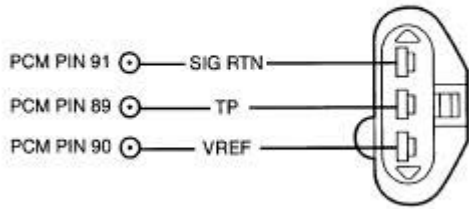


NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA4376-B

All Others

**THROTTLE
POSITION (TP)
SENSOR
HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE AA4377-B**

DH: Pinpoint Tests →

DH: Throttle Position (TP) Sensor

← DH: Introduction

DH1 KOEO AND KOER DTC P1124: CHECK FOR OTHER DTCS

- Check for DTC P1400 in KOEO or KOER Self-Test.

Is KOEO or KOER DTC P1400 present with KOEO DTC P1124?

Yes	No
RETURN to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts for DTC P1400.	KEY OFF. GO to DH2 .

DH2 CHECK FOR STUCK THROTTLE PLATE OR LINKAGE

- Visually inspect the throttle linkage and throttle plate for binding or sticking.
- Verify the throttle plate and linkage is at closed throttle position.

Does the throttle move freely and return to closed throttle position?

Yes	No
Throttle plate and linkage are OK. GO to DH8 .	REPAIR as necessary.

DH3 DTC P1120: CHECK TP CIRCUIT FOR FRAYED WIRES OR CORROSION ON CONNECTORS

- Key off.
- Complete a visual inspection of pins on harness connector at the TP sensor for corrosion.
- Complete a visual inspection of the harness wires between the TP sensor and the PCM for insulation fraying and corrosion.

Is a fault present?

Yes	No
REPAIR as necessary.	GO to DH4 .

DH4 CHECK FOR STUCK TP SENSOR

- Key on, engine off.
- Access TP PID (TP V PID).
- Slowly move throttle from closed throttle position to wide open throttle position and observe the TP PID (TP V PID).

While opening the throttle, is the TP PID (TPV PID) reading below 9.85% (0.49 volt)?

Yes	No
KEY OFF. GO to DH5 .	GO to DH20 .

DH5 CHECK VOLTAGE BETWEEN VREF AND SIG RTN CIRCUITS TO TP SENSOR

- Disconnect TP sensor.
- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. GO to DH6 .	GO to C1 .

DH6 CHECK TP CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of TP circuit between PCM harness connector pin and TP harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to DH7 .	REPAIR open circuit.

DH7 CHECK TP SENSOR VOLTAGE TO PCM

- Reconnect PCM and TP sensor.
- Start engine and idle for 2 minutes.
- Access TP PID (TP V PID).
- Slowly open the throttle from closed position and observe PID(s).

Is TP PID (TP V PID) reading at any time between 3.42-9.85% (0.17-0.49 volt)?

Yes	No
REPLACE TP sensor.	If DTC P1120 is still present, GO to DH20 .

DH8 DTC P0123 OR P1124: ATTEMPT TO GENERATE THE OPPOSITE THROTTLE POSITION ANGLE (VOLTAGE) PID READING

- Disconnect TP sensor.
- Key on, engine off.
- Access TP PID (TP V PID).

Is TP PID (TP V PID) less than 3.42% (0.17 volt)?

Yes	No
GO to <u>DH9</u> .	KEY OFF. GO to <u>DH10</u> .

DH9 CHECK VOLTAGE BETWEEN VREF AND SIG RTN CIRCUITS TO TP SENSOR

- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
REPLACE TP sensor.	GO to <u>C1</u> .

DH10 CHECK TP CIRCUIT FOR SHORT TO VREF OR VPWR IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance between TP and VPWR circuits at the PCM harness connector.
- Measure resistance between TP and VREF circuits at the PCM harness connector. (For 150PIN PCM, measure to both VREF pins.)

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

DH11 DTC P0122: ATTEMPT TO GENERATE THE OPPOSITE THROTTLE POSITION ANGLE (VOLTAGE) PID READING

Note: An intermittent fault can cause a Continuous Memory DTC P0122. If a Continuous Memory DTC P0122 is still present after DH11 through DH14, GO to DH20.

- Disconnect TP sensor.
- Jumper VREF circuit to TP circuit at the TP sensor harness connector.
- Key on, engine off.

Note: If any scan tool communication concern exists, remove jumper and GO to DH14.

- Access TP PID (TP V PID).

Is TP PID (TP V PID) greater than 93% (4.65 volts)?

Yes	No
REPLACE TP sensor.	REMOVE jumper. GO to <u>DH12</u> .

DH12 CHECK VOLTAGE BETWEEN VREF AND SIG RTN CIRCUITS

- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. GO to DH13 .	GO to C1 .

DH13 CHECK TP SENSOR CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of TP circuit between PCM harness connector pin and TP sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to DH14 .	REPAIR open circuit.

DH14 CHECK TP CIRCUIT FOR SHORT TO PWR GND OR SIG RTN IN HARNESS

- Disconnect PCM.
- Disconnect scan tool from DLC.
- Measure resistance between TP and PWR GND circuits at the PCM harness connector.
- Measure resistance between TP and SIG RTN circuits at the PCM harness connector.

Are both resistances greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

DH15 DTC P1121: CHECK RATIONALITY OPERATION BETWEEN TP AND MAF SENSORS

- Attempt to start engine.

Does the engine run?

Yes	No
GO to DH16 .	CHECK for major leaks, cracks, and openings between MAF sensor and throttle body. If OK,

GO to A1.

DH16 CHECK MECHANICAL OPERATION OF TP SENSOR

- Key on, engine off.
- Access TP PID (TP V PID).
- Slowly move throttle from closed throttle position to wide open throttle position.
- Observe and record the TP PID (TP V PID).

While opening and closing the throttle, is there a change in the TP PID (TP V PID) between 9.85% and 93% (0.49 and 4.65 volts)?

Yes	No
GO to <u>DH17</u> .	REPLACE TP sensor. VERIFY a symptom no longer exists.

DH17 CHECK TP SENSOR SIGNAL HIGH VERSUS THE ENGINE LOAD WHILE DRIVING VEHICLE

- Key on, engine running.
- Drive vehicle, exercising the throttle and TP sensor while accessing PIDS.
- Access TP PID (TP V PID) and LOAD PID and record readings.

Is TP PID (TP V PID) greater than 49.02% (2.44 volts) and the LOAD PID reading less than 30%?

Yes	No
LISTEN for air noise around MAF sensor and throttle body while engine is running. REPAIR if necessary. Otherwise, GO to <u>HU1</u> for air restriction. If OK, REPLACE the TP sensor.	GO to <u>DH18</u> .

DH18 CHECK TP SENSOR SIGNAL LOW VERSUS THE ENGINE LOAD WHILE DRIVING VEHICLE

Note: If the vehicle is a no start, GO to A1.

- Drive vehicle exercising the throttle and TP sensor near higher gears (preferably overdrive) while accessing PIDS.
- Access TP PID (TP V PID) and LOAD PID.

Is TP PID (TP V PID) reading less than 4.82% (0.24 volts) and the LOAD PID reading greater than 55%?

Yes	No
TIGHTEN TP sensor to throttle body if necessary. CLEAR Continuous Memory DTCs. DRIVE vehicle exercising the throttle. If Continuous Memory P1121 is now present, REPLACE MAF sensor.	Unable to identify the fault at this time. If vehicle is still a No Start, GO to <u>A1</u> .

DH20 CONTINUOUS MEMORY DTCS P1120 OR P1125: CHECK FOR TP CIRCUIT INTERMITTENT SIGNAL

- Start engine and bring to idle.
- Run throttle up to 1500 rpm for 5 seconds.
- Access TP PID (TP V PID) for a fault indication while completing the following:
 - Lightly tap on TP sensor and wiggle harness connector to simulate road shock.

Is TP PID (TP V PID) changing below the minimum 9.85% (0.49 volt) or above the maximum 93% (4.65 volts)?

Yes	No
INSPECT the TP sensor connector. If OK, REPLACE the TP sensor.	KEY OFF. GO to <u>DH21</u> .

DH21 CHECK TP SENSOR HARNESS FOR INTERMITTENT OPENS OR SHORTS

- Again access the TP PID (TP V PID).
- Key on, engine off.
- Complete the following:
 - Grasp the vehicle harness closest to the TP sensor connector.
 - Shake and bend a small section of the harness all the way to the dash panel.
 - Wiggle, shake and bend the harness from the dash panel to the PCM.

Is TP PID (TP V PID) reading changing below the minimum 9.85% (0.49 volt) or above the maximum 93% (4.65 volts)?

Yes	No
ISOLATE and REPAIR as necessary.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

DH22 DTC P0121: CHECK FOR KOER SELF-TEST COMPLETION

Note: If KOER Self-Test terminates when placing the transmission range selector lever in gear (DRIVE or REVERSE), GO to DH25 directly.

- Start engine, bring to idle (throttle closed).
- Activate Key On Engine Running (KOER) Self-Test.
- Attempt to drive vehicle, while still in Key On Engine Running Self-Test.
- Key off, wait 15 seconds.
- Start engine again.
- Activate KOER Self-Test.

Is DTC P0121 still present or does KOER Self-Test again fail to terminate?

Yes	No
KEY OFF. GO to <u>DH23</u> .	VERIFY a symptom no longer exists.

DH23 ISOLATE BINDING OR STICKING CONCERN

- Disconnect accelerator cable and speed control cable from throttle body linkage.



CAUTION: Do not attempt to clean the throttle bore and plate area. Cleaning will damage the throttle body assembly.

Note: Sticking or binding condition can either appear within cables or throttle body assembly.

- Rotate throttle body linkage.

Does the throttle body rotate freely without a sticking, binding or grabbing condition?

Yes	No
REPAIR cable(s) causing concern. RERUN Quick Test. If the DTC P0121 is still present, GO to <u>DH24</u> .	REPLACE throttle body assembly.

DH24 CHECK FUNCTIONALITY OF THE THROTTLE POSITION SENSOR

- Key on.
- Access TP V PID with the scan tool.
- From closed throttle, slowly begin to press accelerator to wide open throttle.

Did the TP V PID display a smooth reading during accelerator movement?

Yes	No
VERIFY a symptom no longer exists.	KEY OFF. REPLACE TP sensor.

DH25 CHECK TP AND SIG RTN CIRCUITS FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM and TP sensor.
- Key off.
- Measure resistance of TP circuit between PCM harness connector and TP sensor harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector and TP sensor harness connector.

Is each resistance less than 0.5 ohms?

Yes	No
REPLACE TP sensor. VERIFY a symptom no longer exists.	REPAIR open circuit. VERIFY a symptom no longer exists.

DL: Cylinder Head Temperature (CHT) Sensor

DL: Pinpoint Tests →

Introduction

Note

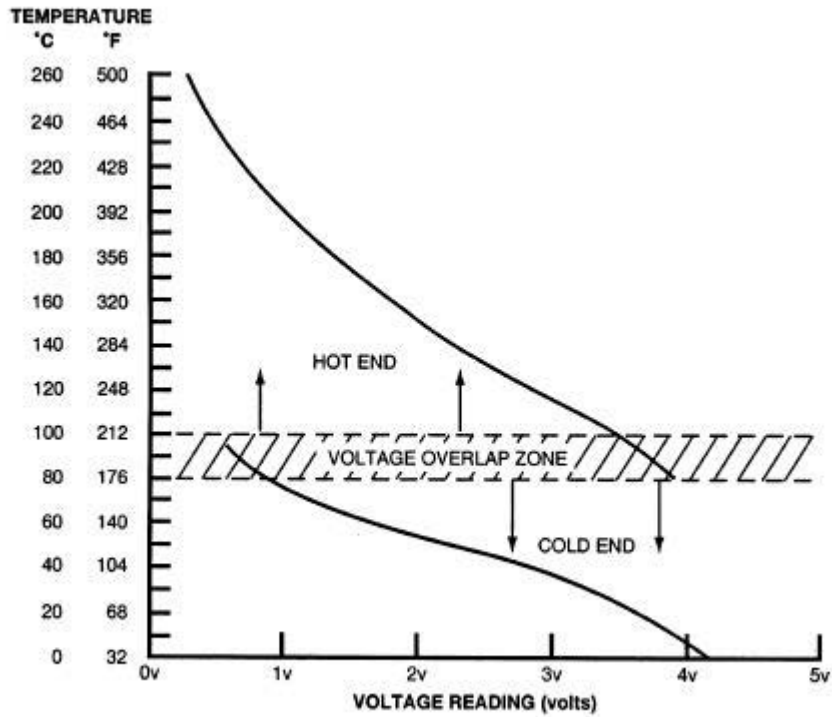
This Pinpoint Test is intended to diagnose the following:

- Cylinder head temperature (CHT) sensor (6G004)
- Harness circuits: CHT, VREF, and SIG RTN
- Powertrain control module (PCM) (12A650)

Tables and Graphs

On applications that do not use a ECT sensor, the CHT sensor is used to determine the engine coolant temperature in place of the ECT sensor. In this case the PCM may store both CHT and ECT Diagnostic Trouble Codes (DTCs). To cover the entire temperature range of both the CHT and ECT sensors, the PCM has a dual switching resistor circuit on the CHT input. A graph showing the temperature switching from the COLD END line to the HOT END line with increasing temperature and back with decreasing temperature is included. Note the temperature to voltage overlap zone. Within this zone it is possible to have either a COLD END or HOT END voltage at the same temperature. For example, at 90°C (194 °F) the voltage could read either 0.60 volt or 3.71 volts. Refer to the table for the temperature to voltage expected values.

Voltage values were calculated for VREF = 5.0 volts. These values can vary 15 percent due to sensor and VREF variations.



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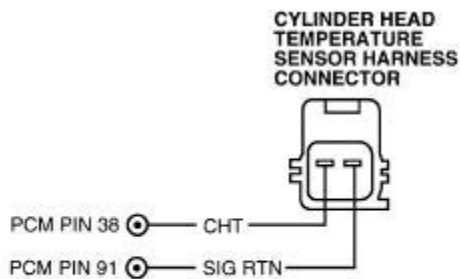
CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES

Temperature		CHT Sensor Values		
°C	°F	COLD END	HOT END	Resistance (K ohms)
-40	-40	4.89	—	965.808
-30	-22	4.81	—	513.019
-20	-4	4.67	—	283.664
-10	14	4.45	—	162.584
0	32	4.14	—	96.255
10	50	3.73	—	59.175
20	68	3.26	—	37.387
30	86	2.74	—	24.215
40	104	2.23	—	16.043
50	122	1.76	—	10.85
60	140	1.36	—	7.487
70	158	1.04	—	5.268
80	176	0.79	3.99	3.775
85	185	0.69	3.86	3.215
90	194	0.60	3.71	2.75
95	203	0.53	3.56	2.361
100	212	0.46	3.41	2.034
110	230	—	3.07	1.523

120	248	—	2.74	1.155
130	266	—	2.41	0.8866
140	284	—	2.10	0.6891
150	302	—	1.81	0.5417
160	320	—	1.55	0.4301
170	338	—	1.33	0.3449
180	356	—	1.13	0.2791
190	374	—	0.96	0.2278
200	392	—	0.82	0.1875
210	410	—	0.70	0.155
220	428	—	0.60	0.130
230	446	—	0.51	0.109
240	464	—	0.44	0.092
250	482	—	0.35	0.078
260	500	—	0.33	0.067

Pinpoint Test Schematics and Connectors

2.0L (4V) Focus, 2.0L (4V) Escape

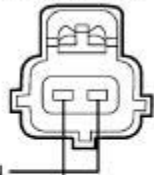


**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**

A0027515

All Others

**CYLINDER HEAD
TEMPERATURE
SENSOR HARNESS
CONNECTOR**



PCM PIN 91 (LS6/LS8, 4.6L
EXPLORER/MOUNTAINEER
150 PIN; PCM PIN C17)

PCM PIN 66 (LS6/LS8, 4.6L
EXPLORER/MOUNTAINEER
150 PIN; PCM PIN C40)

**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE
A0027477**

DL: Pinpoint Tests →

DL: Cylinder Head Temperature (CHT) Sensor ← DL: Introduction

DL1 DTC P1288 OR P1116: CHECK OPERATION OF CYLINDER HEAD TEMPERATURE SENSOR

- Run engine at 2000 rpm until engine temperature becomes stabilized.
- **No Starts or Vehicle that Stalls:**
 - GO to [DL3](#).
- Check that upper radiator hose is hot and pressurized.
- Rerun Key On Engine Running (KOER) Self-Test.

Is DTC P1288 or P1116 present?

Yes	No
GO to DL2 .	Engine temperature was not stabilized. REPAIR any other DTCs as necessary.

DL2 CHECK VREF CIRCUIT VOLTAGE AT TP SENSOR

- Disconnect throttle position (TP) sensor.

Note: GO to Pinpoint Test [DH](#) and refer to **Pinpoint Test Schematics and Connectors** for TP harness connector pin-out information.

- Key on, engine off.
- Measure the voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 volts and 6.0 volts?

Yes	No
There is sufficient VREF voltage. RECONNECT TP sensor. GO to DL3 .	GO to C1 .

DL3 CHECK RESISTANCE OF CYLINDER HEAD TEMPERATURE SENSOR WITH ENGINE OFF

- Disconnect CHT sensor.
- Measure resistance between CHT signal and SIG RTN pins at the CHT sensor. Refer to the table at the beginning of this pinpoint test for resistance specifications.

Is resistance within specification?

Yes	No
For No Starts or Stalls, RETURN to Section 3 , Symptom Charts.	REPLACE CHT sensor.

All others, GO to [DL4](#).

DL4 CHECK RESISTANCE OF CHT SENSOR WITH ENGINE RUNNING

Note: Verify that engine is at operating temperature before taking CHT readings.

- Run engine for two minutes at 2000 rpm.
- Measure resistance between CHT signal and SIG RTN pins at the CHT sensor. Refer to the table at the beginning of this Pinpoint Test for resistance specifications.
- Key off.

Is resistance within specification?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPLACE CHT sensor.

DL5 DTC P1289 OR P1290: ACCESS CHT PID AND CHECK VOLTAGE

- Connect scan tool.
- Key on, engine off.
- Access CHT V PID.

Is the CHT V PID less than 0.2 volt?

Yes	No
GO to DL6 .	GO to DL7 .

DL6 CHECK FOR GROUNDED CIRCUIT

- Disconnect CHT sensor.
- Key on.
- Access CHT V PID.

Is the CHT V PID more than 4.6 volts?

Yes	No
REPLACE CHT sensor.	GO to DL21 .

DL7 CHECK FOR OPEN HARNESS

- Disconnect CHT sensor.
- Connect a jumper wire between the CHT signal and SIG RTN circuits at the CHT sensor vehicle harness connector.
- Key on.
- **Note:** If a Scan Tool communication concern exists, remove jumper wire immediately and GO to

DL12.

- Access CHT V PID.

Is the CHT V PID less than 0.2 volt?

Yes	No
REPLACE CHT sensor.	REMOVE jumper wire. GO to <u>DL11.</u> KEY OFF.

DL10 DTC P0118: SIMULATE OPPOSITE SIGNAL TO PCM

- Disconnect CHT sensor.
- Connect a jumper wire between the CHT signal circuit and SIG RTN circuit at the CHT sensor vehicle harness connector.
- Connect scan tool.
- Key on.
- **Note:** If a Scan Tool communication concern exists, remove jumper wire immediately and GO to DL12.

- Access CHT V PID.

Is the CHT V PID less than 0.2 volt?

Yes	No
REPLACE CHT sensor.	REMOVE jumper wire. GO to <u>DL11.</u>

DL11 CHECK CHT SENSOR SIGNAL AND SIG RTN CIRCUITS FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of CHT circuit between PCM harness connector pin and CHT sensor harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and CHT sensor harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR open circuits.

DL12 CHECK CHT SENSOR SIGNAL FOR SHORT TO VREF IN HARNESS

- Key off.
- Disconnect PCM.
- Measure resistance between CHT and VREF circuits at the PCM harness connector.

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short to VREF.

DL20 DTC P0117: SIMULATE OPPOSITE SIGNAL TO PCM

- Disconnect CHT sensor.
- Connect scan tool.
- Key on.
- Access CHT V PID.

Is the CHT V PID more than 4.6 volts?

Yes	No
REPLACE CHT sensor.	GO to <u>DL21</u> .

DL21 CHECK VREF CIRCUIT VOLTAGE AT TP SENSOR

- Disconnect throttle position (TP) sensor.

Note: GO to Pinpoint Test DH and refer to **Pinpoint Test Schematics and Connectors** for TP harness connector pin-out information.

- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
There is sufficient VREF voltage. RECONNECT TP sensor. GO to <u>DL22</u> . KEY OFF.	GO to <u>C1</u> .

DL22 CHECK CHT SIGNAL CIRCUIT FOR SHORT TO GROUND

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance between CHT signal and SIG RTN circuits and then between CHT signal and PWR GND circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

DL30 DTC P1285: EARLY WARNING OF ENGINE OVERHEAT CONDITION

An engine overheat condition was sensed by the CHT sensor.

- Check cooling system for:
 - Correct coolant level.
 - Internal or external coolant leaks.
 - Blockage of radiator.
 - Cooling fan operation.

Note: If electric cooling fan does not operate, return to [Section 3](#) for electric cooling fan DTC or symptom diagnosis.

Is cooling system OK?

Yes	No
CHECK CHT sensor operation. GO to DL3 .	REPAIR as necessary. REFER to Engine Cooling, Section 303-03 in the Workshop Manual for symptom diagnosis of Engine Overheats or Loss of Coolant.

DL40 ENGINE TEMPERATURE WARNING INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT, BUT ENGINE IS NOT OVERHEATING

Note: PCM Quick Test must be performed prior to entering this Pinpoint Test.

Was PCM Quick Test performed prior to entering this Pinpoint Test?

Yes	No
No Diagnostic Trouble Codes (DTCs) received during PCM Quick Test. GO to DL41 .	GO to Section 3 and RERUN Quick Test. REPAIR any DTCs as necessary.

DL41 ENGINE TEMPERATURE INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT, WITH NO DIAGNOSTIC TROUBLE CODE (DTC)

The Engine Temperature Warning Indicator (gauge or lamp) is a warning of an engine overheating condition. The PCM monitors the cylinder head temperature (CHT) sensor and grounds the engine temperature warning circuit when the engine is overheating. This causes the instrument cluster indicator to illuminate and/or forces the temperature gauge to H (hot) zone. A DTC P1285 will also be stored in the PCM.

This test diagnoses Engine Temperature Warning Lamp ON and/or temperature gauge in the H (hot) zone with no PCM DTCs.

Possible causes:

- Damaged engine coolant temperature sensor.
- Instrument cluster concern.
- Wiring harness fault between PCM and Instrument cluster. (PCM output pins: 19, 42 or 45 depending on vehicle application.)

- Damaged PCM.
- Disconnect PCM.
- Key on.

Is the engine temperature warning indicator lamp OFF and the temperature gauge in the normal zone with the PCM disconnected?

Yes	No
Key off. REPLACE the PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	The PCM has not attempted to ground the Engine Temperature Warning circuit and turn the engine temperature indicator lamp ON or force the temperature gauge to the H (hot) zone. REFER to Instrument Cluster, Section 413-01 in the Workshop Manual for further diagnosis.

DL80 P0116: CHECK TEMPERATURE SENSOR RESISTANCE WITH ENGINE OFF

Note: Verify that engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. Refer to Diagnostic Trouble Code (DTC) Descriptions, in Section 4 for information concerning P0116.

- Key on, engine off.
- Disconnect CHT sensor.
- Measure CHT sensor resistance. Refer to the chart at the beginning of this Pinpoint Test for resistance specifications.

Is resistance within specification?

Yes	No
GO to <u>DL81</u> .	REPLACE suspect sensor.

DL81 P0116: CHECK TEMPERATURE SENSOR RESISTANCE WITH ENGINE RUNNING

Note: Verify that engine is at operating temperature before taking CHT readings.

- Run engine for two minutes at 2000 rpm.
- Measure temperature sensor resistance. Refer to the chart at the beginning of this Pinpoint Test for resistance specifications.

Is resistance within specification?

Yes	No
Fault is not present at this time. COMPLETE OBDII Drive Cycle to determine if Fuel, HEGO, Catalyst and Misfire monitors can be executed (REFER to Section 2, <u>Drive Cycles</u>). Retest if necessary.	REPLACE suspect sensor.

DL90 DTCS P0117, P0118, P1117, P1289 OR P1290: INTERMITTENT CHECK

- Connect scan tool.
- Key on.
- Monitor the CHT PID.
- While observing the PID, complete the following:
 - Tap on the sensor to simulate road shock.
 - Wiggle the sensor connector.

Is there any large change in the temperature reading?

Yes	No
Key off. DISCONNECT and INSPECT connectors. If OK, REPLACE CHT sensor. COMPLETE OBDII Drive Cycle to verify repair (REFER to Section 2, Drive Cycles).	GO to DL91 .

DL91 CHECK ELECTRONIC ENGINE CONTROL (EC) WIRING HARNESS

- Still monitoring PID.
- While observing the appropriate PID, complete the following:
 - Hold the vehicle harness close to the sensor connector. Wiggle, shake and bend small sections of wiring harness while working toward the PCM.

Is there any change in the temperature reading?

Yes	No
ISOLATE fault. REPAIR as necessary. COMPLETE OBDII Drive Cycle to verify repair (REFER to Section 2, Drive Cycles).	GO to DL92 .

DL92 CHECK PCM AND VEHICLE HARNESS CONNECTOR

- Disconnect PCM.
- Disconnect CHT sensor.

Are connectors and terminals OK?

Yes	No
Fault is not present at this time. COMPLETE OBDII Drive Cycle (REFER to Section 2, Drive Cycles).	REPAIR as necessary. COMPLETE OBDII Drive Cycle to verify repair (REFER to Section 2, Drive Cycles).

DL100 DTC P1299 OR P0217 INDICATES AN ENGINE OVERHEAT CONDITION OCCURRED

Note: Refer to [Section 4](#) for possible causes and additional DTC description information.



WARNING: TO AVOID PERSONAL INJURY, DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STREAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.

- Check engine coolant level.

Is the engine coolant level fill correct?

Yes	No
REFER to Engine Cooling, Section 303-03 in the Workshop Manual for symptom, Engine Overheats.	REFER to Engine Cooling, Section 303-03 in the Workshop Manual for symptom, Loss of Engine Coolant.

DL110 DTC P0125: CHECK ENGINE COOLANT LEVEL

Diagnostic Trouble Code (DTC) P0125 indicates the CHT sensor has not achieved the required temperature level to enter closed loop operating conditions within a specified amount of time after starting engine. This DTC will light the MIL.

Possible causes:

- Insufficient warm up time.
- Leaky or stuck open thermostat.
- Low engine coolant level.
- Malfunctioning CHT sensor.



WARNING: TO AVOID PERSONAL INJURY, DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STREAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENDED SLIGHTLY.

- Check engine coolant level.

Is the engine coolant level fill correct?

Yes	No
Go to Engine Cooling, Section 303-03 in the Workshop Manual for further diagnostics.	FILL engine coolant to proper level. Complete Comprehensive Component Monitor Repair Verification Drive Cycle (Refer to <u>Section 2</u> , Drive Cycles).

DM: Thermal Manifold Absolute Pressure (TMAP) Sensor Introduction

DM: Pinpoint Tests →

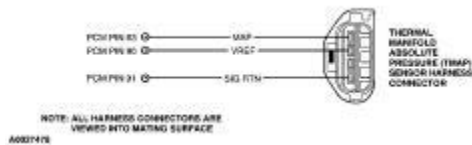
Note

This Pinpoint Test is intended to diagnose the following:

- TMAP sensor (9F479)
- Harness circuits: MAP SIG, SIG RTN, and VREF
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

2.3L (4V) Ranger



DM: Pinpoint Tests →

DM: Thermal Manifold Absolute Pressure (TMAP) Sensor

← DM: Introduction

DM1 DTC P0107 AND P0108: CHECK VOLTAGE BETWEEN VREF AND SIG RTN AT TMAP SENSOR

- Disconnect TMAP connector.
- Measure voltage between VREF and SIG RTN circuits at the TMAP sensor harness connector.

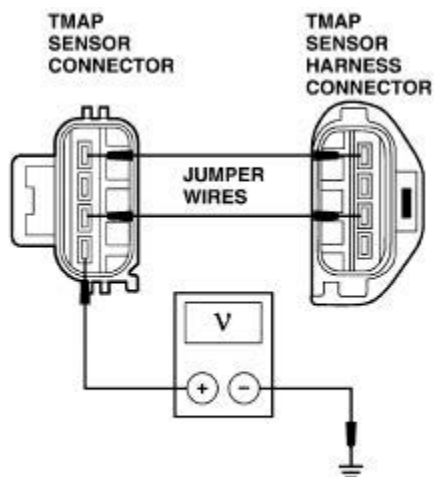
Is VREF voltage between 4.0 and 6.0 volts?

Yes	No
GO to <u>DM2</u>	GO to <u>C1</u> .

DM2 CHECK TMAP SENSOR OPERATION

- Connect a jumper wire for the VREF circuit between the TMAP sensor harness connector and sensor connector.
- Connect jumper wire for the SIG RTN circuit between the TMAP sensor harness connector and sensor connector
- Start engine and let idle.
- Measure voltage between MAP circuit at the MAP sensor connector and chassis ground.
- Observe voltage while rapidly increasing rpm to 3000 by depressing the accelerator pedal and then release.

Did the voltage reading rapidly increase to approximately 4.0 volts and then decrease to approximately 0.7 volts?



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE
A0038681

Yes	No

GO to DM3

Replace TMAP sensor.

DM3 CHECK TMAP CIRCUIT FOR SHORT TO VREF AND SIG RTN IN HARNESS

- Disconnect PCM.
- Measure resistance between the TMAP circuit and both the VREF and SIG RTN circuits at the TMAP sensor harness connector

Is each resistance greater than 10,000 ohms?

Yes	No
GO to <u>DM4</u>	REPAIR short circuit.

DM4 CHECK TMAP SENSOR CIRCUIT FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of MAP circuit between PCM harness connector pin 63 and MAP sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR open circuit.

DM6 CONTINUOUS MEMORY DTC P0107, P0108: CHECK FOR INTERMITTENT CIRCUITS TO TMAP SENSOR

- Key on, engine off.
- Access MAP V PID
- Observe MAP V PID for an indication of a fault while performing the following (a fault will be indicated in a sudden change in the MAP V PID voltage):
 - Shake, wiggle, bend the MAP, SIG RTN and VREF circuits between the MAP sensor and the PCM.
 - Lightly tap on the MAP sensor to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. Unable to duplicate or identify fault at this time. GO to <u>Z1</u>

DP: Vehicle Speed Sensor (VSS)/Transfer Case Speed Sensor (TCSS) Introduction

DP: Pinpoint Tests →

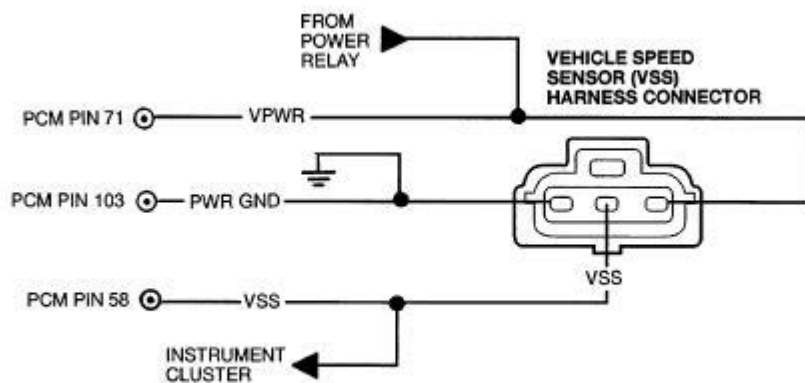
Note

This Pinpoint Test is intended to diagnose the following:

- Vehicle speed sensor (VSS) (9E731)
- Transfer case speed sensor (TCSS) (7H103)
- Harness circuits: VSS + and VSS -
- Harness circuits: TCSS and SIGRTN
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematic and Connectors

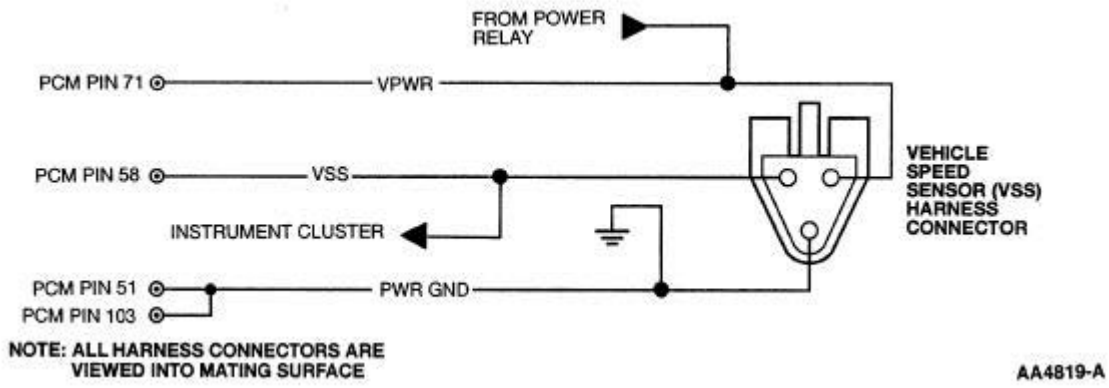
2.0L (MTX) Cougar



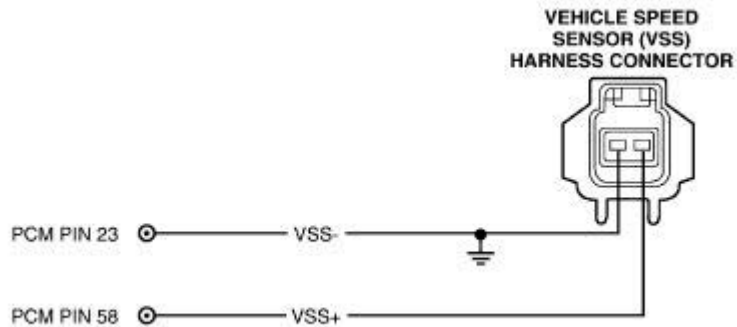
NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA4832-A

2.5L (MTX) Cougar

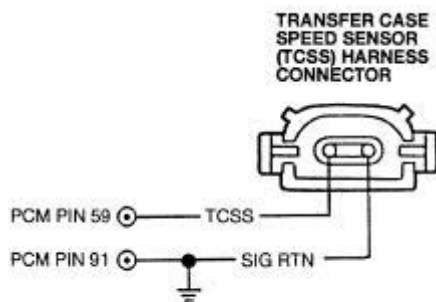


2.0L (MTX) Escape



A0029813

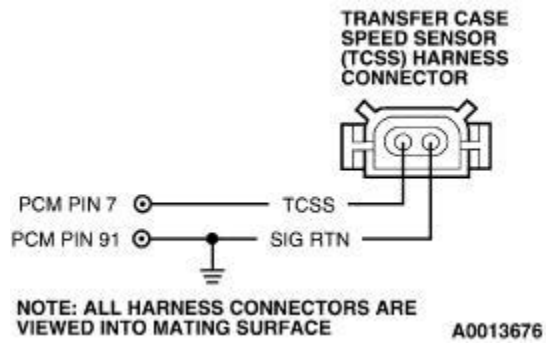
4.2L F-150 4X4 Manual Shift-on-the-Fly (MSOF)



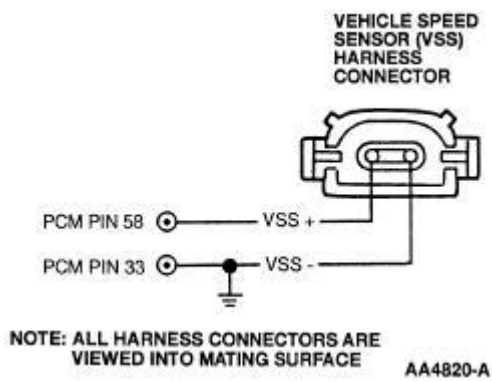
NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA4862-A

4.6L/5.4L F150/F250 4x4 Manual Shift-on-the-Fly (MSOF) NOTE: For 5.4L, use PCM Pin 4 for TCSS



All Others



DP: Pinpoint Tests →

DP: Vehicle Speed Sensor (VSS)/Transfer Case Speed Sensor (TCSS)

← DP: Introduction

DP1 DTC P0500/P0501/P1502: CHECK VSS CIRCUITS FOR OPEN IN HARNESS (VRS TYPE)

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Disconnect VSS.
- Measure resistance of VSS+ circuit between PCM harness connector pin and VSS+ sensor harness connector.
- Measure resistance of VSS- circuit between PCM harness connector pin and VSS- sensor harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to DP2 .	REPAIR open circuit. COMPLETE an OBD II Drive Cycle (REFER to Section 2, Drive Cycles).

DP2 CHECK VSS CIRCUITS FOR SHORT TO GROUND AND POWER IN HARNESS

- Measure resistance between VSS+ and PWR GND circuits at PCM harness connector.
- Measure resistance between VSS+ and VSS- circuits at PCM harness connector.
- Measure resistance between VSS+ and VPWR circuits at PCM harness connector.

Is each resistance greater than 5.0 ohms?

Yes	No
GO to DP3 .	GO to DP12 .

DP3 CHECK VSS RESISTANCE

- Measure VSS resistance.

Is resistance between 170 and 270 ohms?

Yes	No
REPLACE the PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). COMPLETE an OBD II Drive Cycle (REFER to Section 2, Drive Cycles).	REPLACE the VSS. COMPLETE an OBD II Drive Cycle (REFER to Section 2 , Drive Cycles).

DP5 DTC P0500/P0501/P1502: CHECK VSS SIGNAL OUTPUT TO (PCM) POWERTRAIN CONTROL MODULE (HALL TYPE)

- Disconnect PCM.
- Raise the vehicle to allow rotation of the front drive wheel.
- Key on, transmission in NEUTRAL.

Note: The opposite wheel must be held stationary.

- Measure voltage between VSS+ and PWR GND circuits at the PCM harness connector, while slowly rotating the drive wheel.
- The voltage should rise above 5.0 volts and fall below 1.0 volt in a regular cycle. Observe several cycles.
- Key off.

Does the VSS output voltage rise and fall as specified while slowly rotating the drive wheel?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). COMPLETE an OBD II Drive Cycle (REFER to Section 2, Drive Cycles).	GO to DP6 .

DP6 CHECK VOLTAGE BETWEEN VPWR AND PWR GND CIRCUITS AT VSS

- Disconnect VSS.
- Key on.
- Measure voltage between VPWR and PWR GND circuits at the VSS harness connector.

Is the voltage greater than 10.5 volts?

Yes	No
GO to DP7 .	KEY OFF. GO to DP10 .

DP7 CHECK VSS CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on.
- Measure voltage between VSS+ and PWR GND circuits at the PCM harness connector.
- Key off.

Is voltage less than 1.0 volt?

Yes	No
GO to DP8 .	GO to DP12 .

DP8 CHECK VSS CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Measure resistance between VSS+ and PWR GND circuits at the PCM harness connector.

Is resistance greater than 3,000 ohms?

Yes	No
GO to <u>DP9</u> .	GO to <u>DP12</u> .

DP9 CHECK VSS SIGNAL CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of VSS+ signal circuit between PCM harness connector pin and VSS+ sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE VSS. COMPLETE an OBD II Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).	REPAIR open circuit. COMPLETE an OBD II Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).

DP10 CHECK VSS GROUND CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of PWR GND circuit between VSS harness connector and chassis ground.

Is resistance less than 5.0 ohms?

Yes	No
REPAIR open VPWR to VSS. COMPLETE an OBD II Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).	REPAIR open VSS PWR GND circuit. COMPLETE an OBD II Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).

DP12 VERIFY IF VSS CIRCUIT IS SHORTED IN HARNESS OR ANOTHER MODULE

- Determine which, if any, modules are connected to the VSS circuit (Refer to Wiring Diagrams Manual). If no other modules are connected to the VSS circuit, GO to the "YES" Action To Take.
- One at a time, disconnect the modules associated with the VSS circuit. After disconnecting each module, again test for short circuit (Refer to test step that sent you here). Repeat until each associated module has been disconnected or the short circuit has been eliminated.

Does the short circuit remain after all associated modules were disconnected?

Yes	No
REPAIR short circuit. COMPLETE an OBD II Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).	REFER to the Workshop Manual for further diagnosis of appropriate module.

DP15 KOER DTC P1501: CHECK PCM VSS PID FOR INPUT SIGNAL

- Start the engine and idle in NEUTRAL.
- Access the VSS PID with a scan tool and observe for vehicle speed input to the PCM.
- Increase the engine speed, not greater than 2000 rpm, several times while observing the VSS

PID.

Is the reading on the VSS PID less than 5 km/h (3 mph)?

Yes	No
Unable to duplicate or identify fault at this time. If DTC P1501 still exists. GO to <u>Z1</u> . (REFER to Section 4, <u>Diagnostic Trouble Code (DTC) Descriptions</u> for a list of possible causes.)	GO to <u>DP22</u> .

DP20 DTC P0503: INSPECT VSS AND CIRCUIT FOR AN INTERMITTENT

- Check for harness intermittents by verifying that Pins are properly seated in connector shell, wiring is properly crimped, no corrosion exists in the harness and sensor is securely mounted.

Are there any indications of harness intermittents?

Yes	No
REPAIR as necessary. COMPLETE an OBDII Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).	GO to <u>DP21</u> .

DP21 CHECK PCM VSS PID FOR INPUT SIGNAL

- Access the VSS PID with a scan tool.
- Drive the vehicle at several steady state speeds above and below 50 km/h (30 mph).

Note: For Scan Tools which have Data Record feature, record data for playback to help identify variations.

- During each steady state speed observe the VSS PID for variations of (+) or (-) 8 km/h (5 mph) for greater than 10 seconds.

Is there any indications of a noisy or intermittent signal with the VSS PID?

Yes	No
GO to <u>DP22</u> .	Unable to duplicate or identify fault at this time. REPAIR any other DTCs.

DP22 CHECK VSS HARNESS ROUTING

- Check VSS harness routing:
 - Verify that the harness is not routed adjacent to high current wires such as ignition wires or generator wiring.
 - Verify VSS harness is shielded and grounded, if applicable.
 - Check resistance of the VSS harness; refer to Pinpoint Test Schematic and Connectors at beginning of pinpoint test.

Are any concerns evident?

--	--

Yes	No
REPAIR as necessary. COMPLETE an OBDII Drive Cycle (REFER to Section 2, Drive Cycles).	Unable to duplicate or identify a fault at this time. GO to Z1 . (REFER to Section 4, Diagnostic Trouble Code (DTC) Descriptions for a list of possible causes.)

DP25 DTC P1500: VISUAL INSPECTION

- Visually inspect the VSS and VSS harness circuits for any potential failures. Use the following check list for reference:
 - Loose VSS connector.
 - Pushed out VSS connector pins.
 - Damaged VSS wiring harness insulation.
 - Incorrect harness routing.
 - Incorrect VSS mounting.

Did the visual inspection reveal a potential failure?

Yes	No
REPAIR fault as necessary. COMPLETE an OBD II Drive Cycle (REFER to Section 2, Drive Cycles).	RESTORE vehicle. Unable to duplicate or identify fault at this time. GO to Z1 . (REFER to Section 4, Diagnostic Trouble Code (DTC) Descriptions for a list of possible causes.)

DP30 DTC P0500, P1502 VISUAL INSPECTION

Note: The transfer case speed sensor (TCSS) provides rotational speed of output shaft of the transfer case. The PCM use this information to control powertrain behavior and on some applications is used as the source of vehicle speed information.

- Disconnect TCSS sensor.
- Inspect TCSS vehicle harness connector for damage and proper seating.

Have any problems been found?

Yes	No
REPAIR as necessary.	GO to DP31 .

DP31 CHECK RESISTANCE OF TCSS SENSOR

- Measure resistance between TCSS signal and TCSS SIGTRN circuits at the TCSS sensor.

Is resistance between 1,000 and 1,250 ohms?

Yes	No
GO to DP32 .	REPLACE TCSS sensor.

DP32 TCSS OUTPUT CHECK

- Measure frequency between TCSS signal and TCSS SIGRTN circuits at the TCSS sensor.
- Drive vehicle between 0 and 48 km/h (0 and 30 mph).
- Refer to [Section 6](#), Reference Values for frequency ranges.

Does frequency reading increase and decrease with vehicle speed?

Yes	No
GO to DP33 .	REMOVE the TCSS and inspect target wheel. REPAIR as necessary. IF OK REPLACE TCSS.

DP33 CHECK HARNESS FOR SHORT TO PWR

- Key on.
- TCSS sensor disconnected.
- Measure voltage between the TCSS signal circuit at the TCSS harness connector and ground.

If voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to DP34 .	REPAIR short circuit.

DP34 CHECK HARNESS FOR OPEN

- Disconnect PCM.
- Measure resistance of TCSS signal circuit between PCM harness connector pin and TCSS sensor harness connector.
- Measure resistance of TCSS SIGRTN circuit between PCM harness connector pin and TCSS sensor harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to DP35 .	REPAIR open circuit.

DP35 CHECK HARNESS FOR SHORT TO GROUND

- Measure resistance between TCSS signal and SIGRTN circuits at the TCSS harness connector.
- Measure resistance between TCSS signal and GND circuits at the TCSS harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

DQ: Barometric Pressure (BARO) Sensor Introduction

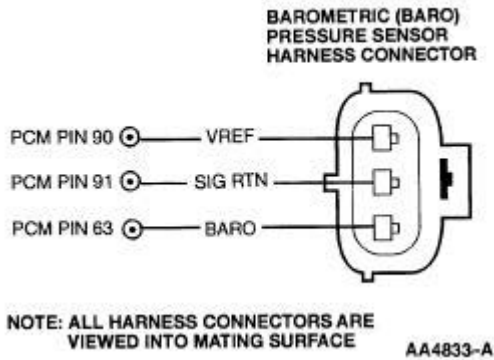
DQ: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- BARO sensor (9F479)
- Harness circuits: BARO SIG, SIG RTN, and VREF
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematics and Connectors



BARO SENSOR DATA

Barometric Pressure		Frequency
in-Hg	kPa	Hz
17.1	58	122.4
18.3	62	125.5
19.5	66	128.7
20.7	70	131.9
21.8	74	135.1
23.0	78	138.3
24.2	82	141.8
25.4	86	145.4
26.6	90	148.9
27.7	94	152.5
28.9	98	156.1
30.1	102	159.6
31.0	105	162.4

DQ: Pinpoint Tests →

DQ: Barometric Pressure (BARO) Sensor

← DQ: Introduction

DQ1 DTC P0106, P0107, P0108 AND P0109: CHECK BARO PID

- Obtain local barometric pressure reading.
- Access BARO PID.
- Compare PID readings with chart.

Does PID reading compare with that of chart?

Yes	No
Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .	GO to <u>DQ2</u> .

DQ2 CHECK BARO SIGNAL AND SIG RTN CIRCUIT FOR OPEN

- Measure resistance of the BARO circuit between PCM harness connector pin and BARO sensor harness connector.
- Measure resistance of the SIG RTN circuit between PCM harness connector pin and SIG RTN at the BARO sensor harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to <u>DQ3</u> . For DTC P0108: GO to <u>DQ7</u> .	REPAIR open circuit.

DQ3 CHECK VREF VOLTAGE TO BARO SENSOR

- Disconnect BARO connector.
- Measure voltage between VREF and SIG RTN circuits at the BARO harness connector.

Is VREF voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. GO to <u>DQ5</u> .	KEY OFF. GO to <u>DQ4</u> .

DQ4 CHECK VREF CIRCUIT FOR OPEN

- Measure resistance of the VREF circuit between PCM harness connector pin and VREF at the BARO sensor harness connector.

Is resistance less than 5.0 ohms?

--	--

Yes	No
GO to DQ5 .	REPAIR open circuit.

DQ5 CHECK BARO CIRCUIT FOR SHORT TO GROUND

- Measure resistance between the BARO and SIG RTN circuits at the PCM harness connector.
- Measure resistance between the BARO circuit at the PCM harness connector and the battery negative post.

Is each resistance greater than 10,000 ohms?

Yes	No
GO to DQ6 .	REPAIR short circuit.

DQ6 CHECK FOR VREF CIRCUIT SHORT TO GROUND

- Measure resistance between the VREF circuit and SIG RTN circuits at the PCM harness connector.
- Measure resistance between the VREF circuit at the PCM harness connector and the battery negative post.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE BARO . If concern is still present, REPLACE PCM. (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

DQ7 DTC P0108: INDUCE OPPOSITE CODE

- Disconnect BARO sensor.
- Key on.
- Check DTCs.

Is DTC P0107 present?

Yes	No
KEY OFF. REPLACE BARO sensor.	KEY OFF. GO to DQ8 .

DQ8 CHECK BARO SIGNAL FOR SHORT TO POWER

- Measure resistance between BARO and VPWR circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No

REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

REPAIR short circuit.

DR: Camshaft Position (CMP) Sensor Introduction

DR: Pinpoint Tests →

Note

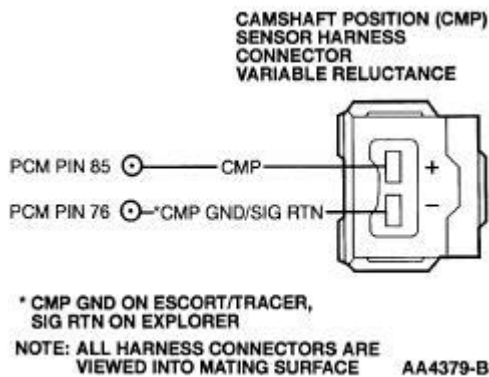
This Pinpoint Test is intended to diagnose the following:

- Camshaft Position (CMP) Sensor (6B288) (12A112)
- Harness Circuits: CMP, VPWR, SIG RTN, PWR GND, CMP/TSS GND
- Powertrain Control Module (PCM) (12A650)

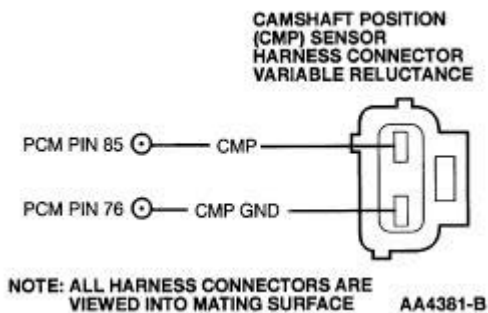
Pinpoint Test Schematics and Connectors

Camshaft Position (CMP) Sensor Connectors

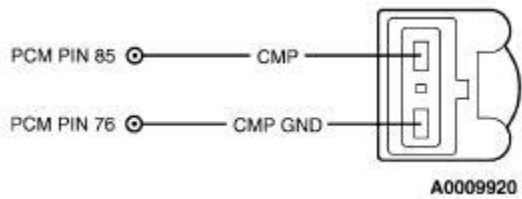
2.0L (2V) Escort, 4.0L SOHC Explorer



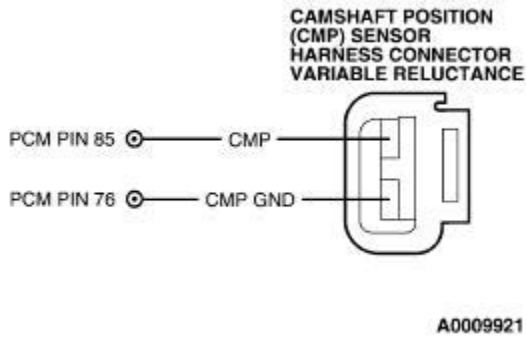
2.0L (4V) Escort, 2.5L Cougar



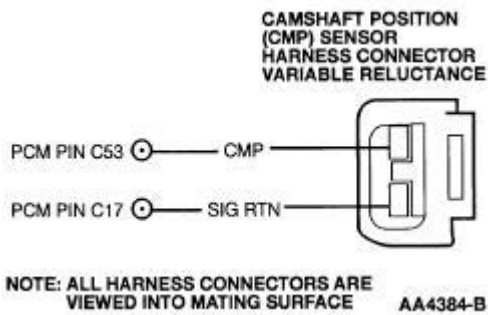
2.0L (2V) Focus



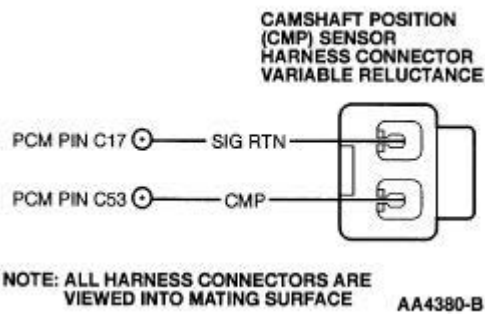
2.0L (4V) Focus, Escape



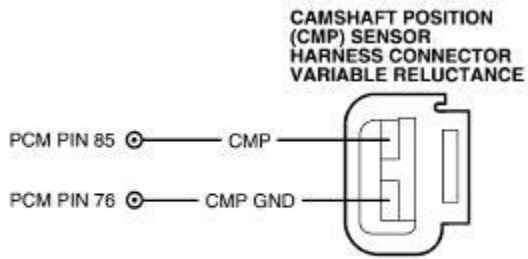
LS6, 150 pin pcm Explorer/Mountaineer



LS8

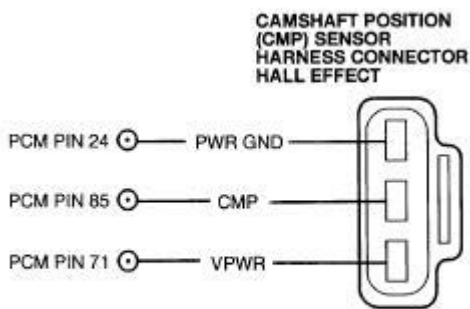


3.0L (4V) Escape



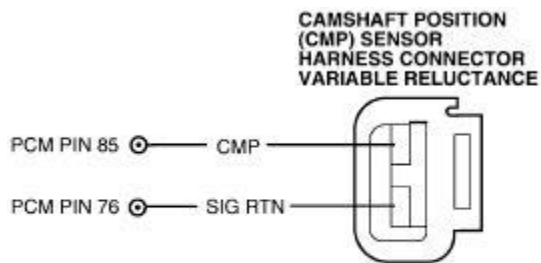
A0009921

4.2L F-Series, 4.2L Econoline



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4378-B

All Others



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** A0015122

DR: Camshaft Position (CMP) Sensor

← DR: Introduction

DR1 DTC P0340: CHECK IF ENGINE WILL START

Note: Refer to the Pinpoint Test Schematic to determine the type of CMP sensor.

- Start engine.

Will the engine start?

Yes	No
GO to DR2 .	DTC P0340 is not the cause of the No Start. GO to Section 3 to diagnose the No Start symptom.

DR2 CLEAR AND ATTEMPT TO RE-GENERATE DTC P0340

- Complete PCM Reset to clear DTCs.
- Increase rpm to greater than 1500 rpm for 10 seconds. Repeat two times.
- Retrieve all Continuous Memory DTCs.

Is DTC P0340 present?

Yes	No
<p>For VR type CMP: KEY OFF. GO to DR5</p> <p>For Hall Effect type CMP: KEY OFF. GO to DR3</p>	The fault that produced DTC P0340 is intermittent. GO to Z1 .

DR3 CHECK VPWR VOLTAGE TO CMP SENSOR

- Disconnect CMP sensor.
- Key on, engine off.
- Measure VPWR circuit voltage between CMP sensor harness connector and battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to DR4 .	REPAIR open circuit.

DR4 CHECK PWR GND TO CMP SENSOR

- Measure resistance of PWR GND circuit between CMP sensor harness connector and battery negative post.

Is resistance less than 5.0 ohms?

Yes	No
GO to DR5 .	REPAIR open circuit.

DR5 CHECK FOR OPEN CMP, SIG RTN/CMP GND AND PWR GND CIRCUITS BETWEEN PCM AND CMP SENSOR

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM and CMP sensor.
- If VR type CMP: Measure resistance of CMP, CMP GND/SIG RTN circuits between PCM harness connector pin and CMP sensor harness connector.
- If Hall type CMP: Measure resistance of CMP, VPWR and PWR GND circuits between PCM harness connector and CMP sensor harness connector.

Are resistance measurements less than 5.0 ohms?

Yes	No
GO to DR6 .	REPAIR open circuit.

DR6 CHECK CMP CIRCUIT FOR SHORT TO POWER IN HARNESS

- Reconnect CMP sensor.
- Key on, engine off.
- If Hall type CMP: Measure voltage between CMP and VPWR circuits at the PCM harness connector.
- If VR type CMP: Measure voltage between CMP and CMP GND/SIG RTN circuits at the PCM connector.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to DR7 .	REPAIR short circuit.

DR7 CHECK CMP CIRCUIT FOR SHORT TO GND AND SIG RTN IN HARNESS

- Disconnect CMP sensor.
- If VR type CMP: Measure resistance between CMP and CMP GND/SIG RTN at the PCM harness connector.
- If Hall type CMP: Measure resistance between CMP and PWR GND at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
GO to DR8 .	REPAIR short circuit.

DR8 CHECK FOR SHORTS IN PCM

- Reconnect PCM.
- For VR type CMP: Measure resistance between CMP and CMP GND/SIG RTN circuits at the CMP harness connector.
- For Hall Effect type CMP: Measure resistance between CMP and VPWR and CMP and PWR GND circuits at the CMP harness connector.

Is each resistance greater than 500 ohms?

Yes	No
<p>For VR type CMP: GO to DR9.</p> <p>For Hall Effect type CMP: GO to DR10.</p>	<p>REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p>

DR9 CHECK CMP SENSOR OUTPUT

- Reconnect CMP sensor.
- Digital multimeter on ac scale (to monitor less than 5.0 volts).
- Measure voltage between CMP and CMP GND/SIG RTN circuits while running engine at varying rpm.

Does AC voltage vary greater than 0.1 volt AC?

Yes	No
<p>REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p>	<p>REPLACE CMP sensor.</p>

DR10 CHECK CMP SENSOR OUTPUT DURING CRANK MODE

- Disconnect PCM.
- Reconnect CMP sensor.
- Connect digital multimeter between CMP and the CMP sensor GND circuit.
- Bump engine in short bursts with the starter without starting engine for at least 10 engine revolutions.

Does voltage reading switch between low (less than 2.0 volts dc) and high (greater than 8.0 volts dc)?

Yes	No
<p>A Hall effect type CMP sensor that is installed out of synchronization will produce a DTC. VERIFY the correct installation by referring to Electronic Engine Controls, Section 303-14 in the Workshop Manual. If CMP is installed properly, REPLACE PCM (refer to Section 2,</p>	

Flash Electrically Erasable Programmable
Read Only Memory (EEPROM).

Note: If vehicle has a miss with the P0340
code, ignition/ alternator noise, RFI, and CKP
concerns should be considered.

REPLACE CMP sensor.

DS: Air Conditioning Pressure (ACP) Sensor Introduction

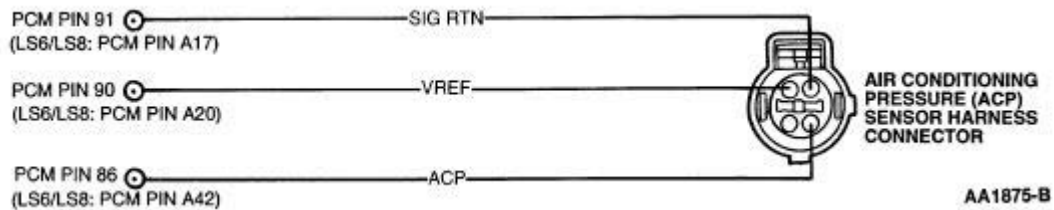
DS: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Harness circuits: ACP, VREF, SIG RTN
- Air Conditioning Pressure (ACP) Sensor (19D594)
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematics and Connector



DS: Pinpoint Tests →

DS: Air Conditioning Pressure (ACP) Sensor

← DS: Introduction

DS1 DTC P1461: CHECK ACP V PID

- Connect scan tool.
- Key on, engine off.
- Access ACP V PID.

Is ACP V PID less than 4.9 volts?

Yes	No
The ACP circuit voltage is now below the maximum. GO to <u>DS18</u> to determine if an intermittent condition exists.	KEY OFF. A hard fault is present. GO to <u>DS2</u> .

DS2 CHECK VOLTAGE BETWEEN VREF AND SIG RTN CIRCUITS TO ACP SENSOR

- Disconnect ACP sensor.
- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the ACP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
GO to <u>DS3</u> .	VREF is out of range, or SIG RTN circuit to ACP sensor is open. KEY OFF. GO to <u>C1</u> .

DS3 INDUCE OPPOSITE ACP SIGNAL

- Key on, engine off.
- Again access ACP V PID.

Is ACP V PID now less than 4.9 volts?

Yes	No
KEY OFF. REPLACE ACP sensor. REFER to the Climate Control System General Information, Section 412-03 in the Workshop Manual. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.	KEY OFF. GO to <u>DS4</u> .

DS4 CHECK ACP CIRCUIT FOR SHORT TO VREF IN HARNESS

- Disconnect scan tool from DLC.
- Disconnect PCM.
- Measure resistance between ACP and VREF circuits at the ACP sensor harness connector.

Is resistance greater than 10,000 ohms?

Yes	No
GO to DS5 .	REPAIR short circuit. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.

DS5 CHECK ACP CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on, engine off.
- Measure voltage between ACP circuit at the ACP sensor vehicle harness connector and chassis ground.

Is voltage less than 1.0 volt?

Yes	No
<p>For Escort, LS6/LS8:</p> <p>KEY OFF. GO to DS6.</p> <p>All others:</p> <p>REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.</p>	<p>REPAIR short circuit. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.</p>

DS6 CHECK FOR OPEN ACP CIRCUIT IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Measure resistance of ACP circuit between PCM harness connector pin and the ACP sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to DS7 .	REPAIR open circuit. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.

DS7 CHECK PCM

- Reconnect PCM.
- Connect a jumper wire between the ACP and SIG RTN Circuits at the ACP sensor harness connector.
- Key on, engine off.

- Access ACP V PID.

Note: If the scan tool is now unable to communicate, follow NO Action to Take.

Is ACP V PID now less than 4.9 volts?

Yes	No
REPLACE ACP sensor. REFER to the Climate Control System General Information, Section 412-00 in the Workshop Manual. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.

DS10 DTC P1462: CHECK ACP V PID

- Connect scan tool.
- Key on, engine off.
- Access ACP V PID.

Is ACP V PID greater than 0.15 volt?

Yes	No
The ACP circuit voltage is now above the minimum. GO to DS18 to determine if an intermittent condition exists.	KEY OFF. A hard fault is present. GO to DS11 .

DS11 CHECK VOLTAGE BETWEEN VREF AND SIG RTN TO ACP SENSOR

- Disconnect ACP sensor.
- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the ACP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
GO to DS12 .	VREF is out of range. KEY OFF. GO to C1 .

DS12 INDUCE OPPOSITE ACP SIGNAL

- Connect a jumper wire between ACP and VREF circuits at the ACP sensor harness connector.
- Key on, engine off.
- Access ACP V PID.

Note: If any scan tool communication concern occurs, remove jumper immediately and GO to [DS13](#).

Is ACP V PID greater than 4.0 volts?

Yes	No

REPLACE ACP sensor. REFER to the Climate Control System General Information, Section 412-03 in the Workshop Manual. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.

GO to [DS13](#).

DS13 CHECK ACP CIRCUIT FOR SHORT TO PWR GND OR SIG RTN IN HARNESS

- Key off.
- Disconnect scan tool from DLC.
- Disconnect PCM.
- Measure resistance between ACP and SIG RTN circuits at the ACP sensor harness connector.
- Measure resistance between the ACP circuit at the ACP sensor harness connector and the battery negative post.

Are both resistances greater than 10,000 ohms?

Yes	No
GO to DS14 .	REPAIR short circuit. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.

DS14 CHECK ACP CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this Pinpoint Test.

- Measure resistance of ACP circuit between PCM harness connector pin and the ACP sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to DS15 .	REPAIR open ACP circuit. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.

DS15 CHECK FOR THE A/C CLUTCH TO ENGAGE

- Reconnect ACP sensor.
- Key on, engine off.
- While listening for the A/C clutch to engage, turn the A/C on. Repeat if necessary.
- Key off.

Did the A/C clutch engage when the A/C was turned on?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). START engine. TURN A/C on, WAIT 15 seconds then TURN	GO to DS16 .

A/C off. RERUN Quick Test.	
----------------------------	--

DS16 VERIFY A/C SYSTEM HAS A REFRIGERANT CHARGE

- Restore vehicle.
- Verify that the A/C system has a refrigerant charge. (Refer to the Electrical/Climate Control Systems Group in the Workshop Manual).

Does the A/C system have a refrigerant charge?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>). START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.	REPAIR A/C system. REFER to Climate Control System General Information, Section 412-00. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.

DS18 CHECK FOR INTERMITTENT ACP CIRCUIT FAULT

- Key on, engine off.
- Access ACP V PID.
- Observe ACP V PID for an indication of a fault while completing the following (a fault will be indicated by a sudden change in ACP V PID voltage):
 - Shake, wiggle, bend the ACP, SIG RTN and VREF circuits between the ACP sensor and the PCM.
 - Lightly tap on the ACP sensor (to simulate road shock).

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary. PERFORM PCM Reset to clear DTC(s). START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

DS20 DTC P1463: VERIFY A/C CLUTCH CAN DISENGAGE

- A/C and defroster off.
- Start engine.
- Verify that the A/C clutch disengages.

Is the A/C clutch disengaged?

Yes	No
KEY OFF. GO to <u>DS21</u> .	GO to <u>Section 3</u> , Symptom Chart 24 (A/C Compressor Runs Continuously, A/C Always On) to diagnose the always engaged A/C clutch.

DS21 CHECK FOR VOLTAGE AND GROUND TO A/C CLUTCH (USING NON POWERED TEST LAMP)

Note: If voltage and ground to A/C clutch has already been checked in the [Section 3](#), Symptom Charts, or the A/C clutch can be heard clicking on when the A/C is turned on, go to the question at the end of this test step.

- Disconnect A/C cycling switch. Install a jumper wire in the A/C cycling switch vehicle harness connector (to complete the circuit).
- Disconnect the A/C clutch.
- Connect a non-powered test lamp between the power pin and ground pin at the A/C clutch vehicle harness connector.
- Start engine.
- Turn A/C on, wait 15 seconds.
- Monitor test lamp.
- After testing turn key off, remove jumper and reconnect A/C clutch and A/C cycling switch.

Does test lamp light (or can A/C clutch be heard clicking on)?

Yes	No
GO to DS22 .	REFER to the Climate Control System, General Information, Section 412-00 in the Workshop Manual.

DS22 CHECK IF A SUFFICIENT A/C PRESSURE CHANGE CAN BE DETECTED BY THE ACP PID

- Start engine.
- A/C off.
- Access ACP V PID.
- Note ACP V PID voltage.
- While monitoring ACP V PID voltage, turn A/C on. Five seconds after A/C clutch engagement, note voltage (if clutch does not engage, follow NO Action To Take).

Did the ACP V PID voltage change more than 0.3 volt within five seconds of clutch engagement?

Yes	No
<p>The ACP Sensor and PCM can detect a sufficient change in A/C system pressure.</p> <p>For Symptom without DTC P1463:</p> <p>RETURN to Section 3.</p> <p>All others:</p> <p>REFER to the Climate Control System General Information, Section 412-00 in the Workshop Manual to check for proper operation of the A/C system. After any service. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.</p>	<p>KEY OFF, A/C off. GO to DS23.</p>

DS23 CHECK A/C SYSTEM PRESSURE AND PRESSURE CHANGE

- Install an A/C System Manifold Gauge Set and check the A/C system high pressure readings.
- Start engine.
- A/C off.
- Note the A/C high pressure reading.
- While monitoring the A/C system high pressure reading, turn the A/C on. Five seconds after clutch engagement, note the pressure (the pressure should increase).
- A/C off.

Did the A/C high pressure reading change more than 207 kPa (30 psi) within five seconds of clutch engagement?

Yes	No
KEY OFF. GO to DS24 .	A/C system pressure did not change as expected. REFER to the Climate Control System General Information, Section 412-00 in the Workshop Manual to check for proper mechanical operation of the A/C system. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.

DS24 CHECK VOLTAGE BETWEEN VREF AND SIG RTN TO ACP SENSOR

- Disconnect ACP sensor.
- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the ACP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. GO to DS25 .	VREF is out of range. KEY OFF. GO to C1 .

DS25 CHECK ACP CIRCUIT FOR OPEN IN SENSOR

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Key off.
- ACP sensor disconnected.
- Disconnect PCM.
- Measure resistance of ACP circuit between PCM harness connector pin and the ACP sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE ACP sensor. REFER to the Climate Control System General Information, Section 412-03 in the Workshop Manual. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick	REPAIR open circuit. START engine. TURN A/C on, WAIT 15 seconds then TURN A/C off. RERUN Quick Test.

Test.

DT: Power Steering Pressure (PSP) Sensor Introduction

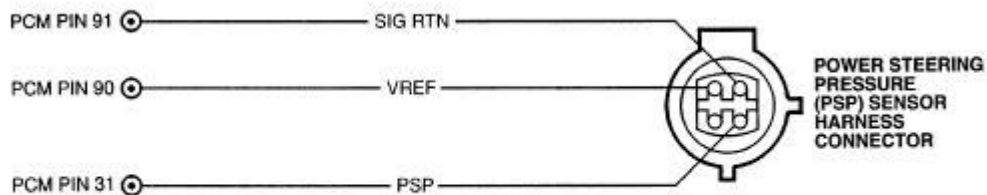
DT: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- PSP sensor (3K215)
- Harness circuits: PSP signal, SIG RTN, VREF
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

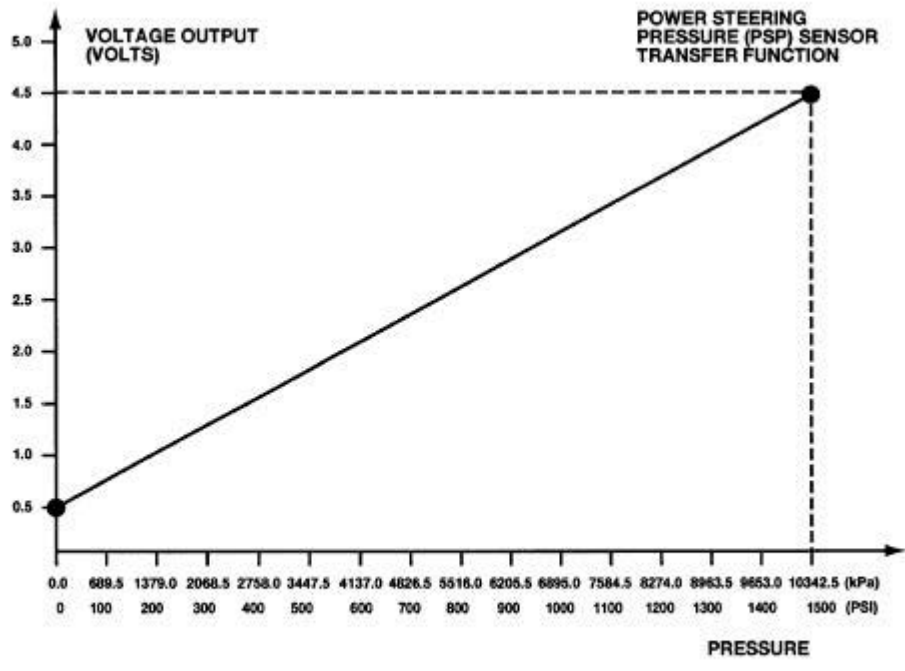


NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA0499-C

Graph

Power Steering Pressure (PSP) Sensor Transfer Function



AA0930-C

DT: Pinpoint Tests →



DT: Power Steering Pressure (PSP) Sensor

← DT: Introduction

DT1 DTC P1550: VERIFY OPERATOR INTERACTION

Did you turn the steering wheel at least one-half turn within 20 seconds of starting KOER self-test?

Yes	No
KEY OFF. If there are any symptoms with the power steering system (for example, lack of power assist), go to Workshop Manual Section 211-00, Steering Systems - General Information. If no symptoms are present with the power steering system, GO to DT2 .	RERUN Quick Test.

DT2 DTC P0552, P0553: CHECK VOLTAGE BETWEEN VREF AND SIG RTN AT PSP SENSOR

- Disconnect PSP sensor.
- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the PSP sensor harness connector.

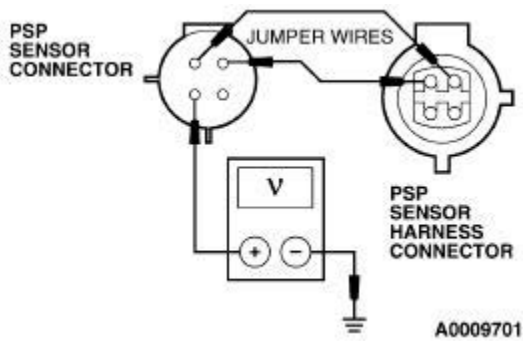
Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. GO to DT3 .	KEY OFF. GO to C1 .

DT3 CHECK PSP SENSOR OPERATION

- Connect a jumper wire for the VREF circuit between the PSP sensor harness connector and sensor connector.
- Connect jumper wire for the SIG RTN circuit between the PSP sensor harness connector and sensor connector.
- Start engine and let idle.
- Measure voltage between PSP circuit at the PSP sensor connector and chassis ground.
- Observe voltage while turning the steering wheel at least one half turn right and left.

Is voltage reading between 0.3 and 4.7 volts, and does the voltage change when the steering wheel is turned?



Yes	No
KEY OFF. GO to DT4 .	REPLACE PSP sensor.

DT4 CHECK PSP SENSOR CIRCUIT FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of PSP circuit between PCM harness connector pin 31 and PSP sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to DT5 .	REPAIR open circuit.

DT5 CHECK PSP CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on, engine off.
- Measure voltage between PSP circuit at the PSP sensor harness connector and chassis ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to DT6 .	REPAIR short circuit.

DT6 CHECK PSP CIRCUIT FOR SHORT TO VREF, SIG RTN AND GROUND IN HARNESS

- Measure resistance between the PSP circuit and both the VREF and SIG RTN circuits at the PSP sensor harness connector.
- Measure resistance between the PSP circuit at the PSP sensor harness connector and chassis ground.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

DT10 CONTINUOUS MEMORY DTC P0552, P0553: CHECK FOR INTERMITTENT CIRCUITS TO PSP SENSOR

- Key on, engine off.
- Access PSP V PID.
- Observe PSP V PID for an indication of a fault while performing the following (a fault will be indicated by a sudden change in the PSP V PID voltage):
 - Shake, wiggle, bend the PSP, SIG RTN and VREF circuits between the PSP sensor and the PCM.
 - Lightly tap on the PSP sensor to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

DU: Intake Air Temperature 2 (IAT2) Introduction

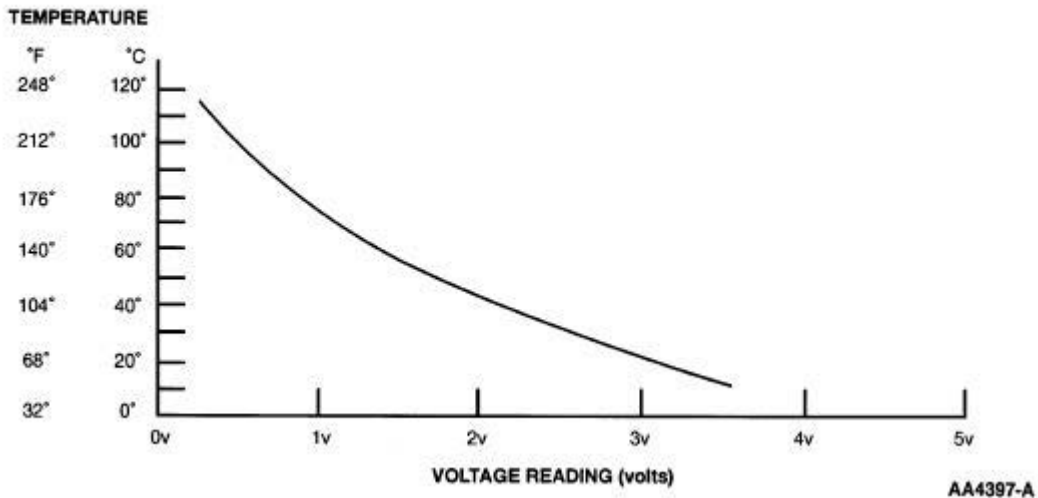
DU: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Intake air temperature 2 (IAT2) sensor (12A697)
- Harness circuits: IAT2 and SIG RTN
- Powertrain control module (PCM) (12A650)

Tables and Graphs



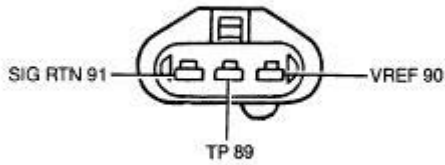
TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage (volts)	Resistance (K ohms)
120	248	0.27	1.18
110	230	0.35	1.55
100	212	0.46	2.07
90	194	0.60	2.80
80	176	0.78	3.84
70	158	1.02	5.37
60	140	1.33	7.70
50	122	1.70	10.97
40	104	2.13	16.15
30	86	2.60	24.27

20	68	3.07	37.30
10	50	3.51	58.75

Pinpoint Test Schematics and Connectors

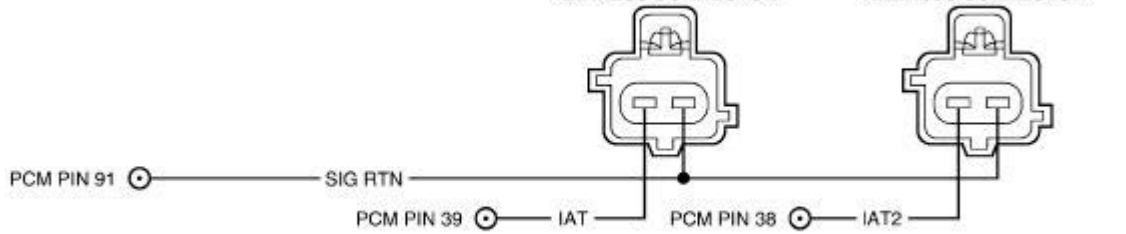
**THROTTLE POSITION (TP)
SENSOR HARNESS CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4400-A

**INTAKE AIR (IAT) SENSOR
HARNESS CONNECTOR**

**INTAKE AIR (IAT2) SENSOR
HARNESS CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**

A0013933

DU: Pinpoint Tests →

DU: Intake Air Temperature 2 (IAT2)

← DU: Introduction

DU10 DTC P1115: SIMULATE OPPOSITE SIGNAL TO PCM

- With IAT2 temperature sensor disconnected, connect a jumper wire between the sensor signal and SIG RTN circuits at the temperature sensor harness connector.
- Key on.

Note: If a scan tool communication concern exists, remove jumper wire immediately and GO to [DU12](#).

- Access IAT2 temperature sensor voltage PID.

Is the IAT2 temperature sensor voltage PID less than 0.2 volts?

Yes	No
REPLACE suspect sensor.	KEY OFF. REMOVE jumper wire. GO to DU11 .

DU11 CHECK TEMPERATURE SENSOR SIGNAL AND SIG RTN CIRCUITS FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers on this pinpoint test cover page.

- Disconnect PCM.
- Measure resistance of sensor signal circuit between PCM harness connector pin and IAT2 sensor harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and IAT2 temperature sensor harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuits.

DU12 CHECK TEMPERATURE SIGNAL FOR SHORT TO VREF IN HARNESS

- Key off.
- Disconnect PCM.
- Measure resistance between IAT2 temperature signal circuit at the sensor harness connector and VREF circuits at the PCM harness connector.

Is the resistance greater than 10,000 ohms?

Yes	No

REPLACE PCM (refer to Section 2, [Flash Electrically Erasable Programmable Read Only Memory \(EEPROM\)](#)).

REPAIR short to VREF.

DU20 P1114: SIMULATE OPPOSITE SIGNAL TO PCM

- Disconnect harness from IAT2 temperature sensor.
- Connect scan tool.
- Key on.
- Access IAT2 temperature sensor voltage PID.
- Key off.

Is the IAT2 temperature sensor voltage PID greater than 4.2 volts?

Yes	No
REPLACE sensor.	GO to DU21 .

DU21 CHECK VREF VOLTAGE TO TP SENSOR

- Refer to schematic at the beginning of the pinpoint test.
- Disconnect TP sensor.
- Key on, engine off.
- Measure the voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
There is sufficient VREF voltage. RECONNECT TP sensor. GO to DU22 . KEY OFF.	GO to C1 .

DU22 CHECK TEMPERATURE SIGNAL CIRCUIT FOR SHORT TO GROUND IN HARNESS

Note: Refer to the PCM connector pin numbers on this pinpoint test cover page.

- Disconnect PCM.
- Measure resistance between sensor signal and SIG RTN circuits and then between sensor signal and PWR GND circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

DU30 P0127 IAT2 TOO HIGH. CHECK SUPERCHARGER INTERCOOLER PUMP

OPERATION

- Connect scan tool.
- Access Output Test Mode.
- Select Mode: ALL ON.
- Command pump to run.

Does supercharger intercooler pump run?

Yes	No
GO to <u>DU31</u> .	KEY OFF. GO to <u>KP1</u> (Charge Air Cooler Pump).

DU31 CHECK INTERCOOLER SYSTEM

- Check intercooler system for:
 - low fluid level.
 - cracked coolant lines.
 - blocked heat exchanger or coolant lines.
 - crossed coolant lines.

Is intercooler system OK?

Yes	No
KEY OFF. GO to <u>DU32</u> .	REPAIR as necessary.

DU32 SIMULATE HIGH IAT2 VOLTAGE SIGNAL

- Connect scan tool.
- Key on.
- Access IAT2 VPID.
- Observe PID while disconnecting IAT2 sensor.

Is PID greater than 4.0V?

Yes	No
GO to <u>DU33</u> .	REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).

DU33 SIMULATE LOW IAT2 VOLTAGE SIGNAL

- Access IAT2 VPID.
- Observe PID while connecting a jumper wire between the sensor signal and SIG RTN circuit at the temperature sensor harness connector.

Is PID less than 1.0V?

Yes	No

RECONNECT sensor and GO to [Section 6](#), Reference Values. COMPARE IAT2 PID to reference values under the given road test conditions. If sensor is not in range, REPLACE IAT2 sensor.

REPLACE PCM (refer to Section 2, [Flash Electrically Erasable Programmable Read Only Memory \(EEPROM\)](#)).

EM: Emissions Compliance Introduction

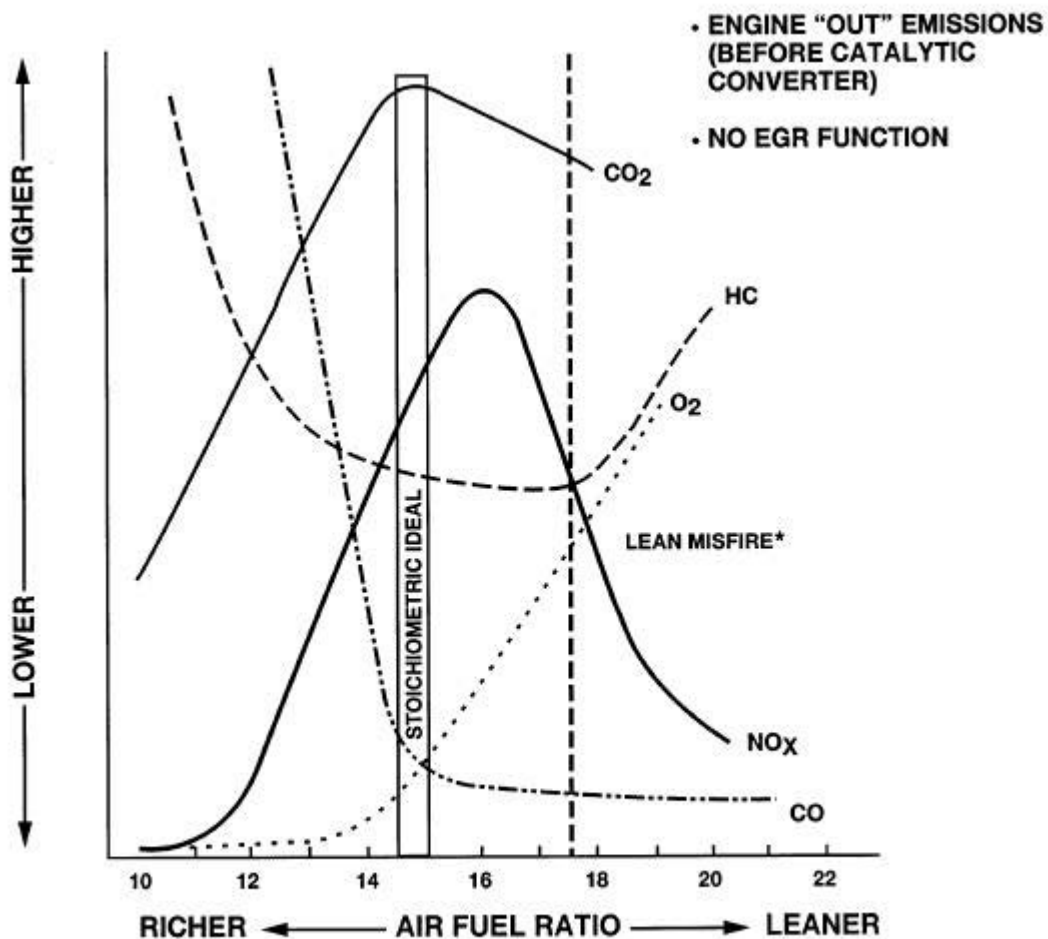
EM: Pinpoint Tests →

Note

Canada and some states or metropolitan areas in the United States require periodic Emission, or Inspection and Maintenance (I/M) Tests. All Ford products have been designed to pass these tests. If a Ford product fails an I/M Test, it is probable that 1) the engine or catalyst temperature was not warm and stabilized before the test, or 2) the vehicle had idled excessively before the test.

- If any emission components are replaced, perform the following before repeating the I/M Test procedure:
 1. Clear Keep Alive Random Access Memory (RAM)—Refer to Section 2, [Powertrain Control Module \(PCM\) Reset](#).
 2. To relearn some basic Adaptive Learning (trim) values, run engine at 2500 rpm for one minute and idle engine for two minutes.

Exhaust Gas Analysis Chart



* EXACT AIR FUEL RATIO VARIES DEPENDING ON ENGINE

Verifying an Excessive Grams Per Mile (GPM) Indication Using a Parts Per Million (PPM) Reading

For the vehicle's gas reading(s) that is excessive, compare the actual GPM reading to the gas cutpoint level needed to pass testing. Determine how much the actual GPM reading is over the cutpoint. This will give an indication of how much the PPM reading will have to be reduced (if the actual reading is twice the cutpoint, the baseline reading will have to be cut in half or more). See following example.

Example:

- The actual HC produced by a vehicle was 1.6 GPM. The cutpoint for HC in this example is 0.8 GPM. The actual reading is twice the cutpoint.
- The HC reading obtained for the same vehicle during the baseline drive averages 440 PPM. In order for this vehicle to pass the I/M test, the HC reading from the verification trip must be at least half of the baseline reading, or an average of 220 PPM or less.
- This method only gives a general idea of how much the PPM reading needs to be reduced in order for the vehicle to pass an I/M test that calculates GPM. This test is not exact. Experience will still have to be used to determine if the emission readings have been reduced enough for the vehicle to pass the I/M test.

EM: Emissions Compliance

← EM: Introduction

EM1 ANALYZE VEHICLE'S INSPECTION AND MAINTENANCE (I/M) TEST REPORT

- Analyze I/M test report for data entry errors:
 - Correct model and year.
 - Correct test weight, if included on report (this number will be less than the vehicle's GVW).
 - Correct calibration, if included on report (such as Calif. or Federal).
- Analyze I/M test report results:
 - Identify which gas readings are high AND which readings are low.
 - For reports that include a drive trace, identify during which mode the gas(es) failed. Be aware that if all gases were high early then decreased, the catalyst may have been cool when testing began.

Has the I/M test report been analyzed?

Yes	No
GO to EM2 .	REPEAT this test step.

EM2 DID THE VEHICLE FAIL ONLY AN EVAP SYSTEM LEAK TEST OR A PURGE FLOW TEST (if these tests were performed)?

Did the vehicle fail only an EVAP system leak test or purge flow test (all gases OK)?

Yes	No
EVAP concern only. GO to EM35 .	GO to EM3 .

EM3 BASELINE VEHICLE

Note: Baselining the vehicle's exhaust gas readings is important so the baseline readings can be used for comparison after any repair is made.

- Baseline vehicle using an exhaust gas analyzer. If the vehicle must be driven, be certain any baseline drive used is repeatable. The same drive cycle will be used to verify any repair.
- During the baseline, check for any related symptoms that may be present (such as driveability, transmission shifting or exhaust smoke concerns).

Has the vehicle been baselined?

Yes	No
GO to EM4 .	REPEAT this test step.

EM4 CHECK IF ANY OTHER SYMPTOMS ARE PRESENT

Are any of the following symptoms present?

- Driveability Concerns (including Idle or Transmission Concerns).
- Exhaust smoke.
- Cooling System Concerns (engine not operating at proper temperature).

Yes	No
GO to Section 3 (begin at Step 1: PCM Quick Test) for direction to repair the additional symptom. Also REFER to the Exhaust Gas Analysis Chart at the beginning of this pinpoint test for additional information. After any repair, GO to EM40 to verify repair.	No other concerns present. GO to EM5 .

EM5 PRELIMINARY CHECKS

- Perform the following preliminary checks:
 - Vacuum lines (leaks/blockage).
 - Electrical connections.
 - Proper scheduled maintenance.
 - Intake air tube and air cleaner concerns (such as obstructions, leaks or dirty air cleaner element).
 - Ford authorized emission controls and components installed on vehicle.

Are all checks OK?

Yes	No
GO to EM6 .	REPAIR as necessary. After repair, GO to EM40 to VERIFY repair.

EM6 PERFORM PCM QUICK TEST

- Complete PCM Quick Test to access any PCM DTCs (Refer to [Section 3](#), Step 1: PCM Quick Test (for Test Step procedure only)).

Is a fault indicated?

Yes	No
FOLLOW Section 3 Quick Test direction. After repair, GO to EM40 to verify repair.	GO to EM7 .

EM7 CHECK CARBON MONOXIDE (CO) LEVELS

Did the vehicle have excessive CO levels?

Yes	No
Excessive CO levels indicate that the engine is running rich. GO to EM15 .	GO to EM8 .

EM8 CHECK HYDROCARBON (HC) LEVELS

Did the vehicle have excessive HC levels?

Yes	No
Excessive HC levels with low to normal CO levels indicate that the engine is running lean. GO to EM25 .	GO to EM9 .

EM9 CHECK OXIDES OF NITROGEN (NO_x) LEVELS

Did the vehicle have excessive NO_x levels?

Yes	No
GO to EM30 .	VERIFY all previous testing.

EM15 HIGH CO LEVELS: CHECK HC LEVELS

Did the vehicle have excessive HC levels?

Yes	No
GO to EM16 (to check for incomplete combustion/running rich).	GO to EM17 (to check for running rich).

EM16 CHECK SECONDARY IGNITION SYSTEM

- GO to [JB1](#) to check the secondary ignition system.

Is a fault indicated?

Yes	No
FOLLOW Pinpoint Test direction. After repair, GO to EM40 to verify repair.	GO to EM17 .

EM17 CHECK FUEL DELIVERY SYSTEM FOR CONCERNS SUCH AS HIGH FUEL PRESSURE AND ABILITY TO HOLD PRESSURE

- For Natural Gas applications:
 - GO to [HB1](#).
- All others:
 - GO to [HC1](#).

Is a fault indicated?

Yes	No
FOLLOW Pinpoint Test direction. After repair, GO to EM40 to verify repair.	GO to EM18 .

EM18 CHECK PCV SYSTEM FOR LEAKS, STUCK VALVE, ETC.

- GO to HG1 to check the PCV System.

Is a fault indicated?

Yes	No
FOLLOW Pinpoint Test direction. After repair, GO to <u>EM40</u> to verify repair.	GO to <u>EM19</u> .

EM19 CHECK EXHAUST SYSTEM

- GO to HF1 to check the exhaust system.

Is a fault indicated?

Yes	No
FOLLOW Pinpoint Test direction. After repair is performed, GO to <u>EM40</u> to verify repair.	GO to <u>EM20</u> .

EM20 CHECK BASE ENGINE

- Go to Engine System—General Information Section 303-00 in the Workshop Manual to check for proper compression, valvetrain, camshaft, etc.

Is a fault indicated?

Yes	No
REPAIR as required according to Workshop Manual direction. After repair, GO to <u>EM40</u> to verify repair.	GO to <u>EM21</u> .

EM21 ADDITIONAL CHECKS

- Additional checks:
 - Incorrect PCV valve.

Are all checks OK?

Yes	No
GO to <u>EM45</u> .	REPAIR as necessary. After repair, GO to <u>EM40</u> to verify repair.

EM25 HIGH HC WITH NORMAL TO LOW CO LEVEL: CHECK FUEL DELIVERY SYSTEM FOR CONCERNS SUCH AS LOW FUEL PRESSURE

- For Natural Gas applications:
 - GO to HB1.
- All others:
 - GO to HC1.

Is a fault indicated?

Yes	No
FOLLOW Pinpoint Test direction. After repair, GO to <u>EM40</u> to verify repair.	GO to <u>EM26</u> .

EM26 CHECK SECONDARY IGNITION SYSTEM

- GO to JB1 to check the secondary ignition system.

Is a fault indicated?

Yes	No
FOLLOW Pinpoint Test direction. After repair, GO to <u>EM40</u> to verify repair.	GO to <u>EM27</u> .

EM27 CHECK PCV SYSTEM

- GO to HG1 to check the PCV system.

Is a fault indicated?

Yes	No
FOLLOW Pinpoint Test direction. After repair, GO to <u>EM40</u> to verify repair.	GO to <u>EM28</u> .

EM28 CHECK BASE ENGINE

- Go to Engine System—General Information Section 303-00 in the Workshop Manual to check base engine for concerns such as intake manifold leaks, improper compression, valvetrain or camshaft damage.

Is a fault indicated?

Yes	No
REPAIR as required according to Workshop Manual direction. After repair, GO to <u>EM40</u> to verify repair.	GO to <u>EM29</u> .

EM29 ADDITIONAL CHECKS

- Additional checks:
 - Incorrect PCV valve.

Are all checks OK?

Yes	No
GO to EM45 .	REPAIR as necessary. After repair, GO to EM40 to verify repair.

EM30 HIGH NO_x WITH NORMAL TO LOW HC AND CO LEVELS: CHECK BASE ENGINE FOR CONCERNS SUCH AS EXCESSIVE CARBON BUILD UP IN COMBUSTION CHAMBER

- Go to the Engine System—General Information Section 303-00 in the Workshop Manual to check for base engine concerns such as excessive carbon build up in the combustion chamber.

Is a fault indicated?

Yes	No
REPAIR as required according to Workshop Manual direction. After repair, GO to EM40 to verify repair.	GO to EM31 .

EM31 ADDITIONAL CHECKS

- Additional checks:
 - Transmission torque converter clutch operation.
 - Cooling System concerns (such as aftermarket front fascia covering intake air, intake air system modifications).
 - Engine running lean (concerns such as vacuum leaks, low fuel pressure (refer to steps starting at **EM25**)).

Are all checks OK?

Yes	No
GO to EM45 .	REPAIR as necessary. After repair, GO to EM40 to verify repair.

EM35 EVAP SYSTEM CONCERN: PRELIMINARY CHECKS

- Analyze I/M Test Report to determine when concern is present. Attempt to verify concern.
- Make the following preliminary checks:
 - Fuel filler cap (check for proper installation, physical damage or contamination).
 - EVAP system lines/hoses (check for proper connections, damage or blockage).
 - Fuel vapor storage canister damage.

Are all checks OK?

Yes	No
GO to EM36 .	REPAIR as necessary. After repair, GO to EM38 to verify repair.

EM36 PERFORM PCM QUICK TEST

- Complete PCM Quick Test to access any PCM DTCs (Refer to [Section 3](#), Step 1: Quick Test (for Test Step procedure only)).

Is a fault indicated?

Yes	No
FOLLOW Section 3 Quick Test direction. After repair, GO to EM38 to verify repair.	GO to EM37 .

EM37 CHECK EVAP SYSTEM

- Go to Evaporative Emissions, Section 303-13, in the Workshop Manual to check for system leaks.

Is a fault indicated?

Yes	No
FOLLOW Pinpoint Test direction. After repair, GO to EM38 to verify repair.	VERIFY test results. If OK, GO to Z1 , or RETURN to Section 3 to repair any additional symptoms. After any repair, GO to EM38 to verify repair.

EM38 EVAP SYSTEM REPAIR VERIFICATION

- Vehicle repair performed.
- Reset the PCM Keep Alive Random Access Memory (RAM). Be aware that this will set DTC P1000 (and reset the On-Board System Readiness Test).
- To relearn some basic Adaptive Learning (trim) values, run the engine at 2500 rpm for one minute and idle engine for two minutes.
- Rerun PCM Quick Test (refer to [Section 3](#), Step 1: Quick Test). REPAIR any DTCs as directed.
- Perform the EVAP system leak test and flow check.

Does the vehicle pass the EVAP system leak test and flow check?

Yes	No
Save any repair documentation that may be required by local/federal laws. RETURN vehicle to customer.	Original concern not repaired, or another concern exists. GO to EM1 and proceed as directed.

EM40 REPAIR VERIFICATION

- Vehicle repair completed.
- Reset the PCM Keep Alive Random Access Memory (RAM). Be aware that this will set DTC P1000 (and reset the On-Board System Readiness Test).
- To relearn some basic Adaptive Learning (Trim) values, run the engine at 2500 rpm for one minute and idle engine for two minutes.
- Rerun PCM Quick Test (refer to [Section 3](#), Step 1: Quick Test). REPAIR any DTCs as directed.
- Again perform the baseline test using the exhaust gas analyzer.

Note: If vehicle needs to be driven for the baseline, it may be necessary to drive the vehicle first for up to 8 km (5 miles) to relearn some additional Adaptive Learning (trim) values. Also, during the baseline be certain to use the same drive mode that was used for the original baseline test (refer to **EM3**).

- For I/M 240 Emission Testing areas (original gas concentrations reported in Grams Per Mile):
 - Refer to the beginning of this pinpoint test for information on verifying an excessive Grams Per Mile indication using a Parts Per Million (PPM) reading.
- All others (original gas concentrations reported in Parts Per Million):
 - Verify gas levels are within acceptable range.

Are all gases within the acceptable range?

Yes	No
SAVE any repair documentation that may be required by local/federal laws. RETURN vehicle to customer.	Gas level is still high, or another gas level is above the acceptable range: GO to <u>EM1</u> and proceed as directed.

EM45 CATALYST DELTA TEMPERATURE TEST

- All previous testing as indicated completed.
- Disable the AIR system, if equipped.
- Run the engine for two minutes at 2500 rpm to heat the exhaust system.
- Key OFF.
- Disconnect and ground one spark plug wire from each cylinder bank (for Coil On Plug applications, disconnect coil connector).
- Start engine and run at 1000 rpm.
- Disconnect IAC valve (maintain 1000 rpm).
- Measure the surface temperature of both the inlet and outlet of each under-body catalytic converter using an infrared temperature probe.
- Compare the difference in temperature between the inlet and outlet readings of each under-body catalytic converter.

Does each catalytic converter have a difference of more than 28°C (50°F) between its inlet and outlet reading?

Yes	No
The catalytic converter(s) is operating correctly. RECONNECT spark plug wire(s), IAC valve and AIR system (if equipped). COMPLETE PCM Reset to clear any DTC(s) set during testing. VERIFY previous test results. If OK, GO to <u>Z1</u> , or RETURN to <u>Section 3</u> to repair any additional symptoms. After any repair is completed, GO to <u>EM40</u> to verify repair.	For the catalytic converter(s), that had less than 28°C (50 °F) difference, testing indicates the catalytic converter is not working. REPEAT test step to verify results. If the temperature difference is still less than required, REPLACE the catalytic converter. RESTORE vehicle. GO to <u>EM40</u> to verify repair.

FB: Power Take Off (PTO) Introduction

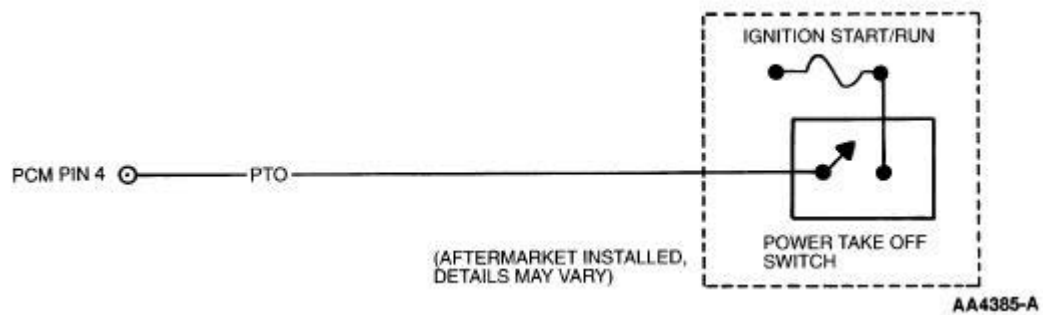
FB: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- PTO Harness circuit
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematic



FB: Pinpoint Tests →

FB: Power Take Off (PTO)

← FB: Introduction

FB1 PTO PID DOES NOT CYCLE: CHECK FOR DEFECTIVE PTO SWITCH

Note: Causes of concern:

- PTO circuit short to power in aftermarket switch/input to the PTO harness connector.
 - PTO circuit short to VPWR.
 - Damaged PCM.
- Disconnect PTO switch harness connector.
 - Measure resistance across PTO switch while in on then off position.

Is resistance less than 5.0 ohms then greater than 10,000 ohms when cycling switch?

Yes	No
GO to FB2 .	REPAIR or REPLACE PTO switch. REFER to aftermarket component manufacturer for service information. RECONNECT PTO switch harness connector. COMPLETE an OBD II Drive Cycle (REFER to Section 2, Drive Cycles).

FB2 CHECK PTO CIRCUIT FOR SHORT TO VPWR

- Disconnect PCM.
- Key on, engine off.
- Measure voltage of PTO circuit between PCM harness connector pin 4 and battery negative post.

Is voltage less than 1.0 volt?

Yes	No
RECONNECT PCM and PTO switch harness connector. GO to FB4 .	REPAIR short circuit.

FB3 MIL ON: CHECK PTO PID

Note: Causes of concern:

- Open in PTO circuit.
 - Short to chassis ground in PTO circuit.
- Connect scan tool to DLC.
 - Key on, engine off.
 - Access the PTO PID.

Is the PTO PID available and displaying on or off?

Yes	No

GO to [FB1](#).

GO to [FB9](#).

FB4 CHECK PTO CIRCUIT WITH SCAN TOOL

Note: This step requires operating the PTO component. Refer to aftermarket manufacturer for PTO operating instructions. Follow all safety precautions.

- Key on (may need to start engine to engage PTO).
- Cycle PTO switch/handle while viewing PTO PID.

Does PTO PID cycle ON, delay, then turn OFF?

Yes	No
RETURN to Section 3 , Symptom Charts.	KEY OFF. GO to FB5 .

FB5 CHECK PTO CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect PCM.
- Disconnect scan tool from DLC.
- Disconnect PTO switch harness connector.
- Measure resistance of PTO circuit between PCM harness connector pin 4 and battery negative post.

Is resistance greater than 10,000 ohms?

Yes	No
RECONNECT PCM. GO to FB7 .	REPAIR short circuit.

FB7 CHECK PTO CIRCUIT FROM PTO SWITCH HARNESS CONNECTOR TO PCM

- Connect scan tool.
- Connect Jumper wire between B+ and PTO circuit at the PTO switch harness connector.
- Key on, engine off.
- Access PTO PID.

Is PTO PID on with jumper inserted and off with jumper removed?

Yes	No
RETURN to Section 3 , Symptom Charts.	KEY OFF. GO to FB8 .

FB8 CHECK PTO CIRCUIT RESISTANCE

- Disconnect PCM.
- Measure resistance of PTO circuit between PCM harness connector pin 4 and PTO switch harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open PTO circuit.

FB9 COMPLETE KOEO AND KOER QUICK TESTS

The following steps are used for PTO diagnostics when the vehicle does not support the PTO circuit or PID.

- Complete KOEO and KOER Quick Tests. Refer to [Section 3](#), Symptom Charts, GO to Quick Test [QT1](#).

Are any KOEO or KOER DTCs present?

Yes	No
FOLLOW direction in GO to Quick Test QT1 to REPAIR the KOEO or KOER DTCs.	GO to FB10 .

FB10 COMPLETE OBD II DRIVE CYCLE WITH PTO DISENGAGED

Note: This test step will determine if the PTO operation resulted in any Continuous Memory DTCs stored due to the extra load of the PTO component on the engine.

- Complete PCM Reset.

Note: Make sure the PTO is disengaged.

- Complete OBD II Drive Cycle (refer to Section 2, [Drive Cycles](#)).
- Retrieve all Continuous Memory DTCs (refer to [Section 2](#), Accessing All Continuous Memory DTCs).

Are any Continuous Memory DTCs stored?

Yes	No
GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts , to ADDRESS the first Continuous Memory DTC.	MIL can be caused by engaging the PTO, creating a load on the engine, while the OBD II Monitors were running. If the symptom persists, GO to Z1 .

FD: Brake Pedal Position (BPP) Switch Introduction

FD: Pinpoint Tests →

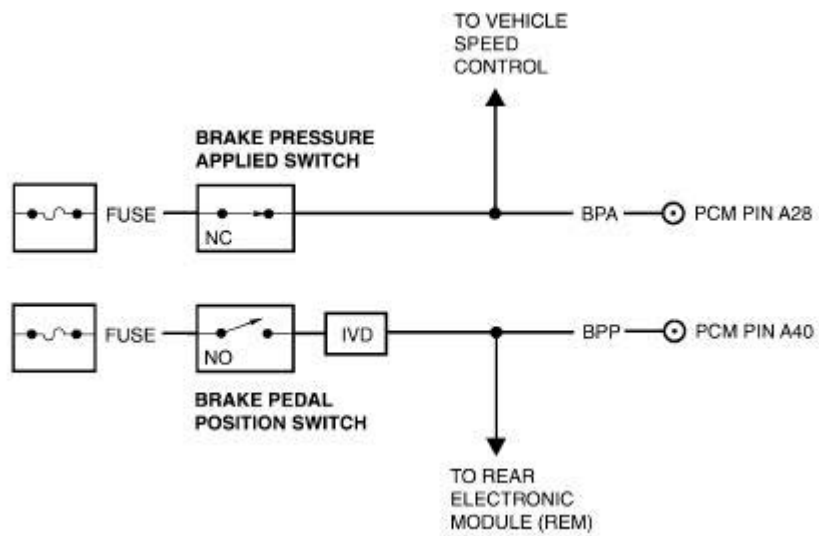
Note

This Pinpoint Test is intended to diagnose the following:

- Brake pedal position (BPP) switch
- Brake pressure applied (BPA) deactivator switch
- Harness circuits: B+, BPA, BPP, GND and stoplamp PWR
- Powertrain control module (PCM) (12A650)

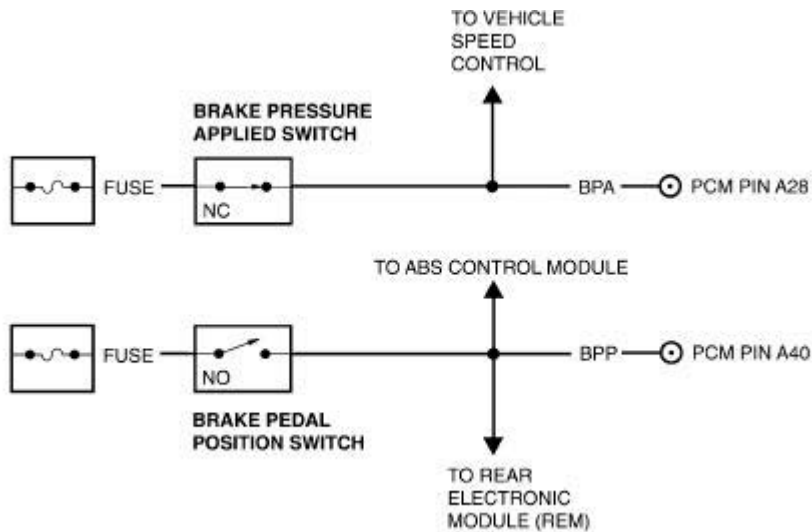
Pinpoint Test Schematics and Connectors

LS6/LS8 (with IVD)



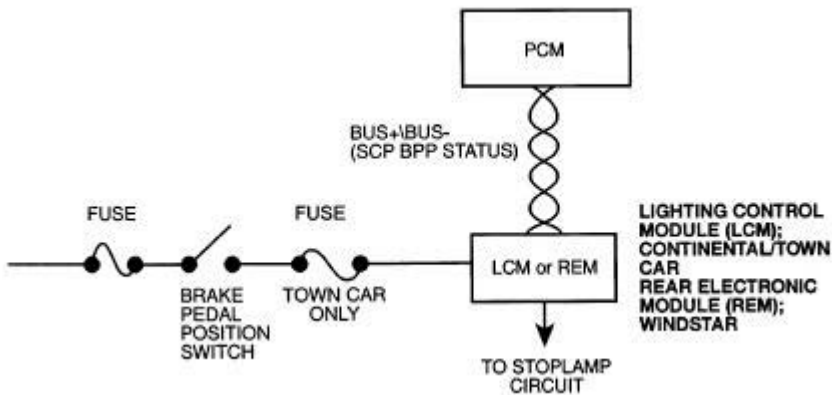
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LS6/LS8 (without IVD)



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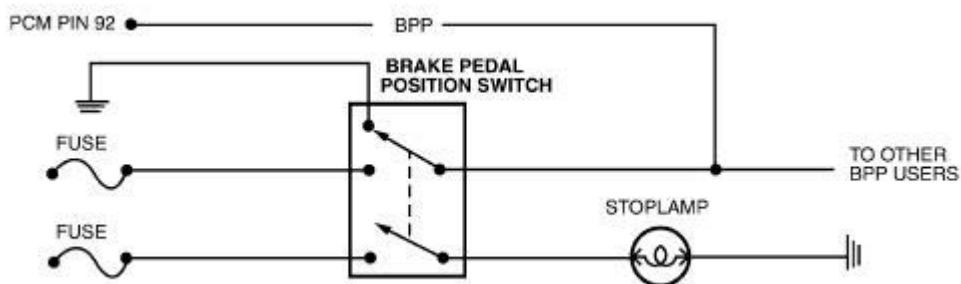
Continental, Town Car and Windstar



AA4387-A

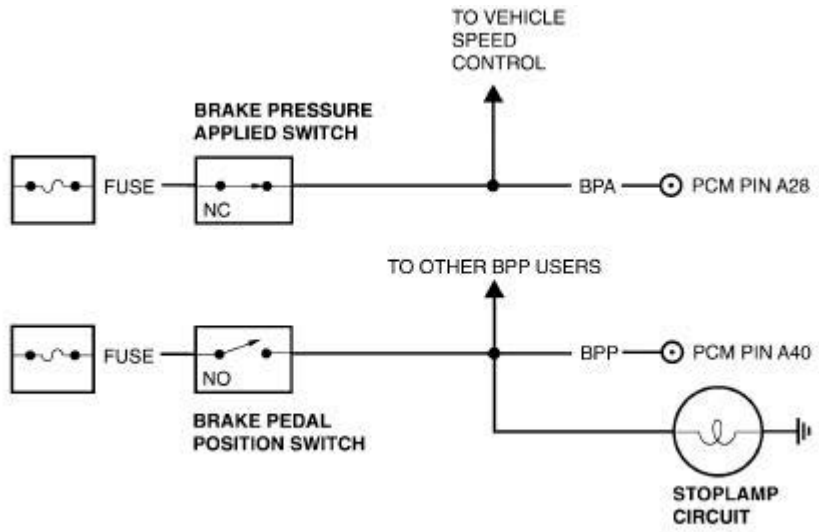
The PCM receives BPP information through the SCP link. This pinpoint test will only verify Self-Test was performed correctly. For detail wiring information, refer to the Workshop Manual or Wiring Diagrams Manual.

Explorer/Mountaineer, Explorer Sport/Sport Trac, Ranger, F-Series, Blackwood, Expedition/Navigator, Excursion



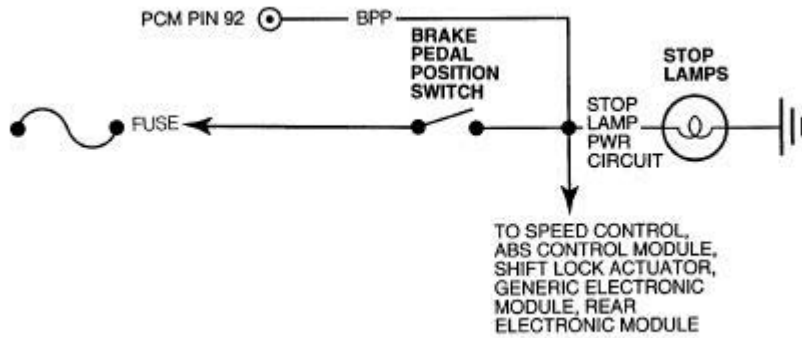
A0009690

Explorer/Mountaineer (150 PIN PCM ONLY)



A0027484

All Others



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA0841-E

FD: Brake Pedal Position (BPP) Switch

← FD: Introduction

FD1 KOER DTC P0703 OR P1703: VERIFY BRAKE PEDAL WAS APPLIED

Was the brake pedal applied and released during KOER Self-Test?

Yes	No
<p>For Continental and Town Car:</p> <p>REFER to Exterior Lighting, Section 417-01 in the Workshop Manual for further diagnosis of the lighting control module (LCM) system.</p> <p>For Windstar:</p> <p>REFER to Exterior Lighting, Section 417-01 in the Workshop Manual for further diagnosis of the Rear Electronic Module (REM).</p> <p>All Others:</p> <p>KEY ON. GO to FD3.</p>	<p>RERUN KOER Self-Test. APPLY and RELEASE brake pedal.</p>

FD2 KOEO DTC P0703 OR P1703: VERIFY BRAKE PEDAL WAS NOT APPLIED

Was the brake pedal applied during KOEO Self-Test?

Yes	No
<p>RERUN KOEO Self-Test. Avoid applying brake pedal during test.</p>	<p>For Continental and Town Car:</p> <p>REFER to Exterior Lighting, Section 417-01 in the Workshop Manual for further diagnosis of the lighting control module (LCM) system.</p> <p>For Windstar:</p> <p>REFER to Exterior Lighting, Section 417-01 in the Workshop manual for further diagnosis of the Rear Electronic Module (REM).</p> <p>All others:</p> <p>KEY ON. GO to FD3.</p>

FD3 DTCS P0703, P1572 AND P1703: CHECK OPERATION OF STOPLAMPS

- Apply and release the brake pedal several times and observe stoplamp operation.

Do the stoplamps operate normally?

--	--

Yes	No
GO to FD4 .	For LS6/LS8: REFER to Exterior Lighting, Section 417-01 in the Workshop Manual for further diagnosis of the rear electrical module (REM). For all others: GO to FD5 for stoplamps never on. GO to FD7 for stoplamps always on.

FD4 CHECK FOR PCM BPP PID CYCLING

- Key on, engine off.
- Access BPP PID.

Note: If BPP PID is not accessible, GO to [FD10](#).

- Apply and release the brake pedal several times while viewing the BPP PID.

Does the BPP PID cycle ON/OFF?

Yes	No
KEY OFF. Unable to duplicate or identify fault at this time. GO to Z1 .	KEY OFF. GO to FD10 .

FD5 CHECK B+ VOLTAGE TO BRAKE PEDAL POSITION SWITCH

Note: Check the condition of the stoplamp bulbs before starting this test.

- Disconnect BPP switch.
- Measure B+ input voltage between BPP switch harness connector and chassis ground.

Is voltage greater than 10 volts?

Yes	No
GO to FD6 .	VERIFY integrity of fuse for B+ to brake pedal position switch. If OK, REPAIR open in B+ circuit. If fuse is damaged, check B+ circuit, BPP circuit, stop lamp PWR circuit and any other associated circuits (REFER to Wiring Diagrams) for short to ground. REPAIR as necessary.

FD6 VERIFY INTEGRITY OF BRAKE PEDAL POSITION SWITCH

- Connect digital multimeter test probes to BPP switch terminals at the BPP switch.
- Apply brake pedal while monitoring reading.

Is the resistance less than 5.0 ohms?

Yes	No
REPAIR open circuit between BPP switch and stoplamp ground.	REPLACE BPP switch.

FD7 VERIFY BRAKE PEDAL POSITION SWITCH IS NOT ALWAYS CLOSED

- Disconnect BPP switch.
- Key on, engine off.

Are stoplamps still on?

Yes	No
KEY OFF. GO to <u>FD8</u> .	VERIFY proper installation of BPP switch. If OK, REPLACE switch.

FD8 CHECK FOR SHORT TO POWER IN PCM

- Disconnect PCM.
- Key on.

Are stoplamps still on?

Yes	No
KEY OFF. GO to <u>FD9</u> .	KEY OFF. REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).

FD9 CHECK STOPLAMP CIRCUIT FOR SHORT TO POWER IN HARNESS

- One at a time, disconnect all modules associated with the stoplamp circuit (Refer to Wiring Diagram Manual). After disconnecting each module, turn key on and observe stoplamps. Turn key off. Repeat until each associated module has been disconnected or stoplamps turn off.

Did stoplamps turn off when any of the modules were disconnected?

Yes	No
REFER to the Workshop Manual for further diagnosis of appropriate module.	REPAIR short to power in stoplamp circuit.

FD10 CHECK FOR BPP CIRCUIT CYCLING

Note: Refer to the PCM connector pin numbers in the beginning of this Pinpoint Test.

- KEY OFF.
- Disconnect PCM.
- Measure voltage between BPP circuit at the PCM harness connector and ground while applying

and releasing the brake.

Does the voltage cycle?

Yes	No
<p>For LS6/LS8, Explorer/Mountaineer (150 PIN PCM): GO to FD11.</p> <p>For all others:</p> <p>REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p>	REPAIR open in BPP circuit to PCM.

FD11 CHECK FOR BPA CIRCUIT CYCLING

Note: Refer to the PCM connector pin numbers in the beginning of this Pinpoint Test.

- Disconnect PCM.
- Measure voltage between BPA circuit at the PCM harness connector and ground while applying and releasing the brake.

Does the voltage cycle?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	GO to FD12 .

FD12 CHECK BPA CIRCUIT FOR OPEN IN HARNESS

- Disconnect BPA deactivator switch.
- Measure resistance of BPA circuit between PCM harness connector pin and BPA deactivator switch harness connector.

Is the resistance less than 5 ohms?

Yes	No
GO to FD13 .	REPAIR open in BPA circuit to PCM.

FD13 CHECK BPA DEACTIVATOR SWITCH

- Connect digital multimeter test probes to BPA switch terminals at the BPA switch.
- Apply brake pedal while monitoring reading.

Is the resistance less than 5 ohms with the brake pedal released and greater than 10,000 ohms with the brake pedal depressed?

Yes	No
REPAIR VPWR circuit to BPA switch.	REPLACE BPA deactivator switch.

FF: Power Steering Pressure (PSP) Switch Introduction

FF: Pinpoint Tests →

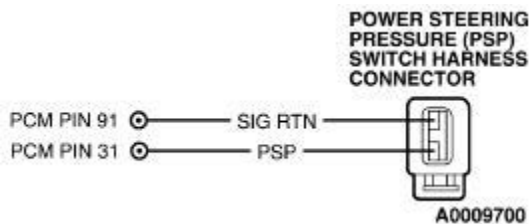
Note

This Pinpoint Test is intended to diagnose the following:

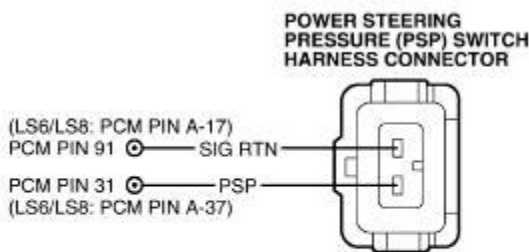
- Power steering pressure (PSP) switch (3N824)
- Harness circuits: PSP and SIG RTN
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

Focus, Escape



All Others



NOTE: THE PSP AND SIG RTN CIRCUITS MAY BE REVERSED IN THE HARNESS CONNECTOR. REFER TO THE WIRING DIAGRAM MANUAL FOR MORE INFORMATION.

A0009699

Shorting Bar for Harness Circuit without PSP Switch



A24595-A

FF: Pinpoint Tests →

FF: Power Steering Pressure (PSP) Switch

← FF: Introduction

FF1 DTC P1650: VERIFY ELECTRICAL FUNCTION

Note: If P1650 was received in Key On Engine Running Self-Test, verify that the steering wheel was turned at least one half turn within 20 seconds of starting test.

- Connect scan tool.
- Key on, engine running.
- Access PSP PID (PSP V PID for Taurus/Sable).
- Turn the steering wheel back and forth.

Does the PSP PID (or PSP V PID) indicate a change?

Yes	No
GO to <u>FF10</u> .	KEY OFF. GO to <u>FF2</u> .

FF2 CHECK FOR PSP SWITCH CYCLING

- Disconnect PSP switch or remove the shorting bar.
- Install a jumper wire across the PSP switch harness connector.
- Key on, engine off.
- Record the PID reading.
- Remove the jumper wire and record the PID reading.

Does the PSP PID change from high to low (or PSP V PID change from less than 1.0 volt to greater than 8 volts)?

Yes	No
REPLACE the PSP switch or shorting bar.	KEY OFF. GO to <u>FF3</u> .

FF3 CHECK PSP CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers at the beginning of the pinpoint test.

- Disconnect PCM.
- Measure resistance of PSP circuit between PCM harness connector pin and PSP switch harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and PSP switch harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to <u>FF4</u> .	REPAIR open circuit.

FF4 CHECK PSP CIRCUIT FOR SHORT TO SIG RTN OR GROUND IN HARNESS

- Measure resistance between PSP signal and SIG RTN at PSP switch harness connector.
- Measure resistance between PSP signal at PSP switch harness connector and chassis ground.

Is either resistance less than 10,000 ohms?

Yes	No
REPAIR short circuit.	REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).

FF10 DTC P1651: CHECK PSP CIRCUITS FOR INTERMITTENT CONCERNS

Note: Be aware that P1651 could be set if the vehicle is towed with the engine running, or if a power steering hydraulic concern was present.

- Key on, engine off.
- Access PSP V PID.
- Check for open circuits while performing the following (a fault will be indicated by a sudden change in the PSP V PID):
 - Shake, wiggle, bend the PSP and SIG RTN circuits between the PSP switch and the PCM.
 - Lightly tap on the PSP switch (to simulate road shock).
- Disconnect PSP switch.
- Check PSP circuit for short to ground while performing the following (a fault will be indicated by a sudden change in the PSP V PID voltage):
 - Shake, wiggle, bend the PSP circuit between the PSP switch and the PCM.

Is a fault indicated?

Yes	No
KEY OFF. ISOLATE fault and REPAIR as necessary.	KEY OFF. RECONNECT PSP switch. Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

FH: Generator Load Input (GLI) Introduction

FH: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- GLI circuit
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematic



FH: Pinpoint Tests →

FH: Generator Load Input (GLI)

← FH: Introduction

FH1 P1244, P1245 OR P1246: CHECK IF ANY BATTERY OR CHARGING SYSTEM CONCERNS ARE PRESENT

- Check generator drive belt condition and tension.
- Verify that the battery is at proper charge.
- Verify that there are no symptoms associated with the charging system.

Does the battery and charging system appear OK?

Yes	No
GO to FH2 .	REFER to Battery and Charging, Section 414-00 in the Workshop Manual.

FH2 CHECK GENERATOR LOAD INPUT (GLI) CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect voltage regulator.
- Disconnect PCM.
- Key on.
- Measure voltage between PCM harness connector Pin 59 and ground.

Is voltage less than 1.0 volts?

Yes	No
KEY OFF. GO to FH3 .	REPAIR short circuit.

FH3 CHECK GLI CIRCUIT FOR SHORT TO GROUND

- Disconnect scan tool from DLC.
- Measure resistance between PCM harness connector Pin 59 and ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to FH4 .	REPAIR short circuit.

FH4 CHECK FOR OPEN GLI CIRCUIT

- Measure resistance of the GLI circuit between PCM harness connector Pin 59 and the voltage regulator harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to <u>FH5</u> .	REPAIR open circuit.

FH5 CHECK PCM

- Reconnect PCM.
- Key on, engine off.
- Measure voltage between the GLI circuit at the voltage regulator harness connector and ground.

Is voltage greater than 2.0 volts?

Yes	No
REFER to Charging System-General Information, Section 414-00 in the Workshop Manual to verify operation of voltage regulator and generator.	REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).

H: Fuel Control Introduction

H: Pinpoint Tests →

Note

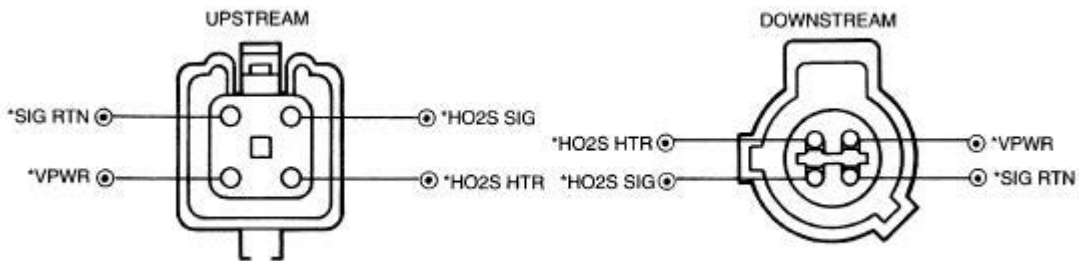
This Pinpoint Test is intended to diagnose the following:

- HO2S/Heater (9F472)
- Fuel Injector(s) (9F593)
- Vacuum Systems

- Harness Circuits: HO2S GND, HO2S, INJ 1-10, VPWR and SIG RTN
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematic

Cougar

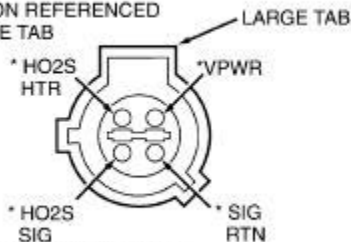


A24541-A

All Others

HO2S VEHICLE HARNESS CONNECTOR

PIN LOCATION REFERENCED FROM LARGE TAB



*GOLD PLATED TERMINALS ON HO2S SIG AND SIG RTN ONLY

A0005245

Note: Location of the small index tabs may differ from illustration.

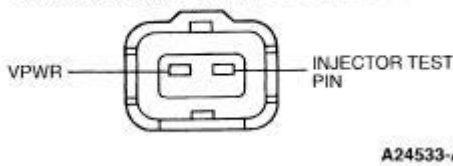
Use the large index tab as your reference during analysis. Some connectors may not have the small index tabs.

PCM CONNECTOR PIN NUMBERS

	HO2S-11	HTR-11	HO2S-12	HTR-12	HO2S-21	HTR-21	HO2S-22	HTR-22	VPWR	SIG RTN	PWR GND	VREF
150 Pin PCM	C45	B7	C28	C15	C44	B8	C29	C16	A32/A33	B7/C17	A-24, 26	A-20, C-20
2.5L Cougar	60	^a 73	35	100	87	99	61	101	71/97	91	51,77, 103	90
All others	60	93	35	95	87	94	61	96	71/97	91	51,77, 103	90

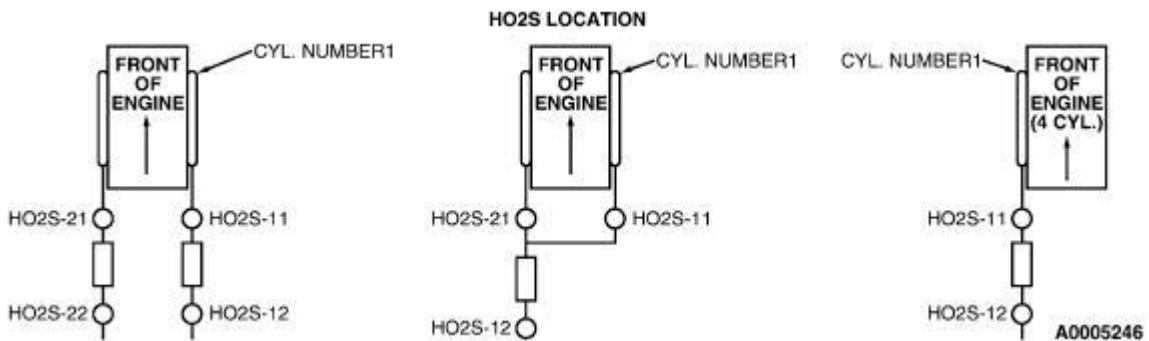
^a 2.0L Cougar with Pin 93.

INJECTOR VEHICLE HARNESS CONNECTOR



INJECTOR PCM CONNECTOR PIN NUMBERS

Vehicles	Inj-1	Inj-2	Inj-3	Inj-4	Inj-5	Inj-6	Inj-7	Inj-8	Inj-9	Inj-10
150 Pin PCM	C2	C14	C24	C32	C11	C21	C29	C37	—	—
2.5L Cougar	70	96	20	95	93	94	—	—	—	—
All others	75	101	74	100	73	99	72	98	68	42



H: Fuel Control

← H: Introduction

H20 PERFORM KOER SELF-TEST

- Key on, engine running and engine at operating temperature.
- Activate Key On, Engine Running (KOER) Self-Test.

Is DTC P1127, P1128 or P1129 present during KOER Self-Test?

Yes	No
GO to Section 4, Powertrain <u>Diagnostic Trouble Code (DTC) Charts</u> and SERVICE DTC P1127, P1128 or P1129.	GO to <u>H21</u> .

H21 DIAGNOSTIC TROUBLE CODE (DTC) P0133 AND P0153: HO2S RESPONSE TEST

DTC/HO2S Reference List:

DTC P0133 = HO2S-11

DTC P0153 = HO2S-21

- Key on, engine off.
- Select Generic OBD II Function from the menu and trigger.
- Press Continue.
- Select Diagnostic Monitoring Test Results from the menu and trigger.
- Scroll to Test ID: 01 trigger and press start.
- Key off. (REFER to Section 2 Diagnostic Monitoring Test Results.)

Is the indicated value greater than the minimum threshold?

Yes	No
COMPLETE PCM Reset to clear DTCs. COMPLETE HO2S Monitor Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>). GO to <u>H20</u> . If test results indicate a pass, testing is complete.	GO to <u>H23</u> .

H23 CHECK FOR UNMETERED AIR LEAKS

Fuel calculations can be affected by unmetered air leaks.

- Carefully inspect the following areas for potential air leaks:
 - Hoses connecting to MAF sensor assembly.
 - Hoses connecting to throttle body.
 - Intake manifold gasket leaks.
 - PCV disconnected.

- Vacuum lines disconnected.
- Improperly seated engine oil dipstick, tube, and oil fill cap.
- Exhaust leaks at flanges and gaskets.

Are any air leaks present?

Yes	No
REPAIR source of air leak. COMPLETE PCM Reset to clear DTCs. COMPLETE HO2S Monitor Drive Cycle (REFER to Section 2, Drive Cycles).	GO to H24 .

H24 CHECK HO2S CIRCUIT WIRING

Note: Refer to the PCM connector pin number in the beginning of this pinpoint test.

- Disconnect suspect HO2S.
- Check for water contamination.
- Jumper HO2S signal to VPWR at the HO2S harness connector.
- Key on, engine off.

Note: HO2S displayed as O2S on Scan Tool.

- Access the correct HO2S PID.

Is the voltage greater than 1.50 volts?

Yes	No
KEY OFF. REPLACE HO2S. CHANGE oil/filter. COMPLETE PCM Reset to clear DTCs. COMPLETE HO2S Monitor Drive Cycle (REFER to Section 2, Drive Cycles).	KEY OFF. REMOVE jumper wire. GO to H25 .

H25 DTCS P0141 AND P0161: HO2S HEATER CIRCUIT IS OPEN, CHECK HO2S SIGNAL AND SIGNAL RETURN CIRCUITS FOR OPEN IN HARNESS

Note: Refer to the PCM harness connector pin numbers in the beginning of this pinpoint test.

DTC/HO2S Reference List:

- DTC P0141 = HO2S HTR-12
- DTC P0161 = HO2S HTR-22

Note: On some applications, a vehicle hoist is required to access the HO2S harness.

- Visually inspect the HO2S circuit for exposed wiring, water contamination, corrosion and proper assembly.
- Measure resistance of HO2S SIG circuit between PCM harness connector pin and HO2S harness connector.
- Measure resistance of HO2S SIG RTN circuit between PCM harness connector pin and HO2S harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
GO to H26 .	REPAIR open circuit. COMPLETE HO2S Monitor Drive Cycle (REFER to Section 2, Drive Cycles).

H26 CHECK HO2S CIRCUIT FOR SHORT TO VPWR IN HARNESS

- Measure resistance between the HO2S SIG and VPWR circuit at the PCM harness connector pin.

Is the resistance greater than 10,000 ohms?

Yes	No
GO to H27 .	GO to H28 .

H27 CHECK FOR SOURCE OF POTENTIAL HO2S CONTAMINATION

- Investigate the following items as potential sources of HO2S contamination:
 - Use of unapproved silicon sealers.
 - Fuel contaminated by silicon additives.
 - Excessive oil burning (i.e. rings, valve seals and oil overfill).
 - Glycol (antifreeze) leaking internally in the engine.
 - Lead contaminated fuel.
 - Short drive cycles in cold weather.
 - Use of unapproved cleaning agents.

Were any of the above conditions or concerns found during inspection?

Yes	No
REPAIR source of contamination. REPLACE HO2S and oil/filter. COMPLETE PCM Reset to clear DTCs. COMPLETE HO2S Monitor Drive Cycle (REFER to Section 2, Drive Cycles).	If diagnosing DTC P0141 or P0161, GO to H30 . All others: REPLACE PCM.

H28 VERIFY WIRING IS IN PROPER PIN LOCATION

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Measure resistance of the HO2S SIG circuit and HO2S Signal Return circuit between the PCM harness connector pin and the HO2S harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
REPLACE HO2S.	REPAIR as necessary.

H30 DTCS P0135 AND P0155: HO2S HEATER CIRCUIT IS SHORTED TO GROUND, SHORTED TO VPWR OR EXCESSIVE CURRENT DRAW, LOW CURRENT DRAW

Note: Refer to the PCM harness connector pin numbers in the beginning of this pinpoint test.

DTC/HO2S Reference List:

- DTC P0135 = HO2S HTR-11
- DTC P0155 = HO2S HTR-21

Note: On some applications, a vehicle hoist is required to access the HO2S harness.

- Visually inspect the HO2S circuit for exposed wiring, water contamination, corrosion and proper assembly.

Were any concerns found during inspection?

Yes	No
REPAIR any concerns found during inspection.	GO to <u>H31</u> .

H31 PERFORM KEY ON ENGINE OFF (KOEO) SELF-TEST

- Key on, engine off.
- Perform KOEO Self-Test.

Is DTCs P0135, P0141, P0155 or P0161 present?

Yes	No
KEY OFF. GO to <u>H32</u> .	KEY OFF. GO to <u>H33</u> .

H32 CHECK VPWR VOLTAGE TO H02S HARNESS CONNECTOR

Note: If DTCs P0135 and P0155 or P0141 and P0161 are displayed, both heater circuits will require testing. DTCs displayed separately are to be tested individually.

- Disconnect the appropriate HO2S(s).
- Key on, engine off.
- Measure voltage between VPWR and SIG RTN circuits at the HO2S harness connector.

Is the voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to <u>H33</u> .	CHECK fuse in circuit. If fuse is OK, REPAIR open circuit. For no VPWR on vehicles equipped with 150 Pin PCM: GO to <u>B5</u> .

H33 CHECK HO2S HEATER CIRCUIT FOR SHORT TO VPWR AND GND

- Disconnect PCM.
- Measure resistance between the suspect HO2S HTR circuit and PWR GND circuit.
- Measure resistance between the suspect HO2S HTR circuit and SIG RTN circuit at the HO2S harness connector.
- Measure resistance between the suspect HO2S HTR circuit and VPWR circuit at the HO2S harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
GO to <u>H34</u> .	REPAIR shorted circuit.

H34 CHECK HO2S HTR CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of the suspect HO2S HTR circuit between PCM harness connector pin and HO2S harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
GO to <u>H35</u> .	REPAIR open or excessive resistance in the heater circuit in harness.

H35 CHECK HO2S HTR RESISTANCE

- Measure the resistance of the HO2S HTR to VPWR (refer to schematic at the beginning of this Pinpoint Test).

Is the resistance between 3 and 30 ohms?

Yes	No
GO to <u>H36</u> .	REPLACE HO2S.

H36 CHECK HO2S CASE FOR SHORT TO VPWR, HTR AND SIG RTN

- Measure resistance between HO2S HTR pin at HO2S connector and the HO2S case.
- Measure resistance between the HO2S HTR pin and the SIG RTN Pin at the HO2S sensor.
- Measure the resistance between the HO2S VPWR pin at the HO2S connector and the HO2S case.

Is the resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM.	REPLACE HO2S.

H40 DTCs P1131, P1132, P1151 AND P1152: UPSTREAM HO2S NOT SWITCHING. DTCs P1130 and P1150: FUEL SYSTEM NOT SWITCHING AT FUEL TRIM (RICH OR LEAN)

Note: It is necessary to address all Continuous Memory Ignition and Misfire DTCs, if received during Continuous Memory testing, before addressing any KOER HO2S DTCs.

DTC/HO2S Reference List:

- HO2S-11 = DTCs P1131, P1132 and P1130
- HO2S-21 = DTCs P1151, P1152 and P1150
- Check intake air system for leaks, obstructions and damage.
- Check air cleaner element, air cleaner housing for blockage.
- Verify integrity of the PCV system.
- Check for vacuum leaks.

Were any concerns found during inspection?

Yes	No
REPAIR as necessary.	GO to <u>DC25</u> .

H41 DTCs P0171, P0172, P0174 AND P0175: FUEL SYSTEM AT THE CORRECTED FUEL TRIM

Note: It is necessary to address all Continuous Memory Ignition and Misfire DTCs, if received during Continuous Memory testing, before addressing any Fuel Trim DTCs.

Fuel System DTC Reference List:

- Bank 1 = DTCs P0171 (lean) and P0172 (rich)
- Bank 2 = DTCs P0174 (lean) and P0175 (rich)
- Check intake air system for leaks, obstructions and damage.
- Check air cleaner element, air cleaner housing for blockage.
- Verify integrity of the PCV system.
- Check fuel delivery system and filter for restriction.
- Check for vacuum leaks.

Were any concerns found during inspection?

Yes	No
REPAIR as necessary. COMPLETE KAM Reset.	GO to <u>DC25</u> .

H42 PERFORM KOER SELF-TEST

- Disconnect fuel vapor hose from intake manifold and plug fitting at intake manifold.
- Start engine and run at 2000 rpm for 5 minutes and return to idle.
- Complete Key On Engine Running (KOER) Self-Test.

Are any HO2S DTCs P1127, P1128, P1129, P1131, P1132, P1151 or P1152 present?

Yes	No
<p>KEY OFF. If DTC P1127, P1128 or P1129 is present, GO to Section 4, Powertrain <u>Diagnostic Trouble Code (DTC) Charts</u> and REPAIR those DTCs first.</p> <p>DTCs (P1131, P1130) or (P1151, P1150):</p> <p>GO to <u>H43</u>.</p> <p>DTCs (P1132, P1130) or (P1152, P1150):</p> <p>GO to <u>H49</u>.</p>	<p>KEY OFF. For Continuous Memory DTCs Only P1130, P1150, P0171, P0174, P0172 and P0175:</p> <p>GO to <u>H52</u>.</p> <p>If DTC(s) P1132 and/or P1152 are no longer present, RECONNECT fuel vapor line.</p> <p>Vehicles experiencing KOER DTC 1131, 1132, 1151 or 1152: REFER to Evaporative Emissions, Section 303-13 in the Workshop Manual for system leakage.</p> <p>All others without recurring DTCs:</p> <p>Unable to duplicate or identify fault at this time. GO to <u>Z1</u>.</p>

H43 HO2S CIRCUIT TEST (WITH LEAN DTCs)

- Disconnect the HO2S related to the DTC.
- Key on, engine off.
- Access the correct HO2S PID.

Note: If arcing occurs (indicating a short), remove jumper and GO to H47 (check fuse in the heater circuit).

- Jumper the HO2S SIG circuit to the VPWR circuit at the HO2S vehicle harness connector.

Is the reading 1.30 volts or greater?

Yes	No
KEY OFF. CHECK SIG RTN circuit. GO to <u>H44</u> .	KEY OFF. GO to <u>H46</u> .

H44 CHECK SIGNAL RETURN CIRCUIT FOR OPEN

- Measure resistance of HO2S SIG RTN circuit between the HO2S harness connector and the battery negative post.

Is the resistance reading less than 5.0 ohms?

Yes	No
GO to <u>H52</u> .	GO to <u>H45</u> .

H45 CHECK HO2S SIGNAL RETURN CIRCUIT FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of HO2S SIG RTN circuit between the PCM harness connector pin and

HO2S harness connector.

Is the resistance reading less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR open circuit.

H46 CHECK HO2S SIGNAL AND HO2S GND CIRCUITS FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of HO2S SIG circuit between PCM harness connector pin and the HO2S harness connector.

Is the resistance reading less than 5.0 ohms?

Yes	No
GO to <u>H47</u> .	REPAIR open circuit.

H47 CHECK HO2S SIGNAL CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect PCM.
- Measure resistance between the HO2S SIG and PWR GND circuits; and the HO2S SIG and SIG RTN circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
GO to <u>H48</u> .	REPAIR short circuit.

H48 CHECK HO2S SIGNAL CIRCUIT FOR SHORT TO GROUND

- Disconnect PCM.
- Reconnect HO2S.
- Measure resistance between HO2S SIG and PWR GND circuits and HO2S SIG and SIG RTN circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPLACE HO2S.

H49 HO2S CIRCUIT CHECK (FOR RICH DTCS)

- Disconnect the HO2S related to the DTC received.

- Key on.
- Access the correct HO2S PID(s).

Is the reading 0.2 volt or less?

Yes	No
KEY OFF. GO to <u>H51</u> .	KEY OFF. GO to <u>H50</u> .

H50 CHECK HO2S CIRCUIT FOR SHORT TO VPWR AND HO2S HEATER GROUND IN HARNESS

- Disconnect PCM.
- Measure resistance between the HO2S SIG and VPWR circuits; and HO2S Signal and HO2S HTR circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

H51 CHECK HO2S SIGNAL FOR SHORT TO HO2S HEATER CIRCUIT IN THE SENSOR

- Suspect HO2S sensor disconnected.
- Measure resistance between the HO2S SIG and HO2S HTR circuits at the HO2S connector.

Is the resistance greater than 10,000 ohms?

Yes	No
KEY OFF. GO to <u>H52</u> .	KEY OFF. REPLACE HO2S.

H52 CHECK FUEL PRESSURE



WARNING: THE FUEL SYSTEM IS PRESSURIZED WHEN THE ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHEN WORKING ON THE FUEL SYSTEM. BECOME FAMILIAR WITH THE WARNING CAUTION AND NOTE IN PINPOINT TEST HC BEFORE SERVICING.

- Connect battery charger.
- Install fuel pressure gauge.
- Key on, engine off.
- Access Output Test Mode and run the fuel pump to obtain maximum fuel pressure.
- NOTE: The fuel pump will only operate for approximately 8 seconds when Output Test Mode is selected and activated. (GO to Pinpoint Test HC to refer to the Fuel Delivery System Test Information Chart.)

Is the fuel pressure within range for the vehicle being diagnosed?

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Yes	No
KEY OFF. GO to <u>H53</u> .	KEY OFF. GO to <u>HC1</u> .

H53 CHECK FUEL SYSTEM FOR PRESSURE STABILITY – FAST LEAKDOWN

- Cycle key on and off several times.
- Key on and Engine off, monitor fuel pressure gauge.

Does the fuel pressure remain within 34 kPa (5 psi) of the highest reading after 10 seconds?

Yes	No
GO to <u>H54</u> .	Check fuel system for external leaks. If external leak is detected: GO to <u>HC1</u> . If no external leak is detected: GO to <u>H55</u> .

H54 CHECK FUEL SYSTEM FOR PRESSURE STABILITY – SLOW LEAKDOWN

- Cycle key on then off several times.
- Key on and engine off, monitor fuel pressure gauge.

Does the fuel pressure remain within 34 kPa (5 psi) of the highest reading after one minute?

Yes	No
For HO2S DTCs displayed with Misfire DTCs: GO to <u>H56</u> . All other DTCs: GO to <u>H59</u>	GO to <u>HC6</u>

H55 CHECK INJECTOR FAULT PIDS AND ASSOCIATED DTCS

- Access INJ1F-INJ10F PIDs.

Note: If misfire DTCs are present, access only injector fault PIDs corresponding to misfire DTCs.

Is DTC P0201 through P0212 or an injector(s) fault present?

Yes	No
GO to <u>H56</u> .	For DTCs P0300 through P0310: GO to <u>HD12</u> . For all other DTCs: GO to <u>H59</u> .

H56 CHECK FUEL INJECTOR(S) AND HARNESS RESISTANCE

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

Note: This erases Continuous Memory DTCs.

- Disconnected PCM.

Note: Use the injector fault PID to determine the fuel injector circuit(s) requiring testing.

- Measure resistance between suspect fuel injector and VPWR circuits at the PCM harness connector.

Is the resistance between 11.0-18.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	GO to <u>H57</u> .

H57 CHECK FUEL INJECTOR HARNESS RESISTANCE

- Disconnect fuel injector harness connector at the suspect fuel injector.
- Measure resistance of VPWR circuit between PCM harness connector pin and the fuel injector harness connector.
- Measure resistance of fuel injector circuit between PCM harness connector pin and the fuel injector harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to <u>H58</u> .	REPAIR open harness circuit.

H58 CHECK FUEL INJECTOR HARNESS CIRCUIT FOR SHORT TO POWER AND GROUND

- Disconnect PCM.
- Suspect fuel injector disconnected.
- Measure resistance between fuel injector SIG and VPWR circuits; and between fuel injector SIG and PWR GND circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
GO to <u>H59</u> .	REPAIR short circuit.

H59 FLOW TEST FUEL INJECTOR(S)

- Use the Rotunda Injector Tester or equivalent to flow test the fuel injectors according to the

instructions for the fuel injector tester.

Is the leakage and flow within specification?

Yes	No
<p>DTC P0171 and P0174: GO to <u>H61</u> .</p> <p>DTC P0172 and P0175: Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .</p> <p>For DTC P1130 and P1150: GO to <u>H61</u> .</p> <p>For DTC P1131 and P1151: GO to <u>H60</u> .</p> <p>For DTC P1132 and P1152: GO to <u>H64</u> .</p>	<p>REPLACE fuel injector.</p>

H60 CHECK FOR SECONDARY AIR INTRUSION

Note: If the vehicle is not equipped with Secondary Air Injection System,GO to H61 .

An HO2S always lean condition can be caused by:

- Leak in hoses from secondary air injection pump to engine.
- Secondary Air diverted upstream of HO2S.
- Disconnect secondary air injection hose(s) from engine and plug engine side of secondary air injection system.
- Key on, engine running and at operating temperature.
- Activate Key On, Engine Running (KOER) Self-Test.

Is DTC P1131 or P1151 present?

Yes	No
<p>GO to <u>H61</u> .</p>	<p>Cause of DTC(s) is in the Secondary Air Injection System. GO to <u>HM7</u> for Secondary Air Injection System diagnostics.</p>

H61 INSPECT INDUCTION SYSTEM FOR AIR LEAKS

- Inspect the following areas for signs of air leaks:
 - Inlet tube(s) from air cleaner to the throttle body.
 - Gaskets which seal the upper and lower intake manifold.
 - Vacuum hoses and lines for cracks and proper connections.
 - PCV system.

Are there any signs of leaks or damage?

Yes	No
REPAIR as necessary.	<p>CONTINUOUS DTCs P0171, P0174, P1130 or P1150:</p> <p>Unable to duplicate or identify fault at this time. GO to <u>Z1</u>.</p> <p>DTCs P1131 and P1130 or P1151 and P1150:</p> <p>GO to <u>H62</u>.</p>

H62 CHECK CYLINDER COMPRESSION

Note: Use the Misfire DTC(s) displayed on prior DTC retrieval to determine which cylinder's compression to check.

- Check cylinder compression. Refer to Engine, Section 303-00, 303-01 in the Workshop Manual.

Are cylinder compression readings within specification?

Yes	No
<p>For DTCs P1131, P1130, P1151 and P1150:</p> <p>GO to <u>H63</u>.</p> <p>For DTCs P1132 and P1152:</p> <p>GO to <u>H64</u>.</p> <p>Misfire DTCs displayed with fuel control DTCs:</p> <p>GO to <u>HD20</u>.</p>	REPAIR as necessary.

H63 CHECK HO2S'S ABILITY TO GENERATE A VOLTAGE GREATER THAN 0.5 VOLT

Any vacuum or air leaks can cause DTCs P1131, P1130, P1151 and P1150.

Possible causes:

- Water contamination in connector.
 - Leaking vacuum actuators.
 - Engine sealing (Intake and IAC).
 - EGR system (valve).
 - PCV system (hose and valve).
 - Unmetered air leaks between throttle body and mass air flow (MAF) sensor assembly.
- Inspect HO2S harness for chafing, burned wires or other damage and repair as necessary.
- Unplug the suspect HO2S.
- Connect digital multimeter to the HO2S Signal and HO2S SIG RTN or HO2S GND at the HO2S sensor connector.

- Run engine at 2000 rpm for three minutes.
- Rerun KOER Self-Test and monitor HO2S voltage.

Is the voltage greater than 0.5 volt during or at the end of Self-Test?

Yes	No
KEY OFF. GO to H70 .	KEY OFF. REPLACE HO2S.

H64 ATTEMPT TO GENERATE DTC P1131 OR P1151

- HO2S disconnected.
- Jumper HO2S Signal at the HO2S harness vehicle connector to the battery negative post.
- Activate Key On Engine Running (KOER) Self-Test.

Is DTC P1131 or P1151 present?

Yes	No
KEY OFF. REMOVE jumper. GO to H65 .	KEY OFF. REMOVE jumper. RECONNECT HO2S. DISCONNECT PCM. INSPECT both ends of connector for damaged or pushed out pins, moisture, corrosion, loose pins and REPAIR as necessary. If OK, REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

H65 HO2S SENSOR VOLTAGE CHECK

- HO2S disconnected.
- Connect digital multimeter to HO2S SIG circuit and HO2S SIG RTN at the HO2S sensor connector.
- Disconnect vacuum hose from vacuum tree.
- Start engine and run at 2000 rpm.

Does the voltage reading indicate less than 0.4 volt within 30 seconds?

Yes	No
KEY OFF. RECONNECT vacuum hose and HO2S. GO to H70 .	KEY OFF. REPLACE HO2S. PERFORM KOER SELF-TEST. If DTCs P1132 or P1152 still exist, REPLACE PCM (refer to Section 2, Flash EEPROM).

H70 MONITOR HO2S (PID) FOR PROPER SWITCHING WHILE PERFORMING WIGGLE TEST

- Key on, engine running.
- Engine at operating temperature.

Note: HO2S displayed as O2S on Scan Tool.

- Monitor suspect HO2S PID.
- Wiggle, bend and shake small sections of the Electronic Engine Control harness from the PCM to the HO2S.

Did the HO2S voltage stay high (greater than 0.45 volt) or low (less than 0.45 volt)?

Yes	No
KEY OFF. ISOLATE area of harness concern causing lack of HO2S switches and repair.	KEY OFF. GO to <u>H71</u> .

H71 TEST DRIVE WHILE MONITORING HO2S PID FOR SWITCHING

Note: This test step requires an observer to monitor HO2S PID.

- Access HO2S PID.
- While observer views PID, test drive vehicle under different road conditions in an attempt to simulate the original fault.

Does the HO2S switch?

Yes	No
KEY OFF. UNABLE to duplicate fault. Testing complete at this time.	KEY OFF. REPLACE HO2S.

H80 DTC P0136 AND P0156 MONITOR DOWNSTREAM HO2S OUTPUT VOLTAGE FOR ACTIVITY. DTCs P1137, P1138, P1157 AND/OR P1158 INDICATE LACK OF HO2S SWITCHING

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

Note: It is necessary to address all Continuous Memory Ignition and Misfire DTCs, if received during Continuous Memory testing, before addressing any KOER HO2S DTCs.

- DTC P0136, P1137 and P1138=HO2S-12
- DTC P0156, P1157 and P1158=HO2S-22
- Visually inspect for:
 - pinched, shorted and corroded wiring and pins
 - crossed sensor wires
 - exhaust leaks
 - contaminated or damaged sensor

Were any concerns found during inspection?

Yes	No
REPAIR as necessary.	<p>Continuous Memory DTC P0136 and P0156:</p> <p>GO to <u>H81</u>.</p> <p>All others:</p> <p>GO to <u>H82</u>.</p>

H81 CHECK FOR KOER DTCS P1137, P1157, P1138 AND P1158

- Key on.
- Engine at 2000 rpm for 3 minutes.
- Activate KOER Self-Test.
- Check for DTCs.

Is DTC P1137, P1138, P1157 or P1158 present?

Yes	No
KEY OFF. GO to H82 .	KEY OFF. For DTC P0136 and P0156: Unable to duplicate or identify at this time. GO to Z1 .

H82 CHECK EXHAUST SYSTEM FOR LEAKS

Note: Any exhaust leaks between the engine and the end of the catalyst can cause DTC P0136 and P0156.

- Place vehicle on a hoist, transmission in PARK, emergency brake applied, raise vehicle.
- Inspect the following:
 - Exhaust flanges for leaks.
 - HO2S torque.
 - Check for punctures and cracks in catalyst and pipes leading to them.

Is an exhaust leak present?

Yes	No
REPAIR as necessary.	GO to H83 .

H83 CHECK HO2S HARNESS CIRCUIT FOR SHORT TO VPWR AND GROUND

- Disconnect PCM.
- Disconnect suspect HO2S.
- Measure resistance between HO2S SIG and SIG RTN circuits at the PCM harness connector.
- Measure resistance between HO2S SIG circuit and VPWR and VREF circuits at the PCM harness connector.
- Measure resistance between HO2S SIG circuit and PWR GND circuit at the PCM harness connector.

Is the resistance greater than 10,000 ohms?

Yes	No
GO to H84 .	REPAIR short in harness.

H84 CHECK HO2S SIGNAL CIRCUIT AND HO2S SIGNAL RETURN CIRCUITS FOR OPEN IN HARNESS

- Measure resistance of VPWR circuit between the PCM harness connector pin and the HO2S harness connector.
- Measure resistance of HO2S SIG circuit between the PCM harness connector pin and the HO2S harness connector.
- Measure resistance of SIG RTN circuit between the PCM harness connector pin and HO2S SIG RTN vehicle harness connector.

Is the resistance reading less than 5.0 ohms?

Yes	No
GO to H85 .	REPAIR open circuit.

H85 CHECK HO2S CIRCUIT VOLTAGE

- Connect PCM.
- Suspect HO2S connected to harness.
- Key on, engine off.

Note: HO2S displayed as O2S on Scan Tool.

- Access the correct HO2S PID.

Is the voltage greater than 1.5 volts?

Yes	No
KEY OFF. GO to H88 .	KEY OFF. GO to H86 .

H86 CHECK HO2S GROUND CIRCUIT IN THE PCM

- Disconnect PCM.
- Measure resistance between SIG RTN and PWR GND circuits at the PCM connector.

Is the resistance reading less than 5.0 ohms?

Yes	No
GO to H87 .	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

H87 HO2S CIRCUIT CHECK

- PCM connected.
- Suspect HO2S disconnected.
- Jumper VPWR to HO2S SIG circuit at the HO2S harness connector.
- Key on.
- Access HO2S PID.

Is the PID value greater than 1.5 volts?

Yes	No

REPLACE HO2S.

REPLACE PCM (refer to Section 2, [Flash Electrically Erasable Programmable Read Only Memory \(EEPROM\)](#)).

H88 CHECK FOR OVER VOLTAGE ON THE HO2S CIRCUIT IN THE PCM

- Key on.
- HO2S disconnected.
- Measure voltage between SIG RTN circuit at the HO2S harness connector and battery negative post.
- Measure voltage between HO2S SIG circuit at the HO2S harness connector and battery negative post.

Are either voltage readings greater than 1.5 volts?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPLACE HO2S.

H100 KOER DTC P1127

- Key on, engine on.
- Access all HO2S heaters and HO2S heater monitor PIDs.

Do all PIDs switch or indicate ON?

Yes	No
Engine still operating. PERFORM KOER Self-Test.	Operate the engine until all PIDs indicate on. PERFORM KOER Self-Test.

H110 DTCS P1128 AND P1129 KOER

Note: Refer to the PCM harness connector pin numbers in the beginning of this pinpoint test.

- P1128 refer to the upstream HO2S.
- P1129 refer to the downstream HO2S.
- Visually inspect vehicle HO2S harness connector(s) for any indication of being crossed (stretched wires, wire harnesses not mounted properly).

Are there crossed connections or wires?

Yes	No
REPAIR as necessary.	GO to H111 .

H111 VERIFY PROPER HO2S SIGNAL PIN LOCATION

- PCM disconnected.

- Disconnect both of the suspect HO2S sensors from the vehicle harness connector.
 - P1128 = HO2S 11/21 Upstream
 - P1129 = HO2S 12/22 Downstream
- Measure resistance of HO2S signal circuits between PCM harness connector pins and HO2S harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
Unable to duplicate or identify at this time. GO to <u>Z1</u> .	CONNECT HO2S connector to proper HO2S signal pins in the PCM harness connector or HO2S harness connectors. RERUN Quick Test.

HA: Natural Gas Fuel Control Introduction

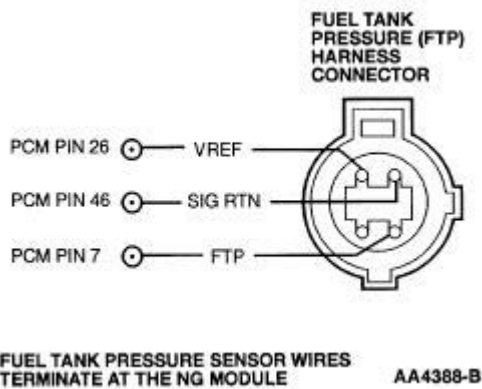
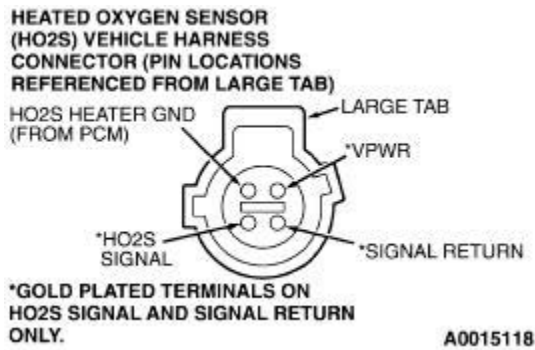
HA: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- HO2S/HTR (Heater) (9F472)
- HO2S Connections
- Vacuum Systems
- Fuel Injector(s) (9F593)
- Harness Circuits: HO2S GND, HO2S, INJ 1-8, VPWR and SIG RTN
- Powertrain Control Module (PCM) (12A650)
- Natural Gas Module (NG) (9F954)

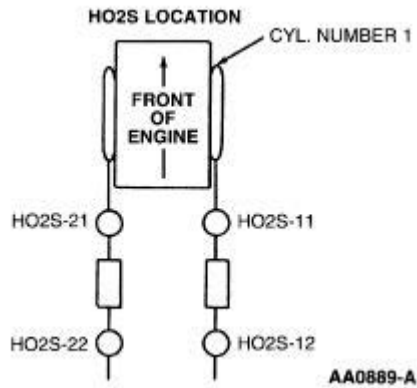
Pinpoint Test Schematic and Connectors



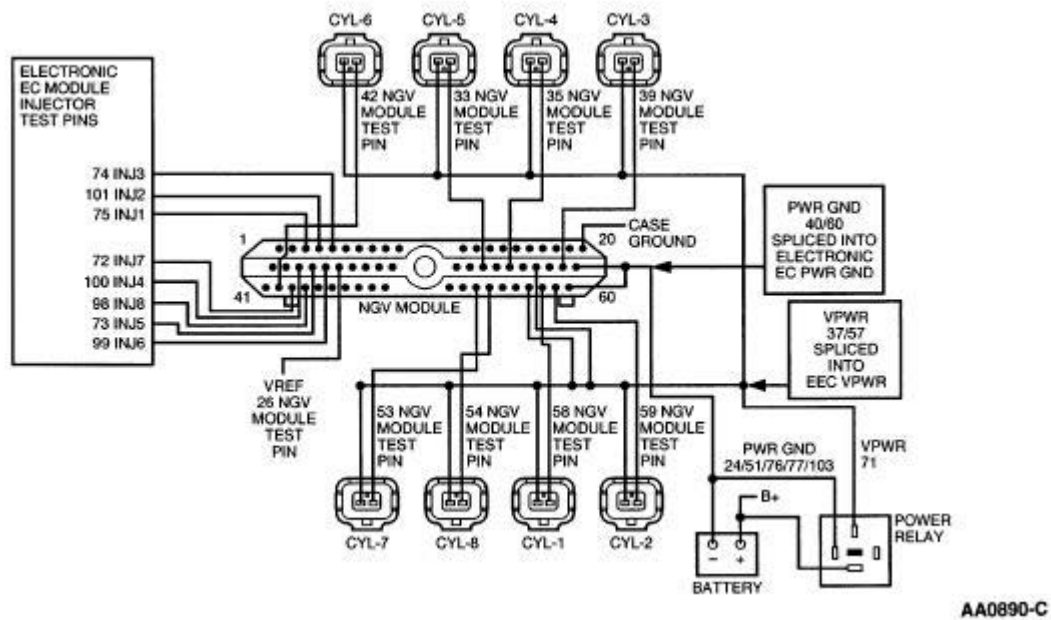
HO2S CONNECTOR PIN ASSIGNMENT

Signal	Pin	HO2S HTR Ground	Pin	HTR VPWR	Pin	HO2S SIG RTN	Pin
HO2S-11	60	HO2S HTR-11 (GND)	93	VPWR	71	SIG RTN	91

HO2S-12	35	HO2S HTR-12 (GND)	95	VPWR	71	SIG RTN	91
HO2S-21	87	HO2S HTR-21 (GND)	94	VPWR	71	SIG RTN	91
HO2S-22	61	HO2S HTR-22 (GND)	96	VPWR	71	SIG RTN	91



NGV Module 60 Pin Connector



HA: Pinpoint Tests →

HA: Natural Gas Fuel Control

← HA: Introduction

HA30 DTCS P0135, P0141, P0155 AND P0161: HO2S HTR SIGNAL CIRCUIT IS OPEN, SHORTED TO GROUND, SHORTED TO VPWR OR EXCESSIVE CURRENT DRAW

DTC/HO2S Reference List

DTC P0135 = HO2S HTR-11

DTC P0141 = HO2S HTR-12

DTC P0155 = HO2S HTR-21

DTC P0161 = HO2S HTR-22

Note: On some applications, a vehicle hoist is required to access the HO2S harness.

- Visually inspect the HO2S circuit for exposed wiring, contamination, corrosion and proper installation.

Were any concerns found during the visual inspection?

Yes	No
REPAIR any concerns found in the visual inspection.	GO to HA31 .

HA31 PERFORM KEY ON ENGINE OFF (KOEO) SELF-TEST

- Key on.
- Engine at 2000 rpm for 1 minute.
- Key off.
- Key on, engine off.
- Perform KOEO Self-Test.

Are DTCS P0135, P0141, P0155 and/or P0161 present?

Yes	No
KEY OFF. GO to HA32 .	KEY OFF. Unable to duplicate or identify fault at this time. GO to Z1 .

HA32 CHECK VPWR VOLTAGE TO HO2S HARNESS CONNECTOR

Note: If DTCS P0135 and P0155 or P0141 and P0161 are displayed, both heater circuits will require testing. DTCS displayed separately are tested individually.

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect the appropriate HO2S(s).

- Key on, engine off.
- Measure voltage between VPWR and SIG RTN circuits at the HO2S harness connector.

Is the voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to HA34 .	KEY OFF. GO to HA33 .

HA33 CHECK VPWR CIRCUIT FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of VPWR circuit between PCM harness connector pin and HO2S harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
GO to HA34 .	CHECK fuse in circuit. If fuse is OK, REPAIR open circuit.

HA34 CHECK HO2S HEATER RESISTANCE

- Measure the resistance of the HO2S HTR.

Is the resistance between 3 and 30 ohms?

Yes	No
GO to HA35 .	REPLACE HO2S.

HA35 CHECK HO2S CASE FOR SHORT TO VPWR AND HTR GND

- Measure resistance between the HO2S HTR GND at the HO2S sensor connector and the HO2S sensor case.
- Measure resistance between the HO2S VPWR at the HO2S sensor connector and the HO2S sensor case.

Is the resistance greater than 10,000 ohms?

Yes	No
GO to HA36 .	REPLACE HO2S.

HA36 CHECK FOR SHORTS TO OTHER GROUNDS AND VPWR IN THE HO2S HTR GROUND HARNESS CIRCUITS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Measure resistance between the suspect HO2S HTR circuit and PWR GND, SIG RTN and VPWR circuits at the HO2S harness connector.

Is the resistance greater than 10,000 ohms?

Yes	No
GO to HA37 .	REPAIR shorted circuit.

HA37 CHECK HO2S HTR GROUND FOR OPEN IN HARNESS

- Measure resistance of the suspect HO2S HTR circuit between PCM harness connector pin and HO2S harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open or excessive resistance in the heater circuit in harness.

HA40 DTC P1131, P1151, P1132 AND P1152: UPSTREAM HO2S(S) NOT SWITCHING. DTCs P1130 AND P1150: FUEL SYSTEM NOT SWITCHING AT THE FUEL TRIM (RICH OR LEAN)

HO2S DTCs Reference list

- HO2S-11 = DTCs P1131, P1132 and P1130
- HO2S-21 = DTCs P1151, P1152 and P1150
- Check intake air system for leaks, obstructions, damage and blockage.
- Verify integrity of the PCV system.
- Check for disconnected spark plug wires.
- Check for vacuum leaks.

Are any of the above concerns present?

Yes	No
REPAIR as necessary.	GO to DC25 .

HA41 DTCs P0171, P0172, P0174 AND P0175: FUEL SYSTEM AT THE CORRECTED FUEL TRIM

Fuel System DTC Reference list:

- BANK 1 = DTCs P0171 (lean) and P0172 (rich)
- BANK 2 = DTCs P0174 (lean) and P0175 (rich)
- Check intake air system for leaks, obstructions and damage.
- Check air cleaner element, air cleaner housing for blockage.
- Verify fuel level.
- Verify integrity of the PCV system.
- Check for disconnected spark plug wires.
- Check for vacuum leaks.
- Verify customer did not run out of fuel.

Are any of the above concerns present?

Yes	No
REPAIR as necessary.	GO to <u>DC25</u> .

HA42 PERFORM KOER SELF-TEST

- Enter Key On Engine Running (KOER) Self-Test.

Are HO2S DTCs P1131, P1132, P1151 or P1152 present?

Yes	No
KEY OFF. GO to <u>HA43</u> .	<p>KEY OFF. For continuous DTCs P1130, P1150 P0171, P0174, P0172 and P0175:</p> <p>GO to <u>HA43</u>.</p> <p>All others:</p> <p>Unable to duplicate or identify fault at this time. GO to <u>Z1</u>.</p>

HA43 CHECK FUEL PRESSURE



WARNING: THE FUEL SYSTEM IS PRESSURIZED WHEN THE ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHEN WORKING ON THE FUEL SYSTEM. BECOME FAMILIAR WITH THE WARNING, CAUTION AND NOTE IN PINPOINT TEST HB BEFORE SERVICING.

Note: Fuel rail pressure gauge is part of the NG Special Rotunda Tool Kit 134-00114. Not all Natural Gas vehicles are equipped with a FRP sensor. On vehicles without a FRP sensor, use the values supplied by the fuel rail pressure gauge.

- NG fuel pressure gauge connected at the fuel rail Schrader valve.
- Access FRP PID (if available) and monitor the fuel pressure.
- Key on, engine off. Record pressure readings.
- Key on, engine on. Record pressure readings.
- Increase engine speed to 2500 rpm and maintain for one minute. Record pressure reading.

Are the fuel pressure readings between 552 or 827 kPa (80-120 psi)?

Yes	No
KEY OFF. GO to <u>HA44</u> .	KEY OFF. GO to <u>HB1</u> .

HA44 CHECK FUEL SYSTEM FOR PRESSURE STABILITY

- Cycle key on and off twice.
- Verify there are no external leaks (service as necessary).

Does the fuel pressure remain within 69 kPa (10 psi) of the highest reading after two minutes?

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Yes	No
For DTCs P1130, P1150, P0171, P0172, P0174 and P0175: GO to HA45 . For No Starts: GO to HA45 . All other DTCs: GO to HA62 .	GO to HB1 .

HA45 CHECK FUEL SYSTEM FOR PRESSURE STABILITY WITH KEY ON

- Access FRP PID, if available, to monitor the fuel pressure. If FRP PID is not available, connect NG Special Rotunda Tool Kit 134-00114, or equivalent to monitor fuel pressure.
- Key On, Engine Off. Monitor the fuel pressure.

Does the fuel pressure remain within 69 kPa (10 psi) of the highest reading after 10 seconds?

Yes	No
For No Starts: GO to HA46 . For DTCs P1130, P1150, P0171 and P0174: GO to HA55 .	For DTCs P0172 and P0175: GO to HA56 .

HA46 CHECK FUEL INJECTOR(S) ABILITY TO DELIVER FUEL

- Access FRP PID, if available, to monitor the fuel pressure. If FRP PID is not available, connect NG Special Rotunda Tool Kit 134-00114, or equivalent to monitor fuel pressure.
- Cycle key twice.
- Locate and disconnect the inertia fuel shutoff (IFS) switch.
- Crank the engine for ten seconds and monitor the fuel pressure reading.

Was there a pressure drop greater than 34 kPa (20 psi)?

Yes	No
The Electronic Engine Control System is not the cause of the no start. GO to Section 3 , Symptom Chart, for further diagnosis.	GO to HA47 .

HA47 CHECK VREF VOLTAGE AT NATURAL GAS (NG) VEHICLE MODULE

- Disconnect PCM.
- NG Module connected.
- Key on, engine off.

- Measure the voltage between VREF and SIG RTN circuits at the NG module harness connector.

Is the voltage reading between 4.0 and 6.0 volts?

Yes	No
KEY OFF. For NO START: GO to HA48 . All others: GO to HA57 .	KEY OFF. GO to HA50 .

HA48 CHECK FOR OPEN IN POWER GROUND CIRCUITS

- NG Module disconnected.
- Measure resistance of PWR GND circuit between NG module harness connector pin and battery negative post.

Is the resistance less than 5.0 ohms?

Yes	No
GO to HA49 .	REPAIR open circuit.

HA49 CHECK FOR OPEN IN POWER GROUND CIRCUIT IN NG MODULE

- NG Module disconnected.
- Measure the resistance between PWR GND and SIG RTN circuits at the NG Module connector.

Is the resistance less than 5.0 ohms?

Yes	No
For NO START: GO to HA57 . All others: RECONNECT PCM, NG Module, and GO to A6 .	REPLACE NG Module.

HA50 IS VREF GREATER THAN 6.0 VOLTS

Is the VREF reading greater than 6.0 volts from the previous test step?

Yes	No
GO to HA55 .	GO to HA51 .

HA51 CHECK BATTERY VOLTAGE

- Measure the voltage across the battery terminals.

Is the voltage reading greater than 10.5 volts?

Yes	No
GO to HA52 .	REFER to the Charging System—General Information Section 414-00 in the Workshop Manual.

HA52 CHECK VPWR AT NG MODULE

- Key on.
- Measure the voltage between VPWR and PWR GND circuits at the NG module harness connector.

Is the voltage reading greater than 10.5 volts?

Yes	No
GO to HA54 .	GO to HA53 .

HA53 CHECK VOLTAGE BETWEEN VPWR AT THE NG MODULE AND BATTERY GROUND

- Key on.
- Measure the voltage between VPWR circuit at the NG module harness connector and battery ground.

Is the voltage reading greater than 10.5 volts?

Yes	No
REPAIR open ground.	REPAIR open power circuit.

HA54 CHECK VREF VOLTAGE TO THE FUEL TANK PRESSURE SENSOR

- Locate fuel tank pressure sensor at the rear of the vehicle and disconnect (On the Crown Victoria, the fuel tank pressure sensor is located under the vent box cover of the upper tank assembly).
- Key on, engine off.
- Measure voltage between the VREF circuit and SIG RTN circuit at the fuel tank pressure sensor harness connector (refer to schematic at the beginning of this Pinpoint Test for pin location).

Is the voltage reading between 4.0 and 6.0 volts?

Yes	No
KEY OFF. REPLACE Fuel Tank Pressure sensor. REFER to Fuel Tank and Lines—Natural Gas, Section 310-01B in the Workshop Manual.	KEY OFF. GO to HA56 .

HA55 CHECK VREF CIRCUIT FOR SHORT TO POWER IN HARNESS

- Fuel tank pressure sensor disconnected.
- Disconnect NG module.
- Key on.
- Measure voltage between the VREF and PWR GND circuits at the NG module harness connector.

Is the voltage reading less than 1.0 volt?

Yes	No
REPLACE NG module.	REPAIR short to power.

HA56 CHECK VREF CIRCUIT FOR SHORTED TO PWR GND

Note: Refer to the NG module pin numbers at the beginning of this pinpoint test.

- NG module disconnected.
- Measure resistance between VREF circuit and the SIG RTN, PWR GND and CASE GND circuits at the NG module harness connector.

Is the resistance greater than 10,000 ohms?

Yes	No
REPLACE NG module.	REPAIR short to ground.

HA57 CHECK FUEL INJECTOR(S) AND HARNESS RESISTANCE FROM THE NATURAL GAS (NG) MODULE TO THE FUEL INJECTOR(S)

- NG module disconnected.
- Measure resistance between suspect fuel injector circuit Pin(s) and VPWR pins 37/57 at the NG module harness connector (use chart for injector pin location).

Cylinder Number	NG Module	Cylinder Number	NG Module
1	58	5	33
2	59	6	42
3	39	7	53
4	35	8	54

Is the resistance between 3.0 and 6.0 ohms?

Yes	No
For No Start and DTCs: GO to HA60 .	GO to HA58 .

HA58 CHECK FUEL INJECTOR(S) HARNESS RESISTANCE BETWEEN NG MODULE AND FUEL INJECTOR

- Measure resistance of injector circuits between the NG module harness connector Pins and the

fuel injector(s) harness connector (use chart from Test Step **HA57** for fuel injector pin location).

- Measure resistance between the NG module harness connector VPWR Pins 37/57 and VPWR circuit at the fuel injector harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to HA59 .	REPAIR open circuit.

HA59 CHECK FUEL INJECTOR HARNESS CIRCUIT FOR SHORTS TO POWER AND GROUND BETWEEN THE NG MODULE AND INJECTORS

- Measure resistance between the NG module fuel injector Pin(s) and NG module Pins 37/57 and 40/60.

Cylinder Number	NG MODULE	Cylinder Number	NG Module
1	58	5	33
2	59	6	42
3	39	7	53
4	35	8	54

Is each resistance greater than 10,000 ohms?

Yes	No
For DTCs P0172 and P0175, GO to HA61 . All Others : REPLACE only damaged fuel injector(s).	REPAIR short circuit.

HA60 CHECK FUEL INJECTOR DRIVER SIGNAL

This test requires a standard 12 volt test lamp.

- NG module connected.

Note: A properly operating system will show a dim glow at idle on the test lamp.

- Connect test lamp between the fuel injector signal circuit pin and VPWR circuit pin at the fuel injector harness connector.
- Crank or start the engine.

Does the test lamp have a dim glow while cranking or running the engine?

Yes	No
PCM and NG circuits are OK. For runs rough condition, RETURN to Section 3 , Symptom Charts. For No Start condition, GO to A4 .	No light/continuous bright light, GO to HA61 .

All others:

GO to [HA64](#).

HA61 CHECK PCM FUEL INJECTOR HARNESS CIRCUIT RESISTANCE

Note: Refer to the PCM and NG module pin numbers at the beginning of this pinpoint test.

- PCM and NG module disconnected.
- Measure resistance of VPWR circuit between PCM harness connector pins and NG module harness connector pins.
- Measure resistance of the Fuel Injector Pin(s) between the PCM and NG module. (Refer to chart for PCM and NG module pin location.)

Cylinder Number	PCM Output to 60-Pin NG Input	
	PCM Pin	NG Module Pin
1	75	3
2	101	4
3	74	5
4	100	23
5	73	24
6	99	25
7	72	43
8	98	44

Is each resistance less than 5.0 ohms?

Yes	No
GO to HA62 .	REPAIR open harness circuit.

HA62 CHECK PCM FUEL INJECTOR CIRCUIT FOR SHORT TO POWER AND GROUND IN HARNESS

- Measure resistance between the Fuel Injector circuit pin(s) and VPWR and PWR GND circuits at the PCM harness connector (GO to [HA61](#) and refer to the chart).
- Measure the resistance between the Fuel Injector circuit pin(s) and VPWR, CASE GND and PWR GND circuits at the NG module harness connector (GO to [HA61](#) and refer to the chart).

Is each resistance greater than 10,000 ohms?

Yes	No
For DTCs P0172 and P0175: GO to HA64 . All others: GO to HA63 .	REPAIR short circuit.

HA63 CHECK FUEL INJECTOR DRIVER SIGNAL FROM PCM

This test requires a standard 12 volt test lamp.

- PCM connected, NG module disconnected.

Note: A properly operating system will show a dim glow or flicker at idle on the test lamp.

- Connect a test lamp between the VPWR circuit and each from PCM Fuel Injector Signal circuit at the NG module harness connector.
- Crank or start the engine.

Does the test lamp have a dim glow or flicker while cranking or starting the engine?

Yes	No
<p>For no starts: REPLACE NG module.</p> <p>For runs rough: Return to symptom chart.</p> <p>For DTCs: GO to HA64.</p>	<p>REPLACE PCM.</p>

HA64 FLOW TEST FUEL INJECTOR(S)

Use Rotunda Natural Gas (NG) Injector Tester found in the Special NG Tool Kit 113-00114 or equivalent to flow test NG fuel injectors. Follow the Rotunda Natural Gas (NG) Injector Tester test steps indicated below, or follow the specific instructions included with the injector tester you are using.

- Observe WARNING, CAUTION and NOTE.
- Key off.
- Key on, engine off.
- Note initial FRP sensor pressure using the scan tool.
- Electronic fuel injector tester installed to suspect fuel injector.
- Select pulse width of 200 m sec.
- Activate the fuel injector tester.
- Note final FRP sensor pressure using scan tool.
- Subtract final pressure from initial pressure to find pressure drop.
- Repeat above test procedures for all remaining fuel injectors.

Is the leakage and flow within specification?

Yes	No
<p>DTCs P0171, P0172, P0174 and P0175: Unable to duplicate or identify fault at this time. GO to Z1.</p> <p>DTCs P1130 and P1150:</p>	<p>REPLACE fuel injector.</p>

GO to [HA66](#).

All others:

GO to [HA65](#).

HA65 CHECK CYLINDER COMPRESSION

- Check cylinder compression. Refer to Powertrain/Engine Group Base Engine/Engine—Service Section of the Workshop Manual.

Are cylinder compression readings within specification?

Yes	No
For DTCs P1131, P1130, P1151 and P1150: GO to HA66 .	REPAIR as necessary.
For DTCs P1132 and P1152: GO to HA71 .	

HA66 CHECK HO2S INTEGRITY

- Inspect HO2S harness for chafing, burned out wires or other damage and service.
- Inspect HO2S and connector for indications of submersions in water, oil and coolant. Repair as necessary.
- Run engine at 2000 rpm for two minutes.
- Perform Key On Engine Running (KOER) Self-Test.
- Key off.

Are DTCs P1131 and/or P1151 present?

Yes	No
GO to HA67 .	Unable to duplicate or identify fault at this time. GO to Z1 .

HA67 CHECK HO2S's ABILITY TO GENERATE A VOLTAGE GREATER THAN 0.5 VOLT

Note: Refer to the PCM pin numbers at the beginning of this pinpoint test.

Any vacuum or air leaks can cause DTCs P1131, P1151, P1130 and P1150.

- Disconnect the suspect HO2S from vehicle harness.
- Connect digital multimeter to the HO2S Signal circuit and HO2S SIG RTN circuit or HO2S GND circuit at the HO2S sensor connector.
- Run engine at 2000 rpm for two minutes.
- Rerun KOER Self-Test and monitor HO2S voltage.

Does voltage reading indicate greater than 0.5 volt during or at the end of Self-Test?

Yes	No
GO to HA68 .	REPLACE HO2S.

HA68 CHECK HO2S SIGNAL AND HO2S GROUND CIRCUITS FOR OPEN IN HARNESS

- Disconnect PCM.
- Disconnect suspect HO2S from harness.
- Measure the resistance of HO2S Signal circuit between PCM harness connector and the HO2S harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector and HO2S SIG RTN harness connector.

Is the resistance reading less than 5.0 ohms?

Yes	No
GO to HA69 .	REPAIR open circuit.

HA69 CHECK HO2S CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Measure resistance of HO2S Signal circuit between the PCM harness connector and battery negative post.

Is the resistance greater than 10,000 ohms?

Yes	No
GO to HA70 .	REPAIR short circuit.

HA70 CHECK HO2S FOR SHORT TO GROUND

- Measure resistance between HO2S Signal and PWR GND/SIG RTN circuits at the PCM harness connector.

Is the resistance greater than 10,000 ohms?

Yes	No
<p>For DTCs P1130 and P1150: GO to HA71.</p> <p>For DTCs P1131C and P1151C: GO to HA76.</p> <p>For KOER DTCs P1131 and P1151: REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p>	REPLACE HO2S.

HA71 CHECK FOR DTCS P1132 AND P1152 WITH P1130 AND P1150

- Activate Key On Engine Running (KOER) Self-Test.

Are DTCS P1132 or P1152 present?

Yes	No
GO to HA72 .	Unable to duplicate or identify fault at this time. GO to Z1 .

HA72 CHECK HO2S SIGNAL FOR SHORT TO VPWR and VREF

DTC P1130, P1132=HO2S-11

DTC P1150, P1152=HO2S-21

- Key on, engine off.

Note: HO2S displayed as O2S on Scan Tool.

- Access the HO2S PID for the DTC generated.

Is the voltage greater than 1.0 volt and less than 4.0 volts?

Yes	No
GO to HA73 .	GO to HA75 .

HA73 CHECK HO2S CIRCUIT FOR SHORT TO VPWR

- Disconnect sensor.
- Disconnect PCM.

Note: Refer to the PCM pin numbers at the beginning of this pinpoint test.

- Measure the resistance between the HO2S signal circuit pin(s) and VPWR circuit at the HO2S harness connector.

Is the resistance greater than 10,000 ohms?

Yes	No
GO to HA74 .	REPAIR short to power.

HA74 CHECK HO2S SIGNAL FOR SHORT TO HO2S HTR CIRCUIT IN THE SENSOR

- HO2S sensor disconnected.
- Key on, engine off.

Note: HO2S displayed as O2S on Scan Tool.

- Access HO2S PID for DTC(s) received.

Is the HO2S voltage less than 0.2 volt?

Yes	No
REPLACE HO2S.	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

HA75 ATTEMPT TO GENERATE DTCS P1131 AND P1151

- Disconnect HO2S.
- Connect jumper between HO2S Signal at the HO2S harness connector and battery negative post.
- Activate Key On Engine Running (KOER) Self-Test.

Is DTC P1131 or P1151 present?

Yes	No
GO to HA76 .	DISCONNECT PCM. INSPECT both ends of connector for damaged or pushed out pins, moisture, corrosion, loose pins. REPAIR as necessary. If OK, REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

HA76 HO2S SENSOR VOLTAGE CHECK

Note: Refer to the PCM pin numbers at the beginning of this pinpoint test.

- Disconnect HO2S.
- Connect digital multimeter to HO2S SIG circuit and HO2S SIG RTN circuit at the HO2S sensor connector.
- Disconnect vacuum hose from vacuum tree.
- Start engine and run at 2000 rpm.

Does the voltage reading indicate less than 0.4 volt within 30 seconds?

Yes	No
GO to HA77 .	REPLACE HO2S.

HA77 MONITOR HO2S PID FOR PROPER SWITCHING

- Key on, engine running.
- Engine at operating temperature.

Note: HO2S displayed as O2S on Scan Tool.

- Access HO2S PID for DTC received.
- Wiggle, bend and shake small sections of the Electronic Engine Control harness from the PCM to

the HO2S harness connector.

Did the HO2S voltage stay high (greater than 0.45 volt) or low (less than 0.45 volt)?

Yes	No
ISOLATE cause of lack of HO2S switches and repair.	GO to HA78 .

HA78 TEST DRIVE WHILE MONITORING HO2S PID FOR PROPER SWITCHING

Note: This test step requires an observer to monitor PID for proper operation.

- Access HO2S PID.
- While observer views HO2S PID, test drive vehicle under different road conditions in an attempt to simulate the original fault.

Does HO2S appear to switch properly?

Yes	No
UNABLE to duplicate fault. Testing complete at this time.	REPLACE HO2S.

HA90 DTC P1127 KOER

Possible causes:

- Engine not operating long enough prior to performing KOER Self-Test.
- Exhaust system too cool.
- Key on, engine running.
- Access HTR11, 21 PIDs.

Do all PIDs indicate ON?

Yes	No
With engine still running, COMPLETE a KOER Self-Test to verify P1127 is no longer present.	OPERATE engine until all PIDs indicate ON. COMPLETE a KOER Self-Test.

HA100 DTC P1128 KOER

- P1128 refers to the upstream HO2S.

Possible causes:

- Crossed HO2S harness connectors.
- Crossed wiring at HO2S harness connectors.
- Crossed HO2S wiring at PCM 104-pin harness connector.
- Key off.
- Visually inspect HO2S harness connector(s) for any crossed or stretched wires or wire harnesses not mounted properly.

Are there any indications of crossed connectors or wires?

Yes	No
REPAIR as necessary.	GO to <u>HA101</u> .

HA101 VERIFY PROPER HO2S SIGNAL PIN LOCATION

- Disconnect PCM.
- Disconnect both of the suspect HO2S sensors at the HO2S harness connector.
P1128 = HO2S 11/21 Upstream
- Measure resistance of HO2S SIG circuits between the PCM harness connector and the HO2S harness connectors.
HO2S-11-Test Pin 60
HO2S-21-Test Pin 87

Is the resistance less than 5.0 ohms?

Yes	No
HO2S SIG circuit is OK.	CONNECT HO2S connector to proper HO2S or RELOCATE HO2S signal pins in the PCM 104-pin harness connector or HO2S harness connector.

HB: Natural Gas Fuel Delivery System Introduction

HB: Pinpoint Tests →

Note

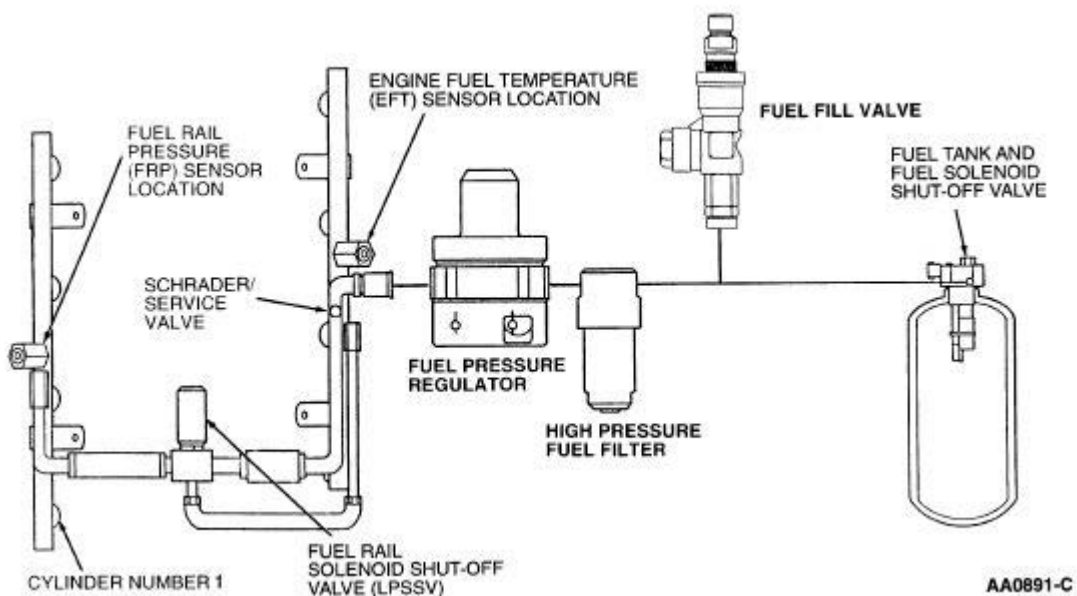
This Pinpoint Test is intended to diagnose the following:

- Fuel Pressure
- Fuel Supply Lines
- Fuel Filter (9155)
- Fuel Injectors (9F593)
- Fuel Pressure Regulator (9C968)
- Fuel Injection Supply Manifold (Fuel Rail) (9F792)
- Fuel Rail Solenoid Shut-Off Valves (9D278)

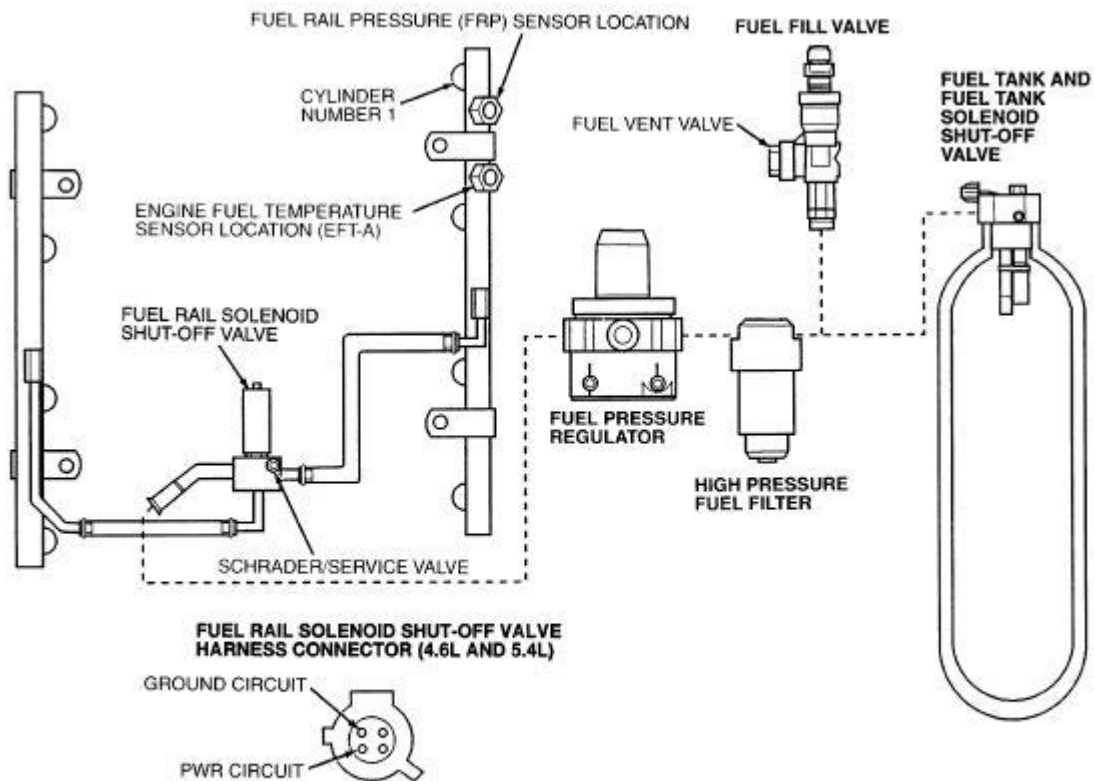
Fuel Delivery System Special Tool Kit		
Tool Kit 134-00114 Contains		
Fuel Pressure Gauge	Filler Connector Venting Tool	Injector Flow Tester

Note: For specific fuel delivery system specifications, refer to the Fuel Delivery System Test Information Chart located at the beginning of section HC.

4.6L Crown Victoria NGV



5.4L E/F-Series (NGV)



AA0892-E

WARNING

NATURAL GAS IN THE FUEL SYSTEM IS AT HIGH PRESSURE AT ALL TIMES. TO AVOID INJURY OR FIRE, RELEASE THE FUEL PRESSURE FROM THE FUEL SYSTEM BEFORE DISASSEMBLING ANY FUEL SYSTEM COMPONENT. TO RELEASE THE PRESSURE FROM THE SYSTEM FOLLOW THE PRESSURE RELIEF PROCEDURE:

PRESSURE RELIEF PROCEDURE

- THUMP INERTIA FUEL SHUTOFF (IFS) SWITCH AND VERIFY THE BUTTON HAS BEEN UPSET (DO NOT RESET).
- CONNECT NATURAL GAS FUEL PRESSURE TESTING KIT 134-00114 AT THE SCHRADER VALVE LOCATED ON THE FUEL INJECTION SUPPLY MANIFOLD (FUEL RAIL). TESTING KIT VALVE MUST BE CLOSED.
- POSITION THE TESTING KIT VENTING HOSE TO A WELL-VENTILATED LOCATION, PREFERABLY OUTSIDE OR INTO VENT STACK.
- GRADUALLY OPEN THE TESTING KIT VALVE TO RELIEVE THE FUEL PRESSURE AND ALLOW IT TO ESCAPE (TAKES APPROXIMATELY ONE TO TWO MINUTES.).

USE CARE TO PREVENT COMBUSTION FROM ESCAPING FUEL. NO SMOKING, OPEN FLAMES OR ANY KIND OF ARCING.

SAFE FUEL HANDLING PRACTICES: NATURAL GAS—FIRE

- REPORT ALL FIRES TO THE APPROPRIATE AUTHORITIES.
- FLAMES FROM NATURAL GAS HAVE A YELLOW AND/OR BLUE COLOR.

- **KNOW THE LOCATIONS OF PORTABLE FIRE EXTINGUISHER, FIRE BLANKETS, AND FIRE ALARMS. LEARN HOW TO USE THEM.**
- **USE AN ABC RATED/CERTIFIED FIRE EXTINGUISHER OR FIRE BLANKET TO FIGHT FLAMMABLE GAS FIRES.**

FIRST AID

- **WHEN OVERCOME BY VAPORS, IF SAFE, MOVE VICTIM TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION OR CPR (CARDIOPULMONARY RESUSCITATION) AS APPROPRIATE. SEEK MEDICAL ATTENTION IMMEDIATELY.**
- **FOR IRRITATED EYES, FLUSH WITH LARGE AMOUNTS OF WATER FOR 15 MINUTES. REMOVE CONTACT LENSES, IF WORN. SEEK MEDICAL ATTENTION.**

HEALTH

- **NATURAL GAS (AND ALL OTHER FUEL VAPORS) CAN BE HARMFUL BY INHALATION.**
- **ALL FUELS CAN BE HARMFUL OR FATAL IF SWALLOWED.**
- **FUELS AND PRODUCTS CONTAINING METHANOL (E.G. WINDSHIELD WASHER FLUID) CAN CAUSE BLINDNESS IF SWALLOWED.**
- **ALL FUELS ARE IRRITATING TO THE EYES AND RESPIRATORY SYSTEM.**

HANDLING

- **BE AWARE OF THE MERCUROUS MERCAPTAN "ROTTEN EGG" SMELL OF NATURAL GAS.**
- **USE FLAMMABLE GAS HANDLING PRECAUTIONS.**
- **KEEP FLAMMABLE GASES IN APPROVED, LABELED CONTAINERS.**
- **USE IN WELL-VENTILATED AREAS AND CONTROL VAPORS. BE AWARE THAT NATURAL GAS IS NOT VISIBLE, IS LIGHTER THAN AIR, CAN TRAVEL ALONG THE CEILING, AND MAY COLLECT IN HIGH HOLLOWES.**
- **WHEN TRANSFERRING FLAMMABLE GASES, CONNECT THE VENT STACK TO THE SOURCE, AND GROUND THE SOURCE TO THE EARTH.**
- **DO NOT SMOKE, OR USE HEAT/SPARK PRODUCING EQUIPMENT NEAR NATURAL GAS.**
- **DO NOT EAT, DRINK OR SMOKE WHERE FUELS ARE HANDLED, PROCESSED OR STORED.**
- **WASH HANDS THOROUGHLY AFTER HANDLING ANY FUEL.**

LEAKAGE

- **NOTIFY THE PROPER AUTHORITIES IN THE EVENT OF ANY LEAKAGE YOU HAVE NOT BEEN TRAINED TO ADDRESS.**
- **STOP, AND ALLOW FUEL TO VENTILATE TO OUTSIDE ATMOSPHERE AFTER ANY FUEL ESCAPE.**

NOTE

A small amount of pressure 21 kPa (3 psig) will remain in the fuel rail.

High pressure still exists in the fuel tanks.

HB: Natural Gas Fuel Delivery System

← HB: Introduction

HB1 CHECK SYSTEM INTEGRITY

 **WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN FUEL SYSTEM WARNING, CAUTION AND NOTE AT THE BEGINNING OF THIS PINPOINT TEST.**

- Key on, engine off for 5 seconds.
- Key off.
- Visually inspect the complete fuel delivery system, including fuel lines, connections, fuel rail, pressure regulator and fuel injector areas for leaks (hissing noise), looseness, cracks, kinks, pinching, or abrasion caused by a collision or mishandling.
- Visually inspect electrical harness and connectors for loose pins, corrosion, abrasion or other damage from collision or mishandling.
- Verify vehicle has followed maintenance schedule.
- Inspect fuel filter element for contamination and service as necessary.
- Verify Inertia Fuel Shutoff (IFS) switch is set.
- Verify vehicle battery is fully charged.
- Verify electrical/fuse integrity.

Have any concerns been identified?

Yes	No
REPAIR as necessary. VERIFY symptom no longer exists.	<p>For symptom of poor fuel range:</p> <p>GO to NG fuel tank venting procedures located in Section 310-00 in the Workshop Manual.</p> <p>For symptom of fuel smell:</p> <p>GO to HB16.</p> <p>All other symptoms:</p> <p>GO to HB2.</p>

HB2 CHECK FUEL TANK PRESSURE

- Install fuel tank venting tool (supplied in Tool Kit 134-00114) to vehicle fueling connector.
- Open bypass on fill valve (refer to Powertrain/Fuel Systems Group in the Workshop Manual for this procedure).
- Key on.
- Record fuel tank pressure reading and fuel gauge reading.

Is the fuel pressure reading greater than 3,448 kPa (500 psi)?

Yes	No

KEY OFF. CLOSE bypass and REMOVE tool.
GO to [HB5](#).

VERIFY fuel level. If OK, CHECK for power at
tank solenoid valve. GO to [HB3](#).

HB3 CHECK FSV PWR AND GND CIRCUITS TO THE FUEL TANK SOLENOID SHUT-OFF VALVE

- Key on.
- Access Output Test Mode.
- Select ALL ON.

Note: Measurement must be made within 7 seconds of activating test mode

- Measure voltage between the FSV PWR and GND circuits at the fuel tank solenoid shut-off valve harness connector (refer to the Electrical and Vacuum Troubleshooting Manual for location).

Is the voltage reading greater than 10.5 volts?

Yes	No
GO to NG fuel tank venting procedures located in Section 310-00 in the Workshop Manual for fuel tank solenoid shut-off valve diagnostics.	GO to HB4 .

HB4 CHECK FOR OPEN GND CIRCUIT TO FUEL TANK SOLENOID SHUT-OFF VALVE

- Measure resistance between the ground circuit at the fuel tank solenoid shut-off valve harness connector and battery negative post.

Is resistance less than 5 ohms?

Yes	No
REPAIR open FSV PWR circuit. VERIFY symptom no longer exists.	REPAIR open GND circuit. VERIFY symptom no longer exists.

HB5 CHECK FUEL PRESSURE

- Observe WARNING, CAUTION AND NOTE.
- Connect Fuel Pressure Tester to schrader valve.
- Release fuel pressure in fuel injection supply manifold (fuel rail) and supply lines.
- Key on, engine on (if possible, start engine).
- Key off.
- After two minutes, obtain pressure reading from pressure tester.

Is fuel pressure within 552 to 827 kPa (80 to 120 psi)?

Yes	No
For no starts: GO to HB6 .	REPLACE fuel pressure regulator. VERIFY symptom no longer exists.

HB6 CHECK FUEL RAIL PRESSURE SENSOR ACCURACY

- Observe WARNING, CAUTION and NOTE.
- Fuel pressure tester connected with vent hose.
- Connect scan tool.
- Key on, engine off.
- Note pressure of FRP sensor with scan tool.
- Note pressure at schrader valve with fuel pressure tester.
- Key off.
- Slowly open the one quarter turn shut off valve on the fuel pressure tester and vent fuel pressure to 345-485 kPa (50-70 psi).
- Remove the fuel pump relay.
- Key on, engine off.
- Note pressure of FRP sensor with scan tool.
- Note pressure at schrader valve with pressure tester.
- Key off.

Is the FRP sensor pressure constant and within 70 kPa (10 psi) of the pressure at the Schrader valve?

Yes	No
<p>For no starts: GO to HB10 .</p> <p>For all others: Return to symptom chart.</p>	<p>GO to HB7 .</p>

HB7 VERIFY FUEL RAIL SOLENOID SHUT-OFF VALVE OPENS

- Observe WARNING, CAUTION and NOTE.
- Fuel pressure tester connected with vent hose.
- Key on, engine off.
- Access Output Test Mode.
- Select ALL ON and then START and STOP several times by toggling the START and STOP button on the scan tool and listening or feeling for a click at the fuel rail solenoid shut-off valve.
- Key off.

Was a click of the solenoid valve felt or heard?

Yes	No
<p>REPLACE fuel rail pressure sensor. VERIFY symptom no longer exists.</p>	<p>GO to HB8 .</p>

HB8 CHECK FSV PWR AND GND CIRCUITS TO THE FUEL RAIL SOLENOID SHUT-OFF VALVE

- Key on, engine off.

- Access Output Test Mode.
- Select ALL ON, and START.
- Measure the voltage between the FSV PWR and GND circuit at the fuel rail solenoid shut-off valve harness connector.

Note: This circuit remains on for only 7 seconds.

Is the voltage reading greater than 10.5 volts?

Yes	No
REPLACE fuel rail solenoid valve. VERIFY symptom no longer exists.	GO to HB9 .

HB9 CHECK FOR OPEN GND CIRCUIT TO FUEL RAIL SOLENOID SHUT-OFF VALVE

- Measure the resistance between the GND circuit at the fuel rail solenoid shut-off valve harness connector and battery negative post.

Is resistance less than 5 ohms?

Yes	No
REPAIR open FSV PWR circuit. VERIFY symptom no longer exists.	REPAIR open GND circuit. VERIFY symptom no longer exists.

HB10 VERIFY FUEL RAIL SOLENOID SHUT-OFF VALVE SEALS

- Observe WARNING, CAUTION and NOTE.
- Fuel pressure tester connected with vent hose.
- Vent fuel pressure in the fuel injection supply manifold (fuel rail) and supply lines.
- Disconnect the fuel rail solenoid shut-off valve at the fuel injection supply manifold (fuel rail) harness connector.
- Crank the engine for 3 seconds.
- After two minutes, turn key on and access FRP PID and note pressure.

Is pressure at FRP sensor less than 70 kPa (10 psi)?

Yes	No
GO to HB11 .	REPLACE solenoid valve. VERIFY symptom no longer exists.

HB11 VERIFY FUEL RAIL SOLENOID SHUT-OFF VALVE PARTIALLY OPENS

- Observe WARNING, CAUTION and NOTE.
- Key off.
- Fuel pressure tester connected with vent hose.
- Vent pressure in the fuel injection supply manifold (fuel rail) and supply lines.
- Disconnect the fuel rail solenoid shut-off valve on the fuel injection supply manifold (fuel rail) at the harness connector.
- Key on, engine off.

- Key off.
- Reconnect the fuel rail solenoid shut-off valve.
- Key on, engine off.
- Access the FRP PID.
- Note the pressure on the pressure gauge.

Is the FRP sensor pressure within 70 kPa (10 psi) of the fuel pressure gauge after turning key on with the engine off?

Yes	No
KEY OFF. GO to HB12 .	REPLACE fuel rail solenoid shut-off valve. VERIFY symptom no longer exists.

HB12 VERIFY FUEL RAIL SOLENOID SHUT-OFF VALVE FULLY OPENS

- Observe WARNING, CAUTION and NOTE.
- Fuel pressure tester connected with vent hose.
- Vent pressure in the fuel injection supply manifold (fuel rail) and supply lines.
- Disconnect the fuel rail solenoid shut-off valve on the fuel injection supply manifold (fuel rail) at the harness connector.
- Key on, engine off.
- Key off.
- Reconnect the fuel rail solenoid shut-off valve.
- Snap start the engine (Key on and immediately start the engine).
- Immediately increase the engine speed to approximately 2500 rpm while monitoring the FRP PID.
- Note the pressure on the pressure gauge.
- Note the FRP pressure.

Is the FRP sensor pressure within 70 kPa (10 psi) of the pressure at the schrader valve?

Yes	No
KEY OFF. GO to HB13 .	REPLACE fuel rail solenoid shut-off valve. VERIFY symptom no longer exists.

HB13 VERIFY FUEL PRESSURE WITH ENGINE ON

- Observe WARNING, CAUTION and NOTE.
- Key on, engine running.
- Note FRP sensor pressure at idle with scan tool.
- Increase engine speed to approximately 2500 rpm.
- Note FRP sensor pressure at 2500 rpm with scan tool.

Is idle fuel pressure between 552 and 827 kPa (80 and 120 psi) and is pressure at 2500 rpm greater than 552 kPa (80 psi)?

Yes	No
KEY OFF. GO to HB14 .	VERIFY a blockage does not exist in fuel lines. REPLACE fuel pressure regulator. VERIFY symptom no longer exists.

HB14 VERIFY REGULATOR THERMOSTAT

- Observe WARNING, CAUTION and NOTE.
- Key on, engine on.
- Allow engine coolant to reach normal operating temperature.
- Measure the temperature of fuel pressure regulator coolant bowl or coolant outlet with a thermometer or temperature probe.

Is the regulator temperature within 15° to 60°C (59° to 140°F)?

Yes	No
KEY OFF. GO to HB15 .	<p>If fuel regulator coolant bowl is less than 15°C (59°F):</p> <p>KEY OFF. CHECK coolant lines and coolant system for proper operation.</p> <p>If OK, REPLACE fuel pressure regulator.</p> <p>If fuel regulator coolant bowl is greater than 60°C (140°F):</p> <p>KEY OFF. REPLACE pressure regulator. VERIFY symptom no longer exists.</p>

HB15 VERIFY FUEL INJECTOR FLOW

- Observe WARNING, CAUTION and NOTE.
- Key off.
- Key on, engine off.
- Note initial FRP sensor pressure using the scan tool.
- Electronic fuel injector tester installed to suspect fuel injector.
- Select pulse width of 200 m sec.
- Activate the fuel injector tester.
- Note final FRP sensor pressure using scan tool.
- Subtract final pressure from initial pressure to find pressure drop.
- Repeat above test procedures for all remaining fuel injectors.

Is the pressure drop within 241 to 345 kPa (35 to 50 psi) and all fuel injectors within 20 kPa (3 psi) of each other?

Yes	No
RETURN to Section 3 , Symptom Charts, for additional symptom diagnostics.	KEY OFF. REPLACE fuel injector(s) that does not meet pressure specification. VERIFY symptom no longer exists.

HB16 FUEL LEAK CHECK

Possible causes:

- Loose fitting connectors.
- Damaged or worn seals or fittings.

- Damaged fuel lines or fuel system components.

Note: After the vehicle has soaked for several hours (has not run), a slight natural gas smell may emanate from within the intake manifold and intake air system. This is normal, as the fuel injectors leak down from the fuel rail to the intake manifold over several hours.

- Key off.
- Install fuel rail pressure gauge.
- Key on, engine off (verify pressure is greater than 586 kPa (85 psi)). If the fuel system does have a fuel leak, it will be necessary to repeat this step to maintain pressure.
- Check for leaks with the natural gas sniffer provided in Rotunda tool kit 134-00114 or a soapy water solution such as Snoop. Cover the complete joint with this solution. Examine the components or joints for 60 seconds for signs of bubbles.

Are any leaks indicated?

Yes	No
VERIFY proper torque on suspect fuel system components. RECHECK for leaks. If leaks still exist, REPAIR or REPLACE as necessary.	No leaks detected. No further diagnostics are required.

HB17 DTC P1180 AND P1181: CHECK FUEL PRESSURE

- Inspect the fuel lines, regulator and fuel filter for restrictions or leaks.

Are there any concerns?

Yes	No
REPAIR as necessary.	GO to HB18 .

HB18 CHECK FUEL TANK PRESSURE

- Key on, engine running and vehicle in park.
- Scan tool connected.
- Access and monitor the TANKPR PID from the NGVM menu and record the value.
- Access and monitor the FRP PID from the PCM menu and record the value.
- Locate the approximate TANKPR value on the chart below, from this value determine the PCM inferred pressure.

Is the PCM inferred pressure ± 22 psi of the fuel rail pressure (FRP) recorded?

Fuel Tank Pressure in kPa	PCM Inferred Pressure (psi)
30000	94
28000	95.5
26000	96
24000	96
23000	96.31
22000	97.25

21000	97.5
20000	98.5
19000	99
18000	99.31
17000	99.75
16000	100.75
14000	101.75
13000	102.25
12000	102.5
11000	103
10000	103.38
9000	104.5
8000	105
7000	105.56
6000	106
5000	106.5
4000	106.88
3000	108.44
2000	109
0	0

Yes	No
ADDRESS other Continuous Memory DTCs if present.	For DTC P1180: GO to HB19 . For DTC P1181: REPLACE fuel pressure regulator.

HB19 CHECK FUEL FILTER FOR WATER OR OTHER CONTAMINATION

- Disassemble fuel filter and check for water and other contamination.

Is there any contamination present?

Yes	No
CLEAN contaminants from filter housing. REPLACE filter element.	GO to HB20 .

HB20 CHECK FUEL LINE FOR RESTRICTION

- Visually inspect all fuel lines for damage which may cause the fuel to be restricted or leaking.

Are there any restrictions?

Yes	No

REPAIR fuel line(s) as required.

REPLACE fuel pressure regulator.

HC: Fuel Delivery System Introduction

HC: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Chassis Components
- Engine Vacuum
- Fuel Pressure
- Fuel Filter

- Fuel Return
- Fuel Supply
- Fuel Injector (9F593)

Tables and Charts

Fuel Delivery System Test Information / Specification Chart

Engine Application	Part Number 9F 593	Connector Color	Resistance (Ohms)	Flow (Lb./Hr.)	Fuel System Type	Fuel Pressure kPa	Fuel Pressure PSI	Injec Supp
CAR:								
2.0L 2V Focus	YS4E-A5A	Ivory	13.8-15.2	17	ERFS ₃	240-448	35-65	B
2.0L 4V Focus	XS4U-AA	Gray	11.4-12.6	21	ERFS ₃	240-448	35-65	B
2.0L 4V Escort ZX2	XS4U-AA	Gray	13.8-15.2	17	ERFS ₃	240-448	35-65	B
2.5L Cougar	XS2E-A5C	Ivory	13.8-15.2	17	ERFS ₃	240-448	35-65	B
2.5L Cougar High Output	XS2E-C5A	Green	11-18	19	ERFS ₃	240-448	35-65	B
3.0L 2V Taurus/Sable	YF1E-F4A	Black	8.5-15.5	16	MRFS ₂	240-448	35-65	V
3.0L Taurus/Sable FFV E85	1F1E-D4A	Green	11.4-12.6	21	MRFS ₂	240-448	30-65	V
3.0L 4V Taurus/Sable	YF1E-A2C	Dark Gray	10.3-17.3	17	MRFS ₂	240-448	35-65	D
3.0L Lincoln LS6	XW4E-A5C	Gray/Black	11-18	24	ERFS ₃	240-448	35-65	B
3.8L Mustang	YR3E-A4A	Black	8.5-15.5	21	ERFS ₃	240-448	35-65	V
3.9L Lincoln LS8	XW43-CA	Black	8.5-15.5	21	ERFS ₃	240-448	35-65	S

4.6L Crown Victoria/Grand Marquis/Town Car	XL2E-C5A	Orange	11-18	19	RFS ₁	207-310	30-45	B
4.6L 2V Mustang	F0TE-D5B	Yellow/Black	11-18	19	ERFS ₃	240-448	35-65	B
4.6L 4V Mustang/Continental	XR3E-C5B	Olive Green	11-18	24	ERFS ₃	240-448	35-65	B
4.6L Crown Victoria NGV	XL3E-C5A	Turquoise	4-6	91	RFS ₁	552-827	80-120	B
TRUCK:								
2.0L 4V Escape	XS4U-AA	Gray	11.4-12.6	21	MRFS ₂	379-448	55-65	B
2.3L Ranger	1L5G-AA	Light Gray	11-13	21	MRFS ₂	240-380	35-55	B
2.5L Ranger	F87E-D2B	Gray	11-18	14	MRFS ₂	207-448	30-65	D
3.0L 4V Escape	YF1E-A2C	Dark Gray	10.3-17.3	17	MRFS ₂	379-448	55-65	D
3.0L Ranger	1L5E-C4A	Black	8.5-15.5	12	MRFS ₂	207-448	30-65	V
3.0L Ranger FFV E85	1L5E-D4B	Green	11.4-12.6	21	MRFS ₂	240-448	30-65	V
3.8L Windstar	XF2E-C4B	Black	8.5-15.5	21	RFS ₁	240-310	35-45	V
4.0L SOHC Ranger	1L2E-B5A	Blue	11-18	19	MRFS ₂	207-448	30-65	B
4.0L SOHC Ranger FFV	1L2E-C5A	Red	11-18	24	MRFS ₂	207-448	30-65	B
4.0L SOHC Explorer Sport/Explorer Sport Trac FFV	1L2E-C5A	Red	11-18	24	MRFS ₂	207-448	30-65	B
4.0L SOHC Explorer/Mountaineer/Explorer Sport Trac	XL2E-A1C	Yellow	11-18	19	MRFS ₂	207-448	30-65	B
4.0L SOHC Explorer USPS	1L2E-A5A	Black	11-18	27	MRFS ₂	207-448	30-65	B
4.2L E+F-Series	YR3E-A6A	Black	8.5-15.5	21	RFS ₁	240-310	35-45	S
4.6L Explorer/Mountaineer	F0TE-D5B	Orange	11-18	19	MRFS ₂	240-380	35-55	B
4.6L E+F-Series/Expedition	F0TE-D5B	Orange	11-18	19	RFS ₁	240-310	35-45	B
5.0L Explorer/Mountaineer	XS2E-A5B	Ivory	11-18	17	MRFS ₂	207-448	30-65	B
5.4L 2V E+F-Series/Expedition/Navigator/Excursion	F0TE-D5B	Orange	11-18	19	MRFS ₂	240-380	35-55	B
5.4L E+F-Series NGV	XL3E-C5A	Turquoise	4-6	91	RFS ₁	552-827	80-120	B

5.4L 2V Lightning	XL3V-A5A	Green	11-18	41	RFS ₁	240-310	35-45	B
5.4L 4V Navigator/Blackwood	XR3E-C5B	Green	11-18	24	RFS ₁	240-310	35-45	B
6.8L E+F-Series/Excursion	XL2E-C5A	Orange	11-18	19	RFS ₁	240-310	35-45	B

1. Return Fuel Systems (RFS) return fuel to the fuel tank by means of a return line from the fuel rail.
2. Mechanical Returnless Fuel Systems (MRFS) do not return fuel to the fuel tank by means of a fuel return line. The fuel pressure regulator is mounted on the Fuel Pump Module located in the fuel tank. Excess fuel is returned from this point.
3. Electronic Returnless Fuel Systems (ERFS) do not return fuel to the fuel tank by means of a fuel return line. There is no fuel pressure regulator and pressure is controlled by continuously varying the fuel pump speed through the Fuel Pump Driver Module (FPDM).
4. Service replacement fuel injectors may not be the same color as the injectors in the vehicle. Verify replacement injector is correct for the application by part number.

Injector supplier key:

B=Bosch

D=Denso

S=Siemens

V=Visteon

Description

For additional information on the Fuel Delivery System, refer to [Section 1](#).



WARNING: FUEL IN THE FUEL SYSTEM REMAINS UNDER HIGH PRESSURE EVEN WHEN THE ENGINE IS NOT RUNNING. TO AVOID INJURY OR FIRE, RELEASE THE FUEL PRESSURE FROM THE FUEL SYSTEM BEFORE DISCONNECTING ANY FUEL LINE. TO RELEASE THE PRESSURE FROM THE SYSTEM PERFORM THE FOLLOWING:

- CONNECT THE ROTUNDA FUEL PRESSURE GAUGE T80L-9974-B OR EQUIVALENT AT THE SCHRADER VALVE LOCATED ON THE FUEL RAIL. TESTING KIT VALVE MUST BE CLOSED. ON VEHICLES NOT EQUIPPED WITH A SCHRADER VALVE, USE ROTUNDA FUEL PRESSURE TEST KIT #134—R0087 OR EQUIVALENT.
- GRADUALLY OPEN THE TESTING KIT VALVE TO RELIEVE FUEL PRESSURE IN THE VEHICLE FUEL SYSTEM AND DRAIN THE FUEL INTO A SUITABLE CONTAINER OR RETURN IT TO THE FUEL TANK.
- TO AVOID UNNECESSARY FUEL SPILLAGE AND FIRE HAZARD, ANY TIME FUEL LINES ARE DISCONNECTED, THE IGNITION SWITCH MUST BE IN THE OFF POSITION UNLESS FUEL PUMP OPERATION IS REQUIRED FOR TEST PURPOSES.



CAUTION: Use care to prevent combustion from fuel spillage. No smoking, open flames or any kind of arcing.

SAFE FUEL HANDLING PRACTICES

Gasoline, Methanol and Methanol Blends

FIRE

- Report all fires to the appropriate authorities.
- Flames from methanol or methanol-gasoline blends can be invisible.
- Know the locations of portable fire extinguishers, fire blankets, fire alarms and eye/wash shower facilities. Learn how to use them.
- Use a B or AFFF (light water) type fire extinguisher to fight flammable liquid fires.

FIRST AID

- If swallowed:
 - If gasoline has been swallowed, do not induce vomiting. Seek medical attention immediately!
 - If methanol or a methanol/gasoline blend has been swallowed, induce vomiting under the direction of a physician or Poison Control Center. Seek medical attention immediately!
- When overcome by vapors, if safe, move victim to fresh air. If not breathing, give artificial respiration or CPR (Cardiopulmonary Resuscitation) as appropriate. Seek medical attention immediately!
- If splashed in eyes, flush with large amounts of water for 15 minutes. Remove contact lenses, if worn. Seek medical attention.
- If splashed on skin, remove contaminated clothing. Wash skin thoroughly with soap and water.

HEALTH

- All fuels can be harmful or fatal if swallowed.
- Be aware, if fuel is swallowed, onset of serious health effects can be delayed 12 to 24 hours.
- Fuels and products containing methanol (e.g. windshield washer fluid) can cause blindness if swallowed.
- All fuel vapors can be harmful if inhaled.
- All fuels can be harmful if absorbed through the skin.
- All fuels are irritating to the eyes and respiratory system.
- Some fuels made with gasoline contain benzene which is a cancer-causing agent.


HANDLING

- Use flammable liquid handling precautions.
- Wear chemical goggles and nitrile gloves (additional protective clothing and equipment may be necessary in some instances).
- Keep flammable liquids in approved, labeled, closed containers.
- Use in well-ventilated areas and control vapors. Be aware that vapors are not visible, are heavier than air, can travel along the floor, and will settle in lower areas.
- When transferring flammable liquids, bond the receiving container to the source and ground the source to the earth.
- Do not smoke or use heat/spark producing equipment near vapors.
- Do not eat, smoke or drink where these products are handled, processed or stored.
- Never siphon by mouth.
- Wash hands thoroughly after handling any fuel .

SPILLS

- Notify the proper authorities in the event of any spill you have not been trained to clean up.
- Stop, contain, and clean up small spills with an absorbent material.

Inertia Fuel Shutoff (IFS) Switch — Reset Instructions

-  **WARNING: IF YOU SEE OR SMELL GASOLINE AT ANY TIME OTHER THAN DURING FUELING, DO NOT RESET THE INERTIA FUEL SHUTOFF (IFS) SWITCH.**
- Turn key off.
- Check for fuel leaks in the engine compartment.
- If no leak is present, reset the IFS switch by pushing the reset button on the top of the switch (refer to Owner Guide for switch location). NOTE: In the closed position, the button can be depressed an additional 1.57 mm (1/16 inch) against a spring.
- Turn key to on or start position for a few seconds, then off again.
- Again, check for leaking fuel.

HC: Pinpoint Tests →

HC: Fuel Delivery System

← HC: Introduction

HC1 CHECK SYSTEM INTEGRITY

- Visually inspect the complete fuel delivery system for damage; including fuel lines, connections, relays, fuel tank, fuel pump, fuel pressure regulator, fuel pulse damper and fuel injector areas for leaks, looseness, cracks, kinks, pinching, or abrasion caused by a collision or mishandling.
- Visually inspect electrical harness and connectors for loose pins, corrosion, abrasion, or other damage from collision or mishandling.
- Check electrical connectors for proper mating.
- Verify vehicle has followed maintenance schedule.
- Verify inertia fuel shutoff (IFS) switch is set.
- Verify battery is fully charged (12.5 volts or greater).
- Verify electrical/fuse integrity.
- Verify fuel level in the tank is sufficient.

Are any concerns present?

Yes	No
REPAIR as necessary.	GO to HC2 .

HC2 CHECK VOLTAGE AT FUEL PUMP HARNESS CONNECTOR

- Connect battery charger.
- Verify IFS switch state. Follow the IFS switch reset procedure at the beginning of this pinpoint test.
- Disconnect the fuel pump harness connector at the fuel pump.
- Key on, engine off.
- Connect a digital multimeter between the fuel pump power circuit and fuel pump ground circuit at the fuel pump harness connector (refer to the Wiring Diagram Manual for correct pin location).
- Access Output Test Mode (refer to [Section 2](#)) and turn on the fuel pump circuit and monitor the voltage reading.

Was the voltage greater than 12.5 volts?

Yes	No
KEY OFF. EXIT Output Test Mode. GO to HC3 .	KEY OFF. FOR vehicles with electronic returnless fuel systems: GO to KB70 . ALL others: CHECK for opens and shorts in the fuel pump power and ground circuits.

HC3 CHECK FUEL FILTER FOR PROPER MAINTENANCE

- Locate and inspect the vehicle maintenance schedule and fuel filter. Check for last repair date.

Was the fuel filter replaced within the last 48,280 km/30,000 miles?

Yes	No
GO to HC4 .	REPLACE fuel filter. GO to HC4 .

HC4 CHECK FUEL PRESSURE



WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN FUEL SYSTEM CAUTION, HANDLING AND WARNING AT THE BEGINNING OF THIS PINPOINT TEST.

- Install fuel pressure tester.
- Release fuel pressure.
- Key on, engine off.
- Access Output Test Mode and run the fuel pump to obtain maximum fuel pressure. (GO to Pinpoint Test [HC](#) to refer to the Fuel Delivery System Test Information / Specification Chart.)

Note: The fuel pump will only operate for approximately 8 seconds when Output Test Mode is selected and activated.

Is the fuel pressure within the specified pressure range as stated in the Fuel Delivery System Test Information / Specification Chart?

Yes	No
<p>KEY OFF. For Electronic Returnless Fuel Systems : GO to HC6.</p> <p>KEY OFF. For Mechanical Returnless Fuel Systems : GO to HC12.</p> <p>All others: GO to HC5.</p>	<p>KEY OFF. For Mechanical Returnless Fuel System with fuel pressure greater than 448 kPa (65 psi). REPLACE fuel pressure regulator in fuel tank.</p> <p>For Mechanical Returnless Fuel System with fuel pressure less than 310 kPa (45 psi): GO to HC6.</p> <p>For Electronic Returnless Fuel Systems with fuel pressure less than 207 kPa (30 psi). GO to HC13.</p> <p>For Electronic Returnless Fuel Systems with fuel pressure greater than 448 kPa (65 psi). RERUN Quick Test. Other DTC's should be present if fuel pressure is out of range.</p> <p>All others:</p> <p>Fuel pressure greater than 280 kPa (40 psi) (Cougar 415 kPa, 60 psi) on returnable fuel systems , GO to HC10.</p> <p>Fuel pressure less than 240 kPa (35 psi) (Cougar 310 kPa, 45 psi) on returnable fuel systems , GO to HC13.</p>

HC5 CHECK FUEL PRESSURE LEAKDOWN

- Observe Warning, Caution and Notes.

- Fuel pressure tester installed.
- Key on, engine off.
- Access Output Test Mode and run the fuel pump to obtain maximum fuel pressure.
- Key off.
- Verify fuel pressure remains within 34 kPa (5 psi) of the maximum fuel pressure for 1 minute after the fuel pump is turned off.

Does the fuel pressure remain within 34 kPa (5 psi)?

Yes	No
GO to HC7.	GO to HC6.

HC6 CHECK PRESSURE REGULATOR AND PULSE DAMPER DIAPHRAGM

- Fuel pressure tester installed.
- Start engine and run engine for 10 seconds.
- Key off, wait 10 seconds.
- Start engine and run engine for 10 seconds.
- Key off, remove vacuum hose from fuel pressure regulator or pulse damper port.
- Inspect for fuel in the vacuum hose or regulator port or pulse damper.

Is fuel present in the vacuum hose, regulator or pulse damper port?

Yes	No
REPLACE fuel pressure regulator. For Mechanical Returnless Fuel System: Replace pulse damper.	GO to HC12.

HC7 CHECK FUEL PRESSURE, ENGINE RUNNING

- Fuel pressure tester installed.
- Disconnect vacuum hose at the fuel pressure regulator and plug it.
- Drive vehicle with heavy accelerations while observing fuel pressure gauge reading.

Does fuel pressure reading hold steady within 21 kPa (3 psi) during test?

Yes	No
GO to HC8.	GO to HC13.

HC8 CHECK FUEL PRESSURE REGULATOR RESPONSE

- Fuel pressure tester installed.
- Install vacuum gauge to intake manifold.
- Start engine and observe both gauges.
- Accelerate and decelerate engine speed to vary vacuum gauge reading.

Does the fuel pressure gauge reading increase as vacuum gauge reading decreases or decrease as vacuum gauge reading increases?

Yes	No
Concern is elsewhere. RETURN to Section 3 , Symptom Charts for further direction.	GO to HC9 .

HC9 CHECK VACUUM SUPPLY

- Fuel pressure tester installed.
- Vacuum hose disconnected and plugged at the fuel pressure regulator.
- Install a hand held vacuum pump to the fuel pressure regulator.
- Start engine, remain at idle.
- Observe fuel pressure while applying vacuum.

Does the fuel pressure change as the vacuum changes?

Yes	No
REPAIR vacuum source.	REPLACE fuel pressure regulator.

HC10 CHECK FOR RESTRICTED FUEL RETURN LINE

- Fuel pressure tester installed.
- Remove fuel return line at the fuel rail and connect a short hose from the fuel rail to a measure container of at least 1.1 liter (1.0 quart) capacity.
- Key on, engine off.
- Access Output Test Mode and run the fuel pump to obtain maximum fuel flow (one cycle of the fuel pump is all that is required).
- Record fuel pressure and observe if fuel is being returned to the measuring container.

Is fuel pressure within specification and is fuel returning to the container?

Yes	No
KEY OFF. GO to HC11 .	KEY OFF. Fuel pressure out of specification. REPLACE fuel pressure regulator.

HC11 CHECK FUEL RETURN SYSTEM

- Observe Warning, Caution and Handling at the beginning of this pinpoint test.
- Disconnect fuel return line at the fuel rail.
- Disconnect fuel return line at the fuel pump.
- Check the fuel return line for restrictions due to blockage, kinking or pinching.
- Apply 21 to 34 kPa (3 to 5 psi) regulated shop air to the return line pressure.

Does air flow freely through the line?

Yes	No
REPLACE the fuel pump module.	REPAIR the fuel return line.

HC12 CHECK FUEL INJECTOR FLOW AND LEAKAGE

- Observe Warning, Caution and Handling at the beginning of this pinpoint test.
- Check injectors for leakage and flow rate using Injector Flow Tester.

Are test results satisfactory?

Yes	No
<p>For symptoms without DTCs and Electronic/Mechanical Returnless Fuel Systems: RETURN to Section 3, Symptom Charts for further direction.</p> <p>All others: VERIFY no other leak exists. REPLACE fuel pump module.</p>	<p>REPLACE faulty fuel injector(s).</p>

HC13 CHECK FUEL SUPPLY LINE FOR RESTRICTION

- Observe Warning, Cautions and Handling at the beginning of this pinpoint test.
- Disconnect fuel supply line at the fuel rail.
- Disconnect fuel supply line at the fuel pump.
- Check the fuel supply line for restrictions due to blockage, kinking, or pinching.
- Apply 21 to 34 kPa (3 to 5 psi) regulated shop air pressure to the supply line.

Does air flow freely through the line?

Yes	No
<p>Air flows freely. REPLACE fuel pump module.</p>	<p>REPAIR cause of restriction.</p>

HD: Misfire Detection Monitor Introduction

HD: Pinpoint Tests →

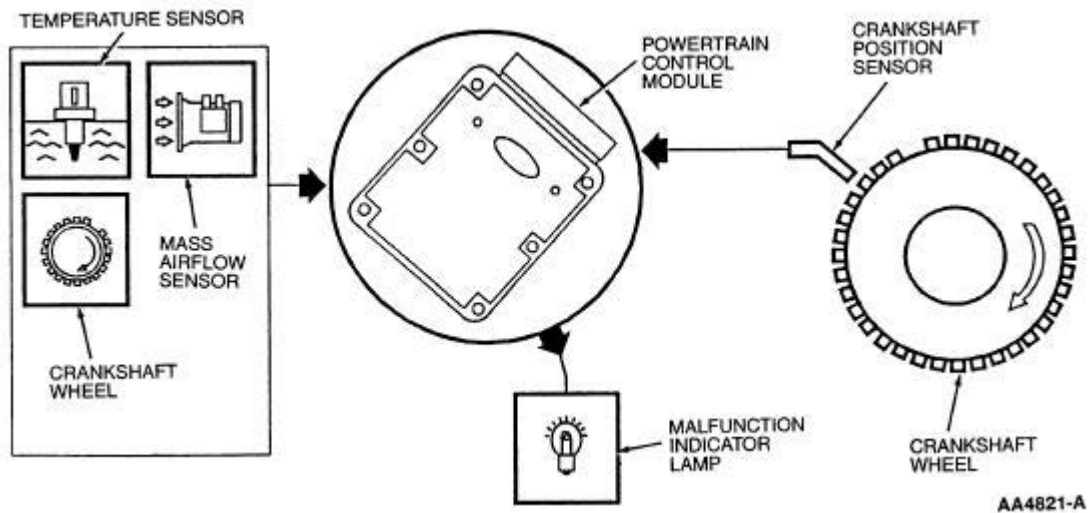
Note

This Pinpoint Test is intended to diagnose the following:

- Ignition System
- Fuel injectors (9F593)
- Fuel pressure
- Vacuum system
- Evaporative emission system
- Fuel vapor storage canister
- EVAP canister purge valve (9C915)
- Base engine
- Crankshaft position (CKP) sensor (6C315)
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

Misfire Detection Monitor



HD: Pinpoint Tests →

HD: Misfire Detection Monitor

← HD: Introduction

HD1 CHECK FOR ADAPTIVE FUEL MONITOR AND HO2S CONTINUOUS MEMORY DTCS

Note: The following is a list of non-misfire DTCS to look for in the Continuous Memory.

P0136, P0156
 P0171, P0172, P0175
 P1130, P1150

Are any of the DTCS listed above present?

Yes	No
GO to HD3 .	GO to HD2 .

HD2 CHECK FOR OTHER NON-MISFIRE CONTINUOUS MEMORY DTCS

Note: Check for other non-misfire Continuous Memory DTCS, which could cause the misfire DTC.

Are other non-misfire Continuous Memory DTCS present?

Yes	No
ADDRESS the next Continuous Memory DTC. DISREGARD Misfire DTC at this time. GO to Section 4 for Powertrain Diagnostic Trouble Code (DTC) Charts .	GO to HD3 .

HD3 CHECK FOR KEY ON ENGINE OFF (KOEO) DTCS

- Check for any key on, engine off DTCS which could cause the Misfire DTC.

Are any key on, engine off DTCS displayed on the Scan Tool?

Yes	No
GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts , and PROCEED as required.	GO to JB1 to evaluate spark plugs and secondary wires. If OK, GO to HD4 .

HD4 CHECK FOR OTHER KEY ON ENGINE RUNNING DTCS

Note: Check for any other key on, engine running DTCS, which can cause the Misfire DTC.

Are any additional key on, engine running DTCS displayed on the Scan Tool?

--	--

Yes	No
<p>If DTCs P1132, P1138, P1152, P1158, P1131, P1137, P1151 or P1157 are present, GO to HD8.</p> <p>All others: GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts, and PROCEED as required.</p>	<p>If Misfire is present: Those with DPFEGR Systems, GO to HD6.</p> <p>All others: GO to HD7.</p> <p>If Intermittent: GO to Section 2, Diagnostic Methods for Freeze Frame Data and GO to Z1 for Intermittent Diagnosis.</p> <p>If OK, GO to HD7.</p>

HD6 CHECK/COMPARE PID VALUES

- Start engine and warm to normal operating temperature.
- Access DPFEGR PID.
- Record DPFEGR PID value.
- Key off.
- Key on, engine off.
- Access DPFEGR.
- Compare key on, engine off and engine running PID values.

Was engine running PID value within 0.15 volt of key on, engine off value?

Yes	No
KEY OFF. GO to HD7 .	KEY OFF. GO to HE100 .

HD7 EGR RESTRICTION/FLOW TEST

Note: DTCs may be induced and will need to be cleared at end of testing.

- Record and clear codes.
- Disconnect vacuum line at EGR valve and plug the vacuum line.
- Complete Misfire Monitor Drive Cycle.

Is Misfire code still present?

Yes	No
GO to HD8 .	REFER to Workshop Manual Section 303-00, Engine, for EGR and intake port inspection.

HD8 CHECK INJECTOR DRIVER PIDS INJ1F THRU INJ10F

- Key on, engine off.
- Access appropriate INJxF PID(s) for the suspect fuel injector.

Is the PID status Yes?

Yes	No
GO to HD9 .	GO to HD10 .

HD9 CHECK FUEL INJECTOR(S) AND HARNESS FOR OPEN

- Disconnect PCM.
- Measure resistance of fuel injector and harness circuit between the fuel injector and VPWR circuits at the fuel injector harness connector (GO to Pinpoint Test H to refer to the injector connector chart).
- GO to Pinpoint Test HC Refer to the Fuel Delivery System Test Information Chart (at the beginning of the pinpoint test) for injector resistance values.

Is the resistance value(s) within specification?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	GO to <u>H57</u> to diagnose fuel injectors.

HD10 CHECK FUEL PRESSURE



WARNING: THE FUEL SYSTEM WILL REMAIN PRESSURIZED WHEN ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHILE WORKING ON THE FUEL SYSTEM.

- Install fuel pressure gauge.
- Start and run engine at idle. Record fuel pressure.
- Increase engine speed to 2500 rpm and maintain for one minute. Note and compare fuel pressure.

Is the fuel pressure at the specified pressure(GO to Pinpoint Test HC to use the fuel pressure chart)?

Yes	No
KEY OFF. GO to <u>HD11</u> .	REFER to Fuel System General Information, Section 310-00 in the Workshop Manual.

HD11 CHECK ABILITY OF FUEL SYSTEM TO HOLD FUEL PRESSURE

- Start and run engine at idle. Note fuel pressure.
- Increase engine speed to 2500 rpm and maintain for one minute.
- Look for fuel leaking at the fuel injector O-ring, fuel pressure regulator, and the fuel lines to the fuel charging assembly.

Did fuel pressure remain at specification within 34 kPa (5 psi) for 60 seconds?

Yes	No
KEY OFF. GO to <u>HD12</u> .	REFER to Fuel System General Information, Section 310-00 in the Workshop Manual to determine which area within the Fuel Delivery System is at fault.

HD12 CHECK FUEL INJECTOR FOR FLOW AND LEAKAGE

- GO to Pinpoint Test [HC](#) to refer to the Warning, Caution, and Handling, to avoid fuel spillage and injury.
- Verify that the flow rate for each fuel injector is within specification, using Injector Flow Tester.

Is flow rate for each fuel injector within specification?

Yes	No
Fuel delivery system is not likely to have caused the Misfire DTC. GO to HD20 to diagnose the vacuum system.	REPLACE or CLEAN the inoperative fuel injector(s) as required. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

HD20 CHECK VACUUM SYSTEM

Note: Some vacuum leaks can be heard.

- Inspect all vacuum lines for damage, such as pinched lines, cracks, proper routing, and assembly.

Is the vehicle vacuum system OK?

Yes	No
GO to HD21 .	REPAIR the vacuum system. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

HD21 CHECK DAMPER AND PULLEY ASSEMBLY

Note: This Pinpoint Test Step is for engines that have damper-mounted pulse rings. Remove the front cover if necessary to observe the crank pulley.

- Observe the crank pulley for wobble.
- Examine the EI pulse ring fastened to the harmonic fastener.

Does the crank pulley wobble or is the pulse ring loose or damaged?

Yes	No
DISCONNECT battery for 5 minutes to allow PCM to learn new data, due to the old pulse ring. REPLACE the pulley or damper assembly. COMPLETE Misfire Monitor Repair Verification Drive Cycle(REFER to Section 2, Drive Cycles).	GO to HD22 .

HD22 CHECK EVAPORATIVE EMISSION SYSTEM

The Misfire Monitor can be influenced by Evaporative Emission System. The next five Pinpoint Test steps will diagnose the Evaporative Emission System.

- Check the EVAP canister for fuel saturation.

Is there an excess amount of liquid fuel present in the fuel vapor storage canister?

Yes	No
REPLACE EVAP. COMPLETE Misfire Monitor Repair Verification Drive Cycle(REFER to Section 2, Drive Cycles).	CHECK fuel tank vent system. GO to HD23 .

HD23 PRESSURE TEST EVAPORATIVE EMISSION SYSTEM

- Pressure test EVAP emission system.
- Install Rotunda Evaporative Emission System Tester 134-00056 or equivalent first at the EVAP SERVICE port, if equipped, then at the fuel filler cap.
- Follow test instructions from the Tester Kit.

Is evaporative emission system holding pressure?

Yes	No
GO to HD24 .	REPAIR as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

HD24 CHECK VACUUM IN EVAPORATIVE EMISSION SYSTEM

- Check for blockage/restrictions or cut hoses between engine vacuum port and EVAP canister.
- Check for blockage in fuel tank vent system.

Is there a fault indicated?

Yes	No
REPLACE damaged vacuum hoses, or REMOVE blockage/restrictions. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).	GO to HD26 .

HD26 CHECK OF EVAP CANISTER PURGE VALVE HOUSING LEAKS

- EVAP canister purge valve electrically connected.
- Install a hand vacuum pump to the fuel vapor port from EVAP canister on the EVAP canister purge valve vacuum at line.
- Apply 53 kPa (16 in-Hg) of vacuum with the vacuum pump.

Does the EVAP canister purge valve hold vacuum at room temperature?

Yes	No
GO to HD27 .	REMOVE vacuum pump. REPLACE damaged EVAP canister purge valve. COMPLETE PCM Reset to clear DTCs.

HD27 CHECK FOR FILTER CONTAMINATION ON DAMAGE EVAP CANISTER PURGE VALVE

- Vacuum line from input vacuum port to intake manifold on the EVAP canister purge valve (control vacuum solenoid part of valve) is removed.
- Install a hand held vacuum pump to the open input vacuum port on the EVAP canister purge valve.
- Apply 48-52 kPa (10-15 in-Hg) of vacuum to the EVAP canister purge valve.

Does the EVAP canister purge valve hold vacuum, or is the valve very slow to release vacuum to atmosphere?

Yes	No
REPAIR EVAP canister purge valve filter. If unable to clean filter or REMOVE blockage to filter, REPLACE EVAP canister purge valve. COMPLETE Misfire Monitor Repair Verification Drive Cycle.	REMOVE vacuum pump. RECONNECT all components. GO to HD29 .

HD29 CHECK FOR BASE ENGINE CONCERNS

This Pinpoint Test step will determine if there are any base engine concerns that may have caused the Misfire DTC or drive concern.

Note: Engine temperature may affect results.

Perform the following tests in order to evaluate base engine integrity:

- Perform Engine Compression and leakdown tests.
- Perform Valve Train analysis.
- Check Positive Crankcase Ventilation System.
- Check possible leakage points.
- Refer to Engine System-General Information, Section 303-00 in the Workshop Manual for all of the above.

Is any service required?

Yes	No
REFER to Engine System, General Information, Section 303-00 in the Workshop Manual, Diagnosis and Testing, to make repairs.	The cause of the Misfire DTC is intermittent. To diagnose the Ignition System, GO to Z1 . If OK, GO to HD30 .

HD30 CHECK FOR ADDITIONAL MISFIRE DTCS

Diagnostic Trouble Code P0300 indicates multiple cylinders are misfiring or PCM cannot identify which cylinder is misfiring.

Are any other misfire DTCs present?

Yes	No
GO to HD1 .	GO to HD31 .

HD31 CHECK FOR OTHER CONTINUOUS MEMORY DTCS

Are other Continuous Memory DTCS present?

Yes	No
GO to Section 4 for Powertrain Diagnostic Trouble Code (DTC) Charts . PROCEED as required.	GO to HD32 .

HD32 CHECK/COMPARE PID VALUES

- Start engine and warm to normal operating temperature.
- Access DPFEGR PID.
- Record PID value.
- Key off.
- Key on, engine off.
- Access DPFEGR.
- Compare key on, engine off and engine running PID values.

Is engine running DPFEGR PID value within 0.15 volt of key on, engine off value?

Yes	No
KEY OFF. Vehicles with VRS type CMP, GO to HD41 . KEY OFF. Vehicles with hall effect type CMP, GO to HD40 .	KEY OFF. GO to HE100 .

HD40 CHECK CMP SENSOR OUTPUT — PCM DISCONNECTED

Diagnostic Trouble Code (DTC) P1309 indicates Misfire Detection Monitor is not enabled.

- Disconnect PCM.
- Connect digital multimeter.
- Measure voltage between CMP and PWR GND circuits at the PCM harness connector.
- Bump engine in short burst with the starter, without starting engine for at least 10 engine revolutions.

Does digital multimeter reading switch between low (less than 2.0 volts DC) and high (greater than 8.0 volts DC)?

Yes	No
Note: A Hall effect type CMP sensor that is installed out of synchronization will produce a DTC. VERIFY the correct installation by referring to the Electronic Engine Controls, Section 303-14 in the Workshop Manual. If the CMP is installed properly, REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory	REPLACE CMP sensor. RESTORE vehicle. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). RERUN Quick Test.

(EEPROM). RESTORE vehicle. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). RERUN Quick Test.

HD41 CHECK CMP SENSOR OUTPUT — PCM CONNECTED

- Connect PCM.
- Connect digital multimeter.
- Start engine and vary engine RPM.
- Measure voltage between CMP and PWR GND circuits at the PCM harness connector.

Does AC voltage vary greater than 0.1 volt AC?

Yes	No
VERIFY the correct installation by referring to the Electronic Engine Controls, Section 303-14 in the Workshop Manual. If CMP is installed properly, REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>). COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>). RERUN Quick Test.	REPLACE CMP sensor. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).

HE: Exhaust Gas Recirculation (EGR) Systems Introduction

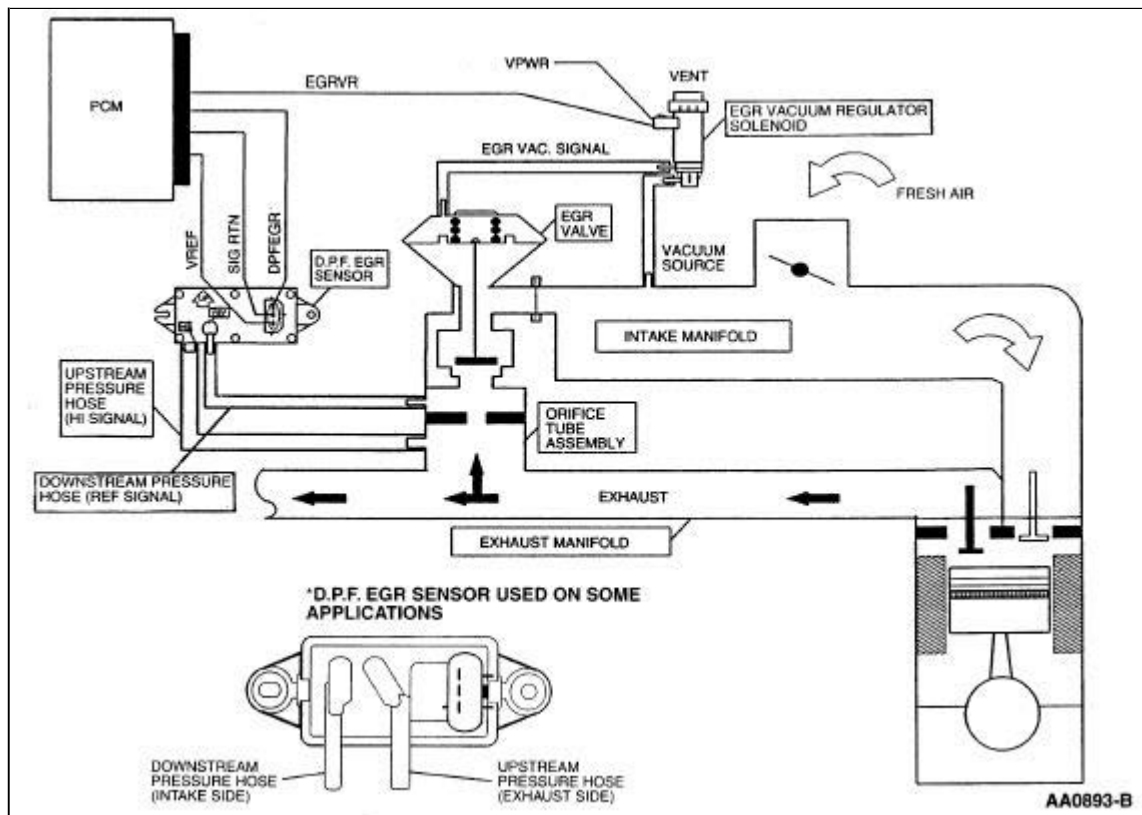
HE: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

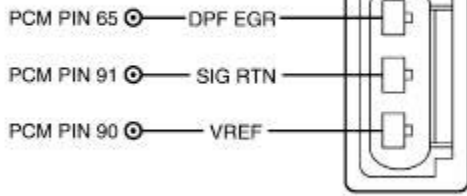
- Differential pressure feedback EGR sensor (9J460)
- Exhaust gas recirculation (EGR) valve (9D460) (9D475)
- EGR vacuum regulator solenoid (9J459)
- Orifice tube assembly (9D477)
- Differential pressure feedback EGR sensor pressure hoses
- Vacuum lines
- Harness circuits: VREF, DPFE, SIG, SIG RTN, EVR, EVR PWR
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematics and Connectors



Taurus/Sable 3.0L 4V

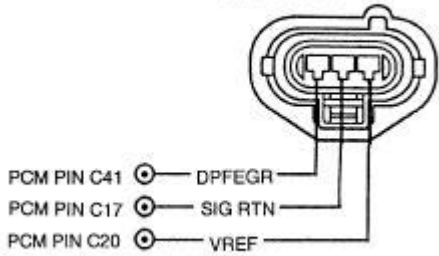
**DIFFERENTIAL PRESSURE
FEEDBACK EGR SENSOR
HARNES CONNECTOR**



**NOTE: ALL HARNES CONNECTORS ARE
VIEWED INTO MATING SURFACE** A0015021

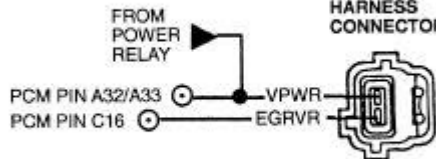
LS6/LS8

**DIFFERENTIAL PRESSURE
FEEDBACK EGR SENSOR
HARNES CONNECTOR**



**NOTE: ALL HARNES CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4822-B

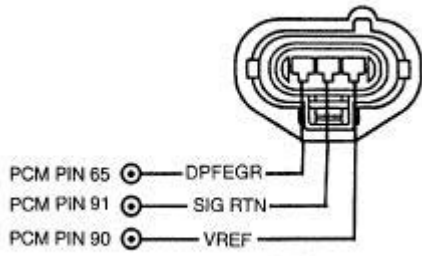
**EGR VACUUM
REGULATOR
SOLENOID
HARNES
CONNECTOR**



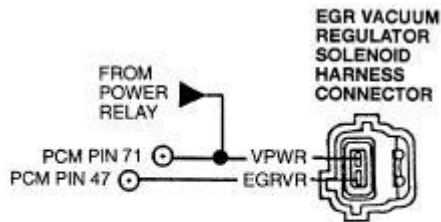
**NOTE: ALL HARNES CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4824-B

All Others

**DIFFERENTIAL PRESSURE
FEEDBACK EGR SENSOR
HARNESS CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4823-A



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4825-A

HE: Exhaust Gas Recirculation (EGR) Systems

← HE: Introduction

HE1 DTC P1400: DETERMINE PRESENT DPFEGR PID VOLTAGE

- Key on, engine off.
- Access DPFEGR PID.

Is DPFEGR PID voltage less than 0.2 volt?

Yes	No
Fault is currently present. KEY OFF. GO to HE2 .	Fault is intermittent. GO to HE5 .

HE2 ATTEMPT TO INDUCE OPPOSITE D.P.F. EGR SENSOR VOLTAGE

- Disconnect D.P.F. EGR sensor.
- Key on, engine off.

Is DPFEGR PID value between 4.0 and 6.0 volts?

Yes	No
REPLACE D.P.F. EGR sensor.	GO to HE3 .

HE3 CHECK VREF AND SIG RTN CIRCUITS FOR OPEN IN HARNESS TO D.P.F. EGR SENSOR

- Measure voltage between VREF and SIG RTN circuits at the D.P.F. EGR sensor harness connector.

Is VREF voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. GO to HE4 .	GO to C1 .

HE4 CHECK DPFEGR CIRCUIT FOR SHORT TO GROUND AND SIG RTN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect scan tool from DLC.
- Disconnect PCM.
- Measure resistance between DPFEGR and SIG. RTN circuits at the PCM harness connector.
- Measure resistance between DPFEGR circuit at the PCM harness connector and battery negative

post.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

HE5 PERFORM WIGGLE TEST ON D.P.F. EGR SENSOR AND CIRCUIT WHILE MONITORING DPFEGR PID FOR A SUDDEN CHANGE

- While monitoring DPFEGR PID, tap on the D.P.F. EGR sensor and wiggle the wiring while looking for a sudden change in value as an indication of an intermittent.

Is intermittent fault found?

Yes	No
REPAIR as necessary.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

HE10 DTC P1401: DETERMINE PRESENT DPFEGR PID VOLTAGE

- Key on, engine off.
- Access DPFEGR PID with a scan tool.

Is DPFEGR PID voltage greater than 4.0 volts?

Yes	No
Fault is currently present. KEY OFF. GO to <u>HE11</u> .	Fault is intermittent. GO to <u>HE19</u> .

HE11 CHECK DPFEGR CIRCUIT FOR SHORT TO PWR

- Disconnect D.P.F. EGR sensor.
- Key on, engine off.
- Measure voltage between DPFEGR circuit at the D.P.F. EGR sensor harness connector and chassis ground.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to <u>HE12</u> .	GO to <u>HE13</u> .

HE12 CHECK DPFEGR CIRCUIT FOR SHORT TO PWR IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Key on, engine off.
- Measure voltage between DPFEGR circuit at the PCM harness connector and the battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
REPAIR short circuit.	REPLACE damaged PCM.

HE13 INDUCE OPPOSITE D.P.F. EGR SENSOR VOLTAGE

- Connect a jumper wire between DPFEGR and SIG RTN circuits at the D.P.F. EGR sensor harness connector.
- **Note:** If a scan tool communication concern exists, key off, remove jumper immediately and GO to [HE18](#).
- Access DPFEGR PID.

Is DPFEGR PID voltage less than 0.05 volt?

Yes	No
REMOVE jumper. GO to HE14 .	Unable to induce opposite signal. KEY OFF. GO to HE16 .

HE14 CHECK VREF VOLTAGE TO D.P.F. EGR SENSOR

- Measure voltage between VREF and SIG RTN circuits at the D.P.F. EGR sensor harness connector.

Is VREF voltage between 4.0 and 6.0 volts?

Yes	No
GO to HE15 .	GO to C1 .

HE15 CHECK DPFEGR CIRCUIT FOR SHORT TO VREF IN HARNESS

- Disconnect PCM.
- Measure resistance between DPFEGR and VREF circuits at the PCM harness connector. (For LS6/LS8 measure to both VREF pins.)

Is resistance greater than 10 K ohms?

Yes	No
REPLACE D.P.F. EGR sensor.	REPAIR short circuit.

HE16 CHECK DPFEGR CIRCUIT FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of DPFEGR circuit between PCM harness connector pin and D.P.F. EGR sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to <u>HE17</u> .	REPAIR open circuit.

HE17 CHECK SIG RTN CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of SIG RTN circuit between PCM harness connector pin and D.P.F. EGR sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR open circuit.

HE18 CHECK DPFEGR CIRCUIT FOR SHORT TO VREF IN HARNESS

- Disconnect PCM.
- Measure resistance between DPFEGR and VREF circuits at the PCM harness connector. (For LS6/LS8 measure to both VREF pins.)

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

HE19 COMPLETE A WIGGLE TEST ON D.P.F. EGR SENSOR AND CIRCUIT WHILE MONITORING DPFEGR PID FOR A SUDDEN CHANGE

- While monitoring DPFEGR PID, tap on the D.P.F. EGR sensor and wiggle the wiring while looking for a sudden change in value as an indication of an intermittent.

Is intermittent fault found?

Yes	No
REPAIR as necessary.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

HE20 DTC P0402: CHECK FOR EGR FLOW AT IDLE WITH EGR VACUUM HOSE DISCONNECTED

Note: If DTC P1405 is in continuous memory, diagnose that first starting with HE50.

- Disconnect vacuum hose at EGR valve and plug hose.
- Run Key On Engine Running (KOER) Self-Test.

Is KOER DTC P0402 output or unable to run KOER Self-Test due to engine stall or no start?

Yes	No
KEY OFF. INSPECT pressure hoses first for pinching and icing. If OK, REMOVE and INSPECT the EGR valve and EGR tube for signs of contamination, unusual wear, carbon deposits, binding and other damage. REPAIR as necessary.	RECONNECT vacuum hose to EGR valve. GO to HE21 .

HE21 CHECK FOR EGR FLOW AT IDLE WITH EGR VACUUM HOSE CONNECTED

- EGR vacuum hose connected.
- Run KOER Self-Test.

Is KOER DTC P0402 output or unable to run KOER Self-Test due to engine stall or no start?

Yes	No
There is possible EGR flow at idle. GO to HE22 .	Fault is intermittent. INSPECT pressure hoses for pinching and icing. REPAIR as necessary. If OK, GO to HE30 .

HE22 CHECK EGR SYSTEM VACUUM HOSES FOR INTEGRITY AND CONNECTION

Note: A pinched or plugged EGR vacuum hose can trap vacuum between the EGR vacuum regulator solenoid and EGR valve not allowing the EGR valve to close.

- Trace each vacuum hose from EGR vacuum regulator solenoid and verify that each hose is connected correctly. (Refer to vehicle vacuum diagram label.)
- Verify that the EGR valve vacuum hose is not pinched or plugged and routed properly.

Are vacuum hoses OK?

Yes	No
RECONNECT vacuum hoses. GO to HE23 .	REPAIR vacuum hoses as necessary.

HE23 CHECK D.P.F. EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP

- Disconnect pressure hoses at D.P.F. EGR sensor.
- Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube).
- Key on, engine off.
- Access DPFEGR PID and note PID value.

- Apply 27 to 30 kPa (8 to 9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds.
- Quickly release vacuum.
 - The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied.
 - The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied.
 - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released.

Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?

Yes	No
REPLACE D.P.F. EGR sensor.	RECONNECT D.P.F. EGR sensor. GO to HE24 .

HE24 CHECK FOR EGR FLOW AT IDLE WITH EGR VACUUM REGULATOR SOLENOID CONNECTOR OFF

- Disconnect vacuum hose at EGR valve and connect hose to vacuum gauge.
- Start engine and bring to an idle.
- While monitoring vacuum gauge, disconnect the EGR vacuum regulator solenoid harness connector.
 - The EGR valve requires vacuum greater than 5.4 kPa (1.6 in-Hg) to begin to open. If the vacuum reading remains greater than 5.4 kPa (1.6 in-Hg) after the EGR vacuum regulator solenoid is electrically disconnected, this would indicate a mechanical fault in the EGR vacuum regulator solenoid.

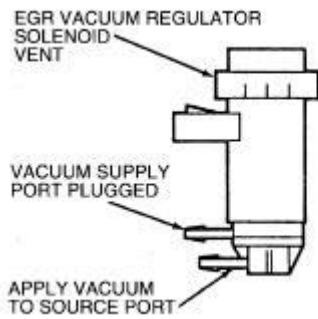
Does the EGR vacuum remain greater than 5.4 kPa (1.6 in-Hg) at idle even after EGR vacuum regulator solenoid is electrically disconnected?

Yes	No
This indicates a fault in the EGR vacuum regulator solenoid. KEY OFF. GO to HE25 .	KEY OFF. GO to HE26 .

HE25 INSPECT EGR VACUUM REGULATOR SOLENOID VENT FOR PLUGGING

Note: A plugged EGR vacuum regulator solenoid vent will not allow EGR vacuum to vent to atmosphere.

- Disconnect EGR vacuum regulator solenoid vacuum hoses.
- Remove EGR vacuum regulator solenoid vent cap (if removable).
- Remove filter and inspect for blockage or icing in some cases.
- With the EGR vacuum supply port plugged, apply 34 to 51 kPa (10 to 15 in-Hg) of vacuum directly to EGR vacuum regulator solenoid vacuum source port with a hand vacuum pump. If the vacuum holds or is slow to release to atmosphere, the EGR vacuum regulator solenoid vent could be plugged or restricted.



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Is the EGR vacuum regulator solenoid vent or vent filter plugged or restricted?

Yes	No
REPAIR EGR vacuum regulator solenoid as necessary. If unable to repair, REPLACE EGR vacuum regulator solenoid.	REPLACE EGR vacuum regulator solenoid.

HE26 MEASURE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Measure resistance across EGR vacuum regulator solenoid.

Is resistance between 26 and 40 ohms?

Yes	No
GO to HE27 .	REPLACE EGR vacuum regulator solenoid.

HE27 CHECK EGRVR CIRCUIT FOR SHORT TO GROUND IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect scan tool from DLC.
- Disconnect PCM.
- Measure resistance between EGRVR circuit at the PCM harness connector and battery negative post.

Is resistance greater than 10,000 ohms?

Yes	No
GO to HE28 .	REPAIR short circuit.

HE28 CHECK EGRVR CIRCUIT FOR SHORT TO VREF

- Measure resistance between EGRVR and VREF circuits at the PCM harness connector. (For LS6/LS8 measure to both VREF pins.)

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash	

Electrically Erasable Programmable Read Only Memory (EEPROM).

REPAIR short circuit.

HE30 CHECK D.P.F. EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP

- Disconnect pressure hoses at D.P.F. EGR sensor.
- Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube).
- Key on, engine off.
- Access DPFEGR PID and note PID value.
- Apply 27 to 30 kPa (8 to 9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds
- Quickly release vacuum.
 - The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied.
 - The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied.
 - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released.

Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?

Yes	No
REPLACE D.P.F. EGR sensor.	RECONNECT D.P.F. EGR sensor. GO to HE31 .

HE31 CHECK D.P.F. EGR SENSOR VOLTAGE WHILE EXERCISING EGR VALVE

- Key on, engine off.
- View DPFEGR PID and make note of voltage.
 - Typical D.P.F. EGR sensor voltage with no EGR flow is between 0.2 and 1.3 volt.
- Disconnect vacuum hose at EGR valve and plug hose.
- Connect a hand vacuum pump to EGR valve.
- Start engine and bring to idle.
- Observe DPFEGR PID at idle and compare to the key on engine off voltage. (A higher voltage at idle could be due to a non-seating EGR valve.)
- Apply just enough vacuum to EGR valve to open it 7-10 kPa (2-3 in-Hg) without stalling engine and release vacuum. Repeat several times while observing DPFEGR PID. (DPFEGR PID voltage must increase as valve begins to open and return to initial value as vacuum is released. A slow to return voltage could be an indication of a binding or a slow-closing EGR valve.)

Does the DPFEGR PID voltage indicate an open, binding or slow-closing EGR valve?

Yes	No
REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding and other damage. REPAIR as necessary.	KEY OFF. GO to HE32 .

HE32 MONITOR EGR VALVE VACUUM WHILE WIGGLING EGRVR CIRCUIT

Note: An intermittent short to GND in the EGRVR circuit will cause the vacuum applied to the EGR valve to be higher than normal while the short is present. The vacuum available at the EGR valve at idle is normally below 3.4 kPa (1.0 in-Hg) and it takes about 5.4 kPa (1.6 in-Hg) for the valve to begin to open.

- Remove hand vacuum pump.
- Connect vacuum gauge to EGR valve vacuum hose.
- Key on, engine running.
- Observe vacuum gauge for an indication of a fault while performing the following:
 - Lightly tap on the EGR vacuum regulator solenoid; wiggle the EGR vacuum regulator solenoid connector and vehicle harness between solenoid and PCM. A fault is indicated by a sudden jump in vacuum reading.

Is intermittent fault found?

Yes	No
ISOLATE fault and REPAIR as necessary.	RECONNECT vacuum hose. KEY OFF. GO to <u>HE33</u> .

HE33 INSPECT EGR VACUUM REGULATOR SOLENOID AND VACUUM HOSES FOR POTENTIAL PLUGGING

- Remove EGR vacuum regulator solenoid vent filter and inspect for contamination and excessive water absorption. (In cold climate, excessive water in filter could freeze and plug the EGR vacuum regulator solenoid vent.)
- Inspect EGR vacuum hose for possible blockage or pinching.

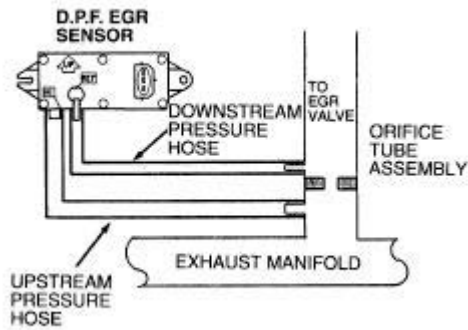
Is EGR vacuum regulator solenoid vent or filter contaminated or vacuum hose plugged?

Yes	No
REPAIR EGR vacuum regulator solenoid or EGR vacuum hose as necessary.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

HE50 DTC P1405: INSPECT UPSTREAM PRESSURE HOSE CONNECTIONS

- Inspect upstream hose at D.P.F. EGR sensor and orifice tube assembly for disconnect or poor connection.

Is hose off or poorly connected?



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Yes	No
REPAIR as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).	GO to HE51 .

HE51 INSPECT UPSTREAM PRESSURE HOSE FOR PLUGGING

Note: It is essential that the D.P.F. EGR pressure hose used is the correct repair part and not a substitute.

- Visually inspect upstream pressure hose routing. Hose must not be pinched or have dips in it where water could settle or freeze.
- Remove upstream pressure hose and carefully inspect for plugging, water or leaks.

Is there a fault detected in the hose?

Yes	No
REPAIR or REPLACE upstream pressure hose as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).	GO to HE52 .

HE52 CHECK ORIFICE TUBE ASSEMBLY AND D.P.F. EGR SENSOR

- Inspect the upstream connection on the D.P.F. EGR sensor for plugging or damage at the sensor.
- Inspect the exhaust manifold side pressure pickup tube at the orifice tube assembly for plugging or damage.

Is the D.P.F. EGR sensor or orifice tube assembly plugged or damaged?

Yes	No
REPAIR or REPLACE D.P.F. EGR sensor or orifice tube assembly as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).	GO to HE53 .

HE53 CHECK D.P.F. EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND

PUMP

- Disconnect pressure hoses at D.P.F. EGR sensor.
- Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube).
- Key on, engine off.
- Access DPFEGR PID and note PID value.
- Apply 27 to 30 kPa (8 to 9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds.
- Quickly release vacuum.
 - The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied.
 - The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied.
 - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released.

Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?

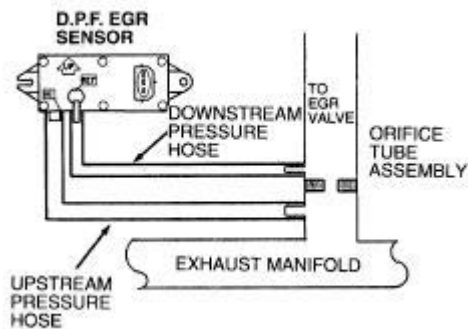
Yes	No
REPLACE D.P.F. EGR sensor. COMPLETE an EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).	Unable to duplicate or identify fault at this time. GO to Z1 .

HE60 DTC P1406: INSPECT DOWNSTREAM PRESSURE HOSE CONNECTIONS

Note: If the fault is currently present, DTC P1408 will be output in Key On Engine Running (KOER) Self-Test.

- Inspect downstream hose at D.P.F. EGR sensor and orifice tube assembly for disconnect or poor connection.

Is hose OFF or poorly connected?



Yes	No
REPAIR as necessary.	GO to HE61 .

HE61 INSPECT DOWNSTREAM PRESSURE HOSE FOR PLUGGING

Note: It is essential that the D.P.F. EGR sensor pressure hose is the correct repair part and not a substitute.

- Visually inspect downstream pressure hose routing. Hose must not be pinched or have dips in it where water can settle or freeze.
- Remove downstream pressure hose and carefully inspect for plugging, water or leaks.

Is there a fault detected in the hose?

Yes	No
REPAIR or REPLACE as necessary.	GO to HE62 .

HE62 CHECK ORIFICE TUBE ASSEMBLY AND D.P.F. EGR SENSOR

- Inspect the connections at the D.P.F. EGR sensor for plugging or damage.
- Inspect the intake manifold side pressure pickup tube and orifice tube assembly for plugging, loose connection or damage.

Is the D.P.F. EGR sensor or orifice tube assembly plugged, loose or damaged?

Yes	No
REPAIR or REPLACE D.P.F. EGR sensor or orifice tube assembly as necessary.	GO to HE63 .

HE63 CHECK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP

- Disconnect pressure hoses at D.P.F. EGR sensor.
- Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube).
- Key on, engine off.
- Access DPFEGR PID and note PID value.
- Apply 27 to 30 kPa (8 to 9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds.
- Quickly release vacuum.
 - The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied.
 - The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied.
 - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released.

Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?

Yes	No
REPLACE D.P.F. EGR sensor.	Unable to duplicate or identify fault at this time. GO to Z1 .

HE70 DTC P0401: RUN KOER SELF-TEST

- Run KOER Self-Test.

Is KOER DTC P1408 output?

Yes	No
Fault is currently present. GO to HE71 .	GO to HE90 .

HE71 DTC P1408: RETRIEVE CONTINUOUS MEMORY DTCS

Note: If any DTC other than DTC P1406 is output, record DTC and refer to [Diagnostic Trouble Code \(DTC\) Charts](#) in Section 4 after completing this Pinpoint Test.

- Retrieve all Continuous Memory DTCs.

Is DTC P1406 output?

Yes	No
GO to HE60 .	GO to HE72 .

HE72 RUN KOER SELF-TEST WHILE MONITORING EGR VACUUM

- Disconnect vacuum hose at EGR valve and connect hose to a vacuum gauge.

Note: Since the EGR vacuum hose is disconnected, ignore DTCs during this KOER Self-Test.

- Run Key On Engine Running (KOER) Self-Test while monitoring gauge. Approximately 30 seconds into test, EGR flow will be requested for a few seconds. The vacuum at this time should increase above 5.4 kPa (1.6 in-Hg) to open the valve.

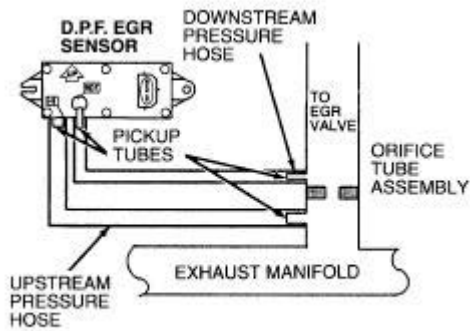
Does the vacuum increase to 10 kPa (3.0 in-Hg) or greater at any time during KOER Self-Test?

Yes	No
The vacuum indicated is sufficient to open the EGR valve. Fault is unlikely to be in EGR vacuum control system. KEY OFF. GO to HE73 .	The vacuum indicated is insufficient to open the EGR valve. KEY OFF. GO to HE80 .

HE73 INSPECT D.P.F. EGR SENSOR PRESSURE HOSES

- Visually inspect both pressure hoses for reversed connection at D.P.F. EGR sensor or at orifice tube assembly.
- Inspect both hoses for improper routing. Hoses should not be pinched or have dips where water could settle or freeze.
- Inspect both hoses for leaks and blockage.
- Inspect D.P.F. EGR sensor and orifice tube assembly for blockage or damage at the pickup tubes.

Is a fault detected?



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Yes	No
REPAIR pressure hoses as necessary.	GO to HE74 .

HE74 CHECK D.P.F. EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP

- Disconnect pressure hoses at D.P.F. EGR sensor.
- Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube.)
- Key on, engine off.
- Access DPFEGR PID and note PID value.
- Apply 27-30 kPa (8-9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds.
- Quickly release vacuum.
 - The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied.
 - The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied.
 - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released.

Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?

Yes	No
REPLACE D.P.F. EGR sensor.	RECONNECT pressure hoses. GO to HE76 .

HE76 CHECK EGR VALVE FUNCTION BY APPLYING VACUUM WITH HAND PUMP

- Disconnect vacuum hose at EGR valve and plug hose.
- Connect a hand vacuum pump to EGR valve.
- Start engine and bring to idle.
- Access DPFEGR and rpm PIDs.
- Slowly apply 27 to 34 kPa (8 to 10 in-Hg) of vacuum to the EGR valve and hold it for 10 seconds. If engine wants to stall, increase rpm with throttle to maintain a minimum of 1000 rpm.
- Look for the following:
 - EGR valve starts opening at about 5.4 kPa (1.6 in-Hg) vacuum indicated by increasing DPFEGR PID voltage.
 - DPFEGR PID voltage increasing until EGR valve is fully open. DPFEGR PID must read 2.5 volts minimum with full vacuum applied.

- DPFEGR PID voltage steady when vacuum is held. If voltage drops within a few seconds, the EGR valve or vacuum source can be leaking.

Does the DPFEGR PID voltage indicate that the EGR valve is operating as described in this test?

Yes	No
GO to HE85 .	REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding, leaking diaphragm and other damage. If EGR valve is OK, look for an obstructed EGR port in the intake manifold or plugged orifice tube assembly. REPAIR as necessary.

HE80 CHECK VACUUM SOURCE AND VACUUM HOSES TO AND FROM EGR VACUUM REGULATOR SOLENOID

- Inspect vacuum lines between vacuum source and EGR vacuum regulator solenoid and between EGR vacuum regulator solenoid and EGR valve for leaks, kinks, disconnects, blockage, routing or any damage.
- Disconnect vacuum hoses at EGR vacuum regulator solenoid.
- Connect EGR vacuum regulator solenoid vacuum source hose to a vacuum gauge.
- With engine warm and at idle, take vacuum gauge reading.

Is the vacuum gauge reading a minimum of 51 kPa (15 in-Hg) at idle and vacuum lines OK?

Yes	No
KEY OFF. GO to HE81 .	ISOLATE fault and REPAIR as necessary.

HE81 CHECK VPWR VOLTAGE TO EGR VACUUM REGULATOR SOLENOID

- Disconnect EGR vacuum regulator solenoid.
- Key on, engine off.
- Measure VPWR circuit voltage at EGR vacuum regulator solenoid harness connector.

Is EGR vacuum regulator solenoid VPWR voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to HE82 .	REPAIR open circuit.

HE82 CHECK EGR VACUUM REGULATOR SOLENOID RESISTANCE

- Measure EGR vacuum regulator solenoid resistance.

Is solenoid resistance between 26 and 40 ohms?

Yes	No
GO to HE83 .	REPLACE EGR vacuum regulator solenoid.

HE83 CHECK EGRVR CIRCUIT FOR SHORT TO PWR IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Key on, engine off.
- Measure voltage between EGRVR circuit at the PCM harness connector and battery negative post.

Is voltage greater than 1.0 volt?

Yes	No
REPAIR short circuit.	KEY OFF. GO to HE84 .

HE84 CHECK EGRVR CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of EGRVR circuit between PCM harness connector pin and EGR vacuum regulator solenoid harness connector.

Is resistance less than 5.0 ohms?

Yes	No
RECONNECT PCM and EGR vacuum regulator solenoid. GO to HE85 .	REPAIR open in EGRVR circuit.

HE85 CHECK EGR VACUUM REGULATOR SOLENOID VACUUM OUTPUT CAPABILITY BY GROUNDING EGRVR CIRCUIT

- Disconnect vacuum hose at the EGR valve and connect to a vacuum gauge.
- Key on, engine running.
- With engine at idle, jumper PCM EGRVR circuit to chassis ground.

Is vacuum gauge reading 13.5 kPa (4.0 in-Hg) or greater?

Yes	No
REPLACE PCM (refer to section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPLACE EGR vacuum regulator solenoid.

HE90 INSPECT EGR SYSTEM FOR AN INTERMITTENT FAILURE

- Visually inspect the EGR system for signs of intermittent failure.

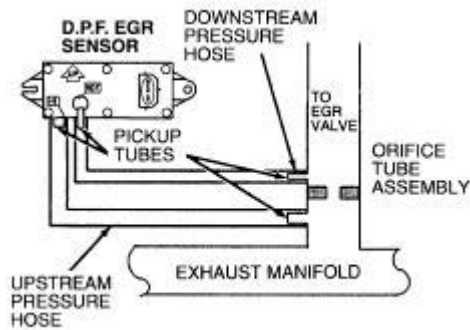
Is a fault found?

Yes	No
REPAIR fault as necessary.	GO to HE91 .

HE91 INSPECT D.P.F. EGR SENSOR PRESSURE HOSES

- Visually inspect both pressure hoses for reversed connection at D.P.F. EGR sensor or at orifice tube assembly.
- Inspect both hoses for improper routing. Hoses should not be pinched or have dips where water could settle or freeze.
- Inspect both hoses for leaks and blockage.
- Inspect D.P.F. EGR sensor and orifice tube assembly for blockage or damage at the pickup tubes.

Is a fault detected?



A21169-B

Yes	No
REPAIR pressure hoses as necessary.	GO to <u>HE92</u> .

HE92 CHECK D.P.F. EGR SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP

- Disconnect pressure hoses at D.P.F. EGR sensor.
- Connect a hand vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube.)
- Key on, engine off.
- Access DPFEGR PID and note PID value.
- Apply 27-30 kPa (8-9 in-Hg) vacuum to the D.P.F. EGR sensor and hold for a few seconds.
- Quickly release vacuum.
 - The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key on and no vacuum applied.
 - The DPFEGR PID voltage must increase to greater than 4.0 volts with the vacuum applied.
 - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when vacuum is released.

Does the DPFEGR PID voltage indicate a fault in the D.P.F. EGR sensor?

Yes	No
REPLACE D.P.F. EGR sensor.	RECONNECT pressure hoses. GO to <u>HE93</u> .

HE93 CHECK EGR VALVE FUNCTION BY APPLYING VACUUM WITH HAND PUMP

- Disconnect vacuum hose at EGR valve and plug hose.
- Connect a hand vacuum pump to EGR valve.
- Start engine and bring to idle.
- Access DPFEGR and RPM PIDs.
- Slowly apply 17 to 34 kPa (5 to 10 in-Hg) of vacuum to the EGR valve and hold it for 10 seconds. If engine wants to stall, increase rpm with throttle to maintain a minimum of 800 rpm.
- Look for the following:
 - EGR valve starts opening at about 5.4 kPa (1.6 in-Hg) vacuum indicated by increasing DPFEGR PID voltage.
 - DPFEGR PID voltage increasing until EGR valve is fully open. DPFEGR PID should read 2.5 volts minimum with full vacuum applied.
 - DPFEGR PID voltage steady when vacuum is held. If voltage drops within a few seconds, the EGR valve or vacuum source could be leaking.

Does the DPFEGR PID voltage indicate that the EGR valve is operating as described in this test?

Yes	No
GO to HE94 .	REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding, leaking diaphragm and other damage. If EGR valve is OK, look for an obstructed EGR port in the intake manifold. REPAIR as necessary.

HE94 INSPECT EGR VACUUM SIGNAL SUPPLY FOR INTERMITTENT FAILURE

- Disconnect plugged hose at EGR valve and connect to a vacuum gauge.
- Key on, engine running.
- Connect a jumper wire between EGRVR circuit and ground to activate the solenoid to full on. At idle, the vacuum gauge should read above 13.5 kPa (4.0 in-Hg).
- Observe vacuum gauge for an indication of a fault while performing the following:
 - Lightly tap on the EGR vacuum regulator solenoid and wiggle the EGR vacuum regulator solenoid connector, vacuum lines and vehicle harness between the solenoid and PCM. A fault is indicated by a sudden drop in vacuum reading.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	Unable to duplicate or identify fault at this time. (In cold climates, the EGR valve may temporarily freeze shut and thaw when the engine warms up causing the intermittent DTC.) GO to Z1 .

HE100 EGR DIAGNOSIS BY SYMPTOM: CHECK FOR EGR FLOW WITH EGR VACUUM HOSE DISCONNECTED AND PLUGGED

Note: Perform KOER Self-Test and repair any DTCs before proceeding with this test.

The symptom charts have indicated possible EGR flow at idle with no EGR diagnostic trouble codes output.

Possible causes:

- EGR valve not fully seating.
- EGR vacuum regulator solenoid vent restricted.
- Damaged EGR vacuum regulator solenoid.
- Disconnect vacuum hose at EGR valve and plug hose.
- Key on, engine off.
- Access DPFEGR PID and note voltage.
- Start engine and bring to idle.
- With engine at idle, look at the DPFEGR PID voltage and compare to the engine off reading. An increase in the voltage at idle indicates that the differential pressure feedback EGR sensor is sensing EGR flow.

Is the DPFEGR PID voltage greater at idle by a minimum of 0.15 volt than with the engine off?

Yes	No
The DPFEGR PID voltage is indicating EGR flow at idle. Since the EGR vacuum hose is disconnected and plugged, the fault is most likely in the EGR valve. REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding and other damage. REPAIR as necessary.	This indicates a fault in the EGR valve vacuum supply. INSPECT the EGR vacuum regulator solenoid vent and vent filter for restrictions. REPAIR as necessary. If OK, REPLACE EGR vacuum regulator solenoid.

HE110 DTC P1409: CHECK EGR VACUUM REGULATOR SOLENOID RESISTANCE

- Disconnect EGR vacuum regulator solenoid.
- Measure EGR vacuum regulator solenoid resistance.

Is solenoid resistance between 26 and 40 ohms?

Yes	No
GO to <u>HE111</u> .	REPLACE EGR vacuum regulator solenoid.

HE111 CHECK VPWR VOLTAGE TO EGR VACUUM REGULATOR SOLENOID

- Key on, engine off.
- Measure VPWR circuit voltage at EGR vacuum regulator solenoid harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to <u>HE112</u> .	REPAIR open in VPWR circuit.

HE112 CHECK EGRVR CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of EGRVR circuit between PCM Pin and EGR vacuum regulator solenoid harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to HE113 .	REPAIR open in EGRVR circuit.

HE113 CHECK EGRVR CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on, engine off.
- Measure voltage between EGRVR at the PCM harness connector and battery negative post.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to HE114 .	REPAIR short circuit.

HE114 CHECK EGRVR CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Measure resistance between EGRVR and PWR GND circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

HE120 CONTINUOUS MEMORY DTC P1409: WIGGLE EGR VACUUM REGULATOR SOLENOID WHILE MONITORING VPWR

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

Note: If DTC P1409 was output in Key On Engine Off (KOEO) or Key On Engine Running (KOER) Self-Test, GO to [HE110](#) to diagnose present fault.

- Disconnect PCM.
- Key on.
- Measure voltage between EGRVR and PWR GND circuits at the PCM harness connector.
- Voltage must read greater than 10.5 volts. For an indication of a fault, look for this voltage to drop while performing the following:
 - Lightly tap on the EGR vacuum regulator solenoid.
 - Wiggle the EGR vacuum regulator solenoid connector.
 - Grasp the EGR vacuum regulator solenoid harness connector and wiggle wires between solenoid and PCM.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

HF: Catalyst Efficiency Monitor and Exhaust Systems Introduction

HF: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Exhaust system pipes (front and rear)
- Exhaust system muffler and tailpipe assembly
- Catalytic converter
- Exhaust manifold
- Harness circuits: Downstream heated oxygen sensors (HO2S)

HF: Pinpoint Tests →

HF: Catalyst Efficiency Monitor and Exhaust Systems

← HF: Introduction

HF1 DTCs P0420 OR P0430: CHECK FOR MISFIRE DETECTION MONITOR DTCS

NOTE 1: Be sure customer has not:

1. Refueled vehicle with leaded gasoline.
2. Noticed high vehicle oil consumption.

NOTE 2: If entering this Pinpoint Test for symptoms only, immediately GO to [HF5](#).

NOTE 3: Internal deterioration of a catalytic converter is usually caused by abnormal engine operation upstream of the catalyst. Events that can produce higher than normal temperatures in the catalyst are particularly suspect. For example, misfiring can cause higher than normal catalyst operating temperatures.

- Retrieve and record all Continuous Memory DTCs (MIL and non-MIL).

Were any of the following Misfire Detection Monitor DTCs recorded: P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309 and P0310?

Yes	No
GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts , to address the Misfire Detection Monitor DTCs.	GO to HF2 .

HF2 CHECK FOR HO2S MONITOR DTCS

NOTE: Incorrect HO2S signal input (such as rich/lean input signal when the engine is operating under lean/rich conditions) can cause an abnormal temperature increase in the catalyst.

Were any of the following HO2S monitor DTCs recorded in HF1: P0136, P0138 and P0141 (Bank 1, rear HO2S) or P0156, P0158 and P0161 (Bank 2, rear HO2S)?

Yes	No
GO to, Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts , to address the HO2S Monitor DTCs.	GO to HF3 .

HF3 CHECK FOR ECT OR CHT SENSOR DTCS

Note: ECT or CHT sensor DTCs can indicate that the thermostat is not operating correctly or that the engine coolant level is not filled to specification, producing above normal operating temperatures.

Were any of the following ECT or CHT sensor DTCs recorded in HF1: P0117, P0118, P0125, P1117, P1285, P1288, P1289, P1290 and P1299?

Yes	No
GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts , to address the ECT or CHT sensor DTCs.	GO to HF4 .

HF4 CHECK FOR ANY OTHER DTCS

Were any other DTCs recorded in HF1 (not including the initial P0420 or P0430 DTCs)?

Yes	No
GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts , to address the DTCs.	GO to HF5 .

HF5 CHECK REAR HO2S WIRING AND PCM CONNECTIONS

Note: If the electrical connections of the rear HO2S are interchanged/crossed, the Catalyst Efficiency Monitor Test will fail.

- Inspect the wiring of each rear HO2S for proper routing and connection.
- Disconnect the PCM, inspect for damaged or pushed out pins, corrosion and loose wires.

Are there any concerns with the HO2S wiring or the PCM connection?

Yes	No
REPAIR any wiring or connection concerns. For PCM pin concerns, REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). COMPLETE Catalyst Monitor OBD II Drive Cycle to verify repair (Refer to Section 2, Drive Cycles).	No Electronic EC root causes related to the DTCs or symptoms. GO to HF6 .

HF6 CHECK FUEL PRESSURE



WARNING: THE FUEL SYSTEM WILL REMAIN PRESSURIZED WHEN THE ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHEN WORKING ON THE FUEL SYSTEM.

Note: Fuel pressures above specification can produce an abnormally rich air/fuel mixture. The rich air/fuel mixture can cause higher than normal catalyst operating temperatures.

- RETURN FUEL SYSTEM
 - Inspect the vacuum hose going to the fuel pressure regulator for proper installation and cracks. Repair as necessary.
 - Verify vacuum source to fuel pressure regulator.
- MECHANICAL RETURNLESS FUEL SYSTEM
 - If applicable, inspect the vacuum hose going to the fuel rail pulse damper for proper installation and cracks. Repair as necessary.
- Install fuel pressure gauge. NOTE: On Electronic Returnless Fuel System, the fuel pressure can

be monitored by scan tool using the Fuel Rail Pressure (FRP) sensor PID.

- Start and run the engine at idle. Record the fuel pressure.
- Increase engine speed to 2500 rpm and maintain for one minute. Record the fuel pressure. GO to Pinpoint Test [HC](#) and compare fuel pressure to the Fuel Pressure Delivery System Test Information Chart at the beginning of the pinpoint.
- Key off.

Was the fuel pressure within specifications?

Yes	No
Fuel pressure is OK. If applicable, REMOVE the fuel pressure gauge. GO to HF7 .	Fuel pressure is out of specification. GO to HC4 , Fuel Delivery Systems in Section 5 for diagnosis.

HF7 CHECK FOR OBVIOUS LEAK SOURCES IN THE EXHAUST SYSTEM

Note: If a catalyst is in series with a leaking exhaust system, it can fail the Catalyst Efficiency Monitor test.

- Inspect the following for leaks, cracks, loose connections or punctures:
 - Exhaust manifold.
 - Front exhaust pipe.
 - Rear exhaust pipe.
 - Muffler/tailpipe assembly.

Are the above components free of cracks and punctures, etc.?

Yes	No
GO to HF8 .	REPAIR the leak source(s). COMPLETE Catalyst Monitor OBD II Drive Cycle to verify repair (Refer to Section 2, Drive Cycles).

HF8 CHECK FOR OBVIOUS RESTRICTIONS IN THE EXHAUST SYSTEM

- Inspect the following for dents, areas of collapsed material and unusual bending:
 - Front exhaust pipe.
 - Rear exhaust pipe.
 - Muffler/tailpipe assembly.

Are the components free of dents and areas of collapsed material or unusual bending, etc.?

Yes	No
GO to HF9 .	REPAIR the restricted component(s) as necessary. COMPLETE Catalyst Monitor OBD II Drive Cycle to verify repair (Refer to Section 2, Drive Cycles).

HF9 CHECK MANIFOLD VACUUM FOR INDICATION OF EXCESSIVE EXHAUST SYSTEM RESTRICTION

- Attach a vacuum gauge to the intake manifold vacuum source.
- Monitor RPM with scan tool or tachometer.
- Observe the vacuum gauge needle while completing the following:

Note: The vacuum gauge reading may be normal when the engine is first started and idling. However, excessive restriction in the exhaust system will cause intake manifold vacuum to decrease with the engine at a steady/constant idle speed.

- Start the engine and gradually increase the engine speed to 2000 rpm with the transmission in NEUTRAL.
- Decrease engine speed to base idle rpm.
- Key off.

Did manifold vacuum rise above 54 kPa (16 inches-Hg) with the engine speed at 2000 rpm?

Yes	No
GO to HF10 .	Manifold vacuum did not reach an acceptable level. GO to HF11 to check for excessive restriction in the exhaust system.

HF10 CHECK MANIFOLD VACUUM FOR INDICATION OF MODERATE EXHAUST SYSTEM RESTRICTION

- Key on, engine idling.
- Increase the engine speed gradually from base idle rpm to 2000 rpm with the transmission in NEUTRAL.
- Observe the speed the vacuum gauge needle rises, while maintaining the increased engine rpm.
- NOTE 1: On a non-restricted exhaust system, the vacuum gauge needle will rise quickly to the normal range as the increased rpm is maintained.
- NOTE 2: On a restricted exhaust system, the vacuum gauge needle will rise slowly to the normal range as the increased rpm is maintained.
- NOTE 3: The rate of speed the vacuum gauge needle rises to the normal range is slower on a restricted system than on a non-restricted system as the increased rpm is maintained.
- Decrease engine speed to base idle rpm.
- Key off.

Is the rate of speed that the vacuum gauge needle rises back to the normal range (above 54 kPa (16 inches-Hg)) much slower than that of a non-restricted system?

Yes	No
A moderate restriction may be present. GO to HF11 .	No indications of restrictions or leaks have been detected in the exhaust system. If here because of DTCs P0420 or P0430, the catalytic converter is chemically inactive. REPLACE the catalytic converter. COMPLETE Catalyst Monitor OBD II Drive Cycle to verify repair (Refer to Section 2, Drive Cycles). For further diagnosis of symptom (e.g. Lack of Power, Loss of Power, or No Start) REFER to Section 3 , Symptom Charts.

HF11 CHECK MANIFOLD VACUUM WITH EXHAUST MANIFOLD DISCONNECTED FOR INDICATION OF A RESTRICTION

Note: An intake manifold gasket leak can also cause the vacuum gauge needle to remain well below the normal range.

- Disconnect exhaust system immediately after the exhaust manifold.
- GO to [HF10](#) and repeat the vacuum measurement.

Did the vacuum needle QUICKLY rise above 54 kPa (16 inches-Hg) with the engine speed at 2000 rpm?

Yes	No
<p>The exhaust system restriction is downstream of the exhaust manifold. RECONNECT exhaust system at exhaust manifold. GO to HF12.</p>	<p>A restriction is present in the exhaust manifold. INSPECT each exhaust port for casting flash/restrictions by dropping a length of chain into it (NOTE: Do not use a wire or lamp to check the ports. The restriction can be small enough for both to pass through, but large enough to cause excessive back-pressure at high engine rpm.). REPLACE the exhaust manifold if unable to remove the casting flash/restriction. COMPLETE Catalyst Monitor OBD II Drive Cycle to verify repair (Refer to Section 2, Drive Cycles).</p>

HF12 CHECK MANIFOLD VACUUM WITH MUFFLER/TAILOPIPE ASSEMBLY DISCONNECTED FOR INDICATION OF A RESTRICTION

- Disconnect muffler/tailpipe assembly from the catalytic converter.
- GO to [HF10](#) to repeat the vacuum measurement.

Did the vacuum needle QUICKLY rise above 54 kPa (16 inches-Hg) with the engine speed at 2000 rpm?

Yes	No
<p>There is a restriction in the muffler/tailpipe assembly. REPLACE the muffler/tailpipe assembly. COMPLETE Catalyst Monitor OBD II Drive Cycle to verify repair (Refer to Section 2, Drive Cycles).</p>	<p>There is a restriction in the catalytic converter. REPLACE the catalytic converter. INSPECT the muffler to be certain converter debris has not entered. COMPLETE Catalyst Monitor OBD II Drive Cycle to verify repair (Refer to Section 2, Drive Cycles).</p>

HG: Positive Crankcase Ventilation (PCV) System Introduction

HG: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose only the following:

- Positive Crankcase Ventilation (PCV) valve (6A666) and related vacuum lines

HG: Pinpoint Tests →

HG: Positive Crankcase Ventilation (PCV) System

← HG: Introduction

HG1 STUCK PCV VALVE CHECK

- Verify PCV valve maintenance schedule has been followed.
- Verify proper PCV valve part number.
- Verify clean PCV valve.
- Shake the PCV valve.

Does PCV valve rattle when shaken?

Yes	No
REINSTALL PCV valve. GO to HG2 .	PCV valve is sticking. REPLACE PCV valve. VERIFY a symptom no longer exists.

HG2 PCV SYSTEM CHECK

- Start engine and bring to normal operating temperature.
- Disconnect closure (fresh air) hose from remote air cleaner or air outlet tube (tube connecting mass air flow sensor and throttle body).
- Place a stiff piece of paper over the hose end. Wait one minute.

Does vacuum hold the paper in place?

Yes	No
PCV System is OK. RETURN to Section 3 for other possible causes of vehicle symptoms.	System is leaking/plugged or Evaporative Emission System is leaking. GO to HG3 .

HG3 EVAPORATIVE EMISSION SYSTEM CHECK

Note: If the evaporative emission hose is not connected to the PCV hose, follow the No Action to Take (refer to VECI decal).

- Disconnect evaporative emission hose at connection to PCV hose (if equipped). Cap the connector.
- Again place a stiff piece of paper over the closure (fresh air) hose end, as in **HG2**. Wait one minute.

Does vacuum now hold the paper in place?

Yes	No
PCV system is OK. REFER to Evaporative Emission Section 303-13 in the Workshop	CHECK for vacuum leaks/obstruction in the PCV system (such as oil cap, PCV valve, hoses, cut grommets, valve cover bolt

Manual.

torque/gasket leak). REPAIR as necessary.

HK: Variable Cam Timing (VCT) Introduction

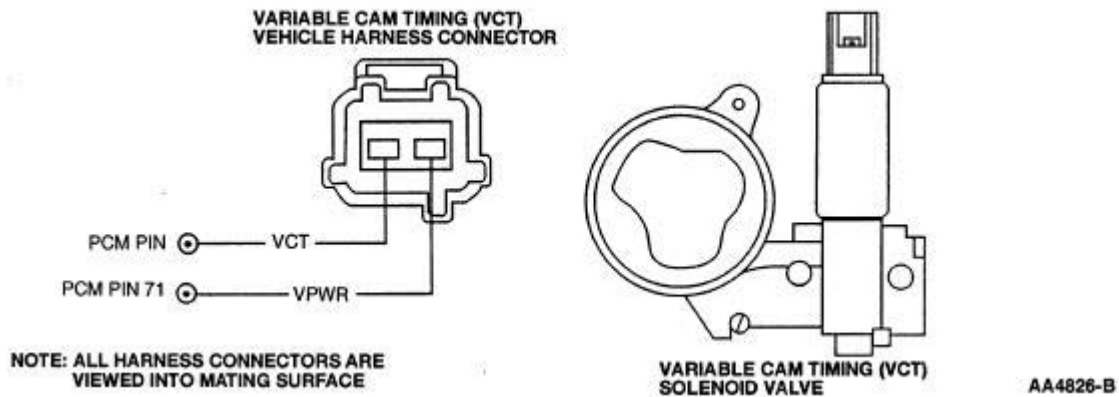
HK: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Powertrain Control Module (PCM) (12A650)
- Harness circuits: VCT and VPWR
- VCT Solenoid (6L713)

Pinpoint Test Schematic



PCM CONNECTOR PINOUT

Application	VPWR	SIG RTN	PWR GND	VCT
2.0L Contour/Mystique/ Cougar (with returnless fuel system)	71	91	51/77/103	45
All others	71	91	51/77/103	44

HK: Pinpoint Tests →

HK: Variable Cam Timing (VCT)

← HK: Introduction

HK1 DTC P1380: CHECK FOR KOEO OR KOER DTC

- Start engine and bring up to operating temperature.
- Check for DTC P1380 during KOEO or KOER Self-Test.

Is DTC P1380 present during KOEO or KOER Self-Test?

Yes	No
KEY OFF. GO to <u>HK2</u> .	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

HK2 CHECK VPWR VOLTAGE AT VCT SOLENOID VALVE HARNESS CONNECTOR

- Disconnect the VCT solenoid valve harness connector.
- Key on.
- Measure VCT circuit voltage at the VCT solenoid valve harness connector.

Is the voltage reading greater than 10.5 volts?

Yes	No
KEY OFF. GO to <u>HK3</u> .	KEY OFF. REPAIR VPWR circuit.

HK3 CHECK VCT CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of VCT circuit between PCM harness connector pin and the VCT solenoid valve harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
GO to <u>HK4</u> .	REPAIR open circuit.

HK4 CHECK VCT CIRCUIT FOR SHORT TO GROUND AND VPWR IN HARNESS

- Measure resistance between VCT PCM Pin and PCM Pins VPWR, SIG RTN and PWR GND.

Is each resistance greater than 10,000 ohms?

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Yes	No
GO to HK5 .	REPAIR short to GND or PWR.

HK5 CHECK VCT SOLENOID VALVE COIL RESISTANCE

- Measure resistance of the VCT solenoid valve coil at the two connector terminals.

Is the resistance between 3.0 and 6.0 ohms?

Yes	No
GO to HK6 .	REPLACE VCT solenoid valve assembly.

HK6 CHECK VCT SOLENOID VALVE FOR SHORT TO CASE

- Measure resistance between each connector terminal of the VCT solenoid valve and the solenoid body.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPLACE VCT solenoid valve.

HK11 DTC P1381 AND P1383: CHECK VCT FOR PROPER OPERATION

- Key on.
- Check for DTC P1381 or P1383 in KOER Self-Test.

Are P1381 or P1383 present during KOER Self-Test?

Yes	No
KEY OFF. DTC P1381 or P1383 present. GO to HK12 .	KEY OFF. Unable to duplicate or identify fault at this time. GO to Z1 .

HK12 CHECK CAMSHAFT TIMING

- Verify camshaft timing. Refer to Engine, Section 303-01 in the Workshop Manual.

Is the camshaft timing within specification?

Yes	No
Camshaft advance mechanism is seized. REPLACE camshaft advance mechanism. REFER to Engine, Section 303-01B in the Workshop Manual for proper repair direction. COMPLETE PCM Reset to clear DTCs. RERUN Quick Test.	REFER to Powertrain/Engine, Section 303-01 in the Workshop Manual for proper direction in setting cam timing. RERUN Quick Test.

HM: Secondary Air Injection (AIR) System Introduction

HM: Pinpoint Tests →

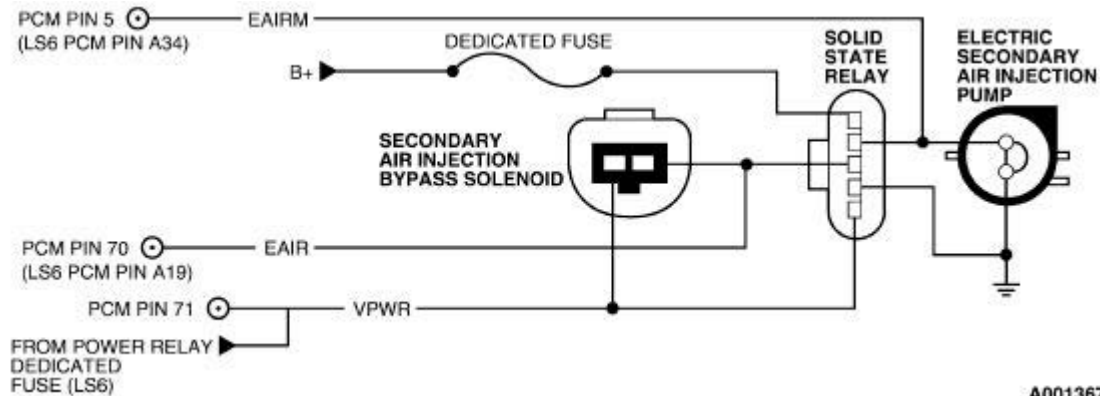
Note

This Pinpoint Test is intended to diagnose the following:

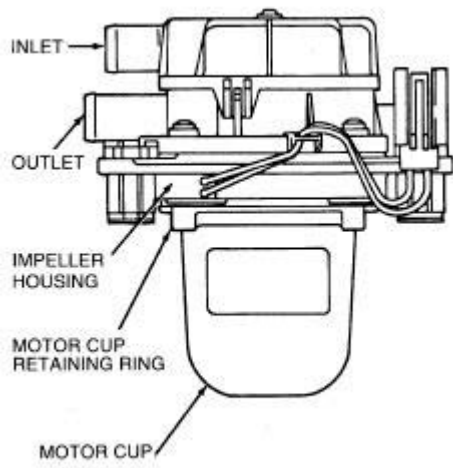
- Harness circuits: B+, EAIR, EAIR Monitor, Ground, AIRB
 - Solid state relay (SSR) (2C013)
 - Electric secondary air injection (AIR) pump (9A486)
 - Secondary air injection (AIR) bypass solenoid (9H465)
 - Powertrain control module (PCM) (12A650)
-
- Secondary air injection (AIR) diverter valve (9F491)
 - Vacuum supply
 - Air silencer (9H467)
 - Secondary air injection (AIR) check valve (12A197)
 - Hoses (9B460)
 - Partial restricted exhaust

Pinpoint Test Schematics and Connectors

Secondary Air Injection System Connectors



Electric AIR Pump



AA0919-B

HM: Pinpoint Tests →

HM: Secondary Air Injection (AIR) System

← HM: Introduction

HM1 DTC P0412: CHECK B+ VOLTAGE TO SOLID STATE RELAY

- Disconnect SSR.
- Key on, engine off.
- Measure voltage of B+ circuit at SSR harness connector and battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
Supplied voltage is OK, GO to HM2 .	GO to HM6 .

HM2 CHECK EAIR CIRCUIT FOR OPEN IN HARNESS

- Key off.
- Disconnect AIR bypass solenoid.
- Remove Secondary Air Injection System dedicated fuse temporarily.
- Disconnect PCM.
- Measure resistance of EAIR circuit between PCM harness connector pin and SSR harness connector and AIR bypass harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to HM3 .	REPAIR open circuit.

HM3 CHECK EAIR CIRCUIT FOR SHORT TO POWER AND GROUND WITH DISCONNECTED AIR BYPASS SOLENOID

- Measure resistance between EAIR and VPWR circuits at the PCM harness connector.
- Measure resistance between EAIR at the PCM harness connector and battery negative post.

Is each resistance greater than 10,000 ohms?

Yes	No
The EAIR harness is OK. GO to HM4 .	REPAIR short circuit.

HM4 CHECK AIR BYPASS SOLENOID RESISTANCE

- Disconnect AIR bypass solenoid harness connector.
- Measure AIR bypass solenoid resistance.

Is resistance between 50 and 100 ohms?

Yes	No
GO to HM5 .	REPLACE AIR bypass solenoid.

HM5 CHECK EAIR CIRCUIT FOR SHORT TO POWER AND GROUND WITH SOLID STATE RELAY RECONNECTED

- AIR bypass solenoid disconnected.
- Reconnect solid state relay.
- Measure resistance of EAIR circuit between VPWR and PWR GND circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
<p>If DTC P0411 is present:</p> <p>GO to HM9.</p> <p>All others:</p> <p>GO to HM16.</p>	REPLACE solid state relay.

HM6 CHECK B+ CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of B+ circuit between solid state relay harness connector and Secondary Air Injection System dedicated fuse.

Is resistance less than 5.0 ohms?

Yes	No
CHECK VPWR circuit for short to ground. REPLACE fuse. GO to HM8 to check electric AIR pump. RECONNECT solid state relay.	REPAIR open circuit. RECONNECT solid state relay and fuse.

HM7 DTC P0411: VISUALLY INSPECT ELECTRIC AIR PUMP HOSES AND AIR SILENCER (9H467)

- Visually inspect electric AIR pump hoses from the electric AIR pump to the AIR diverter valves.
- Visually inspect for damaged exhaust system.
- Inspect air hose for cracks, binding, obstructions, water or ice.
- Inspect Air silencer (9H467) for obstructions.


Are electric AIR pump hoses and Air silencer (9H467)OK?

Yes	No
GO to HM8 .	DRAIN all water from hoses or REPLACE damaged parts.

HM8 CHECK ELECTRIC AIR PUMP OPERATION

- Key on, engine off.
- Enter output test mode

Does the pump run?

Yes	No
KEY OFF. GO to <u>HM17</u> to check electric AIR pump for water contamination.	KEY OFF. Possible intermittent concern. GO to <u>Z2</u> . If OK, GO to <u>HM13</u> .  CAUTION: RUNNING OUTPUT TEST MODE LONGER THAN TWO MINUTES MAY OVERHEAT/DAMAGE AIR PUMP.

HM9 CHECK FOR VACUUM AT AIR DIVERTER VALVES

- Connect a vacuum gauge to the control vacuum hose at the AIR diverter valve(s).
- Apply 53kPa (16in-HG) of vacuum at the intake manifold side of the AIR bypass solenoid vacuum supply hose.
- Key on, engine off.
- Enter output test mode

Is vacuum present at the AIR Diverter valve(s)?

Yes	No
GO to <u>HM10</u> .	GO to <u>HM32</u> .

HM10 CHECK AIR DIVERTER VALVE(S) INTEGRITY

 **CAUTION: Caution must be observed while performing this test.**

Note: On a two valve system make sure that air is flowing from both valves.

- Disconnect air tube from AIR diverter valve(s) outlet side.
- Inspect AIR diverter valve(s) outlets for damage from hot exhaust gases. Repair as necessary.
- Apply 53kPa (16in-HG) of vacuum to the AIR diverter valve(s).
- Key on, engine off.
- Enter output test mode.

Is air present from the AIR diverter valve(s)?

Yes	No
KEY OFF. INSPECT the exhaust tubes from the AIR diverter valve to the exhaust manifold (s). If OK, GO to <u>HM11</u> .	KEY OFF. INSPECT hose from electric AIR pump to AIR diverter valve(s). If OK, REPLACE the appropriate AIR diverter valve (s).

HM11 CHECK MANIFOLD VACUUM WITH EXHAUST MANIFOLD DISCONNECTED FOR INDICATION OF A RESTRICTION

Note: An intake manifold gasket leak can also cause the vacuum gauge needle to remain well below the normal range.

- Disconnect exhaust system immediately after the exhaust manifold.
- Observe the rate of speed the vacuum gauge needle rises, while maintaining 2000 rpm.

Note: The rate of speed the vacuum gauge needle rises to the normal range is slower on a restricted system than on a non-restricted system as the increased rpm is maintained.

Did the vacuum needle QUICKLY rise above 54 kPa (16 inches-Hg) with the engine speed at 2000 rpm?

Yes	No
<p>The exhaust system restriction is downstream of the exhaust manifold. RECONNECT exhaust system at exhaust manifold. GO to HM12.</p>	<p>A restriction is present in the exhaust manifold. INSPECT each exhaust port for casting flash/restrictions by dropping a length of chain into it (NOTE: Do not use a wire or lamp to check the ports. The restriction can be small enough for both to pass through, but large enough to cause excessive back-pressure at high engine rpm.). REPLACE the exhaust manifold if unable to remove the casting flash/restriction.</p>

HM12 CHECK MANIFOLD VACUUM WITH MUFFLER/TAILOPIPE ASSEMBLY DISCONNECTED FOR INDICATION OF A RESTRICTION

- Disconnect muffler/tailpipe assembly from the catalytic converter.
- GO to [HM11](#) to repeat the vacuum measurement.

Did the vacuum needle QUICKLY rise above 54 kPa (16 inches-Hg) with the engine speed at 2000 rpm?

Yes	No
<p>There is a restriction in the muffler/tailpipe assembly. REPLACE the muffler/tailpipe assembly.</p>	<p>There is a restriction in the catalytic converter. REPLACE the catalytic converter. INSPECT the muffler to be certain converter debris has not entered.</p>

HM13 CHECK VOLTAGE ON EAIR MONITOR CIRCUIT

- Disconnect electric AIR pump.
- Key on, engine off.
- Enter output test mode.
- Measure voltage of EAIR monitor circuit between electric AIR pump harness connector and battery negative post.

Is voltage greater than 10.5 volts?

Yes	No

GO to [HM15](#).

GO to [HM14](#).

HM14 CHECK ELECTRIC AIR PUMP GROUND FOR OPEN IN HARNESS

- Measure resistance of EAP ground circuit between electric AIR pump harness connector and battery negative post.

Is resistance less than 5 ohms?

Yes	No
GO to HM21 .	REPAIR open circuit.

HM15 CHECK AIR HOSE TO ELECTRIC AIR PUMP

- Disconnect inlet air hose.
- Visually inspect inlet air hose for binding, obstructions, water or ice to the electric AIR pump.

Is the hose integrity or orientation OK?

Yes	No
GO to HM17 .	DRAIN all water from air hose. REPLACE or RE-ORIENT hose as appropriate. GO to HM17 .

HM16 CHECK SOLID STATE RELAY OUTPUT

- Reconnect AIR bypass solenoid.
- Connect PCM.
- Key on, engine off.
- Enter output test mode.
- Access AIR PID.
- Access AIRM PID.
- Compare AIR and AIRM PIDs.

Were both PIDs on?

Yes	No
REPLACE solid state relay.	Possible intermittent concern. GO to Z2 . If no problem is found, REPLACE PCM (REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

HM17 CHECK AIR PUMP FOR WATER

Note: Water ingested in the electric AIR pump will reduce the life of the pump.

- Disconnect electric AIR pump connector and air hoses.

- Carefully tilt electric AIR pump in various positions to verify if any water is present.

Is any water present?

Yes	No
REPLACE electric AIR pump.	If fuse was replaced, GO to <u>HM6</u> , Testing is complete. All others, GO to <u>HM9</u> .

HM19 DTC P1413: CHECK B+ CIRCUIT VOLTAGE TO SOLID STATE RELAY

- Disconnect solid state relay.
- Key on.
- Measure voltage of B+ circuit between solid state relay harness connector and chassis ground.

Is voltage greater than 10.5 volts?

Yes	No
GO to <u>HM20</u> .	GO to <u>HM26</u> .

HM20 CHECK FOR VPWR TO SOLID STATE RELAY

- Key on, engine off.
- Measure VPWR circuit voltage at the solid state relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to <u>HM21</u> .	For LS6 : GO to <u>B5</u> . All others : REPAIR open VPWR circuit between the solid state relay and Electronic Engine Control power relay.

HM21 CHECK VOLTAGE ON EAIR MONITOR CIRCUIT

- Reconnect solid state relay.
- Disconnect electric AIR pump.
- Key on, engine off.
- Enter output test mode.
- Access AIRM PID.

Is PID on?

Yes	No

GO to [HM25](#). REMAIN in output test mode.

If DTC P0411 is present, REPLACE electric AIR pump. GO to [HM22](#). REMAIN in output test mode.

HM22 CHECK EAIR MONITOR VOLTAGE TO PCM

- Key on, engine off.
- Access AIRM PID.

Is PID on?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	GO to HM23 .

HM23 CHECK EAIR DRIVER AND EAIR MONITOR CIRCUIT FOR OPEN IN HARNESS

- Disconnect solid state relay.
- Measure resistance of EAIR driver circuit between PCM harness connector and solid state relay harness connector.
- Measure resistance of EAIR monitor circuit between PCM harness connector and solid state relay harness connector.
- Measure resistance of EAIR monitor circuit between the solid state relay harness connector and the electric AIR pump harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to HM24 .	REPAIR open circuit.

HM24 CHECK EAIR MONITOR CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Measure resistance between EAIR monitor and PWR GND circuit at the PCM harness connector.

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE solid state relay.	REPAIR short circuit.

HM25 CHECK EAIR MONITOR VOLTAGE TO PCM

- Reconnect electric AIR pump.
- Reconnect PCM.
- Key on, engine off.
- Access AIRM PID.

Is PID on?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR open EAIR circuit.

HM26 CHECK B+ CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of B+ circuit between solid state relay harness connector and dedicated fuse B+ circuit.

Is resistance less than 5 ohms?

Yes	No
REPLACE solid state relay dedicated fuse.	REPAIR open circuit.

HM27 DTC P1414: CHECK EAIR MONITOR CIRCUIT FOR OPEN IN HARNESS

- Disconnect solid state relay.
- Disconnect PCM.
- Disconnect electric AIR pump.
- Measure resistance of EAIR monitor circuit between PCM harness connector and electric AIR pump harness connector.

Is resistance less than 5 ohms?

Yes	No
GO to <u>HM28</u> .	REPAIR open circuit.

HM28 CHECK ELECTRIC AIR PUMP FOR OPEN

- Measure electric AIR pump resistance.

Is resistance between 0.5-5.0 ohms?

Yes	No
GO to <u>HM29</u> .	REPLACE electric AIR pump.

HM29 CHECK EAIR MONITOR CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on.
- Measure voltage between PCM harness connector and chassis ground.

Is voltage greater than 10.5 volts?

Yes	No
REPAIR short circuit.	EAIR Monitor circuit is OK. GO to <u>HM30</u> .

HM30 CHECK SOLID STATE RELAY OUTPUT

- Reconnect AIR bypass solenoid.
- Connect PCM.
- Key on, engine off.
- Enter output test mode.
- Access AIR PID.
- Access AIRM PID.
- Compare AIR and AIRM PIDs.

Were both PIDs on?

Yes	No
REPLACE solid state relay.	REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).

HM32 CHECK VACUUM HOSE INTEGRITY

- Key off.
- Check vacuum hose between Intake manifold and AIR diverter valve(s).
- Check for blockage and restrictions.
- Check for leaks and cracks.
- Check for kinks or disconnects.

Are the above checks OK?

Yes	No
GO to <u>HM33</u> .	REPLACE damaged vacuum hose.

HM33 CHECK AIR BYPASS SOLENOID ELECTRICAL OPERATION

- Key on, engine off.
- Access Output Test Mode.
- Disconnect AIR bypass solenoid.
- Connect digital multimeter to AIR bypass solenoid vehicle harness connector.
- Turn the outputs on, then turn outputs off while observing digital multimeter.

Does EAIR circuit voltage cycle greater than 0.5 volt?

Yes	No
REMAIN in Output Test Mode. GO to <u>HM34</u> .	Key off. GO to <u>HM35</u> .

HM34 CHECK AIR BYPASS SOLENOID FOR MECHANICAL OPERATION

- Reconnect AIR bypass solenoid.

- Disconnect source vacuum hose from AIR bypass solenoid.
- Apply 53 kPa (16 in-Hg) of vacuum to source side of AIR bypass solenoid.
- Turn the outputs on, then turn outputs off.

Was vacuum released?

Yes	No
REPAIR vacuum hose from manifold vacuum tree to AIR bypass solenoid. If OK, GO to <u>Z2</u> .	REPLACE AIR bypass solenoid.

HM35 CHECK AIR BYPASS SOLENOID RESISTANCE

- Disconnect AIR bypass solenoid harness connector.
- Measure AIR bypass solenoid resistance.

Is resistance between 50 and 100 ohms?

Yes	No
GO to <u>HM36</u> .	REPLACE AIR bypass solenoid.

HM36 CHECK VPWR CIRCUIT FOR OPEN IN HARNESS

- Key on, engine off.
- Measure VPWR circuit voltage at the AIR bypass solenoid harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to <u>HM37</u> .	REPAIR open VPWR circuit (and dedicated fuse on LS6).

HM37 CHECK EAIR CIRCUIT FOR OPEN IN HARNESS

- Disconnect solid state relay.
- Disconnect PCM.
- Measure resistance of EAIR circuit between PCM harness connector and the AIR bypass solenoid harness connector and at the solid state relay harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to <u>HM38</u> .	REPAIR open EAIR circuit.

HM38 CHECK EAIR CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Measure resistance between EAIR and PWR GND circuits at the PCM harness connector.

Is resistance greater than 10,000 ohms?

Yes	No
GO to <u>HM39</u> .	REPAIR short to ground.

HM39 CHECK EAIR CIRCUIT FOR SHORT TO POWER IN HARNESS

- Measure resistance between EAIR and PWR GND circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short to power.

HU: Intake Air Systems Introduction

HU: Pinpoint
Tests →

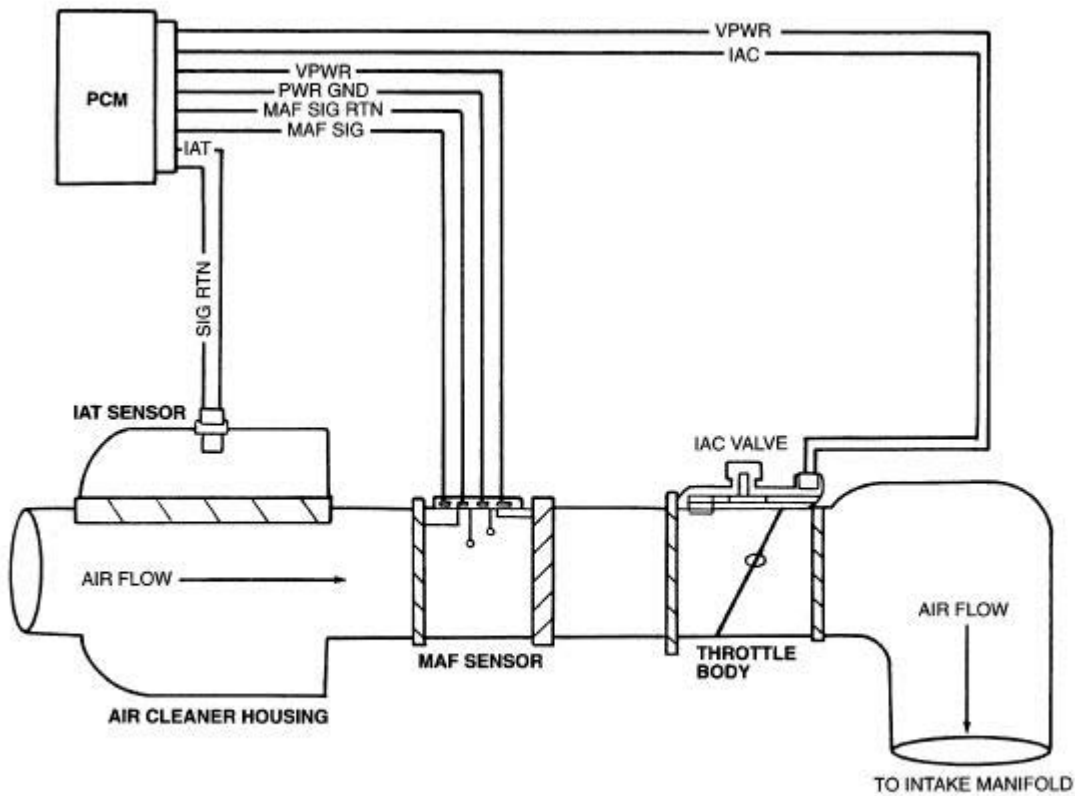
Note

This Pinpoint Test is intended to diagnose the following:

- Throttle body assembly (9E926)
- Speed control cable (9A825)
- Accelerator cable linkage to throttle body (9C799)
- Air cleaner assembly (including air cleaner element)
- Air inlet tube
- Clean air tube hose and resonator (9R504)(9F593)
- Intake manifold runner control housing assembly (IMRC) (9U531) (9U524) and (9J447)
- IMRC actuator assembly (9J559)
- IMSC actuator assembly (9L492)
- Harness circuits: IMRC/IMSC, IMRC/IMSC Monitor, SIG RTN, PWR GND, VREF, VPWR
- Intake manifold tuning valve (IMT Valve) electric (9L490)
- Powertrain control module (PCM) (12A650)

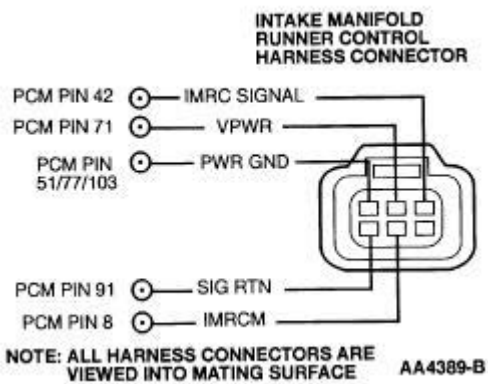
Pinpoint Test Schematics and Connectors

Intake Air System

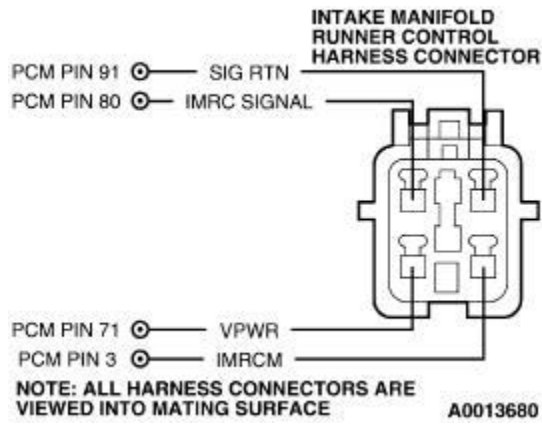


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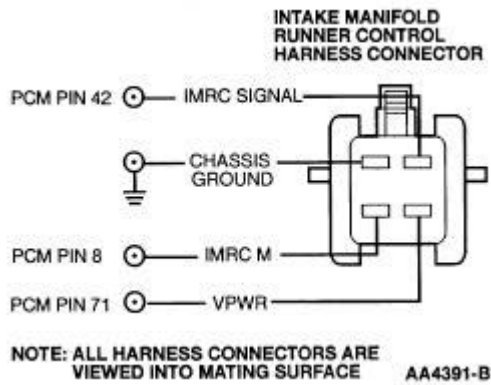
2.5L Cougar



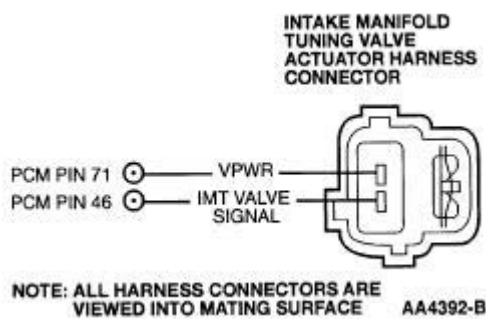
2.0L (2V) Focus/Escort



3.8L Mustang, 3.8L Windstar, 4.2L E/F-Series

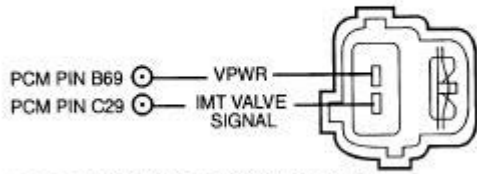


4.6L Expedition/F-Series, 5.4L E-Series, 4V Expedition/Navigator



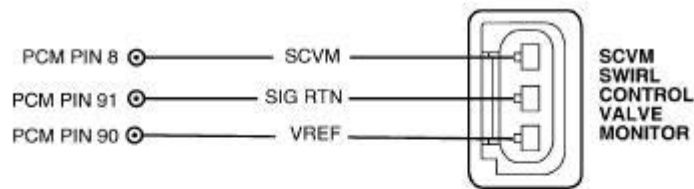
3.0L LS6

**INTAKE MANIFOLD
TUNING VALVE
ACTUATOR HARNESS
CONNECTOR**

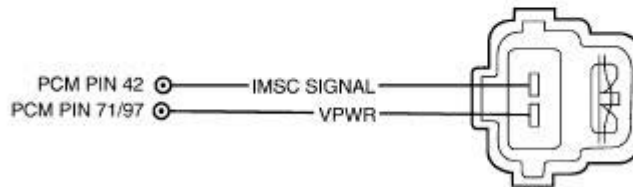


**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4393-B

2.3L (4V) Ranger



**INTAKE MANIFOLD
SWIRL CONTROL
ACTUATOR HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**

A0026390

HU: Intake Air Systems

← HU: Introduction

HU1 CHECK FOR INCORRECT IDLE SPEED

Note: Vehicle must be at operating temperature and at idle for a minimum of one minute. If here for a part throttle symptom, GO to HU4.

- Key on, engine running.
- Determine if idle speed is incorrect. Refer to the Typical Reference Value Charts in Section 6, if necessary.
- Read the vehicle tachometer (if equipped) or connect the scan tool to the data link connector (DLC) and view the rpm PID.

Is vehicle idle speed incorrect?

Yes	No
For a high idle concern, be sure throttle arm contacts return stop, then GO to <u>HU6</u> . For other idle speed concerns, GO to <u>HU7</u> .	KEY OFF. GO to <u>HU2</u> .

HU2 CHECK FOR STICKING/BINDING CONDITION

- Gently cycle throttle from fully closed to fully open and back to fully closed. Check for binding/sticking in travel.

Is a stick or bind condition present?

Yes	No
GO to <u>HU3</u> .	GO to <u>HU4</u> .

HU3 ISOLATE BINDING/STICKING CONCERN

- Disconnect accelerator cable and speed control cable from throttle body linkage.



CAUTION: Do not attempt to clean the throttle bore and plate area. Cleaning will damage the throttle body assembly.

Note: Sticking or binding condition can either be within cables or throttle body assembly.

- Rotate throttle body linkage.

Does the throttle body rotate freely without a sticking, binding or grabbing condition?

Yes	No
REPAIR cable(s) causing the concern.	REPLACE throttle body assembly.

HU4 CHECK FUNCTIONALITY OF THE THROTTLE POSITION SENSOR

- Key on.
- View TP V PID with the scan tool.
- From closed throttle, slowly begin to press accelerator to wide open throttle.

Did the TP V PID display a smooth reading during accelerator movement?

Yes	No
KEY OFF. GO to HU5 .	REPLACE throttle position sensor.

HU5 CHECK FOR AIR CLEANER ELEMENT AND INLET FOR RESTRICTIONS

- Remove air cleaner element. Check for a plugged or dirty element.
- Check for any restrictions along the air inlet path from the air inlet back to the throttle body.

Are any restrictions present?

Yes	No
REPLACE air cleaner element or clear any restrictions.	REINSERT original air cleaner element. GO to HU6 .

HU6 CHECK FOR A POSITIVE CRANK VENTILATION CONCERN

Note: A high idle may indicate incorrect PCV valve size or vacuum leak.

- Inspect PCV valve connections for leaks or cracks.
- Remove PCV valve and inspect for plugging or an incorrect valve.

Is a PCV concern present?

Yes	No
REPLACE PCV valve or REPAIR leak or crack.	For high idle, GO to HU9 , otherwise, RECONNECT PCV valve. GO to HU7 .

HU7 CHECK FOR IDLE AIR CONTROL VALVE RESPONSE

- Key on, engine running.
- With vehicle at operating temperature and at idle for a minimum of one minute, disconnect the IAC valve harness connector.

Did engine idle speed drop or nearly stall?

Yes	No
GO to HU8 .	For a high idle with no idle speed drop when disconnecting IAC, GO to HU9 . For a low idle with no idle speed drop when disconnecting IAC, REPLACE the IAC valve.

HU8 INSPECT THROTTLE BODY PLATE HOLE FOR PLUGGING

Note: Only some applications have a throttle plate hole. If not equipped, return to symptom charts.

- Detach resonator from throttle body assembly.
- Inspect throttle plate hole for any restrictions.

Is the throttle plate hole restricted?

Yes	No
CLEAR throttle plate hole.	Return to Symptom Charts.

HU9 CHECK FOR VACUUM LEAKS

- Listen for vacuum leaks.
- Inspect entire air intake system from the mass air flow (MAF) sensor to the intake manifold for leaks such as:
 - cracked or punctured inlet air tube.
 - loose connections on the inlet air tube at the air cleaner housing or throttle body.
 - idle air control (IAC) valve assembly or gasket seal.
 - EGR valve gasket seal leak to intake manifold.
 - intake manifold assembly or gasket seal.
 - EGR valve diaphragm or control solenoid.
 - vacuum supply connectors and hose.

Are any leaks detected?

Yes	No
KEY OFF. REPAIR any leaks.	REPLACE IAC valve if idle speed does not drop when disconnecting harness connector otherwise, KEY OFF. GO to HU10 .

HU10 CHECK THROTTLE BODY FOR EXCESSIVE WEAR

- Remove throttle body assembly (refer to Intake Air Distribution and Filtering, Section 303-12 in the Workshop Manual).
- Hold throttle body up to a light source.
- Rotate the throttle lever to wide open throttle and inspect bore for excessive wear or grooving.
- Rotate the throttle lever to closed throttle position while inspecting for misaligned or worn plate. Look for excessive gap between bore and plate area.

Is a concern detected?

Yes	No
REPLACE throttle body.	RETURN to Symptom Charts.

HU15 DTCS P1516, P1517, P1518, P1519, P1520, P1537, P1538 VISUAL INSPECTION

Note: Refer to the PCM connector pin numbers in the beginning of the pinpoint test.

- View linkage or cable routing. Check for any binding or improper routing. Cable core wire (if applicable) at IMRC/IMSC housing attachment must have slack and lever must contact close plate stop screw. For Focus/Escort and 2.3L Ranger, a visual inspection may not be appropriate. GO to [HU17](#). Refer to the IMRC/IMSC system description in [Section 1](#), Intake Air and Throttle Body, for illustrations.

Note: The IMRC/IMSC return springs are strong. Make sure the return springs operate properly and plates open and close fully. On vacuum operated systems engine must run for 20 seconds then return to KOEO for testing.

- Manually open and close IMRC/IMSC plates at intake manifold and feel for sticking/binding.

Is concern indicated?

Yes	No
GO to HU16 .	GO to HU17 .

HU16 PERFORM IMRC/IMSC PHYSICAL TEST

- Disconnect IMRC/IMSC linkage or cables(s) from runner(s) or remove actuator assembly for Focus/Escort.

Note: IMRC/IMSC return springs are strong.

- Rotate IMRC/IMSC lever(s) fully open to fully closed without obstruction and contacting closed stop screw.
- Feel for sticking or binding during rotation and spring tension of approximately .34 to .45 Nm (3 to 4 lb-in).

Is concern indicated?

Yes	No
CLEAN or REPAIR runners. REFER to Intake Air Distribution and Filtering, Section 303-12 in the Workshop Manual. GO to HU38 .	REPLACE IMRC/IMSC actuator. GO to HU38 .

HU17 PERFORM IMRC/IMSC FUNCTIONAL TEST

- Connect scan tool to data link connector (DLC).
- Key on, engine off.

Note: All except Focus and 2.3L Ranger, if the IMRC/IMSC plates open immediately when the key is turned on with engine off, GO to [HU23](#).

For Focus and 2.3L Ranger, monitor IMRCM/SCVM PID or voltage. GO to [HU23](#) if PID displays less than 1 volt.

- Access Output Test Mode (OTM) (refer to [Section 2](#)).



WARNING: KEEP FINGERS CLEAR OF IMRC/IMSC LEVER/CABLE MECHANISM.

- Turn all outputs on.
- When IMRC/IMSC is commanded on, lever(s) should rotate to full-open position. At least one of the levers should contact the wide open stop, the other may be slightly off the wide open stop. For Focus/Escort and 2.3L Ranger, listen for IMRC/IMSC to actuate.

Did the IMRC/IMSC lever(s) cycle from fully closed and remain fully open while all outputs were on?

Yes	No
GO to HU25 .	GO to HU18 .

HU18 CHECK IMRC/IMSC ACTUATOR VPWR CIRCUIT FOR AN OPEN IN HARNESS

- Disconnect IMRC/IMSC actuator harness connector.
- Measure VPWR circuit voltage at the IMRC/IMSC actuator harness connector.

Is IMRC/IMSC VPWR voltage greater than 10.5 volts?

Yes	No
GO to HU19 . For Focus/Escort, GO to HU20 .	KEY OFF. REPAIR open circuit. GO to HU38 .

HU19 CHECK IMRC/IMSC GROUND CIRCUIT FOR OPEN IN HARNESS

- Measure voltage between ground and VPWR circuits at the IMRC/IMSC actuator harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to HU20 .	REPAIR open circuit. GO to HU38 .

HU20 VERIFY DRIVER CIRCUIT FUNCTION

- Access Output Test Mode (OTM) (refer to [Section 2](#)).
- Place a test lamp between VPWR and the IMRC/IMSC signal circuit at the IMRC/IMSC actuator harness connector.
- Turn all outputs on.

Did the test lamp cycle from off to on?

Yes	No
KEY OFF. GO to HU32 .	KEY OFF. GO to HU21 .

HU21 CHECK IMRC/IMSC DRIVER CIRCUIT FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of IMRC/IMSC signal circuit between PCM harness connector and the IMRC/IMSC actuator harness connector.

Is resistance less than 5 ohms?

Yes	No
GO to HU22 .	REPAIR open circuit. GO to HU38 .

HU22 CHECK IMRC/IMSC DRIVER CIRCUIT FOR SHORT TO VPWR IN HARNESS

- Key on, engine off.
- Measure voltage between IMRC/IMSC signal circuit at the IMRC/IMSC actuator harness connector and ground.

Is voltage less than 10.5 volts?

Yes	No
Possible intermittent concern. GO to Z1 . REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)) after determining concern is not intermittent. GO to HU38 .	REPAIR short circuit. GO to HU38 .

HU23 CHECK IMRC/IMSC DRIVER CIRCUIT FOR SHORT TO GROUND OR SHORT TO MONITOR CIRCUIT WITH PCM CONNECTED

- Key off.
- Measure resistance between the IMRC/IMSC driver circuit to PWR GND and then to SIG RTN and then to the monitor circuit at the IMRC/IMSC harness connector.

Are all resistances greater than 10,000 ohms?

Yes	No
REPLACE IMRC/IMSC. GO to HU38 .	GO to HU24 .

HU24 CHECK IMRC/IMSC DRIVER CIRCUIT FOR SHORT TO GROUND OR SHORT TO MONITOR CIRCUIT WITH PCM DISCONNECTED

- Disconnect PCM harness connector.
- Measure the resistance between the IMRC/IMSC driver circuit to PWR GND and then to SIG RTN and then to the monitor circuit at the IMRC/IMSC harness connector.

Are all resistances greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash	REPAIR the appropriate circuit for short. GO

Electrically Erasable Programmable Read Only Memory (EEPROM). GO to HU38.

to HU38.

HU25 VIEW IMRC/IMSC MONITOR PID TO DETERMINE PATH FOR POSSIBLE SHORT

Note: All vehicles will display VREF for IMRCM/SCVM PID except 3.8L and 4.2L which will display approximately 2.5 volts.

- With the scan tool, monitor the IMRCM/SCVM PID or voltage.

Is the IMRCM/SCVM PID displaying either VREF or approximately 2.5 volts?

Yes	No
GO to HU26.	GO to HU30.

HU26 CHECK IMRC/IMSC MONITOR PID TO DETERMINE A SHORT TO VPWR

- With the scan tool, monitor the IMRC/IMSCM PID or voltage while in Output Test Mode.
- Turn all output on.

Is the IMRC/IMSCM PID displaying less than 1 volt with all outputs on?

Yes	No
GO to HU27.	GO to HU32.

HU27 CHECK IMRC/IMSC MONITOR CIRCUIT FOR SHORT TO VPWR AT IMRC/IMSC HARNESS CONNECTOR

- Disconnect IMRC/IMSC actuator harness connector.
- Key on, engine off.
- Measure voltage between monitor circuit at the IMRC/IMSC actuator harness connector and ground.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to HU28.	KEY OFF. GO to HU29.

HU28 DETERMINE SHORT TO POWER WITH PCM DISCONNECTED

- Key on, engine off.
- Disconnect PCM.
- Measure voltage between monitor circuit at the IMRC/SCVM harness connector and ground.

Is voltage greater than 10.5 volts?

--	--

Yes	No
KEY OFF. REPAIR short circuit. GO to HU38 .	KEY OFF. REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). GO to HU38 .

HU29 CHECK MONITOR FOR SHORT TO VPWR AT IMRC/IMSC ACTUATOR

- Measure actuator resistance between the monitor circuit and VPWR.

Is resistance greater than 10,000 ohms?

Yes	No
Possible intermittent concern. GO to Z1 . REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)) after determining fault is not intermittent. GO to HU38 .	REPLACE IMRC/IMSC actuator. GO to HU38 .

HU30 DETERMINE IMRC/IMSC MONITOR CIRCUIT SHORT TO GROUND

- With the scan tool, monitor the IMRCM/SCVM PID or voltage.
- While viewing PID, disconnect the IMRC/SCVM harness connector.

Did voltage change from less than 1 volt to VREF when disconnecting the IMRC/SCVM harness connector?

Yes	No
KEY OFF. REPLACE IMRC/IMSC actuator. GO to HU38 .	KEY OFF. GO to HU31 .

HU31 CHECK IMRC/IMSC MONITOR HARNESS FOR SHORT TO GROUND

- Disconnect PCM.
- Measure resistance between IMRC/IMSC monitor and ground (if applicable) and SIG RTN pins at the IMRC actuator harness or SCVM harness connector.

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). GO to HU38 .	REPAIR short circuit. GO to HU38 .

HU32 CHECK MONITOR CIRCUIT RESPONSE

- Disconnect IMRC actuator or SCVM harness connector.
- With the scan tool, monitor the IMRCM/SCVM PID or voltage.

- Connect a jumper lead from the IMRC/IMSC monitor pin to ground at the harness connector.

Did the IMRCM/SCVM PID voltage cycle from VREF to less than 1 volt when inserting the jumper?

Yes	No
KEY OFF. GO to HU33 .	KEY OFF. GO to HU36 .

HU33 CHECK SIG RTN OR CHASSIS GROUND CIRCUIT CONTINUITY WITH PCM CONNECTED

- Measure resistance of SIG RTN or chassis ground circuit between IMRC/IMSC actuator harness or SCVM harness connector and B-.

Is resistance less than 5 ohms?

Yes	No
GO to HU34 .	GO to HU35 .

HU34 CHECK MONITOR LINE FOR INTERMITTENT OPEN

- Measure resistance of monitor line while wiggling and bending harness from IMRC/SCVM harness connector to PCM harness connector.

Is the resistance fluctuating while checking the harness?

Yes	No
REPAIR intermittent open circuit. GO to HU38 .	REPLACE IMRC actuator or IMSC actuator. GO to HU38 .

HU35 CHECK SIG RTN OR CHASSIS GROUND CIRCUIT CONTINUITY WITH PCM DISCONNECTED

- Disconnect PCM from harness connector.
- Measure resistance of SIG RTN or chassis ground circuit between PCM harness connector and IMRC/IMSC actuator harness connector.

Is resistance less than 5 ohms?

Yes	No
Possible intermittent concern. GO to Z1 . REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)) after determining concern is not intermittent. GO to HU38 .	REPAIR open circuit. GO to HU38 .

HU36 CHECK MONITOR LINE CONTINUITY

- Disconnect PCM from harness connector.

- Measure resistance of IMRC/IMSC monitor circuit between PCM harness connector and IMRC actuator or SCVM harness connector.

Is resistance less than 5 ohms?

Yes	No
GO to HU37 .	REPAIR open circuit. GO to HU38 .

HU37 CHECK MONITOR CIRCUIT FOR INTERMITTENT OPEN

- Measure resistance of monitor line while wiggling and bending harness from IMRC/SCVM harness connector to PCM harness connector.

Is the resistance fluctuating while checking the harness?

Yes	No
REPAIR intermittent open. GO to HU38 .	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). GO to HU38 .

HU38 IMRC/IMSC REPAIR VERIFICATION DRIVE CYCLE

- Key on, engine off.
- Connect scan tool to data link connector (DLC)
- Complete PCM reset.
- Access IMRC/IMSC and IMRCM/SCVM PIDs or voltage.
- Drive vehicle, obeying all traffic and safety laws.
- Safely perform three accelerations from stop to more than 3500 rpm.
- Watch for PIDs or voltage to change.
- Perform Quick Test (refer to Section 4, Powertrain [Diagnostic Trouble Code \(DTC\) Charts](#)).

Are any DTCs received?

Yes	No
GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts .	PASSED IMRC/IMSC Drive cycle. No IMRC/IMSC concern is present at this time.

HU65 DTC P1549: PERFORM VISUAL INSPECTION

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Inspect IMT Valve System. Check to be sure the harness is intact and the connector is firmly in place.

Is fault indicated?

Yes	No
REPAIR as necessary. REFER to the Intake Air Distribution and Filtering, Section 303-12 in the Workshop Manual for component removal	Passed visual inspection. GO to HU66 .

procedure. VERIFY a symptom no longer exists.	
---	--

HU66 CHECK PCM DRIVER COMMAND

Note: Vehicle must be driven if rev limiter does not allow 3500 rpm in the bay.

- Connect scan tool to data link connector (DLC).
- Key on, engine running.
- Access IMTV PID.
- Increase engine speed slowly to about 4000 rpm while observing IMTV PID.

Does PID read 100% then drop to 50% while rpm was above 3500?

Yes	No
KEY OFF. Passed test. GO to HU67 .	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). VERIFY a symptom no longer exists.

HU67 CHECK IMT VALVE ACTUATOR VPWR CIRCUIT FOR OPEN IN HARNESS

- Disconnect harness connector from the actuator.
- Key on, engine off.
- Measure VPWR circuit voltage at the harness connector.

Was the voltage greater than 10.5 volts?

Yes	No
KEY OFF. Passed check. GO to HU69 .	REPAIR IMT valve actuator VPWR circuit for open. VERIFY a symptom no longer exists.

HU69 CHECK FOR OPEN SIGNAL CIRCUIT BETWEEN PCM AND IMT VALVE ACTUATOR

- Disconnect PCM.
- Measure resistance of Circuit between PCM test pin 46 and actuator harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
Passed test. GO to HU70 .	REPAIR IMT Valve Actuator Signal Circuit open. VERIFY a symptom no longer exists.

HU70 CHECK IMT VALVE ACTUATOR FOR SHORT TO PWR GND

- Measure resistance between PCM test pin 46 and test pin 77 or 103.

Is resistance greater than 10,000 ohms?

Yes	No
Passed check. GO to HU71 .	REPAIR IMT Valve actuator signal circuit for short to PWR GND. VERIFY a symptom no longer exists.

HU71 CHECK IMT VALVE ACTUATOR SIGNAL CIRCUIT FOR SHORT TO VPWR

- Key on, engine off.
- Measure voltage between PCM test pin 46 and 77 or 103.

Is the voltage less than 1 volt?

Yes	No
KEY OFF. Passed check. GO to HU72 .	REPAIR IMT Valve actuator signal circuit for short to VPWR. VERIFY a symptom no longer exists.

HU72 CHECK PCM DRIVER FOR IMT VALVE ACTUATOR

- Reconnect PCM.
- Connect test lamp to VPWR and signal at the harness connector.
- Connect scan tool to data link connector (DLC).
- Key on, engine off.
- Access Output Test Mode (OTM) (Refer to scan tool instruction manual).
- Command all outputs on.

Was the test lamp off before commanding all outputs on and on with all outputs on?

Yes	No
KEY OFF. Passed test. GO to HU73 .	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). VERIFY a symptom no longer exists.

HU73 CHECK IMT VALVE SHUTTER FOR DAMAGE

- Remove IMT Valve (Refer to the Powertrain/Engine Group of the Workshop Manual).
- Visually inspect IMT valve shutter for damage.
- Rotate shutter by hand.

Does the shutter bind or appear damaged?

Yes	No
Damaged shutter. REPLACE IMT valve. VERIFY a symptom no longer exists.	Passed test. Leave IMT Valve disassembled. GO to HU74 .

HU74 CHECK IMT VALVE ACTUATOR FOR COIL DAMAGE

- Reconnect IMT valve harness connector.
- Key on, engine off.
- Access Output Test Mode (OTM) (Refer to scan tool instruction manual).
- Command all outputs on.

Did the IMT valve shutter rotate when commanding all outputs on?

Yes	No
Passed check. Fault is intermittent. GO to <u>Z1</u> .	REPLACE IMT valve actuator. VERIFY a symptom no longer exists.

HX: Evaporative Emission (EVAP) Monitor and System Introduction

HX: Pinpoint Tests →

Note

Enter this Pinpoint Test only when directed here.

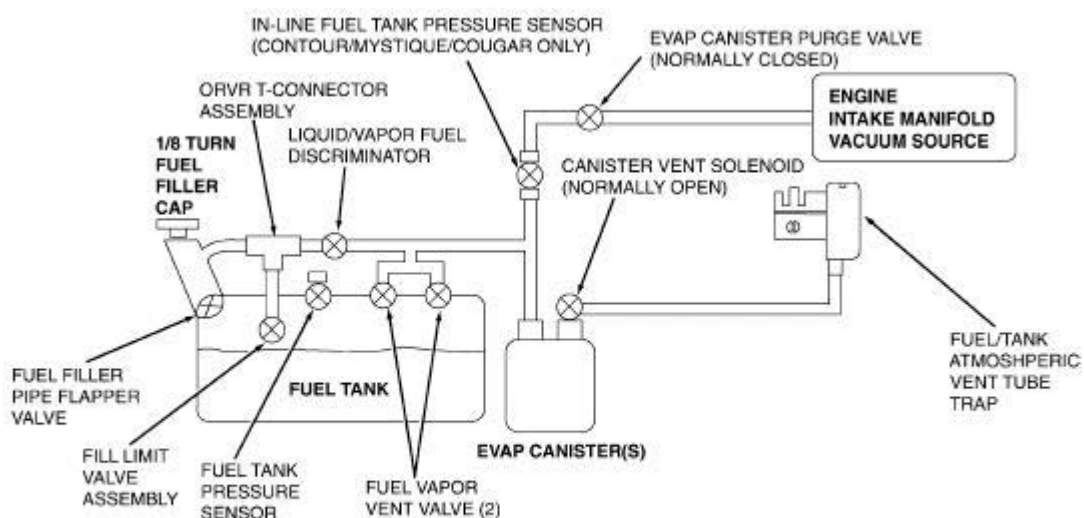
The use of a soap solution, such as SNOOP, around the fuel filler cap or the use of the hydrocarbon emission analyzer to determine an evaporative emission system leak is not recommended. The mandatory Rotunda Evaporative Emission System Leak Tester for OBD II (including the ultra-sonic tester) is the only device to be used at this time for evaporative emission system leak detection.

This Pinpoint Test is intended to diagnose the following:

- Canister vent (CV) solenoid (9F945)
- Fuel filler cap (9030)
- Fuel tank pressure (FTP) sensor (9C052)
- In-line fuel tank pressure (FTP) sensor (9C052)
- EVAP canister purge valve (9C915)
- Harness circuits: CV, FLI, FTP, EVAP Canister Purge Valve, SIG RTN, vehicle power (VPWR), reference voltage (VREF) and power ground (PWR GND)
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

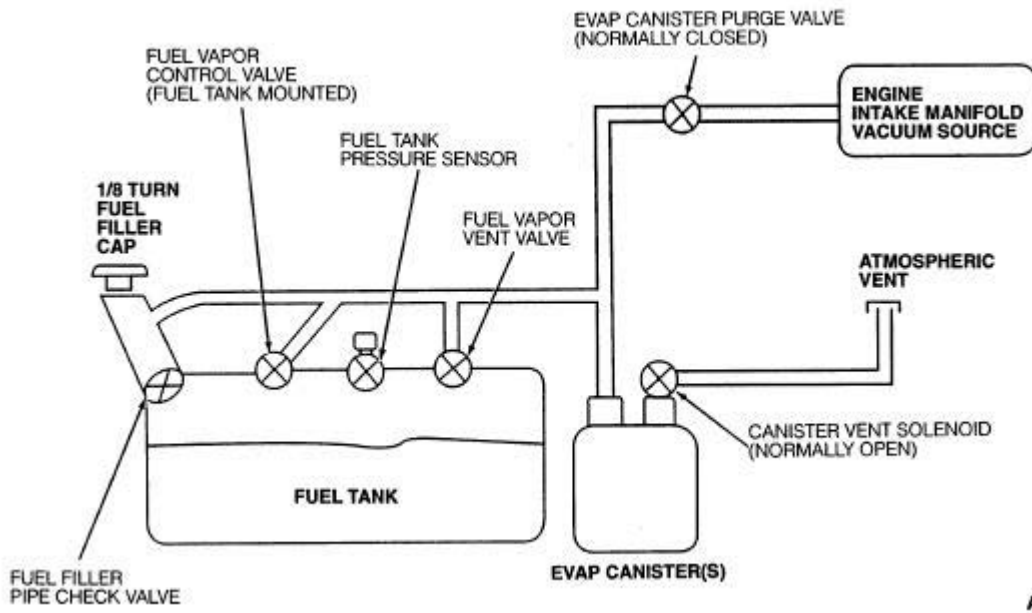
Focus, Escort, Escape, Cougar



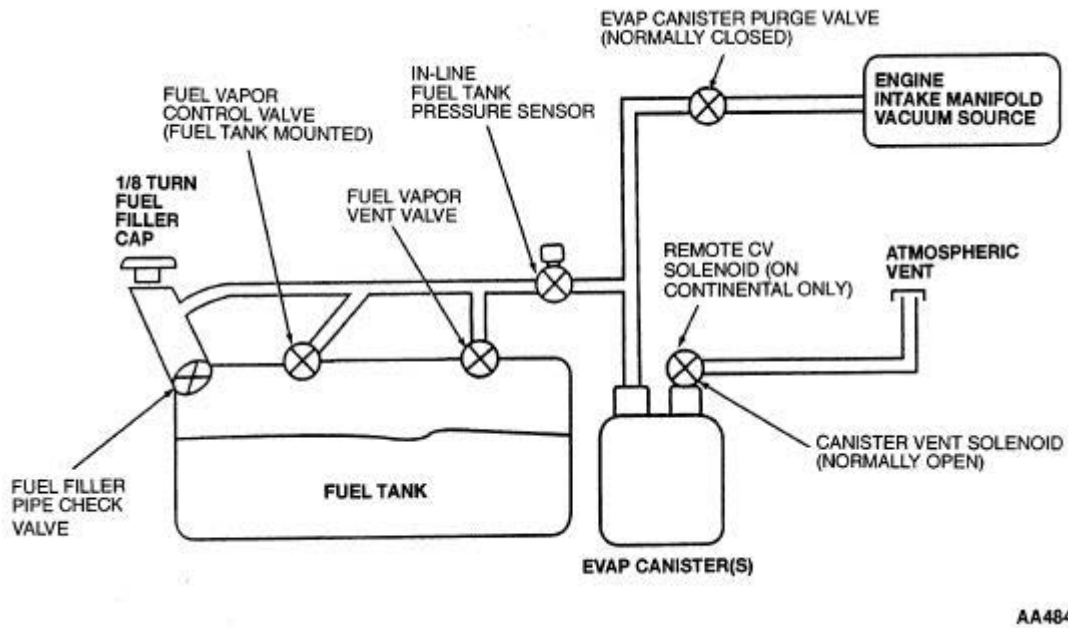
NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0018469

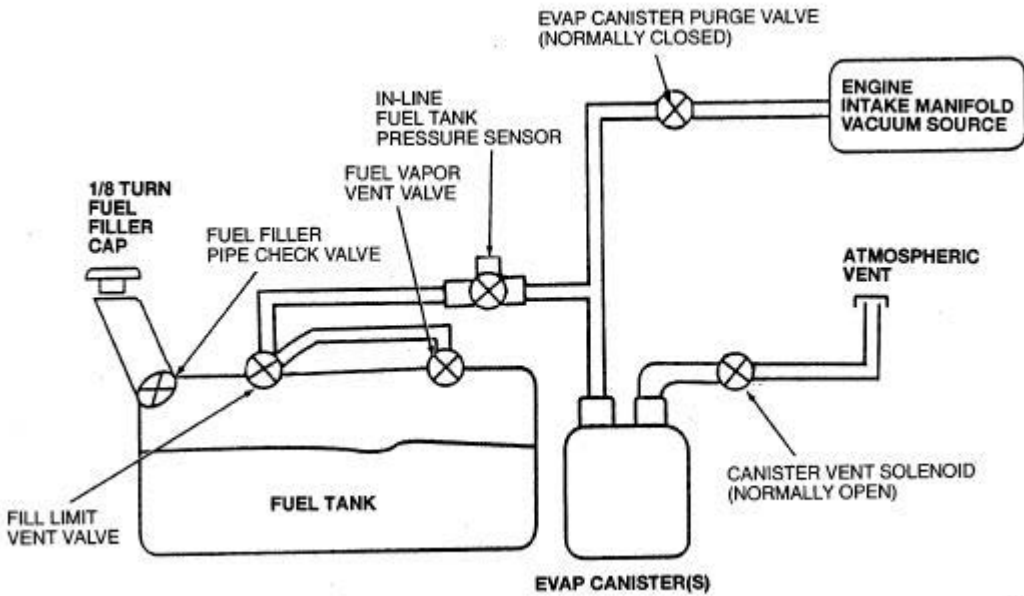
Crown Victoria/Grand Marquis, Town Car



Mustang, Taurus/Sable, Continental

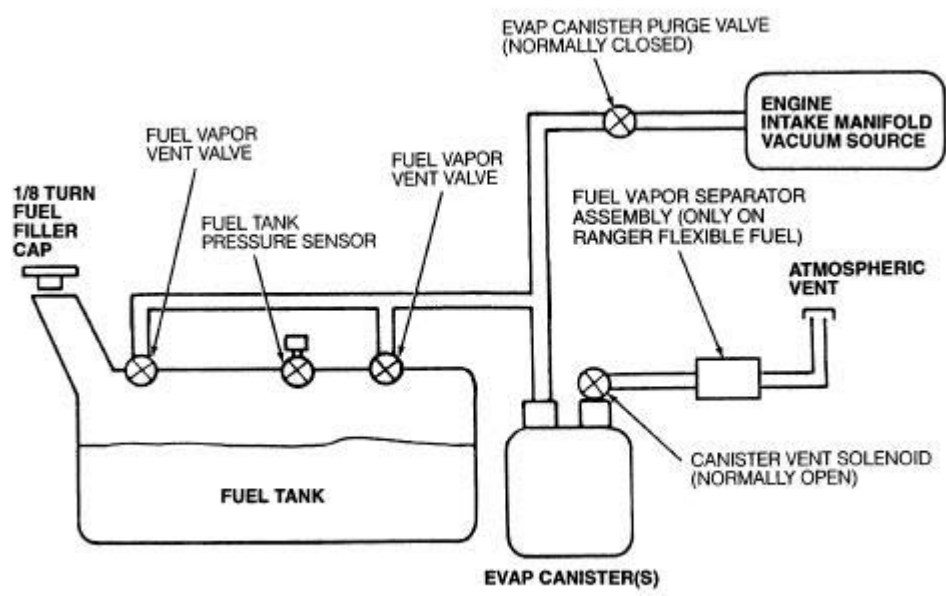


LS6/LS8



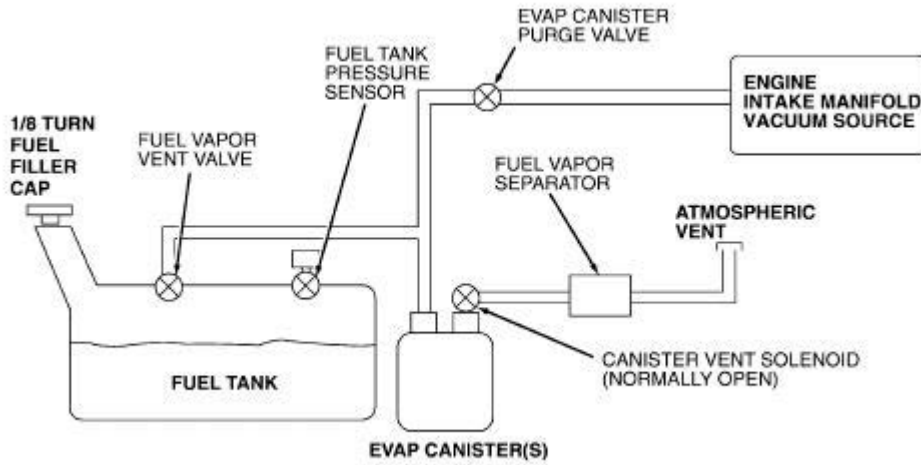
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Ranger, F-Series, E-Series/Club Wagon, Expedition/Navigator/Blackwood



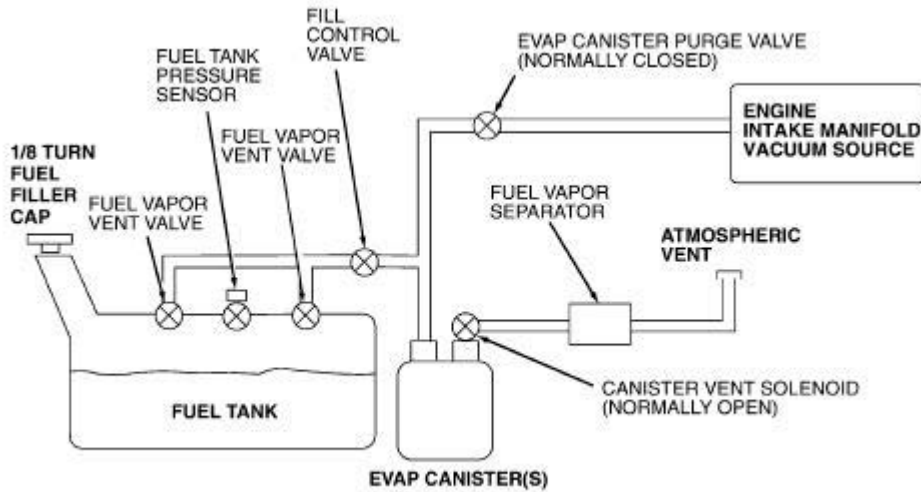
AA0209-F

Explorer/Mountaineer



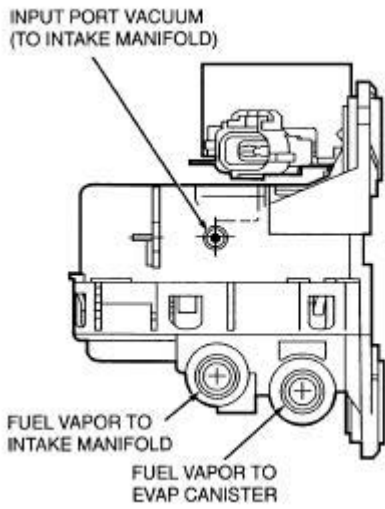
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Windstar



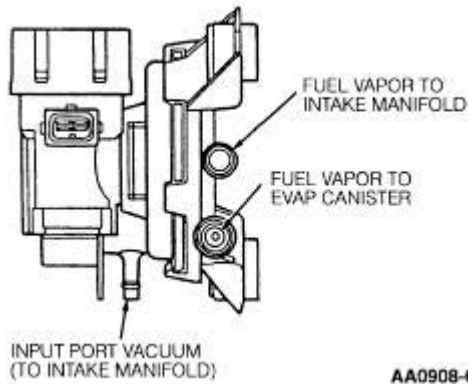
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Focus, Escort, Taurus/Sable, Mustang, LS6/LS8

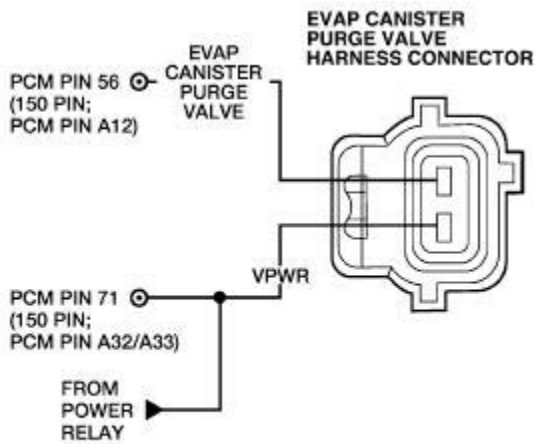


AA4837-A

All Others

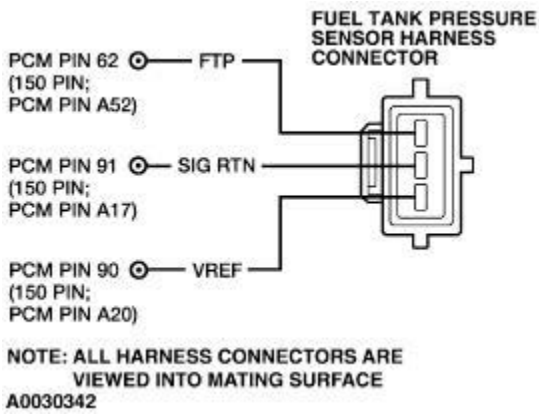
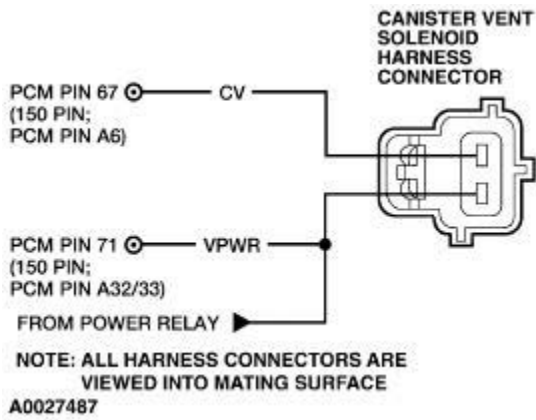


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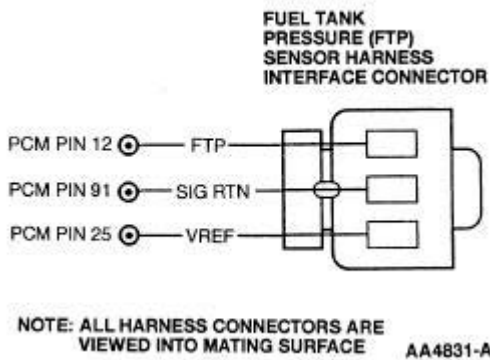


**NOTE: ALL HARNES CONNECTORS ARE
VIEWED INTO MATING SURFACE**

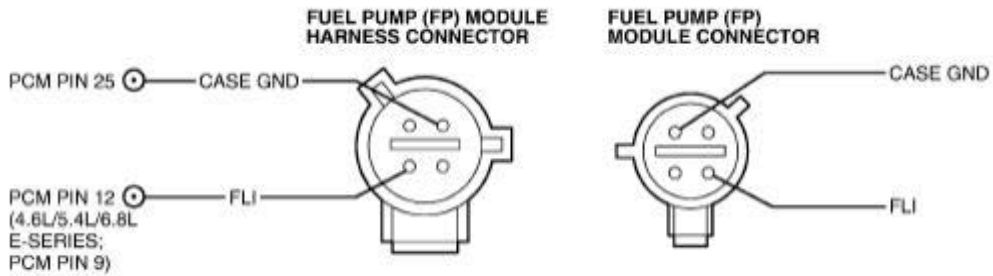
A0027486



Escort



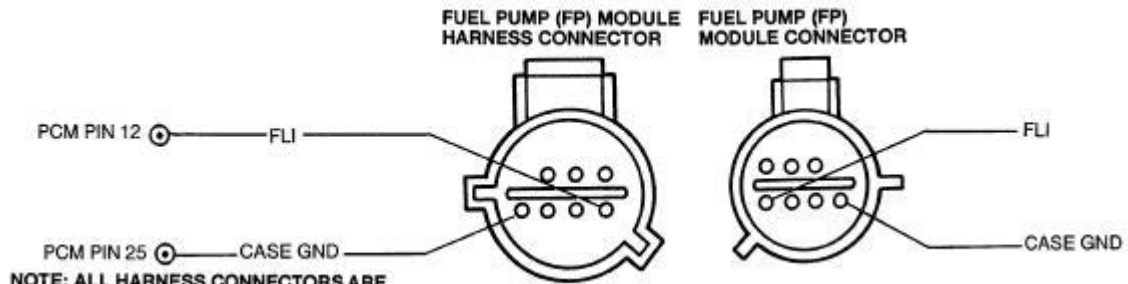
E-Series



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0005264

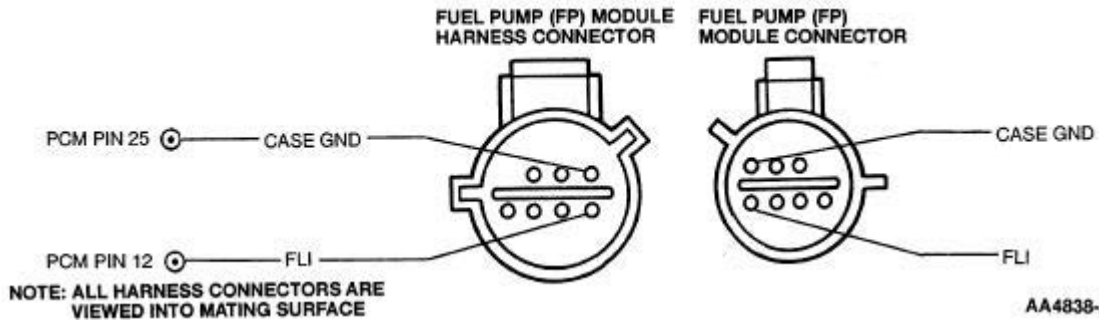
Ranger



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA0917-C

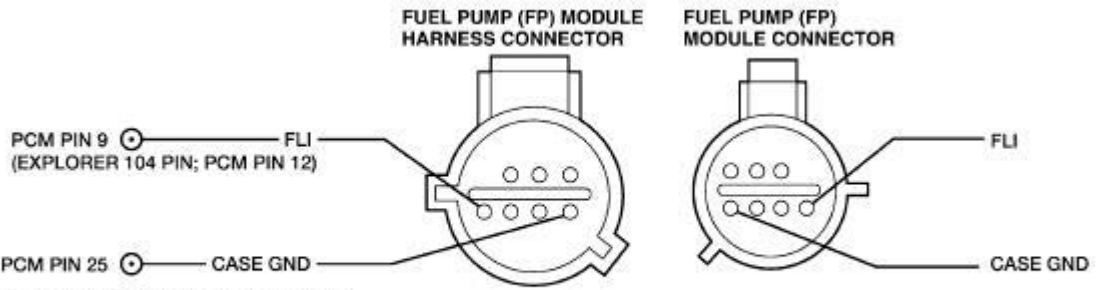
3.0L Flex Fuel Ranger



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA4838-A

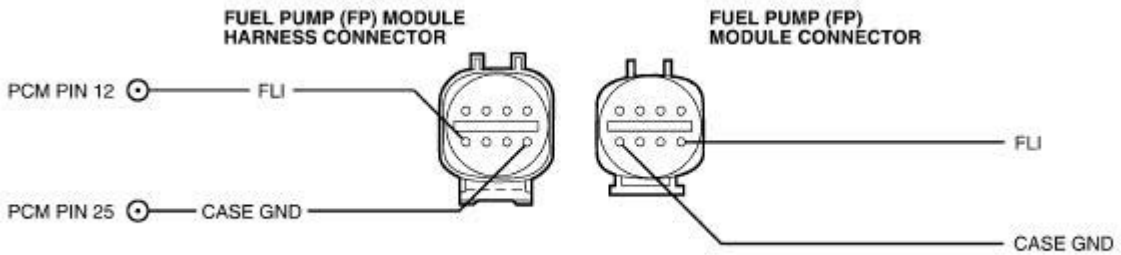
Crown Victoria/Grand Marquis, Continental, Explorer Sport/Sport Trac



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0027493

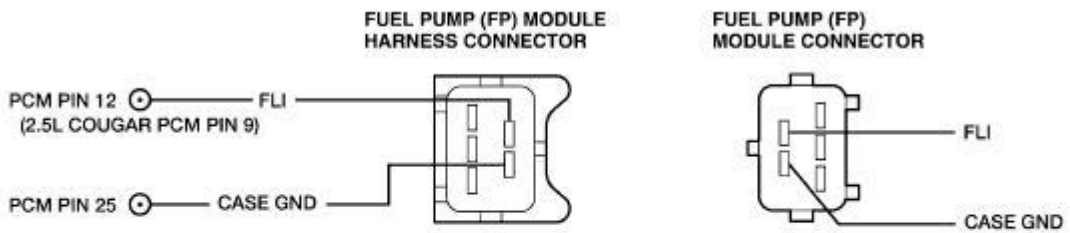
Taurus/Sable



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0015024

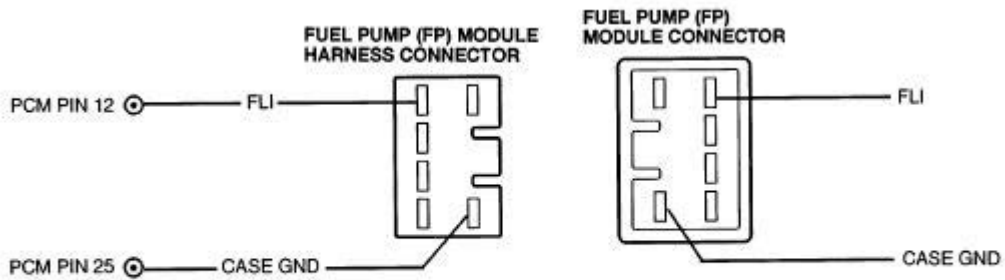
Cougar



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0027485

Escort



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA4840-A

Charts and Tables

Fuel Cap Off Indicator Lamp PCM Pin Number Table

Applications	PCM Pin
Focus, Explorer/Mountaineer 4.0L (104 Pin PCM)	46
Escort	79
Taurus/Sable, Explorer Sport/Sport Trac, Ranger	82
Crown Victoria/Grand Marquis	20

HX: Pinpoint Tests →

HX: Evaporative Emission (EVAP) Monitor and System

← HX: Introduction

HX1 DTC P0443: INSPECT EVAP CANISTER PURGE VALVE CIRCUIT FOR INTERMITTENT FAILURE

- Rerun KOEO, KOER Self-Tests and retrieve Continuous Memory DTCs.

Is DTC P0443 present in Continuous Memory Self-Test only?

Yes	No
The fault that produced Continuous Memory DTC P0443 can be intermittent. GO to <u>Z1</u> . If OK REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	GO to <u>HX2</u> .

HX2 DTC P0443: CHECK VPWR VOLTAGE TO EVAP CANISTER PURGE VALVE

- Key off.
- Disconnect EVAP canister purge valve.
- Key on, engine off.
- Measure voltage between VPWR circuit at the EVAP canister purge valve harness connector and battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to <u>HX3</u> .	REPAIR open circuit.

HX3 CHECK EVAP CANISTER PURGE VALVE RESISTANCE

Note: EVAP canister purge valve resistance reading must be taken with engine cooled down.

- Disconnect EVAP canister purge valve.
- Measure EVAP canister purge valve resistance.

Is resistance between 30 and 38 ohms?

Yes	No
GO to <u>HX4</u> .	REPLACE damaged EVAP canister purge valve. COMPLETE an Evaporative Emission Leak Check Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).

HX4 CHECK EVAP CANISTER PURGE VALVE CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of EVAP canister purge valve circuit between PCM harness connector pin and EVAP canister purge valve harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to HX5 .	REPAIR open circuit.

HX5 CHECK EVAP CANISTER PURGE VALVE CIRCUIT FOR SHORT TO PWR GND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between EVAP canister purge valve circuit at the EVAP canister purge valve harness connector and battery negative post.

Is resistance greater than 10,000 ohms?

Yes	No
GO to HX6 .	REPAIR short circuit.

HX6 CHECK EVAP CANISTER PURGE VALVE CIRCUIT FOR SHORT TO VPWR IN HARNESS

- Key on, engine off.
- Measure voltage between EVAP canister purge valve circuit at the EVAP canister purge valve harness connector and battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
REPAIR short circuit.	REPLACE PCM. (Refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

HX18 DTC P1450: CHECK FOR VISUAL CAUSES OF EXCESSIVE FUEL TANK VACUUM

Note: If the EVAP canister-CV solenoid and fuel tank assemblies are not accessible during this pinpoint test step, GO to Evaporative Emissions, Section 303-13 in the Workshop Manual for removal instructions.

- Check for kinks or bends in the fuel vapor hoses/tubes (EVAP canister purge outlet tube and EVAP canister tube).
- Visually inspect EVAP canister inlet port, CV solenoid filter and canister vent hose assembly for

contamination or debris.

- Check CV solenoid filter for blockage or contamination.

Is a fault indicated?

Yes	No
REMOVE any contamination or debris around fuel vapor hoses/tubes and EVAP canister-CV solenoid assembly. REMOVE kinks or bends in EVAP canister purge outlet tube, EVAP canister tube and canister vent hose assembly. GO to <u>HX19</u> .	GO to <u>HX19</u> .

HX19 CHECK FUEL TANK PRESSURE SENSOR VOLTAGE

- Connect scan tool.
- Key on, engine off.
- Access the FTP V PID.

Is the FTP V PID between 2.40 to 2.80 volts with the fuel filler cap on?

Yes	No
A possible intermittent condition on the FTP sensor circuit can cause the DTC P1450. GO to <u>Z1</u> . If circuit is OK, REFER to Evaporative Emissions, Section 303-13, Diagnostic Trouble Code/Symptom Chart in the Workshop Manual for a blocked (plugged) EVAP system condition.	KEY OFF. GO to <u>HX20</u> .

HX20 CHECK FUEL TANK PRESSURE SENSOR VOLTAGE WITH FUEL FILLER CAP REMOVED

- Remove the fuel filler cap.
- Key on, engine off.
- Access the FTP V PID.

Is the FTP V PID between 2.40 to 2.80 volts with fuel filler cap off?

Yes	No
REFER to Evaporative Emissions, Section 303-13, in the Workshop Manual for a blocked (plugged) EVAP system condition.	KEY OFF. GO to <u>HX21</u> .

HX21 CHECK FOR OTHER DTCS PRESENT

- Check for other three wire sensor DTCs (KOEO, KOER or Continuous Memory) present with the DTC P1450.

Are other DTCS present?

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Yes	No
RETURN to Diagnostic Subroutines, Section 4 , for direction in addressing the other DTCs.	KEY OFF. GO to HX22 .

HX22 CHECK VREF FROM PCM TO FTP SENSOR

- Disconnect FTP sensor.
- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the FTP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. REPLACE damaged FTP sensor. CLEAR Continuous Memory DTCs. FOLLOW the Vehicle Preparation for Monitor Repair Verification Drive Cycle and COMPLETE an Evaporative Emission Leak Check Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). RETRIEVE Continuous Memory DTCs. If DTC P1450 is still present, REFER to Evaporative Emissions, Section 303-13, Diagnostic Trouble Code/Symptom Chart, in the Workshop Manual.	KEY OFF. GO to HX23 .

HX23 CHECK FOR OPEN VREF AND SIG RTN CIRCUITS BETWEEN PCM AND FTP SENSOR

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of VREF circuit between PCM harness connector pin and FTP sensor harness connector.
- Measure resistance of SIG RTN circuit between PCM harness connector pin and FTP sensor harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuit.

HX26 DTC P0452: CHECK FOR FTP SENSOR CONNECTOR CONTAMINATION

- Key off.
- Visually check for contamination of the FTP sensor electrical connector.
- Check for completely submerged FTP sensor (tank mounted type only) in liquid fuel (can affect correct FTP voltage reading).

Does FTP sensor and its electrical connector show signs of contamination?

Yes	No
REPAIR FTP sensor electrical connector as necessary.	GO to HX27 .

HX27 CHECK FOR LOW FTP SENSOR VOLTAGE

Note: FTP sensor input with no pressure/vacuum on the fuel tank (filler cap open or not open to atmosphere) is between 2.37 and 2.97 volts.

- Connect scan tool.
- Key on, engine off.
- Access FTP V PID.
- If FTP V PID is not present on the scan tool, measure voltage between FTP and SIG RTN circuits at the PCM harness connector with PCM connected.

Is measured voltage or FTP V PID reading less than 0.22 volt?

Yes	No
KEY OFF. GO to HX28 .	The fault that produced the DTC P0452 is intermittent. GO to Z1 .

HX28 CHECK OPPOSITE INDUCED HIGH FTP SIGNAL

- Disconnect FTP sensor.
- Connect a jumper wire between VREF circuit and FTP circuits at the FTP sensor harness connector.
- Key on, engine off.
- If a scan tool communication concern exists, remove jumper immediately and GO to [HX29](#).
- Access FTP V PID.
- If FTP V PID is not present on the scan tool, measure voltage between FTP and SIG RTN circuits at the PCM harness connector with PCM connected.

Is measured voltage or FTP V PID reading between 4.0 and 6.0 volts?

Yes	No
REPLACE FTP sensor. REFER to Evaporative Emissions, Section 303-13 in the Workshop Manual for component removal and installation. RESTORE vehicle. FOLLOW the Vehicle Preparation for Monitor Repair Verification Drive Cycle and COMPLETE an Evaporative Emission Leak Check Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).	REMOVE jumper. GO to HX29 .

HX29 CHECK VOLTAGE BETWEEN VREF AND SIG RTN CIRCUITS AT FTP SENSOR

- Key on, engine off.

- Measure voltage between VREF and SIG RTN circuits at the FTP sensor harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. GO to <u>HX30</u> .	VREF voltage is out of range. GO to <u>C1</u> .

HX30 CHECK FTP CIRCUIT FOR SHORT TO SIG RTN OR PWR GND IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Disconnect scan tool from DLC.
- Measure resistance between FTP and SIG RTN circuits at the PCM harness connector.
- Measure resistance between FTP circuit at the PCM harness connector and battery negative post.

Is each resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (REFER to Section 2, <u>Drive Cycles</u>).	REPAIR short circuit.

HX33 DTC P0453: CHECK FOR HIGH FTP SENSOR VOLTAGE

Note: FTP sensor input with no pressure/vacuum on the fuel tank (fuel filler cap open or not open to atmosphere) is 2.37 to 2.97 volts.

- Connect scan tool.
- Key on, engine off.
- Access FTP V PID.
- If FTP V PID is not present on the scan tool, measure voltage between FTP and SIG RTN circuits at the PCM harness connector with PCM connected.

Is measured voltage or FTP V PID reading greater than 4.50 volts?

Yes	No
KEY OFF. GO to <u>HX34</u> .	The fault that produced DTC P0453 is intermittent. GO to <u>Z1</u> .

HX34 CHECK FTP CIRCUIT FOR SHORT TO POWER

- Disconnect FTP sensor.
- Key on, engine off.
- Measure voltage between FTP circuit at the FTP sensor harness connector and battery negative post.

Is the voltage greater than 10.5 volts?

Yes	No

KEY OFF. The FTP is indicating a short to VPWR. GO to [HX35](#).

KEY OFF. GO to [HX36](#).

HX35 CHECK FTP CIRCUIT FOR SHORT TO VPWR IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Key on, engine off.
- Measure the voltage between FTP circuit at the PCM harness connector and battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
REPAIR short circuit.	REPLACE PCM. (REFER to Section 2 , Flash EEPROM.)

HX36 CHECK OPPOSITE INDUCED LOW FTP SIGNAL

- Connect a jumper wire between SIG RTN and FTP circuits at the FTP sensor harness connector.
- Key on, engine off.
- If a scan tool communication concern exists, turn the key off, remove jumper immediately and GO to [HX41](#).
- Access FTP V PID.
- If FTP V PID is not present on the scan tool, measure voltage between FTP and SIG RTN circuits at the PCM harness connector with PCM connected.

Is measured voltage or FTP V PID reading less than 0.10 volt?

Yes	No
REMOVE jumper. GO to HX37 .	Unable to induce opposite signal. KEY OFF. GO to HX39 .

HX37 CHECK FOR IN RANGE VOLTAGE BETWEEN VREF AND SIG RTN CIRCUITS AT FTP SENSOR

- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the FTP sensor vehicle harness connector.

Is voltage between 4.0 and 6.0 volts?

Yes	No
KEY OFF. GO to HX38 .	VREF voltage is out of range. GO to C1 .

HX38 CHECK FTP CIRCUIT FOR SHORT TO VREF IN SENSOR OR HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance between FTP and VREF circuits at the PCM harness connector. (For 150PIN PCM, measure to both VREF pins.)

Is the resistance greater than 10,000 ohms?

Yes	No
REPLACE FTP sensor. REFER to Evaporative Emissions, Section 303-13 in the Workshop Manual for component removal and installation. RESTORE vehicle. FOLLOW the Vehicle Preparation for Monitor Repair Verification Drive Cycle and COMPLETE an Evaporative Emission Leak Check Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).	REPAIR short circuit.

HX39 CHECK FTP CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of FTP circuit between PCM harness connector pin and FTP sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to HX40 .	REPAIR open circuit.

HX40 CHECK FOR OPEN SIG RTN CIRCUIT BETWEEN PCM AND FTP SENSOR

- Measure resistance of SIG RTN circuit between PCM harness connector pin and FTP sensor harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to HX41 .	REPAIR open circuit.

HX41 CHECK FTP CIRCUIT FOR SHORT TO VREF IN PCM

- PCM disconnected.
- Measure resistance between FTP and VREF circuits at the PCM harness connector. (For 150 PIN PCM, measure to both VREF pins.)

Is the resistance greater than 10,000?

Yes	No
-----	----

REPLACE PCM (refer to Section 2, [Flash Electrically Erasable Programmable Read Only Memory \(EEPROM\)](#)).

REPAIR short circuit.

HX43 DTC P0457: CHECK FOR MISSING OR LEAKING FUEL FILLER CAP

- Check for missing fuel filler cap.
- Check for a loose fuel filler cap.
- Check for possible cross-thread fuel filler cap condition.

Is a concern present with the proper installation of the fuel filler cap?

Yes	No
<p>REPLACE cross-threaded or damaged fuel filler cap. RECONNECT and TIGHTEN the fuel filler cap only one-eighth turn so that the cap initially clicks by sound or touch. COMPLETE PCM KAM Reset to clear DTCs and adaptive memory. (REFER to Section 2, Diagnostic Methods). COMPLETE an Evaporative Emission Leak Check Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). RERUN Quick Test. If DTC P0455 is present, REFER to Evaporative Emissions, Section 303-13, Diagnostic Trouble Code/Symptom Chart in the Workshop Manual.</p>	<p>COMPLETE PCM KAM Reset to clear DTCs and adaptive memory. (REFER to Section 2, Diagnostic Methods). COMPLETE an Evaporative Emission Leak Check Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). RERUN Quick Test. If DTC P0455 is present, REFER to Evaporative Emissions, Section 303-13, Diagnostic Trouble Code/Symptom Chart in the Workshop Manual. Otherwise, INFORM the vehicle owner that it is important and necessary to immediately install the fuel filler cap after every refueling event.</p>

HX65 DTC P1451: CHECK VPWR VOLTAGE TO CV SOLENOID

- Key off.
- Disconnect canister vent (CV) solenoid.
- Connect a non-powered test lamp between CV and VPWR circuits at the CV solenoid harness connector.
- Key on, engine off.
- Attempt to close and open CV solenoid driver in PCM by accessing Output Test Mode.
- Select ALL OFF mode.
- Cycle START button ON and OFF, and observe the test lamp.

Does the test lamp cycle on and off (light up and turn off)?

Yes	No
<p>KEY OFF. GO to HX66.</p>	<p>For test lamp always off : GO to HX67.</p> <p>For test lamp always on : KEY OFF. GO to HX70.</p>

HX66 CHECK CV SOLENOID RESISTANCE

- Measure CV solenoid resistance.

Is resistance between 48 and 65 ohms?

Yes	No
Unable to identify fault at this time. GO to Z1 .	REPLACE damaged CV solenoid. COMPLETE an EVAP system leak test at the evaporative test port to VERIFY that a leak did not occur during component replacement. FOLLOW the Vehicle Preparation for Monitor Repair Verification Drive Cycle and COMPLETE an Evaporative Emission Leak Check Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

HX67 CHECK FOR OPEN VPWR CIRCUIT BETWEEN CV SOLENOID AND POWER RELAY

- Measure voltage between VPWR circuit at the CV solenoid harness connector and battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to HX68 .	KEY OFF. REPAIR open circuit.

HX68 CHECK VPWR CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure resistance of VPWR circuit between PCM harness connector pin (or for 150 PIN PCM, the VPWR fuse to the power relay) and CV solenoid harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to HX69 .	REPAIR open circuit.

HX69 CHECK CV CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of CV circuit between PCM harness connector pin and CV solenoid harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuit.

HX70 CHECK CV CIRCUIT FOR SHORT TO PWR GND IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Disconnect scan tool from DLC.
- Measure resistance between CV circuit at the CV solenoid harness connector and battery negative post.

Is resistance greater than 10,000 ohms?

Yes	No
RECONNECT scan tool. GO to <u>HX71</u> .	REPAIR short circuit.

HX71 CHECK CV CIRCUIT FOR SHORT TO PWR OR CHASSIS GND IN HARNESS

- Key on, engine off.
- Measure voltage between CV circuit at the PCM harness connector and chassis ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	KEY OFF. REPAIR short circuit to VPWR, VREF or chassis ground.

HX76 DTC P0460: CHECK FUEL TANK LEVEL

Note: For Focus, Escape, Mustang, LS6/LS8, Town Car, Windstar, Explorer/Mountaineer (150 Pin PCM), F-Series, 5.4L Lightning and Expedition/Navigator/Blackwood applications, go to Instrument Cluster Section 413-01, fuel level indicator or Rear Electronic Module (REM) diagnosis in the Workshop Manual.

- Key on, engine off.
- Observe and record fuel gauge reading.
- Access fuel level input (FLI) PID.

Are both the fuel gauge and the FLI PID indicating between slightly above one-third (33% on FLI PID) and three quarters (75% on the FLI PID) filled?

Yes	No
GO to <u>HX78</u> .	<p>KEY OFF. INSPECT fuel tank for leaks. REPAIR fuel tank if necessary. CHECK for a damaged fuse for the fuel pump (FP) to fuel gauge circuit.</p> <p>For a damaged fuse without a DTC P0460 :</p> <p>CHECK for CASE GND short to VPWR circuit. GO to <u>B1</u> or GO to <u>X1</u> (CCRM applications).</p> <p>For fuel gauge inoperative without a DTC P0460:</p>

REFER to Instrument Cluster Section 413-01 and 413-02 in the Workshop Manual.

For DTC P0460:

GO to [HX77](#).

HX77 CHECK FOR INADEQUATE FUEL LEVEL

- Key on, engine off.
- Observe both the fuel gauge and FLI PID.
- If fuel level is under one third (33% on FLI PID), add fuel (7.57 to 11.36 liters [2 to 3 gallons]) to the fuel tank.
- If fuel level is greater than three quarters (75% on FLI PID), drain (7.57 to 11.36 liters [2 to 3 gallons]) fuel from the fuel tank.

Did either the fuel gauge or FLI PID indicate a movement upward or downward as the fuel is either added or drained?

Yes	No
DRIVE vehicle and RERUN Quick Test for DTCs. If DTC P0460 is still present, GO to HX78 .	KEY OFF. GO to HX79 .

HX78 CHECK FLI CIRCUIT VOLTAGE

Note: The FLI V PID must not be used for diagnosis on the 2.5L Cougar in this Pinpoint Test Step, but only applications without returnless fuel systems.

For 2.5L Cougar (without returnless fuel systems only):

- Key on, engine running.
- Measure voltage between the FLI and SIG RTN circuits at the PCM harness connector.

For All Others:

- Key on, engine running.
- Access FLI V PID.

Is voltage or FLI V PID reading between 1.23 and 2.25 volts (6.14 and 4.39 volts on 2.0L/2.5L Cougar without returnless fuel system)?

Yes	No
KEY OFF. For Continental: GO to HX87 . For All others: GO to HX86 .	KEY OFF. GO to HX79 .

HX79 CHECK FUEL PUMP MODULE RESISTANCE

- Disconnect fuel pump (FP) module (refer to FP module pigtail connector at the beginning of this pinpoint test).
- Measure resistance between FLI and CASE GND pins on the FP module (at pigtail).

Is resistance between 15 and 160 ohms?

Yes	No
GO to HX80 .	CHECK for stuck fuel level float on fuel pump (FP) module. REPAIR as necessary. If free movement is present, REPLACE fuel pump module assembly.

HX80 CHECK FLI CIRCUIT VOLTAGE AT FP MODULE

- Disconnect the instrument cluster connector to the fuel gauge. (Refer to Instrument Cluster Section 413-01 in the Workshop Manual or Wiring Diagram manual for cluster connector configuration.)
- Key on, engine off.
- Measure voltage between FLI circuit at the FP module harness connector and battery negative post.

Is voltage greater than 5 volts?

Yes	No
KEY OFF. GO to HX81 .	KEY OFF. GO to HX82 .

HX81 CHECK FLI CIRCUIT FOR SHORT TO VPWR IN HARNESS

- Disconnect PCM.
- Key on, engine off.
- Measure voltage between FLI circuit at the FP module harness connector and battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
REPAIR short circuit.	REPLACE PCM (REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

HX82 CHECK FLI CIRCUIT FOR SHORT TO PWR GND IN HARNESS

- Disconnect PCM.
- Measure resistance between FLI circuit at the PCM harness connector and battery negative post.

Is resistance greater than 10,000 ohms?

Yes	No

For Continental : GO to HX84 . For All others : GO to HX83 .	REPAIR short circuit.
---	-----------------------

HX83 CHECK FLI CIRCUIT FOR SHORT TO CASE GND IN HARNESS

- Measure resistance between FLI and CASE GND circuits at the PCM harness connector.

Is resistance greater than 10,000 ohms?

Yes	No
GO to HX85 .	REPAIR short between FLI and CASE GND circuits.

HX84 CHECK FLI CIRCUIT FOR SHORT TO CASE GND IN HARNESS ON CONTINENTAL

- Measure resistance between fuel level input Pin 4 and fuel level return Pin 28 at the virtual image instrument cluster harness connector at the fuel gauge. (Refer to the Wiring Diagram manual, fuel pump module to fuel gauge.)
- Measure resistance between fuel level input Pin 4 and fuel logic ground Pin 27 at the virtual image instrument cluster harness connector at the fuel gauge. (Refer to the Wiring Diagram manual, PCM to fuel gauge.)

Is each resistance greater than 10,000 ohms?

Yes	No
GO to HX85 .	REPAIR short between FLI and fuel level return circuits or FLI and fuel logic ground circuits.

HX85 CHECK FLI CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of FLI circuit between PCM harness connector and fuel pump (FP) module (pigtail) harness connector.
- Measure resistance of FLI circuit between PCM harness connector and the instrument cluster fuel gauge harness connector.

Is each resistance less than 10.0 ohms?

Yes	No
For Continental : GO to HX87 . For All others : GO to HX86 .	REPAIR open circuit.

HX86 CHECK CASE GND CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of CASE GND circuit between PCM harness connector and FP module (pigtail) harness connector.
- Measure resistance between the CASE GND circuit at the PCM harness connector and the fuel gauge ground at the instrument cluster fuel gauge harness connector.

Is each resistance less than 10.0 ohms?

Yes	No
REFER to Instrument Cluster Section 413-01 in the Workshop Manual (reference: Wiring Diagram manual) for fuel gauge diagnosis. REPLACE fuel gauge or REPAIR as necessary. Then RERUN Quick Test. If DTC P0460 is still present, REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR open circuit.

HX87 CHECK CASE GND CIRCUIT FOR OPEN IN HARNESS ON CONTINENTAL

- Measure resistance of CASE GND circuit between PCM harness connector Pin 25 and virtual image instrument cluster harness connector Pin 27 at the fuel gauge.
- Measure resistance between CASE GND pin at FP module (pigtail) harness connector and virtual image instrument cluster harness connector Pin 28 at the fuel gauge.

Is each resistance less than 10,000 ohms?

Yes	No
REFER to Instrument Cluster Section 413-01 in the Workshop Manual (reference: Wiring Diagram manual) for fuel gauge diagnosis. REPLACE fuel gauge or REPAIR as necessary. Then RERUN Quick Test. If DTC P0460 is still present, REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR open circuit.

HX88 CHECK FUEL CAP LAMP ALWAYS ON W/O DTCS

- Disconnect PCM.
- Key on, engine off.

Is the Check Fuel Cap Indicator Lamp OFF with the PCM disconnected?

Yes	No
KEY OFF. REPLACE PCM (REFER to Section 2, <u>Flash Electrically Erasable</u>	The PCM has not attempted to ground the circuit between the Check Fuel Cap Indicator Lamp and corresponding PCM pin. This has

Programmable Read Only Memory (EEPROM).

not turned the indicator lamp ON. REFER to Instrument Cluster, Section 413-01, in the Workshop Manual.

HX89 CHECK FUEL CAP LAMP ALWAYS OFF W/O DTCS

- Key off.
- Disconnect the Check Fuel Cap Indicator Lamp harness connector at the instrument cluster.
- Disconnect PCM.
- Measure resistance between PCM harness connector pin (refer to Fuel Cap Off Indicator Lamp PCM Pin Table at the beginning of this pinpoint test for correct pin number) and Check Fuel Cap circuit at the indicator lamp harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REFER to Instrument Cluster, Section 413-01, in the Workshop Manual to diagnose instrument cluster and Check Fuel Cap Bulb. If OK, REPLACE PCM (REFER to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM).</u>). VERIFY repair by turning key to ON position (lamp will turn OFF in 3 seconds).	REPAIR open circuit. VERIFY repair by turning key to ON position (lamp will turn OFF in 3 seconds).

HY: Generator/Regulator System Introduction

HY: Pinpoint Tests →

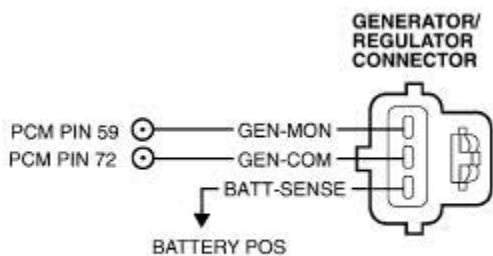
Note

This Pinpoint Test is intended to diagnose the following:

- Generator/Regulator
- Generator/Regulator harness circuits: GEN-MON, GEN-COM, BATT-SENSE
- PCM

Pinpoint Test Schematics and Connectors

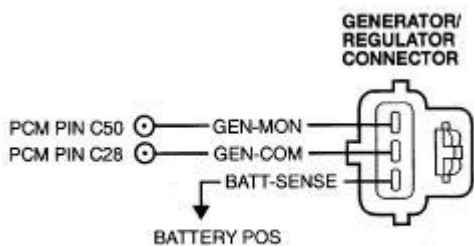
Focus, 2.0L Escape



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0014026

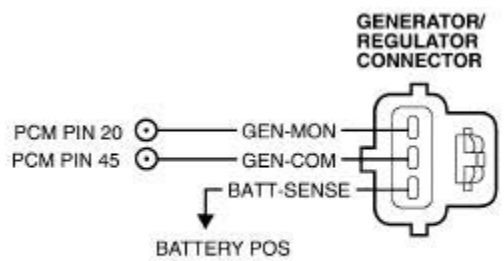
LS6/LS8



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA4843-A

Windstar



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE AA4842-B

HY: Pinpoint Tests →

HY: Generator/Regulator System

← HY: Introduction

HY1 DTC P1246: VERIFY GENERATOR DRIVE FUNCTION

- Check generator drive belt condition.
- Check generator drive belt tension.
- Start engine, verify generator turning.

Does generator turn?

Yes	No
GO to HY2 .	REFER to Charging System Section 414-00 in the Workshop Manual.

HY2 VERIFY CHARGING SYSTEM IS EEC CONTROLLED

- Key off.
- Disconnect battery terminals at battery.
- Disconnect generator harness connector and measure resistance between battery-sense and gen-com pin at the generator.

Is resistance between 950 and 1050 ohms?

Yes	No
GO to HY3 .	REPLACE generator/regulator assembly.

HY3 CHECK BATTERY-SENSE VOLTAGE AT BATTERY

- Reconnect generator.
- Reconnect battery.

Is battery voltage at battery-sense circuit pin at the generator/regulator harness connector within plus or minus 0.5 volt of battery voltage?

Yes	No
GO to HY4 .	REPAIR battery-sense circuit.

HY4 CHECK GENERATOR FAILURE MODE

- All electrical load off.
- Access the GFSF PID.
- Increase engine speed to 2,000 rpm.
- Perform wiggle test.

Is a failure indicated?

Yes	No
GO to <u>HY5</u> .	REFER to Charging System, Section 414-00 in the Workshop Manual.

HY5 CHECK GEN-MON AND GEN-COM CIRCUIT FOR SHORT TO POWER

- Key off.
- PCM and generator/regulator disconnected.
- Key on.
- Measure voltage between gen-com signal pin at the PCM harness connector and chassis ground.
- Measure voltage between gen-mon signal pin at the PCM harness connector and chassis ground.

Is each voltage greater than 0.5 volt?

Yes	No
KEY OFF. REPAIR short circuit.	KEY OFF. GO to <u>HY6</u> .

HY6 CHECK GEN-MON AND GEN-COM CIRCUIT FOR SHORT TO GROUND

- Measure resistance between the gen-com signal pin at the PCM harness connector and chassis ground.
- Measure resistance between the gen-mon signal pin at the PCM harness connector and chassis ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to <u>HY7</u> .	REPAIR short circuit.

HY7 CHECK GEN-MON AND GEN-COM CIRCUIT FOR OPEN

- Measure resistance of the gen-com circuit between the generator/regulator harness connector and the PCM harness connector.
- Measure resistance of the gen-mon circuit between the generator/regulator connector and the PCM harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to <u>HY8</u> .	REPAIR open circuit.

HY8 CHECK GENERATOR MONITOR SIGNAL

- Engine idling.
- Access GFS PID.

Is duty cycle between 6-98%?

Yes	No
GO to <u>HY9</u> .	REPLACE generator/regulator assembly.

HY9 CHECK GENERATOR COMMUNICATOR SIGNAL

- Access GENFDC PID.
- Engine idling.
- Toggle load on and off (headlights).

Does PID switch within 0-99% range?

Yes	No
Generator function is OK. GO to Pinpoint Test <u>Z</u> , intermittent circuit failure diagnosis.	REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).

JB: Secondary Ignition Introduction

JB: Pinpoint Tests →

Note

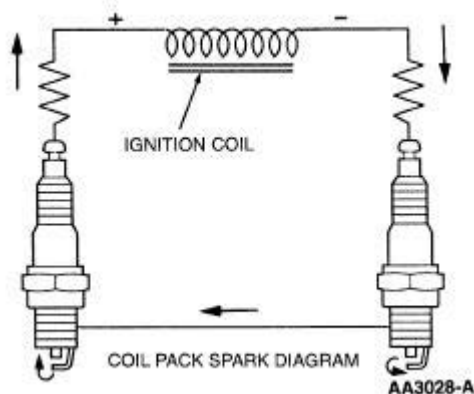
This Pinpoint Test is intended to diagnose the following:

- Spark plugs (12405)
- Spark plug wires (12280, 12281)

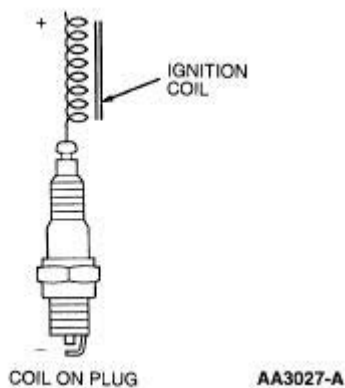
Caution

A malfunctioning ignition system may cause high catalyst temperatures. Check components next to the catalyst and muffler for heat damage.

Escort, Focus, 2.0L Escape, Cougar, Taurus/Sable, 3.8L Mustang, Ranger, Windstar, 4.0L Explorer/Mountaineer, 4.2L E/F-Series, 5.0L Explorer/Mountaineer



3.0L Escape, 4.6L Mustang, Crown Victoria/Grand Marquis, LS6/LS8, Town Car, Continental, 4.6L Explorer/Mountaineer, Expedition, Navigator/Blackwood, Excursion, 4.6L/5.4L/6.8L E/F-Series, 6.8L E-Series



Tables

IGNITION COIL TO CYLINDER CORRELATION AND FIRING ORDER—ALL OTHERS

4 Cylinder Applications— Except 2.5L Ranger									
Firing Order	1	3	4	2					
Ignition Coil	A	B	A	B					
4 Cylinder Applications— 2.5L Ranger									
Firing Order	1	3	4	2					
Ignition Coil	A, C	B, D	A, C	B, D					
6 Cylinder Applications									
Firing Order	1	4	2	5	3	6			
Ignition Coil	A	B	C	A	B	C			
8 Cylinder Applications									
Firing Order	1	3	7	2	6	5	4	8	
Ignition Coil	A	B	C	D	A	B	C	D	

IGNITION COIL AND FIRING ORDER- COIL ON PLUG APPLICATIONS

Firing Order for Coil On Plug Ignition.
LS6, 3.0L Escape 1 4 2 5 3 6
LS8 1 5 4 2 6 3 7 8
8 Cylinder Applications 1 3 7 2 6 5 4 8
10 Cylinder Applications 1 6 5 10 2 7 3 8 4 9

JB: Secondary Ignition

← JB: Introduction

JB1 VISUAL INSPECTION OF IGNITION SYSTEM

- Visually inspect the engine compartment to make sure all coils and spark plug wires are properly and securely connected.
- Examine all wiring harnesses and connectors for damaged, burned or overheated insulation and loose or broken conditions.
- Be certain the battery is fully charged.
- All accessories must be off during diagnosis.

Is a problem indicated?

Yes	No
REPAIR as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).	For coil pack application using engine analyzer: GO to <u>JB2</u> . For coil pack applications not using engine analyzer: GO to <u>JB20</u> . For coil on plug applications: GO to <u>JB15</u> .

JB2 CONNECT ENGINE ANALYZER

Obtain an Engine Analyzer to diagnose concerns in the secondary side of the ignition system.

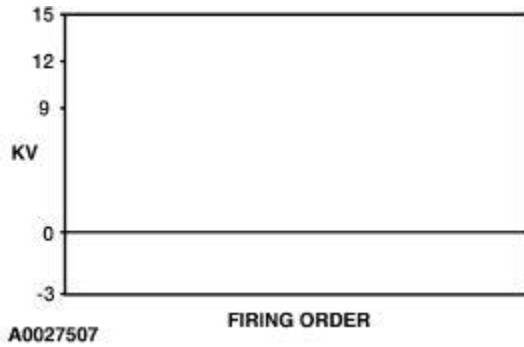
Note: In order for the diagnostic procedures to provide accurate results, it is essential that the calibration of the engine analyzer be maintained. Refer to the equipment manual for the procedure to calibrate the engine analyzer. If the equipment manual is not available, an estimate of the calibration can be made by connecting the Spark Tester D81P-6666-A or equivalent to a properly operating ignition system and measuring the firing voltage of the spark tester only. The spark tester firing voltage should be approximately 12KV.

Is the engine analyzer connected?

Yes	No
GO to <u>JB3</u> .	GO to <u>JB2</u> .

JB3 CHECK FOR IGNITION PATTERN

- Observe pattern on scope while cranking engine.



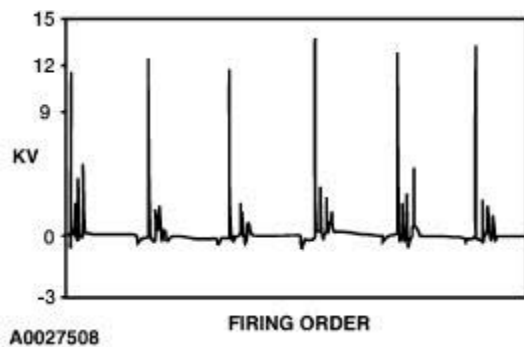
Is the pattern flat which indicates no spark on all cylinders?

Yes	No
<p>KEY OFF. LS6 and LS8: GO to <u>B5</u>.</p> <p>All others : IGN START/RUN circuit concern. CHECK condition of related fuses/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK IGN START/RUN circuit for short to ground. REPAIR as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).</p>	<p>GO to <u>JB4</u>.</p>

JB4 CHECK FOR NORMAL IGNITION PATTERN

Note: Spark plugs are fired up to four strikes per firing. Multi-strike operating mode is dependent on the PCM calibration and is limited to less than 2000 rpm. Above 2000 rpm, spark plugs are fired once per firing.

- Key on, engine running.
- Check spark plug firing voltage average pattern.



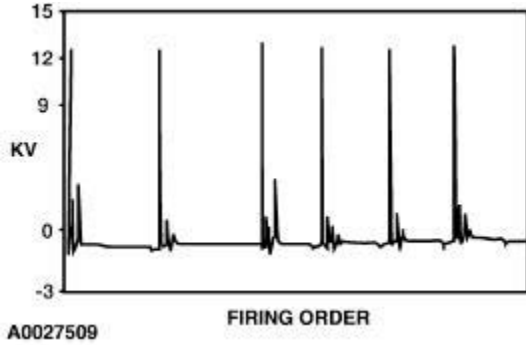
Are the patterns even and is the average value of spark plug firing voltage 12KV (+/- 3KV)?

Yes	No
<p>Intermittents:</p> <p>GO to <u>Z1</u>.</p> <p>All others:</p> <p>If you were directed to this Pinpoint Test from <u>Section 3</u>, RETURN to <u>Section 3</u>. If you were</p>	<p>GO to <u>JB5</u>.</p>

directed to this Pinpoint Test from **HD3** , GO to **HD4**. If you were directed to this Pinpoint Test from Pinpoint Test Step **A6** , GO to **A6**.

JB5 CHECK FOR TWO MISSING SPARK PATTERNS ON THE SAME COIL

- Observe pattern on scope.

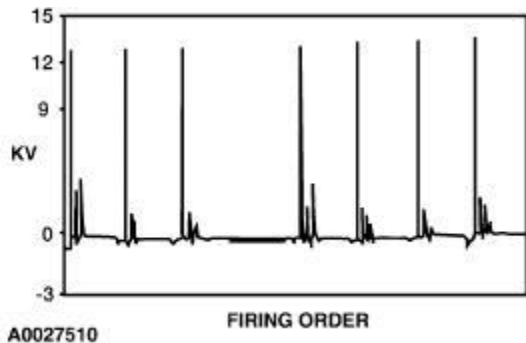


Is the spark pattern missing from two cylinders on the same coil?

Yes	No
INSPECT spark plug wires and spark plugs for missing cylinders. MEASURE resistance of spark plug wires. REPLACE if greater than 7,000 ohms per 30.5 cm (1 foot). Measure resistance of spark plugs. REPLACE if lower than 2000 or higher than 20000 ohms. If spark plug wires and spark plugs are OK, GO to <u>JE1</u> .	GO to <u>JB6</u> .

JB6 CHECK FOR ONE MISSING SPARK PATTERN

- Observe pattern on scope.



Is spark pattern missing from one cylinder?

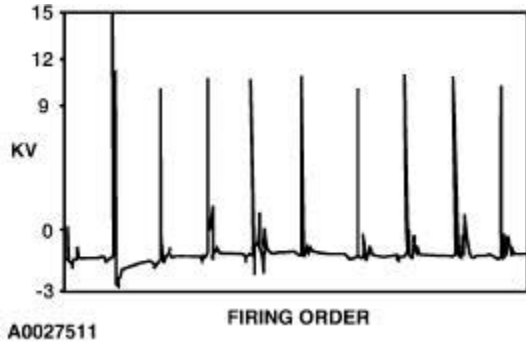
Yes	No
INSPECT spark plug wire and spark plug for missing cylinder. MEASURE resistance of spark plug wire. REPLACE if greater than 7,000 ohms per 30.5 cm (1 foot). MEASURE	

resistance of spark plug. REPLACE if lower than 2000 or higher than 20000 ohms. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

GO to JB7.

JB7 CHECK FOR HIGH SPARK PLUG FIRING VOLTAGE

- Check the spark plug firing voltage average pattern.

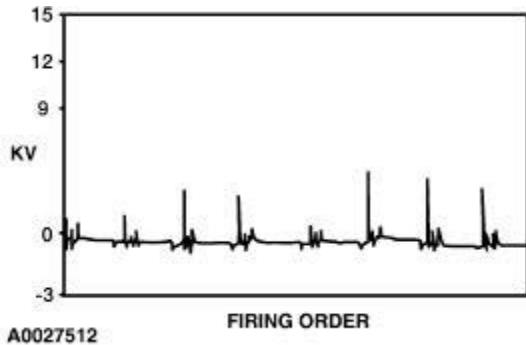


Is the average value of spark plug firing voltage greater than 15KV?

Yes	No
<p>Conditions affect all cylinders. INSPECT spark plug wires and spark plugs. MEASURE resistance of spark plug wires. REPLACE if greater than 7,000 ohms per 30.5 cm (1 foot). CHECK spark plug gaps. MEASURE resistance of spark plugs. REPLACE if lower than 2000 or higher than 20000 ohms. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).</p>	<p>GO to <u>JB8</u>.</p>

JB8 CHECK FOR LOW SPARK PLUG FIRING VOLTAGE

- Check the spark plug firing voltage average pattern.



Is there consistently low spark plug firing voltage or sloping spark line on one or more cylinders?

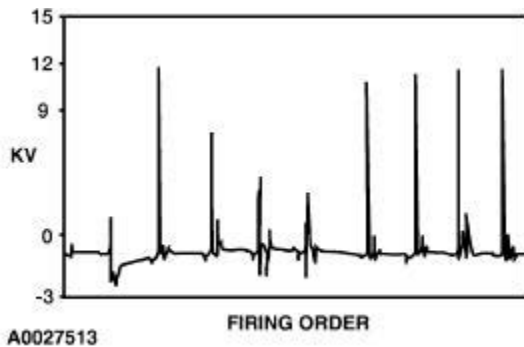
Yes	No

INSPECT spark plug wire and spark plugs. MEASURE resistance of spark plug wires. REPLACE if greater than 7,000 ohms per 30.5 cm (1 foot). MEASURE resistance of spark plugs. REPLACE if lower than 2000 or higher than 20000 ohms. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

GO to JB9.

JB9 CHECK FOR EVENNESS BETWEEN CYLINDERS

- Check the spark plug firing voltage average pattern.



Is the evenness of spark plug firing voltage greater than 6KV?

Yes	No
Inspect spark plug wires and spark plugs. MEASURE resistance of spark plug wires. REPLACE if greater than 7,000 ohms per 30.5 cm (1 foot). CHECK for damaged spark plugs or narrow spark plug gaps. MEASURE resistance of spark plugs. REPLACE if lower than 2000 or higher than 20000 ohms. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).	GO to <u>Z1</u> .

JB15 DTC P0301 THROUGH P0310: MISFIRE ON CYLINDERS 1 THROUGH 10

Are any of the above listed DTCs present?

Yes	No
GO to <u>JB16</u> .	GO to <u>JB17</u> .

JB16 CHECK FOR SPARK AT CYLINDER(S) INDICATED BY DTC(S)

- Disable inertia switch.
- Disconnect ignition coil(s) from spark plug(s).
- Connect a Spark Tester 303-D037 (D81P-6666-A) or equivalent to a coil.
- Check for spark while cranking engine.

Is the bluish-white spark present?

Yes	No
KEY OFF. GO to JB18 .	KEY OFF. INSPECT spark plugs for missing cylinders. MEASURE resistance of spark plugs. REPLACE if lower than 2000 or higher than 20000 ohms. GO to JF1 .

JB17 CHECK FOR SPARK AT ALL CYLINDERS

- Disable inertia switch.
- Using a Spark Tester 303-D037 (D81P-6666-A) or equivalent, check for spark at each cylinder while cranking engine.

Is the bluish-white spark consistent between all cylinders?

Yes	No
KEY OFF. GO to JB18 .	KEY OFF. INSPECT spark plugs for missing cylinders. MEASURE resistance of spark plugs. REPLACE if lower than 2000 or higher than 20000 ohms. Record cylinders with inconsistent spark and GO to JF1 .

JB18 CHECK SPARK PLUGS

- Remove and check plugs for damage, wear, carbon deposits and proper plug gap.

Are plugs OK?

Yes	No
GO to JB19 .	REPAIR plugs. ADJUST gap or REPLACE as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

JB19 CHECK SPARK PLUG RESISTANCE

- Measure spark plug resistance.

Is resistance between 2000 and 20000 ohms?

Yes	No
<p>Intermittents:</p> <p>GO to Z1.</p> <p>All others:</p> <p>If you were directed to this Pinpoint Test from Section 3, RETURN to Section 3. If you were directed to this Pinpoint Test from Pinpoint Test Step HD3, GO to HD4. If you were</p>	<p>REPLACE spark plugs. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).</p>

directed to this Pinpoint Test from Pinpoint Test Step A6 , GO to <u>A6</u> .	
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JB20 DTC P0301 THROUGH DTC P0308: MISFIRE ON CYLINDERS 1 THROUGH 8

Are any of the above listed DTCs present?

Yes	No
GO to <u>JB21</u> .	GO to <u>JB22</u> .

JB21 CHECK FOR SPARK AT CYLINDER(S) INDICATED BY DTC(S)

- Disable inertia switch.
- Disconnect spark plug wire(s) from spark plug(s).
- Connect a Spark Tester 303-D037 (D81P-6666-A) or equivalent to a spark plug wire.
- Check for spark while cranking engine.

Is the bluish-white spark present?

Yes	No
KEY OFF. GO to <u>JB23</u> .	KEY OFF. INSPECT spark plug wires. MEASURE resistance of spark plug wires. REPLACE if greater than 7,000 ohms per 30.5 cm (1 foot). COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>). If spark plug wires are OK, GO to <u>JE1</u> .

JB22 CHECK FOR SPARK AT ALL CYLINDERS

- Disable inertia switch.
- Using a Spark Tester 303-D037 (D81P-6666-A) or equivalent, check for spark at each cylinder while cranking engine.

Is the bluish-white spark consistent between all cylinders?

Yes	No
KEY OFF. GO to <u>JB23</u> .	KEY OFF. INSPECT spark plug wires. MEASURE resistance of spark plug wires. REPLACE if greater than 7,000 ohms per 30.5 cm (1 foot). COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>). If spark plug wires are OK, GO to <u>JE1</u> .

JB23 CHECK SPARK PLUGS

- Remove and check plugs for damage, wear, carbon deposits and proper plug gap.

Are plugs OK?

Yes	No
GO to JB24 .	REPAIR plugs. ADJUST gap or REPLACE as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

JB24 CHECK SPARK PLUG RESISTANCE

- Measure spark plug resistance.

Is resistance between 2000 and 20000 ohms?

Yes	No
<p>Intermittents:</p> <p>GO to Z1.</p> <p>All others:</p> <p>If you were directed to this Pinpoint Test from Section 3, RETURN to Section 3. If you were directed to this Pinpoint Test from Pinpoint Test Step HD3, GO to HD4. If you were directed to this Pinpoint Test from Pinpoint Test Step A6, GO to A6.</p>	REPLACE spark plugs. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

JD: Crankshaft Position (CKP) Sensor Introduction

JD: Pinpoint Tests →

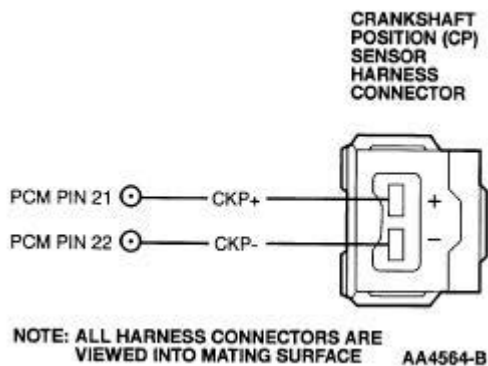
Note

This pinpoint test is intended to diagnose the following:

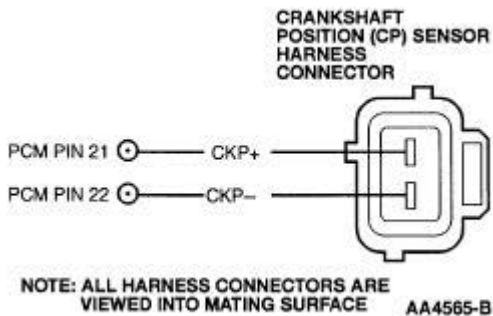
- Crankshaft position (CKP) sensor (6C315)
- Harness Circuits: CKP+ and CKP-
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

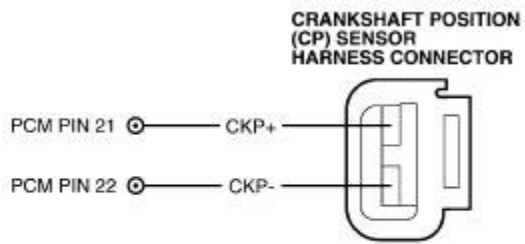
2.0L (2V) Escort, 4.0L SOHC Explorer



Escort (4V), 2.0L Cougar

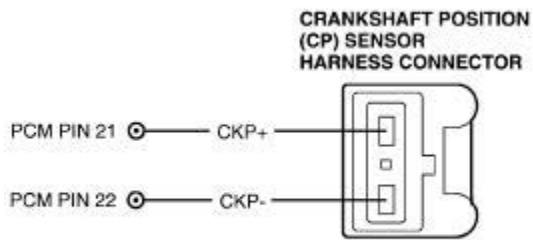


2.0L (2V) Focus



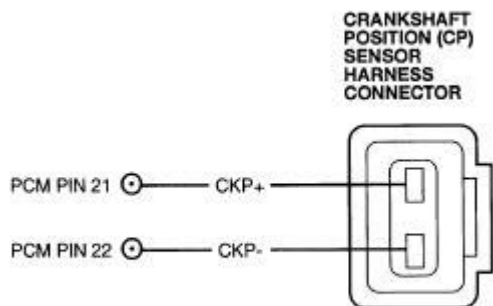
A0009922

2.0L (4V) Focus



A0013927

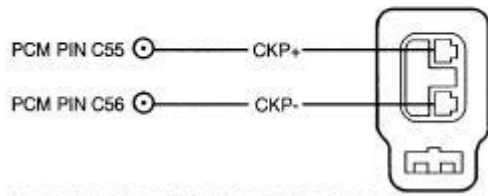
2.5L Cougar



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4566-B

LS8

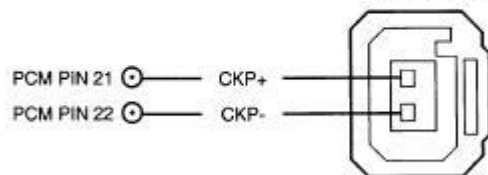
**CRANKSHAFT
POSITION (CP)
SENSOR
HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4567-B

All Others

**CRANKSHAFT
POSITION (CP)
SENSOR
HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** AA4568-B

JD: Crankshaft Position (CKP) Sensor

← JD: Introduction

JD1 CHECK CKP+ CKP—CONTINUITY

Note: Refer to the PCM connector pin numbers in the beginning of this Pinpoint Test.

- Disconnect the CKP sensor and PCM.
- Measure resistance of CKP(+) and CKP(-) circuits between the PCM harness connector and the CKP harness connector.

Is resistance greater than 5 ohms?

Yes	No
REPAIR open circuit.	GO to <u>JD2</u> .

JD2 CHECK FOR CKP+ BIAS VOLTAGE FAULT

- Key on, engine off.
- Reconnect the PCM.
- Measure voltage between CKP(+) at the CKP harness connector and battery negative post.
- Key off.

Was voltage greater than 1.0 volt but less than 2.0 volts?

Yes	No
GO to <u>JD3</u> .	Bias fault. GO to <u>JD19</u> .

JD3 CHECK FOR CKP- BIAS VOLTAGE FAULT

- Key on, engine off.
- Measure voltage between CKP(-) circuit at the CKP harness connector and battery negative post.

Was voltage between 1.0 and 2.0 volts?

Yes	No
KEY OFF. GO to <u>JD10</u> .	Bias fault. GO to <u>JD4</u> .

JD4 DETERMINE IF BIAS HIGH OR BIAS LOW FAULT

Was bias voltage reading in GO to JD3 less than 1.0 volt?

Yes	No
Bias low fault. GO to <u>JD5</u> .	Bias high fault. GO to <u>JD6</u> .

JD5 CHECK CKP- CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect PCM.
- Measure resistance of CKP(-) circuit at the PCM harness connector and battery negative post.

Is each resistance greater than 10K ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

JD6 CHECK CKP- CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.
- Key on, engine off.
- Measure voltage of CKP(-) circuit at the PCM harness connector and battery negative post.

Is voltage less than 0.5 volt?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

JD10 CHECK CKP SENSOR AMPLITUDE AT PCM

- Reconnect CKP sensor.
- Disconnect PCM.
- Measure voltage between CKP(+) and CKP(-) at the PCM harness connector when cranking engine.
- Key off.

Was settled ac voltage reading greater than 0.4 volt?

Yes	No
CKP circuit is OK. GO to <u>JD11</u> .	Amplitude fault. GO to <u>JD12</u> .

JD11 CHECK CKP(+) CIRCUIT FOR SHORT TO GROUND AT SENSOR

- Measure resistance between CKP+ and battery negative post.

Is the resistance greater than 10K ohms?

Yes	No
GO to <u>JB1</u> .	GO to <u>JD17</u> .

JD12 CHECK CKP CIRCUIT RESISTANCE FOR AMPLITUDE FAULT

- Measure resistance between CKP(+) and CKP(-) at the PCM harness connector.

Is resistance between 300 and 800 ohms (900 and 1300 for LS6LS8)?

Yes	No
GO to <u>JD16</u> .	GO to <u>JD13</u> .

JD13 DETERMINE IF RESISTANCE HIGH OR RESISTANCE LOW FAULT

Was the resistance from GO to JD12 less than 300 ohms?

Yes	No
Low resistance fault. GO to <u>JD14</u> .	REPLACE CKP sensor.

JD14 CHECK CKP+ FOR SHORT TO CKP-

- Disconnect CKP sensor.
- Measure resistance between the CKP+ and CKP- at the harness connector.

Is resistance less than 5 ohms?

Yes	No
REPAIR short.	REPLACE CKP.

JD16 CHECK CKP SENSOR AND PULSE WHEEL

- Check pulse wheel and CKP sensor visually for damage.

Is CKP sensor and pulse wheel OK?

Yes	No
REPLACE CKP sensor.	REPAIR or REPLACE damaged parts.

JD17 CHECK FOR OPEN OR SHORT IN PCM

- Disconnect the CKP sensor and connect the PCM.
- Key off.
- Measure the resistance between the CKP+ and CKP- at the CKP harness connector.

Is the resistance between 16K and 24K ohms?

Yes	No
GO to <u>JD18</u> .	REPLACE the PCM.

JD18 CHECK CKP+ CIRCUIT FOR SHORT TO CKP- CIRCUIT IN HARNESS

- Disconnect PCM.
- Measure resistance between CKP+ and CKP- at the PCM harness connector.

Is resistance greater than 1000 ohms?

Yes	No
REPLACE CKP sensor.	REPAIR short circuit.

JD19 DETERMINE IF BIAS VOLTAGE HIGH OR BIAS VOLTAGE LOW FAULT

Was bias voltage reading in GO to [JD2](#) less than 1.0 volt?

Yes	No
Low bias voltage fault. GO to JD20 .	High bias voltage fault. GO to JD21 .

JD20 CHECK CKP+ CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect PCM.
- Measure resistance between CKP+ and battery negative post.

Is resistance greater than 10K ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

JD21 CHECK CKP+ CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.
- Key on, engine off.
- Measure voltage of CKP+ and battery negative post.

Is voltage less than 0.5 volt?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

JE: Integrated Ignition Coil A, B, C or D Failure Introduction

JE: Pinpoint Tests →

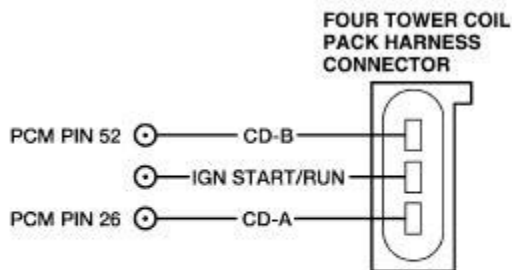
Note

This Pinpoint Test is intended to diagnose the following:

- Ignition coil packs (12029)
- Ignition coil harness
- Ign start/run circuit to coil packs
- Powertrain control module (PCM)(12A650)

Pinpoint Test Schematics and Connectors

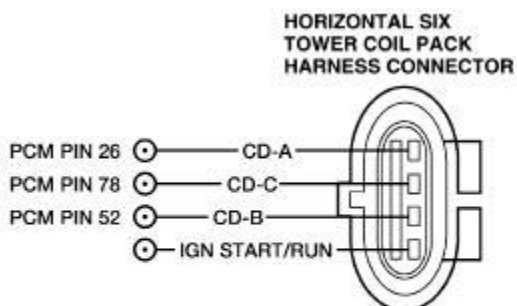
Escort, Focus, 2.0L Cougar, 2.0L Escape, 2.3L Ranger



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0027504

4.0L Ranger, 4.0L Explorer Sport/Sport Trac, 4.0L SOHC Explorer/Mountaineer

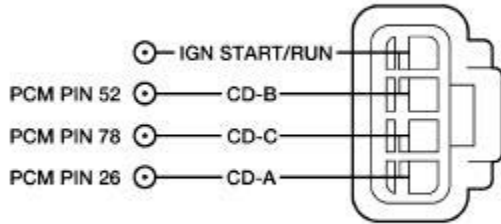


NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0027500

2.5L Cougar, Taurus/Sable, 3.8L Mustang, 3.0L Ranger, Windstar, 4.2L E/F Series

**SERIES 5
IGNITION COIL PACK**

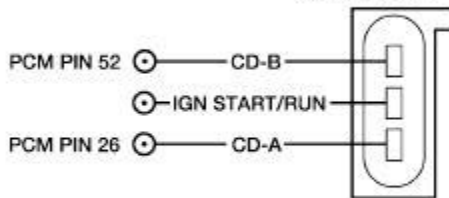


**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**

A0037141

2.5L Ranger, 5.0L Explorer/Mountaineer

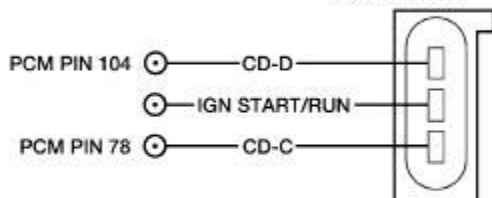
**FOUR TOWER COIL
PACK HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**

A0027501

**FOUR TOWER COIL
PACK HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**

A0027502

Tables

IGNITION COIL TO CYLINDER CORRELATION

Cylinder Number	Coil Driver	PCM Pin	Related DTC

4 Cylinder Applications Except 2.5L Ranger			
1	A	26	P0351
3	B	52	P0352
4	A	26	P0351
2	B	52	P0352
4 Cylinder Applications 2.5L Ranger			
1	A, C	26, 78	P0351, P0353
3	B, D	52, 104	P0352, P0354
4	A, C	26, 78	P0351, P0353
2	B, D	52, 104	P0352, P0354
6 Cylinder Applications			
1	A	26	P0351
4	B	52	P0352
2	C	78	P0353
5	A	26	P0351
3	B	52	P0352
6	C	78	P0353
8 Cylinder Applications			
1	A	26	P0351
3	B	52	P0352
7	C	78	P0353
2	D	104	P0354
6	A	26	P0351
5	B	52	P0352
4	C	78	P0353
8	D	104	P0354

JE: Integrated Ignition Coil A, B, C or D Failure

← JE: Introduction

JE1 DETERMINE WHICH COIL IS NOT FIRING

Note: Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.

- Determine which coil is not firing using information from Pinpoint Test JB or DTC and the table at the beginning of this pinpoint test.
- Record cylinder, coil and PCM pin number from the table.

Have the cylinder number, coil driver and PCM pin number been recorded.

Yes	No
GO to JE2 .	To obtain required information, REPEAT GO to JE1 .

JE2 DTC P0351, P0352, P0353, P0354: CHECK IGN START/RUN VOLTAGE TO COIL PACK

- Disconnect suspect coil (determined from the table).
- Key on, engine off.
- Measure voltage between IGN START/RUN circuit at coil pack harness connector and ground.

Is voltage greater than 10.0 volts?

Yes	No
KEY OFF. GO to JE5 .	IGN START/RUN circuit fault. KEY OFF. CHECK condition of related fuses/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged CHECK IGN START/RUN circuit for short to ground. REPAIR as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

JE5 CHECK FUNCTIONALITY OF SUSPECT COIL DRIVER (CD) CIRCUIT

- Connect incandescent test lamp between IGN START/RUN and suspect CD circuit (determined from the table) at the coil pack harness connector.
- Disable fuel pump by disconnecting inertia fuel shutoff switch.
- Observe incandescent test lamp while cranking engine.

Did test lamp blink consistently?

Yes	No

KEY OFF. GO to [JE11](#).

KEY OFF. GO to [JE6](#).

JE6 CHECK SUSPECT CD CIRCUIT FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of suspect CD circuit between PCM harness connector pin (determined from the table) and coil pack harness connector.

Is resistance less than 5 ohms?

Yes	No
GO to JE7 .	REPAIR open circuit. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

JE7 CHECK SUSPECT CD CIRCUIT FOR SHORT TO VPWR IN HARNESS

- Key on, engine off.
- Measure voltage between suspect CD circuit at the PCM harness connector (determined from the table) and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to JE8 .	KEY OFF. REPAIR short circuit. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

JE8 CHECK SUSPECT CD CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect the scan tool.
- Measure resistance between suspect CD circuit at the PCM harness connector (determined from the table) and ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to JE9 .	REPAIR short circuit. After repair, GO to JE10 to check for damaged coil.

JE9 PERFORM INTERMITTENT TEST ON SUSPECT CD CIRCUIT HARNESS

- Connect digital multimeter between suspect CD circuit at the PCM harness connector (determined from the table) and CD circuit at coil pack harness connector.
- Wiggle and bend CD harness from PCM harness connector to coil pack harness connector.

Did resistance fluctuate during wiggle test?

--	--

Yes	No
REPAIR intermittent fault in harness. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).	REPLACE PCM. (REFER to Section 2, Drive Cycles .) After repair, GO to JE10 to check for damaged coil.

JE10 CHECK SUSPECT PRIMARY COIL FOR OPEN

- Measure resistance of suspect coil between CD and IGN START/RUN circuits at coil pack connector.

Is resistance less than 5 ohms?

Yes	No
COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).	REPLACE coil pack. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

JE11 CHECK SUSPECT PRIMARY COIL FOR OPEN

- Measure resistance of suspect coil between CD and IGN START/RUN circuits at coil pack connector.

Is resistance less than 5 ohms?

Yes	No
GO to JE12 .	REPLACE coil pack. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

JE12 CHECK SUSPECT SECONDARY COIL FOR OPEN

- Remove both plug wires from secondary towers of suspect coil.
- Measure resistance of suspect secondary coil between coil pack towers.

Is resistance between 8.6K and 11.1K for Series 5 coil pack, between 11.5K and 15.5K for all others?

Yes	No
<p>If DTC P0350 is present:</p> <p>GO to JB1.</p> <p>If no additional ignition DTCs are present:</p> <p>GO to Z1.</p>	REPLACE coil pack. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

JF: Integrated Ignition Coil On Plug Coil A Through J Failure Introduction

JF: Pinpoint Tests →

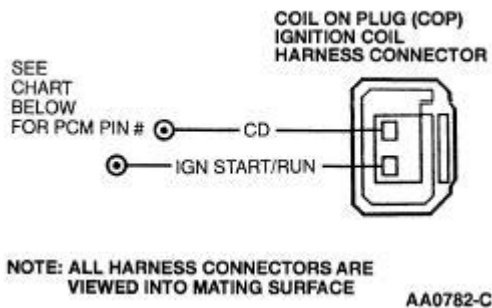
Note

This Pinpoint Test is intended to diagnose the following:

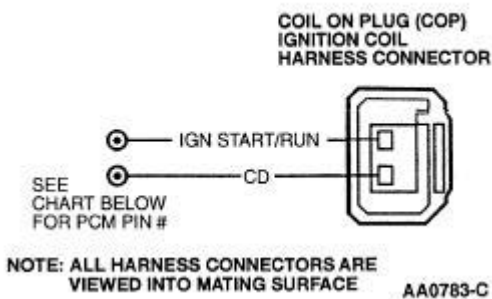
- Ignition coils (12A366)
- Ignition coil harness
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

Crown Victoria/Grand Marquis, Town Car, 4.6L 2V Mustang, 4.6L E/F-Series/Expedition, 5.4L Excursion, , 5.4L E/F-Series/Expedition



3.0L Escape, 4.6L 4V Mustang, 3.0L LS6, 3.9L LS8, 4.6L Continental, 4.6L Explorer/Mountaineer, 5.4L 4V Navigator/Blackwood, 6.8L E/F-Series, 6.8L Excursion



Tables

IGNITION COIL TO CYLINDER CORRELATION

Cylinder Number	Ignition Coil	Coil Driver (CD)	PCM Pin	Related DTC
3.0L Escape				
1	A	A	26	P0351
4	D	D	1	P0354
2	B	B	52	P0352
5	E	E	27	P0355
3	C	C	78	P0353
6	F	F	53	P0356
LS6				
1	A	A	C-31	P0351
4	D	B	C-12	P0354
2	B	C	C-23	P0352
5	E	D	C-22	P0355
3	C	E	C-13	P0353
6	F	F	C-30	P0356
LS8				
1	A	A	C-31	P0351
5	E	B	C-23	P0355
4	D	C	C-13	P0354
2	B	D	C-1	P0352
6	F	E	C-12	P0356
3	C	F	C-22	P0353
7	G	G	C-30	P0357
8	H	H	C-38	P0358
4.6L Explorer/Mountaineer				
1	A	A	C31	P0351
3	C	B	C23	P0353
7	G	C	C13	P0357
2	B	D	C1	P0352
6	F	E	C12	P0356
5	E	F	C22	P0355
4	D	G	C30	P0354
8	H	H	C38	P0358
8 Cylinder Applications				
1	A	A	26	P0351
3	C	B	52	P0353
7	G	C	78	P0357
2	B	D	104	P0352
6	F	E	1	P0356
5	E	F	27	P0355
4	D	G	53	P0354

	H	H	79	P0358
10 Cylinder Applications				
1	A	A	26	P0351
6	F	B	1	P0356
5	E	C	52	P0355
10	J	D	27	P0360
2	B	E	78	P0352
7	G	F	53	P0357
3	C	G	104	P0353
8	H	H	79	P0358
4	D	I	102	P0354
9	I	J	82	P0359

JF: Pinpoint Tests →

JF: Integrated Ignition Coil On Plug Coil A Through J Failure

← JF: Introduction

JF1 DETERMINE WHICH COIL IS NOT FIRING

Note: Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.

- Determine which coil is not firing using information from Pinpoint Test JB or DTC and the table at the beginning of this pinpoint test.
- Record cylinder, coil and PCM pin number from the table.

Have the cylinder number, coil driver and PCM pin number been recorded?

Yes	No
GO to <u>JF2</u> .	To obtain required information, GO to <u>JF1</u> and REPEAT.

JF2 CHECK FUNCTIONALITY OF SUSPECT COIL DRIVER (CD) CIRCUIT

- Disconnect suspect coil (determined from the table).
- Connect incandescent test lamp between IGN START/RUN and suspect CD circuit (determined from the table) at the coil on plug harness connector.
- Disable fuel pump by disconnecting inertia fuel shutoff switch.
- Observe incandescent test lamp while cranking engine.

Is the test lamp blinking consistently?

Yes	No
KEY OFF. GO to <u>JF3</u> .	KEY OFF. GO to <u>JF4</u> .

JF3 CHECK FUNCTIONALITY OF SUSPECT COIL

- Remove suspect coil (determined from the table) from spark plug.
- Connect an air gap spark tester 303-D037 (D81P-6666-A) or equivalent to a suspect coil.
- Reconnect suspect coil harness connector.
- Observe spark tester while cranking engine.

Is the spark present?

Yes	No
KEY OFF. INSPECT spark plug, REPLACE if necessary. GO to <u>Z1</u> .	KEY OFF. REPLACE coil. INSPECT spark plug, REPLACE if necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).

JF4 CHECK IGN START/RUN VOLTAGE TO SUSPECT COIL

- Key on, engine off.
- Measure voltage between IGN START/RUN circuit at the coil on plug harness connector and ground.

Is voltage greater than 10.0 volts?

Yes	No
KEY OFF. GO to <u>JF5</u> .	KEY OFF. LS6 and LS8 : GO to <u>B5</u> . All others : IGN START/RUN circuit fault. CHECK condition of related fuses/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK IGN START/RUN circuit for short to ground. REPAIR as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).

JF5 CHECK SUSPECT CD CIRCUIT FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance of suspect CD circuit between PCM harness connector pin (determined from the table) and coil on plug harness connector.

Is resistance less than 5 ohms?

Yes	No
GO to <u>JF6</u> .	REPAIR open circuit. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).

JF6 CHECK SUSPECT CD CIRCUIT FOR SHORT TO VPWR IN HARNESS

- Key on, engine off.
- Measure voltage between suspect CD circuit at the PCM harness connector (determined from the table) and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to <u>JF7</u> .	KEY OFF. REPAIR short circuit. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).

JF7 CHECK SUSPECT CD CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool.
- Measure resistance between suspect CD circuit at the PCM harness connector (determined from

the table) and ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to <u>JF8</u> .	REPAIR short circuit. If symptom or DTC is still present, GO to <u>JF9</u> to check for damaged coil, otherwise COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).

JF8 PERFORM INTERMITTENT TEST ON SUSPECT CD CIRCUIT HARNESS

- Connect digital multimeter between suspect CD circuit at the PCM harness connector (determined from the table) and CD circuit at coil on plug harness connector.
- Wiggle and bend CD harness from PCM harness connector to coil on plug harness connector.

Did resistance fluctuate during wiggle test?

Yes	No
REPAIR intermittent fault in harness. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).	REPLACE PCM. (REFER to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u> .) If symptom or DTC is still present, GO to <u>JF9</u> to check for damaged coil, otherwise COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).

JF9 CHECK SUSPECT COIL FOR DAMAGE

- Remove suspect coil (determined from the table) from spark plug.
- Connect an air gap spark tester 303-D037 (D81P-6666-A) or equivalent to a suspect coil.
- Disable fuel pump by disconnecting inertia fuel shutoff switch.
- Observe spark tester while cranking engine.

Is the spark present?

Yes	No
KEY OFF. INSPECT spark plug, REPLACE if necessary. GO to <u>Z1</u> .	KEY OFF. REPLACE coil. INSPECT spark plug, REPLACE if necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, <u>Drive Cycles</u>).

JH: Tachometer Output Failure Introduction

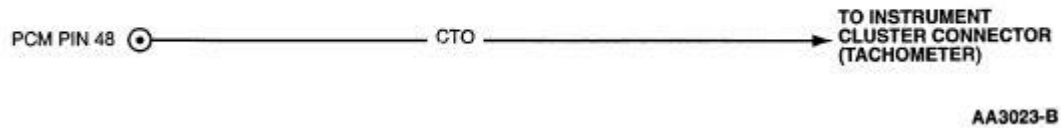
JH: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematic



JH: Pinpoint Tests →

JH: Tachometer Output Failure

← JH: Introduction

JH1 CHECK CTO CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.
- Key on, engine off.
- Measure voltage of CTO circuit between PCM harness connector pin 48 and ground.

Is the voltage less than 0.5 volt?

Yes	No
KEY OFF. GO to JH2 .	REPAIR short circuit. VERIFY symptom no longer exists.

JH2 CHECK CTO CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect instrument cluster connector.
- Measure resistance between PCM harness connector pin 48 and battery negative post.
- Measure resistance between PCM harness connector pin 48 and chassis ground.

Are both resistances greater than 10,000 ohms?

Yes	No
GO to JH3 .	REPAIR short circuit. VERIFY a symptom no longer exists.

JH3 CHECK CTO CIRCUIT FOR OPEN IN HARNESS

- Measure resistance between PCM harness connector pin 48 and instrument cluster harness pin.

Is the resistance less than 5.0 ohms?

Yes	No
GO to JH4 .	REPAIR open circuit. VERIFY symptom no longer exists.

JH4 CHECK CTO SIGNAL FROM PCM

- Reconnect PCM.
- Start engine.
- Measure voltage between CTO pin at the instrument cluster and battery negative post.

Is voltage between 3.0 and 9.0 volts?

--	--

Yes	No
REFER to the Instrument Cluster, Section 413-01A in Workshop Manual for diagnosis and testing.	REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).

KA: Fuel Pump Relay Introduction

KA: Pinpoint Tests →

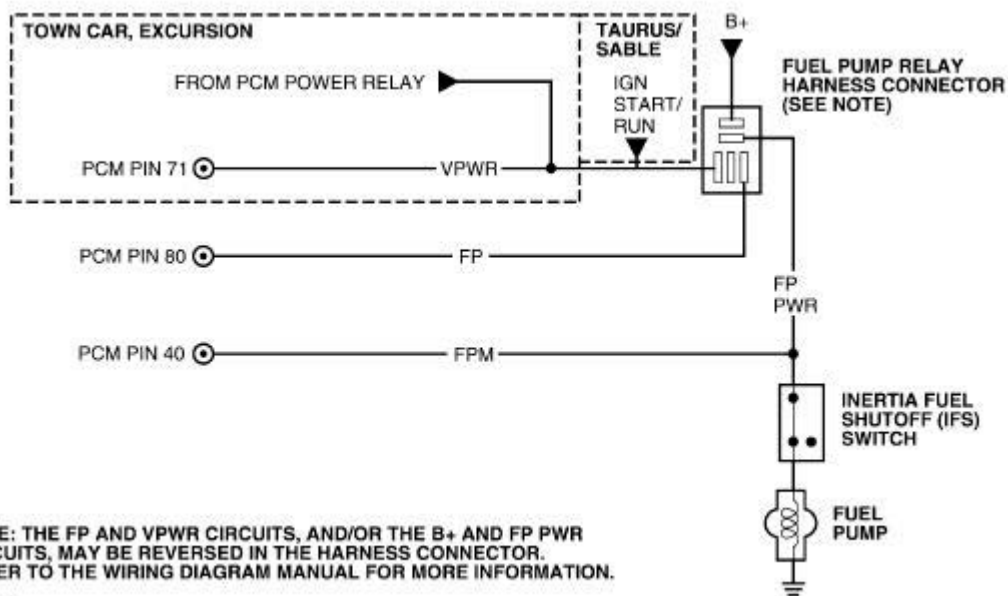
Note

This Pinpoint Test is intended to diagnose the following:

- Fuel pump relay (9345)
- Inertia fuel shutoff (IFS) switch (9341)
- Harness circuits: B+, VPWR, FP, LFP, GND, FPM and FP PWR
- Powertrain Control Module (PCM) (12A650)

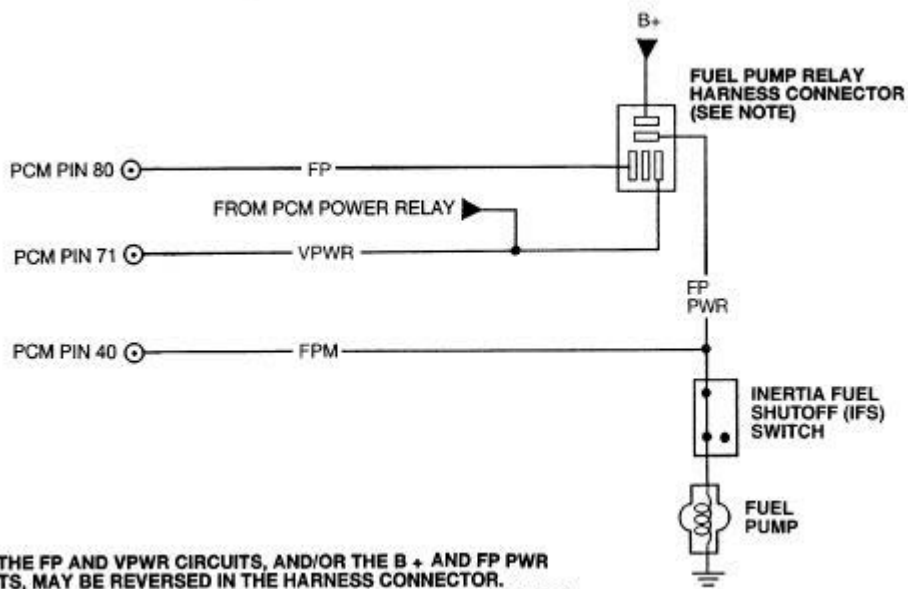
Pinpoint Test Schematics and Connectors

Taurus/Sable, Town Car, Excursion



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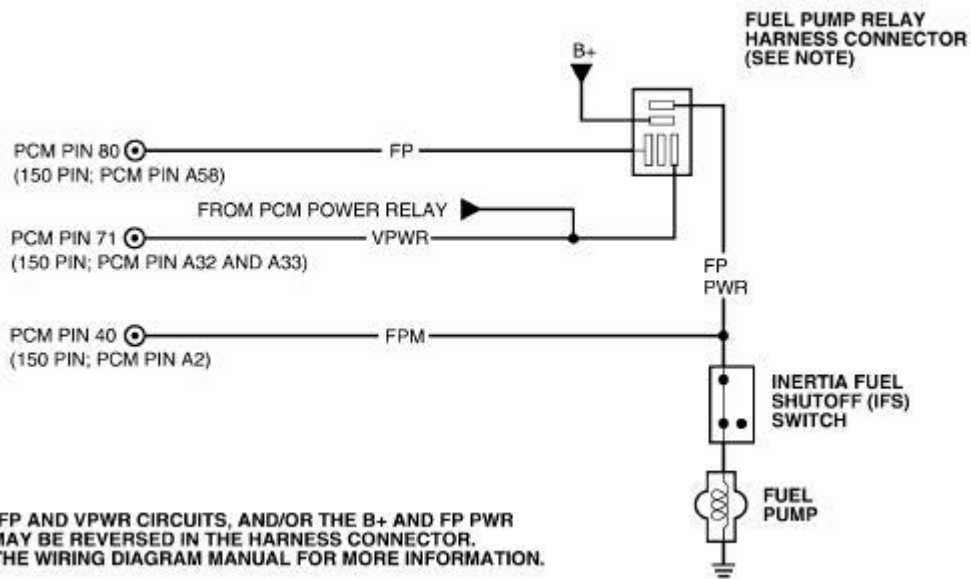
Ranger, Windstar



NOTE: THE FP AND VPWR CIRCUITS, AND/OR THE B + AND FP PWR CIRCUITS, MAY BE REVERSED IN THE HARNESS CONNECTOR. REFER TO THE WIRING DIAGRAM MANUAL FOR MORE INFORMATION

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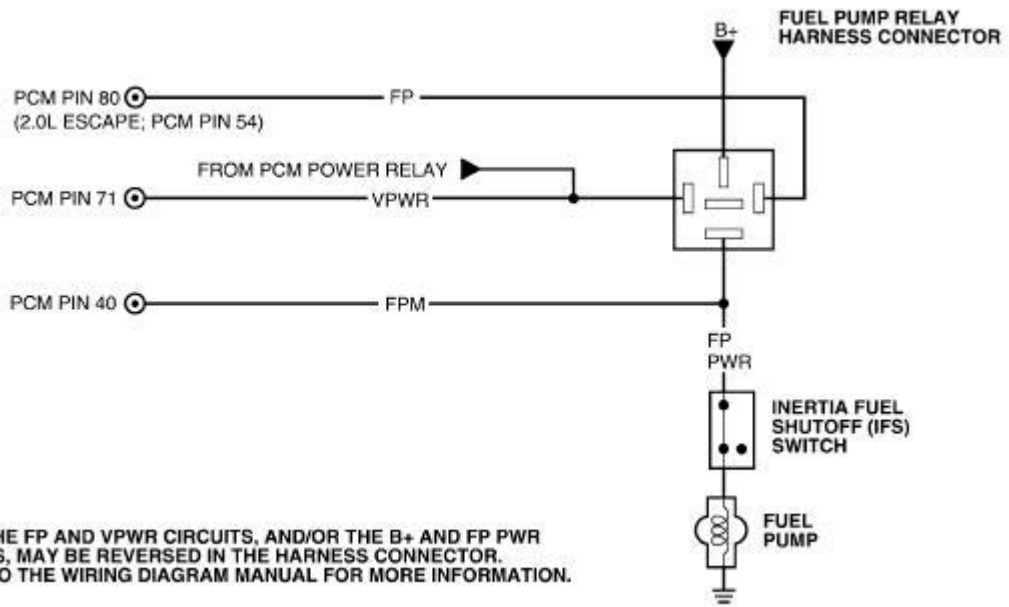
Explorer/Mountaineer



NOTE: THE FP AND VPWR CIRCUITS, AND/OR THE B+ AND FP PWR CIRCUITS, MAY BE REVERSED IN THE HARNESS CONNECTOR. REFER TO THE WIRING DIAGRAM MANUAL FOR MORE INFORMATION.

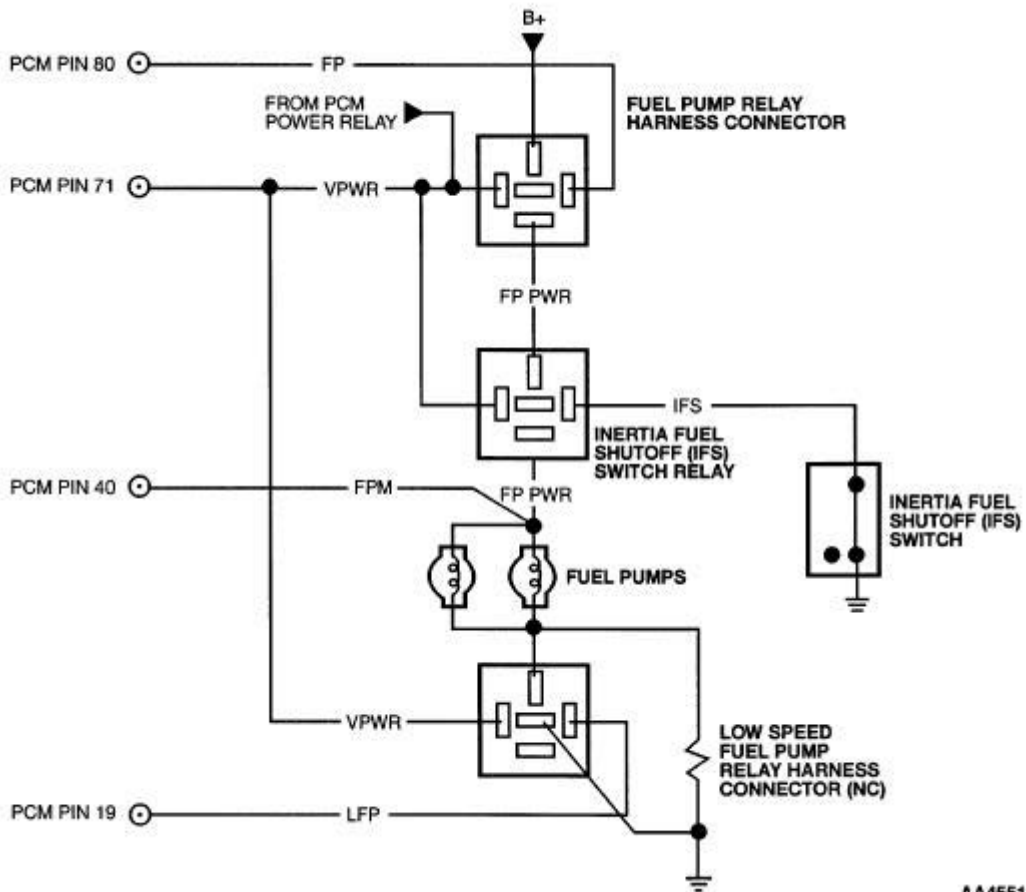
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Crown Victoria/Grand Marquis, Escape, E-Series, Expedition/Navigator/Blackwood, F-Series (Except 5.4L SC Lightning)



A0027491

5.4L (2V) SC F-150 Lightning



AA4551-A

KA: Fuel Pump Relay

← KA: Introduction

KA1 DTC P0230: CHECK VPWR (IGN START/RUN FOR TAURUS/SABLE) VOLTAGE TO FUEL PUMP RELAY

- Disconnect fuel pump relay.
- Key on, engine off.
- Measure VPWR (IGN START/RUN for Taurus/Sable) circuit voltage at the fuel pump relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KA2 .	REPAIR open circuit.

KA2 CHECK FUEL PUMP RELAY

- Refer to the pin numbers moulded on the Fuel Pump Relay. There will be either a pin 1 or pin 85.
- Measure resistance between either pin 1 or pin 85 and all other pins of the Fuel Pump Relay. One measurement should be between 40 and 120 ohms, with the other measurements being greater than 10,000 ohms.

Are all resistance checks OK?

Yes	No
GO to KA3 .	REPLACE fuel pump relay.

KA3 CHECK FUEL PUMP (FP) CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.
- Key on, engine off.
- Measure voltage between FP circuit at the fuel pump relay harness connector and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to KA4 .	REPAIR short circuit.

KA4 CHECK FP CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between FP circuit at the fuel pump relay harness connector and ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to KA5 .	REPAIR short circuit.

KA5 CHECK FP CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Measure resistance of FP circuit between fuel pump relay harness connector and PCM harness connector.

Is resistance less than 5.0 ohms?

Yes	No
<p>If Key On Engine Off (KOEO) DTC P0231 or P0232 is also present with the P0230:</p> <p>GO to KA6.</p> <p>All others:</p> <p>REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p>	REPAIR open circuit.

KA6 CHECK THE FUEL PUMP PRIMARY CIRCUIT INSIDE THE PCM

Note: The next two test steps will check the FP circuit in the PCM. To do this the FPF PID will be monitored. The FPF PID is able to detect for faults on the FP circuit, and will indicate NO when no fault is detected and YES when a fault is detected.

- Reconnect PCM, fuel pump relay and scan tool.
- Key on, engine off.
- Access FPF PID.

Is the FPF PID Yes?

Yes	No
KEY OFF. REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	GO to KA7 .

KA7 CHECK THE FUEL PUMP PRIMARY CIRCUIT INSIDE THE PCM WHILE CRANKING ENGINE

Note: The scan tool must be connected to a reliable power source that is powered with the key in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged.

- While viewing the FPF PID, crank engine.

Is the FPF PID Yes during crank?

Yes	No
KEY OFF. REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	KEY OFF. The fuel pump primary circuit is OK in the harness and PCM. If KOEO P0231 is present: KEY OFF. GO to <u>KA20</u> . If KOEO P0232 is present: GO to <u>KA10</u> .

KA10 DTC P0232: DOES ENGINE START?

Does the engine start?

Yes	No
GO to <u>KA11</u> .	For F-150 Lightning: GO to <u>KA65</u> . All others: GO to <u>KA15</u> .

KA11 VERIFY THAT FUEL PUMP IS OFF

- Key on, wait five seconds.
- Listen for motor noise from fuel pump (it may be necessary to listen near fuel tank).

Is fuel pump off with the key on?

Yes	No
KEY OFF. GO to <u>KA13</u> .	KEY OFF. GO to <u>KA12</u> .

KA12 CHECK FOR FUEL PUMP RELAY ALWAYS CLOSED

- Disconnect fuel pump relay.
- Key on.

Is the fuel pump off?

Yes	No
REPLACE fuel pump relay.	REPAIR short to power in FP PWR/FPM circuit.

KA13 CHECK FOR OPEN FPM CIRCUIT

- Disconnect PCM.

- Disconnect fuel pump relay.
- Measure resistance between PCM harness connector pin 40 and FP PWR circuit at the fuel pump relay harness connector.

Is resistance less than 5.0 ohms?

Yes	No
<p>For P0232: GO to KA14.</p> <p>For P0231: REPLACE PCM (REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p>	<p>REPAIR open circuit.</p>

KA14 CHECK FPM CIRCUIT IN PCM

- Reconnect PCM and fuel pump relay.
- Key on, engine off.
- Access FPM PID.

Is the FPM PID OFF?

Yes	No
<p>Key off.</p> <p>For F-150 Lightning:</p> <p>GO to KA55.</p> <p>All others:</p> <p>No fault is detected. The FPM circuit is OK in the harness and PCM. DISREGARD DTC P0232 at this time. RETURN to Section 3, Step 1: Quick Test and CONTINUE diagnosis as directed.</p>	<p>REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p>

KA15 CHECK INERTIA FUEL SHUTOFF (IFS) SWITCH

- Disconnect inertia fuel shutoff (IFS) switch (verify that switch is reset).
- Measure resistance between the C and NC pins of the IFS switch.

Is resistance less than 5.0 ohms?

Yes	No
<p>GO to KA16.</p>	<p>REPLACE or RESET IFS switch.</p>

KA16 CHECK FOR OPEN FP PWR CIRCUIT BETWEEN IFS SWITCH AND FUEL PUMP RELAY

- Disconnect fuel pump relay.
- Measure resistance of the FP PWR circuit between fuel pump relay and IFS switch harness

connectors.

Is resistance less than 5.0 ohms?

Yes	No
RECONNECT fuel pump relay. GO to KA17 .	REPAIR open in FP PWR circuit between IFS switch and FPM connection to circuit. (REFER to Wiring Diagram Manual to determine IFS switch location in circuit).

KA17 CHECK FOR OPEN FUEL PUMP GROUND CIRCUIT

- Disconnect fuel pump.
- Measure resistance of fuel pump ground circuit between fuel pump harness connector and ground.

Is resistance less than 5.0 ohms?

Yes	No
GO to KA18 .	REPAIR open circuit.

KA18 CHECK FOR OPEN FP PWR CIRCUIT BETWEEN IFS SWITCH AND FUEL PUMP

- Measure resistance of FP PWR circuit between IFS switch and fuel pump harness connectors.

Is resistance less than 5.0 ohms?

Yes	No
GO to KA19 .	REPAIR open circuit.

KA19 CHECK INTERNAL RESISTANCE OF FUEL PUMP

- Measure internal resistance of fuel pump between FP PWR pin and ground pin of the fuel pump.

Is resistance less than 10.0 ohms?

Yes	No
All fuel pump circuit checks are OK. VERIFY test step results. If all test steps are OK, RECONNECT all components. DISREGARD DTC P0232 at this time. RETURN to Section 3 , Step 1: Quick Test and CONTINUE diagnosis as directed.	REPLACE fuel pump.

KA20 DTC P0231: DOES ENGINE START?

Note: If key on, engine off DTC P0230 is also present and has not been diagnosed, GO to [KA1](#) (to check the primary fuel pump circuits first).

Does the engine start?

Yes	No
GO to KA13 .	GO to KA21 .

KA21 CHECK B+ VOLTAGE TO FUEL PUMP RELAY

- Disconnect fuel pump relay.
- Measure B+ circuit voltage at fuel pump relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
For F-150 Lightning: GO to KA23 . All others: GO to KA22 .	VERIFY integrity of fuse for B+ supply to fuel pump relay. If OK, REPAIR open circuit. If fuse is damaged, CHECK B+ and FP PWR circuits for short to ground before replacing.

KA22 CHECK FOR OPEN FP PWR CIRCUIT BETWEEN FUEL PUMP RELAY AND FPM SPLICE

- Measure resistance between FP PWR circuit at the fuel pump relay harness connector and the battery negative post.

Is resistance less than 10.0 ohms?

Yes	No
REPLACE fuel pump relay.	REPAIR open in FP PWR circuit between FPM splice and fuel pump relay.

KA23 CHECK VPWR AND INERTIA FUEL SHUTOFF (IFS) CIRCUITS TO INERTIA FUEL SHUTOFF SWITCH RELAY

- Disconnect inertia fuel shutoff (IFS) switch relay.
- Key on, engine off.
- Measure voltage between the VPWR and IFS circuits at the IFS switch relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KA28 .	GO to KA24 .

KA24 CHECK FOR VPWR TO IFS SWITCH RELAY

- Measure voltage between the VPWR circuit at the IFS switch relay harness connector and chassis ground.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KA25 .	REPAIR open VPWR circuit to IFS switch relay.

KA25 CHECK GROUND CIRCUIT TO IFS SWITCH

- Disconnect IFS switch (verify switch is set).
- Measure resistance of ground circuit between IFS switch harness connector and chassis ground.

Is resistance less than 5.0 ohms?

Yes	No
GO to KA26 .	REPAIR open circuit.

KA26 CHECK IFS SWITCH

- Measure resistance between the C and NC pins of the IFS switch.

Is resistance less than 5.0 ohms?

Yes	No
GO to KA27 .	REPLACE or RESET IFS switch.

KA27 CHECK FOR OPEN IFS CIRCUIT

- Measure resistance of IFS circuit between IFS switch and IFS switch relay harness connectors.

Is resistance less than 5.0 ohms?

Yes	No
No fault is detected. DISREGARD DTC P0232 at this time. RETURN to Section 3 , Step 1: Quick Test and continue diagnosis as directed.	REPAIR open circuit.

KA28 CHECK FP PWR CIRCUIT CONTINUITY BETWEEN FUEL PUMP RELAY AND IFS SWITCH RELAY

- Measure resistance of FP PWR circuit between the fuel pump relay and the IFS switch relay harness connectors.

Is resistance less than 5.0 ohms?

Yes	No
GO to KA29 .	REPAIR open circuit.

KA29 CHECK OPERATION OF IFS SWITCH RELAY AND FUEL PUMP RELAY

- Using jumper wires, energize the IFS switch relay by connecting B+ to pin 86 and battery ground to pin 85 of the relay (pin numbers molded on relay).
- With relay energized, measure resistance between pins 30 and 87 of the relay. Resistance should be less than 5.0 ohms.
- Repeat test using the fuel pump relay.

Are both relays OK?

Yes	No
REPAIR open in FP PWR circuit between FPM splice and IFS switch relay.	REPLACE applicable relay.

KA30 CONTINUOUS MEMORY DTC P0232: CHECK FUEL PUMP SECONDARY CIRCUITS

Note:

1. If Continuous Memory (DTC) P0230 is also present, GO to [KA40](#).
2. Be aware that P0232 could be set if the inertia fuel shutoff (IFS) switch was tripped then reset, or if power was supplied to the FP PWR circuit when the PCM expected the fuel pump to be off (i.e. fuel pump prime procedure).

- Key on, engine off.
- Access FPM PID on Scan Tool.
- Observe the FPM PID for an indication of a fault while completing the following (the FPM PID will turn ON when an open or short to power is detected):
 - Shake, wiggle, bend the FP PWR circuit between the FP PWR pin at the fuel pump relay and the fuel pump.
 - Shake, wiggle, bend the fuel pump ground circuit from the fuel pump to ground.
 - Shake, wiggle, bend the FPM circuit between the PCM and the splice to the FP PWR circuit.
 - Lightly tap the fuel pump, inertia fuel shutoff switch and fuel pump relay to simulate road shock.
 - For F-150 Lightning, disconnect low speed fuel pump relay and note FPM PID.
- Key off.

Was a fault indicated/found?

Yes	No
<p>For F-150 Lightning:</p> <p>If the FPM PID is consistently on with the low speed fuel pump relay disconnected; VERIFY condition of fuel pump ground circuit resistor. If OK, REPAIR open circuit between low speed fuel pump relay, through resistor to splice. Otherwise, GO to "All others" Action to Take.</p> <p>All others:</p> <p>ISOLATE fault and REPAIR as necessary.</p>	<p>Unable to duplicate or identify fault at this time. GO to Z1.</p>

KA35 CONTINUOUS MEMORY DTC P0231: CHECK HARNESS CIRCUITS

- Disconnect PCM.
- Install a jumper wire between PCM harness connector pin 80 (FP) and ground.
- Connect a digital multimeter between PCM harness connector pin 40 (FPM) and ground.
- Key on. The fuel pump will turn on and voltage will be greater than 10.0 volts.
- Observe voltage for an indication of a fault while completing the following (voltage will change suddenly when a fault is detected, indicating an open):
 - Shake, wiggle, bend the B+ circuit to the fuel pump relay.
 - Lightly tap the fuel pump relay to simulate road shock.
 - Shake, wiggle, bend the FP PWR circuit between the fuel pump relay and the FPM splice.
 - For F-150 Lightning, also shake, wiggle and bend the circuits connected to the inertia fuel shutoff (IFS) switch relay. Lightly tap the IFS switch and IFS switch relay.
- Key off.
- Inspect the fuel pump relay connector for corrosion and damaged pins.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

KA40 CONTINUOUS MEMORY DTC P0230: CHECK FUEL PUMP PRIMARY CIRCUITS

- Key on, engine off. Wait 5 seconds.
- Access FPF PID. The FPF PID will be NO, indicating that the PCM detects VPWR (IGN START/RUN for Taurus/Sable) voltage through the fuel pump relay coil and FP circuit.
- Observe the FPF PID for an indication of a fault while completing the following (the FPF PID will read YES, when an open is detected).
 - Shake, wiggle, bend the Fuel Pump (FP) circuit between the PCM and the fuel pump relay.
 - Shake, wiggle bend the VPWR (IGN START/RUN for Taurus/Sable) circuit between the electronic engine control power relay and the fuel pump relay.
 - Lightly tap the fuel pump relay (to simulate road shock).
- Key off.
- Inspect the PCM and fuel pump relay connectors for corrosion, damaged pins.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

KA45 DTC P1232: CHECK VPWR VOLTAGE TO LOW SPEED FUEL PUMP RELAY

- Disconnect low speed fuel pump relay.
- Key on, engine off.
- Measure VPWR circuit voltage at the low speed fuel pump relay harness connector.

Is voltage greater than 10.5 volts?

--	--

Yes	No
KEY OFF. GO to KA46 .	REPAIR open in VPWR circuit between the Electronic Engine Control power relay and the low speed fuel pump relay.

KA46 CHECK LOW SPEED FUEL PUMP RELAY

- Measure resistance between pin 85 and all other pin of the low speed fuel pump relay (pin numbers moulded on relay). One measurement must be between 40 and 100 ohms, with the other measurements being greater than 10,000 ohms.

Are all resistance checks OK?

Yes	No
GO to KA47 .	REPLACE low speed fuel pump relay.

KA47 CHECK LOW FUEL PUMP (LFP) CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.
- Key on.
- Measure voltage between LFP circuit at low fuel pump relay harness connector and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to KA48 .	REPAIR short circuit.

KA48 CHECK LFP CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between LFP circuit at low fuel pump relay harness connector and ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to KA49 .	REPAIR short circuit.

KA49 CHECK FOR OPEN LFP CIRCUIT

- Measure resistance of LFP circuit between PCM harness connector pin 19 and the low speed fuel pump relay harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash	

Electrically Erasable Programmable Read Only Memory (EEPROM).

REPAIR open circuit.

KA55 CHECK FOR OPEN FUEL PUMP GROUND CIRCUIT THROUGH RESISTOR

- Disconnect low speed fuel pump relay.
- Key on, engine off.
- Again, access FPM PID.

Is the FPM PID off?

Yes	No
KEY OFF. No fault is detected. DISREGARD DTC P0232 at this time. RETURN to Section 3 , Step 1: Quick Test and CONTINUE diagnosis as directed.	VERIFY condition of fuel pump ground circuit resistor. If OK, REPAIR open circuit between low speed fuel pump relay, through resistor, to splice.

KA60 CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODE (DTC) P1232: CHECK LOW SPEED FUEL PUMP PRIMARY CIRCUITS

- Key on, engine off. Wait 5 seconds.
- Access LFPF PID. The LFPF PID will be NO, indicating that the PCM detects VPWR voltage through the low speed fuel pump relay coil and LFP circuit (pin 19) to the PCM.
- Observe the LFPF PID for an indication of a fault while completing the following (the LFPF PID will be YES if a fault is detected).
 - Shake, wiggle, bend the LFP circuit between the PCM and the low speed fuel pump relay.
 - Shake, wiggle, bend the VPWR circuit between the electronic engine control power relay and the low speed fuel pump relay.
 - Lightly tap the low speed fuel pump relay (to simulate road shock).
- Key off.
- Inspect the PCM and low speed fuel pump relay connectors for corrosion, damaged pins.

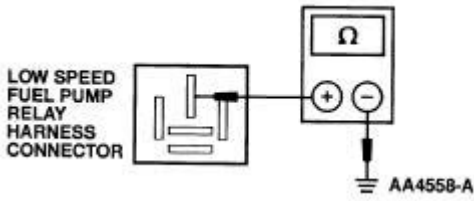
Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	Unable to duplicate or identify fault at this time. GO to Z1 .

KA65 CHECK RESISTANCE OF FUEL PUMP GROUND CIRCUIT THROUGH RESISTOR

- Disconnect low speed fuel pump relay.
- Measure resistance of ground circuit through resistor between low speed fuel pump relay harness connector and chassis ground.

Is resistance less than 7.0 ohms?



Yes	No
GO to KA66 .	VERIFY condition of fuel pump ground circuit resistor. If OK, REPAIR open circuit.

KA66 CHECK FOR OPEN GROUND CIRCUIT BETWEEN LOW SPEED FUEL PUMP RELAY AND FUEL PUMPS

- Disconnect fuel pumps.
- Measure resistance of ground circuit between one of the fuel pumps and the low speed fuel pump relay harness connectors (same relay pin as one used in previous step).
- Repeat same check except check ground to other fuel pump.

Are both resistances less than 5.0 ohms?

Yes	No
GO to KA67 .	REPAIR open circuit(s).

KA67 CHECK INTERNAL RESISTANCES OF EACH FUEL PUMP

- Measure internal resistance of one fuel pump between FP PWR pin and ground pin of the fuel pump.
- Repeat test for other fuel pump.

Are both resistances less than 10.0 ohms?

Yes	No
GO to KA68 .	REPLACE appropriate fuel pump(s).

KA68 CHECK FOR OPEN FP PWR CIRCUIT BETWEEN FPM SPLICE AND FUEL PUMPS

- Disconnect inertia fuel shutoff (IFS) switch relay.
- Measure resistance of FP PWR circuit between IFS switch relay and one of the fuel pump's harness connectors.
- Repeat test for other fuel pump.

Are both resistances less than 5.0 ohms?

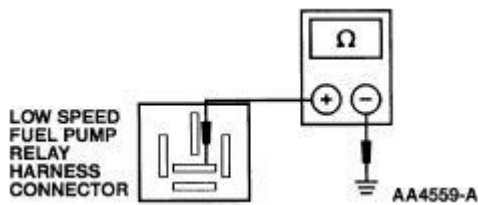
Yes	No
No fault is detected. DISREGARD DTC P0232 at this time. RETURN to Section 3 , Step 1: Quick Test and continue diagnosis as	REPAIR open FP PWR circuit between fuel pump and FPM circuit splice to circuit.

directed.

KA70 HARD START/LACKS POWER: CHECK GROUND CIRCUIT USED FOR HIGH SPEED FUEL PUMP OPERATION BETWEEN LOW SPEED FUEL PUMP RELAY AND CHASSIS

- Disconnect low speed fuel pump relay.
- Measure resistance of ground circuit between low speed fuel pump relay harness connector and chassis ground.

Is resistance less than 5.0 ohms?

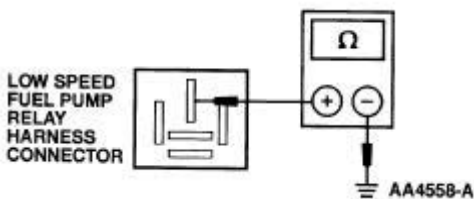


Yes	No
GO to <u>KA71</u> .	REPAIR open ground circuit.

KA71 MEASURE RESISTANCE OF FUEL PUMP GROUND CIRCUIT THROUGH THE RESISTOR TO CHASSIS GROUND

- Measure resistance of fuel pump ground circuit through resistor between low speed fuel pump relay harness connector and chassis ground.

Is resistance less than 7.0 ohms?



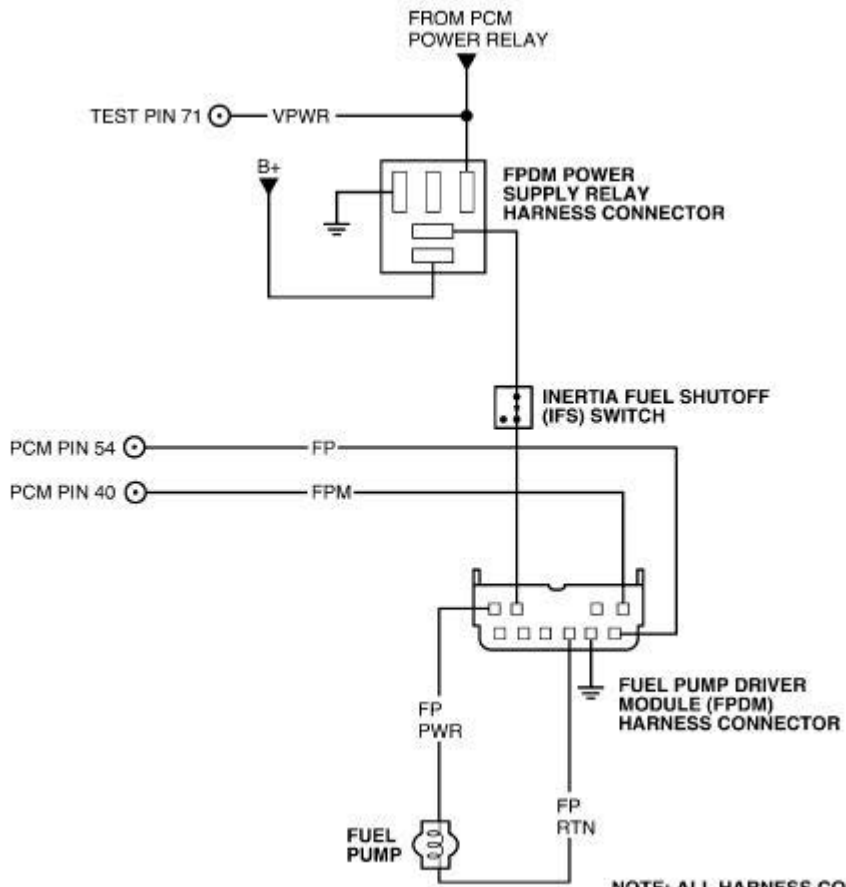
Yes	No
GO to <u>KA72</u> .	REPAIR open circuit between low speed fuel pump relay and splice to ground circuit that goes through resistor.

KA72 CHECK NORMALLY CLOSED CONTACTS OF LOW SPEED FUEL PUMP RELAY

- Measure resistance between pin 30 and pin 87A of the low speed fuel pump relay (pin numbers molded on relay).

Is resistance less than 5.0 ohms?

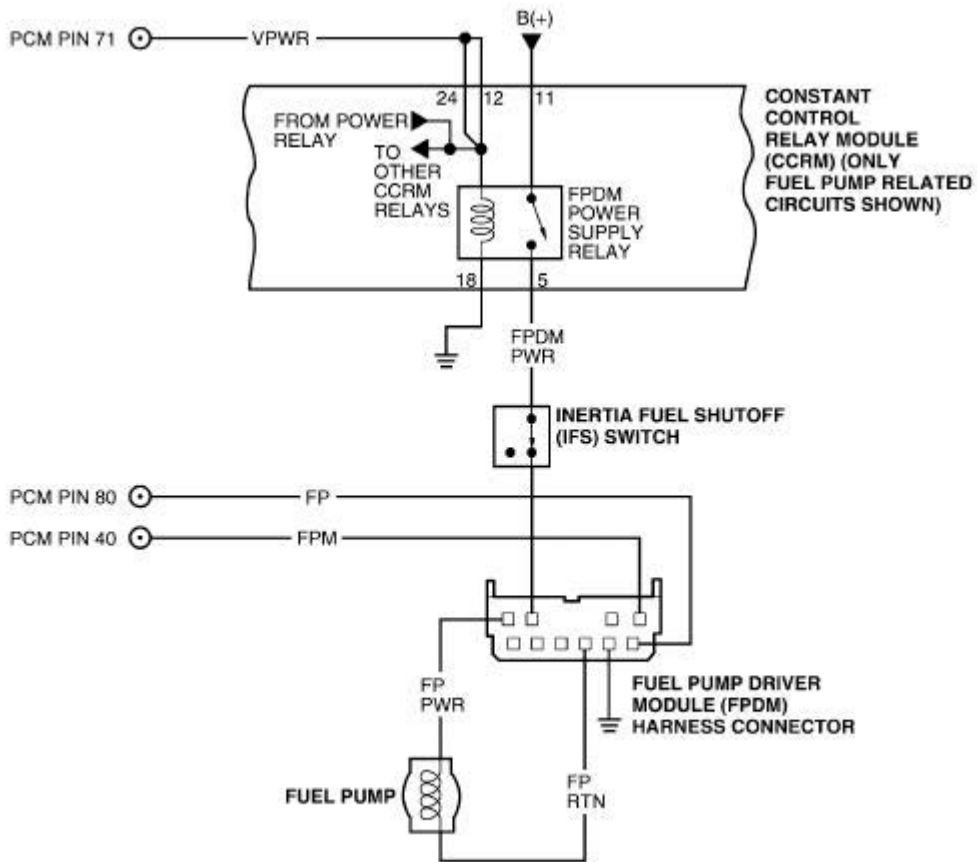
Yes	No
High speed fuel pump circuits OK. RETURN to Section 3 to continue diagnosis.	REPLACE low speed fuel pump relay.



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0038392

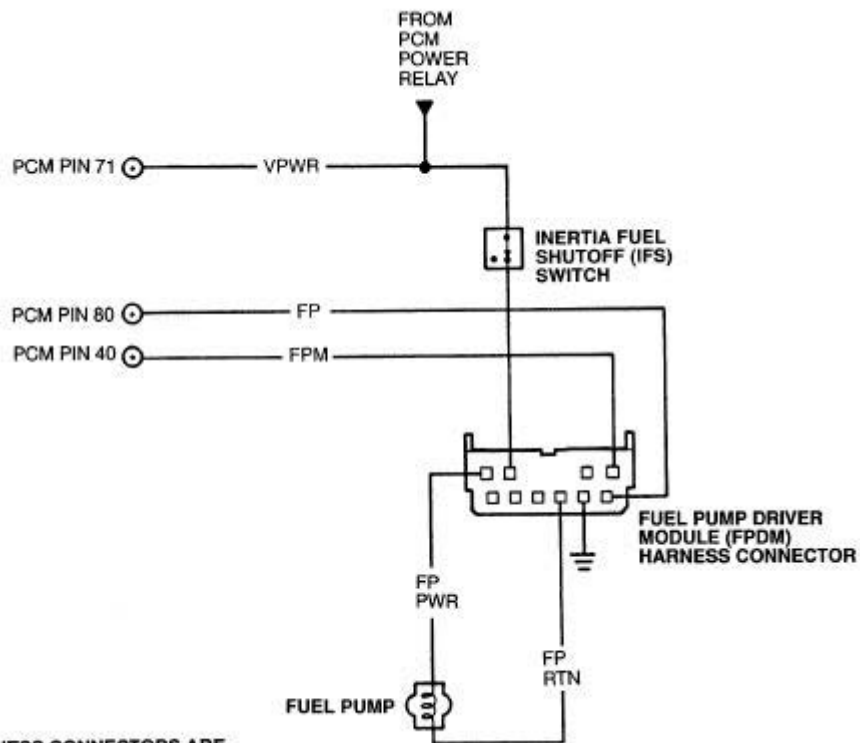
Mustang



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0015025

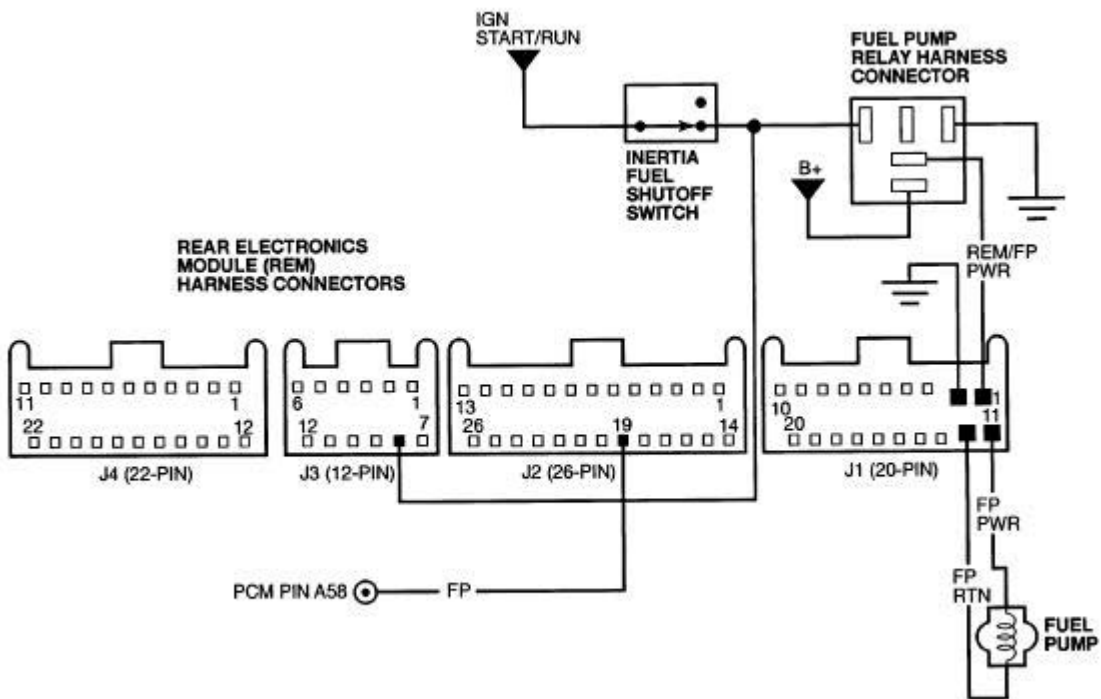
Continental



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA0794-E

LS6/LS8



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA4847-B

KB: Pinpoint Tests →

KB: Fuel Pump Driver Module (FPDM)

← KB: Introduction

KB1 DTC P1233 OR P1234: IS DTC P1233 OR P1234 PRESENT IN KEY ON ENGINE OFF SELF TEST

Is DTC P1233 or P1234 present in Key On Engine Off Self-Test?

Yes	No
A hard fault is present. GO to KB2 .	<p>The PCM is now receiving a signal from the FPDM. One possible cause of the DTC P1233 or P1234 is that the IFS switch was tripped, then reset.</p> <p>If engine is now a no start:</p> <p>Disregard the DTC P1233 or P1234 at this time. RETURN to Section 3 and CONTINUE as directed. After servicing the no start, to diagnose intermittent causes of the DTC P1233 or P1234, RETURN to GO to KB25.</p> <p>If engine will start:</p> <p>GO to KB25 to diagnose intermittent condition.</p>

KB2 DOES THE ENGINE START?

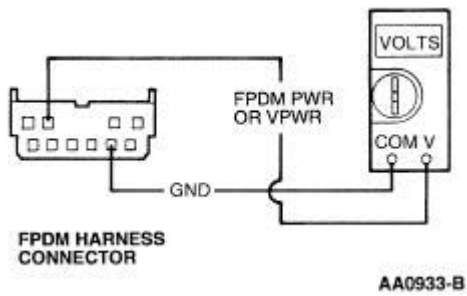
Does the engine start?

Yes	No
GO to KB15 (to check the FPM circuit).	VERIFY IFS switch is set (button depressed). If OK, GO to KB3 .

KB3 CHECK POWER AND GROUND CIRCUITS TO FPDM

- Disconnect FPDM.
- Key on, engine off.
- Measure voltage between the FPDM PWR pin (VPWR for Continental) and ground pin at the FPDM harness connector.

Is voltage greater than 10.5 volts?

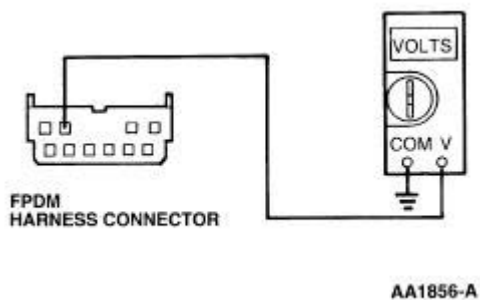


Yes	No
Key off. REPLACE FPDM.	GO to KB4 .

KB4 CHECK POWER TO FPDM

- Key on, engine off.
- Measure voltage between the FPDM PWR pin (VPWR for Continental) at the FPDM harness connector and chassis ground.

Is voltage greater than 10.5 volts?



Yes	No
REPAIR open ground circuit to FPDM.	<p>KEY OFF. No power to FPDM.</p> <p>For Escort, Mustang:</p> <p>GO to KB5.</p> <p>For Continental:</p> <p>GO to KB14.</p> <p>All Others:</p> <p>GO to KB8.</p>

KB5 CHECK B+ VOLTAGE TO CCRM PIN 11 (FPDM POWER SUPPLY RELAY)

- Disconnect CCRM.

- Measure B+ circuit voltage at Pin 11 of the CCRM harness connector.

Is voltage greater than 10.5 volts?

Yes	No
For Mustang: GO to KB6 . For Escort: GO to KB7 .	VERIFY integrity of related fuse. If OK, REPAIR open B+ circuit. If fuse is damaged, CHECK B+ and FPDM PWR circuits for short to ground before replacing.

KB6 CHECK GROUND CIRCUIT TO CCRM PIN 18

- Measure resistance of ground circuit between CCRM harness connector Pin 18 and chassis ground.

Is resistance less than 5.0 ohms?

Yes	No
GO to KB7 .	SERVICE open ground circuit.

KB7 CHECK FOR OPEN FPDM PWR CIRCUIT

- Measure resistance of FPDM PWR circuit between CCRM harness connector (pin 5) and FPDM harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE CCRM.	The FPDM PWR circuit is open. GO to KB13 to help isolate fault.

KB8 CHECK B+ VOLTAGE TO FPDM POWER SUPPLY RELAY

- Disconnect FPDM power supply relay.
- Measure B+ circuit voltage at the FPDM power supply relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to KB9 .	VERIFY integrity of related fuse. If OK, REPAIR open B+ circuit. If fuse is damaged, CHECK B+ and FPDM PWR circuits for short to ground before replacing.

KB9 CHECK FOR GROUND TO FPDM POWER SUPPLY RELAY

- Disconnect scan tool from DLC.
- Measure resistance of ground circuit between FPDM power supply relay harness connector and battery negative post.

Is resistance less than 5.0 ohms?

Yes	No
GO to KB10 .	REPAIR open circuit.

KB10 CHECK FOR OPEN FPDM PWR CIRCUIT

- Measure resistance of FPDM PWR circuit between FPDM power supply relay harness connector and FPDM harness connector.

Is resistance less than 5.0 ohms?

Yes	No
RECONNECT FPDM. GO to KB11 .	The FPDM PWR circuit is open. GO to KB13 to help isolate fault.

KB11 CHECK VPWR CIRCUIT VOLTAGE TO FPDM POWER SUPPLY RELAY

- Key on, engine off.
- Measure VPWR circuit voltage at the FPDM power supply relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
REPLACE FPDM power supply relay.	REPAIR open VPWR circuit.

KB13 ISOLATE OPEN IN FPDM PWR CIRCUIT

- Disconnect IFS switch.
- Measure resistance of FPDM PWR circuit between IFS switch harness connector and FPDM power supply relay harness connector (for Escort, CCRM harness connector [pin 5]).
- Measure resistance of FPDM PWR circuit between FPDM harness connector and IFS switch harness connector.

Are both resistances less than 5.0 ohms?

Yes	No
VERIFY that the IFS switch is set (button depressed). If OK, REPLACE IFS switch.	REPAIR open in appropriate area of FPDM PWR circuit.

KB14 ISOLATE OPEN IN VPWR CIRCUIT TO FPDM

- Disconnect Electronic Engine Control (EC) Power Relay.
- Disconnect IFS switch.

- Measure resistance of VPWR circuit between IFS switch harness connector and electronic EC power relay harness connector.
- Measure resistance of VPWR circuit between IFS switch harness connector and FPDM harness connector.

Are both resistances less than 5.0 ohms?

Yes	No
VERIFY that the IFS switch is set (button depressed). If OK, REPLACE IFS switch.	REPAIR open in the appropriate area of the VPWR circuit to the FPDM.

KB15 CHECK FOR OPEN FPM CIRCUIT

- Disconnect FPDM.
- Disconnect PCM.
- Measure resistance of FPM circuit between PCM harness connector Pin 40 and the FPDM harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to KB16 .	REPAIR open circuit.

KB16 CHECK FPM CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on, engine off.
- Measure voltage between PCM harness connector Pin 40 and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to KB17 .	REPAIR short circuit.

KB17 CHECK FPM CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between PCM harness connector Pin 40 and ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to KB18 .	REPAIR short circuit.

KB18 CHECK FOR FPM OUTPUT FROM FPDM

- Reconnect FPDM.
- Key on, engine off.
- Measure dc voltage between PCM harness connector Pins 40 and 51.

Is voltage between 0.02 and 1.0 volt dc? (It is OK for the voltage to cycle below this range and then return to within range.)

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPLACE FPDM.

KB25 CHECK CIRCUITS THAT MAY CAUSE AN INTERMITTENT LOSS OF POWER SUPPLY TO THE FPDM. ALSO CHECK FOR INTERMITTENT OPENS OR SHORTS ON THE FPM CIRCUIT.

- Key on, engine off.
- Access FP M PID on scan tool.

Note: With no fault detected, the FPDM will send a 50% duty cycle signal (all OK) to the PCM on the FPM circuit. Depending on scan tools, the FP_M PID may display 50%, or a random value that is fluctuating between 85 and 115%.

- Observe FP M PID for an indication of a fault while completing the following (look for the FP M PID to change from the 50% value, or to stop fluctuating):
 - Shake, wiggle, bend the following circuits:
 - FPDM ground.
 - Power supply circuit (VPWR or FPDM PWR) to FPDM.
 - For Escort and Mustang, the B+ circuit to CCRM pin 11. For Mustang, also the ground circuit to CCRM Pin 18.
 - For Focus, Contour/Mystique/Cougar, Taurus/Sable, the B+ and ground circuits to FPDM power supply relay.
 - FPM circuit between the FPDM and the PCM.
 - Lightly tap on the IFS Switch, FPDM and CCRM or FPDM power supply relay to simulate road shock.
- Key off.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

KB30 DTC P1235 OR P1236: IS DTC P1235 OR P1236 PRESENT IN KEY ON ENGINE OFF OR ENGINE RUNNING SELF TEST?

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

Note: For LS6/LS8, the FPDM functions are incorporated in the Rear Electronics Module (REM). In the following steps, if directed to perform an action with the FPDM, complete the action with the REM. Refer to the pin numbers in the beginning of this pinpoint test.

Is DTC P1235 or P1236 present in Key On Engine Off or Engine Running Self-Test?

Yes	No
	DTC P1235 or P1236 is intermittent.

<p>A hard fault is present. GO to KB31 to check the FP circuit.</p>	<p>For LS6/LS8 : GO to KB42.</p> <p>All others : GO to KB45.</p>
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KB31 CHECK FOR OPEN FP CIRCUIT BETWEEN PCM AND FPDM

- Disconnect FPDM.
- Disconnect PCM.
- Measure resistance of FP circuit between PCM harness connector pin and the FPDM harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to KB32 .	REPAIR open circuit.

KB32 CHECK FP CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on, engine off.
- Measure voltage between FP circuit at PCM harness connector pin and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to KB33 .	REPAIR short circuit.

KB33 CHECK FP CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between FP circuit at PCM harness connector pin and ground.

Is resistance greater than 10,000 ohms?

Yes	No
<p>For LS6/LS8 : GO to KB36.</p> <p>All others : GO to KB34.</p>	REPAIR short circuit.

KB34 CHECK FP CIRCUIT IN FPDM

- Reconnect FPDM.

- Key on, engine off.
- Measure voltage between FP circuit at PCM harness connector pin and ground.

Is voltage between 4.5 and 5.5 volts?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPLACE FPDM.

KB36 CHECK FPF PID

- Key on, engine off.
- Access the FP and FPF PIDs on the scan tool (the FP PID may be used in the next step).
- While viewing the FPF PID for 20 seconds, check if the FPF PID will indicate YES. The FPF PID may read NO in the 20 seconds, but will change back to YES.

Does the FPF PID indicate YES within 20 seconds?

Yes	No
GO to KB40 .	GO to KB37 .

KB37 CHECK FP PID

Does the FP PID indicate between 70 and 80%?

Yes	No
GO to KB38 .	TURN KEY OFF then back ON. Wait 5 seconds. REPEAT test step. If result is now YES, follow YES result. If result is still NO, REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

KB38 ACCESS REM PIDS AND CHECK PWM_DC1 PID

- Access the PWM_DC1 PID from the REM menu (the PWM_DC1 PID indicates the signal sent to the REM from the PCM on the FP circuit).

Does the PWM_DC1 PID indicate between 70 and 80%?

Yes	No
KEY OFF. No fault indicated. Disregard DTC P1235 or P1236. RETURN to Section 3 where DTC was received and proceed as directed.	REPLACE REM.

KB40 CHECK REM CIRCUITRY VOLTAGE ON FP CIRCUIT AT PCM

- Key off.

- Disconnect PCM connector A.
- Key on, engine off.
- Measure voltage between Pin A58 at the PCM harness connector A and ground.

Is voltage greater than 8 volts?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPLACE REM.

KB42 CHECK FP CIRCUIT FOR INTERMITTENT CONCERNS

- Key on, engine off.
- Access the REM PID access menu on the scan tool.
- Access the PWM_DC1 PID from the REM menu (the PWM_DC1 PID indicates the signal sent to the REM from the PCM on the FP circuit).
- Observe the PWM_DC1 PID for indication of a fault while completing the following (the PID value will change when a fault is detected):
 - Shake, wiggle and bend the FP circuit between the PCM (Pin A58) and REM (Pin J2-19).

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. Unable to duplicate or identify fault at this time. GO to <u>Z1</u> with the following data: PWM_DC1 PID (REM menu), FP PID (PCM menu, the FP PID is the signal the PCM is sending to the REM).

KB45 CHECK FP CIRCUIT FOR INTERMITTENT OPENS OR SHORTS

- Key on, engine off.
- Access FP M PID on scan tool.

Note: With no fault detected, the FPDM will send a 50% duty cycle signal (all OK) to the PCM on the FPM circuit. Depending on scan tools, the FP M PID may display 50%, or a random value that is fluctuating between 85 and 115%.

- Observe the FP M PID for an indication of a fault while completing the following (look for the FP M PID to change from the 50% value, or to stop fluctuating):
 - Shake, wiggle, bend the FP circuit between FPDM and the PCM.
 - Lightly tap on the FPDM (to simulate road shock).

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

KB47 DTC P1237 OR P1238: IS DTC P1237 OR P1238 PRESENT IN KEY ON

ENGINE OFF OR ENGINE RUNNING SELF TEST

Is DTC P1237 or P1238 present in Key On Engine Off or Key On Engine Running Self-Test?

Yes	No
A hard fault is present. GO to KB48 .	DTC P1237 or P1238 is possibly intermittent. For LS6/LS8 : GO to KB67 . All others : GO to KB56 .

KB48 DOES THE ENGINE START?

Does the engine start?

Yes	No
For LS6/LS8 : GO to KB80 . All others : DISCONNECT FPDM. GO to KB59 .	For LS6/LS8 : GO to KB61 . All others : GO to KB49 to check fuel pump secondary circuits.

KB49 CHECK FP PWR, FP RTN AND INTERNAL FUEL PUMP CIRCUIT RESISTANCE

- Disconnect scan tool from DLC.
- Disconnect FPDM.
- Measure resistance between FP PWR circuit and the FP RTN circuit at the FPDM harness connector.

Is resistance less than 10.0 ohms?

Yes	No
GO to KB50 .	An open secondary circuit exists. GO to KB54 to isolate fault.

KB50 CHECK FP RTN CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on, engine off.
- Measure voltage between the FP RTN circuit in harness and chassis ground.

Is voltage less than 1.0 volt?

Yes	No
GO to KB51 .	REPAIR short circuit.

KB51 CHECK FP PWR CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect fuel pump.
- Measure resistance between the FP PWR circuit in harness and ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to KB52 .	REPAIR short circuit.

KB52 CHECK FOR VOLTAGE TO FUEL PUMP

- Reconnect FPDM.
- Reconnect scan tool.
- Key on, engine off.
- Access Output Test Mode on scan tool. (To complete this test step without a scan tool, the fuel pump can be commanded on for one second by cycling the key from off to on. Repeat as needed.)
- Connect digital multimeter between the FP PWR circuit and the FP RTN circuit at the fuel pump harness connector.
- While monitoring voltage, command outputs on (this commands the fuel pump on for about 5 seconds).

With the fuel pump commanded on, is the voltage greater than 10.0 volts?

Yes	No
REPLACE fuel pump.	VERIFY vehicle battery was at proper charge during test. VERIFY pump on command did not time-out before voltage check was made. If OK, REPLACE FPDM.

KB54 ISOLATE OPEN CIRCUIT

- Disconnect fuel pump.
- Measure resistance of the FP PWR circuit between the FPDM and fuel pump harness connectors.
- Measure resistance of the FP RTN circuit between the FPDM and fuel pump harness connectors.
- Measure internal resistance of the fuel pump.

Is each resistance less than 10.0 ohms?

Yes	No
No fault is detected. VERIFY results of previous test steps.	REPAIR open in appropriate circuit (if open was internal to pump, REPLACE fuel pump).

KB56 VERIFY THAT DTC P1237 OR P1238 IS INTERMITTENT

Note: When the FPDM is detecting a secondary fuel pump circuit fault (the wires going to the fuel

pump), a 75% duty cycle signal will be sent to the PCM on the FPM circuit. On some scan tools, the FP M PID may display the 75% signal as a random value that is fluctuating between 250 and 400%.

- Key on, engine off.
- Access FP M PID.

Is the FP M PID 75% (or varying between 250 and 400%)?

Yes	No
A hard fault is present. GO to KB48 .	DTC P1237 or P1238 is intermittent. GO to KB57 .

KB57 CHECK FUEL PUMP SECONDARY CIRCUITS FOR INTERMITTENT OPEN OR SHORT

- Key on, engine off.
- Access FP M PID on scan tool.

Note: With no fault detected, the FPDM will send a 50% duty cycle signal (all OK) to the PCM on the FPM circuit. Depending on scan tools, the FP M PID may display 50%, or a random value that is fluctuating between 85 and 115%.

- Observe the FP M PID for an indication of a fault while completing the following (the FP M PID will change from the normal (all OK) reading when a fault is detected):
 - Shake, wiggle, bend the FP PWR circuit and FP RTN circuit between the FPDM and the fuel pump.
 - Lightly tap the fuel pump and the FPDM to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. GO to KB58 .

KB58 CHECK FP PWR CIRCUIT FOR SHORT TO GROUND

- Disconnect FPDM.
- Connect a non-powered test lamp between the FP PWR circuit and the FPDM PWR circuit at the FPDM harness connector.
- Key on.
- Observe test lamp for an indication of a fault while completing the following (the test lamp will turn on when a fault is detected, indicating a short to ground):
 - Shake, wiggle, bend the FP PWR circuit between the FPDM and the fuel pump.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. Unable to duplicate or identify fault at this time. RECONNECT FPDM. GO to Z1 .

KB59 CHECK FP PWR CIRCUIT FOR SHORT TO POWER

- FPDM disconnected.
- Key on, engine off.
- Measure voltage between the FP PWR circuit at the FPDM harness connector and chassis ground.

Is voltage less than 1.0 volt?

Yes	No
GO to KB60 .	REPAIR FP PWR circuit short to power.

KB60 CHECK FP RTN CIRCUIT FOR SHORT TO GROUND

- FPDM disconnected.
- Key on.
- Measure voltage between the FPDM PWR (or VPWR) and FP RTN circuits at the FPDM harness connector.

Is voltage less than 1.0 volt?

Yes	No
REPLACE FPDM.	REPAIR FP RTN circuit short to ground.

KB61 CHECK REM/FP PWR AND GROUND CIRCUIT TO REM PINS J1-1, J1-2

Note: Verify inertia fuel shutoff (IFS) switch is not tripped.

- Disconnect REM connector J1.
- Key on.
- Measure voltage between pins J1-1 (REM/FP PWR) and J1-2 (GND) at the REM harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KB49 (The FPDM functions are incorporated in the Rear Electronics Module (REM). In the following test steps, if directed to complete an action with the FPDM, complete the action with the REM. Refer to the pin numbers in the beginning of this pinpoint test).	GO to KB62 .

KB62 CHECK REM/FP PWR CIRCUIT VOLTAGE TO REM USING CHASSIS GROUND AS A REFERENCE

- Key on.
- Measure voltage between pin J1-1 of the REM harness connector and chassis ground.

Is voltage greater than 10.5 volts?

Yes	No
REPAIR open ground circuit in harness to pin J1-2 of the REM.	KEY OFF. GO to KB63 .

KB63 CHECK FOR B+ TO FUEL PUMP RELAY HARNESS CONNECTOR

- Disconnect fuel pump relay.
- Measure B+ circuit voltage at fuel pump relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to KB64 .	VERIFY condition of related fuse(s). If OK, REPAIR open circuit. If B+ fuse is damaged, CHECK for B+ short to ground or FP RTN for short to power before replacing fuse.

KB64 CHECK FOR IGN START/RUN VOLTAGE (THROUGH IFS SWITCH) TO FUEL PUMP RELAY HARNESS CONNECTOR

- Disconnect REM connector J3.
- Key on.
- Measure IGN START/RUN circuit (from IFS switch) voltage at fuel pump relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KB65 .	VERIFY condition of related fuse. If fuse is damaged, CHECK for IGN START/RUN circuit short to ground before replacing fuse. If fuse is OK, GO to KB69 (to isolate open circuit).

KB65 CHECK GROUND CIRCUIT TO FUEL PUMP RELAY

- Measure resistance of ground circuit between the fuel pump relay harness connector and ground.

Is resistance less than 5.0 ohms?

Yes	No
GO to KB66 .	REPAIR open circuit.

KB66 CHECK REM/FP PWR CIRCUIT CONTINUITY

- Measure resistance of REM/FP PWR circuit between the fuel pump relay harness connector and the REM harness connector (pin J1-1).

Is resistance less than 5.0 ohms?

Yes	No
REPLACE fuel pump relay.	REPAIR open circuit.

KB67 CHECK REM/FP PWR, REM GROUND AND CIRCUITS ASSOCIATED WITH THE FUEL PUMP RELAY FOR INTERMITTENTS

- Disconnect REM connector J1.
- Connect a non-powered test lamp between pins J1-1 (REM/FP PWR) and J1-2 (GND) of the REM harness connector.
- Key on.
- Observe test lamp for an indication of a fault while completing the following (the test lamp will go out when a fault is detected):
 - Shake, wiggle and bend the REM/FP PWR and GND (pin J1-2) circuits to REM.
 - Shake, wiggle and bend the circuits going to the fuel pump relay (IGN START/RUN, B+ ground).
 - Lightly tap the fuel pump relay and IFS switch to simulate road shock.

Is a fault detected?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. GO to <u>KB68</u> .

KB68 CHECK FP PWR AND FP RTN CIRCUITS FOR INTERMITTENT CONCERNS

- Connect a DVOM (set to measure resistance) between pins J1-11 (FP PWR) and J1-12 (FP RTN).
- Observe DVOM for an indication of a fault while completing the following (resistance will change suddenly [from less than 10 ohms] when a fault is detected):
 - Shake, wiggle and bend the FP PWR and FP RTN circuits between the fuel pump and REM.
- Connect DVOM between pin J1-12 (FP RTN) and ground.
- Observe DVOM for an indication of a fault while completing the following (resistance will change suddenly [from greater than 10,000 ohms] when a short to ground is detected):
 - Shake, wiggle and bend the FP PWR and FP RTN circuits between the fuel pump and REM.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. Unable to duplicate or identify fault at this time. REMOVE DVOM, RECONNECT REM. GO to <u>Z1</u> .

KB69 ISOLATE OPEN IN IGN START/RUN CIRCUIT

- Disconnect Inertia Fuel Shutoff (IFS) switch.
- Measure resistance across the normally closed contacts of the IFS switch. Note resistance.
- Measure resistance of IGN START/RUN circuit between the IFS switch and fuel pump relay

harness connectors.

Are both resistances less than 5.0 ohms?

Yes	No
REPAIR open IGN START/RUN circuit to IFS switch.	If open was in IGN START/RUN circuit, REPAIR open. If open was in IFS switch, REPLACE switch.

KB70 SENT HERE FROM PINPOINT TEST HC WITH LOW VOLTAGE AT FUEL PUMP AND NO DTCs: CHECK BATTERY VOLTAGE WITH OUTPUTS COMMANDED ON

Note: For LS6/LS8, verify REM Self-Test has been previously performed.

- Scan tool connected.
- Fuel pump disconnected.
- Key on.
- Connect digital multimeter to the battery positive and battery negative posts.
- While monitoring battery voltage, command outputs on. Note voltage within 5 seconds.
- Command outputs off.

Was battery voltage greater than 11.0 volts?

Yes	No
GO to KB71 .	Battery voltage is low. REFER to Charging System, General Information Section 414-00 in the Workshop Manual.

KB71 CHECK GROUND CIRCUIT TO FUEL PUMP BY MEASURING VOLTAGE AT FUEL PUMP USING BATTERY NEGATIVE AS A REFERENCE

- Connect digital multimeter between the FP PWR circuit at the fuel pump harness connector and the battery negative post.
- Key on.
- While monitoring voltage, command outputs on. Note voltage within 5 seconds.

Is voltage greater than 10.5 volts?

Yes	No
Ground fault to fuel pump indicated. CHECK all associated wiring and connections for the fuel pump and FPDM ground circuits. Carefully CHECK the FPDM ground connection to chassis ground. REPAIR as necessary.	KEY OFF. Ground circuit to fuel pump is OK. GO to KB72 .

KB72 CHECK VOLTAGE TO FUEL PUMP DRIVER MODULE (FPDM)

Note: For LS6/LS8, the FPDM functions are incorporated in the Rear Electronics Module (REM). In the following steps, if directed to complete an action with the FPDM, complete the action with

the REM.

- Disconnect fuel pump driver module (FPDM).
- Key on.
- Measure voltage between the FPDM PWR (VPWR for Continental) circuit at the FPDM harness connector and the battery negative post.

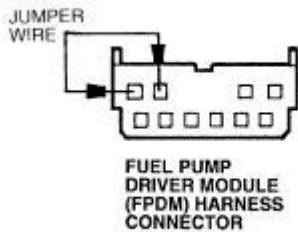
Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KB73 .	KEY OFF. Improper voltage is being supplied to FPDM. GO to KB75 .

KB73 CHECK FP PWR CIRCUIT

- Connect a jumper wire between the FPDM PWR (VPWR for Continental) pin and FP PWR pin at the FPDM harness connector.
- Key on.
- Measure voltage between the FP PWR circuit at the fuel pump harness connector and the battery negative post.

Is voltage greater than 10.5 volts, AND within 0.5 volt of the reading in KB72?



AA0797-C

Yes	No
KEY OFF. REMOVE jumper. VERIFY previous test steps. CHECK related connectors for corrosion, etc. If all checks are OK, REPLACE FPDM.	KEY OFF. REMOVE jumper. CHECK for causes of high resistance in FP PWR circuit.

KB75 CHECK B+ TO ELECTRONIC ENGINE CONTROL (EC) POWER RELAY (CONTINENTAL), CCRM OR FPDM POWER SUPPLY RELAY

- Disconnect CCRM (Escort, Mustang), electronic EC power relay (Continental) or FPDM power supply relay (all others).
- Key on (to put same load on battery as previous steps).
- For Escort, Mustang:
 - Measure voltage between pin 11 (B+) of the CCRM harness connector and the battery negative post.
- For Continental:

- Measure voltage between the B+ circuit at the electronic EC power relay harness connector and the battery negative post.
- For all others:
 - Measure voltage between the B+ circuit at the FPDM power supply relay harness connector and the battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KB76 .	Improper voltage is being supplied to the CCRM, FPDM power supply relay or electronic EC power relay. CHECK associated wiring, connectors, etc. REPAIR as necessary.

KB76 CHECK FPDM PWR CIRCUIT

- For Escort, Mustang:
 - Connect a jumper wire between pin 11 (B+) and pin 5 at the CCRM harness connector.
- For Continental:
 - Connect a jumper wire between the B+ and the VPWR circuit at the electronic EC power relay vehicle harness connector.
- For all others:
 - Connect a jumper wire between the B+ and the FPDM PWR circuit at the FPDM power supply relay harness connector.
- Key on.
- Measure voltage between the FPDM PWR (VPWR for Continental) circuit at the FPDM harness connector and the battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
VERIFY previous test steps. CHECK related connectors for corrosion, etc. If all checks are OK, REPLACE FPDM.	CHECK for causes of high resistance in associated connectors and wiring of the FPDM PWR VPWR circuit, including the IFS switch and its connector. REPAIR as necessary.

KB80 CHECK FP RTN CIRCUIT FOR SHORT TO GROUND

- Disconnect REM connector J1.
- Key on.
- Measure voltage between pins J1-1 and J1-12 at the REM harness connector.

Is voltage less than 1.0 volt?

Yes	No
GO to KB67 .	REPAIR FP RTN circuit short to ground.

KB85 COMPLETE REAR ELECTRONICS MODULE SELF-TEST TO VERIFY IFS SWITCH INPUT TO REM (REM PIN J3-8)

- Complete Rear Electronics Module Self-Test (refer to Workshop Manual section 419-10, Multifunction Electronic Control Modules, for directions).

Is REM DTC B2172 present?

Yes	No
GO to <u>KB86</u> .	GO to <u>A1</u> .

KB86 B2172: CHECK IFS SWITCH INPUT CIRCUIT TO REM (REM PIN J3-8)

- Disconnect REM connector J3.
- Key on, engine off.
- Measure voltage at pin J3-8 of the REM harness connector.

Is voltage greater than 10.5 volts?

Yes	No
<p>KEY OFF.</p> <p>If engine is a no start and REM DTC B2172 was received in on-demand self-test mode:</p> <p>REPLACE REM.</p> <p>If engine will start or REM DTC B2172 is a continuous memory DTC:</p> <p>DTC is intermittent. If engine is a no start, return to <u>Section 3</u> to continue diagnosis. If engine will start, GO to <u>Z1</u> (even though PPT Z is designed for PCM intermittents, the diagnostic techniques will help with the REM diagnosis).</p>	<p>KEY OFF. VERIFY IFS switch is not open. If OK, REPAIR open circuit between IFS switch and REM pin J3-8.</p>

KC: Fuel Shutoff Valve Relay Introduction

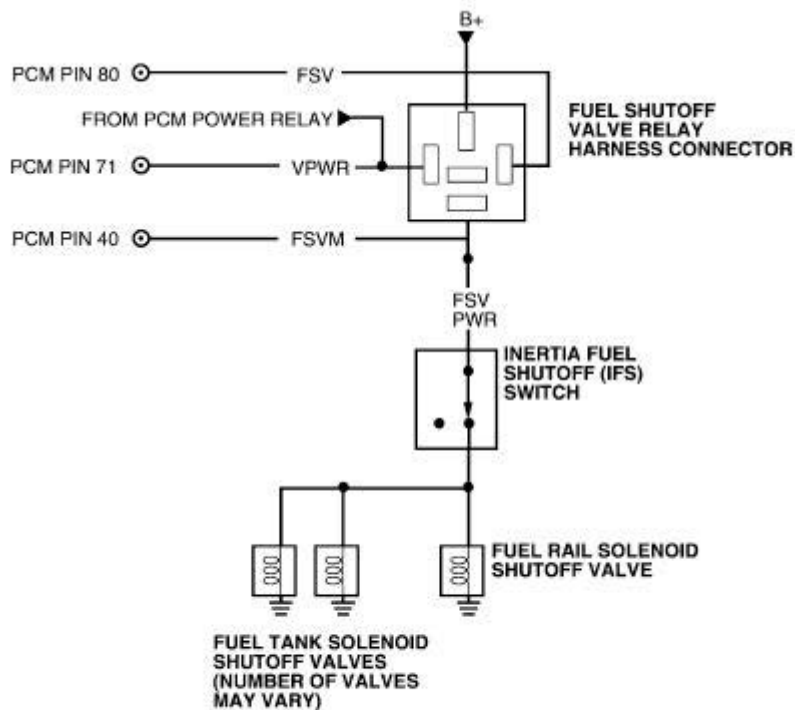
KC: Pinpoint
Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Fuel Shutoff Valve Relay
- Inertia Fuel Shutoff (IFS) switch (9341)
- Harness circuits: B+, VPWR, Fuel Shutoff Valve (FSV), GND, Fuel Shutoff Valve Monitor (FSVM) and Fuel Shutoff Valves Power (FSV PWR)
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematics and Connectors



NOTE: THE FSV AND VPWR CIRCUITS MAY BE REVERSED IN THE HARNESS CONNECTOR. REFER TO THE WIRING DIAGRAM MANUAL FOR MORE INFORMATION.

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KC: Pinpoint Tests →

KC: Fuel Shutoff Valve Relay

← KC: Introduction

KC1 DTC P0230: CHECK VPWR VOLTAGE TO FUEL SHUTOFF VALVE RELAY

- Disconnect fuel shutoff valve relay.
- Key on, engine off.
- Measure VPWR circuit voltage at the fuel shutoff valve relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KC2 .	REPAIR open in VPWR circuit between the Electronic Engine Control power relay and the fuel shutoff valve relay.

KC2 CHECK FUEL SHUTOFF VALVE RELAY

- Refer to the pin numbers indicated on the fuel shutoff valve relay. There will be either a pin 1 or pin 85.
- Measure resistance between either pin 1 or pin 85 and all other pins of the relay. One measurement must be between 40 and 120 ohms, with the other measurements being greater than 10,000 ohms.

Are all resistance checks OK?

Yes	No
GO to KC3 .	REPLACE fuel shutoff valve relay.

KC3 CHECK FUEL SHUTOFF VALVE (FSV) CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.
- Key on.
- Measure voltage between FSV circuit at fuel shutoff valve relay harness connector and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to KC4 .	REPAIR short circuit.

KC4 CHECK FSV CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between FSV circuit at fuel shutoff valve relay harness connector and

ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to KC5 .	REPAIR short circuit.

KC5 CHECK FOR OPEN FSV CIRCUIT

- Measure resistance of the FSV circuit between PCM harness connector pin 80 and the fuel shutoff valve relay harness connector.

Is resistance less than 5.0 ohms?

Yes	No
<p>If Key On Engine Off (KOEO) DTC P0231 or P0232 is also present with DTC P0230:</p> <p>GO to KC6.</p> <p>All others:</p> <p>REPLACE PCM (REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p>	REPAIR open circuit.

KC6 CHECK THE FUEL SHUTOFF VALVE PRIMARY CIRCUIT INSIDE THE PCM

Note: The next two test steps will check the FSV circuit in the PCM. To do this the FSVF PID will be monitored. The FSVF PID is able to detect for faults on the FP circuit, and will indicate NO when no fault is detected and YES when a fault is detected.

- Reconnect PCM.
- Reconnect fuel shutoff valve relay.
- Reconnect scan tool to DLC.
- Key on, engine off.
- Access FSVF PID on scan tool.

Is the FSVF PID YES?

Yes	No
KEY OFF. REPLACE PCM (REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	GO to KC7 .

KC7 CHECK FUEL SHUTOFF VALVE PRIMARY CIRCUIT INSIDE PCM WHILE CRANKING ENGINE

Note: The scan tool must be connected to a reliable power source that is powered with the key in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged.

- Key on, engine off.
- While viewing the FSVF PID, crank the engine.

Is the PID display YES during crank?

Yes	No
KEY OFF. REPLACE PCM (REFER to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	KEY OFF. The fuel pump primary circuit is OK in the harness and PCM. If DTC P0231 is present: GO to <u>KC20</u> . If DTC P0232 is present: GO to <u>KC10</u> .

KC10 DTC P0232: DOES ENGINE START?

Does the engine start?

Yes	No
GO to <u>KC11</u> .	GO to <u>KC15</u> .

KC11 CHECK IF POWER IS ALWAYS BEING SUPPLIED TO FSV PWR CIRCUIT

- Disconnect scan tool from DLC.
- Disconnect PCM.
- Key on, engine off.
- All accessories off (such as interior lamps or radios).
- Measure voltage between PCM harness connector pin 40 and ground.

Is voltage less than 1.5 volts?

Yes	No
GO to <u>KC13</u> .	GO to <u>KC12</u> .

KC12 CHECK FOR FUEL SHUTOFF VALVE RELAY CONTACTS ALWAYS CLOSED

- Disconnect fuel shutoff valve relay.
- Key on, engine off (with accessories off).
- Again measure voltage between PCM harness connector pin 40 and ground.

Is voltage less than 1.5 volts?

Yes	No
REPLACE fuel shutoff valve relay.	REPAIR FSV PWR/FSVM circuit short to power.

KC13 CHECK FOR OPEN FSVM CIRCUIT BETWEEN PCM AND FUEL SHUTOFF VALVE RELAY

- Disconnect fuel shutoff valve relay.
- Measure resistance between PCM harness connector pin 40 and FSV PWR circuit at the fuel shutoff valve relay harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuit.

KC15 CHECK INERTIA FUEL SHUTOFF (IFS) SWITCH

- Disconnect inertia fuel shutoff (IFS) switch (verify that switch is reset).
- Measure resistance between the C and NC pins of the IFS switch.

Is resistance less than 5.0 ohms?

Yes	No
GO to KC16 .	REPLACE or RESET IFS switch.

KC16 CHECK FOR OPEN FSV PWR CIRCUIT BETWEEN IFS SWITCH AND FUEL SHUTOFF VALVE RELAY

- Disconnect fuel shutoff valve relay.
- Measure resistance of FSV PWR circuit between the fuel shutoff valve relay and IFS switch harness connectors.

Is resistance less than 5.0 ohms?

Yes	No
RECONNECT fuel shutoff valve relay. GO to KC17 .	REPAIR open in FSV PWR circuit between IFS switch and FSVM connection to circuit.

KC17 CHECK FSV PWR CIRCUIT RESISTANCE TO GROUND THROUGH THE FUEL SOLENOID SHUTOFF VALVES

- Measure resistance between the FSV PWR circuit to the fuel solenoid shutoff valves at the IFS switch harness connector and chassis ground.

Is resistance less than 10.0 ohms?

Yes	No
No fault is indicated. VERIFY previous test step results. If OK, disregard DTC P0232 at this time. RECONNECT IFS switch. RETURN	REPAIR open circuit. Open is either in the common FSV PWR circuit before any splice to the individual fuel solenoid shutoff valves, or

to [Section 3](#), Step 1: Quick Test and CONTINUE diagnosis as directed.

in each of the individual fuel solenoid shutoff valve circuits path to ground.

KC20 DTC P0231: DOES ENGINE START?

Note: If Key On, Engine Off (KOEO) DTC P0230 is also present and has not been checked, GO to [KC1](#) to check primary fuel shutoff valve circuit first.

Does the engine start?

Yes	No
DISCONNECT PCM. GO to KC13 .	GO to KC21 .

KC21 CHECK B+ VOLTAGE TO FUEL SHUTOFF VALVE RELAY

- Disconnect fuel shutoff valve relay.
- Measure B+ circuit voltage at the fuel shutoff valve relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to KC22 .	VERIFY integrity of fuse for B+ supply to fuel shutoff valve relay. If OK, REPAIR open B+ circuit. If fuse is damaged, check B+ and FSV PWR circuit for short to ground before replacing.

KC22 CHECK FOR OPEN FSV PWR CIRCUIT BETWEEN RELAY AND FSVM SPLICE

- Measure resistance between FSV PWR circuit at fuel shutoff valve relay harness connector and ground.

Is resistance less than 10.0 ohms?

Yes	No
REPLACE fuel shutoff valve relay.	REPAIR open in FSV PWR circuit between FSVM splice and fuel shutoff valve relay.

KC30 CONTINUOUS MEMORY DTC P0232: CHECK HARNESS

Note: If Continuous Memory Diagnostic Trouble Code (DTC) P0230 is also present, GO to [KC40](#).

- Key on, engine off.
- Access FSVM PID.
- Observe the PID for an indication of a fault while completing the following (the FSVM PID will turn ON when an open or short to power is detected):

- Shake, wiggle, bend the FSV PWR circuit between the fuel shutoff valve relay and the fuel solenoid shutoff valves.
- Shake, wiggle, bend the fuel shutoff valves ground circuits from each fuel solenoid shutoff valve to ground.
- Shake, wiggle, bend the FSVM circuit between the PCM and the splice to the FSV PWR circuit.
- Lightly tap inertia fuel shutoff switch and fuel shutoff valve relay to simulate road shock.
- Key off.

Is fault indicated/found?

Yes	No
ISOLATE fault and REPAIR as necessary.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

KC35 CONTINUOUS MEMORY DTC P0231: CHECK FUEL SHUTOFF VALVES SECONDARY CIRCUITS BETWEEN B+ SUPPLY AND FPM CONNECTION

- Disconnect inertia fuel shutoff switch.
- Disconnect PCM.
- Install a jumper wire between PCM harness connector pins 80 (FSV) and ground.
- Connect a digital multimeter between PCM harness connector pins 40 (FPM) and ground.
- Key on. The fuel shutoff valve relay will activate and voltage will be greater than 10.0 volts.
- Observe voltage for an indication of a fault while completing the following (the voltage will change suddenly when a fault is detected, indicating an open):
 - Shake, wiggle, bend the B+ circuit to the fuel shutoff valve relay.
 - Lightly tap the fuel shutoff valve relay to simulate road shock.
 - Shake, wiggle, bend the FSV PWR circuit between the fuel shutoff valve relay and the FSVM splice.
- Key off.
- Inspect the fuel shutoff valve relay connector for corrosion, damaged pins.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

KC40 CONTINUOUS MEMORY DTC P0230: CHECK FUEL SHUTOFF VALVE PRIMARY CIRCUITS

- Key on, engine off. Wait 5 seconds.
- Access FSVF PID. The PID will be NO, indicating that the PCM detects VPWR voltage through the fuel shutoff valve relay coil and FSV circuit to the PCM pin 80.
- Observe the FSVF PID for an indication of a fault while completing the following (the FSVF PID will be YES when an open is detected (this is because the PCM will not detect VPWR voltage on pin 80 (FSV))):
 - Shake, wiggle, bend the fuel shutoff valve circuit between the PCM pin 80 and the fuel shutoff valve relay.
 - Shake, wiggle bend the VPWR circuit between the electronic engine control power relay and the fuel shutoff valve relay.
 - Lightly tap the fuel shutoff valve relay (to simulate road shock).

- Key off.
- Inspect the PCM and fuel shutoff valve relay connectors for corrosion, damaged pins.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

KD: Exhaust Gas Recirculation (EGR) System (Electric) Introduction

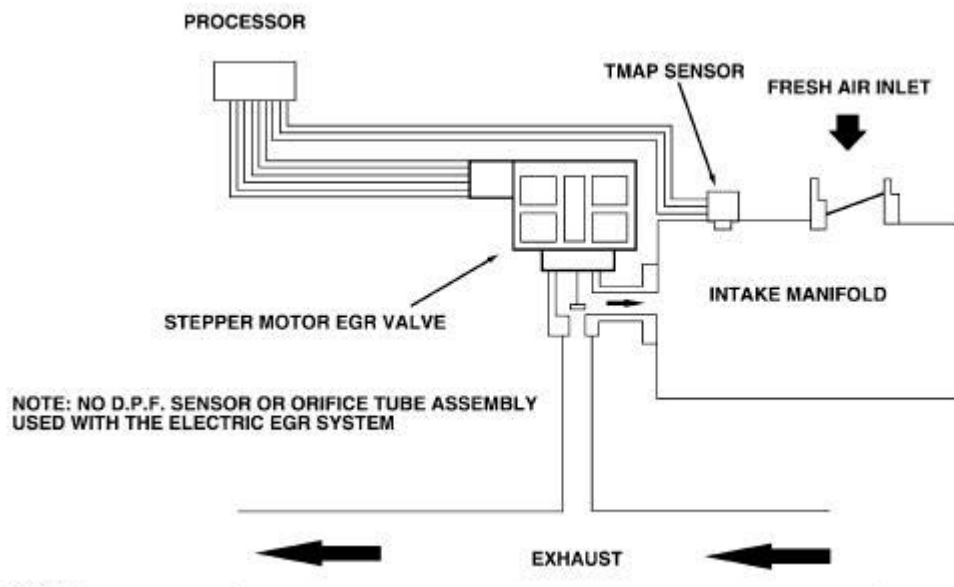
KD: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- EGR Motor/Valve assembly (9D475)
- Harness circuit: EGR
- Powertrain Control Module (PCM) (12A650)

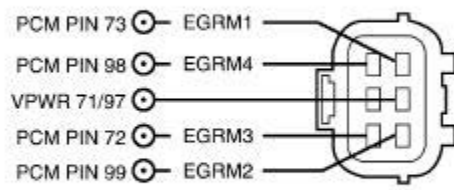
Pinpoint Test Schematic and Connectors



A0027514

Ranger 2.3L

**ELECTRIC EGR MOTOR
HARNESS CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE**

A0029263

KD: Pinpoint Tests →

KD: Exhaust Gas Recirculation (EGR) System (Electric)

← KD: Introduction

KD1 P0403: CHECK CONNECTION OF EGR TO HARNESS

Note: If the DTC (Diagnostic Trouble Code) was generated by an intermittent condition, maximum benefit of the following pin point tests will be obtained by having an assistant wiggle the harness/connectors when making measurements.

- Check the harness connector at the EGR motor.

Is the connector properly seated?

Yes	No
GO to KD2 .	Repair as necessary.

KD2 CHECK FOR B+ AT HARNESS CONNECTOR TO THE EGR MOTOR

- Key on, engine off.
- Measure the voltage at the EGR harness connector between pins 71, 97, and battery negative post.

Is the voltage greater than 10.5 volts?

Yes	No
GO to KD3 .	REPAIR open supply circuit.

KD3 CHECK EGR HARNESS CIRCUIT FOR SHORTS TO GROUND

- Key off.
- Disconnect the PCM and EGR harness connector.
- Measure the resistance of each EGR circuit between the PCM harness connector and battery negative post.

Is the resistance of each circuit greater than 10,000 ohms?

Yes	No
GO to KD4 .	Repair short to ground in the harness.

KD4 CHECK FOR OPEN CIRCUITS IN THE EGR HARNESS

- Measure the resistance between the PCM and EGR connector of each EGR circuit.

Is resistance of each circuit less than 5 ohms?

Yes	No
GO to KD5 .	REPAIR the open circuit in the harness.

KD5 CHECK EEGR HARNESS CIRCUIT FOR SHORTS TO EACH OTHER

- Key off.
- Measure the resistance at the PCM harness connector between pin 72, and pins 73, 98, 99, then pin73 and pins 98, 99.

Is the resistance of each measurement greater than 10,000 ohms?

Yes	No
GO to KD6 .	Repair short in harness

KD6 CHECK FOR SHORTS TO POWER IN THE EEGR HARNESS

- Reconnect the PCM harness connector.
- Key on engine off.
- Measure the voltage between the EEGR connector pins 72, 73, 98, 99, and battery negative post.

Is the voltage less than 0.1 volts?

Yes	No
GO to KD7 .	Repair short to power in harness.

KD7 CHECK EEGR MOTOR WINDINGS FOR OPEN AND SHORT CIRCUITS

- Key off.
- Disconnect the PCM connector and reconnect the EEGR connector.
- Measure the resistance at the PCM harness connector between pin 71/97 and pins 73 and 99 then between pin 71/97 and pins 72 and 98.

Is resistance between 20 and 24 Ohms?

Yes	No
GO to KD8 .	Replace the EEGR assembly.

KD8 CHECK THE EEGR MOTOR WINDINGS FOR SHORTS TO GROUND

- Key off.
- Measure the resistance at the PCM harness connector between the EEGR pins 72, 73, 98, 99, and the battery negative post.

Is the resistance greater than 10,000 Ohms?

Yes	No
Replace the PCM.	Replace EEGR motor.

KD9 DTC P0400/P1408 CHECK FOR STUCK EEGR VALVE OPERATION

Note: Service all of the following DTC's first if present: P0102, P0103, P0107, P0108, P1100, P1101

- Select the Output State Control (OSC) function on the scan tool.
- Enter the EEGR PID (EGRMDS) and the MAP PID (MAP).
- Operate the engine at normal operating temperature between 1000/1200 r.p.m. to prevent engine stalling.
- Add a small amount of EGR (approx. 8 to 12 steps) using the OSC function while monitoring the MAP PID.
- The MAP value should increase as EGR is introduced.

Note: The engine r.p.m. must be held at a fixed value during this test. Additionally, DTC's may have been generated as a result of this procedure. After running this test clear any DTC that may have been induced.

Is a increase in MAP value seen?

Yes	No
Condition is not present at this time, but be sure the MAP is properly seated and the vacuum source is not blocked.	Replace EEGR Motor/Valve assembly.

KE: Idle Air Control (IAC) Valve Introduction

KE: Pinpoint Tests →

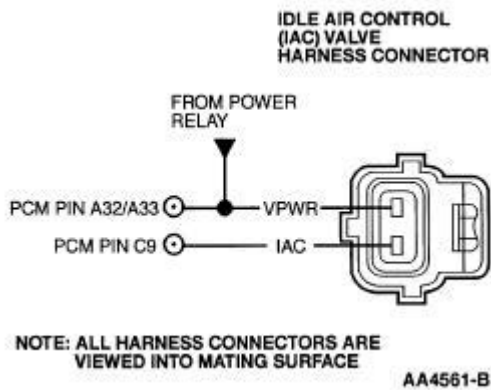
Note

This Pinpoint Test is intended to diagnose the following:

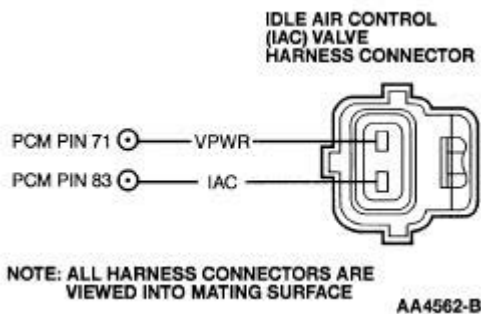
- Idle Air Control (IAC) Valve (9F715)
- Harness Circuits: IAC and VPWR
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

LS6/LS8



All Others



KE: Idle Air Control (IAC) Valve

← KE: Introduction

KE1 IDLE CONCERNS OR STALLS: RUN KOER SELF-TEST AND OUTPUT CONTINUOUS MEMORY DTCS

The Symptom Charts have indicated that there was no change in idle quality when the IAC valve was disconnected.

- Retrieve all Continuous Memory DTCS.

Note: If unable to perform KOER Self-Test to completion, GO to [KE2](#).

- Run Key On Engine Running (KOER) Self-Test.

Is DTC P0505, P1504 or P1507 retrieved during KOER Self-Test or from Continuous Memory?

Yes	No
KEY OFF. GO to KE2 .	The IAC system is OK. RETURN to Section 3 , Symptom Charts.

KE2 DTC P0505, P1504, P1507 OR STARTS ONLY AT PART THROTTLE: CHECK VPWR VOLTAGE TO IAC VALVE

Note: If EGR DTC P0402 was output during Self Test, diagnose it first before continuing with this Pinpoint Test.

- Disconnect IAC valve.
- Key on, engine off.
- Measure VPWR circuit voltage at the IAC valve harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KE3 .	REPAIR open circuit.

KE3 CHECK IAC VALVE RESISTANCE

- IAC valve disconnected.
- Measure IAC valve resistance.

Is resistance between 6.0 and 13.0 ohms?

Yes	No
GO to KE4 .	REPLACE IAC valve.

KE4 CHECK IAC VALVE FOR AN INTERNAL SHORT TO IAC CASE

- Measure the resistance from either IAC valve pin to IAC valve case.

Is resistance greater than 10,000 ohms?

Yes	No
For DTC P1504: GO to KE7 . All others: GO to KE5 .	REPLACE IAC valve.

KE5 CHECK AIR INLET FOR PLUGGING

- Inspect the entire intake air system for debris, blockage and other damage.
- Remove and inspect IAC air tubes (if equipped) for blockage and other damage.
- Remove and inspect the air cleaner element for excessive dirt.

Is the intake air system OK?

Yes	No
RESTORE inlet air system. GO to KE6 .	REPAIR as necessary.

KE6 CHECK FOR INLET AIR LEAKS

- Key on, engine running.
- With engine running at idle, listen for vacuum leaks.
- Inspect the entire intake air system from the mass air flow (MAF) sensor to the intake manifold for leaks such as:
 - Cracked or punctured intake air tube.
 - Damaged or loose IAC air tubes.
 - Loose intake air tube at air cleaner housing or throttle body.
 - IAC valve or gasket seal.
 - EGR valve gasket seal.
 - Vacuum supply connector and hose.
 - PCV connectors and hose.

Are any leaks detected in the above areas?

Yes	No
REPAIR as necessary.	KEY OFF. GO to KE7 .

KE7 CHECK IAC CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this Pinpoint Test.

- IAC valve disconnected.
- Disconnect PCM.
- Measure resistance of IAC circuit between PCM harness connector pin and IAC valve harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to KE8 .	REPAIR open circuit.

KE8 CHECK IAC CIRCUIT FOR SHORT TO PWR IN HARNESS

- Key on, engine off.
- Measure voltage on IAC circuit between PCM harness connector pin and battery negative post.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to KE9 .	REPAIR short circuit.

KE9 CHECK IAC CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between IAC and PWR GND circuits at the PCM harness connector.

Is each resistance greater than 10,000 ohms?

Yes	No
<p>For DTC P1504: REPLACE PCM.</p> <p>All Others: GO to KE10.</p>	REPAIR short circuit.

KE10 CHECK IAC SIGNAL FROM PCM

- Reconnect PCM and IAC valve.

Note: If stalling occurs place a shim under the hard stop screw to maintain idle conditions).

- Key on, engine running.
- Access IAC and RPM PIDS.
- With engine at normal operating temperature, accessories OFF and at closed throttle, the IAC duty cycle must be between approximately 22 percent and 45 percent.
- Slowly increase engine speed to 3000 rpm and return to closed throttle (Note: If closed throttle rpm is significantly higher than normal, ignore this step).

Is the IAC duty cycle within specification at closed throttle and does the duty cycle respond to

the change in rpm?

Yes	No
<p>For Continuous Memory DTCs P1504 and P1507:</p> <p>GO to KE30.</p> <p>All others:</p> <p>KEY OFF. INSPECT throttle body for damage. REPAIR as necessary. If OK, REPLACE IAC valve. RESET Keep Alive Random Access Memory (RAM). (REFER to Section 2, Powertrain Control Module (PCM) Reset).</p>	<p>For DTC P1507, REPLACE IAC valve, otherwise REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p>

KE20 DTC P1506: CHECK FOR VACUUM LEAKS

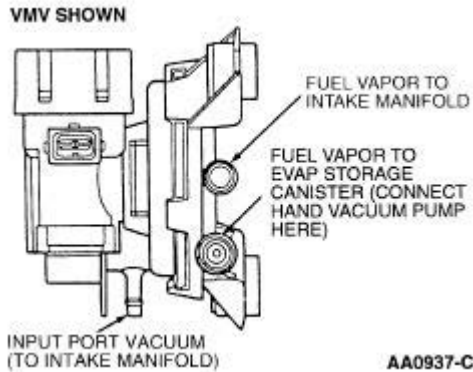
- Key on, engine running.
- With the engine at idle, listen for vacuum leaks.
- Inspect the entire intake air system from the mass air flow (MAF) sensor to the intake manifold for damage or leaks such as:
 - Cracked or punctured intake air tube.
 - Loose or cracked IAC air tubes.
 - Loose intake air tube at the air cleaner housing or throttle body.
 - IAC valve or gasket seal.
 - Intake manifold assembly or gasket seal.
 - EGR valve gasket seal.
 - Vacuum supply connectors and hose.
 - PCV valve, connectors and hose.

Are any leaks detected in the above areas?

Yes	No
KEY OFF. REPAIR as necessary.	KEY OFF. GO to KE21 .

KE21 CHECK EVAP SYSTEM FOR A STUCK OPEN VALVE

- Disconnect hoses at EVAP canister purge valve (or VMV).
- Connect a hand vacuum pump at the fuel vapor port to EVAP canister at the EVAP canister purge valve (or VMV).
- Apply 53 kPa (16 in-Hg) of vacuum to EVAP canister purge valve (or VMV).



Does the EVAP canister purge valve (or VMV) hold vacuum for 20 seconds?

Yes	No
RECONNECT hoses. GO to KE22 .	REPLACE EVAP canister purge valve.

KE22 CHECK IAC VALVE FOR PROPER FUNCTION

- Key on, engine running.
- Bring engine to normal operating temperature.
- Transmission in PARK or NEUTRAL.
- Disconnect IAC valve.

Does the rpm drop or engine stall?

Yes	No
KEY OFF. GO to KE23 .	KEY OFF. INSPECT throttle body for damage. REPAIR as necessary. If OK, REPLACE IAC valve. RESET Keep Alive Random Access Memory (RAM). (REFER to Section 2, Powertrain Control Module (PCM) Reset .)

KE23 CHECK IAC CIRCUIT FOR SHORT TO GND IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this Pinpoint Test.

- Disconnect scan tool from DLC.
- Disconnect PCM.
- Measure resistance between IAC circuit at the PCM harness connector and battery negative post.

Is each resistance greater than 10,000 ohms?

Yes	No
<p>For fast idle symptom currently present:</p> <p>REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p> <p>All others:</p>	REPAIR short circuit.

RESTORE vehicle. GO to KE30.

KE30 CHECK IAC SYSTEM FOR INTERMITTENT OPEN OR SHORT

- Scan tool connected.
- Key on, engine running.
- Access IAC PID and RPM PIDs.
- With engine at normal operating temperature, accessories off and at idle, the IAC duty cycle must be between 20% and 45%.
- Observe the PIDs for an indication of a fault while completing the following at idle:
 - Lightly tap on IAC valve and wiggle harness connector to simulate road shock.
 - Grasp the vehicle harness closest to the IAC valve. Shake and bend a small section of the harness from the IAC to the dash panel and from the dash panel to the PCM.

Do the IAC or RPM PIDs suddenly change in value indicating a fault?

Yes	No
ISOLATE fault and REPAIR as necessary.	For idle quality, starting or stalling symptoms currently present: REPLACE IAC valve. All others: Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

KF: Fan Control (FC) Relay Introduction

KF: Pinpoint Tests →

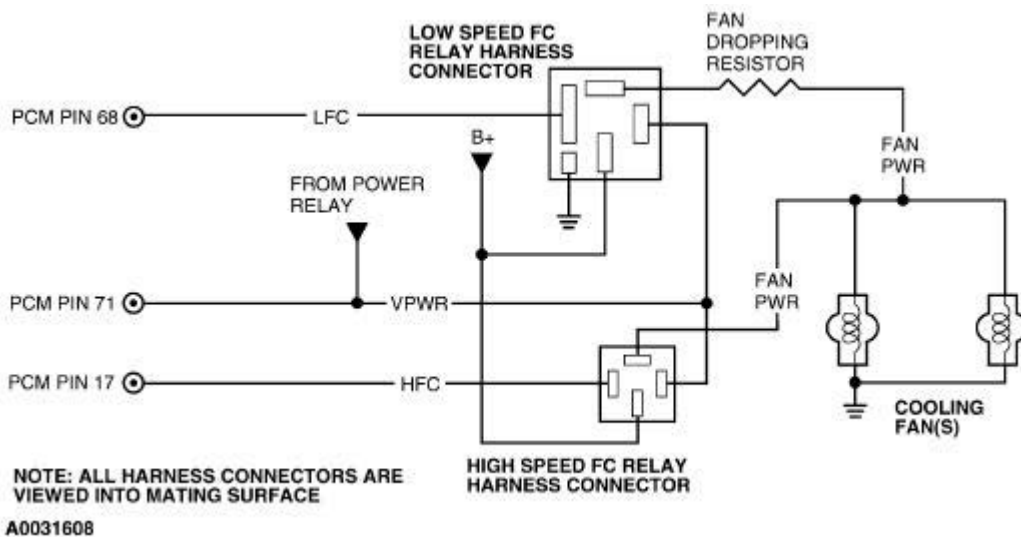
Note

This Pinpoint Test is intended to diagnose the following:

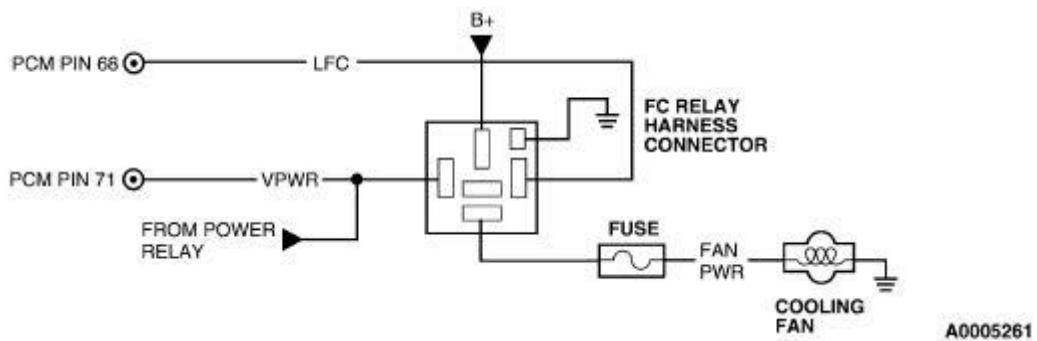
- Harness circuits: VPWR, B+, HFC, LFC, MFC, IGN START/RUN, FAN(s) PWR
- High speed fan control (FC), low speed FC and medium speed FC relays
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

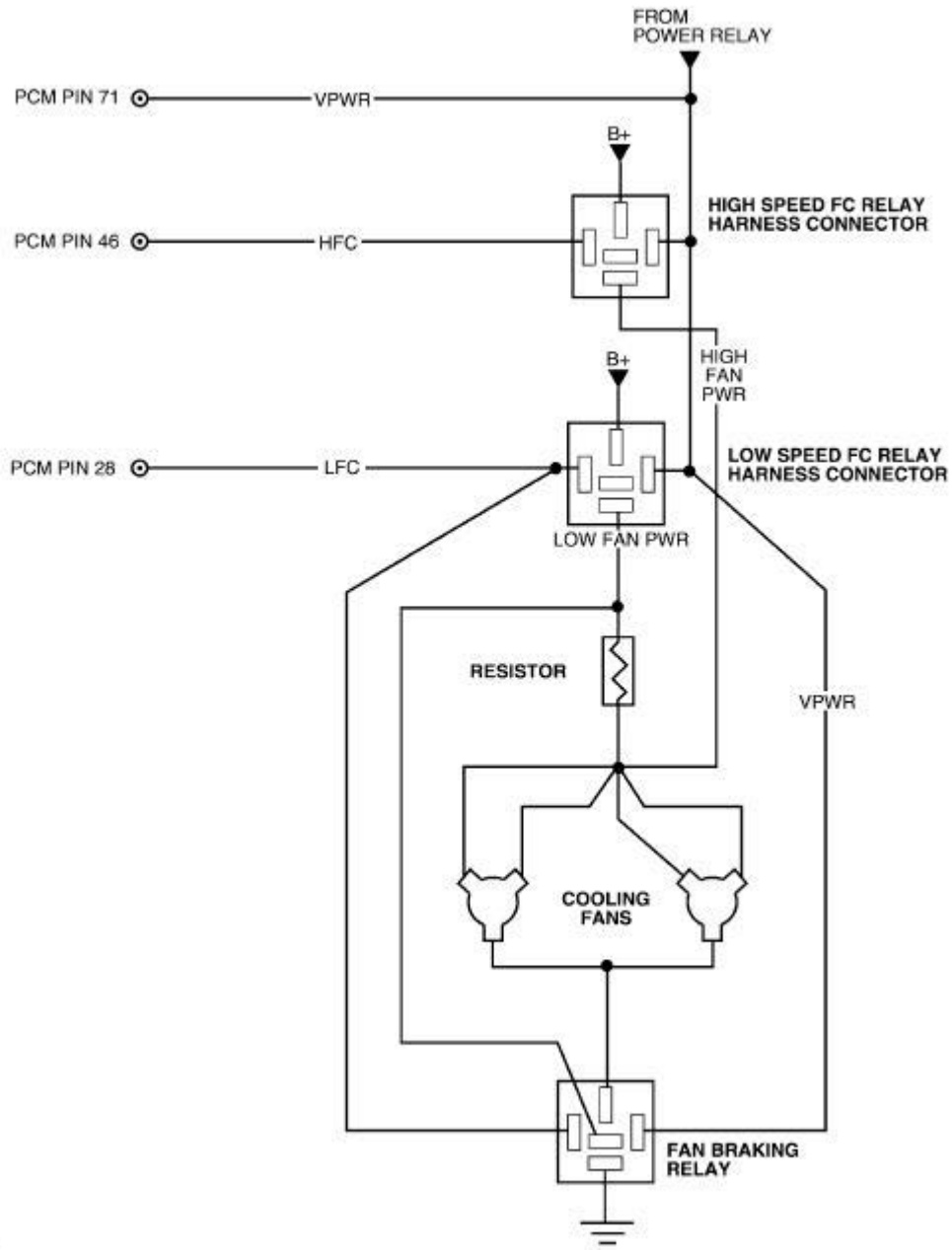
Focus (with A/C), Cougar



Focus (Without A/C)

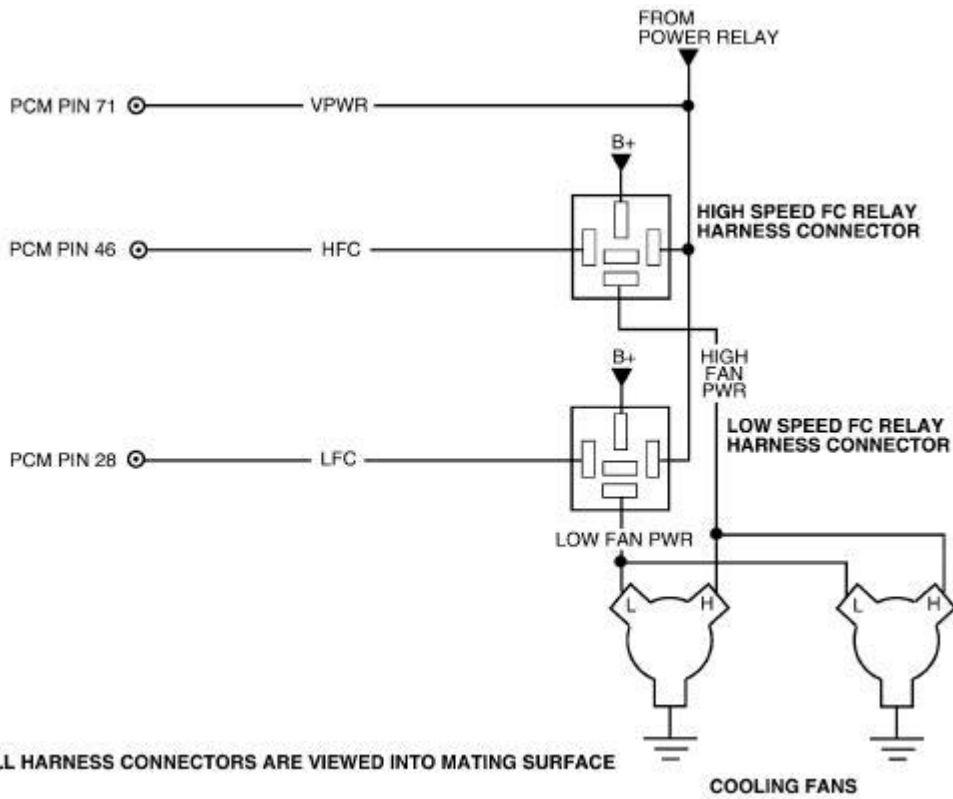


Taurus/Sable



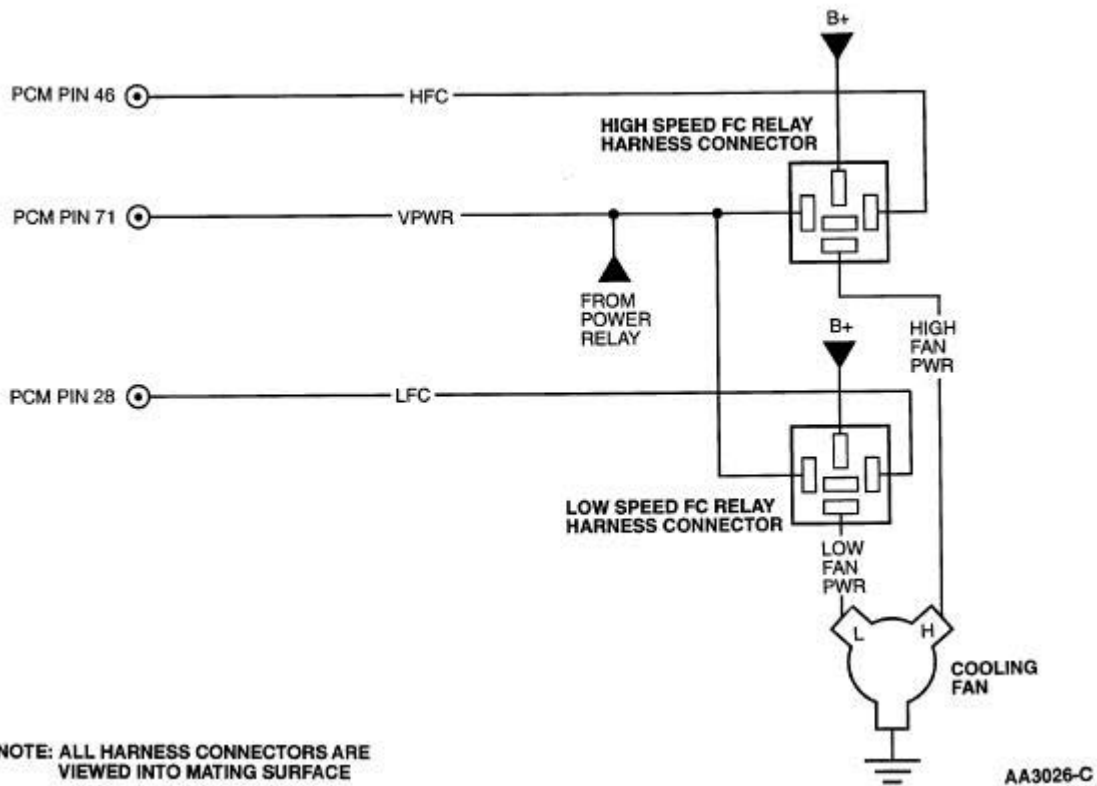
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Continental

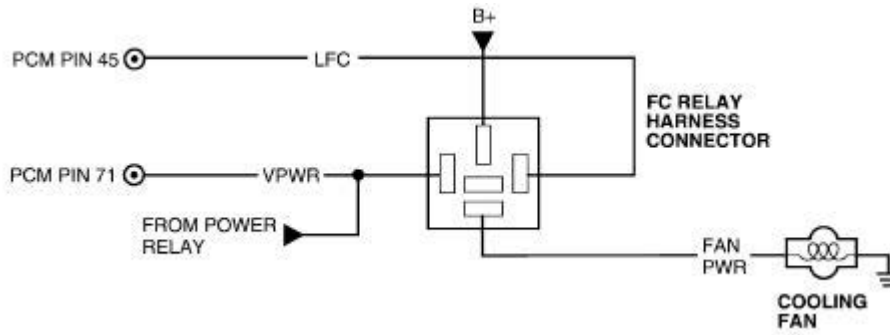


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Crown Victoria/Grand Marquis, Town Car

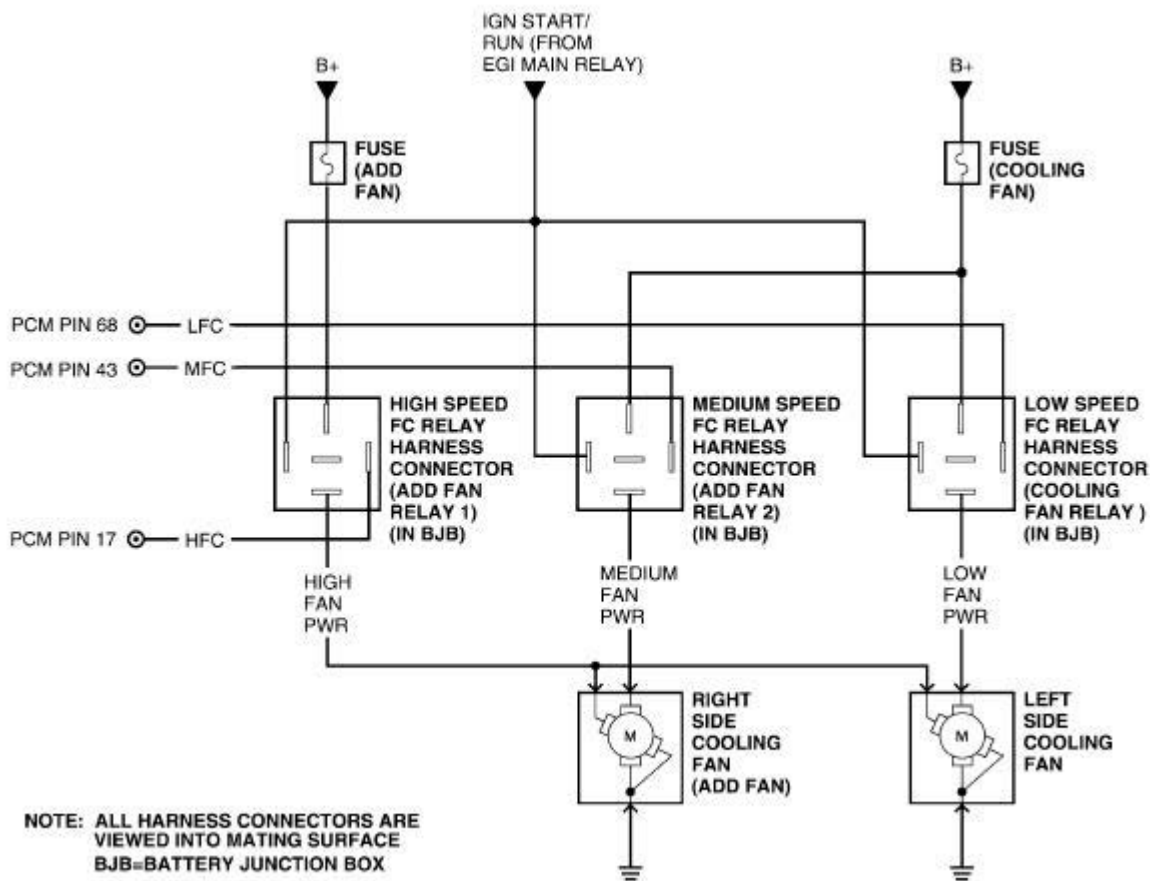


Ranger



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2.0L Escape



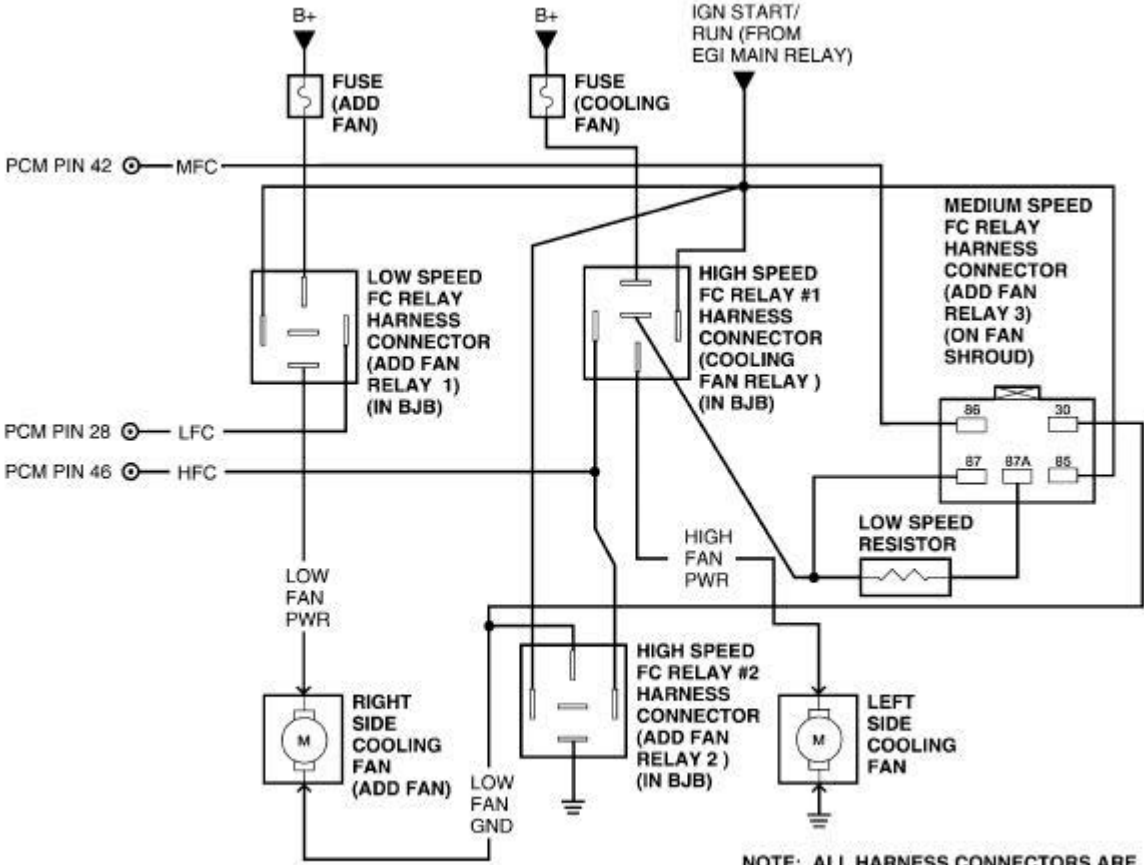
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2.0L Escape Fan Diagnosis Chart

Cooling Fan Motor(s) With Concern	Output Test Mode That Has Concern	FC Relay and Cooling Fan To Be Checked
Both	Low and High	Low, Medium and High Speed FC relays; Both Fans
Both	Low	Low and Medium Speed FC relays; Both Fans

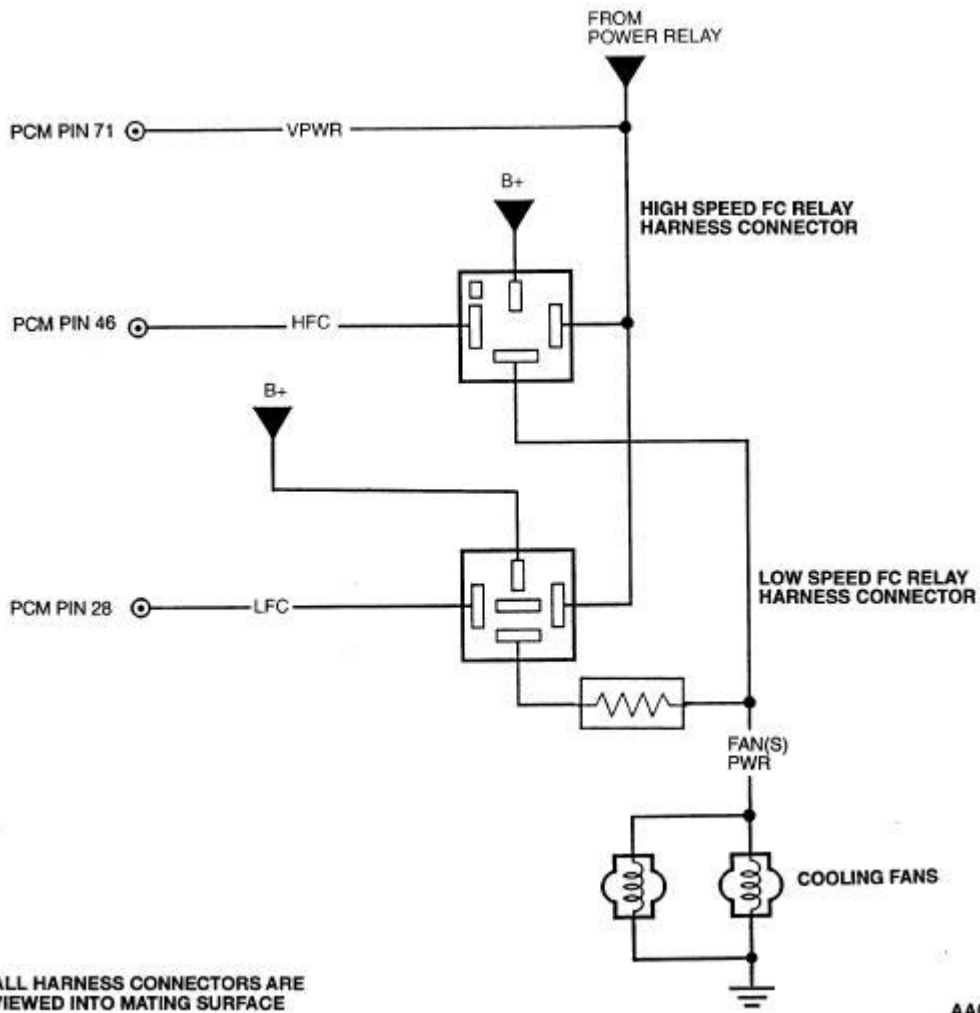
Both	High	High Speed FC relay; Both Fans
Passenger Side Fan	Low and High	Medium and High Speed FC relays; Passenger Side Fan
Passenger Side Fan	Low	Medium Speed FC relay; Passenger Side Fan
Passenger Side Fan	High	High Speed FC relay; Passenger Side Fan
Driver's Side Cooling Fan	Low and High	Low and High Speed FC relays; Driver's Side Cooling Fan
Driver's Side Cooling Fan	Low	Low Speed FC relay; Driver's Side Cooling Fan
Driver's Side Cooling Fan	High	High Speed FC relay; Driver's Side Cooling Fan

3.0L Escape



A0029209

Windstar



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA0805-D

KF: Fan Control (FC) Relay

← KF: Introduction

KF1 DTC P1474/P1477/P1479 or FC PRIMARY CIRCUIT FAULT: CHECK VPWR (or IGN START/RUN for ESCAPE) VOLTAGE TO APPLICABLE FAN CONTROL RELAY

- NOTE: During diagnosis, use the chart below to determine the correct circuit and relay being tested.

DTC	Circuit/ Relay
P1474	LFC
P1477	MFC
P1479	HFC

- Disconnect appropriate fan control relay.
- Key on, engine off.
- Measure VPWR (IGN START/RUN for Escape) circuit voltage at the applicable fan control relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to KF2 .	REPAIR open VPWR (or IGN START/RUN) circuit to the applicable fan control relay.

KF2 CHECK FOR LFC, MFC or HFC CIRCUIT CYCLING

- Key on, engine off.
- Connect a non-powered test lamp between the VPWR (or IGN START/RUN) circuit and the LFC, MFC or HFC circuit at the applicable fan control relay harness connector.
- Access Output Test Mode on scan tool.
- While observing test lamp, command the appropriate cooling fan speed on and off (for Escape, commanding the low speed fan on will also command the medium speed fan output on).

Does the test lamp turn on and off when the cooling fan output is commanded on and off?

Yes	No
REPLACE appropriate fan control relay.	REPEAT test step to VERIFY results. If test lamp still does not turn on and off as expected, turn KEY OFF. REMOVE test lamp. GO to KF3 .

KF3 CHECK LFC, MFC or HFC CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.

- Key on, engine off.
- Measure voltage between the LFC, MFC or HFC circuit at the applicable fan relay harness connector and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to KF4 .	REPAIR short circuit.

KF4 CHECK LFC, MFC or HFC CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between the LFC, MFC or HFC circuit at the applicable fan relay harness connector and ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to KF5 .	REPAIR short circuit.

KF5 CHECK FOR OPEN LFC, MFC or HFC CIRCUIT

Note: Refer to the PCM connector pin numbers at the beginning of this pinpoint test.

- Measure resistance of the LFC, MFC or HFC circuit between the appropriate PCM harness connector pin (LFC, MFC or HFC) and the appropriate fan control relay harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuit.

KF7 DTC P1479 (3.0L Escape) CHECK IGNITION START/RUN CIRCUIT VOLTAGE TO HIGH SPEED FC RELAY #1

- Disconnect high speed FC relay #1 (MAIN FAN in BJB).
- Key on, engine off.
- Measure IGN START/RUN circuit voltage at the high speed FC relay #1 harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to KF8 .	REPAIR open IGN START/RUN circuit.

KF8 CHECK FOR HFC CIRCUIT CYCLING AT HIGH SPEED FC RELAY #1

- Connect a non-powered test lamp between the IGN START/RUN circuit and the HFC circuit at the high speed FC relay #1 harness connector.
- Access Output Test Mode on scan tool.
- While observing test lamp, command the high speed cooling fan on and off .

Does the test lamp turn on and off when the high speed cooling fan output is commanded on and off?

Yes	No
REPLACE high speed FC relay #1.	Leave test lamp connected. GO to KF9 .

KF9 CHECK FOR HFC CIRCUIT CYCLING WITH HIGH SPEED FC RELAY #2 DISCONNECTED

- The non-powered test lamp still connected between the IGN START/RUN circuit and the HFC circuit at the high speed FC relay #1 harness connector.
- Cooling fans commanded off.
- Disconnect high speed FC relay #2 (ADD FAN 2 in BJB).
- While observing test lamp, again command the high speed cooling fan on and off .

Does the test lamp now turn on and off when the high speed cooling fan output is commanded on and off?

Yes	No
REPLACE high speed FC relay #2.	GO to KF3 to diagnose the HFC circuit. Make checks at the high speed FC relay #1 harness connector.

KF10 CONTINUOUS MEMORY DTC P1474: CHECK LOW SPEED FAN CONTROL (LFC) CIRCUIT FOR OPEN OR SHORT TO POWER

- A/C and defrost off.
- Disconnect cooling fan connector (both for applications with two fans).
- Connect a non-powered test lamp between the (LOW) FAN PWR circuit and ground circuit at the cooling fan harness connector. For applications with two fans, connect light to the following fan harness connector:
 - Driver's side for 2.0L Escape.
 - Passenger side for 3.0L Escape.
 - Other applications with two fans, either one can be used.
- Key on, engine off.
- Access Output Test Mode on scan tool.
- Command Low Speed Fan on.
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn off when a fault is detected, indicating an open or short to power):
 - Shake, wiggle and bend the LFC circuit between the PCM and (low speed) FC relay.
 - Shake, wiggle and bend the VPWR (or IGN START/RUN) circuit to the (low speed) FC relay.
 - Lightly tap on the (low speed) FC relay to simulate road shock.

Is a fault indicated?

Yes	No

ISOLATE fault and REPAIR as necessary.

GO to KF11.

KF11 CHECK LFC CIRCUIT FOR SHORT TO GROUND

- Key on, engine off.
- Command Low Speed Fan off.
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn on when a fault is detected, indicating LFC circuit short to ground):
 - Shake, wiggle and bend the LFC circuit between the PCM and (low speed) FC relay.
 - Lightly tap on the (low speed) FC relay to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. GO to <u>Z1</u> .

KF15 CONTINUOUS MEMORY DTC P1477: CHECK MEDIUM SPEED FAN CONTROL (MFC) CIRCUIT FOR OPEN OR SHORT TO POWER

- A/C and defrost off.
- Disconnect both cooling fans.
 - **For 2.0L Escape:**
 - Connect a non-powered test lamp between the MEDIUM FAN PWR circuit and ground circuit at the passenger side cooling fan harness connector.
 - **For 3.0L Escape:**
 - Disconnect medium speed FC relay (ADD FAN 3, on fan shroud).
 - Connect a non-powered test lamp between the MFC circuit and IGN START/RUN circuit at the medium speed FC relay harness connector.
- Key on, engine off.
- Access Output Test Mode on scan tool.
- Command Low Speed Fan on (this also commands on the medium speed fan).
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn off when a fault is detected, indicating an open or short to power):
 - Shake, wiggle and bend the LFC circuit between the PCM and medium speed FC relay.
 - Shake, wiggle and bend the IGN START/RUN circuit to the medium speed FC relay.
 - For 2.0L, lightly tap on the medium speed FC relay to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	GO to <u>KF16</u> .

KF16 CHECK MFC CIRCUIT FOR SHORT TO GROUND

- Key on, engine off.
- Command Low Speed Fan off.
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn on when a fault is detected, indicating MFC circuit short to ground):
 - Shake, wiggle and bend the MFC circuit between the PCM and medium speed FC relay.

- For 2.0L, lightly tap on the medium speed FC relay to simulate road shock.
- For 3.0L, inspect medium speed FC relay for intermittent concerns.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. GO to <u>Z1</u> .

KF20 CONTINUOUS MEMORY DTC P1479: CHECK HIGH SPEED FAN CONTROL (HFC) CIRCUIT FOR OPEN OR SHORT TO POWER

- A/C and defrost off.
- Disconnect cooling fan connector(s) (both for applications with two fans).
- Connect a non-powered test lamp between the (HIGH) FAN PWR circuit and ground circuit at the cooling fan harness connector (for applications with two fans; passenger side for 2.0L Escape, driver's side for 3.0L Escape, either one for others).
- Key on, engine off.
- Access Output Test Mode on scan tool.
- Command High Speed Fan on.
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn off when a fault is detected, indicating an open or short to power):
 - Shake, wiggle and bend the HFC circuit between the PCM and high speed FC relay.
 - Shake, wiggle and bend the VPWR (IGN START/RUN for Escape) circuit to the high speed FC relay (for 3.0L Escape, both relays).
 - Lightly tap on the high speed FC relay to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	GO to <u>KF21</u> .

KF21 CHECK HFC CIRCUIT FOR SHORT TO GROUND

- Command High Speed Fan off.
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn on when a fault is detected, indicating an HFC circuit short to ground):
 - Shake, wiggle and bend the HFC circuit between the PCM and high speed FC relay.
 - Lightly tap on the HFC relay to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. GO to <u>Z1</u> .

KF25 ONE OR ALL FAN SPEEDS INOPERATIVE: CHECK FAN CONTROL FAULT PIDs TO VERIFY FAN CONTROL PRIMARY CIRCUITS

- Verify A/C is off, and engine temperature is below the temperature where the cooling fan would come on.
- Key on, engine off.

- Access the LFCF, MFCF and HFCF PIDs (as appropriate, according to which circuits the vehicle has)(for Escape, early builds will not have the MFCF PID).

Does the LFCF, MFCF or HFCF PID indicate YES?

Yes	No
<p>For the fault PID(s) that are YES, a primary circuit fault is indicated for that circuit. .</p> <p>For 3.0L Escape with HFCF PID indicating YES:</p> <p>GO to KF7 .</p> <p>All others:</p> <p>GO to KF1 .</p>	<p>For Escape: .</p> <p>GO to KF85 .</p> <p>All others:</p> <p>GO to KF30 .</p>

KF30 ELECTRIC COOLING FAN CONCERN (WITH NO DTCs): CHECK FAN FUNCTION

- Key on, engine off.
- Access Output Test Mode on scan tool.
- Command the cooling fan on and check for fan operation. For two speed fan applications, check both fan speeds (wait 20 seconds after commanding high speed fan on, verify fan speed changes).

Does the fan(s) operate (all speeds)?

Yes	No
<p>KEY OFF. Cooling fan circuits OK. RETURN to Section 3 Chart.</p>	<p>COMMAND cooling fan off. REMAIN in Output Test Mode.</p> <p>For Focus (with A/C), Cougar and Windstar :</p> <p>GO to KF50 .</p> <p>For Focus (without A/C) and Ranger:</p> <p>Fan will not operate. GO to KF41 .</p> <p>All others :</p> <p>GO to KF31 .</p>

KF31 DID THE FAN(S) OPERATE AT ANY SPEED?

Note: For applications with two cooling fan motors, if one cooling fan motor does not operate when the other motor operates, GO to [KF70](#) .

During the operational check of both fan speeds, did the fan(s) operate at any speed?

Yes	No
<p>Only one fan speed is operational. GO to</p>	<p>Cooling fan will not operate at any speed. GO</p>

KF40.

to KF32.

KF32 COOLING FAN WILL NOT OPERATE AT ANY SPEED: COMMAND HIGH SPEED FAN ON AND CHECK FOR VOLTAGE TO COOLING FAN

- Key on, engine off.
- Still in Output Test Mode, with fan commanded off.
- Disconnect cooling fan(s) (both for applications with two fans).
- Command high speed fan on.
- Measure voltage between the HIGH FAN PWR circuit at the cooling fan harness connector (either one for Taurus/Sable) and chassis ground.

Is voltage greater than 10.0 volts?

Yes	No
KEY OFF. Power is being supplied to fan. For Taurus/Sable: GO to KF130 (to check fan braking relay and ground circuits). All others: GO to KF37 (to check cooling fan ground circuit).	KEY OFF. Power is not being supplied to fan. GO to KF33 .

KF33 CHECK B+ TO HIGH SPEED FC RELAY AND LOW SPEED FC RELAY

- Disconnect high speed and low speed FC relays.
- Measure B+ circuit voltage at the high speed FC relay harness connector.
- Measure B+ circuit voltage at the low speed FC relay harness connector.

Is voltage greater than 10.0 volts?

Yes	No
GO to KF34 .	B+ circuit fault. CHECK condition of related fuses. If OK, REPAIR open circuit. If fuse is damaged, CHECK B+ and FAN PWR circuits for short to ground before replacing.

KF34 CHECK FOR OPEN HIGH FAN PWR AND LOW FAN PWR CIRCUITS

- Measure resistance of the HIGH FAN PWR circuit between the High Speed FC relay harness connector and the cooling fan harness connector(s). Resistance should be less than 5.0 ohms.
- Measure resistance of the LOW FAN PWR circuit between the low speed FC relay harness connector and the cooling fan harness connector(s). Resistance should be less than 5.0 ohms (7.0 ohms for Taurus/Sable).

Do the HIGH FAN PWR and LOW FAN PWR circuits check OK?

--	--

Yes	No
GO to KF35 .	REPAIR open circuit (for Taurus/Sable, if open is in LOW FAN PWR circuit, verify condition of resistor that is in circuit).

KF35 COMMAND LOW SPEED FAN ON AND CHECK FOR VOLTAGE TO COOLING FAN

- Reconnect low speed FC relay and high speed FC relay.
- Key on, engine off.
- Again, enter Output Test Mode on scan tool.
- Command Low Speed Fan on.
- Measure LOW FAN PWR circuit voltage at the cooling fan harness connector (either one for applications with two fans).

Is voltage greater than 10.0 volts?

Yes	No
KEY OFF. REPLACE the High Speed FC relay, then GO to KF37 (for Taurus/Sable, GO to KF130).	KEY OFF. GO to KF75 , and follow directions for low speed fan inoperative. After repair, GO to KF75 and follow directions for high speed fan inoperative.

KF37 CHECK COOLING FAN GROUND CIRCUIT

- Disconnect scan tool from DLC.
- Measure resistance of ground circuit between the cooling fan harness connector and chassis ground.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE fan motor(s).	REPAIR ground circuit.

KF40 DETERMINE WHICH FAN SPEED IS OPERATIONAL

Is the low speed fan operational?

Yes	No
High speed fan inoperative. GO to KF46 .	Low speed fan inoperative. GO to KF41 .

KF41 (LOW SPEED) FAN INOPERATIVE: COMMAND LOW SPEED FAN ON AND CHECK FOR VOLTAGE TO COOLING FAN

Note: The following steps apply to applications with either a one or two speed fan. Refer to the fan speed in parenthesis as appropriate.

- Key on, engine off.

- Still in Output Test Mode with fan commanded off.
- Disconnect cooling fan(s) (both for applications with two fans).
- Command low speed fan on.
- Measure (LOW) FAN PWR circuit voltage at the cooling fan harness connector (either one for applications with two fans).

Is voltage greater than 10.0 volts?

Yes	No
For Taurus/Sable: REPLACE fan. All others: VERIFY ground circuit to fan. If OK, REPLACE fan motor.	KEY OFF. GO to KF42 .

KF42 CHECK B+ VOLTAGE TO (LOW SPEED) FAN CONTROL (FC) RELAY

- Disconnect (Low Speed) FC relay.
- Measure B+ circuit voltage at the (low speed) FC relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to KF43 .	VERIFY condition of related fuse. If OK, REPAIR open B+ circuit. If fuse was damaged CHECK B+ and (LOW) FAN PWR circuit for short to ground before replacing.

KF43 CHECK FOR OPEN (LOW) FAN PWR CIRCUIT

- Measure resistance of the (LOW) FAN PWR circuit between the (low speed) FC relay harness connector and the cooling fan harness connector(s).

Is resistance less than 5.0 ohms (7.0 ohms for Taurus/Sable)?

Yes	No
GO to KF75 .	REPAIR open circuit (for Taurus/Sable, verify condition of resistor that is in circuit).

KF46 HIGH SPEED FAN INOPERATIVE: COMMAND HIGH SPEED FAN ON AND CHECK FOR VOLTAGE TO COOLING FAN

- Key on, engine off.
- Still in Output Test Mode with fan commanded off.
- Disconnect cooling fan(s) (both for applications with two fans).
- Command high speed fan on.
- Measure HIGH FAN PWR circuit voltage at the cooling fan harness connector.

Is voltage greater than 10.0 volts?

Yes	No
For Taurus/Sable: REPLACE fan. All others: VERIFY ground circuit to fan. If OK, REPLACE fan motor.	KEY OFF. GO to KF47 .

KF47 CHECK B+ VOLTAGE TO HIGH SPEED FAN CONTROL (FC) RELAY

- Disconnect high speed FC relay.
- Measure B+ circuit voltage at the high speed FC relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to KF48 .	VERIFY condition of related fuse. If OK, REPAIR open B+ circuit. If fuse was damaged, CHECK B+ and HIGH FAN PWR circuit for short to ground before replacing.

KF48 CHECK FOR OPEN HIGH FAN PWR CIRCUIT

- Measure resistance of the HIGH FAN PWR circuit between the high speed FC relay harness connector and the cooling fan harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to KF75 .	REPAIR open circuit.

KF50 LOW AND/OR HIGH SPEED COOLING FAN DOES NOT OPERATE: CHECK FOR B+ TO HIGH SPEED FC AND LOW SPEED FC RELAYS

Note: For applications with two cooling fan motors, if one motor does not operate when the other motor operates, GO to [KF70](#).

- Disconnect high speed FC and low speed FC relays.
- Measure B+ circuit voltage at both high speed FC and low speed FC relay harness connectors.

Are both voltages greater than 10.5 volts?

Yes	No
GO to KF51 .	VERIFY condition of related fuses. If OK, REPAIR open B+ circuit. If fuse was damaged, CHECK B+ and fan(s) PWR circuits for short to ground before replacing.

KF51 CHECK FOR OPEN FAN PWR, FAN GROUND AND INTERNAL FAN CIRCUITS

- Measure resistance between battery negative post and the FAN PWR circuit at both the high speed FC and low speed FC relay harness connectors.

Are both resistances less than 15.0 ohms?

Yes	No
GO to KF52 .	GO to KF56 .

KF52 CHECK FAN PWR CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect both cooling fans.
- Measure resistance between the FAN PWR circuit in harness and ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to KF53 .	REPAIR FAN PWR circuit short to ground.

KF53 CHECK HIGH SPEED FC AND LOW SPEED FC RELAY OPERATION

- Reconnect high speed FC and low speed FC relays.
- Key on, engine off.
- Access Output Test Mode on scan tool.
- Check high speed FC relay operation:
 - Command high speed fan on, wait 15 seconds.
 - Measure voltage to the FAN PWR circuit at the cooling fan harness connector (either one).
 - Voltage must be greater than 10.5 volts.
- Check low speed FC relay operation:
 - Command low speed fan on.
 - Measure voltage to the FAN PWR circuit at the cooling fan connector (either one).
 - Voltage must be greater than 10.0 volts.

Do the high speed FC and low speed FC relays operate correctly?

Yes	No
REPLACE cooling fan(s).	KEY OFF. NOTE which fan speed was inoperative. GO to KF75 .

KF56 CHECK FOR OPEN FAN PWR CIRCUIT BETWEEN COOLING FAN AND THE HIGH SPEED FC AND LOW SPEED FC RELAYS

- Disconnect cooling fan (either one).
- Measure resistance of FAN PWR circuit between cooling fan harness connector and both the

high speed FC and low speed FC relay harness connectors.

Are both resistances less than 15.0 ohms?

Yes	No
GO to KF57 .	REPAIR open in FAN PWR circuit (if open is only between low speed FC relay and fan, first verify dropping resistor connection).

KF57 CHECK COOLING FAN GROUND CIRCUIT

- Measure resistance of ground circuit between the cooling fan harness connector and chassis ground.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE inoperative cooling fan(s).	REPAIR ground circuit.

KF60 LOW, MEDIUM AND/OR HIGH SPEED COOLING FAN ALWAYS RUNS (NO DTCS): VERIFY FAN IS NOT ON BECAUSE OF A/C HIGH PRESSURE SWITCH INPUT TO PCM

- Start engine.
- Access ACP PID.

Is the ACP PID "CLOSED"?

Yes	No
The PCM will turn the cooling fan on when the A/C high pressure switch input is "closed". Leave engine running. GO to KF61 .	Input OK. GO to KF65 .

KF61 CHECK A/C HIGH PRESSURE SWITCH (the medium pressure, normally open contacts)

- Disconnect A/C high pressure switch (refer to pinpoint test KM cover pages if needed).
- Again, view the ACP PID on scan tool.

Is the ACP PID still "CLOSED"?

Yes	No
KEY OFF. GO to KF62 (to check A/C high pressure switch input to PCM).	KEY OFF. RECONNECT A/C high pressure switch. REFER to the Climate Control System, General Information Section 412-00 of the Workshop Manual to check for proper A/C high pressure switch function, over-pressurized A/C system and other checks as directed.

KF62 CHECK ACPSW CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Disconnect PCM.
- Measure resistance between PCM harness connector Pin 86 and ground.

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

KF63 LOW AND/OR HIGH SPEED COOLING FAN ALWAYS RUNS (NO DTCS): VERIFY FAN IS NOT ON BECAUSE OF A/C PRESSURE SENSOR INPUT TO PCM

- A/C off.
- Start engine.
- Access ACP V PID.

Is the ACP V PID greater than 3.0 volts?

Yes	No
KEY OFF. REFER to the Climate Control System, General Information Section 412-00 of the Workshop Manual to check for high A/C system pressure and other checks as directed.	Input is not causing the fan to run. GO to <u>KF65</u> .

KF65 CHECK FOR (LOW SPEED) FC RELAY ALWAYS CLOSED

Note: Verify A/C and defrost are off.

- Disconnect (low speed) FC relay.
- Key on, engine off.

Does fan continue to run?

Yes	No
<p>For Focus (without A/C) and Ranger: REPAIR FAN PWR circuit for short to power.</p> <p>All others: KEY OFF. GO to <u>KF66</u>.</p>	KEY OFF. GO to <u>KF80</u> .

KF66 CHECK HIGH SPEED FC RELAY

- Low speed FC relay disconnected.
- Disconnect high speed FC relay (for 3.0 Escape, high speed FC relay #1).

- Key on, engine off.

Does fan continue to run?

Yes	No
<p>For Focus, Contour/Mystique/Cougar, Taurus/Sable, Ranger and Windstar:</p> <p>REPAIR FAN PWR circuit for short to power.</p> <p>For 2.0L Escape:</p> <p>KEY OFF. GO to KF68.</p> <p>For 3.0L Escape:</p> <p>If passenger side fan always runs, REPAIR LOW FAN PWR circuit short to power. If driver's side fan always runs, REPAIR HIGH FAN PWR short to power.</p> <p>All others:</p> <p>KEY OFF. GO to KF67.</p>	<p>KEY OFF. GO to KF80.</p>

KF67 CHECK LOW FAN PWR CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect cooling fan(s).
- Key on, engine off.
- Measure voltage to the LOW FAN PWR circuit at the cooling fan harness connector.

Is voltage less than 1.0 volt?

Yes	No
<p>REPAIR HIGH FAN PWR circuit for short to power.</p>	<p>REPAIR LOW FAN PWR circuit for short to power.</p>

KF68 CHECK MEDIUM SPEED FC RELAY

- Low speed and high speed FC relays disconnected.
- Disconnect medium speed FC relay.
- Key on, engine off.

Does fan continue to run?

Yes	No
<p>KEY OFF. If both fans run, REPAIR HIGH FAN PWR circuit short to power. If only one fan runs, REPAIR the circuit to that fan for short to power (either the LOW FAN PWR or MEDIUM FAN PWR circuit).</p>	<p>KEY OFF. REPLACE medium speed FC relay.</p>

KF70 ONE COOLING FAN MOTOR DOES NOT OPERATE WHEN THE OTHER COOLING FAN MOTOR OPERATES (NO DTCs): CHECK FOR OPEN GROUND CIRCUIT TO INOPERATIVE FAN

- Disconnect inoperative cooling fan.
- **For Taurus/Sable:**
 - Disconnect fan braking relay.
 - Measure resistance of ground circuit between fan and fan braking relay harness connectors.
- **All others:**
 - Measure resistance of ground circuit between fan harness connector and ground.

Is resistance less than 5.0 ohms?

Yes	No
GO to KF71 .	REPAIR open circuit.

KF71 COMMAND FAN ON AND CHECK FOR POWER TO FAN

- Disconnect the other cooling fan (so both are disconnected).
- Access Output Test Mode on scan tool.
- Command high speed fan on.
- Measure voltage to the (HIGH) FAN PWR circuit(s) at the inoperative fan harness connector.

Is voltage greater than 10.0 volts?

Yes	No
REPLACE inoperative cooling fan.	REPAIR open in FAN PWR circuit between inoperative cooling fan and splice to other fan.

KF75 IS SCAN TOOL CAPABLE OF VIEWING PIDS WHILE IN OUTPUT TEST MODE?

Note: The symptom low, medium and/or high speed fan inoperative can be caused by a primary circuit fault, even though a DTC was not set. The next test step will check the primary circuit operation.

Is scan tool being used capable of viewing PIDs while in Output Test Mode?

Yes	No
GO to KF76 .	<p>For low speed fan inoperative (fan inoperative for one speed fan applications):</p> <p>GO to KF77.</p> <p>For medium speed fan inoperative (Escape):</p> <p>GO to KF78.</p> <p>For high speed fan inoperative:</p>

KF76 CHECK OPERATION OF LOW, MEDIUM and/or HIGH SPEED FAN PRIMARY CIRCUITS

- Reconnect cooling fan(s) and low, medium or high speed fan control relay(s).
- Key on, engine off.
- Enter Output Test Mode on scan tool.
- **For low speed fan inoperative (fan inoperative for one speed fan applications):**
 - Access LFC and LFCF PIDs.
 - With LFC PID off (low speed fan commanded off by PCM), the LFCF PID must be NO.
 - Command the Low Speed Fan on (the LFC PID will now be on).
 - The LFCF PID must still be NO.
- **For medium speed fan inoperative (Escape):**
 - Access MFC and MFCF PIDs (if MFC and MFCF PIDs are not available, GO to [KF78](#)).
 - With MFC PID off (medium speed fan commanded off by PCM), the MFCF PID must be NO.
 - Command the Low Speed Fan on (the MFC PID will now be on).
 - The MFCF PID must still be NO.
- **For high speed fan inoperative:**
 - Access HFC and HFCF PIDs.
 - With HFC PID off (high speed fan commanded off by PCM), the HFCF PID must be NO.
 - Command the high speed fan on (the HFC PID will now be on).
 - The HFCF PID must still be NO.

Is the LFCF, MFCF or HFCF PID Yes with the fan commanded on or off?

Yes	No
<p>KEY OFF. An LFC, MFC or HFC primary fault is detected.</p> <p>If the LFCF PID was yes: GO to KF1 and follow DTC P1474 diagnosis.</p> <p>If the MFCF PID was yes: GO to KF1 and follow DTC P1477 diagnosis.</p> <p>If the HFCF PID was yes: GO to KF1 and follow DTC P1479 diagnosis.</p>	<p>Primary circuits OK.</p> <p>For low speed fan inoperative, REPLACE low speed FC relay. For medium speed fan inoperative, REPLACE medium speed FC relay. For high speed fan inoperative, REPLACE high speed FC relay. VERIFY applicable FAN PWR circuit is not short to ground.</p>

KF77 CHECK OPERATION OF LOW SPEED FAN PRIMARY CIRCUITS

- Reconnect cooling fan (if it was disconnected).
- Key on, engine off.
- Connect a non-powered test lamp between the VPWR circuit and the LFC circuit at the low speed FC relay harness connector.
- Access Output Test Mode on scan tool.
- While observing test lamp, command the low speed fan on and off.

Does the test lamp turn on and off when the cooling fan output is commanded on and off?

Yes	No
Primary circuits OK. REPLACE the low speed FC relay. VERIFY applicable FAN PWR circuit is not short to ground.	KEY OFF. An LFC primary fault is detected. GO to <u>KF1</u> and follow DTC P1474 diagnosis.

KF78 CHECK OPERATION OF MEDIUM SPEED FAN PRIMARY CIRCUITS

- Reconnect cooling fan (if it was disconnected).
- Key on, engine off.
- Connect a non-powered test lamp between the VPWR circuit and the MFC circuit at the medium speed FC relay harness connector.
- Access Output Test Mode on scan tool.
- While observing test lamp, command the low speed fan on and off.

Does the test lamp turn on and off when the cooling fan output is commanded on and off?

Yes	No
Primary circuits OK. REPLACE the medium speed FC relay. VERIFY applicable FAN PWR circuit is not short to ground.	KEY OFF. An MFC primary fault is detected. GO to <u>KF1</u> and follow DTC P1477 diagnosis.

KF79 CHECK OPERATION OF HIGH SPEED FAN PRIMARY CIRCUITS

- Reconnect cooling fan (if it was disconnected).
- Key on, engine off.
- Connect a non-powered test lamp between the VPWR circuit and the HFC circuit at the high speed FC relay harness connector.
- Access Output Test Mode on scan tool.
- While observing test lamp, command the high speed fan on (wait 15 seconds) and off.

Does the test lamp turn on and off when the cooling fan output is commanded on and off?

Yes	No
Primary circuits OK. REPLACE the high speed FC relay. VERIFY applicable FAN PWR circuit is not short to ground.	KEY OFF. A HFC primary fault is detected. GO to <u>KF1</u> and follow DTC P1479 diagnosis.

KF80 CHECK OPERATION OF LOW SPEED FAN OR HIGH SPEED FAN PRIMARY CIRCUITS

Note: The symptom cooling fan always runs, can be caused by a primary circuit fault, even though a DTC was not set. This step will check the primary circuit operation.

- Reconnect FC relay(s).
- Key on, engine off.
- **If fan stops running with the (low speed) FC relay disconnected:**
 - Access LFC and LFCF PIDs.
 - With LFC PID off (low speed fan commanded off by PCM), the LFCF PID must be NO.
- **If fan stops running with the high speed FC relay disconnected:**
 - Access HFC and HFCF PIDs.
 - With HFC PID off (high speed fan commanded off by PCM), the HFCF PID must be NO.

Is the HFCF or LFCF PID Yes with the fan commanded off?

Yes	No
<p>KEY OFF. An HFC or LFC primary circuit fault is detected.</p> <p>If the HFCF PID was yes:</p> <p>GO to KF1 and follow DTC P1479 diagnosis.</p> <p>If the LFCF PID was yes:</p> <p>GO to KF1 and follow DTC P1474 diagnosis.</p>	<p>Primary circuits OK.</p> <p>If fan stopped running with the low speed FC relay disconnected, REPLACE the low speed FC relay. If fan stopped running with the high speed FC relay disconnected, REPLACE the high speed FC relay.</p>

KF85 ELECTRIC COOLING FAN CONCERN, WITH NO DTCs (ESCAPE): CHECK FAN FUNCTION

- Key on, engine off.
- Access Output Test Mode on scan tool.
- Command the low speed cooling fan on and note fan operation:
 - Both the low speed and medium speed fans will be commanded on by the PCM. Both cooling fans should be running at low speed (medium speed for 3.0L).
- Command the high speed cooling fan on and note fan operation:
 - Both fans should be running at high speed.

Do the fans operate as expected?

Yes	No
<p>KEY OFF. Cooling fan circuits OK. RETURN to Section 3 Chart.</p>	<p>KEY OFF.</p> <p>For 2.0L:</p> <p>Note which fan and/or fan speed did not operate (refer to PPT KF Pre-Diagnostic Information for schematic and the 2.0L Escape Fan Diagnosis Chart to help identify which fan or fan speed(s) needs to be diagnosed).</p> <p>GO to KF86.</p> <p>For 3.0L:</p> <ul style="list-style-type: none"> ■ For; fans do not operate with low speed fan commanded on, but both fans operate with high speed fan commanded on, GO to KF95.

	<ul style="list-style-type: none"> ■ For; fans do not operate with low speed fan commanded on, and only one fan operates with high speed fan commanded on, GO to KF105. ■ For; fans operate with low speed fan commanded on, but only one fan operates with high speed fan commanded on, GO to KF115. ■ For; only one fan operates with low speed fan commanded on, but both fans operate with high speed fan commanded on, GO to KF124.
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KF86 CHECK B+ VOLTAGE TO LOW, MEDIUM and/or HIGH SPEED FAN CONTROL (FC) RELAYS

- Disconnect the low, medium and/or high speed FC relay(s) (as applicable).
- Measure B+ circuit voltage at the Low, Medium and/or High Speed FC relay(s) vehicle harness connectors.

Is voltage(s) greater than 10.0 volts?

Yes	No
GO to KF87 .	B+ circuit fault. CHECK condition of related fuses. If OK, REPAIR open circuit. If fuse is damaged, CHECK B+ and FAN PWR circuits for short to ground before replacing.

KF87 CHECK CONTINUITY OF APPLICABLE FAN PWR CIRCUITS

- Disconnect applicable cooling fan(s).
- Measure resistance of the LOW FAN PWR, MEDIUM FAN PWR and/or HIGH FAN PWR circuit between the applicable cooling fan harness connector(s) and the applicable FC relay harness connector(s).

Is resistance(s) less than 5.0 ohms?

Yes	No
GO to KF88 .	REPAIR open circuit(s).

KF88 CHECK FOR POWER TO FAN(S)

- Reconnect the low, medium and/or high speed FC relay(s) (whichever were disconnected).
- Disconnect both cooling fans, if not already disconnected.
- Key on, engine off.
- Access Output Test Mode on scan tool.
- **If low speed and/or medium speed fan is inoperative:**
 - Command the low speed fan on.
 - Measure LOW FAN PWR and/or MEDIUM FAN PWR circuit voltage at the applicable cooling fan harness connector(s).
- **If high speed fan is inoperative:**

- Command the high speed fan on.
- Measure HIGH FAN PWR circuit voltage at the applicable cooling fan harness connector (s).

Is voltage(s) greater than 10.0 volts?

Yes	No
GO to KF89 .	GO to KF75 to check cooling fan primary circuit(s).

KF89 CHECK COOLING FAN(s) GROUND

- Disconnect scan tool from DLC.
- Measure resistance of ground circuit between the applicable cooling fan harness connector(s) and chassis ground.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE fan(s) that did not operate correctly in KF85.	REPAIR ground circuit.

KF95 CHECK RESISTANCE OF LOW FAN GND CIRCUIT BETWEEN PASSENGER SIDE COOLING FAN AND MEDIUM SPEED FC RELAY

- Disconnect medium speed FC relay (ADD FAN 3, on fan shroud).
- Disconnect passenger side cooling fan.
- Measure resistance of the LOW FAN GND circuit between the passenger side cooling fan and medium speed fan FC relay harness connectors.

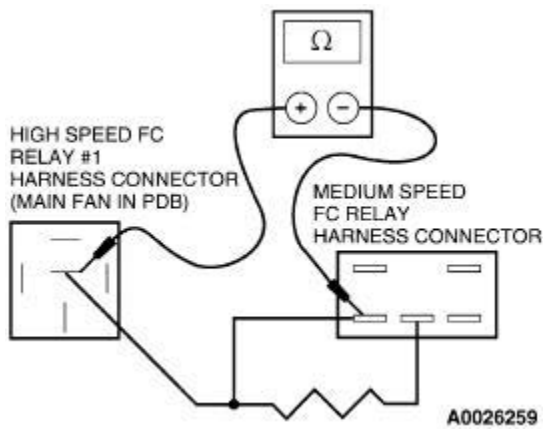
Is resistance less than 5.0 ohms?

Yes	No
GO to KF96 .	REPAIR open LOW FAN GND circuit (open is between medium speed FC relay and splice to high speed FC relay).

KF96 MEASURE RESISTANCE OF CIRCUIT BETWEEN MEDIUM SPEED FC RELAY AND HIGH SPEED FC RELAY #1

- Reconnect cooling fan.
- Disconnect high speed FC relay #1 (MAIN FAN in BJB).
- Measure resistance of the circuit between the medium speed FC relay and high speed FC relay #1 harness connectors as shown below (the circuit that does not go through the resistor is being tested).

Is resistance less than 5.0 ohms?

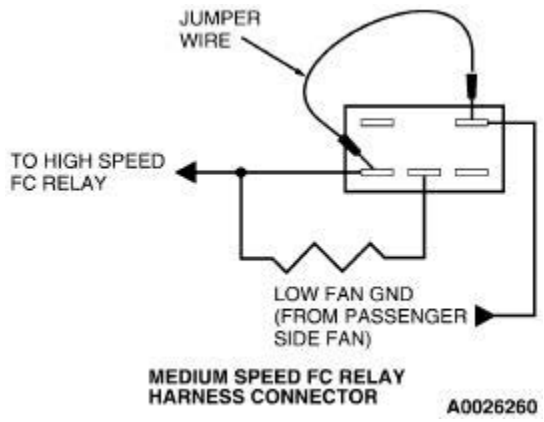


Yes	No
GO to KF97 .	REPAIR open circuit between medium speed FC relay and high speed FC relay #1.

KF97 BYPASS MEDIUM SPEED FC RELAY AND CHECK FAN OPERATION

- Reconnect high speed FC relay #1.
- Connect jumper wire in medium speed FC relay harness connector as shown below (jumper is between LOW FAN GND from passenger side cooling fan pin and circuit between medium speed and high speed FC relays that does not go through low speed resistor pin).
- Key on, engine off.
- Access Output Test Mode on scan tool.
- Command low speed fan on.

Do fans run?



Yes	No
KEY OFF. REPLACE medium speed FC relay.	KEY OFF. GO to KF98 .

KF98 CHECK NORMALLY CLOSED (N/C) CONTACTS OF HIGH SPEED FC RELAY #1

- Again, disconnect the high speed FC relay #1.
- Measure resistance of the normally closed contacts of the high speed FC relay #1 (relay pins 30 and 87A are for the normally closed contacts).

Is resistance less than 5.0 ohms?

Yes	No
No fault is detected. Reconfirm previous test steps. If OK, RETURN to Section 3 .	Replace high speed FC relay #1.

KF105 DID THE DRIVERS SIDE FAN OPERATE IN KF85?

In step KF85, was the driver's side cooling fan the one that DID operate?

Yes	No
Passenger side fan did not operate. GO to KF110 .	Driver's side fan did not operate. GO to KF106 .

KF106 COMMAND HIGH SPEED FAN ON AND CHECK FOR B+ TO DRIVER'S SIDE FAN

- Disconnect driver's side fan.
- Key on, engine off.
- Access Output Test Mode on scan tool.
- Command high speed fan on.
- Measure voltage between the HIGH FAN PWR circuit at the driver's side fan harness connector and chassis ground.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KF107 .	KEY OFF. GO to KF108 .

KF107 CHECK DRIVER'S SIDE FAN GROUND CIRCUIT

- Measure resistance of the driver's side fan ground circuit between the fan harness connector and chassis ground.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE driver's side fan.	REPAIR open ground circuit.

KF108 CHECK HIGH FAN PWR CIRCUIT CONTINUITY

- Disconnect high speed FC relay #1 (MAIN FAN in BJB)
- Measure resistance of the HIGH FAN PWR circuit between the high speed FC relay #1 and fan harness connectors.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE high speed FC relay #1.	REPAIR open circuit.

KF110 CHECK B+ TO LOW SPEED FC RELAY

- Disconnect low speed FC relay (ADD FAN in BJB).
- Measure B+ circuit voltage at the low speed FC relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
GO to KF111 .	B+ circuit fault. CHECK condition of related fuses. If OK, REPAIR open circuit. If fuse is damaged, CHECK B+ and FAN PWR circuits for short to ground before replacing.

KF111 COMMAND LOW SPEED FAN ON AND CHECK FOR B+ TO PASSENGER'S SIDE FAN

- Reconnect low speed FC relay.
- Disconnect passenger's side fan.
- Key on, engine off.
- Access Output Test Mode on scan tool.
- Command low speed fan on.
- Measure voltage between the LOW FAN PWR circuit at the passenger's side fan harness connector and chassis ground.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KF112 .	KEY OFF. GO to KF113 .

KF112 CHECK CONTINUITY OF LOW FAN GND CIRCUIT BETWEEN FAN AND HIGH SPEED FC RELAY #2

- Disconnect high speed FC relay #2 (ADD FAN 2 in BJB).
- Measure resistance of the LOW FAN GND circuit between the high speed FC relay #2 and the passenger side fan harness connectors.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE passenger side cooling fan.	REPAIR open LOW FAN GND circuit between fan and splice to high speed FC relay #2.

KF113 CHECK LOW FAN PWR CIRCUIT CONTINUITY

- Again, disconnect low speed FC relay.
- Measure resistance of the LOW FAN PWR circuit between the low speed FC relay and the passenger's side fan harness connectors.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE low speed FC relay.	REPAIR open circuit.

KF115 WHICH COOLING FAN DID OPERATE IN KF85?

In step KF85, was the driver's side cooling fan the one that DID operate?

Yes	No
Passenger side fan did not operate at high speed. GO to KF118 .	Driver's side fan did not operate at high speed. GO to KF116 .

KF116 CHECK B+ AND IGNITION START/RUN TO HIGH SPEED FC RELAY #1

- Disconnect high speed FC relay #1 (MAIN FAN in BJB).
- Measure B+ circuit voltage at the high speed FC relay #1 harness connector.
- Key on, engine off.
- Measure ignition start/run circuit voltage at the high speed FC relay #1 harness connector.

Are both voltages greater than 10.5 volts?

Yes	No
KEY OFF. REPLACE high speed FC relay #1.	KEY OFF. CHECK condition of related fuses. If OK, REPAIR open circuit. If fuse is damaged, CHECK B+ and HIGH FAN PWR circuits for short to ground before replacing.

KF118 CHECK IGNITION START/RUN AND GND CIRCUITS TO HIGH SPEED FC RELAY #2

- Disconnect high speed FC relay #2 (ADD FAN 2 in BJB).
- Key on, engine off.
- Measure voltage between the ignition start/run circuit and GND circuit at the high speed FC relay #2 harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KF121 .	GO to KF119 .

KF119 CHECK IGNITION START/RUN VOLTAGE TO HIGH SPEED FC RELAY #2, USING CHASSIS GROUND AS REFERENCE

- Measure voltage between the ignition start/run circuit at the high speed FC relay #2 harness connector and chassis ground.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. REPAIR open ground circuit to high speed FC relay #2.	KEY OFF. REPAIR open ignition start/run circuit to high speed FC relay #2.

KF121 CHECK LOW FAN GND CIRCUIT BETWEEN FAN AND HIGH SPEED FC RELAY #2

- Disconnect passenger side cooling fan.
- Measure resistance of the LOW FAN GND circuit between the high speed FC relay #2 and the passenger side fan harness connectors.

Is resistance less than 5.0 ohms?

Yes	No
GO to KF122 .	REPAIR open LOW FAN GND circuit between high speed FC relay #2 and splice to passenger side fan.

KF122 CHECK HFC CIRCUIT CONTINUITY BETWEEN HIGH SPEED FC RELAYS #1 AND #2

- Disconnect high speed FC relay #1 (MAIN FAN in BJB).
- Measure resistance of HFC circuit between the high speed FC relay #1 and high speed FC relay #2 harness connectors.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE high speed FC relay #2.	REPAIR open circuit.

KF124 DISCONNECT HIGH SPEED FC RELAY #2 AND CHECK IF BOTH FANS WILL RUN WITH LOW FAN COMMANDED ON

- Disconnect high speed FC relay #2 (ADD FAN 2 in BJB).
- Key on, engine off.
- Again, access Output Test Mode on scan tool.
- Command low speed fan on.

Do both fans now operate?

Yes	No
REPLACE high speed FC relay #2 (contacts are stuck closed).	No fault is detected. Reconfirm previous test steps. If OK, RETURN to Section 3 .

KF130 BYPASS FAN BRAKING RELAY AND CHECK IF FAN WILL RUN

- Key off.
- Reconnect cooling fans.
- Disconnect fan braking relay.
- Connect a jumper wire between the ground circuit and the circuit from the cooling fans at the fan braking relay harness connector (refer to the relay pinout at the beginning of this pinpoint test).
- Again, access Output Test Mode on scan tool.
- Command high speed fan on.

Does the fan now operate?

Yes	No
KEY OFF. GO to KF135 .	KEY OFF. GO to KF131 .

KF131 CHECK GROUND CIRCUIT FROM FAN BRAKING RELAY

- Disconnect scan tool from DLC.
- Measure resistance of ground circuit between the fan braking relay harness connector and chassis ground.

Is resistance less than 5.0 ohms?

Yes	No
GO to KF132 .	REPAIR ground circuit.

KF132 CHECK CONTINUITY OF FAN GROUND CIRCUIT BETWEEN FAN AND RELAY

- Measure resistance of fan ground circuit between fan and fan braking relay harness connectors.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE FAN MOTOR(s).	REPAIR open circuit.

KF135 CHECK VPWR VOLTAGE TO FAN BRAKING RELAY

- Key on, engine off.
- Measure VPWR circuit voltage to fan braking relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KF136 .	REPAIR open VPWR circuit.

KF136 CHECK CONTINUITY OF LFC CIRCUIT TO FAN BRAKING RELAY

- Disconnect low speed FC relay.
- Measure resistance of the LFC circuit between the low speed FC relay and fan braking relay harness connectors.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE fan braking relay.	REPAIR open circuit.

KH: Hydraulic Cooling Fan Introduction

KH: Pinpoint Tests →

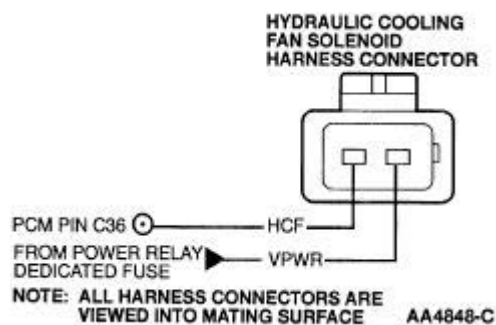
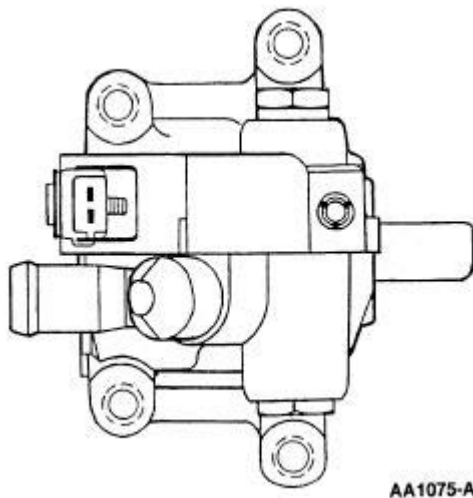
Note

This Pinpoint Test is intended to diagnose the following:

- Hydraulic cooling fan(HCF) solenoid/pump (14A464)
- Harness circuits: VPWR, HCF
- Powertrain control module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

Hydraulic Cooling Fan Pump with Integral Solenoid



KH: Hydraulic Cooling Fan

← KH: Introduction

KH1 DTC P1474 OR COOLING FAN CONCERNS: CHECK HCF SOLENOID RESISTANCE

- Key off.
- Disconnect HCF solenoid.
- Measure HCF solenoid resistance.

Is resistance between 8.5 and 11.5 ohms?

Yes	No
GO to KH2 .	REPLACE HCF solenoid assembly.

KH2 CHECK VPWR VOLTAGE TO HCF SOLENOID

- Key on.
- Measure VPWR circuit voltage at HCF solenoid.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KH3 .	REPAIR open circuit.

KH3 CHECK HCF CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of HCF circuit between PCM harness connector and HCF solenoid harness connector.

Is resistance less than 5 ohms?

Yes	No
GO to KH4 .	REPAIR open circuit.

KH4 CHECK HCF CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on.
- Measure voltage between HCF circuit at the PCM harness connector and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to KH5 .	REPAIR short circuit.

KH5 CHECK HCF CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between HCF circuit at the PCM harness connector and ground.

Is resistance greater than 10,000 ohms?

Yes	No
REFER to Engine Cooling, Section 303-03 in the Workshop Manual for diagnosis and testing. If OK, REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

KJ: Supercharge Bypass Control Introduction

KJ: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

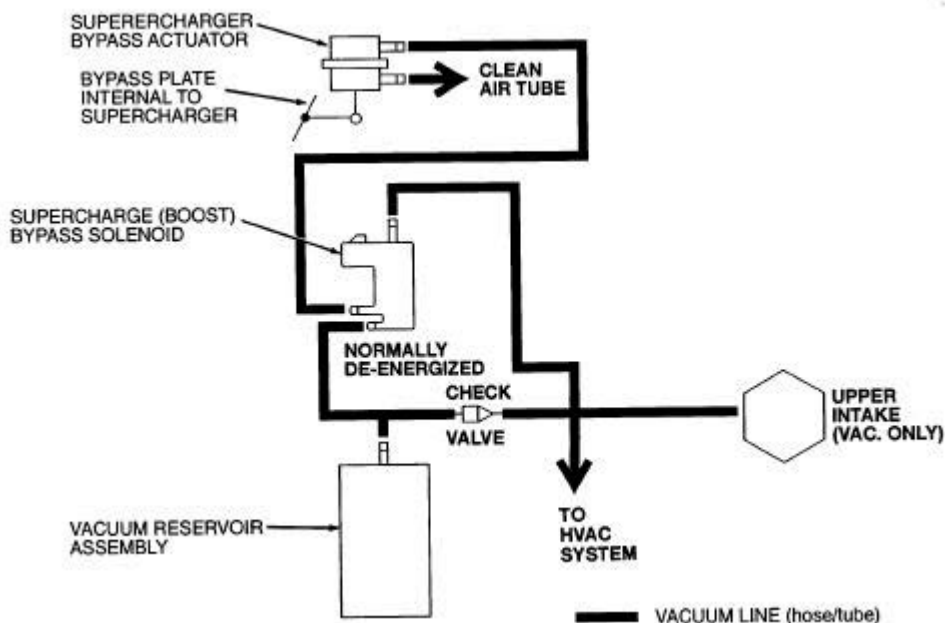
- Supercharger (boost) bypass solenoid (9H465) (service part name is: thermactor air control solenoid/vacuum valve assembly)
- Vacuum reservoir assembly (9J442)
- Vacuum hoses/tubes
- Harness circuits: SCB, vehicle power (VPWR), and power ground (PWR GND)
- Powertrain control module (PCM) (12A650)

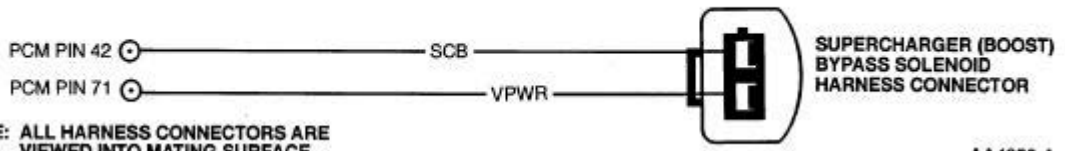
This Pinpoint Test is used to assist in diagnosing the following Supercharger components:

- Supercharger assembly (including supercharger bypass actuator) (6F076)

Pinpoint Test Schematics and Connectors

5.4L Lightning





KJ: Pinpoint Tests →

KJ: Supercharge Bypass Control

← KJ: Introduction

KJ1 DTC P0234: CHECK FOR OTHER DTCS

Note: The supercharger will be bypassed when the brake is on and the throttle is depressed in the wide open throttle position. This is called brake torque and the engine torque is too high.

- Check that the engine has not been subjected to brake torque causing the P0234.
- Drive the vehicle for 10 to 15 minutes with the engine exceeding 2,000 rpm and the engine temperature stabilizing.

No Starts:

- GO to [A1](#) .

For Stalls:

- Return to [Section 3](#) , Symptom Charts.
- Return to repair area and check that upper radiator hose is hot and pressurized.
- Rerun Quick Test and retrieve KOER and continuous and retrieve DTCs.

Are any other KOEO, KOER and Continuous Memory DTCs present with the KOER or Continuous Memory P0234?

Yes	No
KEY OFF. GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts , for Pinpoint Test direction and REPAIR DTCs.	GO to KJ2 .

KJ2 CHECK SCAN TOOL PIDS FOR CAUSES OF OVERBOOST CONDITION

- Key on, engine running.
- Access IAT2, TFT and RPM PIDs.
- Observe the PIDs for values exceeding the following limits:
 - Intake air temperature (downstream), IAT2 PID greater than 230°F.
 - Transmission fluid temperature, TFT PID greater than 275°F.

Do any of the above PIDs exceed the limit?

Yes	No
<p>For IAT2:</p> <p>CHECK for low fluid level in Intercooler System. CHECK for cracked intercooler lines. REPAIR as necessary.</p> <p>For TFT:</p> <p>CHECK for low transmission fluid level. REFER to Automatic Transmission Section 307-01 and 307-02 in the Workshop Manual for fluid changes.</p>	GO to KJ3 .

KJ3 CHECK FOR LOW SPEED FUEL PUMP RELAY NOT SWITCHING

- Key on, engine running.
- Access LFPF PID.

Is a fault indicated on the low speed fuel pump (FP) output?

Yes	No
KEY OFF. GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts for diagnostic direction following DTC P1232.	CHECK for indications of engine knock while driving the vehicle. REPAIR as necessary. If OK, indicate to vehicle owner that transmission damage will occur upon brake torque (reference: GO to KJ1). Otherwise, unable to determine cause of overboost condition at this time.

KJ6 DTC P0243: CHECK SUPERCHARGER (BOOST) BYPASS SOLENOID OUTPUT

- Key off.
- Disconnect supercharger (boost) bypass (SCB) solenoid.
- Connect a non-powered test lamp between SCB and VPWR circuits at the SCB solenoid harness connector.
- Key on, engine off.
- Attempt to close and open SCB solenoid driver in PCM by accessing Output Test Mode or scan tool.
- While observing the test lamp, command the PCM outputs on and off.

Does the test lamp cycle on and off (light up and turn off)?

Yes	No
KEY OFF. GO to KJ7 .	<p>For test lamp always off :</p> <p>GO to KJ8.</p> <p>For test lamp always on :</p> <p>KEY OFF. GO to KJ11.</p>

KJ7 CHECK SCB SOLENOID RESISTANCE

- Measure SCB solenoid resistance.

Is resistance between 68 and 78 ohms?

Yes	No
CHECK for damaged vacuum hoses between engine intake manifold and SCB solenoid. CHECK for vacuum reservoir assembly leaks. REPAIR or REPLACE as necessary. If OK, GO to Z1 for intermittent diagnosis.	REPLACE damaged SCB solenoid.

KJ8 CHECK FOR OPEN VPWR CIRCUIT BETWEEN SCB SOLENOID AND POWER RELAY

- Measure voltage between VPWR circuit at the SCB solenoid harness connector and battery negative post.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KJ9 .	KEY OFF. REPAIR open circuit.

KJ9 CHECK VPWR CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of the pinpoint test.

- Disconnect PCM.
- Measure resistance of VPWR circuit between PCM harness connector pin and SCB solenoid harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to KJ10 .	REPAIR open circuit.

KJ10 CHECK SCB CIRCUIT FOR OPEN IN HARNESS

- Measure resistance of SCB circuit between PCM harness connector pin and SCB solenoid harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuit.

KJ11 CHECK SCB CIRCUIT FOR SHORT TO PWR GND IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Disconnect scan tool from DLC.
- Measure resistance between SCB circuit and multiple PWR GND circuits at the PCM harness connector.

Are all resistances greater than 10,000 ohms?

Yes	No
RECONNECT scan tool. GO to KJ12 .	REPAIR short circuit.

KJ12 CHECK SCB CIRCUIT FOR SHORT TO PWR IN HARNESS

- Key on, engine off.
- Measure voltage between SCB circuit at the PCM harness connector and chassis ground.

Is voltage less than 1.0 volts?

Yes	No
KEY OFF. REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	KEY OFF. REPAIR short circuit to VPWR.

KJ13 LACK OF POWER (LOW BOOST) - CHECK VACUUM HOSES

- Check for holes or cracks in the vacuum hose/tube between the supercharger bypass actuator and the supercharger bypass solenoid.
- Check for holes or cracks in the vacuum hose/tube between the supercharger bypass solenoid and vacuum reservoir assembly.
- Check for bends or kinks in the vacuum hose/tube between the supercharger bypass actuator and the supercharger bypass solenoid.
- Check for bends or kinks in the vacuum hose/tube between the supercharger bypass solenoid and vacuum reservoir assembly.
- Check for disconnect hose(s) between the supercharger bypass actuator, supercharger bypass solenoid and vacuum reservoir assembly.

Are any leaks (holes or cracks) or restrictions (bends or kinks) in the vacuum hose(s) present?

Yes	No
REPAIR or REPLACE vacuum hose(s)/tube as necessary.	RETURN to <u>Section 3</u> , Symptom Chart 8 for Lack/Loss of Power.

KL: Shift Indicator Lamp (SIL) Introduction

KL: Pinpoint Tests →

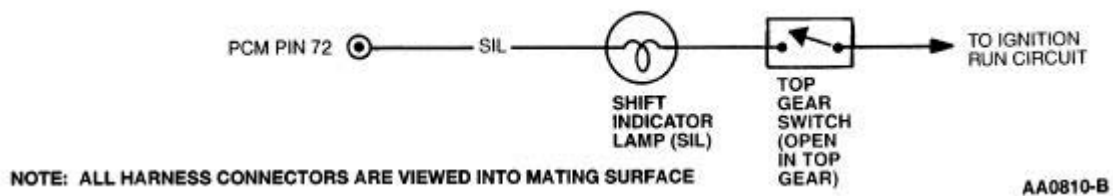
Note

This Pinpoint Test is intended to diagnose the following:

- Harness circuit: SIL
- Top gear switch
- SIL dimmer relay
- SIL bulb and SIL circuit fuse
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematic

Escort ZX2



KL: Pinpoint Tests →

KL: Shift Indicator Lamp (SIL)

← KL: Introduction

KL1 CHECK SHIFT INDICATOR LAMP (SIL) OPERATION

Note: When the SIL is operating properly, it comes on when optimum shift speed is reached. The SIL will turn off after a shift has been completed or while in top gear.

- Drive vehicle through all forward gears.
- Look for the SIL to come on before the next upshift.
- Look for the SIL to be off after a shift has been completed or while in top gear.

Is SIL on all the time?

Yes	No
KEY OFF. GO to KL4 .	KEY OFF. GO to KL2 .

KL2 CHECK SIL CIRCUIT FUSE

- Remove SIL circuit fuse and inspect.

Is fuse OK?

Yes	No
INSTALL SIL circuit fuse. GO to KL3 .	REPAIR short circuit. REPLACE SIL circuit fuse.

KL3 CHECK SIL BULB

- Remove SIL bulb and inspect.

Is SIL bulb OK?

Yes	No
GO to KL5 .	REPLACE SIL bulb.

KL4 CHECK SIL CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Shift transmission to highest gear.
- Disconnect PCM.
- Measure resistance between SIL circuit at PCM harness connector and battery negative post.

Is resistance greater than 10,000 ohms?

Yes	No

REPLACE PCM (refer to Section 2, [Flash Electrically Erasable Programmable Read Only Memory \(EEPROM\)](#)).

REPAIR short circuit.

KL5 CHECK IGN START/RUN VOLTAGE TO SIL SOCKET

- SIL bulb removed.
- Transmission in any gear except top gear.
- Key on, engine off.
- Measure voltage of the SIL circuit between the SIL socket and chassis ground.

Is the voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KL7 .	KEY OFF. RECONNECT SIL bulb. GO to KL6 .

KL6 CHECK OPERATION OF TOP GEAR SWITCH

- Transmission in any gear except top gear.
- Disconnect top gear switch.
- Measure resistance of the top gear switch.

Is resistance less than 5.0 ohms?

Yes	No
REPAIR open circuit.	REPLACE top gear switch.

KL7 CHECK SIL CIRCUIT FOR OPEN IN HARNESS

- SIL bulb removed.
- Disconnect PCM.
- Measure resistance between SIL circuit at PCM harness connector and SIL bulb socket.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuit.

KM: A/C Clutch Relay, A/C Circuits Introduction

KM: Pinpoint Tests →

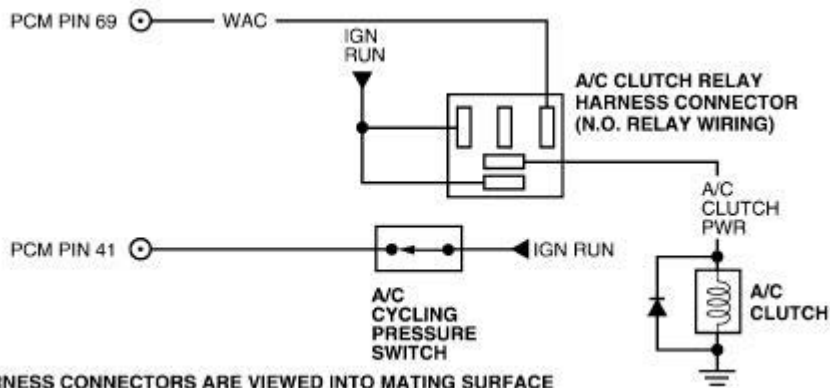
Note

This Pinpoint Test is intended to diagnose the following:

- Harness circuits: VPWR, A/CCS, WAC, A/C Clutch PWR
- A/C clutch relay
- Powertrain control module (PCM) (12A650)

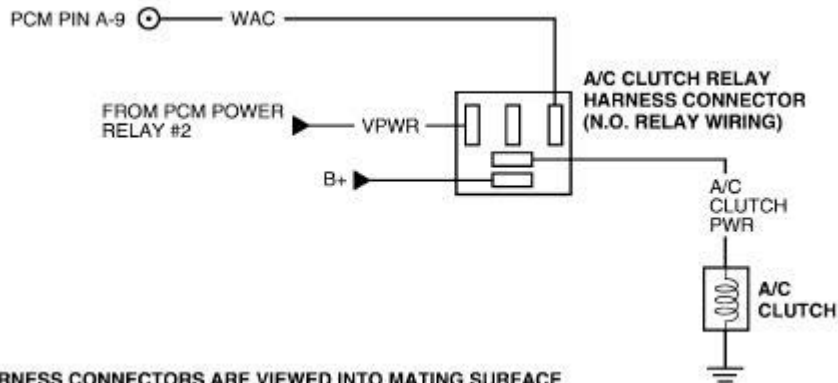
Pinpoint Test Schematics and Connectors

Continental



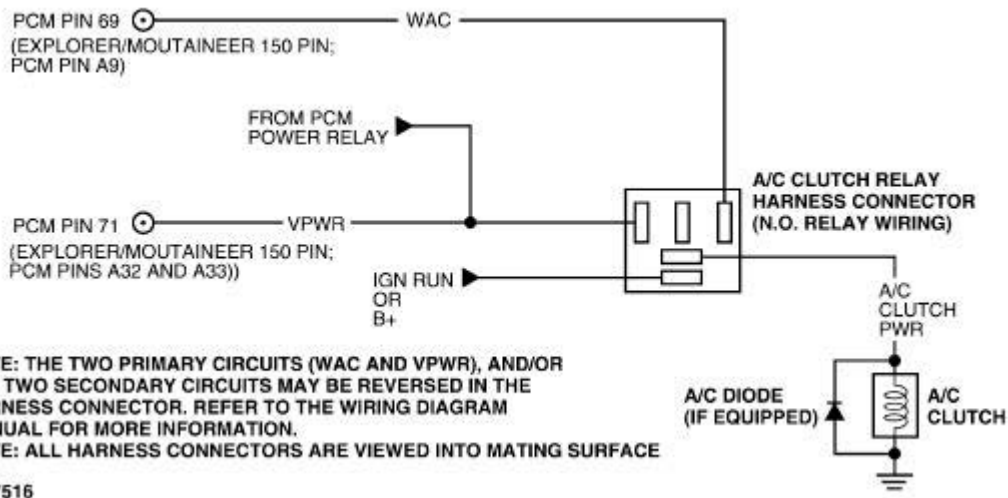
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LS6/LS8

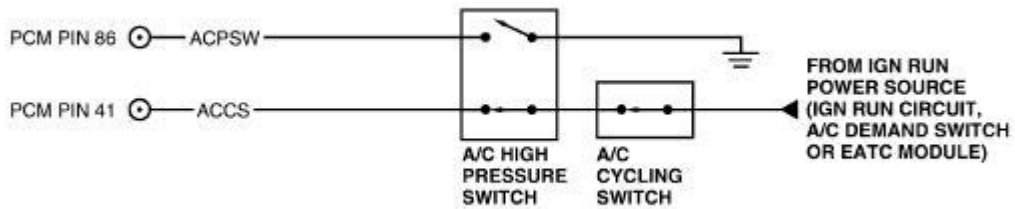


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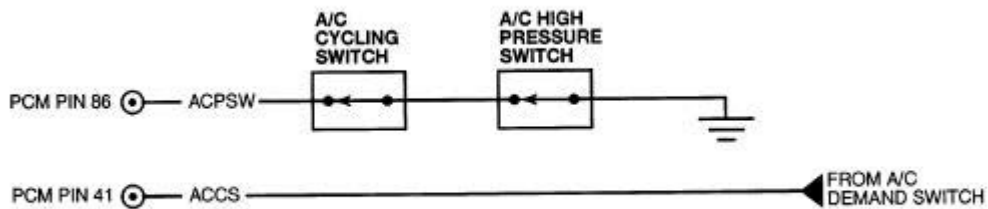
Focus, Cougar, Taurus/Sable, Town Car, Escape, Ranger, Explorer/Mountaineer, Windstar



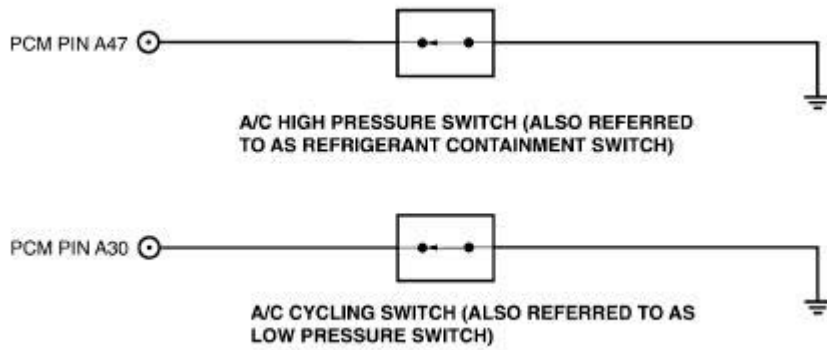
Focus, Cougar, Taurus/Sable, Crown Victoria/Grand Marquis, Town Car, Escape, (ACPSW and ACCS circuits)



Ranger, Explorer/Mountaineer (w/ 104 pin PCM), (ACPSW and ACCS circuits)

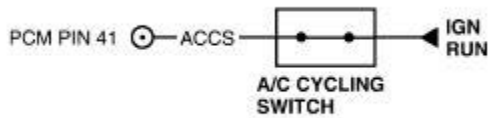


Explorer/Mountaineer (w/ 150 pin PCM), (ACPSW circuits)



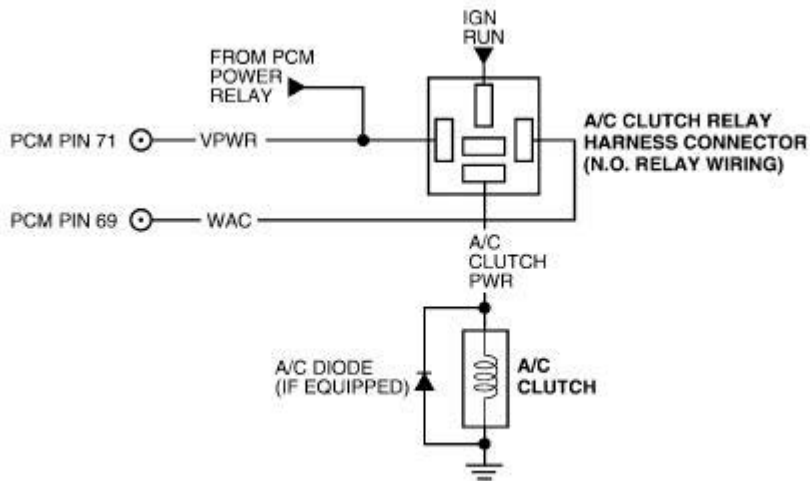
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Windstar (ACCS Circuit)



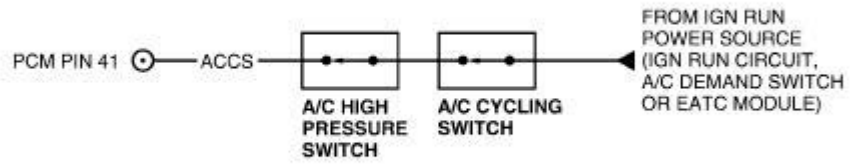
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Crown Victoria/Grand Marquis, F150/250/350, Expedition/Navigator/Blackwood, Excursion, 4.2L E-Series



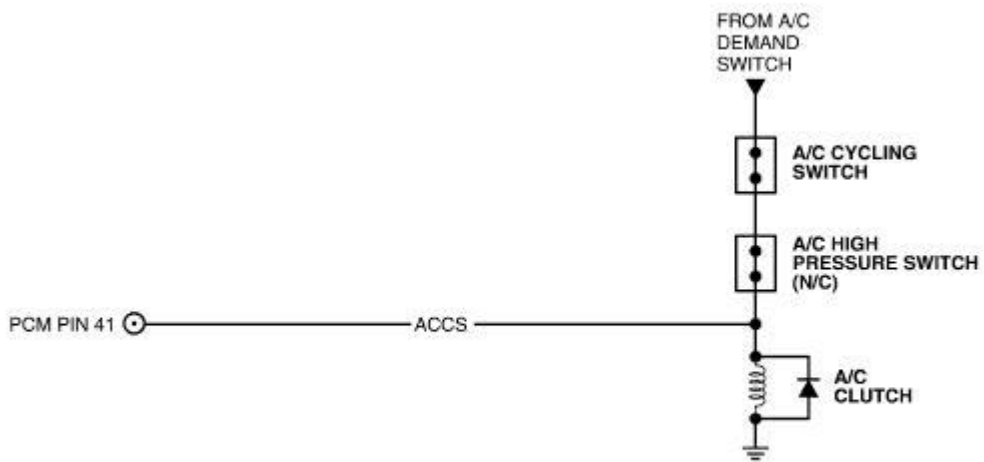
A0029817 NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

F150/250/350, Expedition/Navigator/Blackwood, Excursion, 4.2L E-Series (ACCS Circuit)



A0029818

E-Series (Except 4.2L)



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0005256

KM: Pinpoint Tests →

KM: A/C Clutch Relay, A/C Circuits

← KM: Introduction

KM1 KOEO/KOER DTC P1460: VERIFY ACCS PID IS OFF

Note: Verify A/C and defrost were off during KOEO/KOER Self-Tests. If the vehicle is not equipped with A/C, the WOT A/C Cutoff (WAC) circuit is not used and the DTC P1460 can be ignored.

- Start engine.
- A/C and defroster off.
- Access ACCS PID.

Is the ACCS PID off?

Yes	No
KEY OFF. GO to KM2 .	ACCS input to PCM is requesting A/C. REFER to the Climate Control System — General Information, Section 412-00, in the Workshop Manual to diagnose symptom (A/C always on).

KM2 CHECK VPWR VOLTAGE TO A/C CLUTCH RELAY

- Disconnect A/C clutch relay.
- Key on, engine off.
- Measure VPWR circuit voltage at the A/C clutch relay harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to KM3 .	<p>For LS6/LS8 :</p> <p>GO to B5.</p> <p>All others :</p> <p>REPAIR open circuit. START engine. Turn A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.</p>

KM3 CHECK A/C CLUTCH RELAY

- Refer to pin numbers molded on A/C clutch relay. There will be either a Pin 1 or Pin 85.
- Measure resistance between either Pin 1 or Pin 85 and all other pins of the A/C clutch relay. One measurement must be between 40 and 120 ohms, with the other measurements being greater than 10,000 ohms.

Are all resistance checks OK?

Yes	No
GO to KM4 .	REPLACE A/C clutch relay. START engine. TURN A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.

KM4 CHECK WAC CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.
- Key on, engine off.
- Measure voltage between WAC circuit at A/C clutch relay vehicle harness connector and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to KM5 .	REPAIR short circuit. START engine. Turn A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.

KM5 CHECK WAC CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between WAC circuit at A/C clutch relay vehicle harness connector and ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to KM6 .	REPAIR short circuit. START engine. Turn A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.

KM6 CHECK WAC CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM pin numbers at the beginning of this pinpoint test.

- Measure resistance of WAC circuit between PCM harness connector and the A/C clutch relay harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). START engine. Turn A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.	REPAIR open circuit. START engine. Turn A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.

KM10 ACCS PID OFF WITH A/C ON: VERIFY A/C CLUTCH IS GETTING POWER

- Start engine.
- While listening for A/C clutch to engage, turn A/C on (if clutch cannot be heard, disconnect A/C clutch and connect a non-powered test lamp to A/C clutch PWR and ground circuit to check for power).

Does the A/C clutch engage (or the light turn on)?

Yes	No
Power is getting to A/C clutch, but ACCS PID is OFF. GO to KM11 .	The ACCS PID is OFF because power is not getting to the A/C clutch. This is not a cause of the low idle symptom. RETURN to Section 3 to continue low idle diagnosis, or REFER to the Climate Control System — General Information, Section 412-00, in the Workshop Manual to diagnose A/C system concerns.

KM11 CHECK ACCS CIRCUIT FOR OPEN IN HARNESS

- Disconnect PCM.
- Disconnect A/C clutch.
- Measure resistance between Pin 41 at the PCM harness connector and the A/C clutch power circuit at the A/C clutch harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuit.

KM19 DTC P1464: CHECK ACCS PID

Note: Verify A/C and defrost were off during Self-Test. If A/C or defrost were on, turn off and rerun Self-Test.

- Key on, engine off.
- A/C and defrost off.
- Access ACCS PID.

Is ACCS PID on?

Yes	No
<p>E-Series (except 4.2L):</p> <p>GO to KM20.</p> <p>All others:</p> <p>ACCS input to PCM is requesting A/C. REFER to the Climate Control System — General Information, Section 412-00, in the Workshop Manual to diagnose symptom (A/C always on).</p>	The ACCS PID indicates that the ACCS input to the PCM is low. VERIFY test results. With A/C and defrost off, RERUN Self-Test where P1464 was received.

KM20 ACCS PID ON: DISCONNECT A/C CYCLING SWITCH AND CHECK IF ACCS PID TURNS OFF

- Disconnect A/C cycling switch.
- Key on, engine off.
- Access ACCS PID.

Is ACCS PID off?

Yes	No
VERIFY operation of A/C demand switch. REFER to the Climate Control System, General Information Section 412-00 in the Workshop Manual. If OK, REPAIR short to power in A/C Demand circuit to A/C cycling switch.	KEY OFF. GO to KM21 .

KM21 CHECK ACCS CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.
- Key on.
- Measure voltage between PCM harness connector pin 41 and ground.

Is voltage less than 1.0 volt?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

KM30 CONTINUOUS MEMORY DTC P1460: CHECK WAC CIRCUIT FOR INTERMITTENT SHORT TO GROUND

Note: If the vehicle is not equipped with A/C, the WAC circuit is not used and the P1460 can be ignored.

Note: Refer to the beginning of this pinpoint test for PCM pin numbers.

- Key on, engine off.
- Check WAC circuit for short to ground while completing the following (the A/C clutch will click on when a fault is detected):
 - Shake, wiggle and bend the WAC circuit between the PCM and the A/C clutch relay.
 - Lightly tap on the A/C clutch relay (to simulate road shock).

Is a fault indicated?

Yes	No
KEY OFF. ISOLATE fault and REPAIR as necessary. COMPLETE PCM Reset to clear DTCs. START engine. Turn A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.	GO to KM31 .

KM31 CHECK WAC CIRCUIT FOR INTERMITTENT OPEN OR SHORT TO POWER

- Key on, engine off.
- Access Output Test Mode on scan tool.
- Turn outputs on.
- Check WAC circuit for open or short to power while completing the following (the A/C clutch will click off when a fault is detected):
 - Shake, wiggle and bend the WAC circuit between the PCM and the A/C clutch relay.
 - Shake, wiggle and bend the VPWR circuit to the A/C clutch relay.
 - Lightly tap on the A/C clutch relay (to simulate road shock).

Is a fault indicated?

Yes	No
KEY OFF. ISOLATE fault and REPAIR as necessary. COMPLETE PCM Reset to clear DTCs. START engine. Turn A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.	KEY OFF. Unable to duplicate or identify fault at this time. GO to <u>Z1</u> .

KP: Charge Air Cooler Pump (CAC) Introduction

KP: Pinpoint Tests →

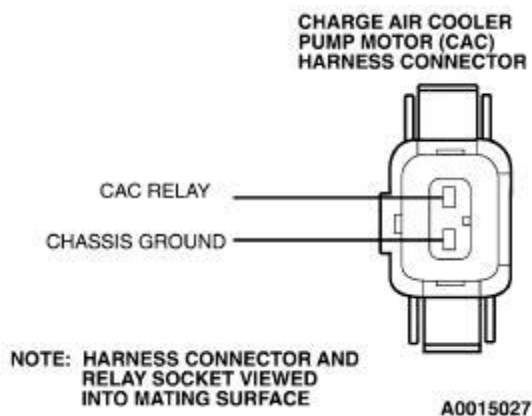
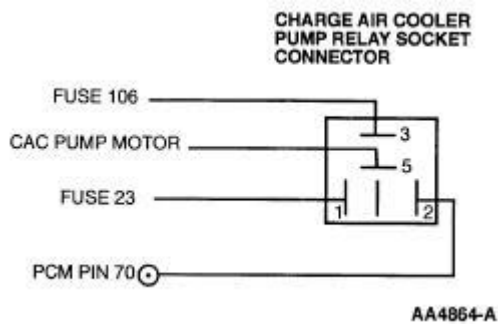
Note

This Pinpoint test is intended to diagnose the following:

- Charge Air Cooler Pump Relay (148192)
- Charge Air Cooler Pump Motor (8501)
- Harness circuits: CAC, Fuse 23, Fuse 106, vehicle power (VPWR) and power ground (PWR GND)

Pinpoint Test Schematics and Connector

5.4L Lightning



KP: Charge Air Cooler Pump (CAC)

← KP: Introduction

KP1 P1229: CHECK POWER FEED TO CAC PUMP RELAY COIL

- Check Fuse 23.

Is the fuse OK?

Yes	No
GO to <u>KP2</u> .	CHECK Circuit 391 and 369 for short to ground.

KP2 CHECK POWER FEED TO CAC PUMP RELAY

- Check Fuse 106.

Is the fuse OK?

Yes	No
GO to <u>KP3</u> .	CHECK Circuit 17 and 18 for short to ground.

KP3 CHECK INTEGRITY OF CAC PUMP GROUND CONNECTION

- Disconnect the CAC pump.
- Measure the resistance between chassis ground circuit at the CAC pump connector and battery negative post.

Is the resistance less than 2 ohms?

Yes	No
GO to <u>KP4</u> .	CHECK the tightness of the ground lug. If tight check wire back to the CAC connector.

KP4 CHECK CAC PUMP MOTOR RESISTANCE

- Disconnect the CAC pump motor.
- Measure the resistance between the pins at the CAC connector to the pump motor.

Is the resistance less than 10 ohms?

Yes	No
GO to <u>KP5</u> .	REPLACE CAC pump motor.

KP5 CHECK CAC PUMP RELAY

- Remove relay from power distribution box.
- Measure resistance between pin 1 or 2 and all other pins. One reading must be between 65-90 ohms and all other readings must be greater than 10K ohms.

Are resistance checks OK?

Yes	No
GO to <u>KP6</u> .	REPLACE CAC pump relay.

KP6 CHECK FOR OPEN CAC CIRCUIT BETWEEN PCM AND CAC RELAY

Note: Refer to PCM Pin numbers in the beginning of this pinpoint test.

- Key off.
- Disconnect the PCM and the CAC pump relay.
- Measure the resistance of the CAC circuit at the PCM harness connector and pin 2 of the relay socket.

Is the resistance less than 5 ohms?

Yes	No
GO to <u>KP7</u> .	REPAIR open circuit.

KP7 CHECK CAC CIRCUIT BETWEEN PCM AND CAC RELAY FOR SHORT TO GROUND

- Key off.
- Measure the resistance of the CAC circuit at the PCM harness connector and the battery negative post.

Is the resistance greater than 10K ohms?

Yes	No
GO to <u>KP8</u> .	REPAIR short to ground condition.

KP8 CHECK CAC CIRCUIT BETWEEN PCM AND CAC RELAY FOR SHORT TO POWER

- Key on, engine off.
- Remove CAC pump relay.
- Measure the voltage between the CAC circuit at the PCM harness connector and the battery negative post.

Is the voltage less than 0.05 volt?

Yes	No

GO to KP9.

REPAIR short to B+.

KP9 CHECK FOR OPEN CIRCUIT BETWEEN CAC PUMP RELAY COIL AND POWER FEED

- Remove the CAC pump relay and fuse 23.
- Measure the resistance between relay socket pin 1 and fuse 23 (load side).

Is resistance less than 5 ohms?

Yes	No
GO to <u>KP10</u> .	REPAIR open circuit.

KP10 CHECK FOR OPEN POWER FEED CIRCUIT AT CAC PUMP MOTOR RELAY

- Remove CAC Pump Relay and fuse 106 from their sockets.
- Measure resistance between relay socket pin 3 and load side of fuse socket.

Is resistance less than 5 ohms?

Yes	No
GO to <u>KP11</u> .	REPAIR open circuit.

KP11 CHECK FOR OPEN CAC CIRCUIT BETWEEN CAC, CAC PUMP RELAY AND PUMP MOTOR

- Disconnect the CAC pump motor.
- Measure resistance between relay socket pin 5 and the CAC harness connector.

Is the resistance less than 5 ohms?

Yes	No
Replace CAC RELAY, FUSE 23, AND FUSE 106. GO to <u>KP12</u> .	REPAIR open circuit.

KP12 CHECK STATUS OF PID

- Key on, engine off.
- Access SCIPC PID.

Does the SCIPC indicate PID on?

Yes	No
If the CAC reservoir is full, no air flow blockage at the CAC radiator, the IAT 2 and	

connecting circuits are not high resistance or open circuited, intercooler hoses are not reversed and DTC P1229 is present in KOEO and KOER, then REPLACE PCM.

Unable to duplicate or identify fault at this time. GO to Z1.

KQ: Thermostat Heater Control (THTRC) Introduction

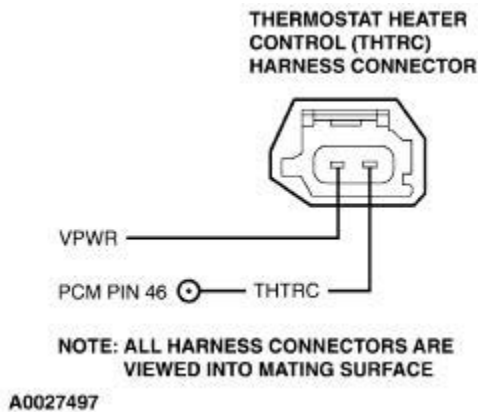
KQ: Pinpoint
Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Thermostat (8575)
- Harness circuits: THTRC and VPWR
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematic and Connector

KQ: Pinpoint Tests →

KQ: Thermostat Heater Control (THTRC)

← KQ: Introduction

KQ10 DTC P1432: CHECK VPWR AT THTRC HARNESS CONNECTOR

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect the thermostat harness connector.
- Key on.
- Measure VPWR circuit voltage at THTRC harness connector.

Is the voltage reading greater than 10.5 volts?

Yes	No
KEY OFF. GO to KQ11 .	KEY OFF. REPAIR VPWR circuit.

KQ11 CHECK THERMOSTAT RESISTANCE

- Measure resistance of the thermostat at the two pin terminal connector.

Is resistance between 14.0 and 16.0 ohms?

Yes	No
GO to KQ12 .	REPLACE thermostat.

KQ12 CHECK THTRC CIRCUIT FOR OPEN IN HARNESS

- Disconnect PCM.
- Measure resistance between THTRC circuit between PCM harness connector pin and the THTRC harness connector.

Is the resistance less than 5.0 ohms?

Yes	No
GO to KQ13 .	REPAIR open circuit.

KQ13 CHECK THTRC CIRCUIT FOR SHORT TO GROUND OR VPWR IN HARNESS

- Measure resistance between THTRC PCM pin and PCM pins VPWR, SIG RTN and PWR GND.

Is each resistance greater than 10,000 ohms?

Yes	No
For Continuous DTC P1432 only, GO to Z1.	REPAIR short to GND or VPWR.

For KOEO or KOER DTC P1432, REPLACE
PCM.

NB: Malfunction Indicator Lamp (MIL) Introduction

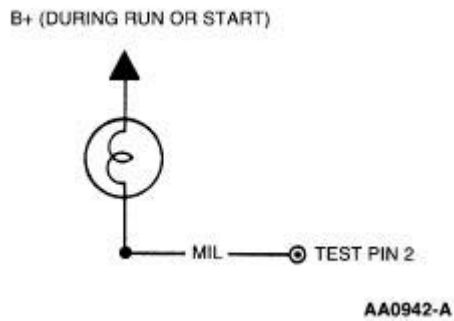
NB: Pinpoint
Tests →

Note

This Pinpoint Test is intended to diagnose only the following:

- Malfunction Indicator Lamp (MIL) circuit
- Powertrain Control Module (PCM)
- Fuse

Pinpoint Test Schematic



NB: Pinpoint Tests →

NB: Malfunction Indicator Lamp (MIL)

← NB: Introduction

NB1 MALFUNCTION INDICATOR LAMP (MIL) ALWAYS ON: CHECK MIL CIRCUIT FOR SHORTS TO GROUND IN HARNESS

Note: If vehicle will not start, GO to A1.

- If any Key On Engine Off or Continuous Memory Diagnostic Trouble Codes are present, repair before proceeding.
- Disconnect PCM.
- Measure resistance between PCM harness connector Pin 2 and PCM harness connector Pin 51 or 103.

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

NB2 MALFUNCTION INDICATOR LAMP (MIL) NEVER ON

Note: If vehicle will not start, GO to A1.

- Key on, engine off.
- Measure voltage from battery negative post to Ground side of the MIL fuse. Refer to the Wiring Diagram Manual for the specific location of the MIL fuse.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to <u>NB4</u> .	KEY OFF. GO to <u>NB3</u> .

NB3 CHECK B+ VOLTAGE TO FUSE

- Key on, engine off.
- Measure voltage from battery negative post to B+ side of the fuse.

Is voltage greater than 10.5 volts?

Yes	No
REPLACE the fuse. VERIFY repair by turning ignition key to the on position.	KEY OFF. REFER to the Wiring Diagrams to repair power distribution (to the fuse) from the Power Distribution Box.

NB4 CHECK VOLTAGE ON THE B+ CIRCUIT

Note: Refer to the Wiring Diagrams for connector location.

- Disconnect Instrument Cluster harness connector.
- Key on, engine off.
- Measure voltage of B+ circuit between the Instrument Cluster harness connector and battery negative post.

Was voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to NB5 .	REPAIR open circuit.

NB5 CHECK FOR OPEN MIL CIRCUIT BETWEEN PCM AND INSTRUMENT CLUSTER

- Disconnect PCM.
- Measure resistance between PCM harness connector Pin 2 and MIL circuit at the instrument cluster connector.

Is resistance less than 5.0 ohms?

Yes	No
REFER to Instrumental Cluster, Section 413-01 in the Workshop Manual to diagnose Instrument Cluster and Bulb. If OK, REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). VERIFY the repair by turning key to the ON position.	REPAIR open circuit. VERIFY repair by turning key to the ON position.

NC: Ignition Engine Speed Input Circuit Introduction

NC: Pinpoint
Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Powertrain Control Module (PCM) (12A650)

NC: Pinpoint Tests →

NC: Ignition Engine Speed Input Circuit

← NC: Introduction

NC1 DTC P0320: ERRATIC IGNITION

Note: Verify all 2-way radio installations. Carefully follow manufacturer's installation instructions regarding the routing of antenna and power leads.

Are any faults present?

Yes	No
REPAIR as necessary.	For No Starts: GO to <u>A1</u> . For Intermittent Faults: GO to <u>Z1</u> . All others: Loss of PIP. GO to <u>JD1</u> .

ND: Engine RPM/Vehicle Speed Limiter

ND1 DTC P1270: EXCESSIVE ENGINE RPM/VEHICLE SPEED

Check for:

- Water, ice, mud and snow causing wheel slippage.
- Excessive engine rpm in NEUTRAL.
- Vehicle driven at high rate of speed.

Was the vehicle operating in any of the above conditions?

Yes	No
OBD II system is OK. RETURN vehicle to customer with information about DTC P1270.	GO to Section 3 , Symptom Charts if there are other driveability concerns. If there are no other symptoms, RETURN vehicle to customer.

QA: Unable To Activate Self-Test/SCP Communication Error/DTC Not Listed Introduction

QA: Pinpoint Tests →

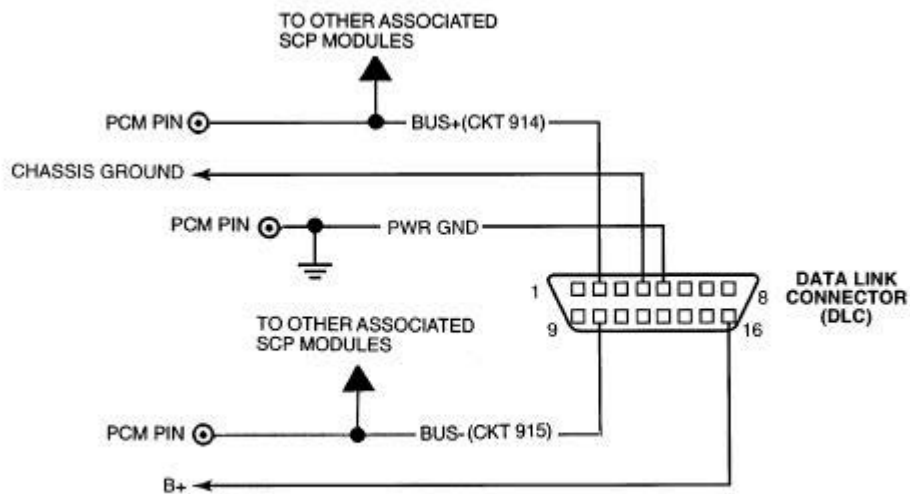
Note

This Pinpoint Test is intended to diagnose the following:

- Standard corporate protocol (SCP) communication bus harness circuits: BUS+, BUS-, between DLC and PCM
- Data link connector harness circuits: chassis ground, power ground (PWR GND), battery positive voltage (B+)
- Powertrain control module (PCM) (12A650)

Note: Concerns found that affect the entire network are referred to in the Module Communication Network, Section 418-00 in the Workshop Manual.

Pinpoint Test Schematics and Connectors



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

AA0934-C

PCM CONNECTOR PIN NUMBERS

Application	BUS (+)	BUS (-)	PWR GND
LS6/LS8, Explorer/Mountaineer (150 pin PCM only)	A-3	A-4	A-24,25,26
All Others	16	15	51,77,103

QA: Unable To Activate Self-Test/SCP Communication Error/DTC Not Listed

← QA: Introduction

QA1 VERIFY SELF-TEST PROCEDURE

- This pinpoint test addresses the following concerns:
 - Unable to access Continuous Memory DTCs.
 - Unable to activate KOEO Self-Test.
 - Unable to activate KOER Self-Test.
 - Scan tool communication concern.
 - DTC displayed by scan tool not listed.
 - Power Take Off (PTO), if equipped.
 - DTC P1001 KOER Self-Test cannot be completed.
- Possible causes:
 - Damaged DLC.
 - Incorrect Self-Test procedure.
 - VREF is not in specification.
 - Idle rpm out of specification.
 - Open in DLC harness circuit.
 - Short in DLC harness circuit or associated modules.
 - Damaged PCM power relay circuit.
 - Damaged PCM.
 - PTO circuit, if equipped.
- Disconnect scan tool from DLC. Inspect vehicle and scan tool DLC for damage. Repair as necessary.
- PTO switch/actuator in OFF position.
- Verify that the correct procedure was used to activate CONT, KOEO or KOER Self-Test for the scan tool (refer to Section 2, [Diagnostic Methods](#)).

Was the correct Self-Test procedure used?

Yes	No
Correct procedure was used for activating Self-Test. GO to QA2 .	Correct procedure was not used for activating Self-Test. RETURN to Section 3 , Symptom Charts, Step 1: PCM Quick Test, and COMPLETE Self-Test using the correct procedure.

QA2 CHECK VREF VOLTAGE TO TP SENSOR

- Disconnect throttle position (TP) sensor.

Note: GO to Pinpoint Test [DH](#) and refer to **Pinpoint Test Schematics and Connectors** for TP harness connector pin-out information.

- Key on, engine off.
- Measure voltage between VREF and SIG RTN circuits at the TP sensor harness connector.

Note: Loss of VREF caused by an open or short to power or ground can cause a SCP link communication error and/or unable to self-test.

Is the voltage between 4.0 and 6.0 volts?

Yes	No
Voltage is in specification. GO to QA3 .	Voltage is not in specification. RECONNECT the TP sensor. GO to C1 .

QA3 CHECK LINK COMMUNICATION WITH TP SENSOR DISCONNECTED

- TP sensor disconnected.
- Scan tool connected.
- Key on, engine off.
- Attempt to access TP V PID.

Note: If TP V PID cannot be accessed. GO to [QA4](#).

- Reconnect TP sensor while monitoring PID.

Does scan tool communication error occur only when TP sensor is reconnected?

Yes	No
VREF shorted to SIG RTN in the sensor. REPLACE TP sensor.	GO to QA4 .

QA4 ABILITY TO ACCESS CONTINUOUS MEMORY DTCs

Can Continuous Memory DTCs be accessed?

Yes	No
GO to QA5 .	UNABLE to access Continuous Memory DTCs. KEY OFF. GO to QA8 .

QA5 ABILITY TO ACTIVATE KOEO SELF-TEST

Can KOEO Self-Test be activated?

Yes	No
GO to QA6 .	UNABLE to activate KOEO Self-Test. GO to QA7 .

QA6 ABILITY TO ACTIVATE KOER SELF-TEST

Can KOER Self-Test be completed?

Yes	No
If here for P1001 and other KOER DTCs are	

present, GO to Section 4, [Diagnostic Trouble Code \(DTC\) Charts and Diagnostic Trouble Code \(DTC\) Descriptions](#), for Pinpoint Test direction. Begin diagnosis with the first KOER DTC outputted. If the DTC is not listed in the (DTC) Charts, CHECK that the correct PCM is installed in the vehicle. Also CHECK for a Technical Service Bulletin (TSB) or OASIS message that indicates a PCM change or calibration (flash) update.

UNABLE to activate or complete KOER Self-Test. GO to [QA7](#).

QA7 RETRIEVE ANY CONTINUOUS MEMORY DTCs

NOTE 1: If failures are present in the following components or systems, this can prevent the Electronic EC strategy from completing Self-Test or cause the PCM to generate a scan tool communication error message: idle speed control; EGR system; fuel control system; electronic secondary air system; vehicle speed sensor circuits; mass air flow sensor circuits; transmission range sensor circuits.

NOTE 2: For information on retrieving MIL and non-MIL DTCs, refer to Section 2, [Quick Test](#), Continuous Memory Self-Test.

- Key on, engine off.
- Retrieve and record all Continuous Memory DTCs (MIL and non-MIL).
- Key off.

Were any Continuous Memory DTCs present?

Yes	No
Continuous Memory DTCs are present. GO to Section 4, Diagnostic Trouble Code (DTC) Charts and Diagnostic Trouble Code (DTC) Discriptions , for Pinpoint Test direction.	UNABLE to retrieve any Self-Test DTCs. GO to QA8 .

QA8 CHECK B+ VOLTAGE TO DATA LINK CONNECTOR (DLC)

- Disconnect scan tool from DLC.
- Inspect the DLC for damage. Repair as necessary.
- Measure voltage between B+ circuit cavity at the DLC and ground.

Is voltage greater than 10.5 volts?

Yes	No
GO to QA9 .	REPAIR open in DLC B+ circuit.

QA9 CHECK DLC CHASSIS GROUND CIRCUIT FOR OPEN HARNESS

- Measure resistance between chassis ground circuit at the DLC and chassis ground.

Is resistance less than 5.0 ohms?

Yes	No
-----	----

GO to [QA10](#).

REPAIR open circuit.

QA10 CHECK DLC PWR GND CIRCUIT FOR OPEN IN HARNESS

- Measure resistance between PWR GND circuit at the DLC and battery negative post.

Is resistance less than 5.0 ohms?

Yes	No
GO to QA11 .	REPAIR open circuit.

QA11 DATA LINK DIAGNOSTIC NETWORK TEST

- Connect scan tool.
- Key on, engine off.
- Run Data Link Diagnostics.
- NOTE: If scan tool does not have Data Link Diagnostic Network Test capability, GO to [QA21](#).
- Typical PCM network error messages:
 - PCM: NO RESPONSE/NOT EQUIPPED
 - PCM: NO RESPONSE CKT914 (BUS+)
 - PCM: NO RESPONSE CKT915 (BUS-)

Are any PCM network error messages displayed?

Yes	No
GO to QA12 .	Data Link passed. RERUN Quick Test.

QA12 NETWORK TEST RESULT — CIRCUIT 914 (BUS+) AND CIRCUIT 915 (BUS-)

- Check the DATA LINK DIAGNOSTIC Network Test Results.
- Typical ECU network error messages:
 - CKT914=ALL MODULE NO RESP/NOT EQUIP
 - CKT915=ALL MODULE NO RESP/NOT EQUIP

Are there any messages indicating "ALL ECU modules are not responding" displayed?

Yes	No
Only BUS(+) CKT914=ALL MODULE NO RESP/NOT EQUIP. GO to QA13 . Only BUS(-) CKT915=ALL MODULE NO RESP/NOT EQUIP. GO to QA16 . Both BUS(+) CKT914 and BUS(-) 915=ALL MODULE NO RESP/NOT EQUIP. GO to QA21 .	CKT914=SOME MODULE NO RESP/NOT EQUIP, PCM: NO RESPONSE ON CKT914 (BUS+). GO to QA15 . CKT915=SOME MODULE NO RESP/NOT EQUIP, PCM: NO RESPONSE ON CKT915 (BUS-). GO to QA18 .

QA13 CHECK BUS+ FOR SHORT TO GROUND IN HARNESS

- Key off.

- Disconnect PCM.
- Measure resistance of BUS+ circuit between PCM harness connector pin and chassis ground.

Is resistance greater than 50 ohms?

Yes	No
GO to QA14 .	REPAIR short circuit. Note: Short circuit can exist in harness or associated modules. REFER to Module Communication Network, Section 418-00 in Workshop Manual for further diagnosis.

QA14 CHECK BUS+ CIRCUIT FOR SHORT TO B+ IN HARNESS

- Key on, engine off.
- Measure voltage between BUS+ circuit at the PCM harness connector pin and chassis ground.

Is the voltage greater than 1.0 volt?

Yes	No
REPAIR short circuit. Note: Short circuit can exist in harness or associated modules. REFER to Module Communication Network, Section 418-00 in Workshop Manual for further diagnosis.	GO to QA15 .

QA15 CHECK DLC BUS+ CIRCUIT FOR OPEN IN HARNESS

- Key off.
- Disconnect PCM.
- Measure resistance of BUS+ circuit between PCM harness connector pin and BUS+ circuit at the DLC.

Is resistance less than 5.0 ohms?

Yes	No
GO to QA19 .	REPAIR open circuit.

QA16 CHECK BUS- FOR SHORT TO GROUND IN HARNESS

- Key off.
- Disconnect PCM.
- Measure resistance of BUS+ circuit between PCM harness connector pin and chassis ground.

Is resistance greater than 50 ohms?

Yes	No
	REPAIR short circuit.

GO to [QA17](#).

Note: Short circuit can exist in harness or associated modules. REFER to Module Communication Network, Section 418-00 in Workshop Manual for further diagnosis.

QA17 CHECK BUS- CIRCUIT FOR SHORT TO B+ IN HARNESS

- Key on, engine off.
- Measure voltage between BUS- circuit at the PCM harness connector pin and chassis ground.

Is the voltage greater than 6.0 volts?

Yes	No
REPAIR short circuit. Note: Short circuit can exist in harness or associated modules. REFER to Module Communication Network, Section 418-00 in Workshop Manual for further diagnosis.	GO to QA18 .

QA18 CHECK DLC BUS- CIRCUIT FOR OPEN IN HARNESS

- Key off.
- Disconnect PCM.
- Measure resistance of BUS- circuit between PCM harness connector pin and BUS- circuit at the DLC.

Is resistance less than 5.0 ohms?

Yes	No
GO to QA19 .	REPAIR open circuit.

QA19 POWER TAKE OFF (PTO) APPLICATIONS

Is the vehicle equipped with a Power Take Off?

Yes	No
GO to QA20 .	Vehicle is not equipped with PTO. REPLACE PCM. (Refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM) .)

QA20 CHECK PTO ON/OFF INPUT

- Key on, engine off.
- Measure the voltage between PCM harness connector Pin 4 and chassis ground while cycling the PTO switch/actuator.

Does the voltage cycle greater than 1.0 volt with the PTO on, and less than 1.0 volt with the PTO

off?

Yes	No
PTO circuit is OK. REPLACE PCM. (Refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u> .)	PTO circuit is not OK. GO to <u>FB1</u> for further diagnosis.

QA21 CHECK FOR BUS+ SHORT TO BUS-

- Key off.
- Disconnect PCM.
- Measure resistance between BUS+ and BUS- circuits at the PCM harness connector.

Is resistance greater than 5.0 ohms?

Yes	No
GO to <u>QA22</u> .	REPAIR short circuit. Note: A short circuit can exist in the harness or associated SCP modules. REFER to Module Communication Network, Section 418-00, in the Workshop Manual for further diagnosis.

QA22 CHECK FOR OPEN BUS+/- OPEN IN HARNESS

- Measure resistance of BUS+ circuit between PCM harness connector pin and BUS+ circuit at the DLC.
- Measure resistance of BUS- circuit between PCM harness connector pin and BUS- circuit at the DLC.

Are both resistances less than 5.0 ohms?

Yes	No
For scan tools with Data Link Diagnostic Network Test capability, GO to <u>QA19</u> . For scan tools without Data Link Diagnostic Network Test capability, REFER to Module Communication Network, Section 418-00, in the Workshop Manual for further diagnosis. NOTE: If after completing Workshop Manual diagnosis and referred back to PC/ED. REPLACE PCM.	REPAIR open circuit.

QB: Diagnostic Trouble Code (DTC) P0603/P1605/P1633 Introduction

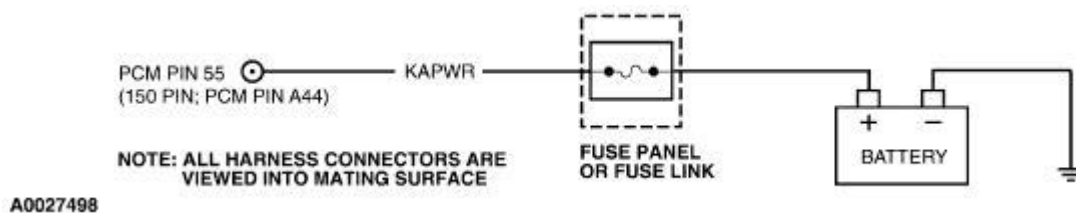
QB: Pinpoint
Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Battery terminal condition
- Keep Alive Power (KAPWR) wire routing
- Harness circuit: KAPWR
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematics and Connectors



QB: Pinpoint Tests →

QB: Diagnostic Trouble Code (DTC) P0603/P1605/P1633

← QB: Introduction

QB1 CHECK BATTERY TERMINALS

Note: If KAPWR is interrupted to the PCM (that is, when a breakout box is installed or the battery is disconnected), DTC P0603/P1605 can be generated on the first power-up.

- Inspect the battery cables for loose connections, corrosion.

Are the battery terminal connections in good condition?

Yes	No
KEY OFF. Battery terminals are OK. GO to QB2 .	REPAIR battery terminals as necessary.

QB2 INSPECT ENGINE COMPARTMENT FOR PROPER WIRE ROUTING

- Inspect Electronic Engine Control (EC) System wiring for proximity to ignition components or wires.

Is wiring too close to ignition components or wires?

Yes	No
REROUTE as necessary.	Engine compartment wire routing is OK. GO to QB3 .

QB3 CHECK KEEP ALIVE POWER (KAPWR) TO PCM

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Measure voltage between KAPWR circuit at the PCM harness connector and ground.
- While observing digital multimeter, grasp the Electronic EC harness and wiggle, shake or bend a small section while working from the PCM to the dash panel.

Does the voltage reading indicate less than 10.5 volts?

Yes	No
ISOLATE and REPAIR open circuit.	No open in KAPWR harness circuit detected. GO to QB4 .

QB4 CHECK FOR REPEAT OF DTC P0603/P1605/P1633

- Reconnect PCM.
- Start engine and allow it to reach operating temperature.
- Run Key On Engine Off Self-Test.
- Retrieve Continuous Memory DTCs.

Is DTC P0603, P1605 or P1633 present?

Yes	No
REPLACE the PCM.	REPAIR other DTCs as necessary. If none, testing is complete.

QC: OBD II Monitor Testing Not Complete - DTC P1000 Introduction

QC: Pinpoint
Tests →

Note

It is not necessary to clear DTC P1000 from the PCM by driving the vehicle unless it is requested by the customer to pass an inspection/maintenance test.

Inform the customer of the need for additional driving when required to pass an inspection/maintenance test.

Diagnostic Trouble Code (DTC) P1000 indicates that not all of the On Board Diagnostic II (OBD II) monitors have completed. In some states, this DTC must be cleared to pass an inspection/maintenance test. The customer should be informed that the law specifies additional city and highway driving must be done to complete the check of the On Board Diagnostic system. This additional driving must occur before the vehicle is tested at the inspection/maintenance station. The amount of driving required varies with individual driving patterns. To complete this requirement in the shortest amount of time, refer to Section 2, [Drive Cycles](#).

The only way a DTC P1000 can be removed from memory is when all the OBD II monitors have successfully completed.

DTC P1000 is set by the PCM with any of the following conditions:

- The vehicle is new from the factory and has not yet completed an OBD II Drive Cycle.
- The battery or PCM has been disconnected.
- An OBD II monitor failure had occurred before completion of an OBD II Drive Cycle.
- The PCM DTCs have been cleared with a scan tool as part of a repair process.

DTC P1000 cannot be cleared from the PCM when:

- The vehicle has a PTO and the circuit is shorted to VPWR or B+ or the PTO is on during testing.

QC: Pinpoint Tests →

QC: OBD II Monitor Testing Not Complete - DTC P1000

← QC: Introduction

QC1 DTC P1000: CHECK FOR OTHER DTCS

Note: Only perform this pinpoint test if a Diagnostic Trouble Code (DTC) P1000 was received from Continuous Memory. Ignore any DTC P1000s in KOEO or KOER.

DTC P1000 indicates that all of the OBD II monitors have not yet been successfully tested.

Were any other DTCs received with the P1000?

Yes	No
GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts , for Pinpoint Test direction and REPAIR other DTCs.	For vehicles with PTO: GO to QC2 . All others: GO to QC3 .

QC2 CHECK PTO PID

- Connect scan tool.
- Key on, engine running.
- Access PTO STAT PID.
- Cycle PTO switch/actuator ON and OFF (follow PTO aftermarket instructions).

Did PTO PID cycle ON, delay, then OFF?

Yes	No
PTO circuit is OK. GO to QC3 .	GO to FB1 .

QC3 REQUEST TO CLEAR DTC P1000

Note: A complete OBD II Drive Cycle has not yet been performed to clear the DTC P1000 from the PCM.

Has the customer requested the DTC P1000 be cleared from the PCM memory?

Yes	No
COMPLETE an OBD II Drive Cycle (REFER to Section 2, Drive Cycles).	INFORM the customer that if the law in this state requires additional driving in order to clear the DTC P1000 from the PCM memory, it must be completed before an inspection/maintenance test.

QD: Diagnostic Trouble Code (DTC) P1260 Introduction

QD: Pinpoint
Tests →

Note

This Pinpoint Test is intended to diagnose DTC P1260.

QD: Pinpoint Tests →

QD: Diagnostic Trouble Code (DTC) P1260

← QD: Introduction

QD1 CHECK FOR PATS DTCs

- Repair all Passive Anti-Theft (PATS) DTCs before P1260. (Refer to Workshop Manual, Anti-Theft Section 419-01 for System Description and Operation).

Have all PATS DTCs been diagnosed?

Yes	No
GO to QD2 .	REFER to Workshop Manual Anti-Theft Section 419-01 for DTC diagnosis.

QD2 CHECK FOR OTHER POWERTRAIN DTCs

- Repair all powertrain DTCs other than P1260.

Have all other powertrain DTCs been diagnosed?

Yes	No
GO to QD3 .	REFER to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts , for Pinpoint Test direction and REPAIR other DTCs.

QD3 ATTEMPT TO START ENGINE

- Complete Keep Alive Memory Reset to clear DTC P1260. Refer to Section 2, [Powertrain Control Module \(PCM\) Reset](#) for detail instructions.
- Attempt to start the engine.

Will the engine start?

Yes	No
<p>No system faults exist at present time. For intermittent No Starts or Start Stalls, CHECK for intermittent PATS faults. (PATS cannot stall the engine after 1 second of operation.) For intermittent stalls while driving, VERIFY scan tool-to-PCM communication during concern. If PCM communication error occurs, possible causes are:</p> <ul style="list-style-type: none"> • Loss of PWRS or GNDS to PCM • Faulty PCM PWR relay • Faulty EEC PWR diode • Shorted VREF signal <p>REPAIR as necessary. RETURN vehicle to</p>	<p>DTC P1260 is not the cause of the No Start. GO to Section 3, Symptom Charts to diagnose the No Start symptom.</p>

customer.



TA: Park/Neutral Position (PNP)/Clutch Pedal Position (CPP) Switches

Introduction

TA: Pinpoint Tests →

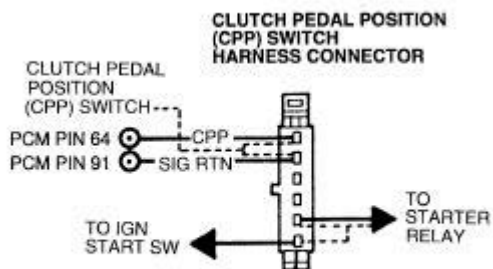
Note

This Pinpoint Test is intended to diagnose the following:

- Clutch Pedal Position Switch (11A152)
- Park Neutral Position Switch (7A247)
- Harness circuits: CPP, PNP and SIG RTN
- Powertrain Control Module (PCM) (12A650)

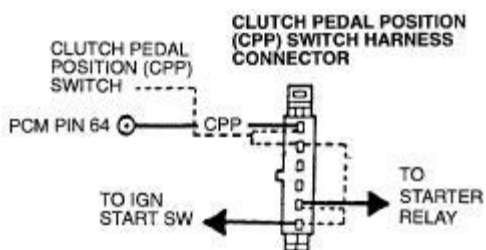
Pinpoint Test Schematic

Ranger/Explorer



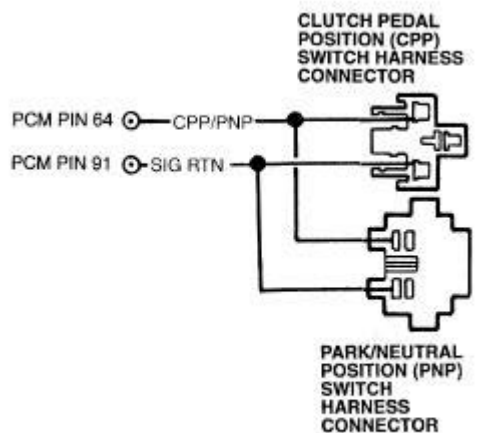
NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE AA3076-C

F-Series



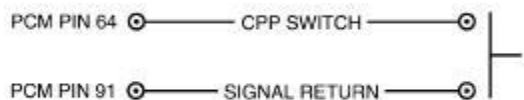
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Escort



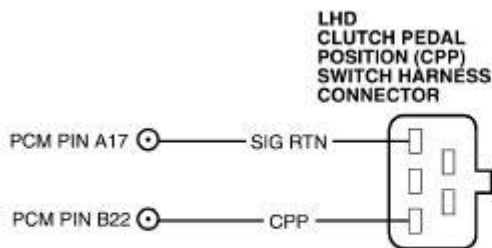
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Focus

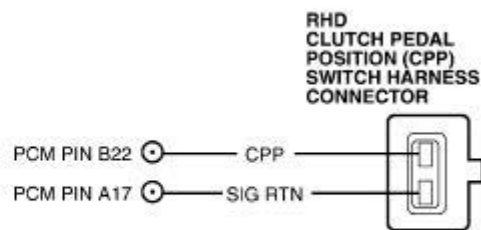


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LS6



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE



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TA: Park/Neutral Position (PNP)/Clutch Pedal Position (CPP) Switches

← TA: Introduction

TA1 CHECK CPP OR PNP SWITCH FUNCTION

P0704, P1709

Note: During KOEO Self-Test, clutch pedal must be down or gearshift lever in NEUTRAL.

- Key off.
- Connect scan tool.
- Key on, engine off.
- Access CPP/PNP PID and observe PID cycling ON/OFF with clutch pedal up, then down or gear shift lever in gear, then NEUTRAL.

Does reading change from ON to OFF?

Yes	No
Fault intermittent DISCONNECT PCM. INSPECT both ends of the connector for damaged or pushed out pins, corrosion, loose wires. REPAIR as necessary. If OK, REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	GO to <u>TA2</u> .

TA2 CHECK CPP OR PNP SWITCH RESISTANCE

- Key off.
- Locate the CPP switch or the PNP switch near the transmission shift linkage.
- Inspect switch and bracket for damage, bent or broken conditions. Repair as required.
- Disconnect CPP or PNP harness connector.
- Measure the CPP or PNP switch resistance with the clutch pedal down.

Is the resistance less than 5.0 ohms?

Yes	No
GO to <u>TA3</u> .	REPLACE the CPP or PNP switch.

TA3 CHECK CPP/PNP CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect scan tool.
- Disconnect PCM.
- Measure resistance of the (CPP/PNP) circuit between PCM harness connector pin and CPP or

PNP switch harness connector.

- Where applicable, measure resistance of the SIG RTN circuit between PCM harness connector pin and CPP or PNP switch harness connector.

Are both resistances less than 5.0 ohms?

Yes	No
GO to TA4 .	REPAIR open circuit.

TA4 CHECK CPP OR PNP CIRCUIT FOR SHORT TO SIG RTN OR CHASSIS GROUND IN HARNESS

- Measure resistance between CPP and SIG RTN circuits at the PCM harness connector.
- Measure resistance of CPP circuit between PCM harness connector pin and chassis ground.

Are both resistances greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR short circuit.

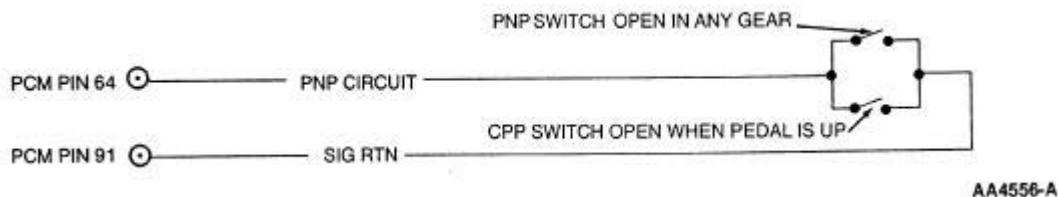
TA5 CHECK CPP/PNP SWITCH FUNCTION

P0704, P1705, P1709

Note: During Self Test, clutch pedal must be down and gearshift lever in NEUTRAL.

- Key off.
- Connect scan tool.
- Key on, engine off.
- Look for CPP/PNP PID cycling ON/OFF with:
 - Transmission in NEUTRAL, then shift into gear and the clutch pedal up.
 - Transmission in GEAR and the clutch pedal up then down.

Does reading change from ON to OFF for both switches?



Yes	No
Fault intermittent DISCONNECT PCM. INSPECT both ends of the connector for damaged or pushed out pins, corrosion and loose wires. REPAIR as necessary. If OK, REPLACE PCM (refer to Section 2, Flash	GO to TA6 .

Electrically Erasable Programmable Read Only Memory (EEPROM).

TA6 CHECK CPP/PNP SWITCHES RESISTANCE

- The CPP switch is near the clutch pedal and the PNP switch is near the transmission shift linkage.
- Inspect both switches and brackets for damage. Repair as required.
- Disconnect CPP and PNP harness connector.
- Measure CPP switch resistance with the clutch pedal down.
- Measure PNP switch resistance with the shift lever in NEUTRAL.

Is the resistance less than 5.0 ohms for both switches?

Yes	No
GO to <u>TA7</u> .	REPLACE damaged CPP or PNP switch.

TA7 CHECK CPP/PNP CIRCUIT FOR OPEN IN HARNESS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect scan tool.
- Disconnect PCM.
- Measure resistance of the SIG RTN circuit between PCM harness connector pin and CPP or PNP switch harness connector.
- Measure resistance of the CPP/PNP circuit between PCM harness connector pin and CPP or PNP switch harness connector.

Are both resistances less than 5.0 ohms?

Yes	No
GO to <u>TA8</u> .	REPAIR open circuit.

TA8 CHECK CPP/PNP CIRCUIT FOR SHORT TO SIG RTN OR CHASSIS GROUND IN HARNESS

- Measure resistance between CPP/PNP and SIG RTN circuits at the PCM harness connector.
- Measure resistance of CPP/PNP circuit between the PCM harness connector pin and chassis ground.

Are both resistances greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM).</u>)	REPAIR short circuit.

TB: Transmission Control Switch (TCS)/Transmission Control Indicator Lamp (TCIL) Introduction

TB: Pinpoint Tests →

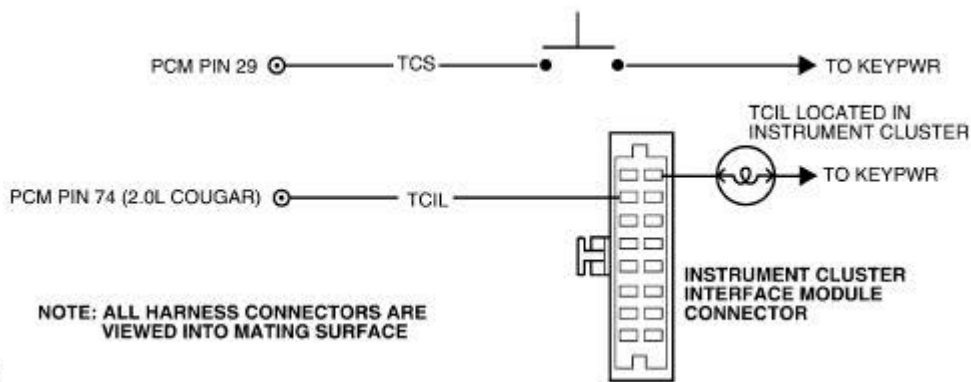
Note

This Pinpoint Test is intended to diagnose the following:

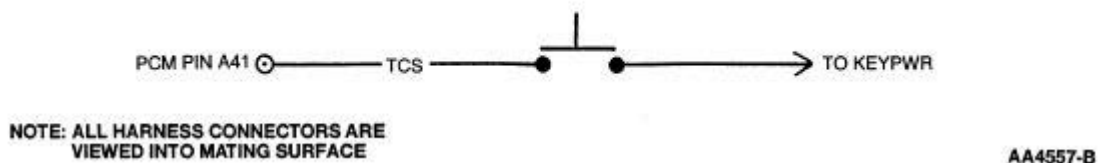
- Harness circuits: Transmission Control Indicator Lamp (TCIL) and transmission Control Switch (TCS)
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

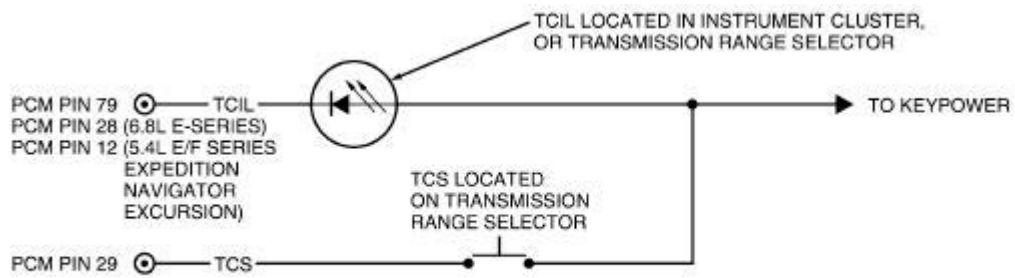
Cougar



LS6/LS8, Explorer/Mountaineer with 150pin PCM



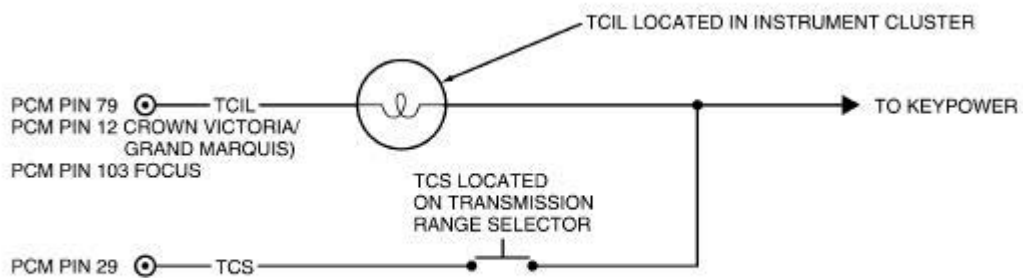
E/F-Series, Expedition/Navigator, Excursion



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0013930

All Others



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0028394

TB: Pinpoint Tests ➔

TB: Transmission Control Switch (TCS)/Transmission Control Indicator Lamp (TCIL)

← TB: Introduction

TB1 CHECK TCS FUNCTION

DTC P1780

- Key on, engine off.
- Access the TCS PID.
- Cycle the TCS switch button, then hold it depressed for three seconds. Release the button
- Key off.

Did TCS PID reading switch from ON to OFF, and did reading indicate ON when button was held depressed?

Yes	No
RERUN KOER Self-Test to cycle TCS.	GO to <u>TB2</u> . FOR WINDSTAR, REFER to Section 307-05 Automatic Transaxle/Transmission External Controls in the Workshop Manual.

TB2 CHECK VOLTAGE TO TCS

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Disconnect PCM.
- Key on, engine off.
- Measure the voltage between the PCM harness connector pin and battery negative post while cycling the TCS several times.
- Key off.

Did the voltage cycle?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	GO to <u>TB3</u> .

TB3 CHECK TCS CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect TCS.
- Measure the resistance TCS circuit between PCM harness connector pin and battery negative post.

Is resistance greater than 10,000 ohms?

Yes	No
GO to <u>TB4</u> .	REPAIR short circuit.

TB4 CHECK TCS CIRCUIT FOR OPEN IN HARNESS

- Measure the resistance of the TCS keypower between fuse junction panel and power side of the TCS harness connector.
- Measure resistance of TCS circuit between PCM harness connector pin and the transmission control switch harness connector.

Are both resistances less than 5.0 ohms?

Yes	No
GO to <u>TB5</u> .	REPAIR open circuit.

TB5 CHECK TCS CIRCUIT FOR SHORTS TO POWER IN HARNESS

- Measure the resistance between TCS and VPWR circuits at the PCM harness connector.

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE damaged transmission control switch.	REPAIR short circuit.

TB6 CHECK TCIL FUNCTION

- Key on, engine off.
- Cycle the transmission control switch (TCS).

Did the TCIL lamp change state?

Yes	No
GO to <u>Z1</u> to check for an intermittent fault .	GO to <u>TB7</u> .

TB7 CHECK TCIL CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Key off.
- Disconnect PCM.
- Key on, engine off.

Did the TCIL lamp change state?

Yes	No
TCIL turns off when PCM is disconnected. REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read</u>	REPAIR short circuit between bulb and the TCIL Test Pin. VERIFY a symptom no longer exists.

Only Memory (EEPROM)).

TB8 CHECK FOR DTC P1780

- Run Key On Engine Running (KOER) Self-Test.

Is DTC P1780 present?

Yes	No
REPAIR DTC 1780. GO to <u>TB1</u> .	GO to <u>TB9</u> .

TB9 CHECK VOLTAGE TO TCIL

Note: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Key off.
- Disconnect PCM.
- Key on, engine off.
- Measure voltage between TCIL circuit at PCM harness connector pin and battery negative post.

Are voltage readings greater than 2.0 volts?

Yes	No
Using proper Wiring Diagram, verify integrity of wiring between the TCIL indicator and the PCM harness connector pin. If no concern exists, REPLACE PCM. (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>). CYCLE TCS to check operation of TCIL.	CHECK indicator bulb and fuse. If OK, open is in the wiring between the Ignition switch and the TCIL Test Pin at the harness connector. REPAIR as necessary.

TG: 4x4 Low (4x4L) Range Introduction

TG: Pinpoint Tests →

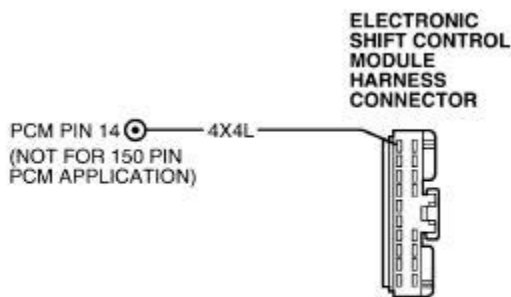
Note

This Pinpoint Test is intended to diagnose the following:

- Harness circuits from Electronic Shift Control Module
- Harness circuit for mechanical 4x4L
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematic and Connectors

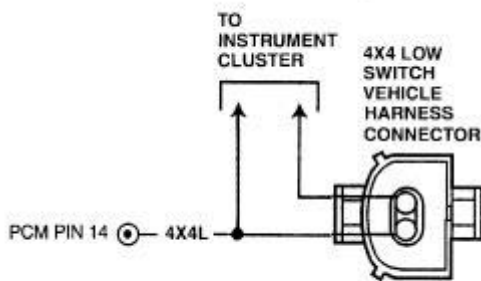
Electronic Shift



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE

A0028395

Mechanical Shift



NOTE: ALL HARNESS CONNECTORS ARE VIEWED INTO MATING SURFACE AA0915-B

TG: 4x4 Low (4x4L) Range

← TG: Introduction

TG1 VERIFY 4x4L SELECTOR POSITION

DTC P1729, P1781

Note: The transmission range (TR) sensor must indicate NEUTRAL position before 4x4L shift.

- Verify vehicle is equipped with 4x4.
- Verify selector is in 4x2 or 4x4H.

Is the selector in 2WD or 4x4H mode during Quick Test ?

Yes	No
GO to <u>TG2</u> .	VERIFY transmission shift lever is in neutral position. SELECT 2WD or 4x4H. Rerun Quick Test.

TG2 CHECK 4x4L CIRCUIT FOR INTERMITTENT FAULT

- Connect scan tool.
- Key on, engine off.
- Access 4x4L PID.
- Cycle the 4x4L switch to 2WD.
- Grasp the vehicle harness starting at the transfer case vehicle harness connector. Shake and bend a small section of the harness all the way to the PCM.
- Tap the vehicle harness connector at the transfer case.
- Shake and bend a small section of the harness between the Instrument Cluster Connector and the PCM.
- Key off.

Did the 4x4L PID reading go ON/OFF during harness and connector movement?

Yes	No
ISOLATE fault and REPAIR as necessary.	GO to <u>TG3</u> .

TG3 CHECK 4X4L SIGNAL VOLTAGE TO PCM

- Disconnect PCM.
- Key on, engine off.
- Observe voltage between 4x4L circuit at PCM harness connector and battery negative post while cycling the switch.
- Key off.

Did the voltage cycle?

--	--

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	GO to <u>TG4</u> .

TG4 CHECK 4X4L CIRCUIT FOR OPEN IN HARNESS

- Disconnect the electronic shift control module.
- Measure resistance of 4x4L circuit between PCM harness connector pin and 4x4L switch harness connector pin.

Is the resistance less than 5.0 ohms?

Yes	No
GO to <u>TG5</u> .	REPAIR open circuit.

TG5 CHECK 4x4L CIRCUIT FOR SHORT TO POWER OR GROUND IN HARNESS

- Connect electronic shift control module.
- Measure resistance between 4x4L circuit at PCM harness connector pin and battery negative post.
- Measure resistance between 4x4L and VPWR circuits at PCM harness connector.

Are both resistances greater than 10,000 ohms?

Yes	No
REFER to the Transfer Case, Section "Four Wheel Drive Systems" in the Workshop Manual for diagnosis.	REPAIR short circuit.

TH: Reverse Switch (RS) Introduction

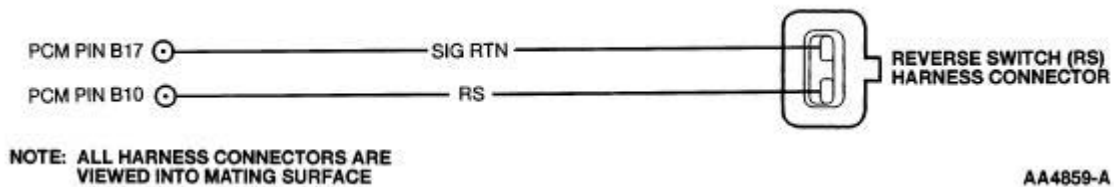
TH: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose the following:

- Reverse Switch (RS)
- RS harness circuits RS and SIG RTN
- PCM

Pinpoint Test Schematics and Connectors



TH: Pinpoint Tests →

TH: Reverse Switch (RS)

← TH: Introduction

TH1 DTC P0812: CHECK RS SWITCH FUNCTION

Note: During KOEO Self-Test, gearshift lever in NEUTRAL.

- Key on, engine off.
- Access RS PID and observe PID cycling ON/OFF with gear shift lever in and out of REVERSE.

Does reading change from ON to OFF?

Yes	No
KEY OFF. Fault intermittent DISCONNECT PCM. INSPECT both ends of the connector for damaged or pushed out pins, corrosion, loose wires. REPAIR as necessary. If OK, REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	KEY OFF. GO to TH2 .

TH2 CHECK RS SWITCH RESISTANCE

- Locate the reverse switch (RS) near the transmission shift linkage.
- Inspect switch and bracket for damage, bent or broken conditions. Repair as required.
- Disconnect RS harness connector.
- Measure the resistance between the reverse switch terminals with the shift lever in reverse.

Is the resistance less than 5.0 ohms?

Yes	No
GO to TH3 .	REPLACE the RS switch.

TH3 CHECK RS CIRCUIT FOR OPEN IN HARNESS

- Disconnect scan tool.
- Disconnect PCM.
- Measure resistance of the RS circuit between PCM harness connector pin and RS harness connector.
- Where applicable, measure resistance of the SIG RTN circuit between PCM harness connector pin and RS harness connector.

Are both resistances less than 5.0 ohms?

Yes	No
GO to TH4 .	REPAIR open circuit.

TH4 CHECK RS CIRCUIT FOR SHORT TO SIG RTN OR CHASSIS GROUND IN HARNESS

- Measure resistance between RS and SIG RTN circuits at the PCM harness connector.
- Measure resistance between RS circuit at the PCM harness connector and chassis ground.

Are both resistances greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPAIR short circuit.

TJ: Output Shaft Speed (OSS) Sensor Introduction

TJ: Pinpoint Tests →

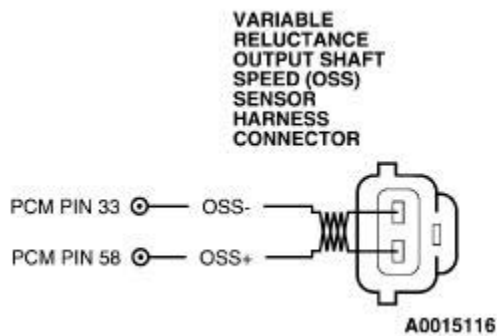
Note

This Pinpoint Test is intended to diagnose the following:

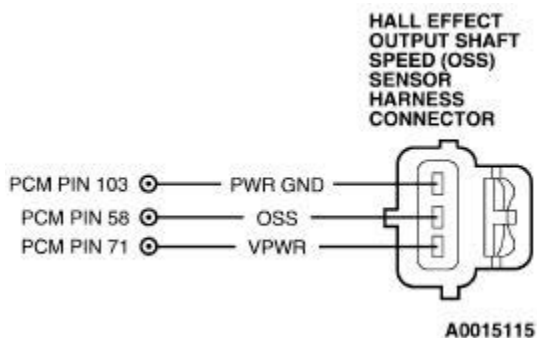
- OSS harness circuits OSS and SIG RTN
- OSS Sensor
- PCM

Pinpoint Test Schematics and Connectors

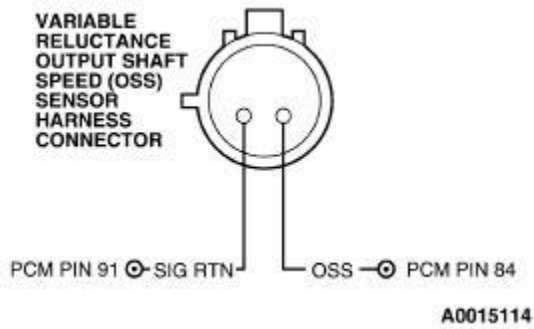
Focus (Automatic Transmission)



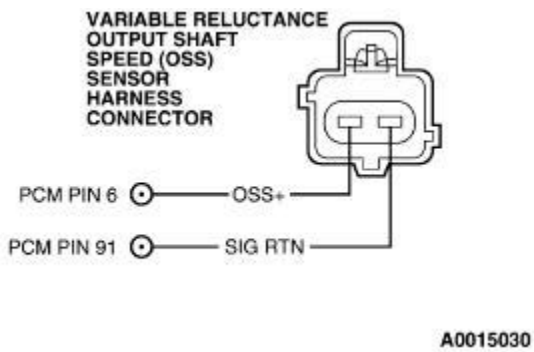
2.0L (MTX) , Focus, Cougar



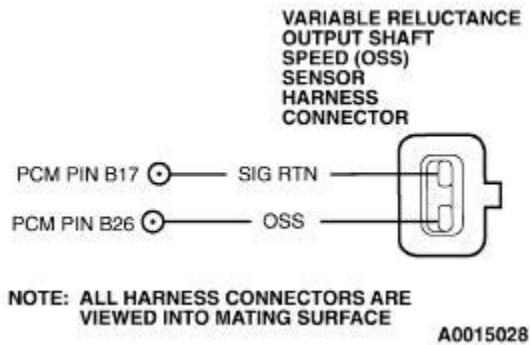
Windstar, Escape



Ranger, Explorer 104 Pin PCM

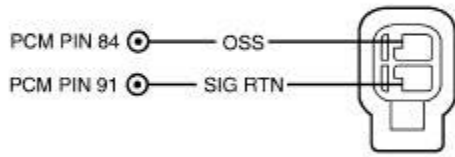


LS6/LS8, Explorer/Mountaineer 150 pin PCM



F, E series, Expedition, Mustang, Explorer/Mountaineer

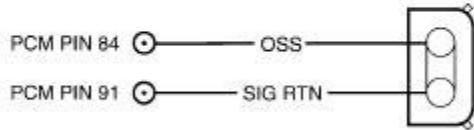
4R70W APPLICATIONS



A0028510

All Others

**VARIABLE RELUCTANCE
OUTPUT SHAFT
SPEED (OSS)
SENSOR
HARNESS
CONNECTOR**



**NOTE: ALL HARNESS CONNECTORS ARE
VIEWED INTO MATING SURFACE** **A0015029**

TJ: Output Shaft Speed (OSS) Sensor

← TJ: Introduction

TJ1 DTC P0720, P0721, P0722, P0723, AND P1900: VERIFY DRIVE CYCLE

- Monitor the OSS PID.
- Drive vehicle.
- Through all gear ranges, shift up and down.

Does PID reading increase and decrease with engine and vehicle speed?

Yes	No
OSS performed as expected. GO to <u>TJ2</u> .	For Hall Effect Type OSS: KEY OFF. GO to <u>TJ3</u> . For VR Type OSS: GO to <u>TJ5</u> .

TJ2 VISUAL INSPECTION

- Disconnect OSS sensor.
- Inspect OSS harness for damage. Inspect OSS vehicle harness connector for damage and proper seating.
- If possible, complete wiggle test.

Have any problems been found?

Yes	No
REPAIR fault.	GO to <u>Z1</u> for intermittent fault diagnosis.

TJ3 CHECK VPWR TO OSS SENSOR

- Key on.
- Disconnect OSS sensor.
- Measure VPWR circuit voltage at OSS sensor harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to <u>TJ4</u> .	KEY OFF. Repair open circuit.

TJ4 CHECK VPWR GND TO OSS SENSOR

- Measure resistance of PWR GND circuit between OSS sensor harness connector and negative

battery post.

Is resistance less than 5.0 ohms?

Yes	No
GO to <u>TJ5</u> .	Repair open circuit.

TJ5 CHECK HARNESS FOR SHORT TO PWR

- Key on.
- Disconnect OSS sensor.
- Measure voltage between the OSS signal circuit at the OSS sensor harness connector and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to <u>TJ6</u> .	KEY OFF. REPAIR short circuit.

TJ6 CHECK HARNESS FOR OPEN

- Disconnect PCM.
- Measure resistance of the OSS signal circuit between the OSS sensor harness connector and the PCM harness connector.
- Measure resistance of the OSS SIG RTN circuit between the OSS sensor harness connector and the PCM harness connector.

Is each resistance less than 5.0 ohms?

Yes	No
GO to <u>TJ7</u> .	REPAIR short circuit.

TJ7 CHECK HARNESS FOR SHORT TO GROUND

- Measure resistance between OSS signal and SIG RTN circuits at the OSS sensor harness connector.
- Measure resistance between the OSS signal at the the OSS sensor harness connector and chassis ground.

Is each resistance greater than 10,000 ohms?

Yes	No
For VR Type OSS: GO to <u>TJ8</u> . For Hall Effect Type OSS: GO to <u>TJ9</u> .	REPAIR short circuit.

TJ8 CHECK RESISTANCE OF OSS SENSOR

- Measure resistance of the OSS sensor between the pins of the OSS sensor.

Is resistance between 450 and 750 ohms?

Yes	No
REPLACE PCM (REFER to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPLACE OSS sensor.

TJ9 CHECK OSS SIGNAL OUTPUT TO PCM, HALL TYPE OSS

- Disconnect PCM.
- Raise vehicle to allow rotation of the front drive wheel.
- Key on, transmission in neutral.
- Measure voltage between OSS+ and PWR GND circuits at the PCM harness connector while slowly rotating the drive wheel.

Note: Opposite wheel must be held stationary.

- The voltage should rise above 5.0 volts and fall below 1.0 volts in a regular cycle. Observe several cycles.

Does the OSS output voltage rise and fall as specified?

Yes	No
REPLACE PCM (REFER to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>).	REPLACE OSS sensor. REFER to the workshop manual group for manual transmissions.

X: Constant Control Relay Module (CCRM) Introduction

X: Pinpoint Tests →

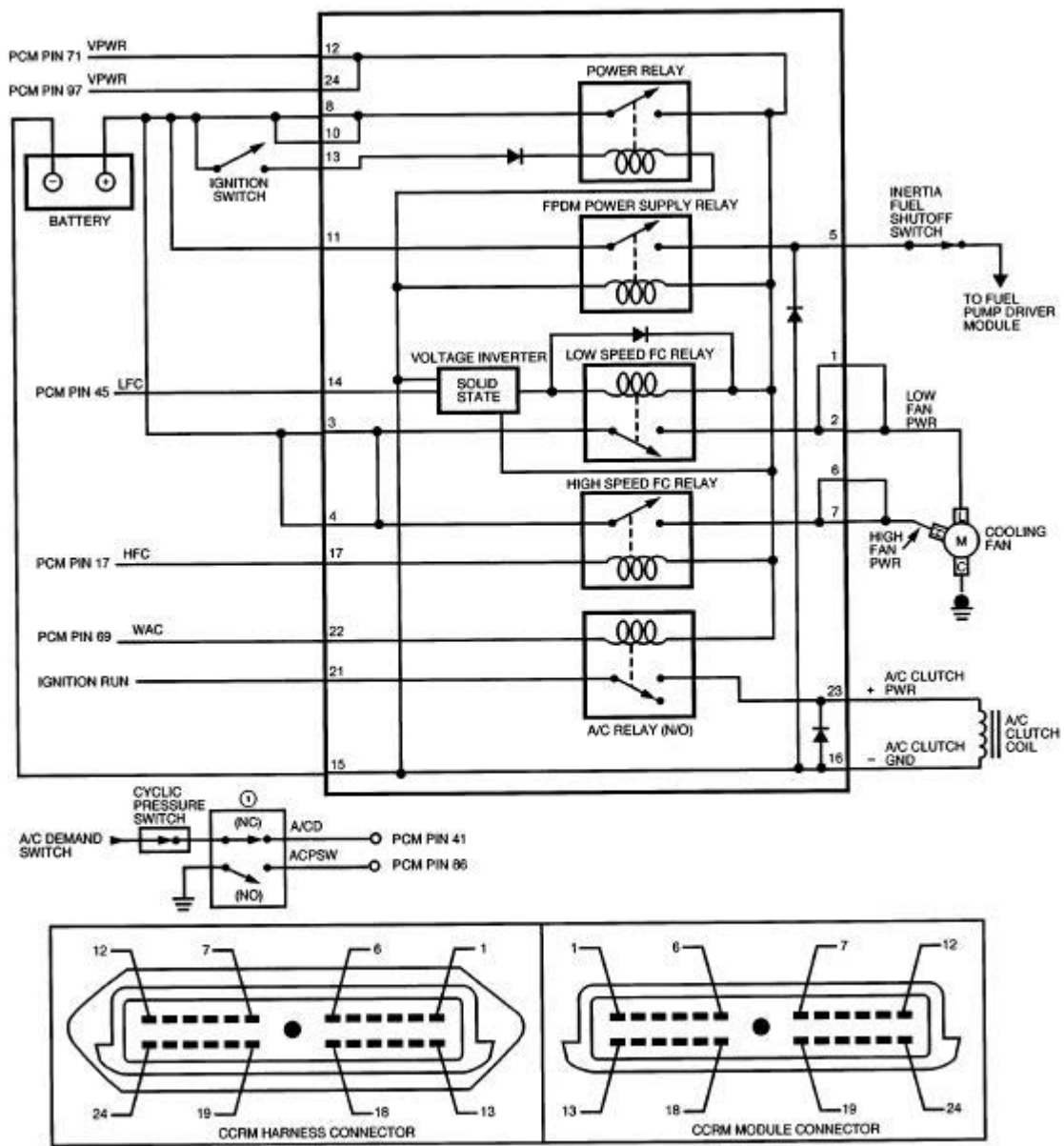
Note

This Pinpoint Test is intended to diagnose the following:

- Constant Control Relay Module (CCRM) (12B581 (w/ bracket), 12B577 (module only))
- Harness circuits: B+, FC, LFC, HFC, ACCS, WAC, VPWR (TO CCRM), A/C Clutch PWR, (Low/High) Fan PWR, GND
- Powertrain Control Module (PCM) (12A650)

Pinpoint Test Schematics and Connectors

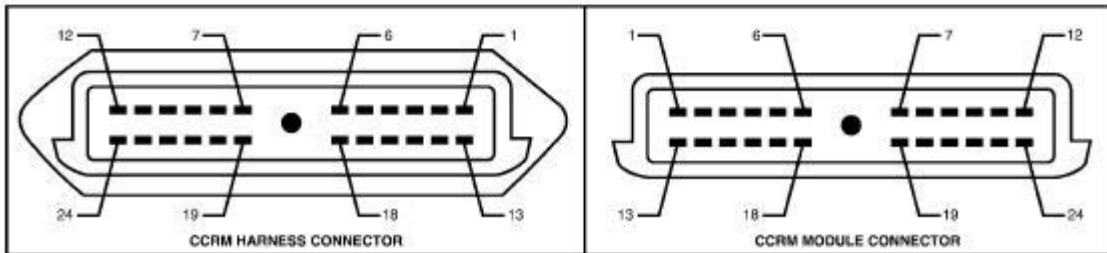
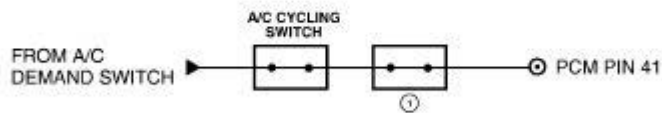
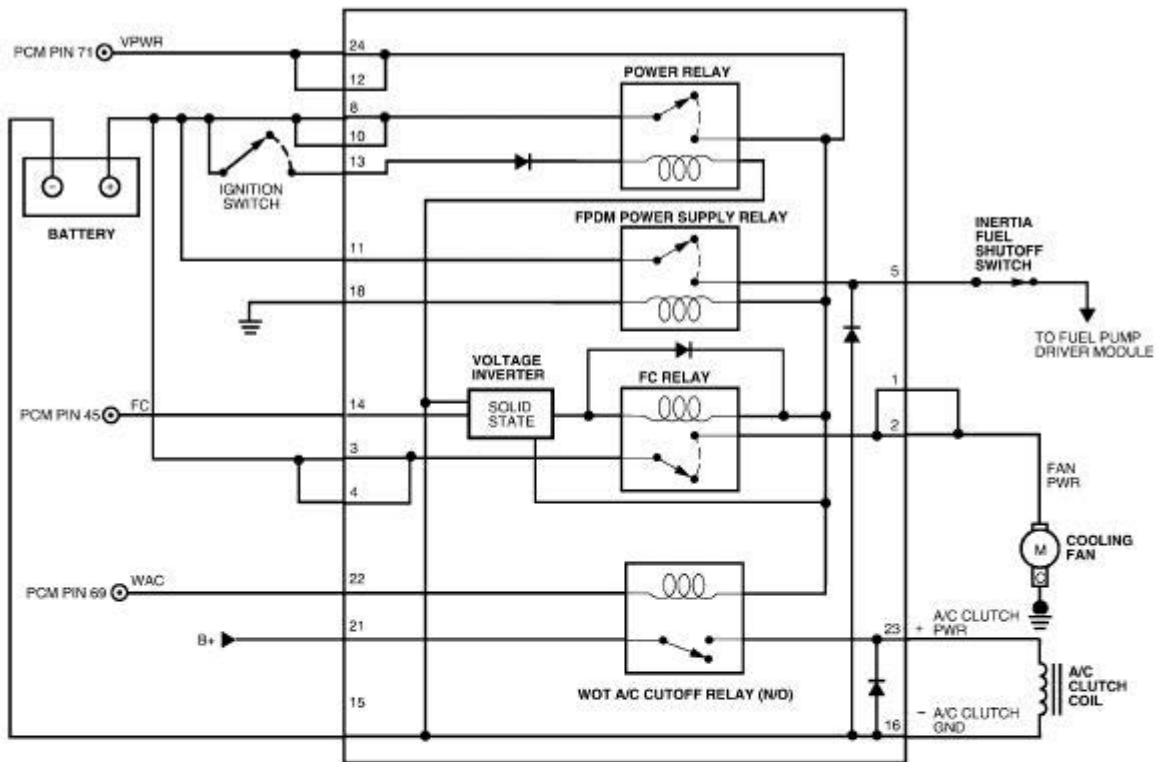
Escort



1 A/C High Pressure Switch

AA0922-E

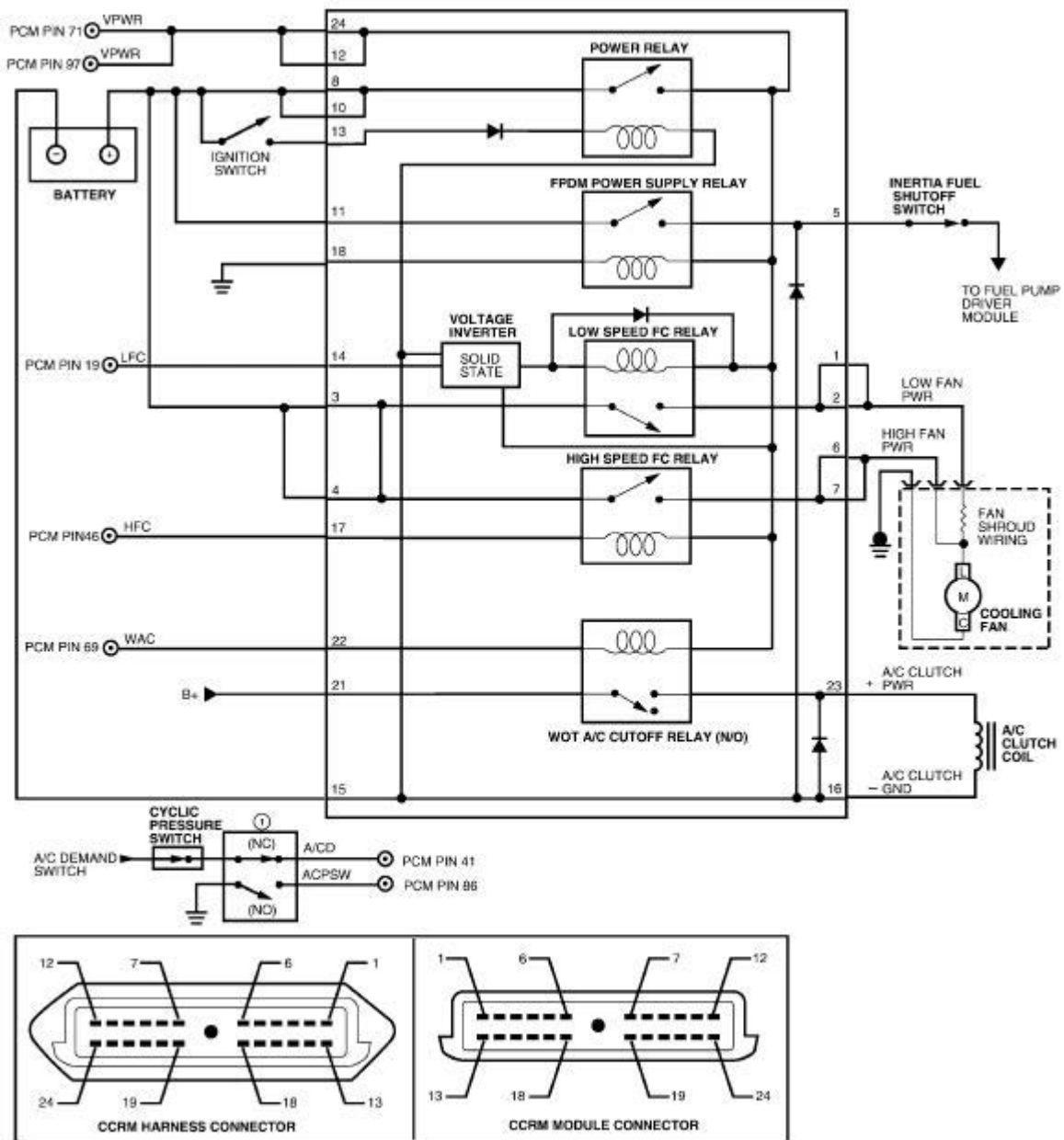
3.8L Mustang



Ⓞ A/C High Pressure Switch

A0031610

4.6L Mustang



¹ A/C High Pressure Switch
A0029815

X: Pinpoint Tests →

X: Constant Control Relay Module (CCRM)

← X: Introduction

X1 VPWR CHECK AT IAC VALVE FAILED IN PINPOINT TEST C: CHECK FOR OPEN VPWR CIRCUIT BETWEEN IAC VALVE AND CCRM

- Disconnect IAC valve.
- Disconnect CCRM.
- Disconnect scan tool from DLC.
- Measure resistance of VPWR circuit between IAC valve harness connector and pins 12 and 24 (VPWR) of the CCRM harness connector.

Is either resistance less than 5.0 ohms?

Yes	No
RECONNECT IAC valve. GO to <u>X2</u> .	BOTH resistances GREATER than 5.0 ohms. REPAIR open VPWR circuit between the CCRM and the splice to the IAC valve.

X2 CHECK B+ AND IGN START/RUN VOLTAGE TO CCRM

- Measure voltage to Pin 8 and Pin 10 (B+) of the CCRM harness connector.
- Key on, engine off.
- Measure voltage to Pin 13 (IGN START/RUN) of the CCRM harness connector.

Are all voltages greater than 10.5 volts?

Yes	No
KEY OFF. GO to <u>X3</u> .	B + or IGN START/RUN circuit fault. CHECK condition of related fuse(s). If OK, REPAIR open circuit. If fuse is damaged, CHECK IGN START/RUN or B+ and VPWR circuits for short to ground before replacing.

X3 CHECK CCRM GROUND CIRCUIT

- Measure voltage between pin 8 (B+) and pin 15 (GND) at the CCRM harness connector.

Is voltage greater than 10.5 volts?

Yes	No
REPLACE CCRM.	REPAIR open ground circuit to CCRM (pin 15).

X15 DTC P1479: CHECK HIGH SPEED FAN CONTROL (FC) RELAY AND HFC CIRCUIT IN CCRM

Note: For one-speed fan applications, disregard DTC P1479.

- Disconnect CCRM.
- Check high speed FC relay coil resistance:
 - Measure resistance between pin 17 and pin 24 of the CCRM.
 - Resistance must be between 65 and 100 ohms.
- Check CCRM for internal shorts:
 - Measure resistance of CCRM between pin 17 and the following pins: 1 through 11, 13, 15 and 21.
 - Measure resistance between pin 17 and the CCRM case.
 - Each resistance must be greater than 1,000 ohms.

Are the CCRM checks OK?

Yes	No
GO to <u>X16</u> .	REPLACE CCRM.

X16 CHECK FOR OPEN HFC CIRCUIT

- Disconnect PCM.
- Measure resistance of HFC circuit between PCM harness connector and pin 17 of CCRM harness connector.

Is resistance less than 5.0 ohms?

Application	HFC PCM Pin
Escort	17
Mustang	46

Yes	No
GO to <u>X17</u> .	REPAIR open circuit.

X17 CHECK HFC CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on.
- Measure voltage between HFC circuit at PCM harness connector and chassis ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to <u>X18</u> .	REPAIR short circuit.

X18 CHECK HFC CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between HFC circuit at PCM harness connector and chassis ground.

Is resistance greater than 10,000 ohms?

Yes	No
<p>If DTC P1479 was received in Quick Test:</p> <p>CONNECT scan tool to DLC. Key on, engine off. Access Output Test Mode on scan tool. Command high speed fan on, wait 10 seconds, then turn fan off. If high speed fan turns on, and off as expected, disregard P1479 and return to Section 3. If fan does not operate correctly, REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p> <p>All others:</p> <p>REPLACE CCRM. VERIFY HIGH FAN PWR circuit is not short to ground.</p>	<p>REPAIR short circuit.</p>

X20 DTC P1474: DOES FAN RUN WITH KEY ON?

Note: During diagnosis, FC applies to the fan control circuit (single-speed fans), and LFC applies to the low fan control circuit (two-speed fans).

Does the cooling fan always run with the key on?

Yes	No
KEY OFF. GO to X24 .	KEY OFF. GO to X21 .

X21 CHECK FC/LFC CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Disconnect PCM.
- Disconnect CCRM.
- Measure resistance between pin 14 of the CCRM harness connector and chassis ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to X22 .	REPAIR short circuit.

X22 CHECK FAN RUNNING MODE

- Connect CCRM.
- Key on, engine off.

Is fan running with the key on?

Yes	No
REPLACE PCM (refer to Section 2, Flash	

Electrically Erasable Programmable Read Only Memory (EEPROM).

REPLACE CCRM.

X24 CHECK FOR OPEN FC/LFC CIRCUIT IN HARNESS

- Disconnect PCM.
- Disconnect CCRM.
- Measure resistance of the FC/LFC circuit between PCM harness connector and pin 14 of the CCRM harness connector.

Is resistance less than 5.0 ohms?

Application	FC/LFC PCM Pin
4.6L Mustang	19
All Others	45

Yes	No
GO to <u>X25</u> .	REPAIR open circuit.

X25 CHECK FC/LFC CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key on.
- Measure voltage between pin 14 of the CCRM harness connector and chassis ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to <u>X26</u> .	REPAIR short circuit.

X26 FC/LFC CIRCUIT FAULT ISOLATION CHECK

- Reconnect CCRM.
- Jumper FC/LFC circuit at PCM harness connector to chassis ground.
- Key on, engine off.

Does fan continue to run?

Yes	No
KEY OFF. REPLACE CCRM.	KEY OFF. REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).

X30 CONTINUOUS MEMORY DTC P1474: CHECK FAN CONTROL (FC) OR LOW FAN CONTROL (LFC) CIRCUIT FOR OPEN OR SHORT TO POWER

- Disconnect cooling fan connector.
- Connect a non-powered test lamp between the (LOW) FAN PWR circuit and ground circuit at the cooling fan harness connector.
- Key on, engine off.
- Observe test lamp for an indication of a fault while completing the following (since the FC/LFC circuit is grounded to turn the fan OFF, the lamp will illuminate when an open or short to power is detected):
 - Shake, wiggle, bend the FC/LFC circuit between the PCM and CCRM.
 - Lightly tap on the CCRM to simulate road shock.

Is a fault indicated?

Yes	No
KEY OFF. ISOLATE fault and REPAIR as necessary.	GO to <u>X31</u> .

X31 CHECK FC/LFC CIRCUIT FOR SHORT TO GROUND

- Key on, engine off.
- Access Output Test Mode on scan tool.
- Command Low Speed Fan on.
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn off when a fault is detected, indicating a short to ground or an open in VPWR):
 - Shake, wiggle, bend the FC/LFC circuit between the PCM and CCRM.
 - Lightly tap on the CCRM to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary.	KEY OFF. GO to <u>Z1</u> .

X35 DTC P1479: CHECK HIGH FAN CONTROL (HFC) CIRCUIT FOR OPEN OR SHORT TO POWER

Note: For one-speed fan applications, disregard DTC P1479.

- Disconnect cooling fan connector. Inspect connector for damaged or pushed out pins, corrosion and loose wires. Repair as necessary.
- Connect a non-powered test lamp between the HIGH FAN PWR circuit and ground circuit at the cooling fan harness connector.
- Key on, engine off.
- Access Output Test Mode on scan tool.
- Command high speed fan on.
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn off when a fault is detected, indicating an open or short to power):
 - Shake, wiggle, bend the HFC circuit between the PCM and CCRM.
 - Lightly tap on the CCRM to simulate road shock.

Is a fault indicated?

Yes	No
KEY OFF. ISOLATE fault and REPAIR as	

necessary.

GO to X36.

X36 CHECK HFC CIRCUIT FOR SHORT TO GROUND

- Key on, engine off.
- Command high speed fan off.
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn on when a fault is detected, indicating a short to ground):
 - Shake, wiggle, bend the HFC circuit between the PCM and CCRM.
 - Lightly tap on the CCRM to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary. RESTORE vehicle.	KEY OFF. GO to <u>Z1</u> .

X40 ELECTRIC COOLING FAN FUNCTIONAL CHECK

Note: For the proper results of these pinpoint tests, no DTCs must have been present during PCM Quick Test.

- Key on, engine off.
- Access Output Test Mode on scan tool.
- Command of the cooling fan on and check for fan operation. For two speed fan applications, check both fan speeds (wait 30 seconds after commanding high speed fan on).

Does the fan operate (all speeds)?

Yes	No
KEY OFF. Cooling fan circuits OK. RETURN to <u>Section 3</u> chart.	COMMAND cooling fan off. REMAIN in Output Test Mode. GO to <u>X41</u> .

X41 ELECTRIC COOLING FAN CONCERN: DID THE FAN OPERATE AT ANY SPEED?

- For 3.8L Mustang, GO to X42.

During the operational check of both fan speeds, did the fan operate at any speed?

Yes	No
Only one fan speed is operational. GO to <u>X50</u> .	Cooling fan will not operate at any speed. GO to <u>X42</u> .

X42 COOLING FAN WILL NOT OPERATE AT ANY SPEED: COMMAND FAN ON (HIGH SPEED FOR TWO-SPEED APPLICATIONS) AND CHECK FOR VOLTAGE AT FAN

- Key on, engine off.
- Disconnect cooling fan.
- Command fan on (high speed for two speed fan applications).
- Measure voltage between the (HIGH) FAN PWR circuit at the cooling fan harness connector and chassis ground.

Is voltage greater than 10.0 volts?

Yes	No
KEY OFF. Power is being supplied to fan. GO to <u>X45</u> .	KEY OFF. GO to <u>X43</u> .

X43 CHECK FOR B+ TO FAN CONTROL RELAYS IN CCRM

- Disconnect CCRM.
- Measure voltage at pins 3 and 4 of the CCRM harness connector.

Is voltage greater than 10.0 volts?

Yes	No
GO to <u>X44</u> .	B+ fault. CHECK condition of related fuses. If OK, REPAIR open circuit. If fuse is damaged, CHECK B+ and FAN PWR circuits for short to ground before replacing.

X44 CHECK FOR OPEN FAN PWR CIRCUIT BETWEEN CCRM AND COOLING FAN

- **For 3.8L Mustang:**
 - Measure resistance of FAN PWR circuit between pin 2 of the CCRM harness connector and the fan harness connector.
- **All others:**
 - Measure resistance of HIGH FAN PWR circuit between pin 6 of the CCRM harness connector and the fan harness connector.
 - Measure resistance of LOW FAN PWR circuit between pin 2 of the CCRM harness connector and the fan harness connector.

Is each resistance less than 7.0 ohms?

Yes	No
For 3.8L Mustang: GO to <u>X70</u> . All others: REPLACE CCRM. VERIFY FAN PWR circuit (s) are not short to ground.	REPAIR open circuits(s).

X45 CHECK FOR OPEN COOLING FAN GROUND CIRCUIT

- Disconnect scan tool from DLC.
- Measure resistance of ground circuit between the cooling fan harness connector and chassis ground.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE fan.	REPAIR open circuit.

X50 DETERMINE WHICH FAN SPEED IS OPERATIONAL

Was the low speed fan operational?

Yes	No
High speed fan inoperative. GO to <u>X65</u> .	Low speed fan inoperative. GO to <u>X51</u> .

X51 LOW SPEED FAN INOPERATIVE: COMMAND LOW SPEED FAN ON AND CHECK FOR VOLTAGE TO COOLING FAN

- Key on, engine off.
- Disconnect cooling fan.
- Command low speed fan on.
- Measure LOW FAN PWR circuit voltage at the cooling fan harness connector.

Is voltage greater than 10.0 volts?

Yes	No
KEY OFF. For 4.6L Mustang: GO to <u>X54</u> . All others: REPLACE fan.	KEY OFF. GO to <u>X52</u> .

X52 CHECK FOR OPEN LOW FAN PWR CIRCUIT BETWEEN CCRM AND FAN

- Disconnect CCRM.
- Measure resistance of the LOW FAN PWR circuit between the cooling fan harness connector and pins 1 and 2 of the CCRM harness connector.

Are both resistances less than 5.0 ohms?

Yes	No
GO to <u>X70</u> .	REPAIR open circuit.

X54 CHECK FOR OPEN DROPPING RESISTOR ON FAN SHROUD ASSEMBLY

- Measure resistance between the LOW FAN PWR and HIGH FAN PWR pins of the fan shroud assembly.

Is resistance less than 6.0 ohms?

Yes	No
REPLACE fan.	Verify condition of dropping resistor, replace as necessary (use care when removing resistor from mounts). If OK, replace fan assembly.

X65 HIGH SPEED FAN INOPERATIVE: COMMAND HIGH SPEED FAN ON AND CHECK FOR VOLTAGE TO COOLING FAN

- Key on, engine off.
- Disconnect cooling fan.
- Command high speed fan on.
- Measure HIGH FAN PWR circuit voltage at the cooling fan harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. REPLACE fan.	KEY OFF. GO to <u>X66</u> .

X66 CHECK FOR OPEN HIGH FAN PWR CIRCUIT

- Disconnect CCRM.
- Measure resistance of HIGH FAN PWR circuit between the cooling fan harness connector and pin 6 of the CCRM harness connector.

Is resistance less than 5.0 ohms?

Yes	No
GO to <u>X70</u> .	REPAIR open circuit.

X70 IS SCAN TOOL CAPABLE OF VIEWING PIDS WHILE IN OUTPUT TEST MODE?

Note: The symptom low speed fan or high speed fan inoperative can be caused by a primary circuit fault, even though a DTC was not set.

Is scan tool being used capable of viewing PIDS while in Output Test Mode?

Yes	No
	For low speed fan inoperative (fan inoperative for 3.8L Mustang):

GO to X71.

GO to X73.

For high speed fan inoperative.

GO to X16.

X71 CHECK OPERATION OF LOW SPEED FAN OR HIGH SPEED FAN PRIMARY CIRCUITS

- Reconnect CCRM and cooling fan.
- Key on, engine off.
- Access Output Test Mode on scan tool.
- **For low speed fan inoperative (fan inoperative for 3.8L Mustang):**
 - Access LFC and LFCF PIDs.
 - With LFC PID off (low speed fan commanded off by PCM), the LFCF PID must be no.
 - Command the Low Speed Fan on (the LFC PID will now be on).
 - The LFCF PID must still be no.
- **For high speed fan inoperative:**
 - Access HFC and HFCF PIDs.
 - With HFC PID off (high speed fan commanded off by PCM), the HFCF PID must be no.
 - Command the high speed fan on (the HFC PID will now be on).
 - The HFCF PID must still be no.

Is the HFCF or LFCF PID yes with the fan commanded on or off?

Yes	No
KEY OFF. An HFC or LFC primary fault is detected. If the HFCF PID was yes: GO to <u>X15</u> and follow DTC P1479 diagnosis. If the LFCF PID was yes: GO to <u>X20</u> and follow DTC P1474 diagnosis.	Primary circuits OK. REPLACE CCRM. VERIFY applicable FAN PWR circuit is not short to ground.

X73 CHECK FC/LFC CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Disconnect PCM.
- Measure resistance between pin 14 of the CCRM harness connector and chassis ground.

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE CCRM. VERIFY applicable FAN PWR circuit is not shorted to ground.	REPAIR short circuit.

X80 LOW AND/OR HIGH SPEED COOLING FAN ALWAYS RUNS (NO DTCS):

VERIFY FAN IS NOT ON BECAUSE OF A/C HIGH PRESSURE SWITCH INPUT TO PCM

- Start engine.
- Access ACP PID.

Is the ACP PID "CLOSED"?

Yes	No
The PCM will turn the cooling fan on when the A/C high pressure switch input is "closed". Leave engine running. GO to X81 .	Input OK. GO to X82 .

X81 CHECK A/C HIGH PRESSURE SWITCH (THE MEDIUM PRESSURE, NORMALLY OPEN CONTRACTS)

- Disconnect A/C high pressure switch.
- Again, view the ACP PID on scan tool.

Is the ACP PID still "CLOSED"?

Yes	No
KEY OFF. GO to X135 (to check A/C high pressure switch input to PCM).	KEY OFF. RECONNECT A/C high pressure switch. REFER to the Climate Control System - General Information, Section 412-00 of the Workshop Manual to check for proper A/C high pressure switch function, over-pressurized A/C system and other checks as directed.

X82 DISCONNECT CCRM AND CHECK IF FAN STILL RUNS

- Accessories off (A/C, blower, lamps).
- Key on, verify cooling fan always on symptom.
- Key off.
- Disconnect CCRM.
- Key on, engine off.

Is cooling fan still on?

Yes	No
KEY OFF. For 3.8L Mustang: REPAIR FAN PWR circuit short to power. For all others: GO to X83 .	Key off. GO to X84 .

X83 CHECK LOW FAN PWR AND HIGH FAN PWR CIRCUITS FOR SHORT TO POWER

- Disconnect cooling fan.
- Key on, engine off.
- Check for voltage on both the LOW FAN PWR and HIGH FAN PWR circuits at the cooling fan harness connector.

Are both voltages less than 1.0 volt?

Yes	No
KEY OFF. No fault is indicated at this time. VERIFY results of previous test steps. If OK, RECONNECT all components and RETURN to Section 3 for further diagnosis of this or any other symptom.	REPAIR short circuit.

X84 CHECK OPERATION OF LOW SPEED FAN OR HIGH SPEED FAN PRIMARY CIRCUITS

Note: The symptom cooling fan always runs can be caused by a primary circuit fault, even though a DTC was not set. This step will check the primary circuit operation.

- Reconnect CCRM.
- Key on, engine off.
- Access LFC and LFCF PIDs. With LFC PID off (low speed fan commanded off by PCM), the LFCF PID must be no.
- For all except 3.8L Mustang, access HFC and HFCF PIDs. With HFC PID off (high speed fan commanded off by PCM), the HFCF PID must be no.

Is the HFCF or LFCF PID yes with the fan commanded off?

Yes	No
KEY OFF. An HFC or LFC primary circuit fault is detected. If the HFCF PID was yes: GO to X15 and follow DTC P1479 diagnosis. If the LFCF PID was yes: GO to X20 and follow DTC P1474 diagnosis.	Primary circuits OK. REPLACE CCRM.

X98 LACK OF COOLING (A/C)/A/C NOT FUNCTIONING: CHECK FOR VOLTAGE TO A/C CLUTCH

Note: If the A/C clutch will engage, follow the "YES" Action to Take of this test step. If not, or unsure, continue this test step.

- Key off.
- Disconnect A/C cycling switch.

- Install a jumper wire in the A/C cycling switch harness connector (to complete the circuit).
- Disconnect A/C clutch.
- Connect digital multimeter between the power pin and ground pin at the A/C clutch vehicle harness connector.
- Start engine.
- Turn A/C on, wait 15 seconds.
- Check voltage reading.
- After testing, turn key off and reconnect A/C clutch.

Was voltage greater than 10.5 volts?

Yes	No
<p>REMOVE jumper. RECONNECT A/C cycling switch.</p> <p>For all except 3.8L Mustang with the symptom "poor A/C system performance in hot ambient temperature":</p> <p>GO to <u>X145</u> to check A/C high pressure switch input to PCM.</p> <p>All others:</p> <p>REFER to the Climate Control System - General Information, Section 412-00 of the Workshop Manual to diagnose symptom. Also be aware that if the engine coolant temperature is detected high, the PCM will disengage the A/C clutch.</p>	<p>No voltage to A/C clutch. GO to <u>X99</u>.</p>

X99 CHECK ACCS INPUT TO PCM WITH A/C ON

- Start engine.
- A/C on.
- Access and view ACCS PID.
- After testing, remove jumper reconnect A/C cycling switch and turn key OFF.

Was the ACCS PID "ON"?

Yes	No
<p>GO to <u>X110</u>.</p>	<p>The PCM is not receiving the ACCS signal, and as a result will not allow the A/C to turn on. GO to <u>X100</u>.</p>

X100 ACCS PID OFF WITH A/C ON: CHECK FOR VOLTAGE TO A/C CYCLING SWITCH

- Key on, engine off.
- Disconnect A/C cycling switch.
- A/C demand switch to A/C on.
- Measure voltage at the A/C demand switch side of the A/C cycling switch harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF. GO to <u>X101</u> .	KEY OFF. REFER to the Climate Control System - General Information, Section 412-00 in the Workshop Manual to check for causes of no voltage to the A/C cycling switch.

X101 CHECK IF A/C CYCLING SWITCH CONTACTS ARE CLOSED

- Measure resistance of the A/C cycling switch contacts at the A/C cycling switch connector.

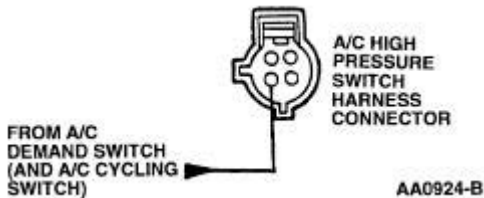
Is resistance less than 5.0 ohms?

Yes	No
GO to <u>X102</u> .	REFER to the Climate Control System - General Information, Section 412-00 in the Workshop Manual to check the operation of the A/C cycling switch and proper refrigerant charge. REPAIR as necessary.

X102 CHECK FOR VOLTAGE TO DUAL FUNCTION A/C HIGH PRESSURE SWITCH

- Reconnect A/C cycling switch.
- Disconnect A/C high pressure switch.
- Key on, engine off.
- A/C on.
- Measure voltage on the A/C demand switch pin at the A/C high pressure switch harness connector.

Is voltage greater than 10.5 volts?

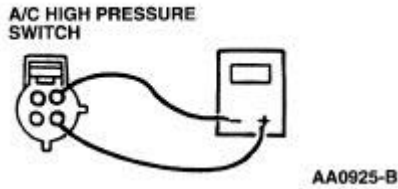


Yes	No
KEY OFF. GO to <u>X103</u> .	REPAIR open between A/C cycling switch and A/C high pressure switch.

X103 CHECK RESISTANCE OF A/C HIGH PRESSURE SWITCH HIGH PRESSURE CONTACTS

- Measure resistance of the normally closed A/C high pressure switch high pressure contacts.

Is resistance less than 5.0 ohms?



Yes	No
GO to X104 .	REFER to the Climate Control System - General Information, Section 412-00 in the Workshop Manual to check for overpressurized A/C system, etc. If OK, REPLACE A/C high pressure switch, following instructions in the Climate Control System - General Information, Section 412-00 of the Workshop Manual.

X104 CHECK FOR VOLTAGE TO PCM ON ACCS CIRCUIT

- Reconnect A/C high pressure switch.
- Disconnect PCM.
- Key on.
- A/C ON.
- Measure voltage at PCM harness connector pin 41.

Is voltage greater than 10.5 volts?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).	REPAIR open circuit between the A/C high pressure switch and PCM.

X105 KOEO/KOER DTC P1460: VERIFY ACCS PID IS OFF

Note: Verify A/C and Defrost were off during KOEO/KOER Self-Test. If vehicle is not equipped with A/C, the WAC circuit is not used and the DTC P1460 can be ignored.

- Start engine.
- A/C and defroster off.
- Access ACCS PID.

Is the ACCS PID off?

Yes	No
KEY OFF. GO to X106 .	KEY OFF. GO to X125 (to check A/C circuits for short to power).

X106 CHECK WAC CIRCUIT AND WOT A/C CUTOFF RELAY IN CCRM

- Disconnect CCRM.
- Check WOT A/C cutoff relay coil resistance:
 - Measure resistance between pin 22 and pin 24 of the CCRM.
 - Resistance must be between 130 and 200 ohms.
- Check CCRM for internal short circuit:
 - Measure resistance of CCRM between pin 22 and the following pins: 1 through 11, 13, 15 and 21.
 - Measure resistance between pin 22 and the CCRM case.
 - Each resistance must be greater than 1,000 ohms.

Are the CCRM checks OK?

Yes	No
GO to X107 .	REPLACE CCRM. Start engine. TURN A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.

X107 CHECK WAC CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect PCM.
- Key on.
- Measure voltage between pin 22 of the CCRM harness connector and chassis ground.

Is voltage less than 1.0 volts?

Yes	No
KEY OFF. GO to X108 .	REPAIR short circuit. START engine. TURN A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.

X108 CHECK WAC CIRCUIT FOR SHORT TO GROUND IN HARNESS

- Disconnect scan tool from DLC.
- Measure resistance between pin 22 of the CCRM harness connector and chassis ground.

Is resistance greater than 10,000 ohms?

Yes	No
GO to X109 .	REPAIR short circuit. START engine. TURN A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.

X109 CHECK FOR OPEN WAC CIRCUIT

- Measure resistance of WAC circuit between PCM harness connector pin 69 and pin 22 of the CCRM harness connector.

Is resistance less than 5.0 ohms?

Yes	No
REPLACE PCM (refer to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>). START engine. TURN A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.	REPAIR open circuit. START engine. TURN A/C on, WAIT 15 seconds. A/C off. RERUN Quick Test.

X110 NO/LOW VOLTAGE TO A/C CLUTCH (ACCS PID IS ON WITH A/C ON AND NO DTCS): CHECK FOR VOLTAGE TO CCRM

- Disconnect CCRM.
- Key on.
- Measure voltage to pin 21 of the CCRM harness connector.

Is voltage greater than 10.5 volts?

Yes	No
KEY OFF, A/C OFF. GO to <u>X111</u> .	Voltage is not being supplied to pin 21 of the CCRM. CHECK condition of any related fuses. If OK, REPAIR open circuit. If fuse is damaged, check IGN RUN/B+ and A/C CLUTCH PWR circuits for short to ground before replacing.

X111 CHECK FOR OPEN A/C CLUTCH PWR AND A/C CLUTCH GROUND CIRCUITS

- Disconnect A/C clutch.
- Disconnect scan tool from DLC.
- Measure resistance of A/C clutch PWR circuit between pin 23 of the CCRM harness connector and the A/C clutch harness connector.
- Measure resistance of A/C clutch ground circuit between pin 16 of the CCRM harness connector and the A/C clutch harness connector.

Are both resistances less than 5.0 ohms?

Yes	No
VERIFY engine is not overheating when there is no voltage to A/C clutch (if engine coolant temperature is high, the PCM will turn off the A/C). If OK, REPLACE CCRM. VERIFY A/C Clutch PWR circuit is not shorted to ground.	REPAIR open circuit.

X115 DTC P1469: CHECK FOR CAUSES OF FAST A/C COMPRESSOR CLUTCH CYCLING

- Refer to the Climate Control System - General Information, Section 412-00 in the Workshop Manual to test A/C compressor clutch cycle times, and to check causes of fast A/C compressor clutch cycling.

Is a fault indicated?

Yes	No
REPAIR as required according to Workshop Manual direction. COMPLETE PCM Reset to clear DTC(s). START engine and turn A/C on for about 2 minutes. A/C off. RERUN Quick Test.	GO to <u>X116</u> to CHECK for intermittent electrical concern.

X116 CHECK FOR INTERMITTENT OPEN IN ACCS CIRCUIT

- Key on.
- Access ACCS PID.
- A/C on.
- Observe ACCS PID for an indication of a fault while completing the following (the ACCS PID will turn off and on quickly when a fault is detected, indicating an intermittent open):
 - Shake, wiggle, bend the ACCS circuit between the PCM and the source of the circuit (such as A/C switch, EATC module).
 - Lightly tap any pressure switches in the circuit to simulate road shock.
- Disconnect and inspect the A/C cycling switch connector.

Is a fault indicated?

Yes	No
KEY OFF. ISOLATE fault and REPAIR as necessary. COMPLETE PCM Reset to clear DTC(s). START engine and TURN A/C on for about two minutes. A/C off. RERUN Quick Test.	UNABLE to duplicate fault at this time. COMPLETE PCM Reset to clear DTC(s). RETURN to <u>Section 3</u> to service any additional symptoms.

X120 DTC P1460: CHECK FOR INTERMITTENT OPEN OR SHORT IN WAC CIRCUIT

Note: If vehicle is not equipped with A/C, the WAC circuit is not used and the DTC P1460 can be ignored.

- Disconnect A/C cycling switch.
- Install a jumper wire in the A/C cycling switch vehicle harness connector (to complete the circuit).
- Key on, engine off.
- For Mustang, A/C demand switch on.
- For Escort:
 - Access Output Test Mode on scan tool (refer to Section 2).
 - Turn outputs on (this will engage the A/C clutch).
- Check WAC circuit for open or short to power while completing the following (the A/C clutch will click on (off for Escort) when a fault is detected):
 - Shake, wiggle, bend the WAC circuit from the CCRM to the PCM.
 - Lightly tap the CCRM to simulate road shock.
- Access Output Test Mode on the scan tool.
- Turn outputs off.
- Check WAC circuit for short to ground while completing the following (the A/C clutch will click off (on for Escort) when a fault is detected):
 - Shake, wiggle, bend the WAC circuit from the CCRM to the PCM.

- Lightly tap the CCRM to simulate road shock.
- Key off, A/C off.

Is a fault indicated?

Yes	No
ISOLATE fault and REPAIR as necessary. COMPLETE PCM Reset to clear DTCs. START engine. TURN AC on, WAIT 15 seconds. A/C off. RERUN Quick Test.	REMOVE jumper wire. GO to <u>Z1</u> .

X124 DTC P1464: CHECK ACCS PID

Note: Verify A/C and defrost were off during Self-Test. If A/C or defrost were on, turn off and rerun Self-Test.

- Key on, engine off.
- A/C and defrost off.
- Access ACCS PID.

Is ACCS PID on?

Yes	No
GO to <u>X125</u> .	The ACCS PID indicates that the ACCS input to the PCM is low. VERIFY test results. With A/C and defrost off, RERUN Self-Test where DTC P1464 was received.

X125 ACCS PID ON: DISCONNECT A/C CYCLING SWITCH AND CHECK IF ACCS PID TURNS OFF

- Disconnect A/C cycling switch.
- Key on, engine off.
- Access ACCS PID.

Is ACCS PID off?

Yes	No
KEY OFF. VERIFY operation of A/C demand switch (REFER to the Climate Control System - General Information, Section 412-00 of the Workshop Manual). If OK, REPAIR short to power in A/C demand circuit to A/C cycling switch.	KEY OFF. For Escort: GO to <u>X127</u> . All others: GO to <u>X126</u> .

X126 CHECK A/C CLUTCH PWR CIRCUIT FOR SHORT TO POWER IN HARNESS

- Disconnect CCRM.

- Key on.
- Measure voltage between pin 23 of the CCRM harness connector and ground.

Is voltage less than 1.0 volt?

Yes	No
KEY OFF. GO to X127 .	REPAIR short circuit. RESTORE vehicle. VERIFY a symptom no longer exists.

X127 CHECK ACCS CIRCUIT FOR SHORT TO POWER IN HARNESS

- Key off.
- A/C cycling switch and CCRM (except Escort) disconnected.
- Disconnect PCM.
- Key on.
- Measure voltage between PCM harness connector pin 41 and ground.

Is voltage less than 1.0 volt?

Yes	No
For Escort: REPLACE PCM. All others: KEY OFF. GO to X128 .	REPAIR short circuit.

X128 CHECK ACCS CIRCUIT VOLTAGE TO PCM WITH CCRM CONNECTED

- Reconnect CCRM.
- Key on.
- Again, measure voltage between PCM harness connector pin 41 and ground.

Is voltage less than 1.0 volt?

Yes	No
REPLACE PCM.	REPLACE CCRM.

X130 DOES THE A/C TURN OFF WHEN THE A/C DEMAND SWITCH IS TURNED OFF?

Does the A/C turn off when the A/C demand switch is turned off?

Yes	No
GO to X131 .	GO to X140 .

X131 CHECK IF A/C CUTS OFF DURING WOT

- Start engine.
- A/C on.
- Initiate brief Wide Open Throttle (WOT) and return to idle. Listen for the A/C clutch to disengage during the WOT, then re-engage a few seconds after returning to idle (a "click" sound will be heard when the clutch re-engages).

Note: If the clicking sound cannot be heard, disconnect the A/C clutch. With a test lamp connected between the power pin and ground pin of the A/C clutch harness connector, observe the test lamp while performing the brief WOT. The test lamp must go off during the brief WOT, then come back on a few seconds after returning to idle.

- Repeat test, if necessary, to verify results.

Does A/C clutch or test lamp operate as indicated?

Yes	No
KEY OFF. RECONNECT A/C clutch (if necessary). The WAC circuit is operating properly. At this time the A/C will cut-off during WOT. GO to Z1 to diagnose intermittent concerns, or RETURN to Section 3 to service any other concerns.	GO to X132 .

X132 NO WOT A/C CUTOFF, NO DTCS PRESENT: CHECK CCRM

- Reconnect A/C clutch (if necessary).
- Key on, engine off.
- Access Output Test Mode on scan tool.
- A/C demand switch on.
- While listening to the A/C clutch, command the outputs off and on a couple of times.

Does the A/C clutch engage and disengage when the outputs are cycled off and on?

Yes	No
KEY OFF. WOT A/C cutoff is operating properly. If symptom is intermittent, GO to Z1 . Otherwise, testing is complete. RETURN to Section 3 to service any other symptoms.	VERIFY that the A/C clutch was engaged during testing. If not, REPEAT test with clutch engaged. If clutch was engaged, REPLACE CCRM.

X135 ACPSW PID CLOSED WITH A/C HIGH PRESSURE SWITCH DISCONNECTED: CHECK ACPSW CIRCUIT FOR SHORT TO GROUND IN HARNESS

- A/C high pressure switch disconnected.
- Disconnect scan tool from DLC.
- Disconnect PCM.
- Measure resistance between PCM harness connector pin 86 and ground.

Is resistance greater than 10,000 ohms?

Yes	No
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read	REPAIR short circuit.

Only Memory (EEPROM).

X140 A/C ALWAYS ON: CHECK FOR VOLTAGE AT A/C CLUTCH WITH A/C OFF

- A/C and defroster OFF.
- Disconnect A/C clutch.
- Connect a digital multimeter between the power pin and ground pin at the A/C clutch harness connector.
- Start engine.
- Monitor voltage.
- After testing, turn key off and reconnect A/C clutch.

Was voltage less than 2.0 volts?

Yes	No
The electrical portion of the A/C system is not at fault. REFER to the Climate Control System - General Information, Section 412-00 in the Workshop Manual.	A fault is indicated in the A/C electrical system. GO to <u>X141</u> .

X141 CHECK ACCS INPUT TO PCM WITH A/C OFF

- Key off.
- Connect scan tool to data link connector.
- Start engine.
- A/C and defrost off.
- Access ACCS PID (Powertrain Menu).

Is the ACCS PID "OFF"?

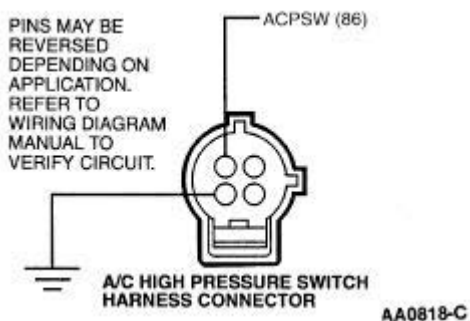
Yes	No
KEY OFF. REFER to the Climate Control System - General Information, Section 412-00 in the Workshop Manual.	KEY OFF. GO to <u>X125</u> .

X145 CHECK A/C HIGH PRESSURE SWITCH MEDIUM PRESSURE CIRCUITS

Note: An A/C high pressure switch medium pressure circuit concern can result in the high speed cooling fan not coming on when the A/C refrigerant pressure becomes high. In hot ambient conditions, this may result in the refrigerant pressure continuing to increase until the A/C high pressure switch high pressure contacts open, shutting off the A/C until the pressure drops to an acceptable range.

- Key off.
- Disconnect A/C high pressure switch.
- A/C off (to prevent chance of short circuits).
- Connect a jumper wire between the A/C high pressure switch circuit and ground circuit at the A/C high pressure switch harness connector.
- Start engine, wait 15 seconds.

Does the high speed fan come on?



Yes	No
<p>KEY OFF. A/C high pressure switch medium pressure circuits are OK. REMOVE jumper. RECONNECT A/C high pressure switch. REFER to the Climate Control System, General Information Section 412-00 in the Workshop Manual to diagnose symptom.</p>	<p>An A/C high pressure switch medium pressure circuit concern may exist. GO to X146.</p>

X146 CHECK FOR OPEN GROUND CIRCUIT TO A/C HIGH PRESSURE SWITCH

- Key on, engine running.
- Connect jumper wire between the A/C high pressure switch circuit at the A/C high pressure switch harness connector and the battery negative post.
- Wait 15 seconds.

Does the high speed fan come on now?

Yes	No
<p>KEY OFF. REPAIR open ground circuit to the A/C high pressure switch. REMOVE jumper wire.</p>	<p>KEY OFF. REMOVE jumper wire. GO to X147.</p>

X147 CHECK FOR OPEN A/C HIGH PRESSURE SWITCH (ACPSW) CIRCUIT BETWEEN A/C HIGH PRESSURE SWITCH AND PCM

- Disconnect PCM.
- Measure resistance of the ACPSW circuit between the PCM harness connector pin 86 and the A/C high pressure switch harness connector.

Is resistance less than 5.0 ohms?

Yes	No
<p>REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).</p>	<p>REPAIR open circuit.</p>

Z: Intermittent Introduction

Z: Pinpoint Tests →

Note

This Pinpoint Test is intended to diagnose and isolate intermittent concerns for the following:

- All Electronic EC subsystems
- Coil Pack ignition systems using the Distributorless Ignition System Tester (DIST)

This chart is used to determine which test to run for the suspect circuit. Corresponding PIDs to each circuit are listed. Some circuits do not have an associated PID or the PID may not be available and will to be measured with a digital multimeter. If the vehicle has a coil pack system with no start, perform the ignition test with the distributorless ignition system tester. Do not use the DIST for coil on plug applications.

INTERMITTENT TEST CHART

PID	Associated Circuit	Test Type
4X4L	4X4L	input
ACCS	A/CCS	input
ACP, ACP V	A/CP	input
Use digital multimeter	AFC	input
AIR	AIR	output
AIR B	AIRB	output
AIR D	AIRD	output
AIRM	AIRM	input
BPP/BOO	BPP	input
Use digital multimeter	BPS	input
CAS GND	Case GND	input
CCS	CCS	output
Use digital multimeter	CD-A (primary)	output
Use digital multimeter	CD-B (primary)	output
Use digital multimeter	CD-C (primary)	output
Use digital multimeter	CD-D (primary)	output
Use digital multimeter	CD-E (primary)	output
Use digital multimeter	CD-F (primary)	output
Use digital multimeter	CD-G (primary)	output
Use digital multimeter	CD-H (primary)	output
Use digital multimeter	CD-I (primary)	output
Use digital multimeter	CD-J (primary)	output
CFCIL	CFCIL	output

CHT, CHT V	CHT	input
CHTIL	CHTIL	output
Use digital multimeter	CKP+	input
Use digital multimeter	CMP	input
CPP/PNP	CPP	input
Use digital multimeter	CTO	output
Use digital multimeter	DOL	output
DPFEGR	DPFEGR	input
ECT, ECT V	ECT	input
Use digital multimeter	EGRMC 1	output
Use digital multimeter	EGRMC 2	output
Use digital multimeter	EGRMC 3	output
Use digital multimeter	EGRMC 4	output
EFTA, EFTA V	EFT-A	input
EFTB, EFTB V	EFT-B	input
EGRVR	EGRVR	output
EPC, EPC V	EPC	output
Use digital multimeter	EPC 2	output
Use digital multimeter	EPC 3	output
EVAPCP, EVAPPDC	EVAPCP	output
EVAPCV	EVAPCV	output
EVAPPF	EVAPPF	input
LFC	FC	output
FF	FF	input
FLI, FLI V	FLI	input
FP	FP	output
FPM, FP M	FPM	input
FRP, FRP V	FRP	input
FSV	FSV	output
FSVM	FSVM	input
FTP, FTP V	FTP	input
GENFDC	GENFDC	output
GFS	GFS	input
Use digital multimeter	HCDS	input
HFC	HFC	output
O2S11	HO2S-11	input
O2S12	HO2S-12	input
O2S21	HO2S-21	input
O2S22	HO2S-22	input
HTR11	HTR-11	output
HTR12	HTR-12	output
HTR21		

	HTR-21	output
HTR22	HTR-22	output
IAC	IAC	output
IAT, IAT V	IAT	input
IAT2	IAT2	input
IAT2 V	IAT2 V	output
Use digital multimeter	ILC	input
IMRC	IMRC	output
IMRCM	IMRCM	input
Use digital multimeter	IMSC	output
IMTV	IMT Valve	output
FUELPW1	INJ-1	output
FUELPW1	INJ-2	output
FUELPW1	INJ-3	output
FUELPW1 or FUELPW2	INJ-4	output
FUELPW1 or FUELPW2	INJ-5	output
FUELPW2	INJ-6	output
FUELPW2	INJ-7	output
FUELPW2	INJ-8	output
FUELPW2	INJ-9	output
FUELPW2	INJ-10	output
KS1, KS2	KS	input
LFC	LFC	output
Use digital multimeter	LFP	output
MAF, MAF V	MAF	input
MFC	MFC	output
MIL	MIL	output
OCTADJ	OCT ADJ	input
OSS	OSS	input
Use digital multimeter	PATSIL	output
Use digital multimeter	PATSIN	input
Use digital multimeter	PATSOUT	output
Use digital multimeter	PATSTRT	output
CPP/PNP	PNP	input
PSP, PSP V	PSP	input
PTO	PTO	input
Use digital multimeter	SCC	output
Use digital multimeter	SCCS	input
Use digital multimeter	SCMA	output
Use digital multimeter	SCMB	output
Use digital multimeter	SCMC	output
Use digital multimeter		

	SCVM	input
Use digital multimeter	SIL	output
SCB	SCB	output
SCICP	SCICP	output
SS1	SS1	output
SS2	SS2	output
SS3	SS3	output
TCC	TCC	output
TCIL	TCIL	output
TCS	TCS	input
TFT, TFT V	TFT	input
Use digital multimeter	THTRC	output
TMAP	TMAP	input
TP, TP V	TP	input
TPB, TPB V	TPB	input
Use digital multimeter	TPO	output
TR, TR V	TR	input
TSS/ISS	TSS	input
CAMDCR, RCAM	VCT	output
VPWR	VPWR	input
Use digital multimeter	VREF	output
Use digital multimeter	VSO	output
VSS	VSS+	input
WAC	WAC	output

Z: Intermittent

← Z: Introduction

Z1 DIRECTION FOR INTERMITTENT DIAGNOSTIC PATH

- There are two main procedures used in this section to isolate and repair an intermittent concern. One will utilize the Rotunda Distributorless Ignition System Tester (DIST) and the other, a scan tool with digital multimeter.
- The DIST is only available for use on vehicles with coil pack ignition systems. If a DIST is not available, GO to Z2.

Is this a predetermined ignition concern?

Yes	No
GO to <u>Z50</u> for a coil pack application except 2.0L Cougar/Contour/Mystique/ Focus, GO to <u>Z2</u> .	GO to <u>Z2</u> .
GO to <u>Z2</u> for coil on plug application.	

Z2 PERFORM PCM RESET TO CLEAR FMEM

Note: Proceed with this step only if a PCM Reset was not done earlier; otherwise, GO to Z3. Eliminating FMEM will insure reproduction of any PCM related symptom.

- Connect scan tool to Data Link Connector (DLC).
- Key on, engine off.

Note: Be sure freeze frame data has been recorded before resetting the PCM.

- Complete a PCM reset.

Is the PCM Reset complete?

Yes	No
GO to <u>Z3</u> .	Complete PCM Reset. GO to <u>Z3</u> .

Z3 SELECT PIDS RELATED TO THE SYMPTOM

- A list of PIDs is needed for use with the scan tool to indicate the area of fault. Obtain the customer symptom description. Use the Reference Value Symptom Chart and proceed to the Reference Value PID/Masurement Signal Chart. These are located in the beginning of Section 6, Reference Values.
- Highlight each PID recommended by the charts under the PID selection menu on the scan tool.

Have all PIDs related to the symptom been chosen?

--	--

Yes	No
GO to Z4 .	REPEAT Z3 .

Z4 DECISION TO VERIFY SYMPTOM

- The path to symptom verification is optional, but is recommended for several reasons; some are because:
 - Vehicle is in for repeat repair.
 - No DTC is present.
 - Customer has difficulty describing the symptom.

Does symptom need to be verified?

Yes	No
GO to Z5 .	GO to Z11 .

Z5 COLLECT ANY AVAILABLE DATA TO AID IN SYMPTOM VERIFICATION

Note: Only MIL codes will trigger freeze frame data. Refer to scan tool instruction manual to retrieve freeze frame information.

- Prepare freeze frame data for use which was recorded earlier from the Symptom Charts in [Section 3](#).
- Continuous Memory DTCs should already be recorded from an earlier pinpoint test.
- Access information from the customer worksheet or any other available data from the customer.

Has all data been recorded?

Yes	No
GO to Z6 .	GATHER as much data as possible to aid in isolation of the intermittent fault area. REPEAT Z5 .

Z6 RECREATE SYMPTOM USING ALL DATA

Note: Vehicle may require some driving to proceed with this test step. The concern must be verified by recreating the conditions that originally set the DTC or caused the symptom.

- With the scan tool, select and monitor the same PIDs as displayed in freeze frame along with the previous highlighted PIDs from Step **Z3** . Using freeze frame data recorded earlier, recreate the conditions described by each freeze frame PID. Pay special attention to ECT, LOAD, RPM and VSS. Also, use any available customer data to aid in producing the correct conditions for recreating the symptom.
- When the symptom occurs, press trigger to begin recording (Refer to the scan tool instruction manual for recorder function).

Could symptom be reproduced?

Yes	No

GO to [Z11](#).

GO to [Z7](#).

Z7 RECREATE SYMPTOM USING KOEO ROAD TEST PROCEDURE

- The road test is the last attempt to locate the area of concern before physically disturbing vehicle circuits.

Note: PIDs for outputs in the Reference Value Charts represent commanded values only. Circuit measurements with digital multimeter indicate actual output status. Therefore, in the case of a fault, the PID and circuit reading on the vehicle may not correspond with each other. PIDs for PCM inputs with a mismatch to the circuit measurement indicate a possible PCM concern.

- The Intermittent Road Test Procedure is a set of instructions for monitoring PIDs with a scan tool and circuit measurements with a digital multimeter. This is done under four different conditions - KOEO, HOT IDLE, 48 and 88 kmh (30 and 55 mph). Use the [Typical Diagnostic Reference Values](#) from Section 6, Reference Values to compare with the actual vehicle values. For 48 and 88 kmh (30 and 55 mph) procedures, a planned route with passenger is required.
- Locate the corresponding Reference Value chart in [Section 6](#).
- Set vehicle up to measure circuits with a digital multimeter and scan tool.
- Connect scan tool to DLC.
- Key on, engine off.
- With the scan tool, select and monitor PIDs and also measure circuits shown in the Reference Value Chart in [Section 6](#).
- Compare the scan tool PIDs and digital multimeter values to the Reference Value Charts.

Are any values out of range?

Yes	No
GO to Z11 .	GO to Z8 .

Z8 RECREATE SYMPTOM USING HOT IDLE ROAD TEST PROCEDURE

- Key on, engine running and at least 87°C (195°F).
- Continue to monitor the same PIDs and circuits as in the previous step at hot idle.

Are any values out of range?

Yes	No
GO to Z11 .	GO to Z9 .

Z9 RECREATE SYMPTOM USING 48 KMH (30 MPH) SLOW CRUISE ROAD TEST PROCEDURE

- Drive vehicle on preplanned route.
- Continue to monitor the same PIDs and circuits during slow cruise as in the previous step.

Are any values out of range?

Yes	No
GO to Z11 .	GO to Z10 .

Z10 RECREATE SYMPTOM USING 88 KMH (55 MPH) HIGH CRUISE ROAD TEST PROCEDURE

- Continue to drive vehicle on preplanned route.
- Continue to monitor the same PIDs and circuits during high cruise as in the previous step.

Are any values out of range?

Yes	No
GO to Z11 .	It is now necessary to physically disturb selected vehicle circuits in an attempt to recreate the intermittent concern. GO to Z11 .

Z11 SELECT CIRCUITS FROM THE INTERMITTENT TEST CHART

- Remain in the PID selection menu with the scan tool.
- If the Intermittent Road Test was used to verify the symptom, highlight PIDs or signals that displayed a mismatch to the Reference Values from [Section 6](#). Otherwise, highlight only the PIDs from Step **Z3**.
- Proceed to the Intermittent Test Chart located at the beginning of this pinpoint test.
- Match selected PIDs to the corresponding circuit in the chart. There may be more than one circuit to test. If a PID recording was made with the scan tool, it may be helpful to replay at this time (refer to the scan tool instruction manual for recorder function).
- From the same chart, select and proceed to the appropriate test:
 - Input Test - Used on sensing devices such as temperature, position or oxygen.
 - Output Test - Used on output devices such as relays, coils or solenoids.

Has a test been chosen?

Yes	No
For Input Test : GO to Z12 . For Output Test : GO to Z16 .	To diagnose other driveability symptoms, GO to Section 3 , Symptom Charts.

Z12 KOEO INPUT TEST PROCEDURE FOR PCM SENSORS



WARNING: WHEN PERFORMING ANY OF THE TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, OR HOT SURFACES.

- Using circuits chosen from the Intermittent Test Chart, select only the recommended PID(s) to monitor with the scan tool. If a PID is not available for the circuit, use a digital multimeter.
- Proceed to the area of the suspect wiring or component fault.
- Key on, engine off.
- If the input is a switch-type component, turn on manually.
- Monitor the PID or digital multimeter values while tapping on component.

- Monitor while wiggling sensor harness wire from component to PCM.
- Look for abrupt changes in values. Compare the actual values to the KOEO [Typical Diagnostic Reference Values](#) in Section 6 Reference Values.

Are values fluctuating in and out of range?

Yes	No
REPAIR as necessary. VERIFY repair.	GO to Z13 .

Z13 KOER INPUT TEST PROCEDURE FOR PCM SENSORS

 **WARNING: WHEN PERFORMING ANY OF THE TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, ENGINE DRIVE BELTS OR HOT SURFACES.**

- Key on, engine running.
- Continue to monitor PIDs or circuits as in Step **Z12**.
- Proceed to the area of the suspect wiring or component fault.
- If the input is a switch-type component, turn on manually.
- Monitor the PID or digital multimeter values while tapping on component.
- Monitor while wiggling sensor harness wire from component to PCM.
- Look for abrupt changes in values. Compare the actual values to the HOT IDLE [Typical Diagnostic Reference Values](#) in Section 6, Reference Values.

Are any values fluctuating in and out of range?

Yes	No
REPAIR as necessary. VERIFY repair.	GO to Z14 .

Z14 KOEO WATER SOAK TEST PROCEDURE FOR PCM SENSORS

 **WARNING: WHEN PERFORMING ANY OF THE TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS OR HOT SURFACES.**

- Key on, engine off.
- Continue to monitor PIDs or circuits scan tool as in Step **Z13**.
- Proceed to the area of the suspect wiring or component fault.
- If the input is a switch-type component, turn on manually.
- Monitor the PID or digital multimeter values while lightly spraying a water mist on the component.
- Monitor while spraying sensor harness wire from component to PCM.
- Look for abrupt changes in values. Compare the actual values to the KOEO [Typical Diagnostic Reference Values](#) in Section 6, Reference Values.

Are any values fluctuating in and out of range?

Yes	No
REPAIR as necessary. VERIFY repair.	GO to Z15 .

Z15 KOER WATER SOAK TEST PROCEDURE FOR PCM SENSORS

 **WARNING: WHEN PERFORMING ANY OF THE TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, ENGINE DRIVE BELTS OR HOT SURFACES.**

- Key on, engine running.
- Continue to monitor PIDs or circuits scan tool as in Step **Z14** .
- Proceed to the area of the suspect wiring or component fault.
- If the input is a switch-type component, turn on manually.
- Monitor the PID or digital multimeter values while lightly spraying a water mist on the component.
- Monitor while spraying sensor harness wire from component to PCM.
- Look for abrupt changes in values. Compare the actual values to the KOEO [Typical Diagnostic Reference Values](#) in Section 6, Reference Values.

Are values fluctuating in and out of range?

Yes	No
REPAIR as necessary. VERIFY repair.	GO to Z16 .

Z16 KOEO OUTPUT TEST PROCEDURE FOR PCM ACTUATORS

 **WARNING: WHEN PERFORMING ANY OF THE TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS OR HOT SURFACES.**

Note: PIDs selected from the Intermittent Test Chart will display commanded values only. Digital multimeter measurements will display actual values.

- Using circuits chosen from the Intermittent Test Chart, select the recommended PID(s) to monitor using the scan tool. Also, use a digital multimeter to compare circuit values with the scan tool PID values. If PIDs are not available for a particular circuit, look for a digital multimeter fluctuation to occur when doing any of the following tests.

Note: Output Test Mode may not control some outputs, such as injectors and ignition coils. To test these output types, GO to [Z17](#) . Caution must be used for the next steps. Cooling fans or fuel pump may turn on.

- Key on, engine off.
- With the scan tool, turn all outputs on using Output Test Mode (refer to scan tool instruction manual).
- Proceed to the area of the suspect wiring or component fault.
- Monitor the PID and digital multimeter values while tapping on component.
- Monitor while wiggling actuator harness wire from component to PCM.
- Look for abrupt changes or PID to digital multimeter value mismatches. Also, compare the actual values to the KOEO [Typical Diagnostic Reference Values](#) in Section 6, Reference Values.

Is there a mismatch or are any values fluctuating in and out of range on the Reference Value Charts?

Yes	No
REPAIR as necessary. VERIFY repair.	GO to Z17 .

Z17 KOER OUTPUT TEST PROCEDURE FOR PCM ACTUATORS

 **WARNING: WHEN PERFORMING ANY OF THE TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, ENGINE DRIVE BELTS OR HOT SURFACES.**

- Key on, engine running.
- Proceed to the area of the suspect wiring or component fault.
- Monitor PIDs with the scan tool (if PIDs are available) using the PID monitor function. Compare the digital multimeter values with scan tool or look for a fluctuation in idle while tapping on the component.
- If a coil for a coil on plug application has been tapped and is suspect, with key off, it may be helpful to remove the coil and measure continuity from the spark plug terminal to the signal terminal while tapping the coil. A large fluctuation in resistance will indicate an intermittent open. Otherwise, monitor while wiggling actuator harness wire from component to PCM.
- Look for abrupt changes in idle or PID to digital multimeter value mismatches or fluctuation. Also, compare the actual values to the HOT IDLE [Typical Diagnostic Reference Values](#) in Section 6, Reference Values.

Is there an idle fluctuation, a digital multimeter value mismatch or fluctuation?

Yes	No
REPAIR as necessary. VERIFY repair.	GO to Z18 .

Z18 KOEO WATER SOAK TEST PROCEDURE FOR PCM ACTUATORS

 **WARNING: WHEN PERFORMING WATER SOAK TEST ON ELECTRICAL COMPONENTS AND/OR HARNESSSES, AVOID CONTACT WITH EEC, GEM AND OTHER MODULES IF POSSIBLE. ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS OR HOT SURFACES.**

Note: Output Test Mode may not control some outputs, such as injectors. To test these output types, GO to [Z19](#).

- Key on, engine off.
- With the scan tool, turn all outputs on using Output Test Mode (refer to scan tool instruction manual).
- Proceed to the area of the suspect wiring or component fault.
- Monitor the PID and digital multimeter value while spraying a light mist of water on the component.
- Monitor while spraying actuator harness wire from component to PCM.
- Look for abrupt changes or PID to digital multimeter value mismatches. Also, compare the actual values to the KOEO [Typical Diagnostic Reference Values](#) in Section 6, Reference Values.

Is there a PID to digital multimeter value mismatch or fluctuation in and out of range according to the Reference Value Charts?

Yes	No
REPAIR as necessary. VERIFY repair.	GO to Z19 .

Z19 KOER WATER SOAK TEST PROCEDURE FOR PCM ACTUATORS



WARNING: WHEN PERFORMING WATER SOAK TEST ON ELECTRICAL COMPONENTS AND/OR HARNESSSES, AVOID CONTACT WITH EEC, GEM AND OTHER MODULES IF POSSIBLE. ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, ENGINE DRIVE BELTS OR HOT SURFACES.

- Key on, engine running.
- Monitor PIDs (if available) with the scan tool using the PID monitor function and continue to compare with the digital multimeter.
- Proceed to the area of the suspect wiring or component fault.
- Monitor the PID and digital multimeter value while spraying water mist on the component.
- Monitor while lightly spraying actuator harness wire from component to PCM.
- Look for abrupt changes in idle or PID to digital multimeter value mismatches. Also, compare the actual values to the Hot Idle [Typical Diagnostic Reference Values](#) in Section 6, Reference Values.

Is there an idle fluctuation, value mismatch or values fluctuating in and out of range according to the Reference Value Charts?

Yes	No
REPAIR as necessary. VERIFY repair.	KEY OFF. GO to Z20 .

Z20 INSPECT FOR INTERMITTENT MECHANICAL CONCERNS

Note: It is possible for an intermittent mechanical concern to cause a good PCM system to react abnormally.

- An inspection of mechanical systems relating to the DTC or symptom should have been performed in an earlier section. If not, visually inspect at this time.
- Look for the possibility of wires, vacuum lines or hoses that may short or kink during normal engine operation, such as:
 - Engine rock during acceleration.
 - Components moving during conditions of vibrations (high rpm or rough road).
 - Accelerator or transmission linkage contact or interference.

Is a mechanical concern detected?

Yes	No
REPAIR as necessary. VERIFY repair.	It is necessary to seek additional help. REFER to the OASIS system or Hotline. A customer flight recorder may also be useful.

Z50 INTERMITTENT IGNITION PROCEDURE

PRELIMINARY CHECKS

Note: This pinpoint test must be used with the Rotunda DIST Tester 418-F024 (007-00075) or equivalent for non coil on plug applications. The DIST cannot be used on the 2.0L Cougar/Contour/Mystique/Focus coil pack application. Quick Test must be performed and instructions in [Section 5](#) Pinpoint Test steps completed before starting the intermittent ignition procedure.

- Check sensor shield connector.
- Be certain the battery is fully charged.

- All accessories must be off during diagnosis.

Is vehicle prepared for equipment set-up?

Yes	No
GO to Z51 .	REPEAT Z50 .

Z51 INSTALL DIST TESTER

- All accessories must be off during testing.
- Select proper Overlay and Program Cartridge to match the ignition system to be tested.
- Install overlay on front panel of tester.
- Insert Program Cartridge into the cartridge slot (marked on the RH side of the front panel). Make sure the cartridge is fully inserted.
- Select and install the proper harness adapter to the Rotunda DIST Distributor/Less Ignition System Tester 104-Pin PCM Adapter 007-00110. Set the rotary knob to position I.
- Verify that the WIGGLE TEST switch is in the OFF position. For 2.5L Ranger, verify that the SYSTEM TYPE switch is set to DUAL PLUG; all other four cylinders set to NON DUAL PLUG.
- WIGGLE TEST can only be used during key on, engine off.
 - WIGGLE TEST monitors circuits for intermittent faults.
 - WIGGLE TEST MODES A, B, and C check for short to power, open, and short to ground respectively.
 - Simulate fault conditions by wiggling the wiring harness and tapping on connectors and components.
 - The DIST will beep and turn on the LED for the circuit on which a fault is detected.
- Disconnect the vehicle wiring harness from PCM.
- Hook Tester to PCM and vehicle wiring harness.
- Key on, engine off. Press Tester RESET button. The tester performs Self-Test when it is reset or powered up. During the Self-Test, all LEDs will light and a beep will be heard.
- If the CASE GND (CKP SHIELD) FAULT MEMORY LED (EI only) stays on, run a ground line from the PCM Case to GND and continue with test.

Does the tester perform Self-Test and is the VPWR LED on?

Yes	No
GO to Z223 .	REFER to warranty supplied with the DIST tester.

Z223 RECREATE THE CONCERN

- With the DIST connected to the vehicle, try to recreate the fault by test driving the vehicle. If the vehicle is a No Start, crank engine for 5 to 10 seconds.

Are any FAULT MEMORY LEDs on during crank or engine run?

Yes	No
KEY OFF. GO to Z234 .	RECREATE the fault with Freeze Frame data or information from the customer. GO to Z234 .

Z234 WIGGLE TEST MODE

- Place WIGGLE TEST switch to ON.
- Place MODE switch to A.
- Press RESET button.
- Wait for WIGGLE TEST ACTIVE LED to light.
- Wiggle Test and tap circuit components.
- Repeat procedure with mode switch to B and C.

Are any **FAULT MEMORY** LEDs on?

Yes	No
PRESS RESET and WAIT for WIGGLE TEST ACTIVE LED to light. CONTINUE to test until intermittent is isolated. REPAIR as necessary. VERIFY repair.	REPLACE PCM (REFER to Section 2, <u>Flash Electrically Erasable Programmable Read Only Memory (EEPROM)</u>). VERIFY repair.

Powertrain Control/Emissions Diagnosis Manual

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On Board Diagnostics II

SECTION 6: Reference Values

Choose an item on the left side to display section contents.

Reference Value Symptom Chart

The Reference Value Symptom Chart is used to provide guidance in selecting the appropriate PID or measured signal related to the fault area. Select a symptom from the symptom chart along with the category number and proceed to the PID/Measured Signal Chart. For multiple symptoms, select the most evident.

Symptom Chart

Symptom occurs during	Symptom	Category Number
STARTUP:	No start/Normal crank	1
	Hard start/Long crank	2
	Stall after start	3
	Diesels/Runs on	4
IDLE:	MIL	5
	Stalls/Quits	6
	Slow	7
	Slow return	8
	Rolling	9
	Fast	10
	Rough	11
	Misses	12
	Backfires	13
	ACCELERATION:	Stalls/Quits
Misses		12
Bucks/Jerks		14
Backfires		13
Hesitation		15
Lack/Loss of power		16
Surge		17
Spark knock		18
Cooling system temperature		19
Poor fuel economy		20
Emissions compliance	21	
CRUISE:	Stalls/Quits	6
	Misses	12
	Bucks/Jerks	14
	Backfires	13
	Lack/Loss of power	16

	Surge	17
	Spark knock	18
	Cooling system temperature	19
	Poor fuel economy	20
	Emissions compliance	21
DECELERATION:	Stalls/Quits	6
	Backfires	13
TRANSMISSION OPERATION: (AUTOMATIC)	Shift/Engagement Concerns	22
	No overdrive	23
TRANSMISSION OPERATION: (MANUAL)	No reverse lights	24

Reference Value PID/Measured Signal Chart

The listing reflects PIDS and/or measured values which may reveal a possible concern within each system shown. Match the category number with the related PID/measured signal and proceed to the Typical Diagnostic Reference Value Charts.

PID/Measured Signal Chart

Category Number	Related PIDS/Measured Signals
5-9-10-17	ACCS
5-10-17	ACP
5-10-17	ACP V
5-21	AIR
5-21	AIRM
23	BPP/BOO
22-23	CCS
18-19	CHT
18-19	CHT V
1-2-3-5-6-7-11-12-13-14-15-16-17-20-21	CKP
1-2-3-5-6-7-11-12-13-14-15-16-17-20-21	CMP
10	CPP/PNP
3-5-6-7-9-11-15-16-20-21	DPFEGR
4-18-19-21-22	ECT ^a
4-18-19-21-22	ECT V
2-5-7-10-15-16-18-19-20-21	EFTA
2-5-7-10-15-16-18-19-20-21	EFTA V
2-5-7-10-15-16-18-19-20-21	EFTB
2-5-7-10-15-16-18-19-20-21	EFTB V
3-5-6-7-9-11-15-16-20-21	EGRVR
5-18-19-20-21	EOT
5-18-19-20-21	EOT V
22	EPC
22	EPC V
3-5-6-11-21	EVAPCV
3-5-6-11-21	EVAPPDC
5-21	EVAPPF
5-21	FF
20	FLI
20	FLI V
1 thru 21	FP

1 thru 21	FP M
1 thru 21	FPM
1 thru 21	FRP
1 thru 21	FRP V
1 thru 21	FSV - NGV
1 thru 21	FSVM
5	FTP
5	FTP V
1 thru 21	FUELPW1/2
1 thru 21	FUELSYS1/2 ^a
22-23	GEAR
5	GENFDC
5	GFS
19	HFC
1 thru 21	HTR11/12/21/22
1 thru 21	IAC
2-3-5-7-8-10-22	IAT ^a
2-3-5-7-8-10-22	IAT2 ^a
2-3-5-7-8-10-22	IAT V ^a
2-3-5-7-8-10-22	IAT2 V ^a
5-14-15-16-17-20	IMRC
5-14-15-16-17-20	IMRCM
5-14-15-16-17-20	IMTV
4-5-16-18-19-20-21	KS1 ^a
4-5-16-18-19-20-21	KS2 ^a
19	LFC
1 thru 21	LONGFT1/2 ^a
1 thru 23	MAF ^a
1 thru 23	MAF V
1 thru 22	MISF
1 thru 21	O2S11/12/21/22
15-18-20-21	OCTADJS
22	OSS
10	PSP
10	PSP V
5	PTO
24	REVERSE
1 thru 23	RPM ^a
5-14-16-17	SCB SCICP
1 thru 21	SHRTFT1/2/11/12/21/22
15-16-18-19-20-21	SPRKADV ^a

22-23	SS1/SS2/SS3
22	TCIL
6-14-16-20	TCC
22-23	TCS
22-23	TFT
22-23	TFT V
1-23	TP
1-23	TP V
22-23	TR
22-23	TR V
22-23-24	TR D
22-23	TSS
2-4-5-9-10-11-16-17-18-19-20-21	VCT
1-2-3-5-6-11-12-13-14	VPWR
22-23	VSS
5-9-10-17	WAC

^a Generic PID

Some signals are measured only and will require the use of a breakout box and digital multimeter.

Typical Diagnostic Reference Values

Notes:

The footnotes are referenced throughout the Typical Diagnostic Reference Value Charts. A letter in parentheses next to a value indicates supplemental information is applicable.

An attempt is made to provide as much information as possible; some vehicles may not display all input and output signals.

The Typical Diagnostic Reference Value Charts do not display fault PIDs. These are PIDs which indicate a hard fault with the circuit. They display a value of "YES" or "NO" and are PIDs ending with an "F".

Reference values may vary +/-20% depending on operating conditions and other factors. RPM values are axle and tire dependent.

For downstream O2S (12, 22) greater activity will result when catalyst monitor is active.

Refer to Section 2, Parameter Identification Access, for PID descriptions.

gs-green state

fs-federal state

- A. A/C on.
 - B. Cooling fan on (single, low or high speed).
 - C. O2S(s) should switch from rich to lean at least once every 3 seconds. O2S voltage should toggle above and below 0.450 DCV and never be a negative value. Valid O2S switching only occurs during closed loop fuel control.
 - D. Downstream O2S(s) will stay close to a constant voltage when the catalyst monitor is off (positive value only). When the catalyst monitor is on, O2S will switch rich to lean above and below 0.450 DCV and never be a negative value.
 - E. Brake pedal applied.
 - F. Catalyst monitor off.
 - G. While pressing transmission control switch (TCS) or switching to manual drive mode.
 - H. Values shown are commanded by the PCM and may not be actual.
 - I. Steering wheel turned.
 - J. Clutch pedal applied.
 - K. Value is dependent upon ambient air temperature and may fall outside of range.
 - L. Value is not useful under this condition.
 - M. If equipped.
 - N. Transmission in selected range.
 - O. Values recorded using 100% unleaded gasoline.
 - P. May change state under this condition.
 - Q. While pressing switch.
 - R. Frequency cycles high within a few seconds of turning headlamps on. Frequency cycles back to 0 Hz shortly after cycling high.
 - S. Generator under full load.
 - T. Refer to Workshop Manual Section 419-01.
-

2.0L 2V Escort (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TROD/TR	6	VBAT/OD (N)	VBAT/OD (N)	VBAT/OD	VBAT/OD	DCV/MODE
TRL/TR	7	VBAT/MAN1 (N)	VBAT/MAN1 (N)	.1/OD	.1/OD	DCV MODE
IMRCM	8	5/2.5	5/2.5	5/2.5	5/2.5	DCV
TRD/TR	9	VBAT/DRIVE (N)	VBAT/DRIVE (N)	.1/OD	.1/OD	DCV/MODE
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-425	770-900	1200-1400	Hz
PSP	31	.5/LOW	VBAT/HI (I)	.5/LOW	.5/LOW	DCV/LOW-HIGH
TRR/TR	32	VBAT/REV (N)	VBAT/REV (N)	.1/OD	.1/OD	DCV/MODE
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/50	3.5/50	3.5/50	3.5/50	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
VSS (+)	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IIN-H20
FRP V/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PSI
PNP	64	.1/ON	.1/ON	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
KS	57	0	0	0	0	DCV
TSS	84	0	340-380/ 680-720	620-680/ 1160-1180	1090-1150/ 2150-2220	Hz/RPM
CID	85	0	5-7	11-15	17-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
MAF V	88	0	.6-.9	1-1.6	1.3-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON

EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	10-20	20-31	25-52	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	730-790	1450-1630	1750-2100	RPM

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/OFF	.1/OFF	VBAT/ON	VBAT/ON	DCV/OFF-ON
IMRC	42	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
LFC	45	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	11.5-VBAT/0-40	10-VBAT/0-60	DCV/%
CTO	48	0	25-38	40-48	72-85	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/ON	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
TCC	54	.1/0	.1/0	.1/0	VBAT/ 95-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ3	74	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ1	75	0	3.3-3.7	4.1-8	4.4-10.1	mS
FP	80	3.7/75	1.5/33	1.5/33	1.5/33	DCV/%
EPC	82	7.5/17	2.5/73	2.8/62	1.9/49	DCV/%
IAC	83	VBAT/0	9-10/20-40	8-11.1/34-40	6-7/45-55	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ4	100	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ2	101	0	3.3-3.7	4.1-8	4.4-10.1	mS
FUEL PW1	PID	(L)	3.3-3.7	4.1-8	4.4-10.1	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%

SPARKADV	PID	0	15-22	28-35	25-35	DEG
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Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20(+)20	%
LOAD	32-38	16-20	%
MAF	2.4-2.7	7.2-8	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	15-22	25-30	DEG

2.0L 2V Escort (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
IMRCM	8	5/2.5	5/2.5	5/2.5	5/2.5	DCV/DCV
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	425-460	700-930	1150-1400	Hz
PSP	31	.5	VBAT (I)	.5	.5	DCV
O2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS	57	0	0	0	0	DCV
VSS (+)	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FRPV/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PSI
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CID	85	0	5-7	11-15	16-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
MAF V	88	0	.6-9	1-1.6	1.3-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
LOAD	PID	(L)	10-20	20-31	25-52	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	700-820	1400-1700	1700-2200	RPM

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON

HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
IMRC	42	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
LFC	45	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	11.5-VBAT/0-40	10-VBAT/0-60	DCV/%
CTO	48	0	25-38	37-50	72-85	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV/%
EVAPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPC V	67	0	0-10/0-100	0-10/0-100	0-10/0-100	DVC/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SIL	72	VBAT	VBAT	VBAT	VBAT	DCV
INJ3	74	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ1	75	0	3.3-3.7	4.1-8	4.4-10.1	mS
FP	80	3.7/75	1-5/33	1-5/33	1-5/33	DCV/%
IAC	83	VBAT/0	9-10/20-40	8-11.1/34-40	6-7/45-55	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ4	100	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ2	101	0	3.3-3.7	4.1-8	4.4-10.1	mS
FUELPW1	PID	(L)	3.3-3.7	4.1-8	4.4-10.1	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-22	28-35	25-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	32-38	16-20	%
MAF	2.6-2.7	7.2-8	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%

SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	15-22	25-30	DEG

2.0L 4V Escort (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TROD/TR	6	VBAT/OD (N)	VBAT/OD (N)	VBAT/OD	VBAT/OD	DCV/MODE
TRL/TR	7	VBAT/MAN1 (N)	VBAT/MAN1 (N)	.1/OD	.1/OD	DCV MODE
TRD/TR	9	VBAT/DRIVE (N)	VBAT/DRIVE (N)	.1/OD	.1/OD	DCV/MODE
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-425	770-900	1200-1400	Hz
PSP V/PSP	31	.5/LOW	VBAT/HIGH (I)	.5/LOW	.5/LOW	DCV/HIGH-LOW
TRR/TR	32	VBAT/REV (N)	VBAT/REV (N)	.1/OD	.1/OD	DCV/MODE
O2S12	35	0.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/50	3.5/50	3.5/50	3.5/50	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
VSS (+)	58	0	0	65/30	125/55	Hz/MPH
KS	57	2.5	2.5	2.5	2.5	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IIN-H20
FRP V/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PSI
PNP	64	.1/ON	.1/ON	5/OFF	5/OFF	DCV/OFF-ON
EPC	82	7.5/20	2.6/72	2.2/60	1.3/40	DCV/%
TSS	84	0	340-380/ 680-720	620-680/ 1160-1180	1090-1150/ 2150-2220	Hz/RPM
CID	85	0	5-7	11-15	17-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
MAF V	88	0	.6-9	1-1.6	1.3-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
EFT A	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG

GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	10-20	20-31	25-52	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	750-820	1450-1630	1750-2100	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/OFF	.1/OFF	VBAT/ON	VBAT/ON	DCV/OFF-ON
VCT	44	VBAT	VBAT	10.5/VBAT	10.5/VBAT	DCV
LFC	45	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
CTO	48	0	25-38	40-48	72-85	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/ON	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
TCC	54	.1/0	.1/0	.8/60-80	VBAT/ 95- 100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPC V	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
INJ3	74	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ1	75	0	3.3-3.7	4.1-8	4.4-10.1	mS
FP	80	3.7/75	1.5/33	1.5/33	1.5/33	DCV/%
IAC	83	VBAT/0	9-10/20-40	8-11.1/34- 40	6-7/45-55	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ4	100	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ2	101	0	3.3-3.7	4.1-8	4.4-10.1	mS
FUELPW1	PID	(L)	3.3-3.7	4.1-8	4.4-10.1	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-22	28-35	25-35	DEG

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Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)-20(+)+20	%
LOAD	20-22	22-24	%
MAF	2.0-2.4	7.2-8	G/S
SHRTFT1	(-)10-(+)10	(-)-10-(+)+10	%
SHRTFT11	(-)10-(+)10	(-)-10-(+)+10	%
SHRTFT12	95-100	95-100	%
SPARKADV	18	25-34	DEG

2.0L 4V Escort (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-425	700-900	1150-1400	Hz
PSP V/PSP	31	.5/LOW	2.5/HIGH (I)	.5/LOW	.5/LOW	DCV/HIGH-LOW
O2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/50	3.5/50	3.5/50	3.5/50	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS	57	2.5	2.5	2.5	2.5	DCV
VSS (+)	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FRPV/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PSI
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
CID	85	0	5-7	11-15	16-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
MAF V	88	0	.6-.9	1-1.6	1.3-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
LOAD	PID	(L)	10-20	20-31	25-52	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	750-820	1400-1630	1700-2100	RPM

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV

VCT	44	VBAT	VBAT	10.5-VBAT	10.5-VBAT	DCV
LFC	45	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
CTO	48	0	25-38	37-48	72-85	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
SIL	72	VBAT	VBAT	VBAT	VBAT	DCV
INJ3	74	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ1	75	0	3.3-3.7	4.1-8	4.4-10.1	mS
FP	80	3.7/75	1.5/33	1.5/33	1.5/33	DCV/%
IAC	83	VBAT/0	9-10/20-40	8-11.1/34-40	6-7/45-55	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ4	100	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ2	101	0	3.3-3.7	4.1-8	4.4-10.1	mS
FUELPW1	PID	(L)	3.3-3.7	4.1-8	4.4-10.1	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-22	28-35	25-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	32-38	16-20	%
MAF	2.6-2.7	7.2-8	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%



2.0L 2V Focus (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TCS	29	.1/OFF	VBAT/ON(G)	.1/OFF	.1/OFF	DCV/OFF-ON
IMRCM	3	5/2.5	5/2.5	5/2.5	5/2.5	DCV
TRR/TR	4	VBAT/REV (N)	VBAT/REV (N)	.1/OD	.1/OD	DCV/MODE
TRL/TR	7	VBAT/MAN1 (N)	VBAT/MAN1 (N)	.1/OD	.1/OD	DCV MODE
TRD/TR	9	VBAT/DRIVE (N)	VBAT/DRIVE (N)	.1/OD	.1/OD	DCV/MODE
TROD/TR	11	VBAT/OD (N)	VBAT/OD (N)	VBAT/OD	VBAT/OD	DCV/MODE
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-425	770-900	1200-1400	Hz
PSP V/PSP	31	.1/LOW	VBAT/HI (I)	.1/LOW	.1/LOW	DCV/LOW-HIGH
TSS	34	0	340-380/ 680-720	620-680/ 1160-1180	1090-1150/ 2150-2220	Hz/RPM
O2S12	35	0.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
EPC SW	44	VBAT	VBAT	VBAT	VBAT	DCV
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	53	(T)	(T)	(T)	(T)	(T)
GFS	59	0	130/30	130/27	130/23	Hz/%
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRP V/FRP	63	3/93	2.8/39	2.8/39	2.8/39	DCV/PSI
CPP/PNP	64	.1/ON	.1/ON	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
KS	57	0	0	0	0	DCV
OSS	58	0	0	67/400	120/730	Hz/RPM
GFS	59	0	130/30	130/27	130/23	Hz/%
CID	85	0	5-7	11-15	17-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-

						CLOSED
MAF V	88	0	.6-.9	1-1.6	1.3-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI	PID	50	50	50	50	
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	10-20	20-31	25-52	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	730-790	1450-1630	1750-2100	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ3	20	0	3.3-3.7	4.1-8	4.4-10.1	mS
PATSOUT	19	(T)	(T)	(T)	(T)	(T)
PATSIL	42	(T)	(T)	(T)	(T)	(T)
PATSTRT	27	(T)	(T)	(T)	(T)	(T)
VSO	28	0	0	65	125	Hz
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
EGRVR	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-40	10-VBAT/0- 60	DCV/%
CTO	48	0	25-38	40-48	72-85	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
FP	54	3.7/75	1.5/33	1.5/33	1.5/33	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
LFC	68	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	73	.1/OFF	.1/OFF	VBAT/ON	VBAT/ON	DCV/OFF-ON
INJ1	70	0	3.3-3.7	4.1-8	4.4-10.1	mS
GEN FDC	72	0	0	0	0	Hz/%
IMRC	80	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EPC	81	0	2.5/73	2.8/62	1.9/49	DCV/%
IAC	83	VBAT/0	9-10/20-40	8-11.1/34-40	6-7/45-55	DCV/%

DPC 1	82	0	0	3.93	4.10	DCV
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
PC2	99	0	0	0	0	DCV
INJ4	95	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ2	96	0	3.3-3.7	4.1-8	4.4-10.1	mS
DPC3	102	0	0	0	0	DCV
HTR12	100	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
FUELPW1	PID	(L)	3.3-3.7	4.1-8	4.4-10.1	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-22	28-35	25-35	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	32-38	16-20	%
MAF	2.4-2.7	7.2-8	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	15-20	25-33	DEG

2.0L 2V Focus (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
OSS	58	0	0	67/400	120/730	Hz/RPM
IMRCM	3	VBAT/5	VBAT/5	VBAT/5	VBAT/5	DCV
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-425	750-950	1150-1400	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (1)	.1/LOW	.1/LOW	DCV/HIGH-LOW
O2S12	35	0.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	53	(T)	(T)	(T)	(T)	(T)
GFS	59	0	130/30	130/27	130/23	Hz/%
KS	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
FRP V/FRP	63	3/43	2.8/39	2.8/39	2.8/39	DCV/PSI
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CID	85	0	5-7	11-15	16-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
MAF V	88	0	.6-.9	1-1.6	1.3-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON	.1/OFF	.1/OFF	DCV/OFF-ON
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI	PID	50	50	50	50	%
LOAD	PID	(L)	10-20	20-31	25-52	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	700-800	1500-1700	1700-2100	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ3	20	0	2.7-3.7	4.1-8	4.4-10.1	mS
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSOUT	19	(T)	(T)	(T)	(T)	(T)
PATSTRT	27	(T)	(T)	(T)	(T)	(T)
VSO	28	0	0	65	125	Hz
PATSIL	42	(T)	(T)	(T)	(T)	(T)
EGRVR	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-45	10-VBAT/0- 60	DCV/%
CTO	48	0	25-38	37-48	72-85	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV/%
FP	54	3.7/75	1.5/33	1.5/33	1.5/33	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPC V	67	0	0-10/0-100	0-10/0-100	0-10/0-100	DVC/OFF-ON
LFC	68	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DVC/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
GENFDC	72	0	0	0	0	Hz/%
INJ1	70	0	2.7-3.7	4.1-8	4.4-10.1	mS
IMRC	80	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
IAC	83	VBAT/0	9-10/20-40	8-11.1/34-46	6-8/45-62	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ4	95	0	2.7-3.7	4.1-8	4.4-10.1	mS
INJ2	96	0	2.7-3.7	4.1-8	4.4-10.1	mS
HTR12	100	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
FUELPW1	PID	(L)	2.7-3.7	4.1-8	4.4-10.1	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-22	28-35	25-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	32-38	16-20	%
MAF	2.6-2.7	7.2-8	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	15-22	25-30	DEG

2.0L 4V Focus (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TRR/TR	4	VBAT/REV (N)	VBAT/REV (N)	.1/OD	.1/OD	DCV/MODE
TRL/TR	7	VBAT/MAN1 (N)	VBAT/MAN1 (N)	.1/OD	.1/OD	DCV MODE
TRD/TR	8	VBAT/DRIVE (N)	VBAT/DRIVE (N)	.1/OD	.1/OD	DCV/MODE
TROD/TR	11	VBAT/OD (N)	VBAT/OD (N)	VBAT/OD	VBAT/OD	DCV/MODE
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-425	900-1000	1200-1400	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HI (I)	.1/LOW	.1/LOW	DCV/LOW-HIGH
TSS	34	0	340-380/ 680-720	620-680/ 1160-1180	1090-1150/ 2150-2220	Hz/RPM
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
CHT V/CHT	38	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
EPCSW	44	VBAT	VBAT	VBAT	VBAT	DCV
PATSIN	53	(T)	(T)	(T)	(T)	(T)
OSS	58	0	0	67/400	120/730	Hz/RPM
GFS	59	0	130/30	130/27	130/23	Hz/%
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IIN-H20
FRP V/FRP	63	3/43	2.8/39	2.8/39	2.8/39	DCV/PSI
CPP/PNP	64	VBAT/ON	VBAT/ON	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
KS	57	0	0	0	0	DCV
CID	85	0	5-7	11-15	17-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED

MAF V	88	0	.6-.9	1-1.6	1.3-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ECT	PID	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI	PID	50	50	50	50	%
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	10-20	20-31	25-52	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	730-790	1450-1630	1750-2100	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	19	(T)	(T)	(T)	(T)	(T)
INJ3	20	0	3.3-3.7	4.1-8	4.4-10.1	mS
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSTRT	27	(T)	(T)	(T)	(T)	(T)
VSO	28	0	0	65	125	Hz
PATSIL	42	(T)	(T)	(T)	(T)	(T)
EGRVR	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-40	10-VBAT/0- 60	DCV/%
CTO	48	0	25-38	40-48	72-85	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
FP	54	3.7/75	1.5/33	1.5/33	1.5/33	DCV/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
LFC	68	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	73	.1/OFF	.1/OFF	VBAT/ON	VBAT/ON	DCV/OFF-ON
INJ1	70	0	3.3-3.7	4.1-8	4.4-10.1	mS
GENFDC	72	0	0	0	0	Hz/%
EPC	81	0	9.3/57	9.0/68	9.4/86	DCV/PSI
DPC1	82	0	0	3.93	4.10	DCV
IAC	83	VBAT/0	9-10/20-40	8-11.1/34-40	6-7/45-55	DCV/%

HTR11	93	.1/ON (P)	switching	switching	switching	DCV/OFF-ON
INJ4	95	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ2	96	0	3.3-3.7	4.1-8	4.4-10.1	mS
HTR12	100	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
DPC3	102	0	0	0	0	DCV
DPC2	99	0	0	0	0	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.3-3.7	4.1-8	4.4-10.1	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SPARKADV	PID	0	15-22	28-35	25-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	32-38	16-20	%
MAF	2.4-2.7	7.2-8	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	15-22	25-32	DEG

2.0L 4V Focus (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-6	.5-6	.5-6	.5-6	DCV
CKP (+)	21	0	400-425	900-1000	1150-1400	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/LOW-HIGH
O2S12	35	.1	(D)	(D)	(D)	DCV
CHT V/CHT	38	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	53	(T)	(T)	(T)	(T)	(T)
KS	57	0	0	0	0	DCV
OSS	58	0	0	200-220/430-450	360-827	Hz/RPM
GFS	59	0	130/30	130/27	130/23	Hz
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FRPV/FRP	63	3/43	2.8/39	2.8/39	2.8/39	DCV/PSI
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CID	85	0	5-7	11-15	16-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
MAF V	88	0	.6-9	1-1.6	1.3-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI	PID	50	50	50	50	%
LOAD	PID	(L)	10-20	20-31	25-52	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	700-750	1630-1820	2100-2400	RPM

VSS	PID	0	0	30	55	MPH
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Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ3	20	0	3.3-3.7	4.1-8	4.4-10.1	mS
PATSOUT	19	(T)	(T)	(T)	(T)	(T)
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSTRT	27	(T)	(T)	(T)	(T)	(T)
VSO	28	0	0	65	125	Hz
PATSIL	42	(T)	(T)	(T)	(T)	(T)
EGRVR	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-40	10-VBAT/0- 60	DCV/%
CTO	48	0	25-38	48-59	72-85	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV/%
FP	54	3.7/75	1.3-26	1.5/27	1.5/30	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPC V	67	0	0-10/0-100	0-10/0-100	0-10/0-100	DVC/OFF-ON
LFC	68	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
GENFDC	72	0	0	0	0	Hz/%
INJ1	70	0	3.3-3.7	4.1-8	4.4-10.1	mS
IAC	83	VBAT/0	9-11/20-40	8-11.1/34-50	6-7.5/45-60	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ2	96	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ4	95	0	3.3-3.7	4.1-8	4.4-10.1	mS
HTR12	100	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.3-3.7	4.1-8	4.4-10.1	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-33	28-35	25-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	38-48	16-20	%
MAF	1.6-2.6	7.2-8	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	15-33	35-38	DEG

2.0L Cougar (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.1	.1	.1	.1	DCV
CKP (+)	21	0	470-650	990-1200	1350-1460	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/HIGH-LOW
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/87-114	3.5/87-114	3.5/87-114	3.5/87-114	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	53	(T)	(T)	(T)	(T)	(T)
KS1	57	0	0	0	0	DCV
OSS	58	0	0	590/1400	1050/1400	Hz/RPM
GLI	59	(L)	8.2 (S)	7.6	7.9	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
FRP V/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PSI
TR V/TR	64	4.4/PARK	4.4/PARK	2.1/OD	2.1/OD	DCV/MODE
TSS	84	0	40-56/680-710	65-85/ 1100-1220	125-140/ 2000-2800	Hz/RPM
CID	85	0	5-7	11-15	17-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
MAF V	88	0	.6-9	.8-1.5	1.2-2.5	DCV
TP V	89	.53-1.27	53-1.27	1-1.3	1.1-1.4	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	10-20	20-28	34-42	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO

						RETARD
RPM	PID	0	790-900	1785-1835	2250-2390	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	19	(T)	(T)	(T)	(T)	(T)
INJ3	20	0	2.3-2.9	2.9-5.6	6.5-9.3	mS
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSTRT	27	(T)	(T)	(T)	(T)	(T)
VSO	28	0	0	65	125	Hz
PATSIL	42	(T)	(T)	(T)	(T)	(T)
VCT	45	VBAT	VBAT	10.5-VBAT	10.5-VBAT	DCV
CTO	48	0	22-31	55-67	75-89	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
FP	54	3.7/75	1.5/33	1.5/33	1.5/33	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
LFC	68	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ1	70	0	2.3-2.9	2.9-5.6	6.5-9.3	mS
SS1	73	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCIL	74	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EPC	81	7.7-17	7-8/0	9-10/23-28	8-11/35-48	DCV/PSI
IAC	83	VBAT/0	10.7/32	7.5-10.6/35-48	7-10/40-55	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ4	95	0	2.3-2.9	2.9-5.6	6.5-9.3	mS
INJ2	96	0	2.3-2.9	2.9-5.6	6.5-9.3	mS
TCC	99	VBAT/0	VBAT/0	VBAT/0	.2/95-100	DCV/%
HTR12	100	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
SS3	102	8.1	7-9.5	8.3-9.5	8.3-9.5	DCV
FUELPW1	PID	(L)	2.3-2.9	2.9-5.6	6.5-9.3	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-25	19-33	25-36	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	25-35	18-28	%
MAF	2-4	7-10	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	15-17	32-34	DEG

2.0L Cougar (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.1	.1	.1	.1	DCV
CKP (+)	21	0	470-650	985-1210	1345-1455	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/HIGH-LOW
O2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/87-114	3.5/87-114	3.5/87-114	3.5/87-114	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	53	(T)	(T)	(T)	(T)	(T)
KS1	57	0	0	0	0	DCV
VSS	58	0	0	65/30	125/55	Hz/RPM
GLI	59	(L)	8.2 (S)	7.6	7.9	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IIN-H20
FRP V/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PSI
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
CID	85	0	5-7	11-15	17-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
MAF V	88	0	.6-.9	.8-1.5	1.2-2.5	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.4	DCV
LOAD	PID	(L)	10-20	19-30	40-47	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	790-900	1680-1840	2250-2385	RPM

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON

HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	19	(T)	(T)	(T)	(T)	(T)
INJ3	20	0	2.9-4.0	2.9-5.6	6.5-9.3	mS
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSTRT	27	(T)	(T)	(T)	(T)	(T)
VSO	28	0	0	65	125	DCV
PATSIL	42	(T)	(T)	(T)	(T)	(T)
VCT	45	VBAT	VBAT	10.5-VBAT	10.5-VBAT	DCV
CTO	48	0	22-31	54-68	73-90	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
FP	54	3.7/75	1.2/25	1.2/25	1.2/25	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
LFC	68	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ1	70	0	2.3-2.9	2.9-5.6	6.5-9.3	mS
IAC	83	VBAT/0	10.7/32	7.5-10.6/35-48	7-10/40-55	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ4	95	0	2.9-4.0	2.9-5.6	6.5-9.3	mS
INJ2	96	0	2.9-4.0	2.9-5.6	6.5-9.3	mS
HTR12	100	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
FUELPW1	PID	(L)	2.9-4.0	2.9-5.6	6.5-9.3	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-25	19-33	25-36	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	25-35	18-28	%
MAF	2-4	7-10	G/S

SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	15-17	32-34	DEG

2.5L Cougar (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
IMRCM	8	5/2.5	5/2.5	5/2.5	5/2.5	DCV/OFF-ON
FLI V/FLI	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.1	.1	.1	.1	DCV
CKP (+)	21	0	410-480	830-1000	1220-1400	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/HIGH-LOW
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS1	57	0	0	0	0	DCV
OSS	58	0	0	590/1400	1050/1400	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
FRP V/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PSI
TR V/TR	64	4.4/PARK	4.4/PARK	2.1/OD	2.1/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
TSS	84	0	46-50/ 700-730	70-95/ 1240-1500	130-145/ 2030-3020	Hz/RPM
CID	85	0	5-7	10-14	15-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-9	1.1-1.3	1.2-1.6	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.4	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	104	(T)	(T)	(T)	(T)	(T)
CPP/PNP	PID	OFF	OFF	ON	ON	OFF-ON

GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	10-20	20-28	30-42	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	700-760	1700-1800	2100-2390	RPM
VSS (+)	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
SS2	11	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	19	(T)	(T)	(T)	(T)	(T)
INJ3	20	0	3.5-4	3-6	3.3-7.3	mS
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
VSO	28	0	0	65	125	Hz
IMRC	42	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIL	44	(T)	(T)	(T)	(T)	(T)
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/0-40	10.5-VBAT/0-40	DCV/%
CTO	48	0	35-42	73-86	88-120	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
FP	54	3.7/75	1.5/30	1.5/30	1.5/30	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
LFC	68	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ1	70	0	3.5-4	3-6	3.3-7.3	mS
HTR11	73	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
TCC	80	VBAT/0	VBAT/0	VBAT/0	.2/95-100	DCV/%
EPC	81	7.7/17	7-8/0	9-10/23-28	8-11/30-35	DCV/PSI
PATSTRT	82	(T)	(T)	(T)	(T)	(T)
IAC	83	VBAT/0	9.2/33	7.5-10/40-48	7-10/40-55	DCV/%
HTR21	99	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	100	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON

HTR22	101	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ5	93	0	3.5-4	3-6	3.3-7.3	mS
INJ6	94	0	3.5-4	3-6	3.3-7.3	mS
INJ4	95	0	3.5-4	3-6	3.3-7.3	mS
INJ2	96	0	3.5-4	3-6	3.3-7.3	mS
SS3	102	6-7.5	7-9.5	8.3-9.5	8.3-9.5	DCV
FUELPW1	PID	(L)	3.5-4	3-6	3.3-7.3	mS
FUELPW2	PID	(L)	3.5-4	3-6	3.3-7.3	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	4-7	19-30	25-36	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	25-32	28-35	%
MAF	3-5	10-13	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	4-7	25-32	DEG

2.5L Cougar (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
IMRCM	8	5/2.5	5/2.5	5/2.5	5/2.5	DCV
FLI V/FLI	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.1	.1	.1	.1	DCV
CKP (+)	21	0	440-480	850-1000	1250-1400	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/HIGH-LOW
O2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	3.5-12/ON	3.5-12/ON	3.5-12/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS1	57	0	0	0	0	DCV
VSS (+)	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IIN-H20
FRP V/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PSI
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CID	85	0	5-7	10-14	15-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-9	.9-1.2	1.2-1.8	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.4	DCV
BPP	92	.1-OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	104	(T)	(T)	(T)	(T)	(T)
LOAD	PID	(L)	10-20	20-28	30-42	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	730-815	1700-1800	2150-2390	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	19	(T)	(T)	(T)	(T)	(T)
INJ3	20	0	3.5-4	3-6	3.3-7.3	mS
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
IMRC	42	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIL	44	(T)	(T)	(T)	(T)	(T)
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-40	10.5-VBAT/ 0-40	DCV/%
CTO	48	0	35-42	75-86	88-120	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
FP	54	3.7/75	1.5/30	1.5/30	1.5/30	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
LFC	68	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ1	70	0	3.5-4	3-6	3.3-7.3	mS
HTR11	73	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
PATSTRT	82	(T)	(T)	(T)	(T)	(T)
IAC	83	VBAT/0	9.2/33	7.2-10.3/36- 50	6.8-10.2/35- 60	DCV/%
INJ5	93	0	3.5-4	3-6	3.3-7.3	mS
INJ6	94	0	3.5-4	3-6	3.3-7.3	mS
INJ4	95	0	3.5-4	3-6	3.3-7.3	mS
INJ2	96	0	3.5-4	3-6	3.3-7.3	mS
HTR21	99	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	100	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	101	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
FUELPW1	PID	(L)	3.5-4	3-6	3.3-7.3	mS
FUELPW2	PID	(L)	3.5-4	3-6	3.3-7.3	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	4-7	19-30	25-36	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	25-32	28-35	%
MAF	2-4	10-13	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	4-7	26	DEG

3.0L LS6 (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	A13	.1	.1	.1	.1	DCV
BPS	A28	VBAT/OFF	.1/ON(E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MAF V	A31	0	.7	1.6-1.85	2.1-2.3	DCV
AIRM (M)	A34	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	A37	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/HIGH-LOW
BPP	A40	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ACP	A42	1/80	1.1/80	.8/36	.8/30	DCV/PSI
IAT	A51	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FTP V/FTP	A52	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN. H2O
SCCS	A57	5	.1 (Q)	5	5	DCV
TRV	B09	.1	.1	1.7	1.7	DCV
TR4	B10	.1	.1	VBAT	VBAT	DCV
TR2	B18	.1	.1	VBAT	VBAT	DCV
TR1	B22	.1	.1	VBAT	VBAT	DCV
TFT	B23	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
OSS	B26	0	0	570-595/1400-1500	1070-1100/2660	Hz/RPM
TSS	B27	0	365-380/680-720	595/1080	1070/2060	Hz/RPM
O2S12	B28	0	switching (D)	switching (D)	switching (D)	DCV
O2S22	B29	0	switching (D)	switching (D)	switching (D)	DCV
PS1	B30	10.2	11.7	11.7	11.7	DCV
CHT	C40	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
DPFEGR	C41	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
O2S21	C44	0	switching (C)	switching (C)	switching (C)	DCV
O2S11	C45	0	switching (C)	switching (C)	switching (C)	DCV
FRP V/FRP	C49	1.3/14	2.7/39	2.7/39	2.7/39	DCV/PSI
AFS	C50	0	130/30-45	130/20-30	130/15-25	Hz/%
KS1	C51	0	0	0	0	DCV
KS2	C52	0	0	0	0	DCV

CID	C53	0	6.6	10-12	17	Hz
CKP	C55	0	435	700-800	1160-1180	Hz
TP V	C57	.53-1.27	.53-1.27	1.1	1.3	DCV
EFT A	PID	120-50 (K)	120-50 (K)	120-50 (K)	120-50 (K)	DEG
LOAD	PID	(L)	17-18.6	26-35.7	30-50	%
GEAR	PID	1	1	4	5	GEAR
RPM	PID	0	737	1422	1950	RPM

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EVAPCV	A06	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	A09	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EVAPPDC	A12	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
AIR (M)	A19	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SCMA	A29	VBAT	VBAT	VBAT	VBAT	DCV
SCMB	A36	VBAT	VBAT	VBAT	VBAT	DCV
SCC	A45	VBAT	VBAT	VBAT	VBAT	DCV
SCMC	A46	VBAT	VBAT	VBAT	VBAT	DCV
FP	A58	8.6/75	3.8/27	3.8/27	3.8/27	DCV/%
SS1	B01	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	B02	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS3	B03	VBAT/OFF	VBAT/OFF	.35/ON	.1/ON	DCV/OFF-ON
SS4	B04	.1/ON	.1/ON	.35/ON	.1/ON	DCV/OFF-ON
TCC	B05	VBAT/0	VBAT/0	VBAT/0	.6/100	DCV/%
EPC	B07	6.1	8.1	10.4	10.5	DCV
EPC3	B12	5.8	8.1	VBAT	VBAT	DCV
EPC2	B13	8.6	10.7	10.4	10.5	DCV
HTR12	B15	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR22	B16	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ1	C02	(L)	2.4-3.2	4.9	6.7-7.1	mS
HTR11	C07	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	C08	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
IAC	C09	VBAT/0	11/30	7.2/53	6.1/67	DCV/%
INJ5	C11	(L)	2.4-3.2	4.9	6.7/7.1	mS
CDB	C12	VBAT	VBAT	VBAT	VBAT	DCV
CDE	C13	VBAT	VBAT	VBAT	VBAT	DCV
INJ2	C14	(L)	2.4-3.2	4.9	6.7-7.1	mS

EGRVR	C16	VBAT/0	VBAT/0	10.1/40	10.2/55	DCV/%
INJ6	C21	(L)	2.4-3.2	4.9	6.7-7.1	mS
CDD	C22	VBAT	VBAT	VBAT	VBAT	DCV
CDC	C23	VBAT	VBAT	VBAT	VBAT	DCV
INJ3	C24	(L)	2.4-3.2	4.9	6.7-7.1	mS
GENFDC	C28	0	0-130/0-100 (R)	0	0	Hz/%
IMTV	C29	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
CDF	C30	VBAT	VBAT	VBAT	VBAT	DCV
CDA	C31	VBAT	VBAT	VBAT	VBAT	DCV
INJ4	C32	(L)	2.4-3.2	4.9	6.7-7.1	mS
HFC	C36	VBAT	10.9 (B)	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
LONGFT1	PID	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+) 20	(-)20 - (+) 20	%
LONGFT2	PID	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+) 20	(-)20 - (+) 20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD
SHRTFT1	PID	(L)	(-)10 - (+)10	(-)10 - (+) 10	(-)10 - (+) 10	%
SHRTFT2	PID	(L)	(-)10 - (+)10	(-)10 - (+) 10	(-)10 - (+) 10	%
SPARKADV	PID	0	12-17	34	32-40	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	A32	VBAT	VBAT	VBAT	VBAT	DCV
VREF	A20	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	21-27	20-25	%
MAF	3-4.8	12-18	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%

SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	12-17	35-40	DEG

3.0L LS6 (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	A13	.1	.1	.1	.1	DCV
BPS	A28	VBAT/OFF	.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MAF V	A31	0	.7	1.6-1.85	2.1-2.3	DCV
AIRM (M)	A34	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	A37	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/HIGH-LOW
BPP	A40	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ACP	A42	1/80	1.1/80	.8/36	.8/30	DCV/PSI
IAT	A51	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FTP V/FTP	A52	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN. H2O
SCCS	A57	5	.1 (Q)	5	5	DCV
REVERSE	B10	VBAT/OFF	.1/ON (N)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CSTT	B22	.1	VBAT (J)	.1	.1	DCV
OSS	B26	0	0	570-595/1400-1500	1070-1100/2660	Hz/RPM
O2S12	B28	0	switching (D)	switching (D)	switching (D)	DCV
O2S22	B29	0	switching (D)	switching (D)	switching (D)	DCV
CHT	C40	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
DPFEGR	C41	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
O2S21	C44	0	switching (C)	switching (C)	switching (C)	DCV
O2S11	C45	0	switching (C)	switching (C)	switching (C)	DCV
FRP V/FRP	C49	3.6/54	2.7/39	2.7/39	2.7/39	DCV/PSI
GFS	C50	0	130/30-45	130/20-30	130/15-25	Hz/%
KS1	C51	0	0	0	0	DCV
KS2	C52	0	0	0	0	DCV
CID	C53	0	6.6	10-12	17	Hz
CKP	C55	0	435	810-870	1170-1180	Hz
TP V	C57	.53-1.27	.53-1.27	1.1	1.3	DCV
EFTA	PID	120-50 (K)	120-50 (K)	120-50 (K)	120-50 (K)	DEG
LOAD	PID	(L)	17-18.6	30-35.7	30-50	%
OCTADJS	PID	NO	NO RETARD	NO	NO	RETARD/NO

		RETARD		RETARD	RETARD	RETARD
RPM	PID	0	737	1422	1950	RPM

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EVAPCV	A06	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	A09	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EVAPPDC	A12	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
AIR (M)	A19	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SCMA	A29	VBAT	VBAT	VBAT	VBAT	DCV
SCMB	A36	VBAT	VBAT	VBAT	VBAT	DCV
SCC	A45	VBAT	VBAT	VBAT	VBAT	DCV
SCMC	A46	VBAT	VBAT	VBAT	VBAT	DCV
FP	A58	8.6/75	3.8/27	3.8/27	3.8/27	DCV/%
HTR12	B15	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR22	B16	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ1	C02	(L)	2.4-3.2	4.9	6.7-7.1	mS
HTR11	C07	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	C08	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
IAC	C09	VBAT/0	11/30	9.2/53	7.1/67	DCV/%
INJ5	C11	(L)	2.4-3.2	4.9	6.7/7.1	mS
CDB	C12	VBAT	VBAT	VBAT	VBAT	DCV
CDE	C13	VBAT	VBAT	VBAT	VBAT	DCV
INJ2	C14	(L)	2.4-3.2	4.9	6.7-7.1	mS
EGRVR	C16	VBAT/0	VBAT/0	11.3/40	10.2/55	DCV/%
INJ6	C21	(L)	2.4-3.2	4.9	6.7-7.1	mS
CDD	C22	VBAT	VBAT	VBAT	VBAT	DCV
CDC	C23	VBAT	VBAT	VBAT	VBAT	DCV
INJ3	C24	(L)	2.4-3.2	4.9	6.7-7.1	mS
GENFDC	C28	0	0-130/0-100 (R)	0	0	Hz/%
IMTV	C29	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
CDF	C30	VBAT	VBAT	VBAT	VBAT	DCV
CDA	C31	VBAT	VBAT	VBAT	VBAT	DCV
INJ4	C32	(L)	2.4-3.2	4.9	6.7-7.1	mS
HFC	C36	VBAT	10.9 (B)	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
LONGFT1	PID	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	%

LONGFT2	PID	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	%
SHRTFT1	PID	(L)	(-)10 - (+)10	(-)10 - (+)10	(-)10 - (+)10	%
SHRTFT2	PID	(L)	(-)10 - (+)10	(-)10 - (+)10	(-)10 - (+)10	%
SPARKADV	PID	0	12-17	34	32-40	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	A32	VBAT	VBAT	VBAT	VBAT	DCV
VREF	A20	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	21-27	20-25	%
MAF	3-4.8	12-18	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	12-17	35-37	DEG

3.9L LS8 (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	A13	.1	.1	.1	.1	DCV
BPS	A28	VBAT/OFF	.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MAF V	A31	0	.7-.8	1.2-1.4	1.5-1.9	DCV
PSP V/PSP	A37	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/HIGH-LOW
BPP	A40	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
TCS	A41	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
ACP	A42	1.3/106	.9/50	1.1/52	.2/52	DCV/PSI
IAT	A51	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FTP V/FTP	A52	2.6/1.31	2.6/1.06	2.75/.82	2.65/.98	DCV/IN. H2O
TRV	B09	.1	.1	1.7	1.7	DCV
TR4	B10	.4	.1	VBAT	VBAT	DCV
TR2	B18	.4	.1	VBAT	VBAT	DCV
ISS	B21	0	0	700	1320	Hz
TR1	B22	.4	.1	VBAT	VBAT	DCV
TFT	B23	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
OSS	B26	0	0	595/1500	1070/2660	Hz/RPM
TSS	B27	0	340/642	590/1080	1075/2000	Hz/RPM
O2S12	B28	0	switching (D)	switching (D)	switching (D)	DCV
O2S22	B29	0	switching (D)	switching (D)	switching (D)	DCV
PS1	B30	10.5	VBAT	11.7	11.7	DCV
EOT	C39	.9	1	.9	1.2	DCV
CHT	C40	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
DPFEGR	C41	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
O2S21	C44	0	switching (C)	switching (C)	switching (C)	DCV
O2S11	C45	0	switching (C)	switching (C)	switching (C)	DCV
FRP V/FRP	C49	1.3/14	2.5/75	2.8/39	2.8/39	DCV/PSI
GFS	C50	0	130/30-45	130/20-30	130/15-25	Hz/%
KS1	C51	0	0	0	0	DCV

KS2	C52	0	0	0	0	DCV
CID	C53	0	6	11	16	Hz
CKP	C55	0	380	770-800	1060-1160	Hz
TP V	C57	.53-1.27	.53-1.27	1.1-1.3	1.3-1.5	DCV
EFTA	PID	120-50 (K)	120-50 (K)	120-50 (K)	120-50 (K)	
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
ECT	PID	50-120	50-120	50-120	50-120	DEG
FUEL PW1	PID	(L)	2.9-3.6	5.1	6.5-7.5	mS
FUEL PW2	PID	(L)	2.9-3.6	5.5	6.5-7.5	mS
LOAD	PID	(L)	17	23	30	%
GEAR	PID	1	1	5	5	GEAR
RPM	PID	0	750-770	1250-1350	1990-2020	RPM

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EVAPCV	A06	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	A09	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EVAPPDC	A12	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
SCMA	A29	VBAT	VBAT	VBAT	VBAT	DCV
SCMB	A36	VBAT	VBAT	VBAT	VBAT	DCV
SCC	A45	VBAT	VBAT	VBAT	VBAT	DCV
SCMC	A46	VBAT	VBAT	VBAT	VBAT	DCV
SCCS	A57	4.6	.1 (Q)	4.6	4.6	DCV
FP	A58	8.6/75	3.5/26	4.0/29	3.8/27	DCV/%
SS1	B01	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	B02	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS3	B03	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
SS4	B04	.1/ON	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
TCC	B05	VBAT/0	VBAT/0	VBAT/0	.2/100	DCV/%
EPC	B07	6	7.4	9.3	9.9	DCV
EPC3	B12	5.6	7.5	VBAT	VBAT	DCV
EPC2	B13	VBAT	VBAT	9.3	9.9	DCV
HTR12	B15	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR22	B16	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
CDD	C01	VBAT	VBAT	VBAT	VBAT	DCV
INJ1	C02	(L)	2.9-3.6	5.1	6.5-7.5	mS
HTR11	C07	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON

HTR21	C08	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
IAC	C09	VBAT/0	10.6/32.5	7.5/54	5.9/72	DCV/%
INJ5	C11	(L)	2.9-3.6	2.9	6.1/7.5	mS
CDE	C12	VBAT	VBAT	VBAT	VBAT	DCV
CDC	C13	VBAT	VBAT	VBAT	VBAT	DCV
INJ2	C14	(L)	2.9-3.6	5.1	6.5-7.5	mS
EGRVR	C16	VBAT/0	VBAT/0	11.2/40	10.8/40	DCV/%
INJ6	C21	(L)	2.9-3.6	5.1	6.5-7.5	mS
CDF	C22	VBAT	VBAT	VBAT	VBAT	DCV
CDB	C23	VBAT	VBAT	VBAT	VBAT	DCV
INJ3	C24	(L)	2.9-3.6	5.1	6.5-7.5	mS
GENFDC	C28	0	0-130 (R)	0	0	Hz
INJ7	C29	(L)	2.9-3.6	5.1	6.5-7.5	mS
CDG	C30	VBAT	VBAT	VBAT	VBAT	DCV
CDA	C31	VBAT	VBAT	VBAT	VBAT	DCV
INJ4	C32	(L)	2.9-3.6	5.1	6.7-7.5	DCV/mS
HFC	C36	VBAT/OFF	10.9 (B)/ON	VBAT/OFF	VBAT/OFF	DCV
INJ8	C37	(L)	2.9-3.6	5.1	6.5-7.5	mS
CDH	C38	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10 - (+) 10	(-)10 - (+) 10	(-)10 - (+) 10	%
SHRTFT2	PID	(L)	(-)10 - (+) 10	(-)10 - (+) 10	(-)10 - (+) 10	%
SPARKADV	PID	0	10-20	36	33	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	A32	VBAT	VBAT	VBAT	VBAT	DCV
VREF	A20	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

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PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	10-20	15-25	%
MAF	4.8-5.3	18.1-21	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	10-20	30-33	DEG

3.0L Taurus/Sable

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.5	10.5	DCV
TSS	6	0	50-65/820-900	82-99/1400-1500	88-120/1740-1900	Hz/RPM
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-6	.5-6	.5-6	.5-6	DCV
PATSIN	17	(T)	(T)	(T)	(T)	(T)
CKP (+)	21	0	410-510	810-950	1050-1820	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	0-7/85-115	0-7/85-115	0-7/85-115	0-7/85-115	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.5	10.5	DCV
TR4	50	0	0	10.5	10.5	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/.51	2.6/.48	2.6/.49	2.6/.44	DCV/IN-H2O
FRP V/FRP	63	3.7/55	3.6/54	2.8/42	2.7/40	DCV/PSI
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	300/1750	500/2550	Hz/RPM
CID	85	0	6-8	12-14	13-16	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-9	1-1.5	1.1-2.0	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	.8-1.2	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	10-20	16-30	13-50	%

MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	660-800	1440-1625	1830-1970	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Breakout Box Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	(T)	(T)	(T)	(T)	(T)
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
LFC	28	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIL	30	(T)	(T)	(T)	(T)	(T)
PATSTRT	44	(T)	(T)	(T)	(T)	(T)
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-40	10.4-11.8/ 36-50	DCV/%
CTO	48	0	35-50	65-78	91-105	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	11/42	.4/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	3.8-4.7	3.9-8	3-9	mS
INJ3	74	0	3.8-4.7	3.9-8	3-9	mS
INJ1	75	0	3.8-4.7	3.9-8	3-9	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	3.6/75	.1/100	.1/100	.1/100	DCV/%
EPC (AX4N)	81	7.4/15	10.6/40	8.5/15	9.7/42	DCV/PSI
EPC (AX4S)	81	7.4/15	9/15	9.4/17	10.7/40	DCV/PSI
IAC	83	VBAT/0	8.4/40	7.5-10/40- 60	8.8-10.5/40- 57	DCV/%
HTR11	93	VBAT/OFF	SWITCH	SWITCH	SWITCH	DCV/OFF-ON
HTR21	94	VBAT/OFF	SWITCH	SWITCH	SWITCH	DCV/OFF-ON
HTR12	95	VBAT/OFF	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	VBAT/OFF	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	3.8-4.7	3.9-8	3-9	mS

INJ4	100	0	3.8-4.7	3.9-8	3-9	mS
INJ2	101	0	3.8-4.7	3.9-8	3-9	mS
FUELPW1	PID	(L)	3.3-4.7	3.9-8	3-9	mS
FUELPW2	PID	(L)	3.3-4.7	3.9-8	3-9	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	24-30	34-42	33-46	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-25	15-22	%
MAF	4-5	11-13	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	24-30	44	DEG

3.0L Taurus Flexible Fuel

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.7	10.7	DCV
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
TSS	6	0	40-65/ 650-850	72-98/ 1190-1430	88-118/ 1950-2200	Hz/RPM
FEPS	13	.5-6	.5-6	.5-6	.5-6	DCV
PATSIN	17	(T)	(T)	(T)	(T)	(T)
CKP (+)	21	0	510-540	810-930	1050-1820	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/LOW-HIGH
FFS	34	40-60 (O)	40-60 (O)	40-60 (O)	40-60 (O)	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.7	10.7	DCV
TR4	50	0	0	10.7	10.7	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
FRP V/FRP	63	2.3/33	4.1/60	2.8/39	2.7/40	
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CID	85	0	6-8	11-13	14-17	Hz
OSS	84	0	0	270/1500	506/2550	Hz/RPM
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-1	.9-1.9	1.5-2.5	DCV
TP V	89	.53-1.27	.53-1.27	1-1.2	1-1.4	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON

GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	10-20	18-28	19-36	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	840-900	1560-1750	1830-1990	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	(T)	(T)	(T)	(T)	(T)
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
LFC	28	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIL	30	(T)	(T)	(T)	(T)	(T)
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-40	10-VBAT/ 0- 50	DCV/%
CTO	48	0	42-50	65-78	91-105	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	VBAT/	.4/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	2.3-2.8	2.5-6	3.3-7	mS
INJ3	74	0	2.3-2.8	2.5-6	3.3-7	mS
INJ1	75	0	2.3-2.8	2.5-6	3.3-7	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	3.6/0	1.7/36	1.2/70	.9/100	DCV/%
EPC (AX4N)	81	7.4/15	8/15	8.5/15	9.7/42	DCV/PSI
EPC (AX4S)	81	6-8/12-18	10-11/38-42	9-10/26-30	9.8-11.2/38- 42	DCV/PSI
IAC	83	VBAT/0	9.5-10.6/28- 45	7.1-10/40-60	9.1-10.5/40- 50	DCV/%
HTR11	93	.1/ON (P)	switching	switching	switching	DCV/OFF-ON
HTR12	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	95	.2/ON (P)	switching	switching	switching	DCV/OFF-ON

HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	2.3-2.8	2.5-6	3.3-7	mS
PATSTRT	44	(T)	(T)	(T)	(T)	(T)
INJ4	100	0	2.3-2.8	2.5-6	3.3-7	mS
INJ2	101	0	2.3-2.8	2.5-6	3.3-7	mS
FUELPW1	PID	(L)	2.3-2.8	2.5-6	3.3-7	mS
FUELPW2	PID	(L)	2.3-2.8	2.5-6	3.3-7	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	24-34	34-45	33-43	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	10-30	10-30	%
MAF	4.3-4.8	11.3-13.2	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	10-12	30-39	DEG

3.0L 4V Taurus/Sable

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
AIR M	5	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FLI V/FLI	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
PATSIN	17	(T)	(T)	(T)	(T)	(T)
CKP (+)	21	0	390-520	850-1120	1140-1220	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
TR1	34	0	0	10.7	10.7	DCV
02S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
FPM	40	0-7/85-115	0-7/85-115	0-7/85-115	0-7/85-115	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.7	10.7	DCV
TR4	50	0	0	10.7	10.7	DCV
KS1	57	0	0	0	0	DCV
TSS	58	0	43/700	85-105/ 1480-1570	110-125/ 1690-2000	Hz/RPM
02S11	60	0	switching (C)	switching (C)	switching (C)	DCV
02S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/.41	2.6/.41	2.6/.41	2.6/.41	DCV/IN-H2O
FRP V/FRP	63	3.15/46	2.74/39	2.88/41	2.86/40	DCV/OFF-ON
TR V/TR	64	4.4/PARK	4.4/PARK	2.1/OD	2.1/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	300/1650	506/2600	Hz/RPM
CID	85	0	5-7	10-13	14-17	Hz
ACP V/ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
02S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.5-.7	.7-1.5	1.3-2	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	1-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON

CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
IAT	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	15-20	20-35	15-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	700-730	1350-1650	1800-2060	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDD	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
SS2	11	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
PATSOUT	18	(T)	(T)	(T)	(T)	(T)
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDE	27	VBAT	VBAT	VBAT	VBAT	DCV
LFC	28	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIL	30	(T)	(T)	(T)	(T)	(T)
IMRC	42	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSTRT	44	(T)	(T)	(T)	(T)	(T)
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-50	9.5-VBAT/ 0-60	DCV/%
CTO	48	0	33-45	75-85	92-120	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDF	53	VBAT	VBAT	VBAT	VBAT	DCV
SS3	20	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	.2/100	.2/100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz/RPM
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	2.2-2.7	2.3-5.5	2-7	mS
INJ3	74	0	2.2-2.7	2.3-5.5	2-7	mS
INJ1	75	0	2.2-2.7	2.3-5.5	2-7	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV

FP	80	3.6/75	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.5/15	9/15	8.9-10.1/ 16-25	9.2/27	DCV/%
IAC	83	VBAT/0	9.8-11.2/25-35	7.5-10/30-55	7.2-8.0/50-59	DCV/%
HTR11	93	VBAT/OFF	switching	switching	switching	DCV/OFF-ON
HTR21	94	VBAT/OFF	switching	switching	switching	DCV/OFF-ON
HTR12	95	VBAT/OFF	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	VBAT/OFF	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	2.2-2.7	2.3-5.5	2-7	mS
INJ4	100	0	2.2-2.7	2.3-5.5	2-7	mS
INJ2	101	0	2.2-2.7	2.3-5.5	2-7	mS
FUELPW1	PID	(L)	2.2-3.4	2.3-5.5	2-7	mS
FUELPW2	PID	(L)	2.2-3.3	2.3-5.5	2-7	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	12-27	25-42	20-40	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	30-34	30-40	%
MAF	3.5-4	12-14	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%

3.8L Mustang (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR 1	3	0	0	11.5	11.5	DCV
AIRM (gs)	5	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	390-450	650-700	875-1000	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
CHT	66	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR 2	49	0	0	11.5	11.5	DCV
TR 4	50	0	0	11.5	11.5	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRP V/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PST
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	115-125/1150-1300	240/2400	Hz/RPM
CID	85	0	5-7	9-11	10-15	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.8-1.6	1.1-2.3	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.8-1.2	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI	PID	50	50	50	50	%

GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	10-20	16-36	25-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	700-730	1000-1200	1500-1700	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
LFC	45	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-40	10.4-VBAT/ 35-45	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.2/100	VBAT/0	11.1-VBAT/ 0-45	.2/95-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
AIR (gs)	70	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	3.8-4.9	5.3-10.1	6.5-12	mS
INJ3	74	0	3.8-4.9	5.3-10.1	6.5-12	mS
INJ1	75	0	3.8-4.9	5.3-10.1	6.5-12	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	3.7/75	1.2/26	1.2/26	1.2/26	DCV/%
EPC	81	7/8	9/8	9-9.8/12-22	9-10.7/18-22	DCV/PSI
IAC	83	VBAT/0	9.1-10.7/34- 39	8.3-10.1/44- 73	6.7-10/50-75	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	3.8-4.9	5.3-10.1	6.5-12	mS
INJ4	100	0	3.8-4.9	5.3-10.1	6.5-12	mS
INJ2	101	0	3.8-4.9	5.3-10.1	6.5-12	mS
FUELPW1	PID	(L)	3.8-4.9	5.3-10.1	6.5-12	mS

FUELPW2	PID	(L)	3.8-4.9	5.3-10.1	6.5-12	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	17-23	30-40	31-40	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-22	15-20	%
MAF	3.4-3.9	14.9-15.4	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	17-20	28-35	DEG

3.8L Mustang (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
AIRM (gs)	5	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	390-450	650-700	875-1000	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
CHT	66	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRP V/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PSI
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	115-125/ 1150-1300	200-250/ 1950-2500	Hz/RPM
CID	85	0	5-7	9-11	10-15	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.8-1.6	1.1-2.3	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.8-1.2	DCV
EFTA	PID	50-120	50-120	50-120	50-120	DCV/DEG
FLI	PID	50	50	50	50	%
LOAD	PID	(L)	10-20	16-36	25-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	700-780	1000-1200	1500-1700	RPM
VSS (+)	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	

CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
LFC	45	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/0-40	10-VBAT/35-45	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
AIR (gs)	70	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	3.8-4.9	5.3-10.1	6.5-12	mS
INJ3	74	0	3.8-4.9	5.3-10.1	6.5-12	mS
INJ1	75	0	3.8-4.9	5.3-10.1	6.5-12	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	3.7/75	1.8/36	1.8/36	1.8/36	DCV/%
IAC	83	VBAT/0	10.7/34	8.0-10.1/44-73	6.7-10/40-75	DCV/%
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	3.8-4.9	5.3-10.1	6.5-12	mS
INJ4	100	0	3.8-4.9	5.3-10.1	6.5-12	mS
INJ2	101	0	3.8-4.9	5.3-10.1	6.5-12	mS
FUELPW1	PID	(L)	3.8-4.9	5.3-10.1	6.5-12	mS
FUELPW2	PID	(L)	3.8-4.9	5.3-10.1	6.5-12	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	17-23	30-40	20-40	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-22	15-20	%
MAF	3.9-4.8	16-19	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	17-23	35-37	DEG

4.6L 2V Mustang (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.1	.1	.1	.1	DCV
CKP (+)	21	0	390-450	650-760	980-1020	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR 1	34	0	0	11.5	11.5	DCV
02S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR 2	49	0	0	11.5	11.5	DCV
TR 4	50	0	0	11.5	11.5	DCV
02S11	60	0	switching (C)	switching (C)	switching (C)	DCV
02S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/5-1.4	2.6/5-1.4	2.6/5-1.4	2.6/5-1.4	DCV/IN-H20
FRP V/FRP	63	3.35/50	3/43	2.8/39	2.8/39	DCV/PSI
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	135-141/ 1385-1420	240-255/ 2400-2500	Hz/RPM
CID	85	0	5-7	10-12	12-16	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
02S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-9	.8-1.2	1.4-1.9	DCV
TP V	89	.53-1.27	.53-1.27	1-1.2	1.2-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
EFTA	PID	120-50 (K)	120-50 (K)	120-50 (K)	120-50 (K)	DEG
FLI	PID	50	50	50	50	%
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	10-20	16-30	20-30	%

MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	660-700	1200-1300	1700-1740	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
LFC	19	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10-VBAT/0- 40	9.8-10.7/44- 50	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.1/100	VBAT/0	VBAT/0	.2/95-100	DCV/%
EVAPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	.1/ON	VBAT/OFF (A)	.1/ON	.1/ON	DCV/OFF-ON
INJ7	72	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ5	73	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ3	74	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ1	75	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	3.7/75	1.3/28	1.3/28	1.3/28	DCV
FP	80	3.7/75	1.3/28	1.3/28	1.3/28	DCV/%
EPC	81	7.6/20	9-9.5/15-20	9-9.8/40	9-9.8/40	DCV/PSI
IAC	83	VBAT/0	10/30	9/45	9/41	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ6	99	0	3.5-3.7	3.8-5.5	4.9-9.6	mS

INJ4	100	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ2	101	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.5-3.7	3.8-5.5	4.9-9.6	mS
FUELPW2	PID	(L)	3.5-3.7	3.8-5.5	4.9-9.6	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	29-38	34-41	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	15-26	15-24	%
MAF	4.7-6	16-19	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	17-20	30	DEG

4.6L 2V Mustang (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.1	.1	.1	.1	DCV
CKP (+)	21	0	390-450	650-750	970-1030	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRPV/FRP	63	3.35/50	3/43	2.8/3.9	2.8/3.9	DCV/PSI
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	135/1385	240-2500	Hz/RPM
CID	85	0	5-7	10-12	12-16	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-9	.8-1.3	1.2-2	DCV
TP V	89	.53-1.27	.53-1.27	1-1.2	1.2-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI	PID	50	50	50	50	%
LOAD	PID	(L)	10-20	16-30	20-30	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	660-700	1200/1300	1690-1750	RPM
VSS	PID	0	0	30	55	MPH

Actuators/	PCM Pin/PID	Measured/PID Values				Units

Outputs	only	KOEO	Hot Idle	30 MPH	55 MPH	Measured/PID
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
LFC	19	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	VBAT/0	9.8-10.7/44-50	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
INJ7	72	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ5	73	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ3	74	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ1	75	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	3.7/75	1.3/28	1.3/28	1.3/28	DCV/%
IAC	83	VBAT/0	9/38	9/45	9/41	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ6	99	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ4	100	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ2	101	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.5-3.7	3.8-5.5	4.9-9.6	mS
FUELPW2	PID	(L)	3.5-3.7	3.8-5.5	4.9-9.6	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	28-39	35-42	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	15-26	15-24	%
MAF	4.7-6	16-19	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	10	27	DEG

4.6L 4V Mustang

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-6	.5-6	.5-6	.5-6	DCV
CKP (+)	21	0	360-420	680-800	860-950	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	2.5-7.5/87-110	2.5-7.5/87-110	2.5-7.5/87-110	2.5-7.5/87-110	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS1	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP (gs)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRP V/FRP	63	3.3/40	2.8/39	2.8/39	2.8/39	DCV/PSI
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	270/1365	470/2440	Hz/RPM
CID	85	0	5-7	9-12	11-14	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.5-8	.8-1.3	1.2-1.7	DCV
TP V	89	.53-1.27	.53-1.27	.9-1.2	1-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
KS2	102	0	0	0	0	DCV
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI	PID	50	50	50	50	%
LOAD	PID	(L)	10-20	16-30	20-30	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	630-750	1180-1360	1530-1750	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
LFC	19	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-40	10.6-VBAT/ 0-40	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	.1/ON	VBAT/OFF (A)	.1/ON	.1/ON	DCV/OFF-ON
INJ7	72	0	2.4-2.8	1.6-5	3.3-6	mS
INJ5	73	0	2.4-2.8	1.6-5	3.3-6	mS
INJ3	74	0	2.4-2.8	1.6-5	3.3-6	mS
INJ1	75	0	2.4-2.8	1.6-5	3.3-6	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	3.6/75	1.2/24	1.2/24	1.2/24	DCV/%
IAC	83	VBAT/0	10.3/35	8.7-9/34-46	8-9/34-54	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	2.4-2.8	1.6-5	3.3-6	mS
INJ6	99	0	2.4-2.8	1.6-5	3.3-6	mS
INJ4	100	0	2.4-2.8	1.6-5	3.3-6	mS
INJ2	101	0	2.4-2.8	1.6-5	3.3-6	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	2.4-2.8	1.6-5	3.3-6	mS
FUELPW2	PID	(L)	2.4-2.8	1.6-5	3.3-6	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%

SPARKADV	PID	0	11-15	17-32	19-34	DEG
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Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	23-35	17-23	%
MAF	4.3-5.3	15-18	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	11-15	30	DEG

4.6L Crown Victoria/Grand Marquis

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	440-490	560-780	900-1100	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR 1	34	0	0	11.5	11.5	DCV
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR 2	49	0	0	11.5	11.5	DCV
TR 4	50	0	0	11.5	11.5	DCV
VSS (+)	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	126-136/ 1260-1330	225-243/ 2265-2400	Hz/RPM
CID	85	0	6-7	10-11	13-14	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.9-1.5	1.4-2.1	DCV
TP V	89	.53-1.27	.53-1.27	1-1.2	1-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	15-19	20-26	23-28	%

MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	790-815	1250-1400	1540-1620	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCIL	12	5/OFF	5/OFF	5/OFF	5/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
LFC	28	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CHTIL	45	4.7/OFF	4.7/OFF	4.7/OFF	4.7/OFF	DCV/OFF-ON
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-40	8-11.3/ 39- 50	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.2/100	VBAT/0	9.9-10.1/42- 44	.3/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	VBAT/OFF	.1 /ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3.4-3.7	3.7-6	5.5-9	mS
INJ5	73	0	3.4-3.7	3.7-6	5.5-9	mS
INJ3	74	0	3.4-3.7	3.7-6	5.5-9	mS
INJ1	75	0	3.4-3.7	3.7-6	5.5-9	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.9/20	9.5/20	9.3/22	9.5/22	DCV/PSI
IAC	83	VBAT/0	9.2-10.3/32- 36	8.3-10.7/30- 55	5.7-8/40-70	DCV/%
HTR11	93	.1/ON (P)	SWITCH	SWITCH	SWITCH	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	SWITCH	SWITCH	SWITCH	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.4-3.7	3.7-6	5.5-9	mS

INJ6	99	0	3.4-3.7	3.7-6	5.5-9	mS
INJ4	100	0	3.4-3.7	3.7-6	5.5-9	mS
INJ2	101	0	3.4-3.7	3.7-6	5.5-9	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.4-3.7	3.7-6	5.5-9	mS
FUELPW2	PID	(L)	3.4-3.7	3.7-6	5.5-9	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	20-35	32-38	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	19-24	19-24	%
MAF	4.7-6	13-16	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-20	40	DEG

4.6L NG Crown Victoria

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	440-490	580-770	850-1100	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FSVM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
VSS (+)	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
EFTA V/EFT A	62	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FRP V/FRP	63	2.7-3.7/ 105-130	2.7-3.7/ 105-130	2.7-3.7/ 100-130	2.7-3.7/ 105-130	DCV/PSI
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	95-110/ 950-1100	175-190/ 1750-1915	Hz/RPM
CID	85	0	6-7	8-10	11-17.5	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.9-1.5	1.2-2.1	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.9-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	15-19	22-30	31-46	%

MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
RPM	PID	0	790-825	925-1125	1320-1395	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
LFC	28	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CHTIL	45	3.5/OFF	3.5/OFF	3.5/OFF	3.5/OFF	DCV/OFF-ON
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	9.7-VBAT/ 0-40	8-VBAT/ 0- 50	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.2/100	VBAT/0	9-VBAT/ 0- 50	.2-10/80- 100	DCV/%
WAC	69	VBAT/OFF	.1 /ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3.9-5.2	4.7-12	4.7-12.2	mS
INJ5	73	0	3.9-5.2	4.7-12	4.7-12.2	mS
INJ3	74	0	3.9-5.2	4.7-12	4.7-12.2	mS
INJ1	75	0	3.9-5.2	4.7-12	4.7-12.2	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FSV	80	VBAT/OFF	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
EPC	81	7.9/20	9.5/20	9/18	9.5/25	DCV/PSI
IAC	83	VBAT/0	8-9.5/32- 46	8.3-10.7/30- 55	5.7-8/40-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON(P)	.1/ON(P)	.1/ON(P)	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON(P)	.1/ON(P)	.1/ON(P)	DCV/OFF-ON
INJ8	98	0	3.9-5.2	4.7-12	4.7-12.2	mS
INJ6	99	0	3.9-5.2	4.7-12	4.7-12.2	mS
INJ4	100	0	3.9-5.2	4.7-12	4.7-12.2	mS
INJ2	101	0	3.9-5.2	4.7-12	4.7-12.2	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.5-5.2	4.7-12	4.7-12.2	mS
FUELPW2	PID	(L)	3.5-5.2	4.7-12	4.7-12.2	mS

LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)15-(+)15	(-)15-(+)15	(-)15-(+)15	%
SHRTFT2	PID	(L)	(-)15-(+)15	(-)15-(+)15	(-)15-(+)15	%
SPARKADV	PID	0	4-9	20-31	20-28	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	27-35	25-30	%
MAF	6.5-7.3	17-19.5	G/S
SHRTFT1	(-)15-(+)15	(-)15-(+)15	%
SHRTFT2	(-)15-(+)15	(-)15-(+)15	%
SHRTFT11	(-)15-(+)15	(-)15-(+)15	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)15-(+)15	(-)15-(+)15	%
SHRTFT22	95-100	95-100	%
SPARKADV	4-9	16-25	DEG

4.6L Continental

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	330-420	800-850	990-1100	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/LOW-HIGH
TR1	34	0	0	10.7	10.7	DCV
O2S12	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FP M	40	0-7/100	0-7/100	0-7/100	0-7/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.7	10.7	DCV
TR4	50	0	0	10.7	10.7	DCV
KS1	57	0	0	0	0	DCV
TSS	59	0	40-45/645-680	85-105/1350-1520	110-118/1600-1765	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRP V/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PSI
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CID	85	0	4-6	10-13	12-16	Hz
ACP	86	.6/30	.6/30	.6/28	.5/24	DCV/PSI
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.5-.8	.8-1.6	1.1-1.9	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.8-1.2	DCV
KS2	102	0	0	0	0	DCV
BPP	PID	OFF	ON (E)	OFF	OFF	OFF-ON
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	10-20	16-36	23-33	%

MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	695-760	1350-1440	1700-1820	RPM
TRAC	PID	ON	ON	ON	ON	OFF-ON
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
SS2	11	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
SS3	20	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
LFC	28	VBAT/OFF	.1 /ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-40	10.2-VBAT/ 35-55	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	VBAT/0	.2/95-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	2.8-2.9	2.9-5.5	4.5-8	mS
INJ5	73	0	2.8-2.9	2.9-5.5	4.5-8	mS
INJ3	74	0	2.8-2.9	2.9-5.5	4.5-8	mS
INJ1	75	0	2.8-2.9	2.9-5.5	4.5-8	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	3.6/75	1.5-1.7/27- 33	1.5/31	1.5-1.7/33	DCV/%
EPC	81	7.5-8/14- 17	8.2-9.5/15- 18	9-9.8/12-16	10.1-10.7/ 18-27	DCV/PSI
IAC	83	VBAT/0	10-10.6/28- 30	8-10.1/44-55	5-8.5/51-75	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON

HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	2.8-2.9	2.9-5.5	4.5-8	mS
INJ6	99	0	2.8-2.9	2.9-5.5	4.5-8	mS
INJ4	100	0	2.8-2.9	2.9-5.5	4.5-8	mS
INJ2	101	0	2.8-2.9	2.9-5.5	4.5-8	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	2.8-2.9	2.9-5.5	4.5-8	mS
FUELPW2	PID	(L)	2.8-2.9	2.9-5.5	4.5-8	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	8-10	35-45	30-45	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	18-27	13-20	%
MAF	5.1-5.5	14-17.5	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	10-12	37-39	DEG

4.6L Town Car

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.1	.1	.1	.1	DCV
CKP (+)	21	0	440-490	680-700	870-900	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/ON-OFF
ACCS	41	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	116/1200	216/2130	Hz/RPM
CID	85	0	6-7	9.5-10.5	12-14	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-9	.9-1.3	1.3-2	DCV
TP V	89	.53-1.27	.53-1.27	1-1.2	1-1.4	DCV
BPP	PID	OFF	ON (E)	OFF	OFF	OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
FLI	PID	50	50	50	50	%
ECT	PID	160-200	160-200	160-200	160-200	DEG
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	12-18	17-23	24-28	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD

RPM	PID	0	790-815	1150-1250	1480-1600	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
LFC	28	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.2-VBAT/ 0-40	9-10.5/38- 57	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.2/100	VBAT/0	10.1-10.6/ 40-47	.2/100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3.3-3.5	3.7-5.5	5.6-10	mS
INJ5	73	0	3.3-3.5	3.7-5.5	5.6-10	mS
INJ3	74	0	3.3-3.5	3.7-5.5	5.6-10	mS
INJ1	75	0	3.3-3.5	3.7-5.5	5.6-10	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.9/20	9.5/20	9.1/18	9.5/30	DCV/PSI
IAC	83	VBAT/0	9.2-10.7/29- 36	8.5-9/42-47	6.6-8.8/52- 65	DCV/%
HTR11	93	.1/ON (P)	.1/ON (P)	.1/ON (P)	.1/ON (P)	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON (P)	.2/ON (P)	.2/ON (P)	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.3-3.5	3.7-5.5	5.6-10	mS
INJ6	99	0	3.3-3.5	3.7-5.5	5.6-10	mS
INJ4	100	0	3.3-3.5	3.7-5.5	5.6-10	mS
INJ2	101	0	3.3-3.5	3.7-5.5	5.6-10	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON

FUELPW1	PID	(L)	3.3-3.5	3.7-5.5	5.6-10	mS
FUELPW2	PID	(L)	3.3-3.5	3.7-5.5	5.6-10	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	18-24	33-36	32-38	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	19-24	19-24	%
MAF	4.7-6	16-19	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	18-24	38	DEG

2.0L 4V Escape (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-6	.5-6	.5-6	.5-6	DCV
CKP (+)	21	0	470-550	985-1210	1350-1450	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
O2S12	35	.1	(D)	(D)	(D)	DCV
CHT V/CHT	38	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
IAT	39	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	53	VBAT	VBAT	VBAT	VBAT	DCV
KS	57	0	0	0	0	DCV
VSS	58	0	0	65/30	125/55	Hz/MPH
GLI	59	10	10	10	10	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6.0	2.6/0	DCV/IIN-H2O
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CID	85	0	5-7	11-15	17-21	Hz
ACP V/ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN- CLOSED
MAF V	88	0	.6-9	1-1.7	1.2-2.5	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-2	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG
FLI	PID	50	50	50	50	%
LOAD	PID	(L)	10-20	19-30	35-44	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	800-900	1700-1780	2380-2440	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	19	1	1	1	1	DCV
INJ3	20	0	2.5-3	3.3-5.2	4.6-6.5	mS
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSTRT	27	0	0	0	0	DCV
VSO	28	0	0	65	125	Hz
MFC	43	.1	VBAT (B)	.1	.1	DCV
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV/%
FP	54	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EVAPPDC	56	0	0-10/0- 100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0- 100	0-10/0-100	0-10/0-100	DVC/OFF-ON
LFC	68	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ1	70	0	2.5-3	3.3-5.2	4.6-6.5	mS
GENFDC	72	100/60	0	0	0	Hz/%
EGRVR	79	VBAT/0	VBAT/0	11.8/36	11/51	DCV/%
IAC	83	VBAT/0	11.5/26	7.5-10/40- 55	7-10/40-60	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ4	95	0	2.5-3	3.3-5.2	4.6-6.5	mS
INJ2	96	0	2.5-3	3.3-5.2	4.6-6.5	mS
HTR12	100	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUEL PW1	PID	(L)	2.5-3	3.3-5.2	4.6-6.5	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+) 10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	10-20	30-45	25-36	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	10-15	15-20	%
MAF	2.6-4.8	8-15	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	10-20	40	DEG

3.0L 4V Escape (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-6	.5-6	.5-6	.5-6	DCV
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	390-450	850-1050	1100-1200	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/LOW-HIGH
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS	57	0	0	0	0	DCV
TSS	59	0	45-50/700-765	90-100/1450-1500	110-120/1700-1800	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	.1	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6.0	2.6/0	DCV/IN-H2O
TR V/TR	64	4.4/PARK	4.4/PARK	2.1/OD	2.1/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	400/1450	700-740/2550-2700	HZ/RPM
CID	85	0	5-7	12-15	14-16	Hz
ACP V/ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.7-1.5	1.3-2	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	1-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
FLI	PID	50	50	50	50	%
GEAR	PID	1	1	3	4	GEAR

LOAD	PID	(L)	15-20	25-35	35-50	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	730-750	1550-1650	1800-2000	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDD	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
SS2	11	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	11.2	12	12	12	DCV
SS3	20	VBAT/OFF	8.8/OFF	8.8/OFF	8.8/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDE	27	VBAT	VBAT	VBAT	VBAT	DCV
LFC	28	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MFC	42	VBAT	.1 (B)	VBAT	VBAT	DCV
PATSTRT	44	0	0	0	0	DCV
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-50	9.5-VBAT/0- 60	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDF	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	.2/100	.2/100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	DVC/OFF-ON
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	2.6-3.2	2.5-5.5	3.5-8.5	mS
INJ3	74	0	2.6-3.2	2.5-5.5	3.5-8.5	mS
INJ1	75	0	2.6-3.2	2.5-5.5	3.5-8.5	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.5/0	8.4/0	9-10/25-37	10.3-11.2/ 42-51	DCV/PSI
IAC	83	VBAT/0	9.8-10.5/25- 35	7.5-10/30- 55	6-8/50-79	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON

HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	2.6-3.2	2.5-5.5	3.5-8.5	mS
INJ4	100	0	2.6-3.2	2.5-5.5	3.5-8.5	mS
INJ2	101	0	2.6-3.2	2.5-5.5	3.5-8.5	mS
FUELPW1	PID	(L)	2.6-3.2	2.5-5.5	3.5-8.5	mS
FUELPW2	PID	(L)	2.6-3.2	2.5-5.5	3.5-8.5	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	36-44	30-40	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	27-35	25-29	%
MAF	3.7-5.3	11-16	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-20	41	DEG

2.3L Ranger (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.5	10.5	DCV
TSS	6	0	92/682	211/1600	290/2150	Hz/RPM
SCVM	8	.1	.1	.1	.1	DCV
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	390-450	850-1000	1220-1500	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HI (I)	.1/LOW	.1/LOW	DCV/LOW-HI
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.5	10.5	DCV
TR4	50	0	0	10.5	10.5	DCV
KS1	57	0	0	0	0	DCV
ISS	59	0	623	1480	1980	Hz
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
MAP	63	4	1.7	3	3.5	DCV
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	213/1600	385/2860	Hz/RPM
CID	85	0	6-8	12-15	12-18	Hz
ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
MAF V	88	0	.6-1	.8-1.6	1.5-2.8	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON

ECT	PID	160-200	160-200	160-200	160-200	DEG
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	10-20	16-36	35-60	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
RPM	PID	0	800-950	1400-1700	1930-2150	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	1	1	1	1	DCV
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS4	28	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
PATSIL	30	0	0	0	0	DCV
IMSC	42	.2	.2	.2	.2	DCV
PATSTRT	44	0	0	0	0	DCV
THTRC	46	VBAT	VBAT	VBAT	VBAT	DCV
CTO	48	0	23-35	50-60	60-74	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	VBAT/0	.2/95-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRMC 3	72	VBAT	VBAT	VBAT	VBAT	DCV
EGRMC 1	73	VBAT	VBAT	VBAT	VBAT	DCV
INJ3	74	0	3-4.5	5.3-10.1	10.1-18	mS
INJ1	75	0	3-4.5	5.3-10.1	10.1-18	mS
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	9/35	10/35	9.1/20	9.8/32	DCV/PSI
CFCIL	82	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
IAC	83	VBAT/0	10/38	6-7/50-60	5-6/60-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
EGRMC 4	98	VBAT	.2	.2	.2	DCV
EGRMC 2	99	VBAT	.2	.2	.2	DCV

INJ4	100	0	3-4.5	5.3-10.1	10.1-18	mS
INJ2	101	0	3-4.5	5.3-10.1	10.1-18	mS
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
EGRMDS	PID	60	3	3-31	3-31	STEPS
FUELPW1	PID	(L)	3-4.5	5.3-10.1	10.1-18	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	7-8	25-35	15-30	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	18-26	17-20	%
MAF	2.7-3.5	9-10.7	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	7-8	29-31	DEG

2.3L Ranger (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SCVM	8	.1	.1	.1	.1	DCV
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	390-450	850-1000	1220-1500	Hz
PSP V/PSP	31	.1/LOW	VBAT/HI (I)	.1/LOW	.1/LOW	DCV/LOW-HI
O2S12	35	.1	(D)	(D)	(D)	DCV
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS1	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
MAP	63	4	1.7	3	3.5	DCV
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/MODE
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	213/1600	385/2860	Hz/RPM
CID	85	0	6-8	12-15	12-18	Hz
ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
MAF V	88	0	.6-1	.8-1.6	1.5-2.8	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG
LOAD	PID	(L)	10-20	16-36	35-60	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
RPM	PID	0	800-950	1400-1700	1930-2150	RPM
VSS	PID	0	0	30	55	MPH

Actuators/	PCM Pin/PID	Measured/PID Values				Units

Outputs	only	KOEO	Hot Idle	30 MPH	55 MPH	Measured/PID
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	1	1	1	1	DCV
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSIL	30	0	0	0	0	DCV
IMSC	42	.2	.2	.2	.2	DCV
PATSTRT	44	0	0	0	0	DCV
THTRC	46	VBAT	VBAT	VBAT	VBAT	DCV
CTO	48	0	23-35	50-60	60-74	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRMC 3	72	VBAT	VBAT	VBAT	VBAT	DCV
EGRMC 1	73	VBAT	VBAT	VBAT	VBAT	DCV
INJ3	74	0	3-4.5	5.3-10.1	10.1-18	mS
INJ1	75	0	3-4.5	5.3-10.1	10.1-18	mS
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
CFCIL	82	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
IAC	83	VBAT/0	10/38	6-7/50-60	5-6/60-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
EGRMC 4	98	VBAT	.2	.2	.2	DCV
EGRMC 2	99	VBAT	.2	.2	.2	DCV
INJ4	100	0	3-4.5	5.3-10.1	10.1-18	mS
INJ2	101	0	3-4.5	5.3-10.1	10.1-18	mS
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
EGRMDS	PID	60	3	3-31	3-31	STEPS
FUELPW1	PID	(L)	3-4.5	5.3-10.1	10.1-18	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	7-8	25-35	15-30	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	18-26	17-20	%
MAF	2.7-3.5	9-10.7	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	7-8	29-31	DEG

2.5L Ranger (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	11.5	11.5	DCV
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	450-600	800-950	1220-1500	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HI (I)	.1/LOW	.1/LOW	DCV/LOW-HI
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
VSS (+)	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
TSS	84	0	120-125/ 900-950	160-185/ 1250-1425	260-280/ 1925-2070	Hz/RPM
CID	85	0	6-8	11-14	12-18	Hz
ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
MAF V	88	0	.6-1	.8-1.6	1.5-2.8	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	10-20	16-36	35-50	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
RPM	PID	0	800-950	1400-1630	2100-2200	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CCS	28	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-40	10-VBAT/ 0- 50	DCV/%
CTO	48	0	23-35	50-55	60-74	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	VBAT/0	.2-4/80-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	VBAT/OFF	.1/ ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ3	74	0	3-4.5	5.3-10.1	10.1-18	mS
INJ1	75	0	3-4.5	5.3-10.1	10.1-18	mS
CDA	78	VBAT	VBAT	VBAT	VBAT	DCV
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	8.3/25	10/25	10/27	10-11.7/ 26- 30	DCV/PSI
IAC	83	VBAT/0	9.8/40	10-10.8/42- 48	9.7-10.2/45- 52	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ4	100	0	3-4.5	5.3-10.1	10.1-18	mS
INJ2	101	0	3-4.5	5.3-10.1	10.1-18	mS
CDBA	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3-4.5	5.3-10.1	10.1-18	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	7-8	25-35	15-30	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV

VREF	90	5	5	5	5	DCV
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NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	22-26	17-20	%
MAF	2.7-3.5	9-10.7	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	7-8	29-31	DEG

2.5L Ranger (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	450-600	800-950	1220-1500	Hz
PSP V/PSP	31	.1/LOW	VBAT/HI (I)	.1/LOW	.1/LOW	DCV/LOW-HI
2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
VSS (+)	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CID	85	0	5-7	9-11	15-22	Hz
ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
MAF V	88	0	.6-1	.8-1.6	1.5-2.8	DCV
TP V	89	.53-1.27	.53-1.27	.9-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
LOAD	PID	(L)	10-20	16-36	35-50	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
RPM	PID	0	800-950	1350-1500	2100-2200	RPM

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
EGRVR	47	VBAT/0	VBAT/0	10.9-VBAT/0-40	10-VBAT/0-50	DCV/%
CTO	48	0	23-35	50-55	60-74	Hz

CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ3	74	0	3-4.5	5.3-10.1	10.1-18	mS
INJ1	75	0	3-4.5	5.3-10.1	10.1-18	mS
CDA A	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
IAC	83	VBAT/0	9.8/40	9.7-10.8/30-55	8.7-10.2/45-63	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ4	100	0	3-4.5	5.3-10.1	10.1-18	mS
INJ2	101	0	3-4.5	5.3-10.1	10.1-18	mS
CDBA	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3-4.5	5.3-10.1	10.1-18	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	7-8	20-33	15-30	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	22-26	17-19	%
MAF	2.7-3.5	9-10.7	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	7-8	29-31	DEG

3.0L Ranger (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	11.5	11.5	DCV
TSS	6	0	115-120/ 870-920	140-190/ 1000-1400	268-275/ 2010-2080	Hz/MPH
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	460-480	800-855	1180-1230	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
ISS	59	0	623	1480	1980	Hz
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TRV/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	290/1435	530/2640	Hz/RPM
CID	85	0	6-8	13-15	17-19	Hz
ACP V/ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN- CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.8-1.1	1.4-1.7	2-2.5	DCV
TP V	89	.53-1.27	.53-1.27	1-1.2	1.2-1.7	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	4	4	GEAR

LOAD	PID	(L)	17-21	23-27	35-40	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	880-920	1430-1550	1750-2100	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	1.1	1.1	1.1	1.1	DCV
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS4	28	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIL	30	0	0	0	0	DCV
PATSTRT	44	0	0	0	0	DCV
EGRVR	47	VBAT/0	VBAT/0	11-VBAT/ 0- 40	11-VBAT/ 0- 40	DCV/%
CTO	48	0	42-48	70-90	99-115	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	VBAT/0	.2-.3/80-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	4-4.8	6.3-8	7-13	mS
INJ3	74	0	4-4.8	6.3-8	7-13	mS
INJ1	75	0	4-4.8	6.3-8	7-13	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	8.5/35	10.2-10.9/ 35-50	10.5-11/23- 38	10-10.7/ 25- 39	DCV/PSI
CFCIL	82	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
IAC	83	VBAT/0	10.7-11.9/ 25-35	10-10.7/38- 47	8.4-10.5/40- 57	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON

INJ6	99	0	4-4.8	6.3-8	7-13	mS
INJ4	100	0	4-4.8	6.3-8	7-13	mS
INJ2	101	0	4-4.8	6.3-8	7-13	mS
FUELPW1	PID	(L)	4-4.8	6.3-8	7-13	mS
FUELPW2	PID	(L)	4-4.8	6.3-8	7-13	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	16-18	26-36	25-32	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-21	27-30	%
MAF	3.7-4.8	11.5-13	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	16-18	24	DEG

3.0L Ranger (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4 (M)	14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	460-480	800-855	1180-1230	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	290/1435	530/2640	Hz/RPM
CID	85	0	6-8	12-15	17-19	Hz
ACP V/ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.8-1.1	1.4-1.7	2-2.5	DCV
TP V	89	.53-1.27	.53-1.27	1-1.2	1.2-1.7	DCV
LOAD	PID	(L)	17-21	23-27	35-40	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	800-830	1435-1475	1900-2100	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	1.1	1.1	1.1	1.1	DCV

CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSIL	30	0	0	0	0	DCV
PATSTRT	44	0	0	0	0	DCV
EGRVR	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-40	11.5-VBAT/ 0-40	DCV/%
CTO	48	0	34-42	70-81	95-120	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	4-4.8	4.4-5.8	5.8-9.5	mS
INJ3	74	0	4-4.8	4.4-5.8	5.8-9.5	mS
INJ1	75	0	4-4.8	4.4-5.8	5.8-9.5	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
CFCIL	82	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
IAC	83	VBAT/0	10.7-11.9/ 25-35	10-10.7/ 38- 47	8.4-10.5/ 40- 57	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	4-4.8	4.4-5.8	5.8-9.5	mS
INJ4	100	0	4-4.8	4.4-5.8	5.8-9.5	mS
INJ2	101	0	4-4.8	4.4-5.8	5.8-9.5	mS
FUELPW1	PID	(L)	4-4.8	4.4-5.8	5.8-9.5	mS
FUELPW2	PID	(L)	4-4.8	4.4-5.8	5.8-9.5	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	16-18	26-36	25-32	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-21	24-27	%
MAF	3.7-4.8	13-17.5	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	16-18	24	DEG

3.0L Ranger Flexible Fuel (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	11	11	DCV
TSS	6	0	115-120/ 870-920	140-190/ 1000-1400	268-275/ 2010-2080	Hz/MPH
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	460-480	800-855	1150-1230	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11	11	DCV
TR4	50	0	0	11	11	DCV
ISS	59	0	623	1480	1980	Hz
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TRV/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	290/1435	530/2640	Hz/RPM
CID	85	0	6-8	13-15	17-19	Hz
ACP V/ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN- CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.8-1.1	1.4-1.7	2-2.5	DCV
TP V	89	.53-1.27	.53-1.27	1-1.2	1.2-1.7	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	4	5	GEAR

LOAD	PID	(L)	17-21	23-27	35-40	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	880-920	1430-1550	1750-2100	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	1.1	1.1	1.1	1.1	DCV
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS4	28	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
PATSIL	30	0	0	0	0	DCV
PATSTRT	44	0	0	0	0	DCV
EGRVR	47	VBAT/0	VBAT/0	11-VBAT/ 0- 40	11-VBAT/ 0- 40	DCV/%
CTO	48	0	42-48	70-90	99-115	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	.1/ON	VBAT/OFF	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	VBAT/0	.2-.3/80-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	4-4.8	6.3-8	7-13	mS
INJ3	74	0	4-4.8	6.3-8	7-13	mS
INJ1	75	0	4-4.8	6.3-8	7-13	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	8.5/35	10.2-10.9/ 35-50	10.5-11/23- 38	10-10.7/ 25- 39	DCV/PSI
CFCIL	82	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
IAC	83	VBAT/0	10.7-11.9/ 25-35	10-10.9/38- 47	8.4-10.5/40- 57	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON

INJ6	99	0	4-4.8	6.3-8	7-13	mS
INJ4	100	0	4-4.8	6.3-8	7-13	mS
INJ2	101	0	4-4.8	6.3-8	7-13	mS
FUELPW1	PID	(L)	4-4.8	6.3-8	7-13	mS
FUELPW2	PID	(L)	4-4.8	6.3-8	7-13	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	16-19	26-36	25-32	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-21	27-30	%
MAF	3.7-4.8	11.5-13	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	16-18	24	DEG

4.0L Ranger (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.7	10.7	DCV
TSS	6	0	100-125/ 790-860	185-205/ 1400-1475	250-280/ 1900-2090	Hz/RPM
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	430-500	870-900	1230-1300	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.7	10.7	DCV
TR4	50	0	0	10.7	10.7	DCV
KS1	57	0	0	0	0	DCV
ISS	59	0	623	1480	1980	Hz
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
TRV/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	300-1500	560-2780	RPM/Hz
CID	85	0	6-8	11-15	17-19	Hz
ACP V/ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN- CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.8-1	1.4-1.8	2-2.7	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	1.2-1.7	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON

GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	10-25	17-21	30-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	800-1000	1400-1475	1525-1880	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	0	0	0	0	DCV
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS4	28	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
PATSIL	30	0	0	0	0	DCV
PATSTRT	44	0	0	0	0	DCV
TPO	45	1.1/15	1.1/15	1.4/18	1.8/20	DCV/%
EGRVR	47	VBAT/0	VBAT/0	11-VBAT/0- 40	10-VBAT/0- 55	DCV/%
CTO	48	0	35-49	70-82	90-120	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	3.2/90	1.5/80-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	3-4.8	5.5-8	7-17	mS
INJ3	74	0	3-4.8	5.5-8	7-17	mS
INJ1	75	0	3-4.8	5.5-8	7-17	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	8.5/30	10.2/30	10.5-11/23- 45	10.1-11.1/ 34-40	DCV/PSI
CFCIL	82	VBAT	VBAT	VBAT	VBAT	DCV
IAC	83	VBAT/0	10.3/35	9.6-11/35- 41	6-8.4/57-68	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON

HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	3-4.8	5.5-8	7-17	mS
INJ4	100	0	3-4.8	5.5-8	7-17	mS
INJ2	101	0	3-4.8	5.5-8	7-17	mS
FUELPW1	PID	(L)	3-4.8	5.5-8	7-17	mS
FUELPW2	PID	(L)	3-4.8	5.5-8	7-17	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	13-17	26-35	25-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	10-25	20-24	%
MAF	3.5-5.1	13-17	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	13-17	27	DEG

4.0L Ranger (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4 (L)	14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	435-460	870-900	1225-1300	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS1	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	300/1500	560/2780	Hz
CID	85	0	6-8	11-15	16-18	Hz
ACP V/ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	1.1-1.4	1.6-2.1	DCV
TP V	89	.53-1.27	.53-1.27	1-1.2	1.2-1.5	DCV
LOAD	PID	(L)	10-25	17-21	30-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	800-1000	1400-1535	1950-2100	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	

MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	0	0	0	0	DCV
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSIL	30	0	0	0	0	DCV
PATSTRT	44	0	0	0	0	DCV
TPO	45	1.1/15	1.1/15	1.4/18	1.8/20	DCV/%
EGRVR	47	VBAT/0	VBAT/0	11-VBAT/0-40	10-VBAT/0-55	DCV/%
CTO	48	0	36-40	73-79	99-115	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPCDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	3-4.3	4.4-5.8	6-17	mS
INJ3	74	0	3-4.3	4.4-5.8	6-17	mS
INJ1	75	0	3-4.3	4.4-5.8	6-17	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
CFCIL	82	VBAT	VBAT	VBAT	VBAT	DCV
IAC	83	VBAT/0	10.9/27	9-10.6/40-45	6-10.2/45-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	3-4.3	4.4-5.8	6-17	mS
INJ4	100	0	3-4.3	4.4-5.8	6-17	mS
INJ2	101	0	3-4.3	4.4-5.8	6-17	mS
FUELPW1	PID	(L)	3-4.3	4.4-5.8	6-17	mS
FUELPW2	PID	(L)	3-4.3	4.4-5.8	6-17	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	13-17	25-35	25-40	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	10-25	20-24	%
MAF	3.5-5	13-17	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	13-17	27	DEG

3.8L Windstar

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.7	10.7	DCV
TSS	6	0	43/650	88-93/ 1320-1370	99-113/ 1660-1690	Hz/RPM
IMRCM	8	5/2.5	5/2.5	5/2.5	5/2.5	DCV
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
GFS	20	0	130/37	130/25	130/22	Hz/%
CKP (+)	21	0	390-450	740-800	950-1050	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/LOW-HIGH
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.7	10.7	DCV
TR4	50	0	0	10.7	10.7	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	260-270/ 1290-1330	475/2360	Hz/RPM
CID	85	0	5-7	10-11.5	13-15	Hz
ACP V/ACP	86	1.2/76	1/54	.8/22	.75/18	DCV/PSI
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.8	.9-1.4	1.3-2	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.3	.8-1.3	DCV
BPP	PID	OFF	ON (E)	OFF	OFF	OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON

FLI	PID	50	50	50	50	%
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	15-20	19-27	27-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	700-730	1250-1400	1700-1870	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
PATSOUT	18	10.5	VBAT	VBAT	VBAT	DCV
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
LFC	28	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIL	30	10.5	VBAT	VBAT	VBAT	DCV
IMRC	42	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSTRT	44	0	0	0	0	DCV
GENFDC	45	0	0-130 (R)	0	0	Hz/%
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-40	8.6-11.8/35- 55	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	.2/100	.2/100	DCV/%
EVAPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	3-4	4-7	6.1-11.7	mS
INJ3	74	0	3-4	4-7	6.1-11.7	mS
INJ1	75	0	3-4	4-7	6.1-11.7	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7/15	9.2/15	8-10.1/16-25	9.3/24	DCV/PSI
IAC	83	VBAT/0	9.8-11.2/25- 35	7.5-10/30-55	7.5-8.8/50- 59	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON

INJ6	99	0	3-4	4-7	6.1-11.7	mS
INJ4	100	0	3-4	4-7	6.1-11.7	mS
INJ2	101	0	3-4	4-7	6.1-11.7	mS
FUELPW1	PID	(L)	3-4	4-7	6.1-11.7	mS
FUELPW2	PID	(L)	3-4	4-7	6.1-11.7	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	25-35	27-36	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	20-24	18-21	%
MAF	4.0-4.6	14-17	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-20	28	DEG

4.0L SOHC Explorer Sport/Sport Trac (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.7	10.7	DCV
TSS	6	0	100-125/ 790-860	185-205/ 1400-1475	355/2000	Hz/RPM
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	390-430	810-870	1100-1230	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	1.7-3.5/120- 50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.7	10.7	DCV
TR4	50	0	0	10.7	10.7	DCV
KS1	57	0	0	0	0	DCV
ISS	59	0	623	1480	1980	RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TRV/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	190-1400	264-2640	RPM/Hz
CID	85	0	6-8	11-15	17-19	Hz
ACP V/ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN- CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.8-1	1.4-1.8	2-2.7	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	1.2-1.7	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON

GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	13-20	21-27	30-38	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	760-880	1400-1475	1800-2000	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	0	0	0	0	DCV
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS4	28	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
PATSIL	30	0	0	0	0	DCV
PATSTRT	44	0	0	0	0	DCV
TPO	45	1.1/15	1.1/15	1.4/18	1.8/20	DCV/%
EGRVR	47	VBAT/0	VBAT/0	11-VBAT/0- 40	10-VBAT/0- 55	DCV/%
CTO	48	0	35-49	70-82	90-120	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	3.6-4.7/84- 90	1.8/80-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	3.1-4.8	5.5-8	7-17	mS
INJ3	74	0	3.1-4.8	5.5-8	7-17	mS
INJ1	75	0	3.1-4.8	5.5-8	7-17	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	8.9-26	9.7/26	10.5-11/23- 45	10.1-11.1/ 34-40	DCV/PSI
CFCIL	82	0	0	0	0	DCV
IAC	83	VBAT/0	8.7-10.3/35- 45	8.5-11/35- 50	6-8.4/57-68	DCV/%

HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	3.1-4.8	5.5-8	7-17	mS
INJ4	100	0	3.1-4.8	5.5-8	7-17	mS
INJ2	101	0	3.1-4.8	5.5-8	7-17	mS
FUELPW1	PID	(L)	3.1-4.8	5.5-8	7-17	mS
FUELPW2	PID	(L)	3.1-4.8	5.5-8	7-17	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	11-18	26-35	19-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	22-35	30-34	%
MAF	4-5.1	13-17	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	11-18	23	DEG

4.0L SOHC Explorer Sport/Sport Trac (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	390-430	810-870	1100-1230	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS1	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	190-1400	264-2640	RPM/Hz
CID	85	0	6-8	11-15	16-18	Hz
ACP V/ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.8-1	1.4-1.8	2-2.7	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	1.2-1.7	DCV
BPP	PID	OFF	ON (E)	OFF	OFF	OFF-ON
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	13-20	21-27	30-38	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	760-880	1400-1475	1800-2000	RPM
VSS	PID	0	0	30	55	MPH

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Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	0	0	0	0	DCV
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSIL	30	0	0	0	0	DCV
PATSTRT	44	0	0	0	0	DCV
TPO	45	1.1/15	1.1/15	1.4/18	1.8/20	DCV/%
EGRVR	47	VBAT/0	VBAT/0	11-VBAT/0-40	10-VBAT/0-55	DCV/%
CTO	48	0	35-49	70-82	90-120	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	3.1-4.8	5.5-8	7-17	mS
INJ3	74	0	3.1-4.8	5.5-8	7-17	mS
INJ1	75	0	3.1-4.8	5.5-8	7-17	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
CFCIL	82	0	0	0	0	DCV
IAC	83	VBAT/0	8.7-10.3/35-45	8.5-11/35-50	6-8.4/57-68	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	3.1-4.8	5.5-8	7-17	mS
INJ4	100	0	3.1-4.8	5.5-8	7-17	mS
INJ2	101	0	3.1-4.8	5.5-8	7-17	mS
FUELPW1	PID	(L)	3.1-4.8	5.5-8	7-17	mS
FUELPW2	PID	(L)	3.1-4.8	5.5-8	7-17	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	11-18	26-35	19-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	

VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	22-35	30-34	%
MAF	4-5.1	13-17	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	11-18	23	DEG

4.0L SOHC Explorer/Mountaineer (A/T) 104 Pin

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.7	10.7	DCV
OSS	6	0	0	205/1520	355/2650	Hz/RPM
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.1	.1	.1	.1	DCV
4X4L (M)	14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
ARC	19	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
CKP (+)	21	0	375-475	800-1000	1140-1220	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.7	10.7	DCV
TR4	50	0	0	10.7	10.7	DCV
KS	57	0	0	0	0	DCV
VSS (+)	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0.1	D	D	D	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
TSS	84	0	80-90/600-650	200/1500	265/2000	Hz/RPM
CID	85	0	6-8	11-15	16-19	Hz
ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	1.3-1.7	1.5-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.4	1.2-1.7	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON

CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	14-20	21-27	30-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	670-750	1400-1600	1800-2100	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS4	28	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
TPO	45	1.1/15	1.1/15	1.4/18	1.8/20	DCV/%
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-40	10-VBAT/0- 55	DCV/%
CTO	48	0	35-49	65-90	90-120	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	.2-6.5/75- 100	.2-6.5/75- 100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	3.4-3.8	3.6-7.5	6-9.8	mS
INJ3	74	0	3.4-3.8	3.6-7.5	6-9.8	mS
INJ1	75	0	3.4-3.8	3.6-7.5	6-9.8	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	8.5-9.2/26	9.2/26	9.6-11/23- 38	9.4/22	DCV/PSI
IAC	83	VBAT/0	9.5/33	9.8-11/35- 49	7.3-11/30-68	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	3.4-3.8	3.6-7.5	6-9.8	mS

INJ4	100	0	3.4-3.8	3.6-7.5	6-9.8	mS
INJ2	101	0	3.4-3.8	3.6-7.5	6-9.8	mS
FUELPW1	PID	(L)	3.4-3.8	3.6-7.5	6-9.8	mS
FUELPW2	PID	(L)	3.4-3.8	3.6-7.5	6-9.8	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	11-20	31-36	32-40	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	22-28	23-29	%
MAF	4-5.1	16-19	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	11-18	23	DEG

4.0L SOHC Explorer/Mountaineer (A/T) 150 Pin

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FPM	A02	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ILC	A08	.1	8.7	8.7	7.8	DCV
FEPS	A13	.1	.1	.1	.1	DCV
PATSIN	A14	VBAT	VBAT	VBAT	VBAT	DCV
4X4(L)	A23	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
BPS	A28	VBAT/OFF	.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SCMA	A29	VBAT	VBAT	VBAT	VBAT	DCV
ACP V/ACP	A30	.1/OPEN	.1/OPEN	.1/OPEN	.1/OPEN	DCV/ OPEN-CLOSED
MAF V	A31	0	.7-.9	1.2-1.4	1.6-2.1	DCV
SCMB	A36	VBAT	VBAT	VBAT	VBAT	DCV
BPP	A40	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
TCS	A41	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
SCMC	A46	VBAT	VBAT	VBAT	VBAT	DCV
ACDS	A47	.1	.1	.1	.1	DCV
FFS	A49	40-60 (O)	40-60 (O)	40-60 (O)	40-60 (O)	Hz
ACCS	A50	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
IAT	A51	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FTP V/FTP	A52	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
SCCS	A57	5	5	5	5	DCV
TR V/TR	B09	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
TR 4	B10	0	0	VBAT	VBAT	DCV
TR 2	B18	0	0	VBAT	VBAT	DCV
HCDS	B21	0	140	700	1270	Hz
TR 1	B22	0	0	VBAT	VBAT	DCV
TFT	B23	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
OSS	B26	0	0	525-550/ 1250-1300	950-1000/ 2350-2400	Hz/RPM
TSS	B27	0	390/750	700-745/ 1300-1375	950-990/ 1750-1860	Hz/RPM
O2S12	B28	.1	(D)	(D)	(D)	DCV
O2S22	B29	.1	(D)	(D)	(D)	DCV

DPFEGR	C41	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
O2S21	C44	0	switching (C)	switching (C)	switching (C)	DCV
O2S11	C45	0	switching (C)	switching (C)	switching (C)	DCV
ECT	C46	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
KS1	C51	0	0	0	0	DCV
CID	C53	0	6	11-12	14-16	Hz
CKP	C55	0	425-450	750-800	1000-1050	Hz
TPV	C57	.53-1.27	.53-1.27	1.1-1.3	1.3-1.5	DCV
CPP/PNP	PID	ON	ON	OFF	OFF	OFF/ON
FLI	PID	50	50	50	50	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	17-28	17-24	30-40	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	750	1300-1350	1780	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EVAPCV	A06	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	A07	0	0	65	125	Hz
WAC	A09	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
TPO	A10	1/15	1/15	1.4/18	1.8/20	DCV/%
PATSOUT	A11	1	1	1	1	DCV
EVAPPDC	A12	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
PATSIL	A22	11.3	11.8	11.8	11.8	DCV
PATSTRT	A39	.1	.1	.1	.1	DCV
SCC	A45	VBAT	VBAT	VBAT	VBAT	DCV
FP	A58	VBAT/0	.1/100	.1/100	.1/100	DCV/%
SS1	B01	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	B02	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS3	B03	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
SS4	B04	.1/ON	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
TCC	B05	VBAT/0	VBAT/0	.2/100	.2/100	DCV/%
EPC	B07	6	7	9	9.7	DCV
EPC3	B12	10.6	11.2	11.2	11.5	DCV
EPC2	B13	8.2	8.3	7.1	9.4	DCV

HTR12	B15	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	B16	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ1	C02	0	2.9-3.3	3.1-5.1	6-7	mS
HTR11	C07	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	C08	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
IAC	C09	VBAT/0	9/38	9.1/45	8/57	DCV/%
INJ5	C11	0	2.9-3.3	3.1-5.1	6-7	mS
CDC	C13	VBAT	VBAT	VBAT	VBAT	DCV
INJ2	C14	0	2.9-3.3	3.1-5.1	6-7	mS
EGRVR	C16	VBAT/0	VBAT/0	10.8/37	10/45	DCV/%
INJ6	C21	0	2.9-3.3	3.1-5.1	6-7	mS
CDB	C23	VBAT	VBAT	VBAT	VBAT	DCV
INJ3	C24	0	2.9-3.3	3.1-5.1	6-7	mS
CDA	C31	VBAT	VBAT	VBAT	VBAT	DCV
INJ4	C32	0	2.9-3.3	3.1-5.1	6-7	mS
FUELPW1	PID	0	2.9-3.3	3.1-5.1	6-7	mS
FUELPW2	PID	0	2.9-3.3	3.1-5.1	6-7	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	20-25	30	30-35	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	A32	VBAT	VBAT	VBAT	VBAT	DCV
VREF	A20	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-28	17-24	%
MAF	4.8-7	14-17	G/S

SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	20-25	40	DEG

4.0L SOHC Explorer/Mountaineer (M/T) 150 Pin

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FPM	A02	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ILC	A08	.1	8.7	8.7	8.7	DCV
FEPS	A13	.1	.1	.1	.1	DCV
PATSIN	A14	VBAT	VBAT	VBAT	VBAT	DCV
4X4(L)	A23	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
BPS	A28	VBAT/OFF	.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SCMA	A29	VBAT	VBAT	VBAT	VBAT	DCV
ACP V/ACP	A30	.1/OPEN	.1/OPEN	.1/OPEN	.1/OPEN	DCV/ OPEN-CLOSED
MAF V	A31	0	.7-.9	1.2-1.4	1.6-2.1	DCV
SCMB	A36	VBAT	VBAT	VBAT	VBAT	DCV
BPP	A40	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
SCMC	A46	VBAT	VBAT	VBAT	VBAT	DCV
ACDS	A47	.1	.1	.1	.1	DCV
FFS	A49	40-60 (O)	40-60 (O)	40-60 (O)	40-60 (O)	Hz
ACCS	A50	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
IAT	A51	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FTP V/FTP	A52	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
SCCS	A57	5	5	5	5	DCV
CPP/PNP	B22	.1/OFF	VBAT/ON (J)	.1/OFF	.1/OFF	DCV/OFF-ON
OSS	B26	0	0	525-550/ 1250-1300	950-1000/ 2350-2400	Hz/RPM
O2S12	B28	.1	(D)	(D)	(D)	DCV
O2S22	B29	.1	(D)	(D)	(D)	DCV
DPFEGR	C41	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
O2S21	C44	0	switching (C)	switching (C)	switching (C)	DCV
O2S11	C45	0	switching (C)	switching (C)	switching (C)	DCV
ECT	C46	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
KS1	C51	0	0	0	0	DCV
CID	C53	0	6	11-12	14-16	Hz

CKP	C55	0	425-450	750-800	1000-1050	Hz
TPV	C57	.53-1.27	.53-1.27	1.1-1.3	1.3-1.5	DCV
FLI	PID	50	50	50	50	%
LOAD	PID	(L)	17-28	17-24	20-40	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	750	1300-1350	1780	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EVAPCV	A06	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	A07	0	0	65	125	Hz
WAC	A09	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
TPO	A10	1/15	1/15	1.4/18	1.8/20	DCV/%
PATSOUT	A11	1	1	1	1	DCV
EVAPPDC	A12	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
PATSIL	A22	11.3	11.8	11.8	11.8	DCV
PATSTRT	A39	.1	.1	.1	.1	DCV
SCC	A45	VBAT	VBAT	VBAT	VBAT	DCV
FP	A58	VBAT/0	.1/100	.1/100	.1/100	DCV/%
HTR12	B15	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	B16	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ1	C02	0	2.9-3.3	3.1-5.1	6-7	mS
HTR11	C07	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	C08	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
IAC	C09	VBAT/0	9/38	9.1/45	8/57	DCV/%
INJ5	C11	0	2.9-3.3	3.1-5.1	6-7	mS
CDC	C13	VBAT	VBAT	VBAT	VBAT	DCV
INJ2	C14	0	2.9-3.3	3.1-5.1	6-7	mS
EGRVR	C16	VBAT/0	VBAT/0	10.8/37	10/45	DCV/%
INJ6	C21	0	2.9-3.3	3.1-5.1	6-7	mS
CDB	C23	VBAT	VBAT	VBAT	VBAT	DCV
INJ3	C24	0	2.9-3.3	3.1-5.1	6-7	mS
CDA	C31	VBAT	VBAT	VBAT	VBAT	DCV
INJ4	C32	0	2.9-3.3	3.1-5.1	6-7	mS
FUELPW1	PID	0	2.9-3.3	3.1-5.1	6-7	mS
FUELPW2	PID	0	2.9-3.3	3.1-5.1	6-7	mS

LONGFT1	PID	(-)20-(+)20	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	0	(-)10-(+) 10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+) 10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	20-25	30	30-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	A32	VBAT	VBAT	VBAT	VBAT	DCV
VREF	A20	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-28	17-24	%
MAF	4.8-7	14-17	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	20-25	40	DEG

4.6L Explorer/Mountaineer

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FPM	A02	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ILC	A08	8.6	8.6	8.6	8.6	DCV
FEPS	A13	.1	.1	.1	.1	DCV
PATSIN	A14	VBAT	VBAT	VBAT	VBAT	DCV
4X4(L)	A23	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
BPS	A28	VBAT/OFF	.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SCMA	A29	VBAT	VBAT	VBAT	VBAT	DCV
ACP V/ACP	A30	.1/OPEN	.1/OPEN	.1/OPEN	.1/OPEN	DCV/ OPEN-CLOSED
MAF V	A31	0	.7-.9	1.2-1.4	1.5-1.9	DCV
SCMB	A36	VBAT	VBAT	VBAT	VBAT	DCV
BPP	A40	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
TCS	A41	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
SCMC	A46	VBAT	VBAT	VBAT	VBAT	DCV
ACDS	A47	.1	.1	.1	.1	DCV
ACCS	A50	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
IAT	A51	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FTP V/FTP	A52	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
SCCS	A57	5	5	5	5	DCV
TR V/TR	B09	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
TR 4	B10	0	0	VBAT	VBAT	DCV
TR 2	B18	0	0	VBAT	VBAT	DCV
HCDS	B21	0	200	780	1230	Hz
TR 1	B22	0	0	VBAT	VBAT	DCV
TFT	B23	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
OSS	B26	0	0	550/1250	950-1000/ 2350-2400	Hz/RPM
TSS	B27	0	360/670	745/1375	990/1860	Hz/RPM
O2S12	B28	.1	(D)	(D)	(D)	DCV
O2S22	B29	.1	(D)	(D)	(D)	DCV
CHT	C40	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG

DPFEGR	C41	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
O2S21	C44	0	switching (C)	switching (C)	switching (C)	DCV
O2S11	C45	0	switching (C)	switching (C)	switching (C)	DCV
KS1	C51	0	0	0	0	DCV
KS2	C52	0	0	0	0	DCV
CID	C53	0	6	11-12	16	Hz
CKP	C55	0	480	800	1000-1050	Hz
TPV	C57	.53-1.27	.53-1.27	1.1-1.3	1.3-1.5	DCV
CPP/PNP	PID	ON	ON	OFF	OFF	OFF/ON
FLI	PID	50	50	50	50	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	17-24	23	38	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	890	1425	1950	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EVAPCV	A06	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	A07	0	0	65	125	Hz
WAC	A09	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	A11	11.3	11.8	11.8	11.8	DCV
EVAPPDC	A12	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
AFC	A19	.1	.1	.1	.1	DCV
PATSIL	A22	11.3	11.8	11.8	11.8	DCV
PATSTRT	A39	.1	.1	.1	.1	DCV
SCC	A45	VBAT	VBAT	VBAT	VBAT	DCV
FP	A58	VBAT/0	.1/100	.1/100	.1/100	DCV/%
SS1	B01	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	B02	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS3	B03	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
SS4	B04	.1/ON	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
TCC	B05	VBAT/0	VBAT/0	.2/100	.2/100	DCV/%
EPC	B07	6.7	7.4	9.7	9.9	DCV
EPC3	B12	6.7	7.4	7.4	VBAT	DCV
EPC2	B13	8.8	9.4	VBAT	9.9	DCV
HTR12	B15	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON

HTR22	B16	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
CDD	C01	VBAT	VBAT	VBAT	VBAT	DCV
INJ1	C02	0	3.3-3.8	5.1	6-7	mS
HTR11	C07	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	C08	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
IAC	C09	VBAT/0	9.9/28	9.1/45	7.4/65	DCV/%
INJ5	C11	0	3.3-3.8	5.1	6-7	mS
CDE	C12	VBAT	VBAT	VBAT	VBAT	DCV
CDC	C13	VBAT	VBAT	VBAT	VBAT	DCV
INJ2	C14	0	3.3-3.8	5.1	6-7	mS
EGRVR	C16	VBAT/0	VBAT/0	10.2/37	10.8/40	DCV/%
INJ6	C21	0	3.3-3.8	5.1	6-7	mS
CDF	C22	VBAT	VBAT	VBAT	VBAT	DCV
CDB	C23	VBAT	VBAT	VBAT	VBAT	DCV
INJ3	C24	0	3.3-3.8	5.1	6-7	mS
INJ7	C29	0	3.3-3.8	5.1	6-7	mS
CDG	C30	VBAT	VBAT	VBAT	VBAT	DCV
CDA	C31	VBAT	VBAT	VBAT	VBAT	DCV
INJ4	C32	0	3.3-3.8	5.1	6-7	mS
INJ8	C37	0	3.3-3.8	5.1	6-7	mS
CDH	C38	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	0	3.3-3.8	5.1	6-7	mS
FUELPW2	PID	0	3.3-3.8	5.1	6-7	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	12-16	30	28-33	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	A32	VBAT	VBAT	VBAT	VBAT	DCV
VREF	A20	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-24	18-20	%
MAF	4.8-7	17-20	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	12-16	35	DEG

5.0L Explorer/Mountaineer

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.7	10.7	DCV
FLI V/FLI	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.1	.1	.1	.1	DCV
ARC	19	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
CKP (+)	21	0	420-450	700-780	950-1050	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S12	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.7	10.7	DCV
TR4	50	0	0	10.7	10.7	DCV
VSS (+)	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
OSS	84	0	0	115-145/ 1200-1380	230-280/ 2300-2500	Hz/RPM
CID	85	0	5-10	10-15	11-17	Hz
ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.8-1	.9-1.7	1.5-2.5	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.3	1-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	10-20	19-30	28-38	%

MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
RPM	PID	0	700-750	1290-1350	1570-1730	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CD1	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	11-VBAT/ 0-40	10-VBAT/ 0-47	DCV/%
CTO	48	0	45-55	80-90	100-125	Hz
CD2	52	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.1/100	VBAT/0	10-VBAT/0-50	.2/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	VBAT/OFF	.1 /ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3.2-4.5	4.1-8	5.5-12	mS
INJ5	73	0	3.2-4.5	4.1-8	5.5-12	mS
INJ3	74	0	3.2-4.5	4.1-8	5.5-12	mS
INJ1	75	0	3.2-4.5	4.1-8	5.5-12	mS
CD3	78	VBAT	VBAT	VBAT	VBAT	DCV
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.5/10	9/10	9.3-11/ 23-40	10-11.3/ 34-40	DCV/PSI
IAC	83	VBAT/0	9.7/40	9-10.8/ 30-45	8-9/46-50	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.2-4.5	4.1-8	5.5-12	mS
INJ6	99	0	3.2-4.5	4.1-8	5.5-12	mS
INJ4	100	0	3.2-4.5	4.1-8	5.5-12	mS
INJ2	101	0	3.2-4.5	4.1-8	5.5-12	mS
CD4	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.2-4.5	4.1-8	5.5-12	mS
FUELPW2	PID	(L)	3.2-4.5	4.1-8	5.5-12	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%

LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	17-20	30-40	25-37	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	30-35	20-25	%
MAF	4.8-7	18.1-22	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	17-20	37	DEG

4.2L E/F-Series (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	11.5	11.5	DCV
IMRCM	8	5/2.5	5/2.5	5/2.5	5/2.5	DCV
FLI V/FLI (E-Series)	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	430-500	700-900	1000-1200	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
TCSS	59	0	0	265	471	Hz
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	.1	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	125-131/1250-1310	240-255/2400-2550	Hz/RPM
CID	85	0	5-7	10-12	13-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	1.3-1.7	1.2-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.6	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON

CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG
FLI (F-Series)	PID	50	50	50	50	%
GEAR	PID	1	1	3	4	GEAR
VSS	PID	0	0	30	55	MPH
LOAD	PID	(L)	10-20	20-27	30-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
RPM	PID	0	750-850	1200-1500	1600-1800	RPM
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
MIL (E-Series)	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
IMRC	42	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CHTIL (E-Series)	45	2/OFF	2/OFF	2/OFF	2/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-45	10-VBAT/ 0- 50	DCV/%
CTO (E-Series)	48	0	35-49	65-90	80-110	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.2/100	VBAT/0	.2-VBAT/0- 100	.2/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	55	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	2.7-4.5	4.5-8	5.5-11	mS
INJ3	74	0	2.7-4.5	4.5-8	5.5-11	mS
INJ1	75	0	2.7-4.5	4.5-8	5.5-11	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.7/15-20	8.8-10.2/15- 20	10.3-10.6/ 35-40	10.6/45	DCV/PSI
IAC	83	VBAT/0	10-12/25-40	7.5-10/30-55	7.2-8.1/60- 70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON

HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	2.7-4.5	4.5-8	5.5-11	mS
INJ4	100	0	2.7-4.5	4.5-8	5.5-11	mS
INJ2	101	0	2.7-4.5	4.5-8	5.5-11	mS
CHTIL (F-Series)	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	2.7-4.5	4.5-8	5.5-11	mS
FUELPW2	PID	(L)	2.7-4.5	4.5-8	5.5-11	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL (F-Series)	PID	OFF	OFF	OFF	OFF	OFF/ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	20-30	10-20	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	10-20	19-25	%
MAF	4-5.1	14-18	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-20	40	DEG

4.2L F-Series (M/T)

Typical Diagnostic Reference Manual

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
IMRCM	8	5/2.5	5/2.5	5/2.5	5/2.5	DCV
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	460-500	660-850	950-1090	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS	57	0	0	0	0	DCV
TCSS (4X4)	59	0	0	265	471	Hz
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	.1	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS (4X2)	84	0	0	218/1170	403/2000	Hz/RPM
CID	85	0	5-7	10-12	13-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.7-1.7	1.2-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.2-1.6	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG
FLI	PID	50	50	50	50	%
LOAD	PID	(L)	10-20	20-27	30-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
RPM	PID	0	750-850	1200-1500	1600-1800	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
IMRC	42	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5- VBAT/ 0-45	11-VBAT/ 0- 50	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	2.5-4.1	3.8-7	4.6-10	mS
INJ3	74	0	2.5-4.1	3.8-7	4.6-10	mS
INJ1	75	0	2.5-4.1	3.8-7	4.6-10	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
IAC	83	VBAT/0	10-12/20- 40	10-11/25- 45	7-9.5/50-75	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	2.5-4.1	3.8-7	4.6-10	mS
INJ4	100	0	2.5-4.1	3.8-7	4.6-10	mS
INJ2	101	0	2.5-4.1	3.8-7	4.6-10	mS
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	2.5-4.1	3.8-7	4.6-10	mS
FUELPW2	PID	(L)	2.5-4.1	3.8-7	4.6-10	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	20-30	10-20	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	10-20	19-25	%
MAF	4-5.1	14-18	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	15-20	40	DEG

4.6L E/F-Series/Expedition (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TCSS (M)	7	0	0	240-265	471	Hz
FLI V/FLI (E-Series)	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	390-430	650-770	850-1050	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.1	11.1	DCV
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.1	11.1	DCV
TR4	50	0	0	11.1	11.1	DCV
KS1 (Expedition)	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	.1	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	120/1200	215/2150	Hz/RPM
CID	85	0	5-7	10-12	12-14	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.9-1.5	1.2-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.6	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
KS2 (Expedition)	102	0	0	0	0	DCV

CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG
FLI	PID	50	50	50	50	%
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	15-23	25-30	40-50	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	680-830	1200	1500	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL (E-Series)	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
ACL (Expedition)	19	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
CHTIL (E- Series)	19	2.2/OFF	2.2/OFF	2.2/OFF	2.2/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
TPO (M)	42	.65/15	.65/15	.8/18	1.3/20	DCV/%
IMTV	46	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
EGRVR	47	VBAT/0	VBAT/0	11-VBAT/ 0- 40	7-10/40-90	DCV/%
CTO (E-Series)	48	0	35-49	65-90	90-120	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.2/100	VBAT/0	.2/100	.2/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC (M)	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	2.7-4.1	4.5-8	5.5-11	mS
INJ5	73	0	2.7-4.1	4.5-8	5.5-11	mS
INJ3	74	0	2.7-4.1	4.5-8	5.5-11	mS
INJ1	75	0	2.7-4.1	4.5-8	5.5-11	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV

CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.7/5	8.7/5	10/35	10/40	DCV/PSI
IAC	83	VBAT/0	10/37	8-9/50-60	5/80	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	2.7-4.1	4.5-8	5.5-11	mS
INJ6	99	0	2.7-4.1	4.5-8	5.5-11	mS
INJ4	100	0	2.7-4.1	4.5-8	5.5-11	mS
INJ2	101	0	2.7-4.1	4.5-8	5.5-11	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	2.7-4.1	4.5-8	5.5-11	mS
FUELPW2	PID	(L)	2.7-4.1	4.5-8	5.5-11	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	14-19	15-35	20-39	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	18-23	15-20	%
MAF	4-5.1	15-24	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%

SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	14-19	25	DEG

4.6L F-Series (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TCSS (M)	7	0	0	240-265	471	Hz
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4x4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	390-425	650-770	850-1050	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	.1	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS (M)	84	0	0	120-131/1200-1310	230-255/2300-2550	Hz/RPM
CID	85	0	5-7	10-12	13-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-9	.7-1	1.2-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.6	DCV
BPP (M)	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG
FLI	PID	50	50	50	50	%
LOAD	PID	(L)	18-23	25-30	35-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	680-830	1190-1500	1500-1700	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
IMTV	46	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
EGRVR	47	VBAT/0	VBAT/0	11-VBAT/ 0-40	10-VBAT/ 0-55	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	2.7-4.1	4.5-8	5.5-11	mS
INJ5	73	0	2.7-4.1	4.5-8	5.5-11	mS
INJ3	74	0	2.7-4.1	4.5-8	5.5-11	mS
INJ1	75	0	2.7-4.1	4.5-8	5.5-11	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
IAC	83	VBAT/0	10-11/25-32	7.5-10/30-55	7-8.2/55-75	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	2.7-4.1	4.5-8	5.5-11	mS
INJ6	99	0	2.7-4.1	4.5-8	5.5-11	mS
INJ4	100	0	2.7-4.1	4.5-8	5.5-11	mS
INJ2	101	0	2.7-4.1	4.5-8	5.5-11	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	2.7-4.1	4.5-8	5.5-11	mS
FUELPW2	PID	(L)	2.7-4.1	4.5-8	5.5-11	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%

SHRTFT2	PID	(L)	(-)10-(+)10 10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	19-24	15-35	20-39	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	18-23	15-20	%
MAF	4-5.1	15-24	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	19-24	44	DEG

5.4L E-Series (4R70W)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO (M)	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FLI V/FLI (M)	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	410	600-800	900-1125	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF (G)	.1/OFF (G)	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR (M)	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	120/1200	228/2280	Hz/RPM
CID	85	0	5-8	9-12	13-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.9-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	0	15	21-28	30-38	%

MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	720	1000-1150	1580-1680	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL (M)	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	.1/ON	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL (M)	45	4.7/OFF	5/OFF	5/OFF	5/OFF	DCV/OFF-ON
EGRVR (M)	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-40	10-12.5/ 30-45	DCV/%
CTO (M)	48	0	46	67	107	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.2/100	VBAT/0	VBAT/0	.3/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV (M)	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC (M)	69	VBAT/OFF	.1/ON(A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3.2-3.8	4-6.9	6.5-12	mS
INJ5	73	0	3.2-3.8	4-6.9	6.5-12	mS
INJ3	74	0	3.2-3.8	4-6.9	6.5-12	mS
INJ1	75	0	3.2-3.8	4-6.9	6.5-12	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7/5	8.3/5	9.6/45	9.6/45	DCV/PSI
IAC	83	VBAT/0	8.7/43	5.5/70	2.5-4.5/ 70-90	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12 (M)	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.2-3.8	4-6.9	6.5-12	mS
INJ6	99	0	3.2-3.8	4-6.9	6.5-12	mS

INJ4	100	0	3.2-3.8	4-6.9	6.5-12	mS
INJ2	101	0	3.2-3.8	4-6.9	6.5-12	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.2-3.8	4-6.9	6.5-12	mS
FUELPW2	PID	(L)	3.2-3.8	4-6.9	6.5-12	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	16-20	29	32-36	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	22-27	20-25	%
MAF	4.8-6	18.1-21	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	16-20	38	DEG

5.4L F-Series (4R70W)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TCSS (M)	4	0	0	260	470	Hz
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	410	600-800	900-1125	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF (G)	.1/OFF (G)	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	120/1200	228/2280	Hz/RPM
CID	85	0	5-8	9-12	13-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.9-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
FLI	PID	50	50	50	50	%
GEAR	PID	1	1	4	4	GEAR

LOAD	PID	0	15	21-28	30-38	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	OPEN-CLOSED
RPM	PID	0	720	1000-1150	1580-1680	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
EGRVR	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-40	10-12.5/ 30- 45	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.2/100	VBAT/0	VBAT/0	.3/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC (M)	69	VBAT/OFF	.1/ON(A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3.2-3.8	4-6.9	6.5-12	mS
INJ5	73	0	3.2-3.8	4-6.9	6.5-12	mS
INJ3	74	0	3.2-3.8	4-6.9	6.5-12	mS
INJ1	75	0	3.2-3.8	4-6.9	6.5-12	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7/5	8.3/5	9.6/45	9.6/45	DCV/PSI
IAC	83	VBAT/0	8.7/43	5.5/70	2.5-4.5/ 70-90	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.2-3.8	4-6.9	6.5-12	mS
INJ6	99	0	3.2-3.8	4-6.9	6.5-12	mS
INJ4	100	0	3.2-3.8	4-6.9	6.5-12	mS

INJ2	101	0	3.2-3.8	4-6.9	6.5-12	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.2-3.8	4-6.9	6.5-12	mS
FUELPW2	PID	(L)	3.2-3.8	4-6.9	6.5-12	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	16-20	29	32-36	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	22-27	20-25	%
MAF	4.8-6	18.1-21	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	16-20	38	DEG

5.4L E/F250/F350-Series (4R100)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FLI V/FLI (M)	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	360-380	700-800	900-1100	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
VSS (F-Series)	58	0	0	65/30	125/55	Hz/MPH
TSS	59	0	325/610	740/925	0/1660	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	130/1320	240/2385	Hz/RPM
CID	85	0	5-8	10-12	14-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	.9-1.6	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON

GEAR	PID	1	1	4	4	GEAR
LOAD	PID	0	15-20	21-30	30-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	630-700	1100-1200	1150-1400	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	.1/ON	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CCS	20	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	45	2.2/OFF	2.2/OFF	2.2/OFF	2.2/OFF	DCV/OFF-ON
EGRVR (M)	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-40	11.5- VBAT/ 0-40	DCV/%
CTO (M)	48	0	41-44	80-90	113	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.2/100	VBAT/0	VBAT/0	.2/100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV (M)	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO (M)	68	0	0	65	125	Hz
WAC (F-Series)	69	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
INJ7	72	0	3.2-4.2	4-8	8-16	mS
INJ5	73	0	3.2-4.2	4-8	8-16	mS
INJ3	74	0	3.2-4.2	4-8	8-16	mS
INJ1	75	0	3.2-4.2	4-8	8-16	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	8/0	9.5/0	10.5/40	10.5/40	DCV/PSI
IAC	83	VBAT/0	11.7/25	8.5-10.9/30- 55	6-8/50-70	DCV/%

HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12 (M)	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.2-4.2	4-8	8-16	mS
INJ6	99	0	3.2-4.2	4-8	8-16	mS
INJ4	100	0	3.2-4.2	4-8	8-16	mS
INJ2	101	0	3.2-4.2	4-8	8-16	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.2-4.2	4-8	8-16	mS
FUELPW2	PID	(L)	3.2-4.2	4-8	8-16	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	20-25	25-32	20-37	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	15-20	20-25	%
MAF	4.8-6	18.1-21	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	20-25	42	DEG

5.4L F250/F350-Series (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FLI V/FLI (M)	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	360-380	700-800	900-1100	Hz
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS	57	0	0	0	0	DCV
VSS	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV//IN-H2O
CPP/PNP	64	5/OFF	.1/ON	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR (M)	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
CID	85	0	5-8	10-12	14-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	.9-1.6	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
LOAD	PID	0	15-20	21-30	30-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	630-700	1100-1200	1150-1400	RPM

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	

CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	45	2.2/OFF	2.2/OFF	2.2/OFF	2.2/OFF	DCV/OFF-ON
EGRVR (M)	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-40	11.5- VBAT/ 0-40	DCV/%
CTO	48	0	41-44	80-90	113	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV (M)	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
INJ7	72	0	3.2-4.2	4-8	8-16	mS
INJ5	73	0	3.2-4.2	4-8	8-16	mS
INJ3	74	0	3.2-4.2	4-8	8-16	mS
INJ1	75	0	3.2-4.2	4-8	8-16	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
IAC	83	VBAT/0	11.7/25	8.5-10.9/30- 55	6-8/50-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12 (M)	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.2-4.2	4-8	8-16	mS
INJ6	99	0	3.2-4.2	4-8	8-16	mS
INJ4	100	0	3.2-4.2	4-8	8-16	mS
INJ2	101	0	3.2-4.2	4-8	8-16	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.2-4.2	4-8	8-16	mS
FUELPW2	PID	(L)	3.2-4.2	4-8	8-16	mS
LONGFT1	PID	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	20-25	25-32	20-37	DEG

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Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	15-20	20-25	%
MAF	4.8-6	18.1-21	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	20-25	42	DEG

5.4L Lightning (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	410	650	1060	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT2	38	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
IAT1	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
TSS	59	0	110/200	0/1000	0/1820	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	.1	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
BARO	63	155	155	155	155	Hz
TR V/TR	64	0/PARK	0/PARK	1.7/0D	1.7/0D	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	420/1400	770/2550	Hz/RPM
CID	85	0	6-8	9-10	14-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	1-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON

GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	18-21	27-32	35-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	700	1200-1250	1575-1670	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FPL	19	VBAT	.1	.1	.1	DCV
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
SCB	42	.1/ON	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	10.5-VBAT/ 0-45	10-12/35- 55	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	VBAT/0	.2/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
ICP	70	VBAT/OFF	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ7	72	0	2-3.8	3-6	3.5-9	mS
INJ5	73	0	2-3.8	3-6	3.5-9	mS
INJ3	74	0	2-3.8	3-6	3.5-9	mS
INJ1	75	0	2-3.8	3-6	3.5-9	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7/5	8.8/5	8.8/5	8.5-9/5-10	DCV/PSI
IAC	83	VBAT/0	9.4/33	9/47	8-8.5/50-59	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON

HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	2-3.8	3-6	3.5-9	mS
INJ6	99	0	2-3.8	3-6	3.5-9	mS
INJ4	100	0	2-3.8	3-6	3.5-9	mS
INJ2	101	0	2-3.8	3-6	3.5-9	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	2-3.8	3-6	3.5-9	mS
FUELPW2	PID	(L)	2-3.8	3-6	3.5-9	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	25-35	28-38	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	18-21	15-20	%
MAF	5.3-6.5	21-25	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-20	33	DEG

5.4L F-Series/Expedition (4R100)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TCSS (M)	4	0	0	265	471	Hz
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	411	750-800	975-1000	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
TSS	59	0	350/660	730/1350	0/1672	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	400/1300	700/2350	Hz/RPM
CID	85	0	6-8	10-12	14-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1	1-1.4	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG

FLI	PID	50	50	50	50	%
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	14-16	19-25	35-43	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	700-760	1270-1370	1590-1675	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
ACL (M)	19	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
TPO (M)	42	.4	.5	.8	1	DCV
EGRVR	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-40	10.3-12.2/ 35-56	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	.2/90-100	.2/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3-5	4.1-6.9	6.5-12	mS
INJ5	73	0	3-5	4.1-6.9	6.5-12	mS
INJ3	74	0	3-5	4.1-6.9	6.5-12	mS
INJ1	75	0	3-5	4.1-6.9	6.5-12	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.5/5	9.1/5	9/5	9.1/5-15	DCV/PSI
IAC	83	VBAT/0	10.2-11/30- 34	9-10.8/43- 55	7-9/58-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON

HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ8	98	0	3-5	4.1-6.9	6.5-12	mS
INJ6	99	0	3-5	4.1-6.9	6.5-12	mS
INJ4	100	0	3-5	4.1-6.9	6.5-12	mS
INJ2	101	0	3-5	4.1-6.9	6.5-12	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3-5	4.1-6.9	6.5-12	mS
FUELPW2	PID	(L)	3-5	4.1-6.9	6.5-12	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-22	27-35	28-37	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	27-35	20-27	%
MAF	4.8-6	18.1-22	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-22	39	DEG

5.4L 4V Navigator/Blackwood (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.1	.1	.1	.1	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	410	800-850	900-1125	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
TSS	59	0	130/241	660/1230	0/1670	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	380/1260	707/2350	Hz/RPM
CID	85	0	6-8	10-12	14-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	1-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON

FLI	PID	50	50	50	50	%
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	14-17	19-25	26-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	690-710	1270-1390	1590-1675	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
ACL	19	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF/ON
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
TPO (M)	42	.9/15	.9/15	1.4/18	1.8/20	DCV/%
IMTV	46	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
EGRVR	47	VBAT/0	VBAT/0	11.5- VBAT/ 0-40	10.5- VBAT/ 0-50	DCV/%
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	VBAT/0	.2/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3.2-3.8	4-6.9	6.5-12	mS
INJ5	73	0	3.2-3.8	4-6.9	6.5-12	mS
INJ3	74	0	3.2-3.8	4-6.9	6.5-12	mS
INJ1	75	0	3.2-3.8	4-6.9	6.5-12	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	8.1/5	9.9/5	9.4/5	9.5/5-15	DCV/PSI
IAC	83	VBAT/0	10.5/41	8.9/55	8.5/65	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON

HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.2-3.8	4-6.9	6.5-12	mS
INJ6	99	0	3.2-3.8	4-6.9	6.5-12	mS
INJ4	100	0	3.2-3.8	4-6.9	6.5-12	mS
INJ2	101	0	3.2-3.8	4-6.9	6.5-12	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.2-3.8	4-6.9	6.5-12	mS
FUELPW2	PID	(L)	3.2-3.8	4-6.9	6.5-12	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	12-18	31-40	28-38	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	27-35	25-30	%
MAF	4.8-6.5	21-24	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%

5.4L Excursion (4R100)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FLI (M)	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CKP (+)	21	0	380-411	750-800	975-1000	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
VSS	58	0	0	65/30	125/55	Hz/MPH
TSS	59	0	100/200	680-725/1270-1370	0/1635-17700	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR (M)	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	400-415/1300-1380	700-750/2350-2489	Hz/RPM
CID	85	0	6-8	10-12	14-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	1-1.4	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON

ECT	PID	160-200	160-200	160-200	160-200	DEG
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	17-25	19-25	35-50	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	650-760	1200-1400	1590-1750	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	45	2.2/OFF	2.2/OFF	2.2/OFF	2.2/OFF	DCV/OFF-ON
EGRVR (M)	47	VBAT/0	VBAT/0	11.5-VBAT/ 0-40	10.3-12.2/ 35-55	DCV/%
CTO	48	0	43	85	110	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	.2/90-100	.2/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV (M)	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3.2-4.5	4.1-6.9	7-14	mS
INJ5	73	0	3.2-4.5	4.1-6.9	7-14	mS
INJ3	74	0	3.2-4.5	4.1-6.9	7-14	mS
INJ1	75	0	3.2-4.5	4.1-6.9	7-14	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.5/5	9.1/5	9.1/5	9.6/10	DCV/PSI
IAC	83	VBAT/0	10.2-11/30- 34	7-10.8/43- 60	5-9/58-75	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON

HTR12 (M)	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.2-4.5	4.1-6.9	7-14	mS
INJ6	99	0	3.2-4.5	4.1-6.9	7-14	mS
INJ4	100	0	3.2-4.5	4.1-6.9	7-14	mS
INJ2	101	0	3.2-4.5	4.1-6.9	7-14	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.2-4.5	4.1-6.9	7-14	mS
FUELPW2	PID	(L)	3.2-4.5	4.1-6.9	7-14	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	16-20	27-35	28-37	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-25	20-27	%
MAF	4.8-6	18.1-22	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	16-20	43	DEG

5.4L NG Econoline (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-440	810-870	1089-1120	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FSVM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
TSS	59	0	315/170	725-780/1360-1460	0/1940-1950	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
EFTA V/EFTA	62	1.7-3.5/50-120 (K)	1.7-3.5/50-120 (K)	1.7-3.5/50-120 (K)	1.7-3.5/50-120 (K)	DCV/DEG
FRP V/FRP	63	2-3.7/90-100	2-3.7/90-100	2-3.7/90-100	2-3.7/90-100	DCV/PSI
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	405-430/1360-1460	815/2729	Hz/RPM
CID	85	0	6-8	9-12	15-17.5	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.95	.9-1.7	1.2-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	.9-1.6	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
FLI	PID	50	50	50	50	%
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	13-19	21-30	31-38	%

MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
RPM	PID	0	715-850	1400-1490	1900-1950	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	45	2.3/OFF	2.3/OFF	2.3/OFF	2.3/OFF	DCV/OFF-ON
CTO	48	0	45-50	90-100	120-130	Hz
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	.2-.3/90-100	.2-.3/90-100	DCV/%
VSO	68	0	0	65	125	Hz
INJ7	72	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ5	73	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ3	74	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ1	75	0	3.9-6.5	4.7-12	4.7-12.2	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FSV	80	VBAT/OFF	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
EPC	81	7.6/5	9.8/5	9.2/5	9.8/13	DCV/PSI
IAC	83	VBAT/0	9.2-10.1/32-40	8-10.7/30-60	5.7-8/40-65	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ8	98	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ6	99	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ4	100	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ2	101	0	3.9-6.5	4.7-12	4.7-12.2	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.9-6.5	4.7-12	4.7-12.2	mS

FUELPW2	PID	(L)	3.9-6.5	4.7-12	4.7-12.2	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)15-(+)15	(-)15-(+)15	(-)15-(+)15	%
SHRTFT2	PID	(L)	(-)15-(+)15	(-)15-(+)15	(-)15-(+)15	%
SPARKADV	PID	0	8-15	20-35	20-30	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	25-28	21-30	%
MAF	4.8-6.2	18.1-22.4	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	8-15	41	DEG

5.4L NG F-Series (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-440	810-870	1089-1120	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FSVM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
TSS	59	0	315/170	725-780/1360-1460	0/1943	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
EFTA V/EFTA	62	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FRP V/FRP	63	2-3.7/90-100	2-3.7/90-100	2-3.7/90-100	2-3.7/90-100	DCV/PSI
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	405-430/1360-1460	815/2729	Hz/RPM
CID	85	0	6-7	9-12	14-17.5	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.95	.9-1.7	1.2-2.4	DCV
TP V	89	.53-1.27	.53-1.27	8-1.2	9-1.6	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
FLI	PID	50	50	50	50	%
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	13-19	21-30	31-38	%

MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
RPM	PID	0	715-850	1270-1490	1900-1950	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF	27	VBAT	VBAT	VBAT	VBAT	DCV
CDB	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	.2-.3/90-100	.2-.3/90-100	DCV/%
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ5	73	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ3	74	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ1	75	0	3.9-6.5	4.7-12	4.7-12.2	mS
CDC	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FSV	80	VBAT/OFF	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
EPC	81	7.6/5	9.8/5	9.2/5	9.8/13	DCV/PSI
IAC	83	VBAT/0	9.2-10.1/32-40	8-10.7/30-60	5.7-8/40-65	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ8	98	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ6	99	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ4	100	0	3.9-6.5	4.7-12	4.7-12.2	mS
INJ2	101	0	3.9-6.5	4.7-12	4.7-12.2	mS
CDD	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.9-6.5	4.7-12	4.7-12.2	mS
FUELPW2	PID	(L)	3.9-6.5	4.7-12	4.7-12.2	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%

LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)15-(+)15	(-)15-(+)15	(-)15-(+)15	%
SHRTFT2	PID	(L)	(-)15-(+)15	(-)15-(+)15	(-)15-(+)15	%
SPARKADV	PID	0	8-15	20-35	20-30	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	25-28	21-30	%
MAF	4.8-6.2	18.1-22.4	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	8-15	41	DEG

6.8L E/F-Series (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FLI V/FLI (M)	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.1	.1	.1	.1	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	380-480	800-1050	1100-1300	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
VSS (F-Series)	58	0	0	65/30	125/55	Hz/MPH
TSS	59	0	100/200	700/1300	0/1670	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR (M)	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.61 or 3.7/194	.61 or 3.7/194	.61 or 3.7/194	.61 or 3.7/194	DCV/DEG
OSS	84	0	0	400/1300	700/2350	Hz/RPM
CID	85	0	7-10	10-13	13-15	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-1	1.2-1.7	1.6-2.7	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.9-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON

GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	14-16	20-25	25-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	600-900	1200-1380	1600-1800	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDB	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDD	27	VBAT	VBAT	VBAT	VBAT	DCV
INJ10	42	0	3.8-4.6	5.2-6.5	6.6-11	mS
CHTIL	45	2.2/OFF	2.2/OFF	2.2/OFF	2.2/OFF	DCV/OFF-ON
VSO (E-Series)	46	0	0	65	125	Hz
EGRVR (M)	47	VBAT/0	VBAT/0	9-VBAT/0- 40	8-9/30-55	DCV/%
CTO	48	0	50-60	110-130	140-175	Hz
CDC	52	VBAT	VBAT	VBAT	VBAT	DCV
CDF	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	.1/90-100	.1/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV (M)	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
INJ9	68	0	3.8-4.6	5.2-6.5	6.6-11	mS
WAC (F-Series)	69	VBAT/OFF	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ5	73	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ3	74	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ1	75	0	3.8-4.6	5.2-6.5	6.6-11	mS
CDE	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	8.7/5	9.2/5	9.2/5	9.2/11	DCV/PSI
CDJ	82	VBAT	VBAT	VBAT	VBAT	DCV

IAC	83	VBAT/0	9.3-11.5/25-41	8-9.5/30-55	4.9-9/50-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12 (M)	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ6	99	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ4	100	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ2	101	0	3.8-4.6	5.2-6.5	6.6-11	mS
CDI	102	VBAT	VBAT	VBAT	VBAT	DCV
CDG	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.8-4.6	5.2-6.5	6.6-11	mS
FUELPW2	PID	(L)	3.8-4.6	5.2-6.5	6.6-11	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	17-23	23-34	26-34	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	14.1	24-28	%
MAF	6-8	20-25	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	17-23	38	DEG

6.8L F-Series (M/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FLI V/FLI (M)	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.1	.1	.1	.1	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	400-500	380-800	1100-1300	Hz
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS	57	0	0	0	0	DCV
VSS	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR (M)	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.61 or 3.7/194	.61 or 3.7/194	.61 or 3.7/194	.61 or 3.7/194	DCV/DEG
CID	85	0	5-7	10-13	15-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-1	1.2-1.7	1.6-2.7	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.9-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
LOAD	PID	(L)	14-16	20-25	24-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	600-900	1280-1450	1600-1800	RPM

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	

CDB	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDD	27	VBAT	VBAT	VBAT	VBAT	DCV
INJ10	42	0	3.8-4.6	5.2-6.5	6.6-11	mS
CHTIL	45	2.2/OFF	2.2/OFF	2.2/OFF	2.2/OFF	DCV/OFF-ON
EGRVR (M)	47	VBAT/0	VBAT/0	9-VBAT/ 0-40	8-VBAT/ 0-50	DCV/%
CTO	48	0	50-60	110-130	140-175	Hz
CDC	52	VBAT	VBAT	VBAT	VBAT	DCV
CDF	53	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV (M)	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
INJ9	68	0	3.8-4.6	5.2-6.5	6.6-11	mS
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ7	72	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ5	73	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ3	74	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ1	75	0	3.8-4.6	5.2-6.5	6.6-11	mS
CDE	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
CDJ	82	VBAT	VBAT	VBAT	VBAT	DCV
IAC	83	VBAT/0	9.3-11/25- 41	8-9/30-55	4.9-8/50- 70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12 (M)	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ6	99	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ4	100	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ2	101	0	3.8-4.6	5.2-6.5	6.6-11	mS
CDI	102	VBAT	VBAT	VBAT	VBAT	DCV
CDG	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.8-4.6	5.2-6.5	6.6-11	mS
FUELPW2	PID	(L)	3.8-4.6	5.2-6.5	6.6-11	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	17-23	23-34	26-34	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	14.1	24-28	%
MAF	6-8	20-25	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	17-23	38	DEG

6.8L Excursion (A/T)

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FLI V/FLI (M)	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.1	.1	.1	.1	DCV
4X4L (M)	14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CKP (+)	21	0	500-525	750-940	1000-1195	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
VSS	58	0	0	65/30	125/55	Hz/MPH
TSS	59	0	410/470	690/1300	0/1362	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V	64	0	0	1.7	1.7	DCV
DPFEGR	65	.95-1.05	.95-1.05	.95-4.65	.95-4.65	DCV
CHT V/CHT	66	.61 or 3.7/194	.61 or 3.7/194	.61 or 3.7/194	.61 or 3.7/194	DCV/DEG
OSS	84	0	0	390/1300	690/2290	Hz/RPM
CID	85	0	7-10	10-13	13-15	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-1.1	1.2-2	1.6-2.7	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.9-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	3	4	GEAR

LOAD	PID	(L)	14-16	25-30	30-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	RETARD/NO RETARD
RPM	PID	0	800-950	1200-1380	1600-1900	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDB	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA	26	VBAT	VBAT	VBAT	VBAT	DCV
CDD	27	VBAT	VBAT	VBAT	VBAT	DCV
INJ10	42	0	3.8-4.6	5.2-6.5	6.6-11	mS
CHTIL	45	2.2/OFF	2.2/OFF	2.2/OFF	2.2/OFF	DCV/OFF-ON
EGRVR (M)	47	VBAT/0	VBAT/0	9-VBAT/0- 40	9-VBAT/0- 40	DCV/%
CTO	48	0	60-70	100-120	130-150	Hz
CDC	52	VBAT	VBAT	VBAT	VBAT	DCV
CDF	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	VBAT/0	.1/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV (M)	67	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
INJ9	68	0	3.8-4.6	5.2-6.5	6.6-11	mS
WAC	69	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
INJ7	72	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ5	73	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ3	74	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ1	75	0	3.8-4.6	5.2-6.5	6.6-11	mS
CDE	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.7/5	9.2/5	9.2/5	9.2/5	DCV/PSI
CDJ	82	VBAT	VBAT	VBAT	VBAT	DCV
IAC	83	VBAT/0	9.3-11/25- 41	8-9.5/30-55	4.9-9/50-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON

HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12 (M)	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ6	99	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ4	100	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ2	101	0	3.8-4.6	5.2-6.5	6.6-11	mS
CDI	102	VBAT	VBAT	VBAT	VBAT	DCV
CDG	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.8-4.6	5.2-6.5	6.6-11	mS
FUELPW2	PID	(L)	3.8-4.6	5.2-6.5	6.6-11	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	23-34	26-34	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

NOTE: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	47	34	%
MAF	8-9	20-25	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	17-23	38	DEG

